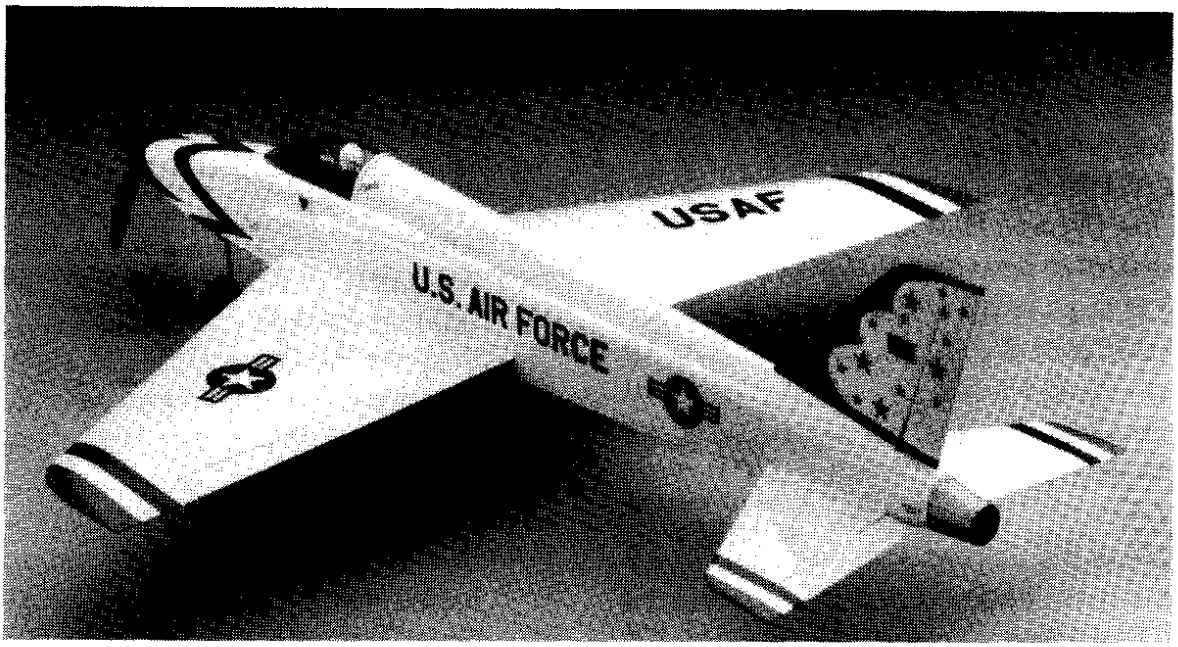
PATRIOT

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.O. BOX 788 URBANA, ILLINOIS 61801 (217) 398-8970

PAT4P03

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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 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.

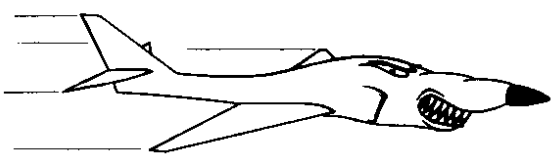
Academy of Model Aeronautics
5151 East Memorial Drive
Muncie, IN 47302-9252
Tel: (800) 435-9262
Fax: (317) 741-0057

INTRODUCTION

Congratulations! Thank you for purchasing the Great Planes **Patriot**!

The Great Planes Patriot is a high performance propeller-driven sport airplane that looks like a jet. 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 ducted fan model.

The Patriot is not a scale model of any particular airplane, but rather it incorporates many key attributes of jet airplanes in general, to result in the "jet-like" effect. Not being tied to a particular scale outline allowed the Great Planes designers to design out any undesirable characteristics, to give you an easy-building and great flying sport airplane...one that you feel comfortable with, flight after flight. We think you'll like it.



This is not a beginner's airplane! While the Patriot is easy 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 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 Patriot is an excellent choice. If you currently fly an aileron airplane, but you are unsure about your ability to handle the Patriot, we recommend that you have a more experienced pilot help you with the first few flights.

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.

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

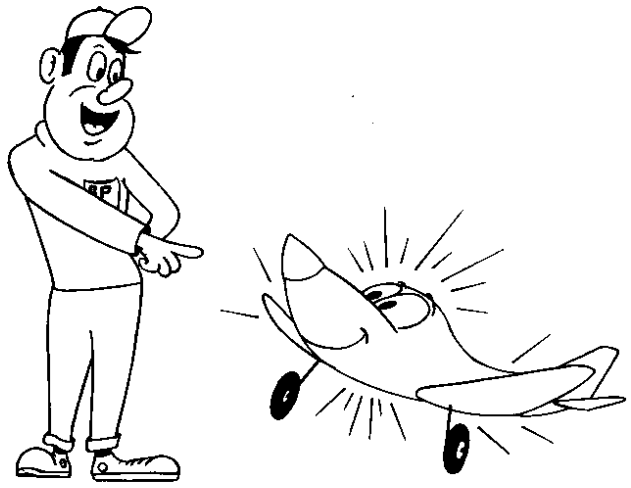
3. You must use a proper R/C **radio** that is in first class condition and meets the current AMA and FCC requirements and the requirements of your local flying club, the correct sized **engine** and correct **components** (fuel tank, wheels, etc.).

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, and 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 at this time.

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



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

OTHER ITEMS REQUIRED

- ❑ Four-channel radio with 4 servos (additional channel and low-profile retract servo and additional standard servo required if retracts are being used).
- ❑ Propellers (see engine instructions for recommended sizes).
- ❑ Spinner (1-3/4" diameter)
- ❑ Fuel Tank (8 ounce maximum if retracts are used)
- ❑ 5/32" Wheel Collars - 6
- ❑ Iron-on Covering Material (Top Flite Super Monokote recommended).
- ❑ Fuelproof Paint for Tail Cone, and possibly for trim. Note: Chevron "Perfect Paint" matches Top Flite Super Monokote, and is available in convenient spray cans.
- ❑ Silicone Fuel Tubing
- ❑ Wing Seating Tape (or silicone sealer . . . see instructions)
- ❑ Latex Foam Rubber Padding (1/4" thick)
- ❑ 4 - Dubro "E-Z Connectors" (optional, See page 28)
- ❑ Plastic Pilot: Williams Bros. Military 1-1/2" Scale #171
- ❑ 14 - Hinges

NOTE: Due to the many types of hinges available and the fact that everybody seems to have their own favorite, we did not include hinges in this kit. We can, however, highly recommend the "laminated" type hinges that are glued in with thin CA. Our R&D department has thoroughly tested these hinges and found them to be easy to install and sufficiently strong and durable for this type of airplane. However, as the kit builder, you are reminded that you are ultimately responsible for the structural integrity of your aircraft. If you are not confident using this type of hinge, please feel free to use your favorite hinge.

SUPPLIES AND TOOLS NEEDED

- ❑ 2 oz. Thin CA Adhesive
- ❑ 2 oz. Medium or Thick CA Adhesive
- ❑ 2.5 oz. 5-Minute Epoxy
- ❑ 2.5 oz. 30-Minute Epoxy
- ❑ Hand or Electric Drill
- ❑ Drill Bits: 1/16", 5/64", 3/32", 7/64", 1/8", 5/32", 3/16", 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 (Required for construction)
- ❑ 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.

DECISIONS YOU MUST MAKE NOW

ENGINE, MOUNT AND MUFFLER SELECTION

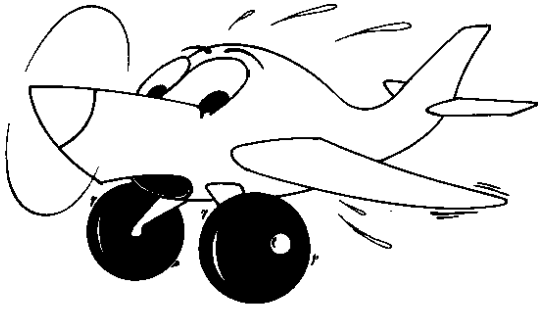
The recommended engine for the Patriot is a.40* - .46 cubic inch displacement **2-cycle.** *NOTE: Performance may be marginal if a non-schneurle-ported .40 cu.in. 2-cycle engine is used. The engine you select will determine how you build the fuselage, so it is important that you have the engine close 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.

The shape of the fuselage permits the use of standard mufflers without modification. For maximum speed, you may choose to install a **tuned pipe** instead of a normal muffler. On one of our prototypes, we did so, using a MACS Tuned Pipe #1040 and a MACS Header #2581 Long. In this installation the pipe was attached to the bottom of the wing using a MACS #9380 Pipe Mount. Because all radio gear is located aft in the fuselage, we suspect that some innovative modelers will experiment with enclosed tuned pipes.

This kit includes a Great Planes **MM40** engine mount **(or similar mount)** that fits most .40 - .46 (2-cycle) engines (slight modification of this mount is required to mount the OS40SF and OS46SF, by filing the inside edges of the engine mount beams). If the supplied mount does not 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" main wheels and a 1-3/4" or 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.

RETRACTABLE LANDING GEAR (optional)

NOTE: 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 (if you are prepared for the extra work involved in their installation).

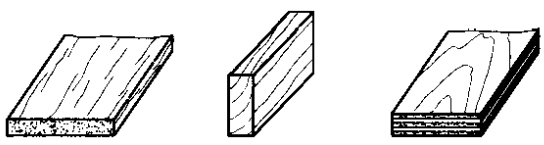
Because of space limitations in the nose of this airplane, we recommend only Hobbico Low-Profile 3-gear retracts (HCAP4000).

A standard servo may be used to actuate the nose gear retract; however, a "low profile" retract servo (such as the Futaba FP-S136G) is strongly recommended for the main gear retracts.

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)
"	=	Inches
Tri	=	Triangle

TYPES OF WOOD

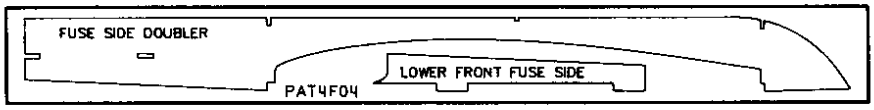


Balsa **Basswood** **Plywood**

DIE PATTERNS

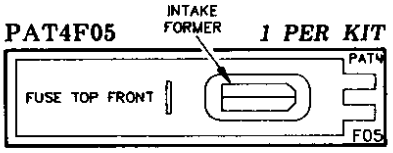
Use this drawing to identify the die-cut parts

PAT4F04 — *2 PER KIT*



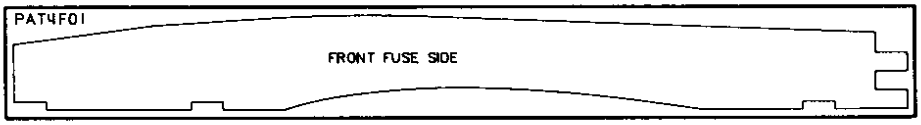
BALSA 1/8" x 3" x 27"

PAT4F05 — *1 PER KIT*



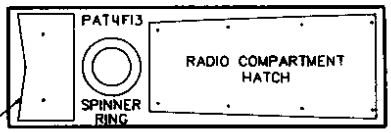
BALSA 3/32" x 3" x 11-7/8"

PAT4F01 — *2 PER KIT*



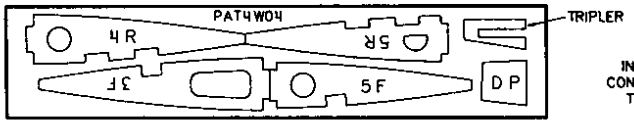
BALSA 1/8" x 3-1/2" x 28-1/2"

PAT4F13 — *1 PER KIT*



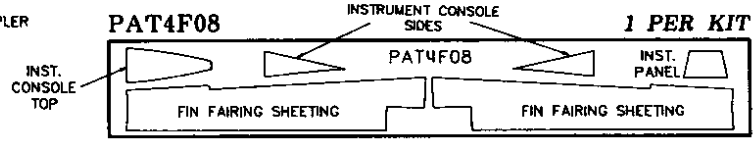
PLY 1/16" x 3-3/4" x 11-3/4"

PAT4W04 — *2 PER KIT*



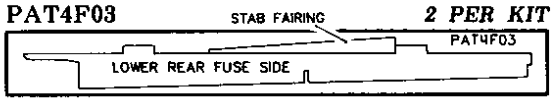
PLY 1/8" x 3-1/2" x 17"

PAT4F08 — *1 PER KIT*



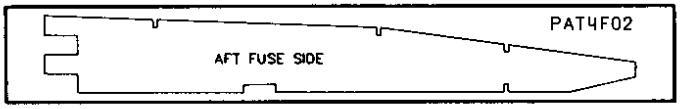
BALSA 1/16" x 3" x 20"

PAT4F03 — *2 PER KIT*



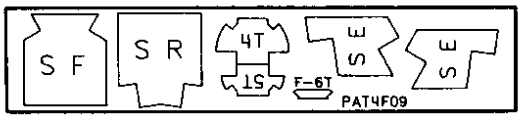
BALSA 1/8" x 2" x 17"

PAT4F02 — *2 PER KIT*



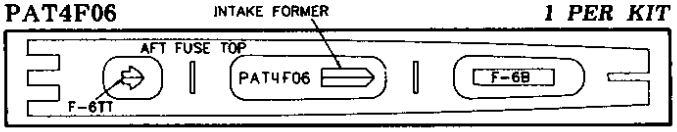
BALSA 1/8" x 3" x 20-7/8"

PAT4F09 — *1 PER KIT*



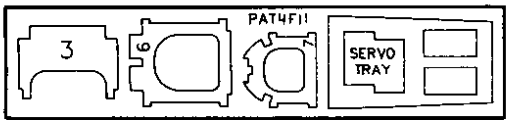
BALSA 1/8" x 3-1/4" x 16"

PAT4F06 — *1 PER KIT*



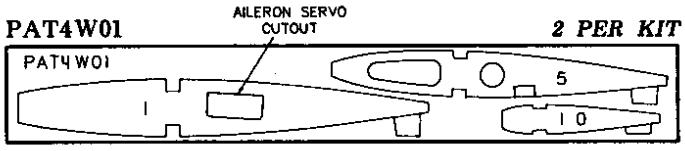
BALSA 3/32" x 3" x 20-3/4"

PAT4F11 — *1 PER KIT*



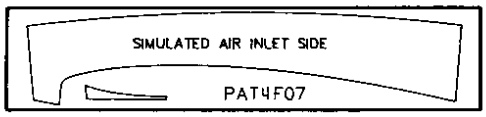
PLY 1/8" x 3-1/2" x 15-3/4"

PAT4W01 — *2 PER KIT*



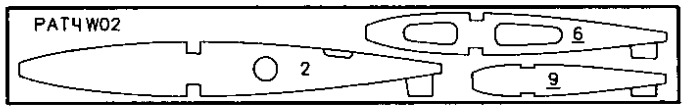
BALSA 3/32" x 3" x 21"

PAT4F07 — *2 PER KIT*



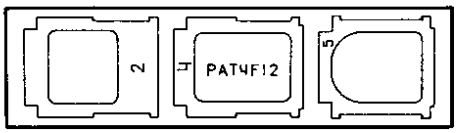
BALSA 1/16" x 3-1/4" x 14-7/8"

PAT4W02 — *2 PER KIT*



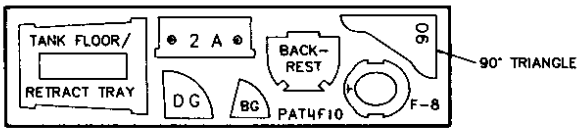
BALSA 3/32" x 3" x 21"

PAT4F12 — *1 PER KIT*



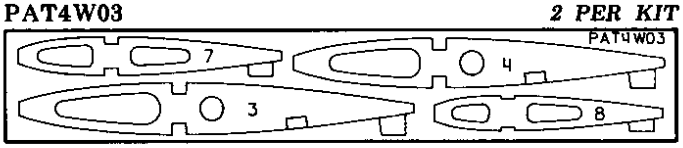
PLY 1/8" x 3-3/4" x 14"

PAT4F10 — *1 PER KIT*



PLY 1/8" x 3-3/4" x 14"

PAT4W03 — *2 PER KIT*



BALSA 3/32" x 3-1/2" x 21"

GET READY TO BUILD

☐ 1. Unroll the plan sheets. Re-roll the plans inside out to make them lie flat.

☐ 2. Remove all parts from the box. As you do, figure out the name of each part by comparing it with the plans and the parts list 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 patterns shown on page 6 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**.

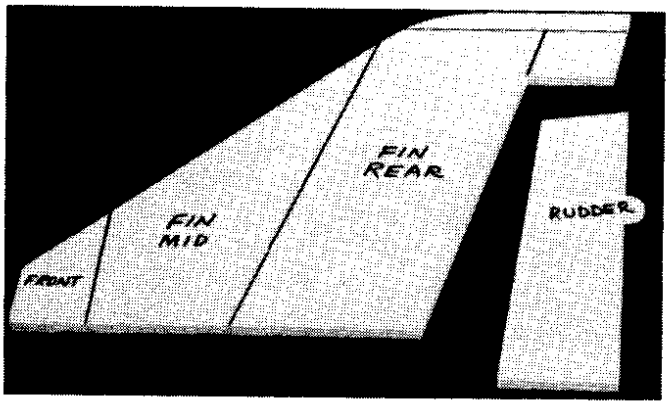
"TAIL FEATHERS"

BUILD THE FIN AND RUDDER

To build the fin and rudder you'll need the following:

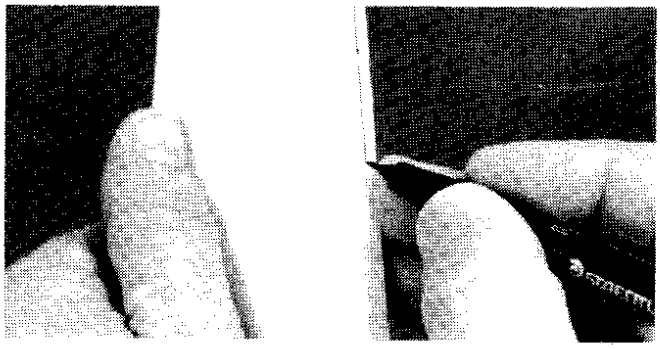
1/4" shaped balsa **fin front**
1/4" shaped balsa **fin mid**
1/4" shaped balsa **fin rear**
1/4" shaped balsa **rudder**
1/4" x 1/2" x 4-1/2" balsa stick

☐ 1. Tape the **fuselage plan** down to your flat work surface. Tape a piece of waxed paper over the fin and rudder portion of the plan.



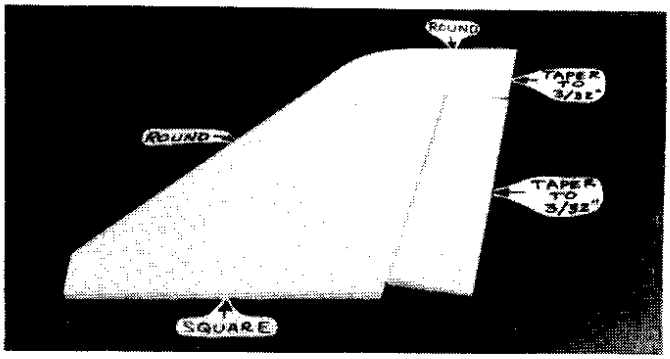
☐ 2. Working on a flat surface covered with waxed paper, glue the **fin front** to the **fin mid**. Glue the **fin rear** to the fin mid. Glue the 1/4" x 1/2" x 4-1/2" **fin tip** to the top edge of the fin rear. Finally, cut 1-3/8" off the top of the **rudder** and glue this piece to the fin rear and fin tip.

☐ 3. Trim the edges of the fin to match the plan, then use your T-bar with medium grit sandpaper to sand both sides of the fin smooth.



☐ 4. Carefully draw a **centerline** all around the edges of the fin and rudder (this will help to maintain symmetry when sanding).

☐ 5. 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.



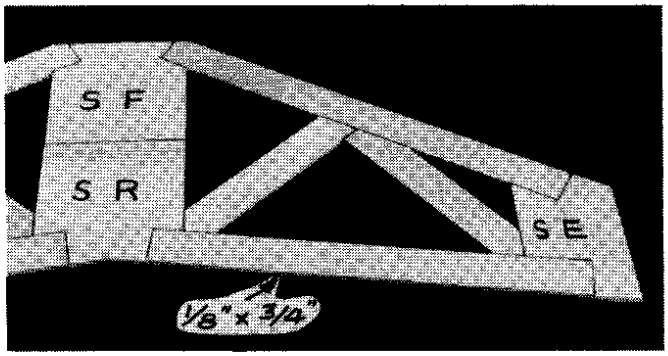
☐ 6. Sand the top and front edges of the fin to a rounded shape (see cross-section on plans). Sand the trailing edge of the fin (at the top of the rudder) to the same taper as the rudder.

BUILD THE STABILIZER AND ELEVATORS

To build the stab and elevators you'll need the following:

1/8" die-cut balsa **stab center front**
1/8" die-cut balsa **stab center rear**
1/8" die-cut balsa **stab ends**
1/8" x 3/4" x 30" balsa sticks
1/16" x 2-5/8" x 18" balsa sheets
Tapered balsa elevator stock
1/4" x 1" x 4-1/4" balsa **stab tips**

☐ 1. Tape the **fuselage plan** down to your flat work surface. Tape a piece of waxed paper over the stab and elevator portion of the plan.

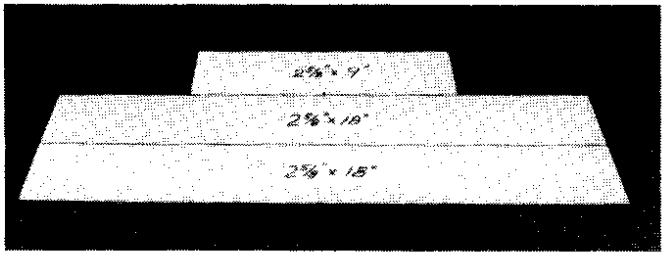


☐ 2. Pin the die-cut **stab center front, stab center rear** and the **stab ends** over the plan.

☐ 3. Using a razor saw, cut pieces of 1/8" x 3/4" balsa (from the 30" sticks) and glue them to the die-cut pieces to make the **stab framework.** Use thin CA glue at first, then follow with medium or thick CA.

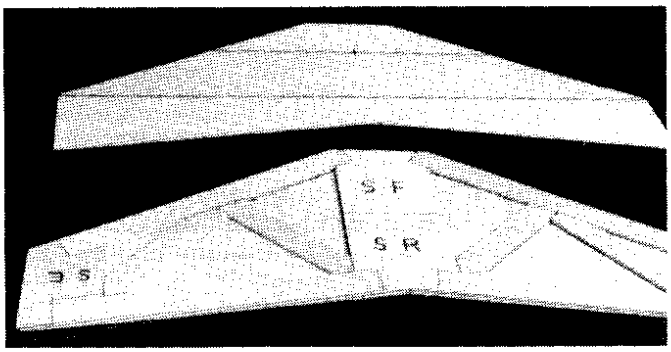
☐ 4. Examine the stab framework and add thick CA glue to any open joints, then use your T-bar with medium grit sandpaper to sand the stab framework smooth.

☐ 5. Cut one of the 1/16" x 2-5/8" x 18" balsa sheets in half, making two 9" lengths.



☐ 6. Edge glue two of the 1/16" x 2-5/8" x 18" balsa sheets together, then edge glue one of the 9" pieces, to the above pair, centering it so there is an equal amount on both ends. Lay the stab framework on the sheeting and mark the outline. Sand this sheeting smooth **before** gluing to the stab framework.

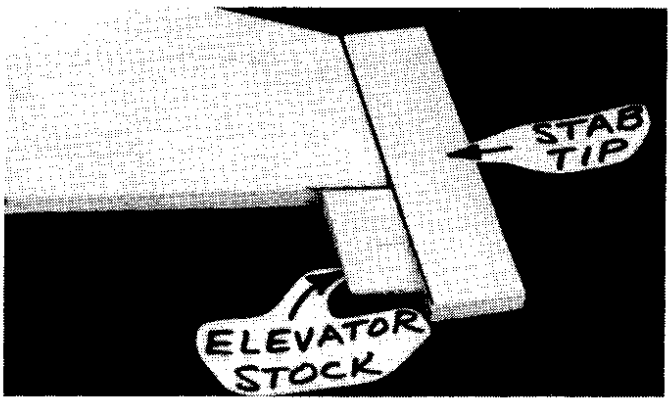
IMPORTANT NOTE: It is essential to get a very good glue bond between the stab framework and the sheeting!



☐ 7. **Securely** glue the 1/16" balsa sheeting to the **top** and **bottom** of the stab framework.

☐ 8.Trim and sand the edges of the sheeting flush with the perimeter of the stab framework.

☐ 9. Carefully draw a **centerline** all around the edges of the stab (this will help to maintain symmetry when sanding).



☐ 10. Glue the 1/4" x 1" x 4-1/4" balsa stab tips to the ends of the stab, then cut two pieces from the tapered elevator stock as shown on the plans, and glue these pieces to the stab and

stab tips. **NOTE**: When gluing the tapered pieces, make sure they are positioned with an equal amount of taper on the top and bottom.

☐ 11. Trim and sand the perimeter of the stab to match the plan. Sand the stab tips to match the taper of the elevator end pieces, but **do not sand the TE to a sharp edge**, as they would be too easily damaged. Now sand the leading edge and tips to a rounded shape as shown on the stab cross-section on the plan. **NOTE**: Leave the trailing edge and the center portion of the leading edge square.

☐ 12. Cut the remaining tapered elevator stock in half and trim the ends to match the plan. Sand the leading edge of the elevators to a "V"-shape as shown on the plan.

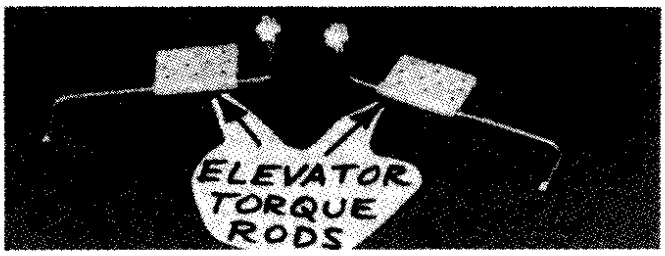
TEMPORARILY INSTALL HINGES AND TORQUE RODS

☐ 1. Using the plans as a guide, mark the hinge locations on the stab, elevators, fin and rudder.

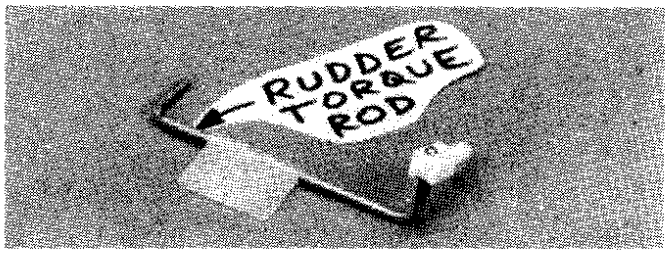
NOTE: There are many types of good hinges on the market, and everyone has their personal preferences; therefore, hinges have not been included in this kit. The current favorite for many modelers is the type of laminated hinge that permits hinge slotting with an Xacto knife, and gluing with thin CA adhesive.

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 while performing this step.

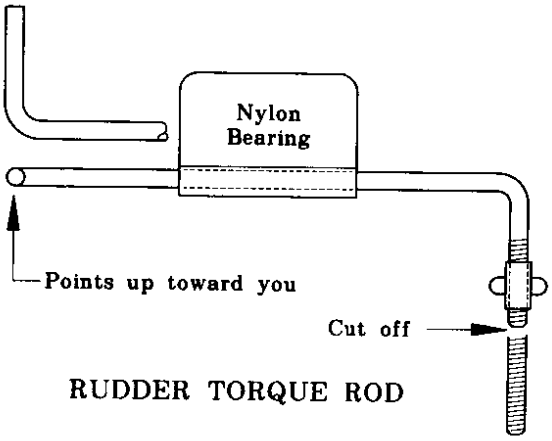
☐ 2. Cut the hinge slots and temporarily install the elevator and rudder hinges.



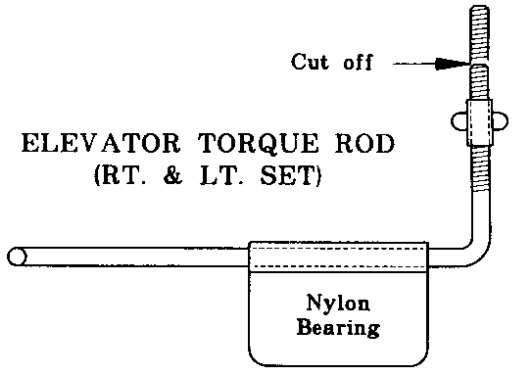
☐ 3. Prepare the torque rods by cutting off part of the threaded portions as shown in the sketches. Screw the nylon swivel onto the rudder torque rod. Screw the nylon swivels



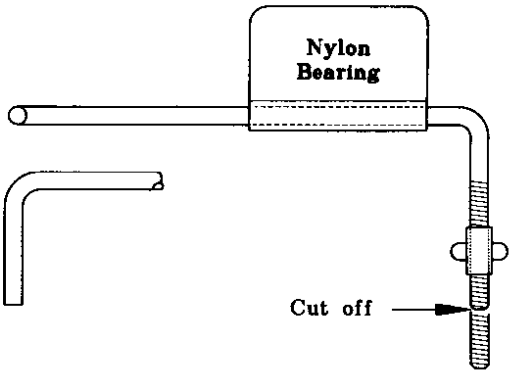
onto the elevator torque rods. **NOTE:** The rudder torque rod swivel must be loose enough to swivel freely; therefore, we recommend that you **cut threads** in the hole in the nylon rudder swivel using a **4-40 tap**.



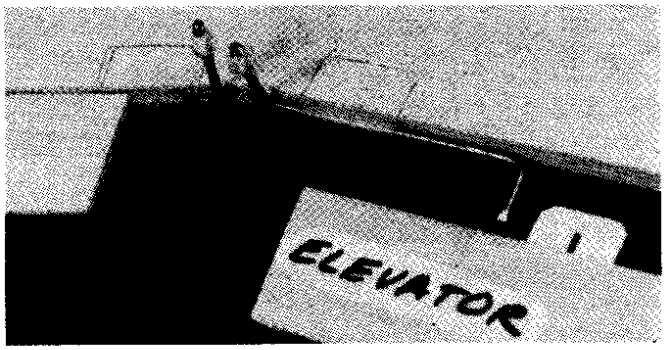
RUDDER TORQUE ROD

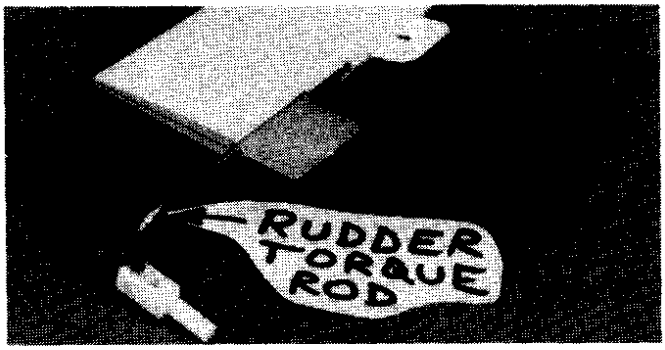


ELEVATOR TORQUE ROD
(RT. & LT. SET)

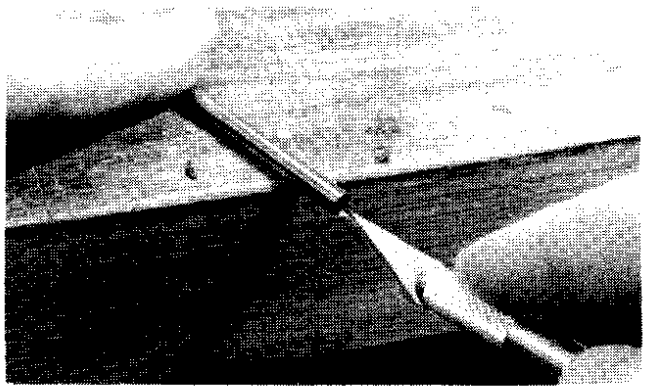


☐ 4. Check the plans and mark the location of the torque rods on the rudder and elevators. Drill 7/64" holes in the rudder and elevators (the holes are drilled slightly oversize to allow for positioning, and to create a hard epoxy "sleeve"





around the wire). Then **groove** the rudder and elevator leading edge to accept the torque rod wires and nylon bearings.



HINT: Using an Xacto 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 rudder and elevator.

☐ 5. Determine the torque rod bearing locations from the plan, then use a hinge slotting tool to cut the slots in the stab and fin for the nylon torque rod bearings.

☐ 6. Trial fit all these parts together, then set them aside until later. **Do not glue!**

WING

NOTE: The following instructions explain how to build the wing on a flat surface, directly on the plans. Because this wing has a lot of taper and sweep, it is not advisable to build this wing on a Wing Jig.

PREPARE WING PARTS

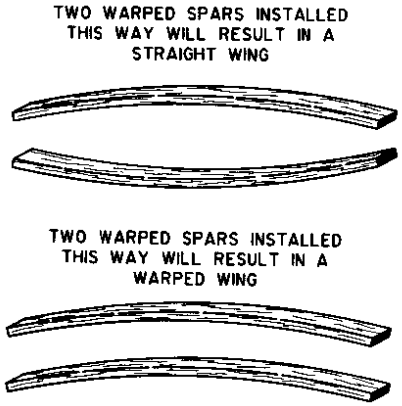
Before assembling the wing, there are several preliminary assemblies that must be made...

SPARS

Parts needed:

1/8" x 3/8" x 24-1/2" balsa **long spar**
1/8" x 3/8" x 17-3/4" balsa **medium spar**
1/8" x 3/8" x 8-3/4" balsa **short spar**

☐ 1. Before using the 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). **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.



☐ 2. Sand one end of each of the medium and short spars to a 2" taper as shown in the **"Wing Spar Detail"** on the plan.

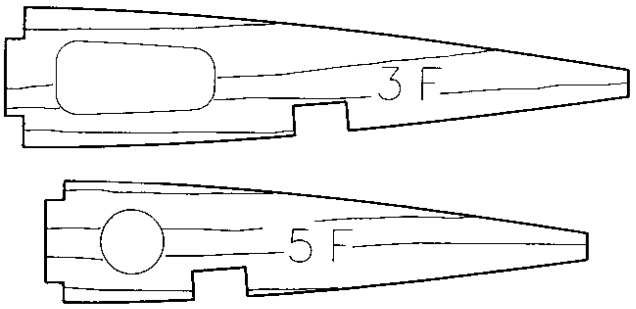
☐ 3. Glue the medium spars to the long spars, and glue the short spars to the medium spars, as shown in the "Wing Spar Detail."

RIB DOUBLERS (Fixed Landing Gear)
(Skip steps 1-3 if you will be installing retracts)

☐ 1. Note that the wing plan shows the location of the main landing gear blocks. Note also that Ribs W-3, W-4 and W-5 have **partial cutouts** for the grooved landing gear block. If you are building your plane with a fixed (not retractable) landing gear, finish cutting out the notches in these ribs.

☐ 2. Identify the die-cut 1/8" ply **landing gear doublers for fixed gear**, using the following sketch.

1/8" PLY RIB DOUBLERS FOR FIXED GEAR

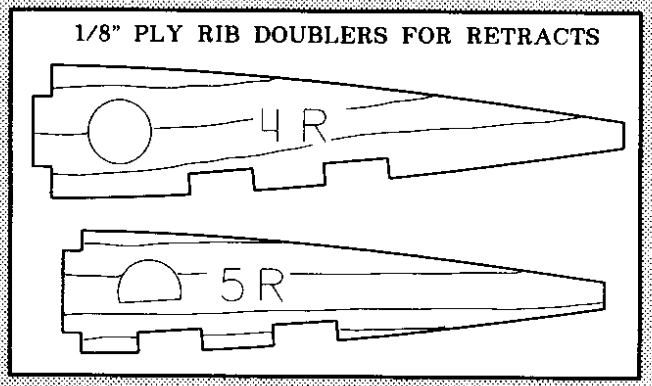


☐ 3. Glue the die-cut 1/8" ply landing gear doublers to ribs W-3 and W-5 (for fixed gear only). **NOTE: Make a RIGHT and a LEFT set, gluing the doublers to the inboard side of the ribs.**

RIB DOUBLERS (Optional Retractable Landing Gear)

☐ 1. Identify the die-cut 1/8" ply **landing gear doublers for retracts**, using the following sketch.

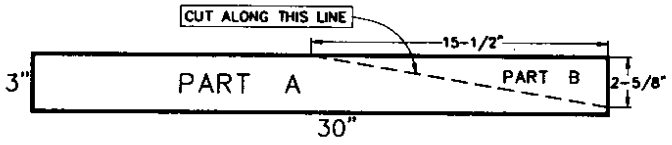
1/8" PLY RIB DOUBLERS FOR RETRACTS



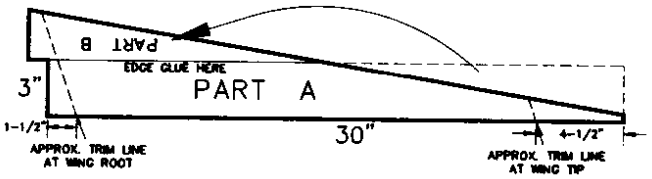
☐ 2. Glue the die-cut 1/8" ply landing gear doublers to ribs W-4 and W-5 (for retractable landing gear only). **NOTE: Make a RIGHT and a LEFT set, gluing the doublers to the outboard side of W-4** (toward the tip), **and the inboard side of W-5.**

LEADING EDGE SHEETING

☐ 1. Prepare the **leading edge sheeting** by trimming the four 3/32" x 3" x 30" balsa sheets as shown in the following sketch. HINT: Use an Xacto knife and cut a straight line using a metal straightedge.



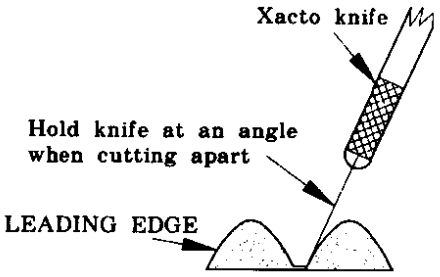
☐ 2. Then flip the small trimmed-off portion and edge glue it to the large portion as shown in the following sketch.



☐ 3. Sand the glue joints smooth with a sanding block.

LEADING & TRAILING EDGES

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



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.

An alternate method which we have found to work very well for construction of this wing is briefly outlined here, in the event that you want to give this method a try:

A. Cut out the right and left wing panels from the plan.

B. Spray the **back** of the right wing panel plan with a light mist of **3M "77" Spray Adhesive.** Allow to dry for a few minutes, then press the plan down onto your flat work surface.

C. Tear off a 12" x 29" piece of **waxed paper**, spray one side lightly with 3M "77", allow to dry for a few minutes, then press the waxed paper (adhesive side down) over the plan. Tape the corners down with masking tape, for additional security.

D. Spray a light mist of 3M "77" onto the waxed paper along the spar and along the trailing edge sheeting area. Allow to dry for at least 5 minutes.

E. Press the spar and ribs in place. They will be held in place by the spray adhesive. (A drop of CA will hold the tabs down a little more securely).

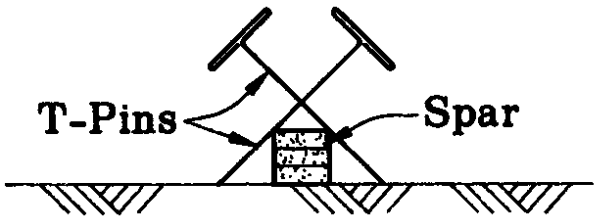
F. When applying the leading edge sheeting, prevent the trailing edge tabs from lifting from the plan by applying weights along the trailing edge.

G. When it is time to flip the wing over, gently and slowly lift the wing panel from the waxed paper, working from one end. If the spar is stubborn to release, carefully work a thin strip of metal between the spar and waxed paper.

NOTE: You should also be aware of the following... This wing is constructed with 1/2-degree of **washout** 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 apply the bottom sheeting, you will support the trailing edge with the supplied "trailing edge jig," which will continue to hold the wing at the proper twist.

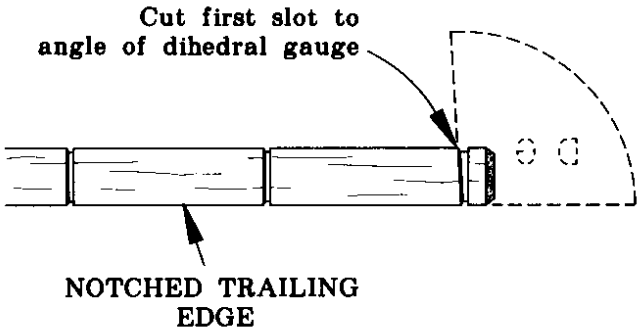
☐☐1. Tape the right (or left) wing panel plan to your flat work surface, and cover the wing drawing with waxed paper (so you won't glue the wing to the plan!). **NOTE:** If your work space is limited, you may cut the left and right wing half drawings apart.

☐☐2. 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 retracts, cut out the small notch in the top of the W-2 ribs, which are clearance slots for the retract pushrods.



☐☐3. Cross-pin one of the spars to the plan with the long spar down, and with the thick end (3 laminations) 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.

☐☐4. Place the ribs on the spar in their approximate position, but do not glue. A die-cut 90-degree triangle is provided to aid in setting up the ribs vertically. **NOTE:** Make sure ribs W-3 and W-4 are installed with the LG notches **down**. It will probably be necessary to bevel the spar notches in the ribs that have landing gear doublers attached (but sand only the ply doublers, not the balsa ribs).



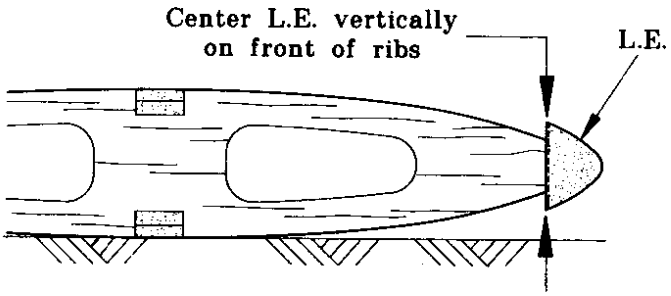
☐☐5. Examine the shaped, notched balsa **trailing edges**. Notice that the notches at one end of each TE are only 1-1/2" apart. These are the notches for W-1 and W-2. Also notice that all notches in the TE are **vertical**; however, rib W-1 will be installed at a slight angle using the Dihedral Gauge. 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 TE as shown above.

☐☐6. Insert the rear ends of the ribs into the notches in the **TE**.

☐☐7. Glue ribs W-2 through W-10 to the TE with thin CA.

☐☐8. Insert the front ends of ribs W-2 through W-10 into the notches in the **LE**. **NOTE:** Position the LE as shown in

the following sketch. **NOTE:** Because of the angle of the leading edge, it is not possible to fully insert the ribs into the LE notches; therefore, these notches are to be used only as a positioning aid. It will be helpful to block up one end of the LE while positioning the other end.



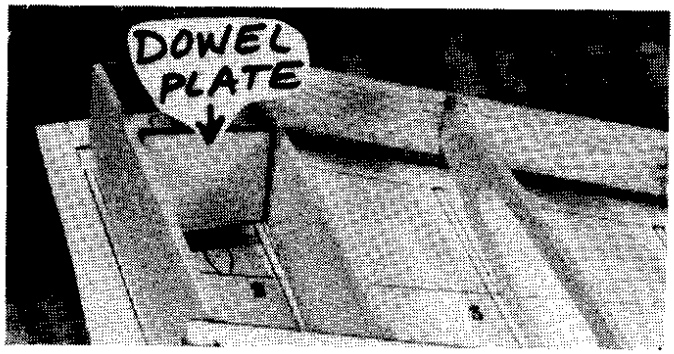
☐☐9. Make sure the ribs are fully down on the plan and ribs 2 - 10 are located in the LE notches. Glue ribs 2 - 10 to the LE and bottom spar. Angle rib W-1 slightly using the **dihedral gauge (DG)**. Glue W-1 to the TE and bottom spar. **NOTE:** Thin CA glue may be used in tight-fitting joints, but to insure strong joints we recommend that you follow up by also applying medium or thick CA to all joints.

☐☐10. Glue the **top spar** in place (with the long spar facing up), making sure you do not change the angle of W-1.

IMPORTANT: 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.

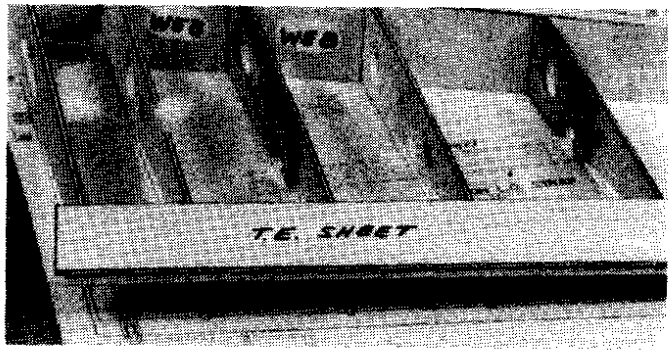
☐☐11. Glue the pre-cut 1/16" balsa vertical grain **shear webs** to the rear edge of the spars in all rib bays **except between ribs W-1 and W-2. NOTE:** You may wish to trial fit, mark, and trim each web before gluing in. **NOTE:** The

webs must be securely glued to the spars,



☐☐12. Securely glue the die-cut 1/8" ply **dowel plate (DP)** between W-1 and W-2. The dowel plate is located approximately 1-5/8" behind the front of rib W-1. **NOTE:** You may have to trim the dowel plate slightly for a perfect fit between the ribs, and to avoid bending W-1.

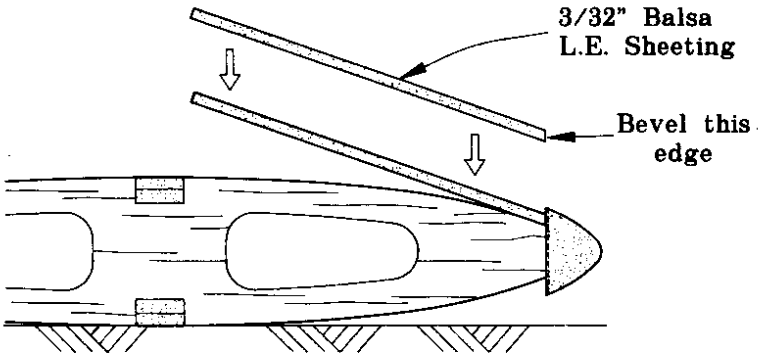
NOTE: In the next steps, maintain straightness by keeping the jig tabs and spar down on the flat surface.



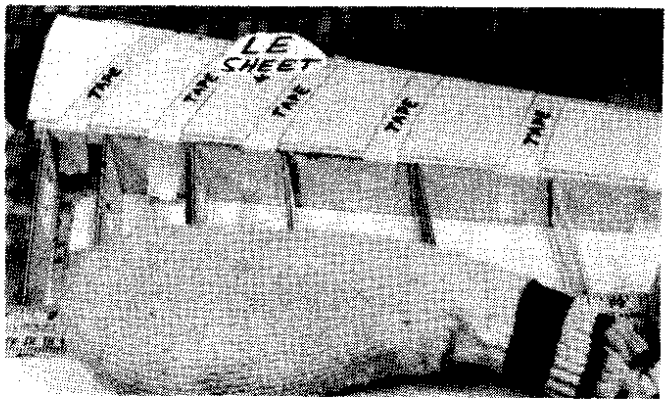
☐☐13. Lightly sand the tops of the ribs to blend with the notched trailing edge; then glue one of the 3/32" x 1-3/8" x 24" balsa **trailing edge sheets** in place. **NOTE:** The edge of the TE sheet may not be exactly straight, but just position the sheet so it slightly overlaps past the TE, and any overlap can be sanded off later.

☐☐14. 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.

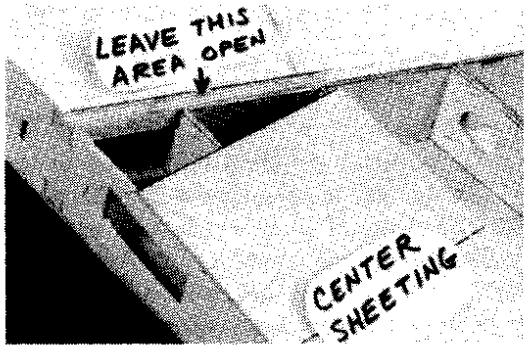
☐☐15. Prepare the 3/32" balsa **leading edge sheeting** by sanding the front edge to a slight bevel so it will fit snugly against the back of the leading edge. Trial fit before proceeding. Position the sheeting left or right until the aft edge of the sheeting is approximately in the middle of the spar, then cut off the excess sheeting on the ends, leaving approx. 1/4" extra to allow for positioning. (The sketch on p.11 shows the approximate sheeting trim lines).



NOTE: It will be helpful to have the following items handy for the next step... thin CA, thick (slow cure) CA, a wet cloth and twelve 8-inch strips of masking tape. Read through the following step and go through a "dry run" before actually gluing.

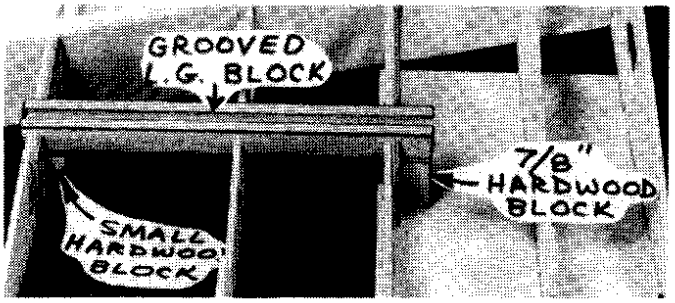


☐☐16. Apply thick CA glue to the top edge of the ribs and to the front half of the spar. Working quickly, position the leading edge sheeting at the rear edge of the notched LE. Using thin CA, glue the front (beveled) edge of the leading edge sheeting to the back edge of the leading edge. Now wet the top surface of the sheeting so it will bend easier. Then immediately bend the sheeting down onto the ribs and spar. Hold the sheeting down with long strips of masking tape until the glue has set. Do not press the sheeting down with a lot of pressure of your hands, as this will tend to lift the TE and twist the wing.



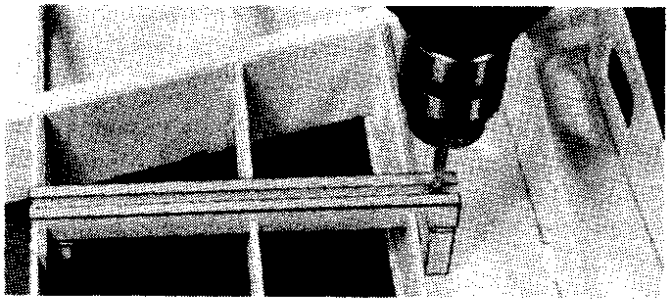
☐☐17. Using the 3/32" x 3" x 3-7/8" balsa sheets, cut and glue the top **center section sheeting** in place as shown on the plan, **but you must leave the top open for approximately 1-1/2" behind the spar to allow later installation of the center brace.**

NOTE: If you are installing retracts, disregard steps 18 through 22.

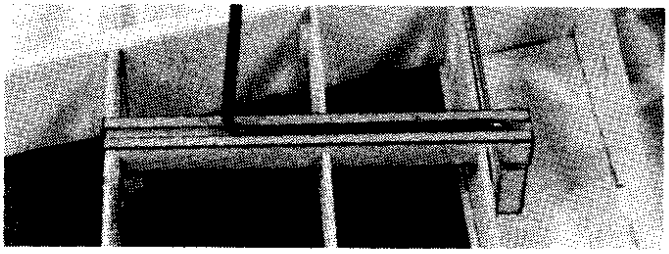


☐☐18. Remove the wing from the building board and trial fit the long grooved hardwood **LG block** into the notches in ribs W-3, W-4 and W-5 (see the landing gear detail drawing on the wing plan for proper positioning). File the notches if necessary for a good fit. Now use epoxy to securely glue the block in place. **NOTE:** The block should protrude 3/32" past the edge of the ribs.

☐☐19. Epoxy the 7/16" x 5/8" x 7/8" **hardwood block** to the LG block and to the 1/8" ply doubler on rib W-3, 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 1/8" ply doubler on rib W-5.



☐☐ 20. Drill a 5/32" hole 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, but try not to drill through the top sheeting.



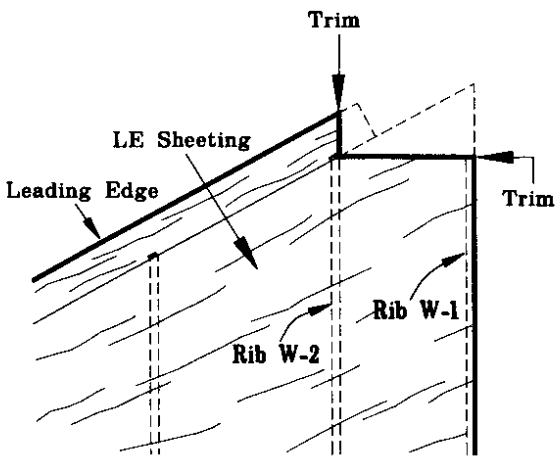
☐☐ 21. Trial fit the 5/32" diameter **main landing gear wire** into the landing gear block at this time. Cut or file the groove and hole in the landing gear block as necessary for a good fit.

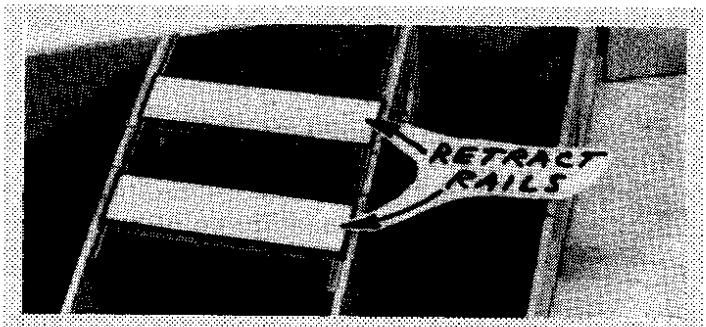
☐☐ 22. Now double check to make sure the 1/8" ply landing gear doublers have been **securely** glued to the spars.

Perform steps 23 and 24 regardless of the landing gear type you are using.

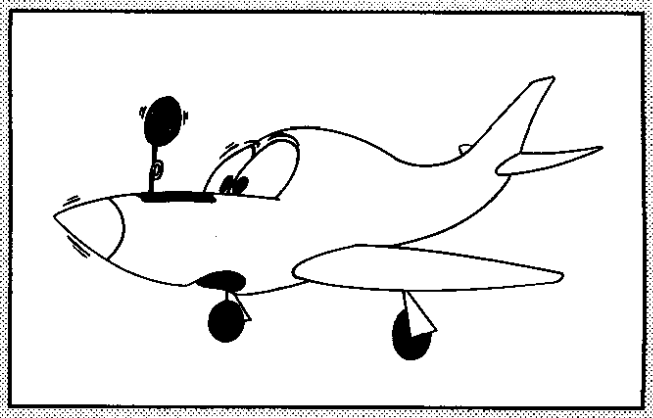
☐☐ 23. Cut and sand off the **jig tabs** on the bottom of the ribs. The cut lines must blend with the edge of the ribs.

☐☐ 24. Using a razor saw and a sanding block, carefully cut off and sand all excess sheeting, spars, LE and TE even with W-1 and W-10. Cut off the leading edge flush with the inboard side of W-2, and cut the LE sheeting on a straight line from the front of W-1 to the front of W-2 as shown in the sketch. (Also see the photo at step 27, page 16).





NOTE: If you will be installing retracts, now is the time to install the 1/4" x 3/4" x 2-3/4" ply **retract mounting rails** with epoxy on the bottom of the wing in the slots in the 1/8" ply doublers on ribs W-4 and W-5, as shown on the plan. **Installing retracts requires careful planning and a lot of trial fitting**, customizing the installation as necessary to accommodate your retracts; therefore, you should take the time now to plan out your installation.

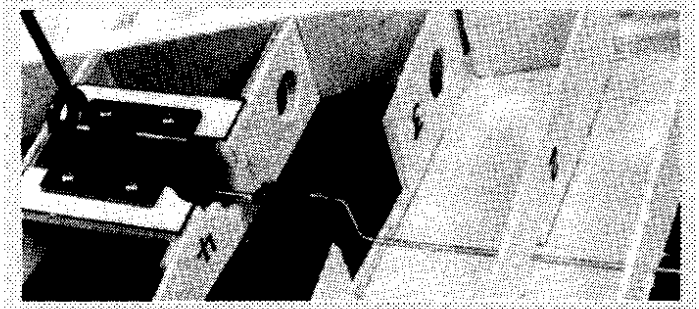


Here are some typical tasks you must perform when installing retracts:

NOTE: All photos in this book show installation of the Hobbico Low-Profile mechanical retracts.

☐ A. If you have not already done so, glue in the 1/8" ply rib doublers to reinforce ribs W-4 and W-5 where retracts are to be installed.

☐ B. Trial fit the retract unit to determine the mounting location and angles. Cut away the ribs as necessary for clearance.

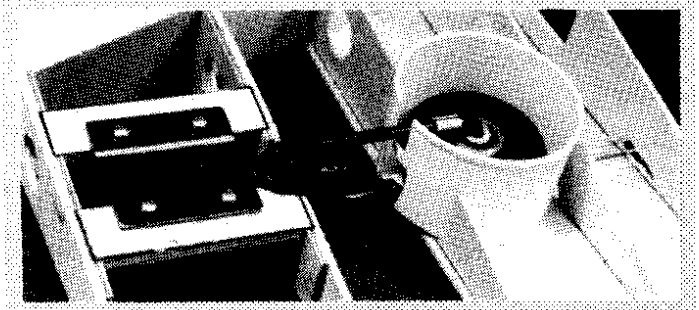


☐ C. If not already done, glue in 1/4" ply retract mounting rails using epoxy.

☐ D. Trim the rails as necessary to fit your retracts.

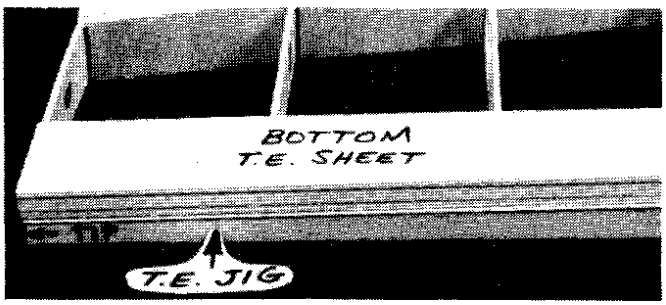
☐ E. Install pushrod and guide tube just under the top sheeting.

☐ F. Install retract unit and check operation.



☐ G. Make wheel well from the cover of a spray paint can (for 2" diameter wheels), or from some other suitable plastic cup, etc.

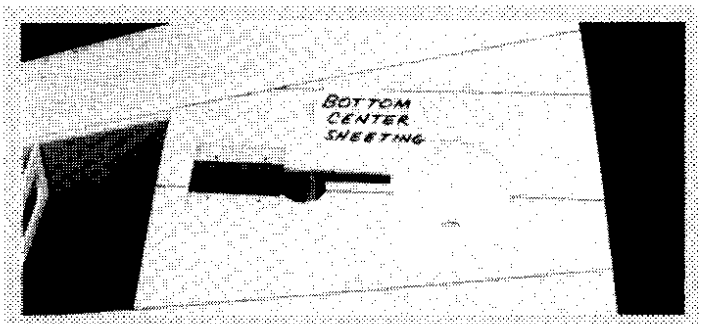
☐ H. Sheet bottom of wing, taking note where sheeting will be cut away for retract.



☐☐25. With the wing upside down, use the **TE Jig** to support the TE (**the narrow end of the TE Jig must be at the wing tip**). 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!

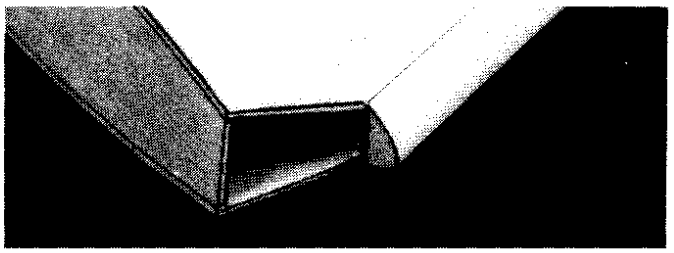
*As you apply the bottom center section sheeting (from 3/32" x 3" x 8-7/8" balsa sheets), remember to mark the sheeting in the exact areas of the retract mechanism, LG wire, and wheel well locations, so you can easily find and trim the sheeting from these areas later.



(Retracts): Trim away the sheeting in the area of the retract and wheel well.

NOTE ON RETRACTS: Additional instructions and photos covering installation of retracts will be found at the end of the Wing section, on page 22

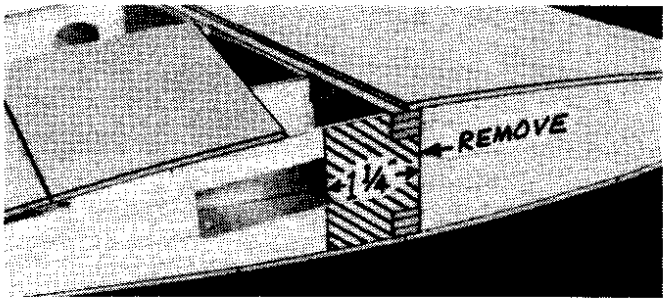
☐☐26. From the 3/32" x 3/8" x 30" balsa sticks, cut and glue **cap strips** to all exposed ribs, top and bottom. **HINT:** For easier positioning of the cap strips, first mark the location of each rib on the LE and TE sheeting.

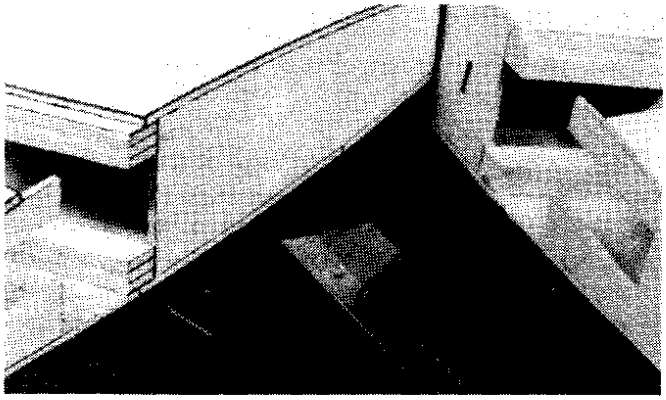


☐☐27. Trim the sheeting flush with ribs W-1 and W-10 and sand the entire wing panel smooth. Sand the leading edge to smoothly blend with the LE sheeting. **NOTE:** The leading edge has been approximately pre-shaped, but we recommend that you cut out the **Leading Edge Template** (on the plan), and use it as a guide when sanding the leading edge to final shape. **To avoid tip stalls, make sure the leading edges of both wing panels have the same shape.**

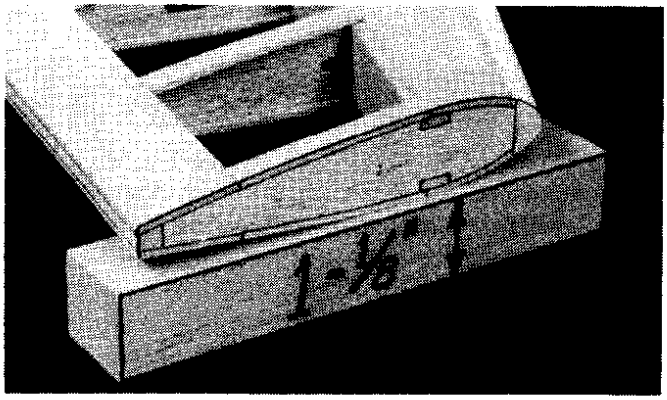
☐ 28. Now go back and repeat Steps 1 through 27 to build the **left** wing panel.

JOIN THE WING PANELS





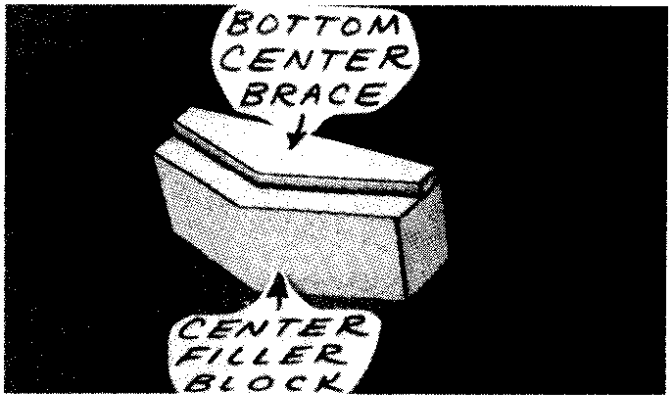
☐ 1. Using an Xacto knife and razor saw, carefully cut away part of the W-1 wing ribs to allow installation of the center wing braces. This cutout begins at the front of the spars and runs 1-1/4" aft, as shown in the photo. Carefully trim and sand off any remaining glue residue.

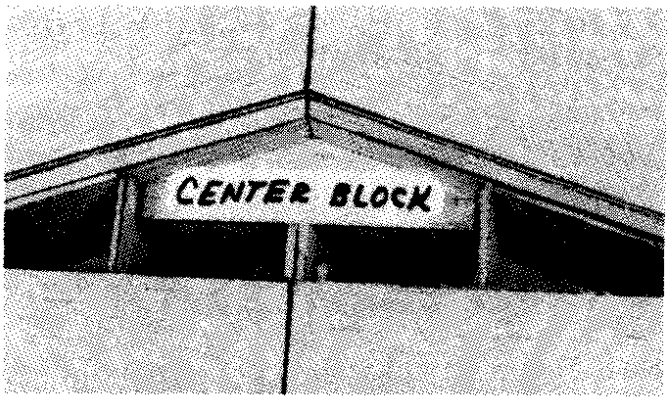


☐ 2. Lay a piece of waxed paper down and place the two wing panels, **right side up**, so that the W-1 ribs are together. Use the wing tip blocks to block up **both** wing tips **1-1/8 inch**. Sand the wing panels at the center so they will fit together without a gap.

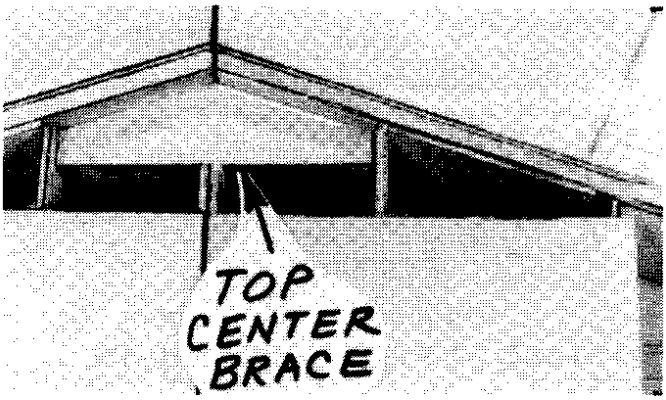
☐ 3. Trial fit and sand the balsa **center filler block** until it fits between the spars.

☐ 4. Securely glue one of the 1/8" birch plywood **center braces** to the **bottom** of the center filler block. The aft edge of the center brace lines up with the aft edge of the filler block.





☐ 5. Trial fit the center brace and block assembly into the wing center section (with the wing tips blocked up 1-1/8"). To bring the wing halves together it will probably be necessary to sand the ends of the center block at a slight angle. **Do not glue yet!**



☐ 6. With the center block in place, trial fit the **top** 1/8" birch ply center brace on top of the center block and against the aft edge of the spars. It will be necessary to trim the ends of this brace to fit between the W-2 ribs.

NOTE: Read steps 7 through 9, then make a "dry run," practicing these steps before actually proceeding.

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

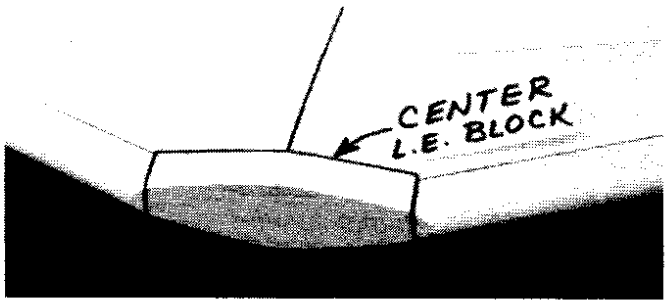
☐ 7. Working on waxed paper, mix up a batch of **30-minute** epoxy and smear some on the spars, spar ends, and on the contact surfaces of the center block and brace. Slide the center block and brace in place, push the wing panels together and **immediately proceed to the next step.**

☐ 8. 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. IMMEDIATELY PROCEED TO THE NEXT STEP.**

☐ 9. Smear additional epoxy on the top of the center block and the aft edge of the top spars, then press the top center brace in place. Allow the epoxy to fully harden before disturbing the wing.

☐ 10. Finish sheeting the top center section with 3/32" balsa.

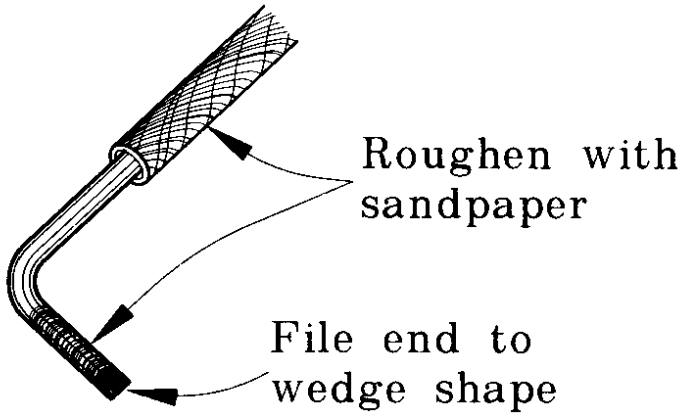
☐ 11. Sand the wing joint smooth all around.



☐ 12. Sand the 1/2" x 1-1/4" x 3-1/4" balsa **center LE block** to fit in the opening in the front of the wing. Glue the block in place, and sand to blend with the top and bottom of the wing.

INSTALL AILERON TORQUE RODS

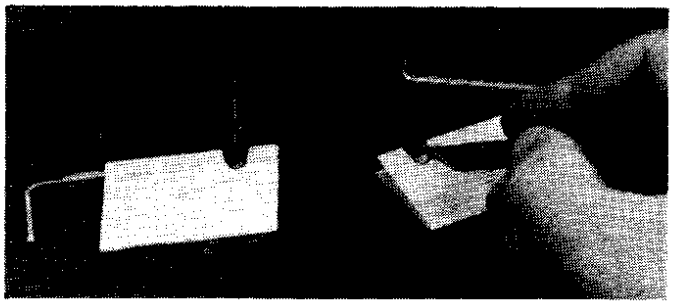
☐ 1. Roughen the short end of the **aileron torque rods** with 100-grit sandpaper, and file the same end to a wedge shape. See the sketch at the top of the next column.



☐ 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.

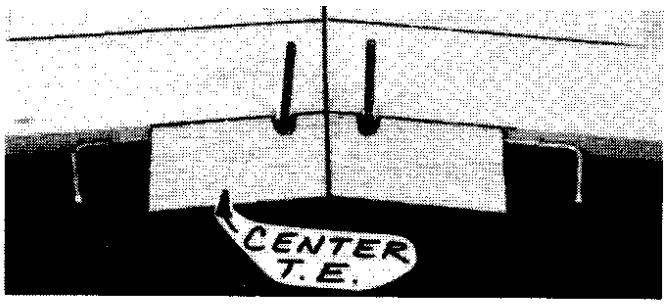


☐ 5. Trial fit the torque rods into the center TE pieces. Determine from the plan where to cut the clearance notches which will permit the torque rod horns to travel freely. Also cut small clearance notches in the wing TE. **Note: The torque rod horns must exit the TOP of the wing!**

☐ 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 pieces in place with epoxy. **HINT:** Use masking tape to hold these



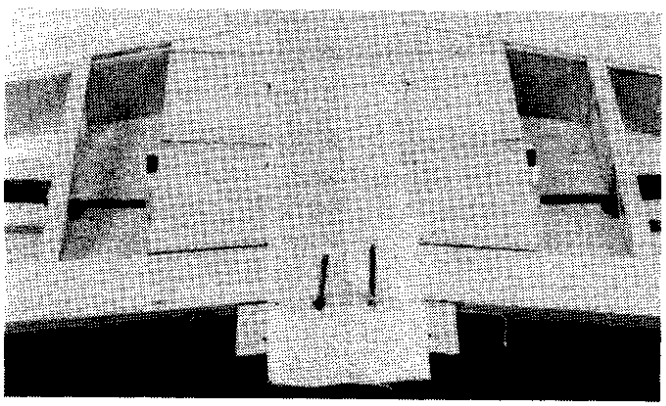
pieces to the wing TE, to aid in positioning them. **They must line up with the top and bottom surfaces of the wing and not be tilted up or down.**

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, 1-1/2" each way from the wing centerline. Cut the 3" x 34" strip of glass cloth in half, making two strips approx. 17" long.



☐ 2. **Trial fit** the 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. Spray a **very light mist** of 3M "77" Spray Adhesive on one side of a strip of fiberglass cloth. **Hold the spray can <u>at least</u> 12" away from the cloth** when doing this to avoid a heavy buildup. The purpose of this is **only** to give the cloth a little "tackiness". If you apply too much spray it could result in a poor glue bond. Allow the spray to dry for a few minutes before proceeding to Step 4.

☐ 4. Beginning at the trailing edge, lay the glass cloth 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. Wrap the glass cloth down over the center leading edge. Do not attempt to wrap the glass cloth around the trailing edge.

☐ 5. 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!**

☐ 6. 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.

☐ 7. To make sure the glass cloth is fully "wetted out" and bonded to the balsa, you may apply more thin or medium CA, a few drops at a time, and spread it out with a piece of waxed paper.

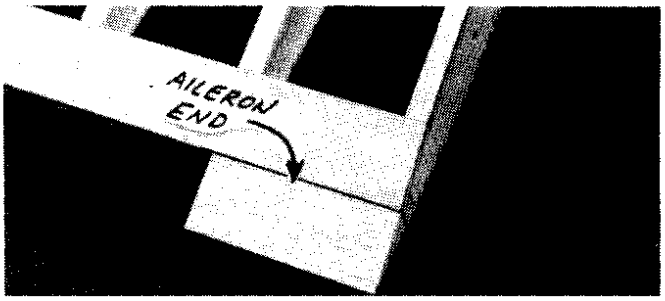
☐ 8. After the glue has set, trim the excess cloth at the trailing edge with a sharp Xacto knife followed by a sanding block.

☐ 9. Repeat the process for the other side of the wing.

☐ 10. Carefully feather out the **edges** of the glass cloth with a T-bar sander with 80 or 100-grit sandpaper to blend smoothly with the sheeting. 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 safety goggles and a dust mask to avoid breathing airborne glass fibers.**

INSTALL AILERON ENDS

☐ 1. Using the plan as a guide, cut off a portion of each tapered balsa **aileron** approximately 3" long. Cut these pieces on an angle as shown on the plan.



☐ 2. Use a piece of masking tape to hold these pieces against the trailing edge, near the tip, and check their alignment carefully. **It is essential that these pieces line up with the top and bottom surfaces of the wing following the airfoil contour!**

☐ 3. When you have these tapered pieces positioned correctly, secure them to the trailing edge with thin CA. Remove the tape and add medium or thick CA to fill any gaps.

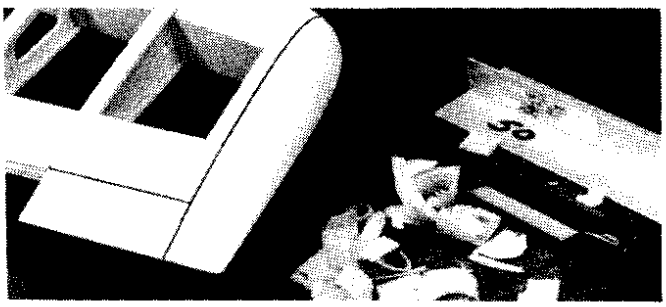
☐ 4. Sand the tapered aileron ends to blend with the top and bottom surfaces of the wing, and flush with rib W-10.

INSTALL WING TIPS

NOTE: The **wing tips** will be carved from the 1-1/8" x 1-1/4" x 6-7/8" balsa blocks.

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

☐ 2. Securely glue the wing tip blocks to the left and right wing tips, lining up the centerlines you previously drew. **REMINDER:** The aft edge of the wing tip block must be approximately 3/16" behind the TE, to allow for wing sweep.



☐ 3. Cut, carve and sand the wing tips to the appropriate shape as shown on the plan. Blend the tips with the top and bottom surfaces of the wing, and with the tapered TE. **HINT:** Use 50-grit sandpaper and a razor plane to speed up this operation. **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.

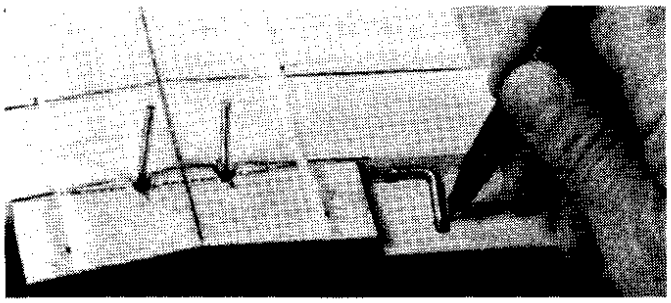
☐ 4. When you have finished final shaping the wing tip, apply a few drops of thin CA to harden the tip at the trailing edge.

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 **ailerons** 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.



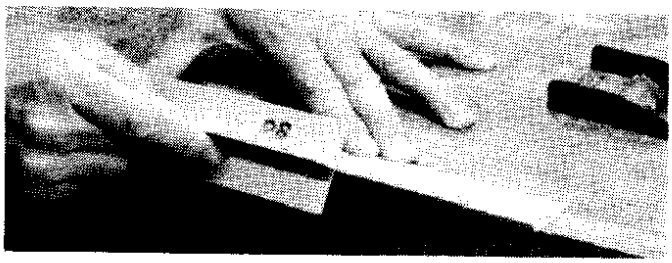
☐ 3. Lay the ailerons in place in the openings, with the torque rods resting on top of the ailerons. **Mark the torque rod locations on the top of the ailerons.**

☐ 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 oversize 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. Trial fit the ailerons onto the torque rods and cut or file the groove as necessary until they fit.

☐ 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.

☐ 7. Cut the hinge slots in the ailerons and wing TE using an Xacto knife following the procedure and cautions on page 9.

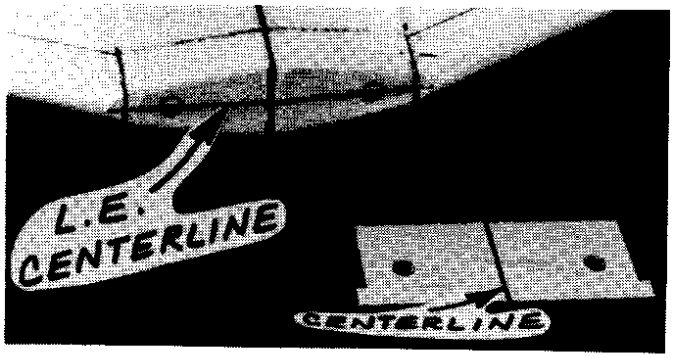


☐ 8. Sand the leading edge of the ailerons to the same **"V"-shape** as shown on the wing rib detail drawing.

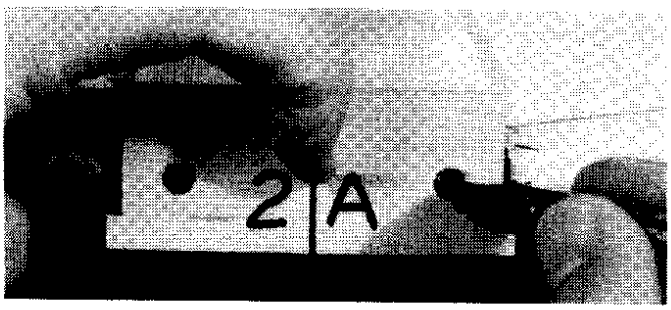
☐ 9. Insert the hinges into the slots and trial fit the ailerons in place on the wing. **Do not glue the hinges until after you have covered the wing.**

There should be no hinge gap!

TEMPORARILY INSTALL WING DOWELS



☐ 1. Mark a **horizontal centerline** on the wing center LE block. Also mark a vertical centerline on the die-cut 1/8" ply former **F-2A**.

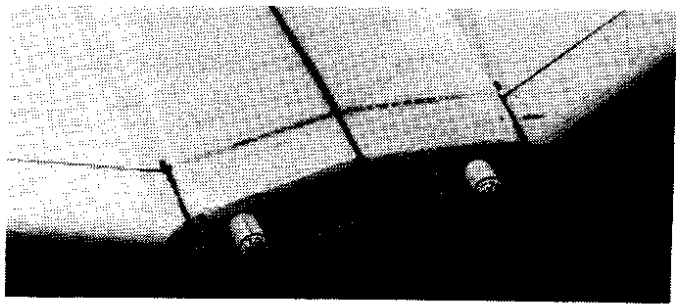


☐ 2. Holding the die-cut 1/8" balsa **F-2A** on the leading edge, in the exact center of the wing, mark the dowel locations through the holes in F-2A.

☐ 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 at least **2-1/4"** into the wing to penetrate the inner dowel plates.

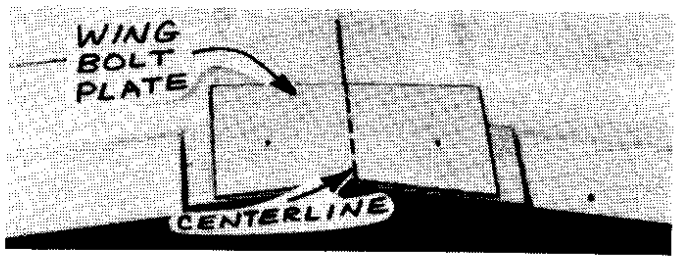
☐ 5. Sand **one end** of each wing dowel to a rounded or pointed shape. This is the end that will be inserted. Do not sand the other end at this time.



☐ 6. Trial fit the dowels into the dowel holes, and trial fit F-2A 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" ply **wing bolt plate**. Notice that there are two punch marks, at which you will later drill holes for the wing bolts. When gluing this plate to the wing, the **punch marks** should be visible for later reference.



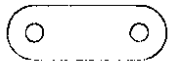
☐ 2. Position the wing bolt plate on the **bottom** of the wing, and line it up with the wing TE and centerline. Glue it in place.

3. Sand the aft edge of the wing bolt plate flush with the wing TE.

FILL LANDING GEAR SLOTS (Fixed gear only)

☐ 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 #2 x 3/8" sheet metal screws.



☐ 3. Using scraps of balsa, fill the ends of the slots in the notched LG blocks and sand flush with the surface of the wing. This will aid in covering later.

INSTALL MAIN GEAR RETRACTS (OPTIONAL)

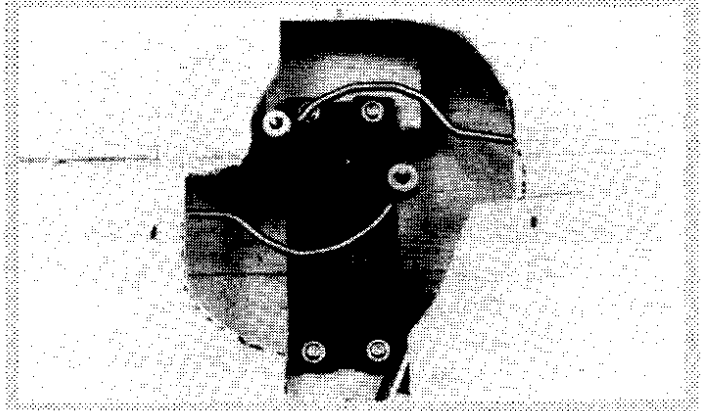
NOTES: A "low profile" retract servo (such as the Futaba FP-S136G) is strongly recommended for the main gear retracts. Hardware for retract installation is not included in the kit.

At this point most of your retract installation should already be completed, and all that remains is to install the retract servo and "fine tune" the installation.

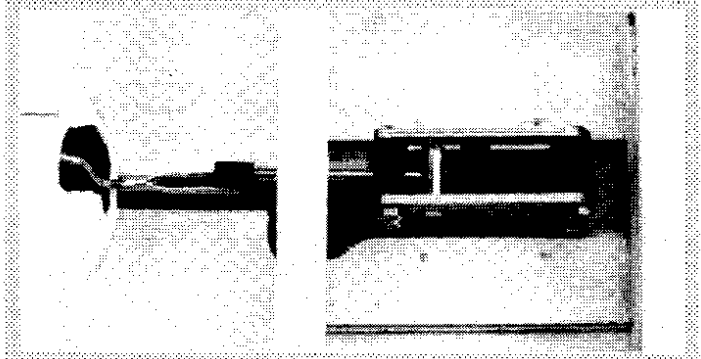
☐ 1. If you have not already done so, cut the bottom sheeting away in the areas of the retract mechanism, LG wire and wheel well.

☐ 2. Install "wheel wells" made from cut-down tops of spray paint cans or other suitable containers, such as a plastic drinking cups, etc. Keep the wheel wells just far enough away from the top wing sheeting to permit routing of the retract pushrods between the wheel well and the sheeting.

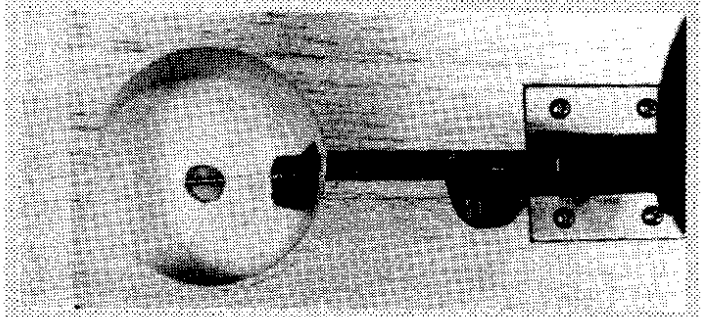
☐ 3. Cut out an opening in the top sheeting in the area of the **retract servo**. See the wing plan for recommended location. Cut out a portion of the W-1 ribs to fit your servo, and fabricate two 1/8" ply servo mounting rails in the general



area shown on the fuse plan side view, using the 1/8" x 3/8" x 6" birch ply stick provided. Install the retract servo, bend the pushrods as necessary (make two identical pushrods) and attach the pushrods to the servo arm. There is a full size drawing of the pushrods on the wing plan.



☐ 4. Temporarily install all retract components. It will probably be necessary to "tweak" the pushrod routing and bending to achieve smooth operation. 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.



☐ 5. Blend the bottom sheeting as neatly as possible around the retracts.

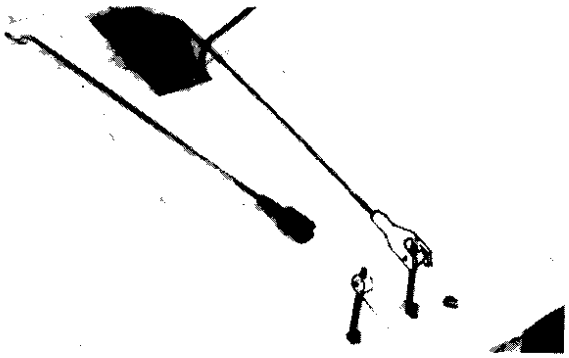
☐ 6. Use polyester resin or 30-minute epoxy thinned with alcohol to fuelproof all exposed wood in the entire retract area.

INSTALL AILERON SERVO

☐ 1. Study the plans to determine the location of the **aileron servo cutout**. Mark the location on the top of the wing and cut an opening in the fiberglass and sheeting slightly larger than your servo. **CAUTION: Do not cut into the wing spars or center brace!**

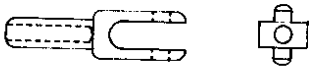
☐ 2. Remove a sufficient portion of the W-1 ribs to fit your servo (see the plan to determine what the cutout should look like). **NOTE:** A Dremel Moto Tool with a 1/8" router bit is excellent for this, but it may also be done with an Xacto knife and a long-nose pliers.

☐ 3. Make two **servo rails** from the 1/8 x 3/8" ply stick, and glue them in place. (See the side view of the aileron servo installation on the plan).



☐ 4. Mount the **aileron servo** using the screws provided with your radio.

☐ 5. Screw the nylon **aileron clevises** approximately 7 turns onto the threaded end of the two 12" steel wire pushrods.



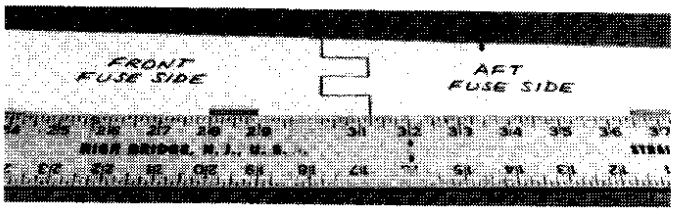
☐ 6. Screw the nylon **swivels** onto the aileron torque rods.

☐ 7. Attach the clevises to the swivels, then, with the ailerons in the neutral position, mark the pushrod wires where they cross the holes in the servo arm. Remove the pushrods and make a **"Z-bend"** in the rods at that point, using a "Z-bend pliers" or a standard pliers.

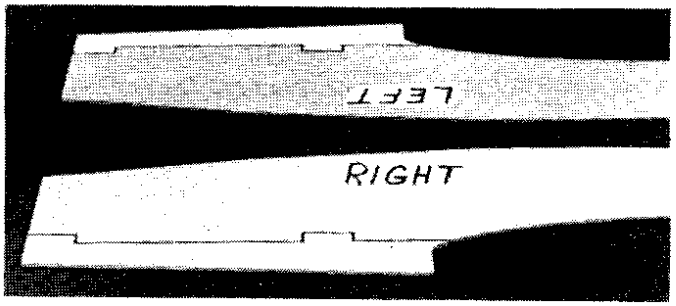
☐ 8. Remove the servo wheel from the servo and work the Z-bends into the wheel (**NOTE:** You may have to enlarge the servo wheel holes with a 5/64" diameter drill bit). Replace the servo wheel and check the operation of the ailerons. (See page 46 for the recommended amount of aileron movement).

FUSELAGE ASSEMBLY

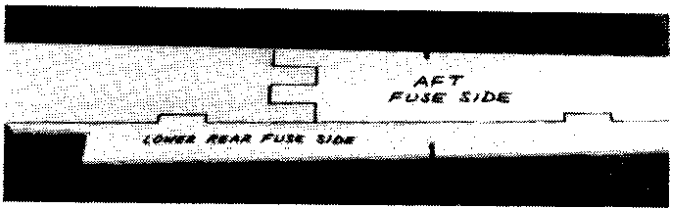
PREPARE FUSE SIDES



☐☐ 1. Working on a flat surface covered with waxed paper, trial fit the die-cut 1/8" balsa **front fuse side** and **aft fuse side** together at the "zig-zag" joint, sanding as necessary for a good fit. While assembling, **lay a straightedge along the bottom edge of these parts**, to make sure they are properly lined up. Glue these parts together.



☐☐ 2. Glue the die-cut 1/8" balsa **lower front fuse side** to the upper fuse side assembly.

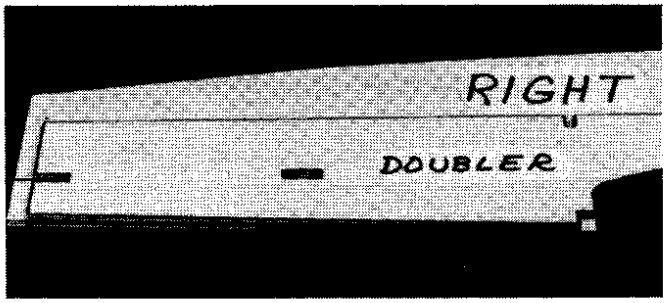


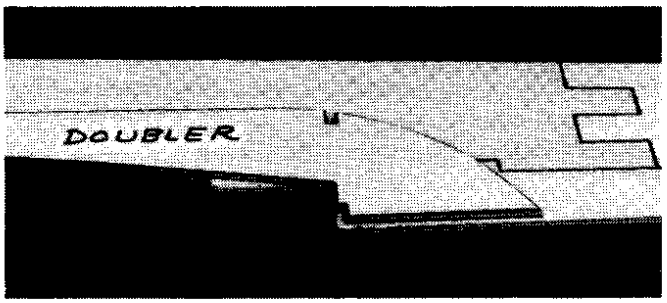
☐☐ 3. Glue the die-cut 1/8" balsa **lower rear fuse side** to the upper fuse side assembly.

☐☐ 4. Inspect the glue joints for gaps, add thick CA glue if necessary. Sand the glue joints smooth on both sides using a T-bar and 100-grit sandpaper, then repeat the above steps to make the other fuse side.

☐ 5. Place the two assembled fuse sides together. Sand the edges as necessary to make the two sides **identical**.

☐ 6. As shown in the above photo, designate the fuse sides "RIGHT" and "LEFT".





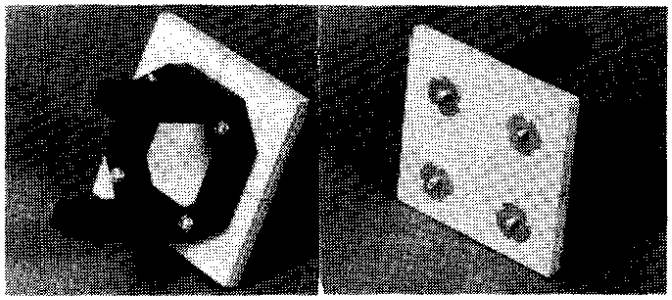
☐ 7. Glue the two die-cut 1/8" balsa **fuse doublers** to the fuse sides, making a right and a left side. Accurately position this doubler in the wing saddle opening. The bottom front edge should line up with the bottom front edge of the lower front fuse side. The bottom rear edge should be 1/8" above the bottom edge of the lower rear fuse side. **NOTE:** If you use thin CA for gluing this doubler, apply CA liberally around the edges of the doubler, **and** (to insure a complete bond) poke approximately 20 evenly spaced pinholes through the doubler and apply a couple drops of thin CA to each pinhole.

PREPARE THE FIREWALL (F1)

☐ 1. Study the fuse plan side view and the cross-section drawing of F-1, and note that one edge of F-1 is cut at a slant. This edge is the **top**. Note also the location of the engine mount on F-1.

NOTE: Photos show a 40-size engine mount (Great Planes MM40 or similar mount included in kit) set up for side mounted 2-cycle engine. If you will be using a mount not shown on the plans you'll have to determine the correct mounting position.

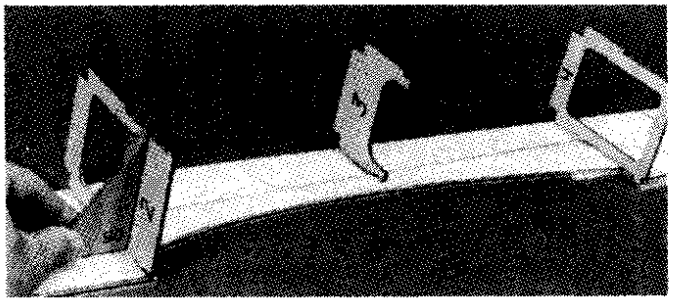
☐ 2. Hold the engine mount on the firewall in the location shown on the plan, and mark the bolt locations through the mount. Drill **5/32"** holes at the bolt locations, then install the **6-32 blind nuts** on the back of F-1. Press the blind nuts in with a vise, or tap them in with a hammer.



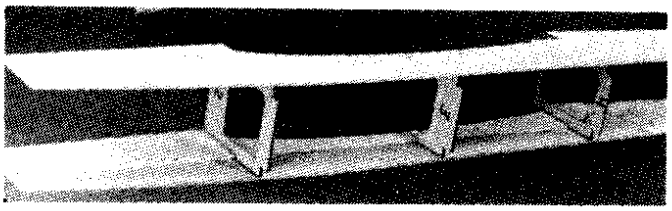
☐ 3. Temporarily attach the engine mount to the firewall with the 6-32 x 3/4" bolts. Cut or file off any portion of the bolts that protrude behind F-1.

ASSEMBLE LOWER FUSELAGE

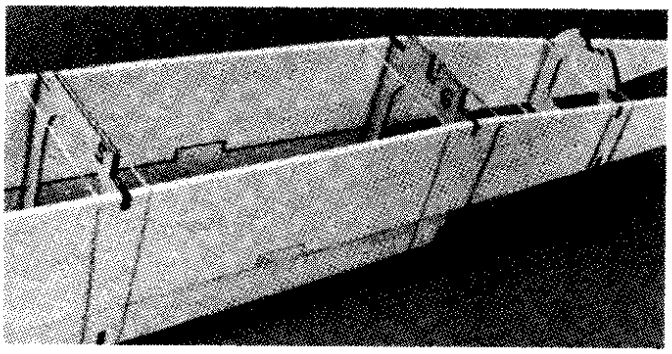
☐ 1. Trial fit the die-cut 1/8" ply formers F-2, F-3, F-4, F-5, F-6, F-7 and F-8, to make sure the tabs fit into the appropriate slots. If there is any excess glue in the fuse doubler slots, clean it out with an Xacto knife. If it is necessary to trim any of the formers, be sure to trim both sides of the formers the same amount to keep them symmetrical.



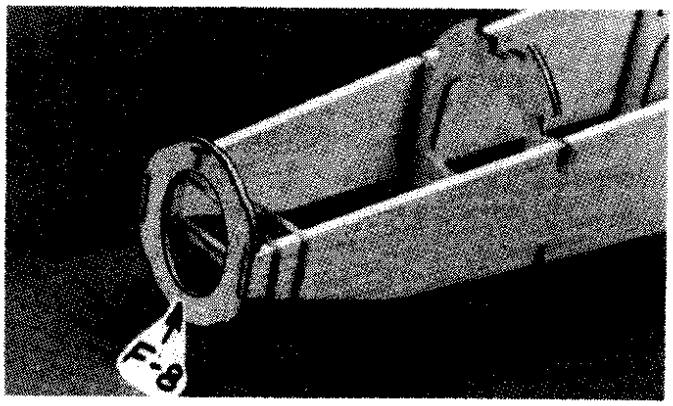
☐ 2. Securely glue formers **F-2, F-3** and **F-4** to the right fuselage side. **Use the 90-degree triangle provided to square up the formers to the fuse side** (this is very important). Begin by applying thin CA, then follow with medium CA to fill any small gaps. Do not build up any excess glue around the bottom rear of F-2, however. **NOTE: Make sure the bottom tab of F-2 is fully forward, and the bottom tab of F-4 is fully aft in the fuselage doubler slots.**



☐ 3. Press the left fuselage side onto formers F-2, F-3 and F-4, and glue in place. **NOTE:** Make sure the bottom tab of F-2 is fully forward, and the bottom tab of F-4 is fully aft in the fuselage doubler slots.

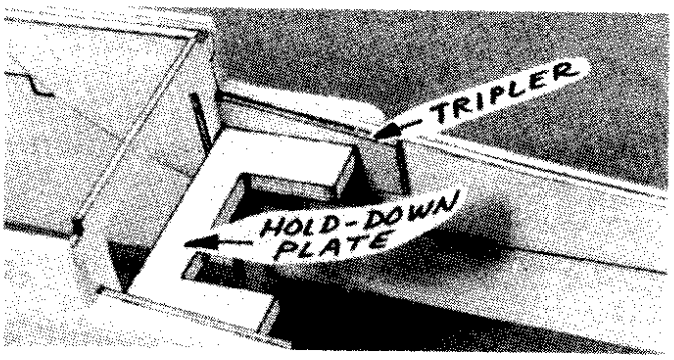


☐ 4. Insert formers **F-5, F-6** and **F-7** into the appropriate slots in the fuse sides, holding the fuse sides firmly against the formers with rubber bands. Glue these formers in place.

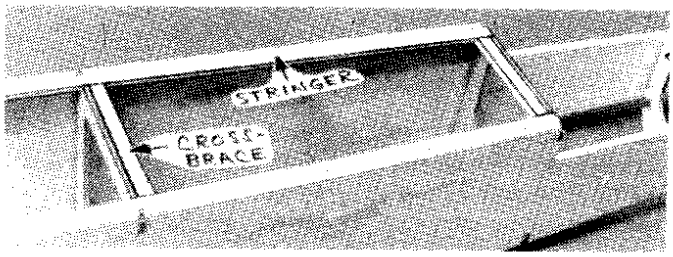


☐ 5. Install **F-8** and hold the aft ends of the fuse sides together with rubber bands. Glue F-8 to the fuse sides. **NOTE:** F-8 has a "T" on the top. Make sure you install it correctly (see the sketch on page 37).

☐ 6. Trial fit the 1/4" ply **wing hold-down plate** and the die-cut 1/8" ply **triplers** between the fuse sides, sanding as necessary for a good fit. Note that the edges of the triplers line up with the wing saddle. Glue these parts in place with **epoxy**. The photo for this step is at the top of the next page.

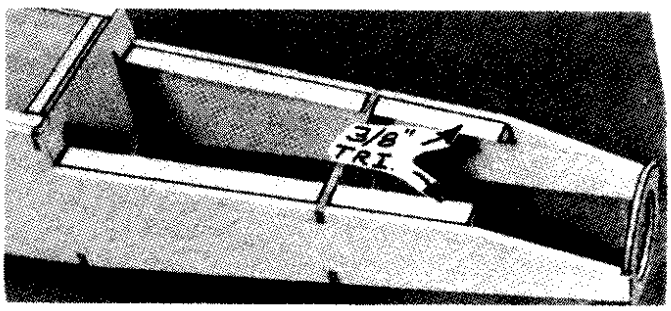


☐ 7. Notice the die-cut "bumps" on the fuse sides in the aft portion of the wing saddle. Sand off these bumps flush with the fuse doubler.



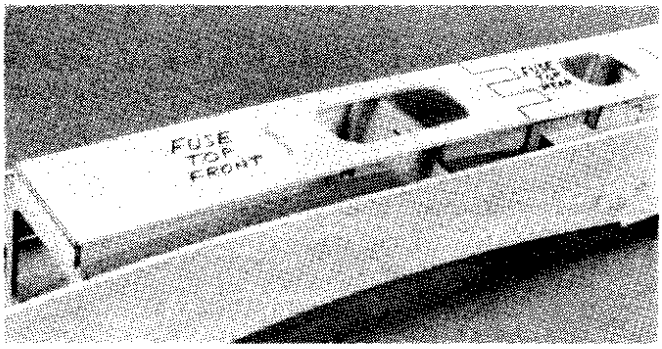
☐ 8. Trial fit the 1/8" x 1/4" x 15" basswood **stringers** into the notches in F-4, F-5 and F-6 along the bottom corners of the fuse. Glue these stringers in place with medium or thick CA, then trim and sand the stringers flush with the front of F-4 and the rear of F-6.

☐ 9. Using the third piece of 1/8" x 1/4" x 15" basswood, cut **cross-braces** to fit at the rear of F-5 and the front of F-6, between the stringers you previously installed. Glue in place with medium or thick CA.



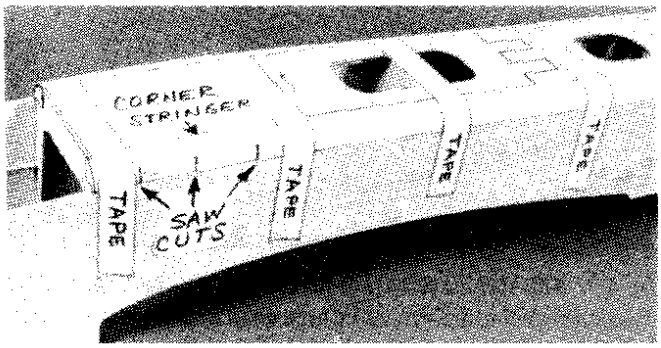
☐ 10. The stabilizer will mount to the bottom edges of the fuse sides behind F-6. Reinforce this area with **3/8" balsa triangle**, as shown in the photo. From the 23-7/8" length provided, cut two 3-7/8" lengths of 3/8" tri to fit along the bottom of the fuse sides, from F-6 to F-7. Cut two 1-15/16" lengths to fit between the aft edge of F-7 and the point where the fuselage begins to angle upward. Glue these balsa triangles in place with CA.

☐ 11. Lay a piece of waxed paper on the fuse plan top view, and accurately position the die-cut 3/32" balsa **fuse top front** and **fuse top rear** on the plan. Check the fit of these parts at the zig-zag joint and sand if necessary for a good fit. With these parts aligned with the plan and pushed down flat, glue them together with thin CA. Follow with medium or thick CA to fill the gaps, then sand smooth on both sides.



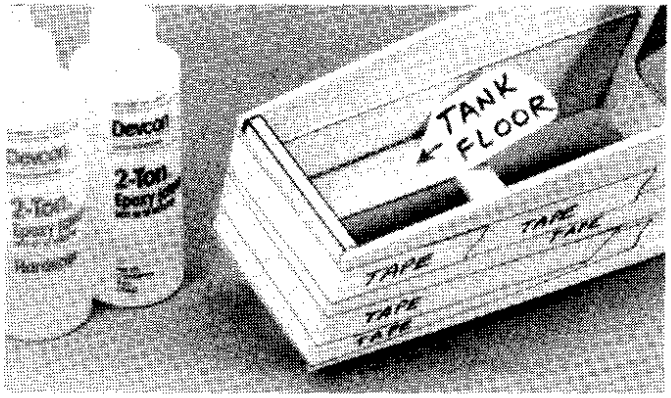
☐ 12. Lay the 3/32" fuse top assembly on the tops of the formers, with the aft end of the fuse top centered on F-6 and the front of the fuse top centered on F-2. Move the fuse top fore and aft until the aft edges of the slots line up with the front edges of F-4 and F-5. Glue the fuse top to F-6 and F-2. After the glue has cured, glue F-4, F-3 and F-5 to the fuse top (in that order), centering each former on the fuse top. **NOTE:** When finished, the edges of the fuse top should line up with the sides of all formers. Now trim and sand the fuse top flush with the front edge of F-2 and the aft edge of F-6.

☐ 13. The shaped balsa **upper fuse corner stringers** (1/4-round molding) are fastened together by a thin strip of balsa. Separate them by **cutting** with an Xacto knife in a similar manner as the wing leading and trailing edges.



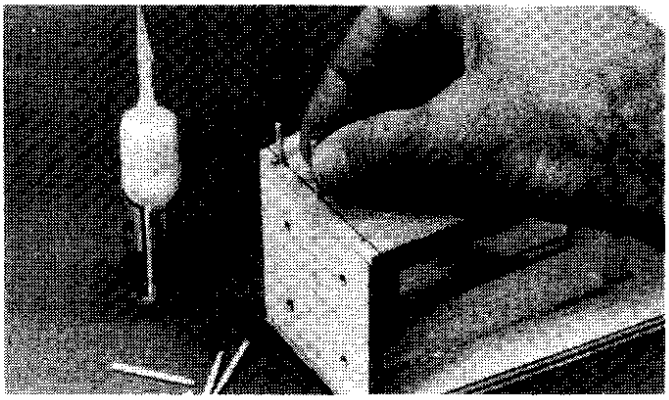
☐ 14. Trial fit the upper fuse corner stringers in the square corners at the tops of the formers, and cut them to the correct length. You will probably have to make a few partial **saw cuts** in the stringers to permit easy bending near F-2. Use long strips of masking tape to hold both stringers in place, then apply thin CA glue at all joints. Sand the stringers flush with the front of F-2 and the back of F-6.

NOTE: We recommend an 8 oz. fuel tank for this airplane, but if you are **not** installing retracts and you consider it essential to install a fuel tank larger than 8 oz., it will be possible to do so if you do not install the die-cut 1/8" ply **fuel tank floor / nose gear retract mounting tray**. This part is not absolutely essential to the structural integrity of the Patriot; therefore, you may leave it out of the next step.



☐ 15. Pull the front ends of the fuse sides together, while installing the die-cut 1/8" ply **fuel tank floor / nose gear retract mounting tray** and the 1/4" ply **firewall (F-1)**. Note that you will have to cut away two small portions of the fuel tank floor to make room for the blind nuts. When satisfied with the fit, apply **30-minute epoxy** to the gluing surfaces of these parts, and reassemble. Hold the fuse sides together with long strips of masking tape or with clamps until the glue has fully cured.

☐ 16. After the epoxy has fully cured, sand off the fuse sides flush with the front of F-1.



☐ 17. Now "pin" F-1 to the fuse sides by drilling 3/32" holes through the fuse sides into F-1 and gluing three round tooth-

picks into the holes on both sides. Measure back 1/8" from the front of F-1 and draw a drilling guideline to center the holes in F-1. When the glue has cured, trim and sand the toothpicks flush with the fuse sides.

☐ 18. Sand the top surface of the fuse to remove any excess glue so the fuse will lie flat on the workbench.

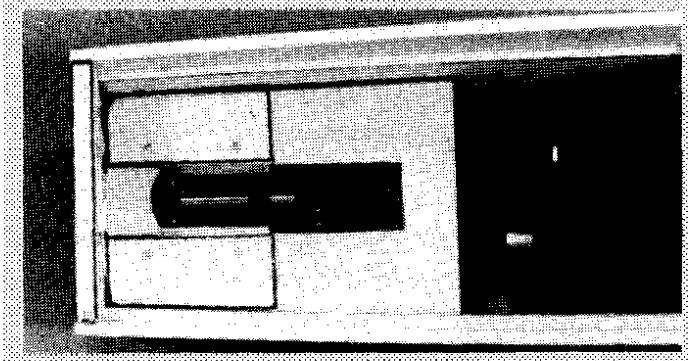
This completes the basic fuselage. Various tasks will now be taken care of before closing up and completing the fuselage.

INSTALL NOSE GEAR RETRACT (Optional)

NOTE: Because of space limitations, the Hobbico Low-Profile retractable nose gear is recommended. However, it is desirable to locate the nose gear **steering** pushrod on the opposite side of the fuselage from the throttle pushrod; therefore, it may be necessary to rotate the nose gear wire and steering arm 180 degrees. This will depend on the configuration of your retracts.

☐ 1. Study the fuse plan top and side views and note the location of the **nose gear retract.** If you use any retract other than the one specified, it will probably end up protruding below the bottom of the chin block.

☐ 2. Trial fit the retract as shown on the plan, and mark the location of the mounting screw holes on the bottom of the 1/8" ply nose gear retract mounting tray.

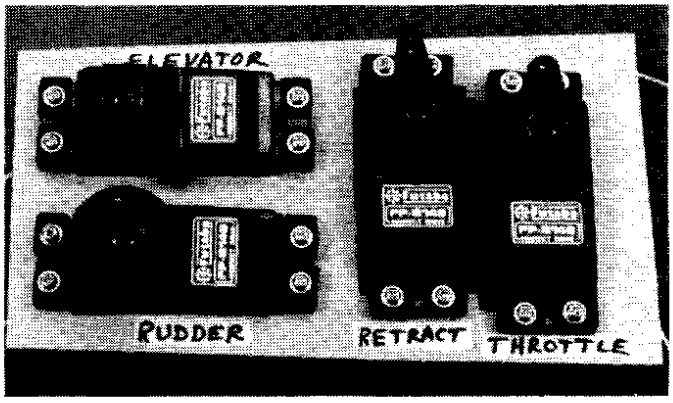


☐ 3. From 1/8" ply die-cutting scrap, cut two pieces approximately 7/8" x 1-7/8" and glue them to the **top** of the nose gear retract mounting tray in the area where the retract will mount. These pieces double the thickness of the tray and provide a more secure "bite" for the mounting screws.

☐ 4. If you will be using #4 x 3/8" sheet metal screws (recommended, not supplied) for mounting your nose gear retract, drill 5/64" holes at the mounting screw locations.

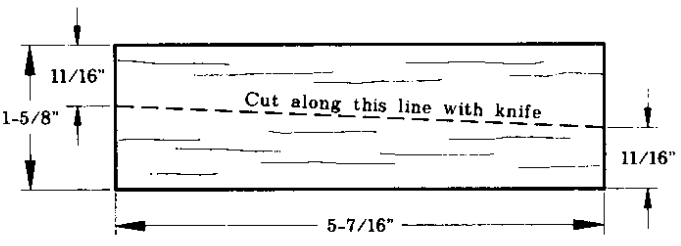
☐ 5. Temporarily mount your nose gear retract and check its operation. **IMPORTANT: If the screws protrude above the doublers, cut or file them off to avoid the possibility of puncturing the fuel tank.**

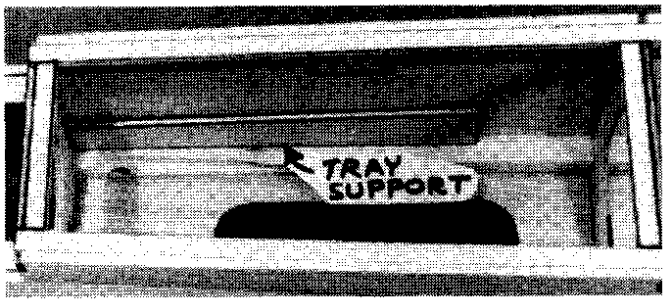
INSTALL SERVO TRAY



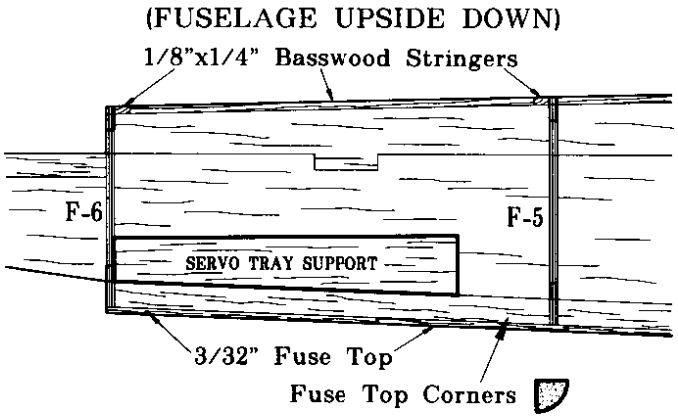
☐ 1. Temporarily mount three or four servos into the die-cut 1/8" ply **servo mounting tray** (4th. servo is for optional nose gear retract). Servos shown on the plans and in the photos are Futaba FP-S148 servos. Notice that the throttle and retract servos are offset to provide pushrod clearance. Install the throttle servo in the aft location if you will not be using a retractable nose gear.

☐ 2. Find the 1/8" x 1-5/8" x 5-3/8" balsa sheet and use an Xacto knife and a straightedge to cut it as shown in the following sketch to make the **servo tray supports.**





☐ 3. Glue the servo tray supports to the fuse sides. The narrow ends of the supports are at the front of F-6, and the long edge of the supports rests on the upper fuse corner stringers.

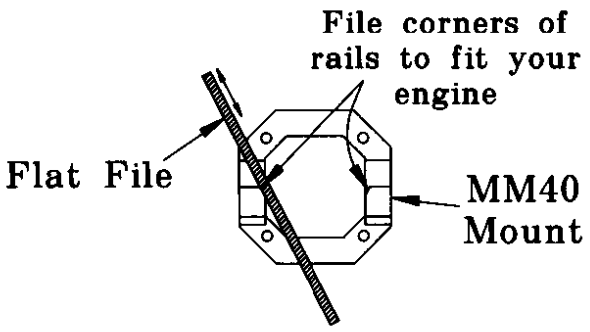


☐ 4. Trial fit the servo tray and servos into the radio compartment as shown on the plan. It is desirable to mount the servos as far aft as possible. It will be necessary to carve away part of the balsa upper fuse corner stringers to make room for the elevator and rudder servos.

☐ 5. Remove the servos and securely glue the servo tray in place.

DRILL ENGINE MOUNT (Great Planes MM40 or similar glass-filled nylon mounts)

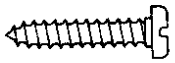
NOTE: If the engine mount supplied in the kit does not appear to fit your engine (example: OS 40 SF), you may have to file the corners of the engine mount rails to make room for the crankcase. (See sketch).



☐ 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.

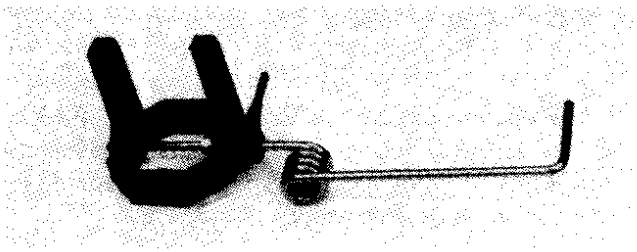
☐ 2. Now you may use one of the following methods to attach your engine to the mount:

Method 1: Screw the #6 x 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.

MOUNT THE NOSE GEAR



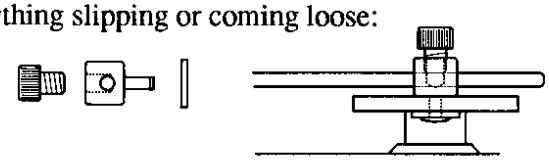
☐ 1. Attach the nose gear to the engine mount using the wheel collars and steering arm provided. (See the cross-section of F-1 on the plan).

☐ 2. Attach the engine mount to F-1 using the 6-32 x 3/4" machine screws.

INSTALL PUSHRODS FOR THROTTLE, STEERING (AND NOSE GEAR RETRACT)

NOTE (PUSHROD CONNECTIONS AT THE SERVOS): There are several options available to you for connecting the pushrods to the servo arms. They include: Z-bend, L-bend with keeper, Solder clevis, Solder-on threaded coupler with clevis, and EZ Connector. If you use one of the solder options, make sure you use the

soldering procedure given below. The internal elevator and rudder linkage dictates that you will have to make adjustments at the servo end of these pushrods; therefore EZ Connectors or solder-on threaded couplers with clevises are the most workable choices. However, any time you use EZ Connectors for the main flight controls, you must take special precautions to avoid the possibility of anything slipping or coming loose:



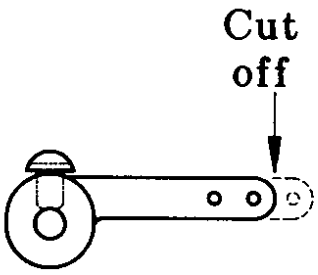
A. Use the ball end of a small ball-peen hammer to peen on the small washer, permanently securing the EZ Connector to the servo arm, rather than using the nylon "button" which can come off.
B. After your final adjustments have been made, remove the set screw, apply a drop of Loctite 242 Threadlocker to the threads, and re-insert the screw.
C. To tighten the set screw, grasp the EZ Connector body with a pliers while tightening the set screw as tight as possible without stripping out the threads. Some modelers substitute a small 4-40 socket head cap screw for the set screw so they can more securely tighten the screw with a balldriver or hex wrench.

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:

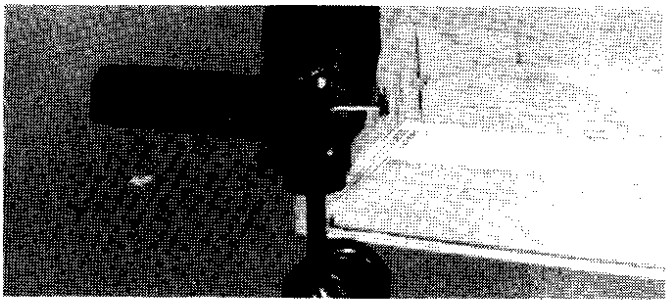
A. Thoroughly clean the items to be soldered with alcohol or degreasing solvent.
B. Roughen the area to be soldered with fine sandpaper, then clean again.
C. Assemble the items to be soldered.
D. Apply a small dab of soldering flux.
E. Heat the metal with a soldering gun or iron, and apply solder to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

NOTE: If your Patriot has a fixed (non-retractable) nose gear, you will run **two** pushrods to the front (throttle and nose gear steering). If you are installing a retractable nose gear, you will **also** run a pushrod (not included) to activate the retract mechanism.

☐ 1. Temporarily install the **engine mount, nosegear** and **nosegear steering arm.**

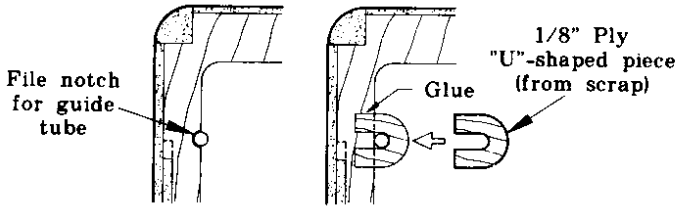


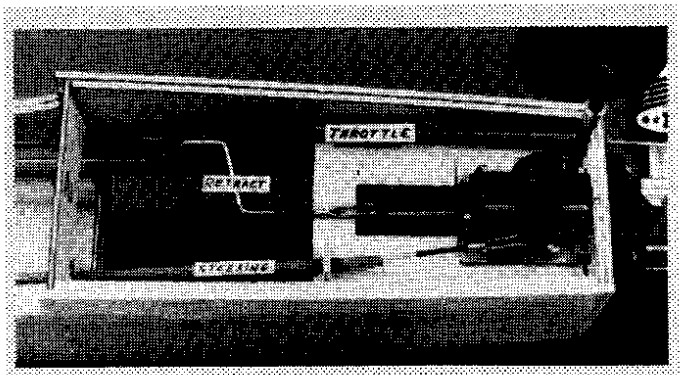
☐ 2. **Cut 1/4" off the end of the steering arm,** then drill a 3/16" hole in F-1, just above the outer hole of the arm.



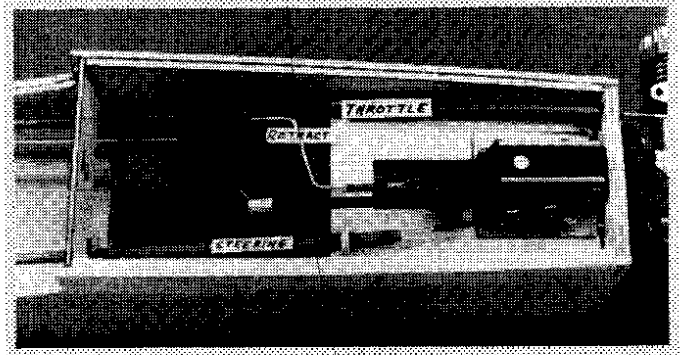
☐ 3. The steering pushrod will run from the steering arm to the rudder servo arm on the opposite side of the rudder pushrod (see plan). Roughen the outer surface of the **outer pushrod guide tube** with sandpaper, then route the outer pushrod tube down the left side of the fuselage, gluing* it to the edges of the openings in F-2, F-4 and F-5, keeping the pushrod as straight as possible. **NOTE:** Do not drill a pushrod hole through the lower part of F-2, as this would interfere with the installation of former F-2A.

*For a better glue bond, you may use a round file to file a semicircle in the edges of the formers, or you may cut a "U"-shaped keeper from scrap 1/8" ply (see sketches).

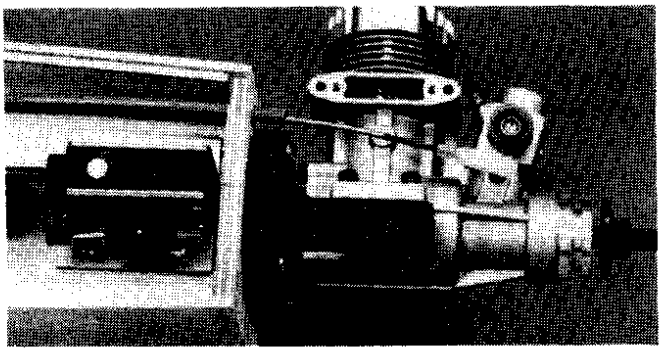




☐ 4. Run a pushrod (not supplied) along the right side of the fuselage to activate the retract mechanism. Bend the pushrod as necessary to avoid binding between the wheel and the pushrod. When bending, also consider possible interference with the fuel tank.

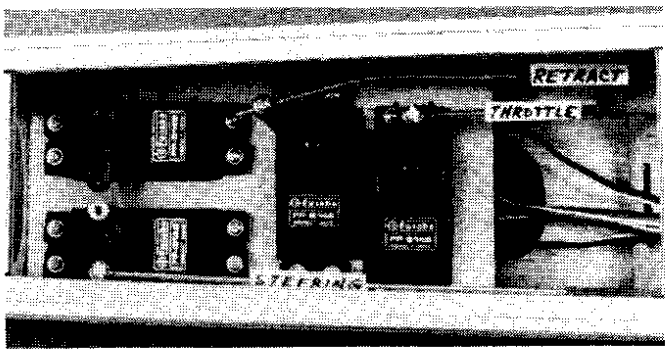


☐ 5. Install the pushrod for retractable nose gear **steering**. For this installation, you will have to anchor the pushrod guide tube to the mounting tray to hold the steering pushrod clevis in the correct position vertically for proper operation. Check the retracting and steering operations by manually working the pushrods, and "tweak" as necessary. It is working properly when the nose gear does not turn as the gear is being retracted. Also, when retracted, the steering pushrod must be able to move freely to allow the rudder to operate without binding.



☐ 6. Screw your engine to the mount, and determine the location where the **throttle pushrod** will pass through F-1. Drill a 3/16" hole in F-1 for the throttle pushrod guide tube. Again, route the guide tube through the openings in the formers. Do not glue the guide tube to the formers until you have also laid out your nosegear retract pushrod.

☐ 7. Sand the plastic pushrod guide tubes with 100-grit sandpaper, then glue them in place.



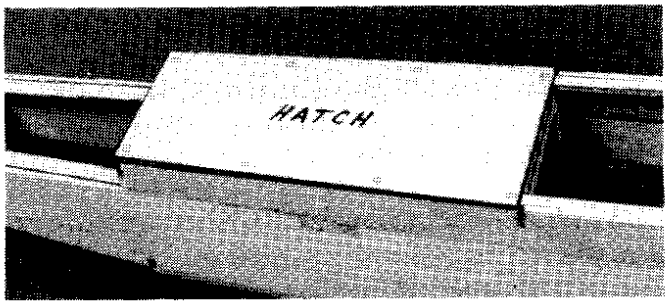
MOUNT RADIO COMPARTMENT HATCH

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

☐ 2. The die-cut 1/16" ply **hatch** is slightly oversize to allow for fitting. Using a few long pieces of masking tape, secure the hatch in place with the front edge of the hatch lined up with the aft edge of F-5. When applying tape, do not cover any of the punch holes.

☐ 3. Drill 1/16" holes through the hatch and the basswood stringers.

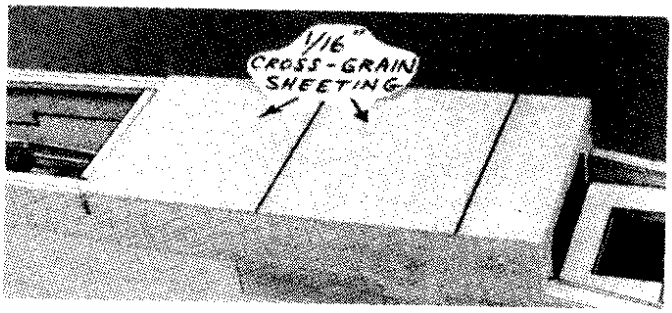
☐ 4. Remove the hatch, and enlarge the holes **in the hatch only** to 3/32".



☐ 5. Attach the hatch to the fuselage with eight #2 x 3/8" sheet metal screws.

☐ 6. Sand the edges of the hatch even with the fuse sides and the aft edge of F-6.

SHEET AFT FUSE BOTTOM



☐ 1. From the 1/16" x 3" x 24" balsa sheet, cut and glue pieces of **cross-grain sheeting** to the bottom of the fuse, beginning 1/32" from the front edge of the hatch and running to the front edge of F-4. **CAUTION:** Remove the hatch when you are ready to glue the first piece of sheeting, to avoid gluing the hatch.

☐ 2. Now sand the edges of the bottom sheeting flush with the fuse sides and the front of F-4.

MOUNT THE WING TO THE FUSE

☐ 1. Sand the entire wing saddle area lightly until the fuse side doublers and fuse sides are flush.

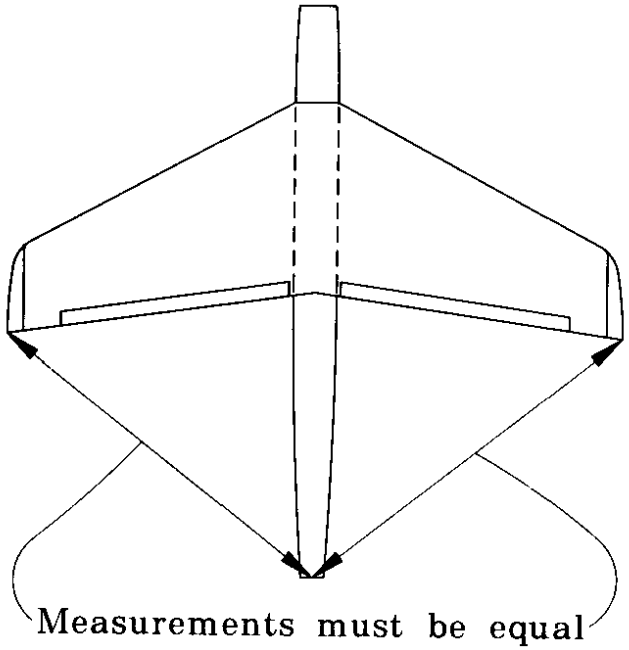
☐ 2. Insert the die-cut 1/8" ply **F-2A** in place against the back of F-2 **(do not glue)**.

☐ 3. Insert the 1/4" wing dowels into the wing so they stick out **only 1/8"**.

☐ 4. 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 with approximately 1/32" to spare. Inspect the fit of the wing in the saddle, and sand any obvious high spots of the saddle until the wing matches the saddle reasonably well.

☐ 5. Carefully **align** the wing in the saddle as follows:

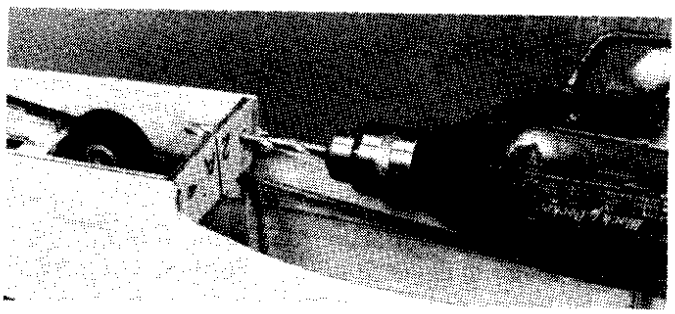
If you have drilled the dowel holes accurately, the wing should now be **centered**, side to side. Measure from the rear corner of each wing tip to a point on the fuse centerline near



the aft end of the fuselage (for example, the center of former F-7). These measurements must agree within 1/16". If not, shift the wing slightly until they do.

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

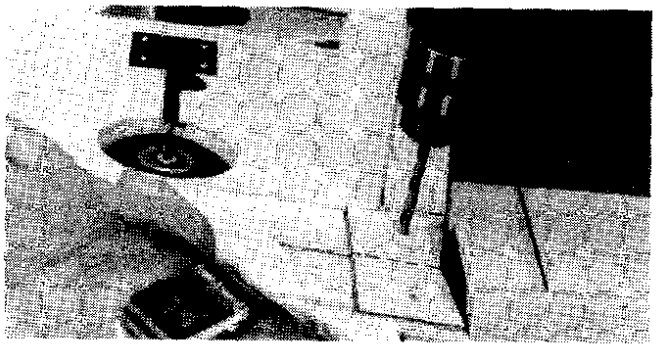
☐ 7. Remove the wing and **securely glue** F-2A in place by flowing thin CA into the wing dowel holes and around the edges. Follow with thick CA around the edges.



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

☐ 9. 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** (for maximum strength), use a small stick to work plenty of epoxy into the dowel holes in the wing, 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.

☐ 10. Replace the wing in the saddle and re-align it accurately, as in step 5.



☐ 11. Holding the wing **firmly** in place, drill 13/64" holes at the punch locations, 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!**

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

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

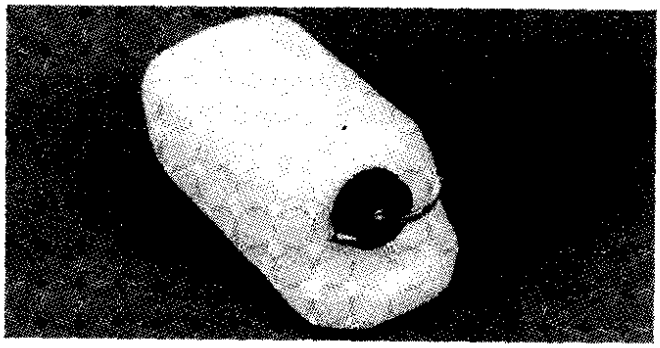
☐ 14. **Harden** the threads in the hold-down block with thin CA glue, then re-tap the threads after the glue has **completely** hardened.

☐ 15. **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.

☐ 16. 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.

FIT FUEL TANK and FUELPROOF TANK COMPARTMENT

☐ 1. Assemble your **8 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

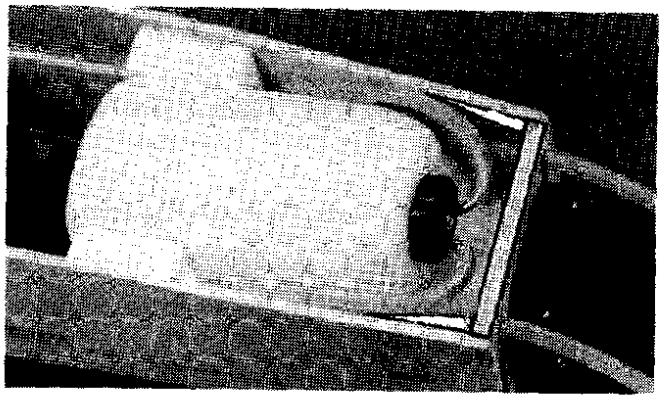


the firewall. **HINT:** To avoid kinking the tubes when bending, we use **K&S Tubing Bending Springs**.

☐ 2. Drill two holes (7/32" or size to fit your fuel tubing) in F-1 for your **fuel tubing** vent and fill lines. Check the cross-section drawing of F-1 on the plan for the approximate location of the holes.

☐ 3. 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.

☐ 4. Cut two 1" x 4" pieces of latex foam rubber and glue them to the top of the ply fuel tank base to cushion the fuel tank from engine vibration.



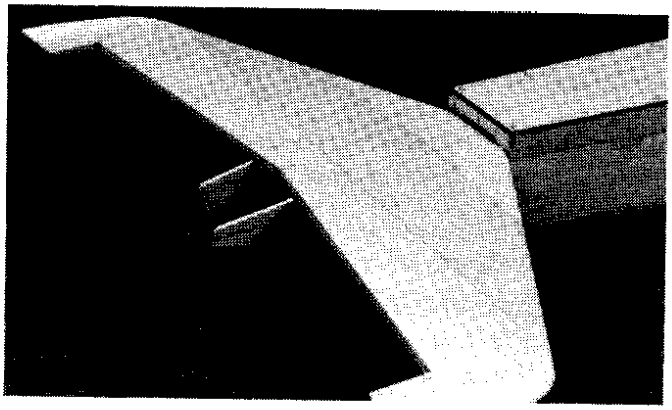
☐ 5. Permanently install the **fuel tank** at this time. Be sure to **cushion** the tank from vibration and prevent it from moving by surrounding the tank on all sides (and front) with **latex foam rubber**. Leave 6-8 inches of extra fuel tubing in front of F-1 (you can cut off the excess later). The photo shows how to route the fuel tubing to prevent kinking.

☐ 6. Install two 1" lengths of 1/4" tri. in the upper front corners of the fuse just behind F-1, as shown in the photo for step 5.

MOUNT THE STABILIZER

☐ 1. Lightly sand the **stab saddle area** smooth with a T-bar or sanding block.

☐ 2. Temporarily mount the wing in the saddle (for reference), and block up the tips until the wing is level.



☐ 3. Lay the **stab** in position on the stab saddle and carefully center it, side to side. The front edge of the stab should be against the aft edge of F-6. Carefully check the stab alignment in relation to the wing by viewing from behind, and by measuring from the stab tips to the wing tips (or to a point on the center of the fuse near the nose). Sand the stab saddle **(a little at a time!)** until the stab rests in proper alignment. With the stab in alignment, make a mark on the front of the stab and a corresponding mark on the back of F-6, and where the fuse sides intersect the stab, which will be used for rapid alignment when gluing.

☐ 5. Mix up a batch of 5-minute or 30-minute epoxy and apply it to the stab saddle. Press the stab into position and **hold or pin in proper alignment until the glue has firmly set.** Wipe off any excess epoxy before it sets up.

☐ 6. Temporarily attach the elevators to the stab and check the elevator clearance at the fuse sides. Sand the elevators as necessary to provide approximately 1/16"-3/32" clearance.

PERMANENTLY ATTACH ELEVATORS

NOTE: To install the internal elevator and rudder linkage with the least amount of hassle, it is necessary to follow a specific procedure. If you do not follow this procedure, you may find yourself in some "impossible" situations later on.

☐ 1. Cover the elevators with Top Flite Super Monokote,.

☐ 2. Draw lines on the **bottom** of the stab to represent the outside edge of the fuselage sides.

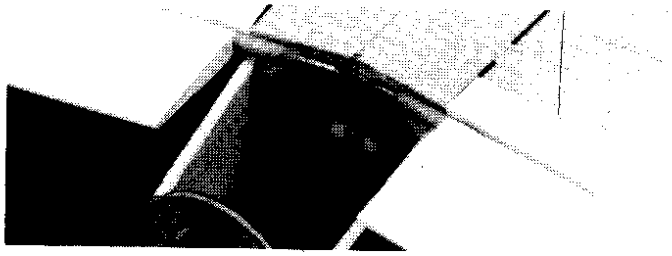
☐ 3. Cover the stab*, excepting the area between the lines you drew in step 2. **CAUTION:** You are advised to **pre-cut** your covering to match the lines drawn in step 2. **DO NOT cut the covering material along these lines after it has been applied to the stab.** Modelers who do this often cut through the covering and part-way into the balsa stab. This can weaken the stab to the point where it may fail in flight! ***NOTE:** If you prefer not to cover the stab at this time, you should at least cut a 1-1/4" wide strip of covering and use it to cover the stab TE, with the covering wrapping 1/2" onto the top and bottom of the stab (as shown in the photos).

☐ 4. Slit the covering material in the area of the hinges and the torque rod bearing slots.

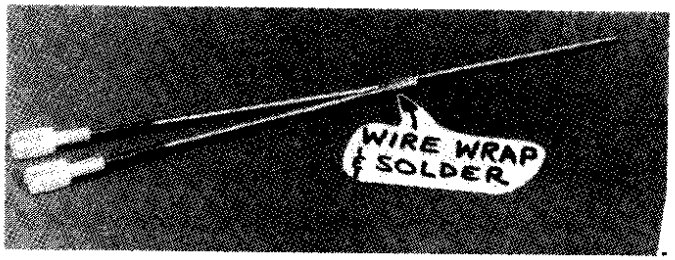
☐ 5. Using a toothpick, apply a small amount of Vaseline around the ends of the torque rod bearings to prevent glue from getting inside and locking them up.

☐ 6. Using epoxy, permanently glue the elevator torque rod bearings into the slots in the stab. **HINT:** Scoop up the epoxy with a plastic soda straw, pinch the end of the straw and insert it into the slot, then squeeze the straw to force epoxy into the slot. Wipe off any excess epoxy that squeezes out.

☐ 7. Using coarse sandpaper, roughen the part of the elevator torque rods that will be glued into the elevators, then clean off the sanded portion of the rods with alcohol or degreasing solvent.

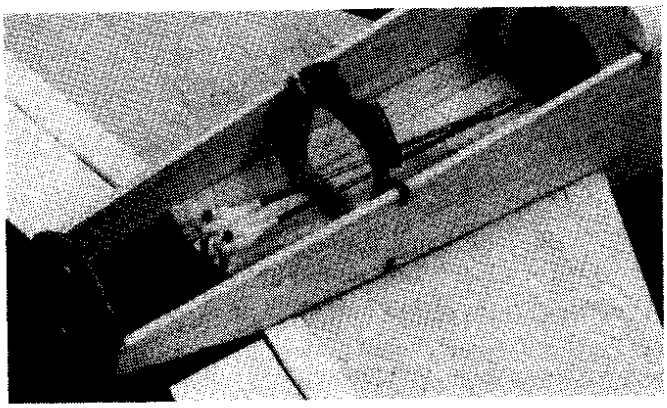


☐ 8. Using a small stick, work a generous amount of epoxy into the holes in the elevators, push the elevators into place and **wipe off all excess epoxy.** Check the side-to-side positioning of the elevators, then glue the hinges with thin CA (if you are using laminated hinges).



☐ 9. Make up the **elevator pushrods** according to the drawing on the plan. Note that you are required to wrap the

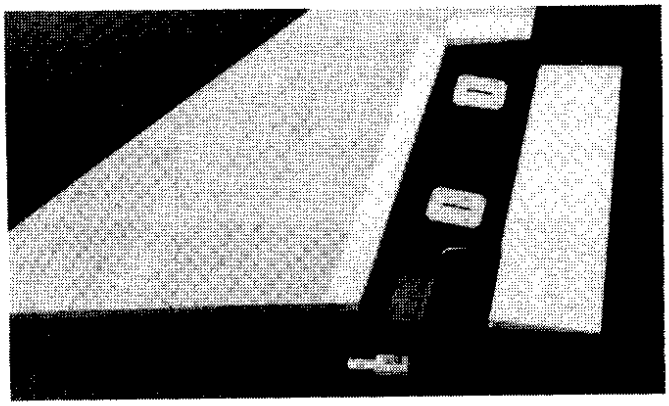
solder joint with fine copper wire (included). Please refer to the soldering technique on page 29.



☐ 10. Screw the special "swivel clevises" onto the threaded pushrod ends (screw on approximately 7 turns), and hook up the pushrods to the torque rods and the elevator servo. Adjust the clevises until both elevators are lined up with each other. Hook up your radio system and check the elevator throw (see page 46). Check for any possibility of binding. **This is your last chance to "easily" make all these checks and adjustments, so please be 100% sure that everything is working properly before proceeding.**

PERMANENTLY ATTACH RUDDER TO FIN

☐ 1. Double-check to make sure your rudder outline matches the plan. Then cover the **rudder** with Top Flite Super Monokote, or your choice of covering material.



☐ 2. Cut a 1-1/4" wide strip of covering and use it to cover the **fin TE**, with the covering wrapping 1/2" onto the sides of the fin. **Do not cover the entire fin yet!**

☐ 3. Slit the covering material in the area of the hinges and the torque rod bearing slot.

☐ 4. Using a toothpick, apply a small amount of Vaseline around the ends of the torque rod bearing.

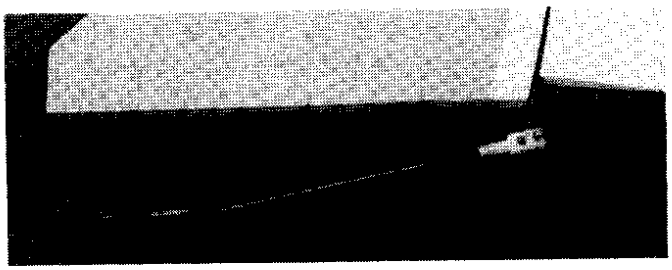
☐ 5. Using epoxy, permanently glue the rudder torque rod bearing into the slot in the fin.

☐ 6. Using coarse sandpaper, roughen the part of the rudder torque rod that will be glued into the rudder, then clean off the sanded portion of the rod with alcohol or a degreasing solvent.

☐ 7. Using a small stick, work a generous amount of epoxy into the hole in the rudder, push the rudder into place and **wipe off all excess epoxy.** Check the gap at the top of the rudder (approximately 3/32"), then glue the hinges with thin CA (if you are using that type of hinge).

MOUNT FIN TO FUSELAGE

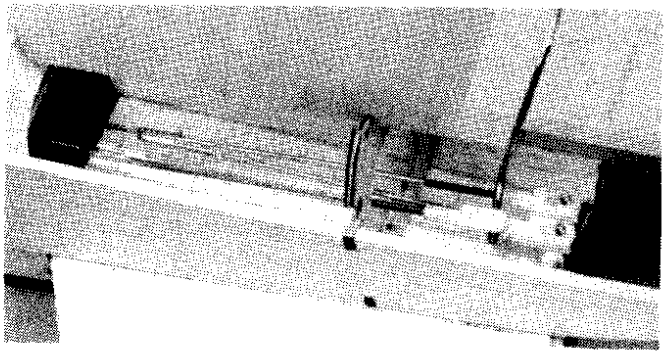
☐ 1. For reference, carefully measure and mark the center of the fuse top at F-2, then make marks 1/8" left and right of the center mark.



☐ 2. Make up the **rudder pushrod** according to the drawing on the plan. **IMPORTANT:** As the rudder operates, the pushrod has a twisting motion also; therefore, it is desirable for this pushrod to be free to rotate at one end. For this reason, we feel the best hookup at the servo end is achieved by using a solder-on threaded coupler and a metal clevis, as shown in the sketch on the plan. **NOTE: Remove the nylon clevis before soldering this rod.**

☐ 3. Screw the "swivel clevis" onto the threaded pushrod end (screw on approximately 7 turns), and attach the clevis to the nylon swivel.

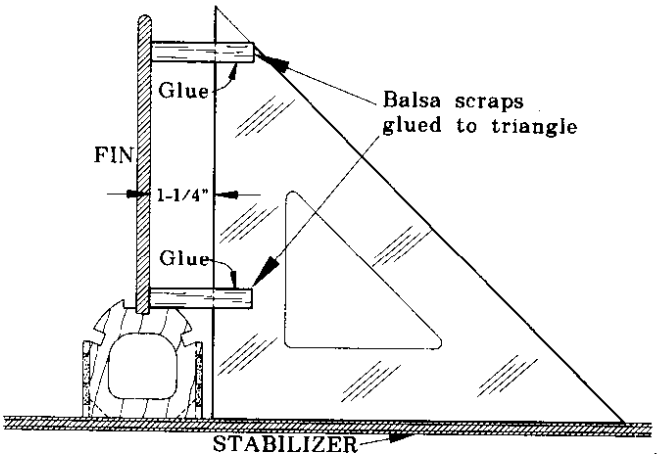
☐ 4. Trial fit the fin into the slots in F-6 and F-7 and temporarily pin or tape it in place, also attaching the pushrod



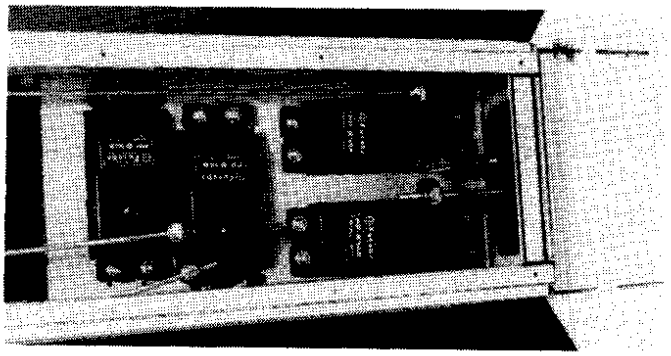
rudder throw (see page 46). Also check for any possibility of binding. **This is your last chance to "easily" make these checks and adjustments, so please be 100% sure that everything is working properly before proceeding.**

☐ 5. Check the alignment of the fin by holding a straight-edge against one side of the fin and on the corresponding reference mark on the fuse top at F-2 (see Step 1). If the fin does not line up with the mark, adjust the fin, sanding the slots in F-6 and F-7 if necessary.

☐ 6. Make a fixture for accurately checking the vertical alignment of the fin. We tack glued two sticks to an 8" drafting triangle as shown in the following sketch.



☐ 7. Remove the fin and apply 30-minute epoxy to the slots in F-6 and F-7. Set the fin in place in the slots, pin it in place and re-check its alignment. Also make sure the fin is **vertical** (perpendicular to the stab). **IMPORTANT:** It is necessary to install the rudder pushrod as you are gluing the



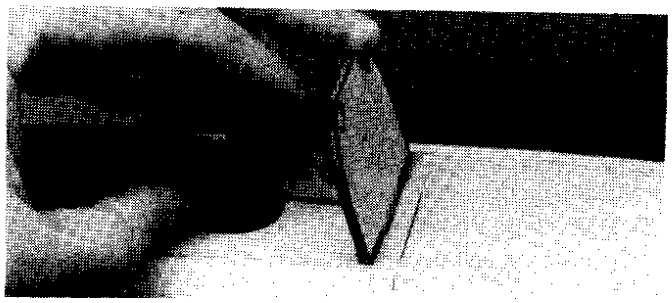
fin in place, as it would be very difficult to make this hookup later.

NOTE: Don't concern yourself with the apparently "flimsy" fin mounting arrangement. We'll take care of that later when we install the fin fairings.

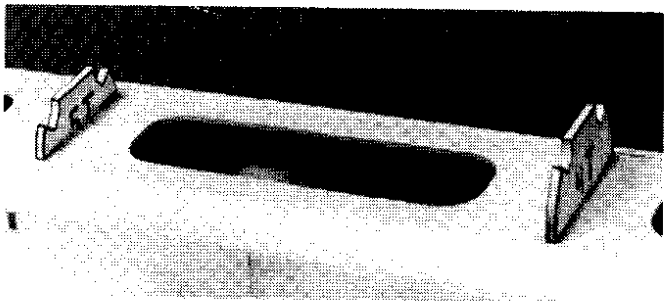
ASSEMBLE AFT DECK

You'll need the following parts:

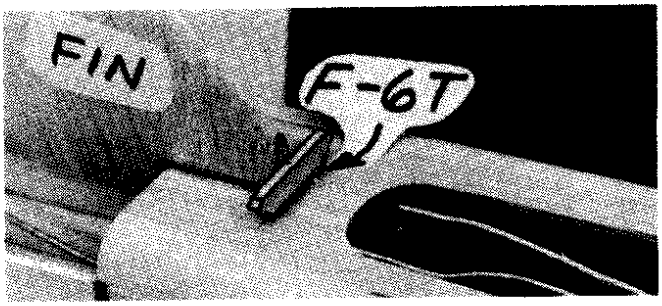
Die-cut 1/8" ply **Backrest**
Die-cut 1/8" balsa **F-4T**, **F-5T** and **F-6T**
Two 1/4" x 1/4" x 23-7/8" balsa sticks
Two 1/16" x 2-5/8" x 23-7/8" balsa **aft deck side sheeting**
3/8" x 1-5/8" x 23-7/8" balsa **aft deck top block**



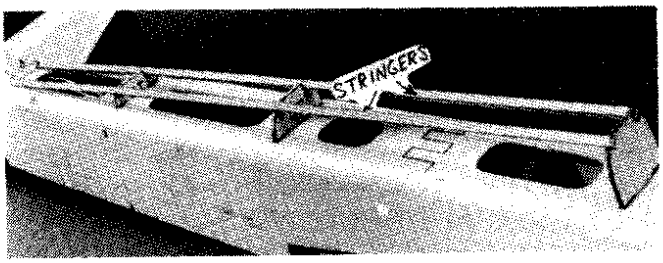
☐ 1. Glue the **Backrest** into the slot in the fuse top, using the **backrest gauge (BG)** to set the correct angle.

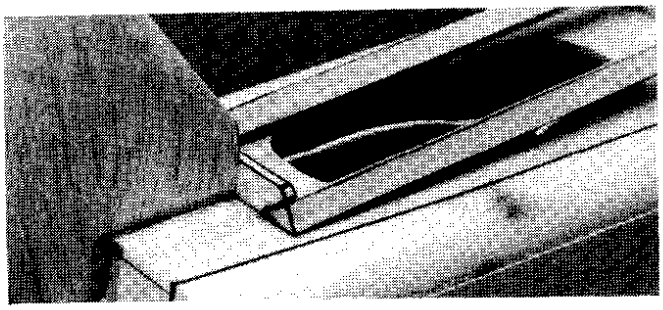


Glue **F-4T** to F-4 through the slot in the fuse top.
Glue **F-5T** to F-5 through the slot in the fuse top.



Center **F-6T** on the front of the fin, and glue it to the front of the fin and the fuse top.

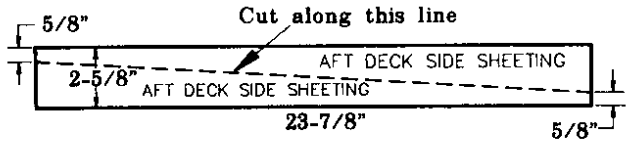




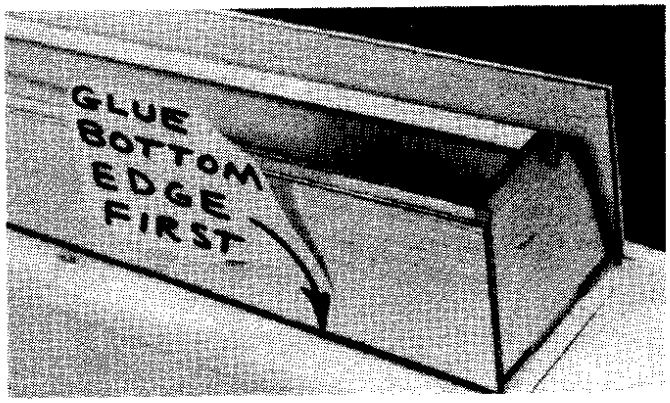
☐ 2. Glue the 1/4" x 1/4" balsa **stringers** into the notches in the formers. **NOTE:** You'll have to sand off part of the stringers near the aft end, to permit fitting under F-6T.

☐ 3. Use a sanding block to sand the sides of the stringers to blend with the formers (see the cross-section drawings on the plan). Trim the ends of the stringers even with the front of the backrest and the rear of F-6T.

☐ 4. Prepare the **aft deck sides** by cutting the 1/16" x 2-5/8" x 23-7/8" balsa sheet to the angle shown in the following sketch.



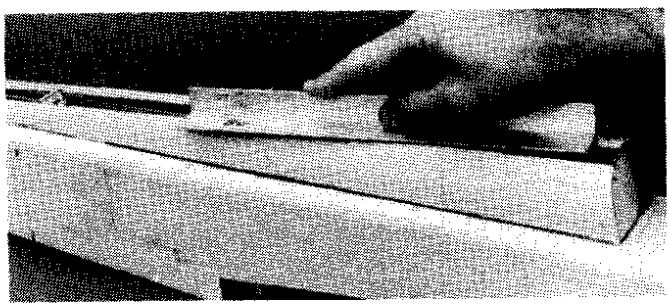
☐ 5. **Trial fit** one edge of the sheeting down onto the top of the fuse side. Sand the edge of the sheeting if necessary, for a good fit.



☐ 6. Glue the **bottom edge** of both side sheets to the top of the fuse sides. When gluing the aft 6" of this sheeting, tilt the sheeting in toward the formers approximately 10 - 20 degrees

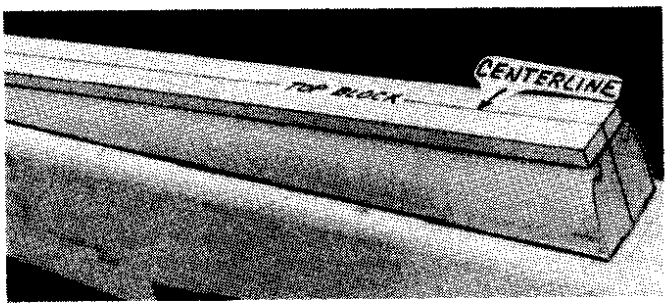
☐ 7. Wet the outside surface of the sheeting with a damp rag to permit easier bending. Apply thick CA glue to the edges of the formers and the stringers, then immediately bend the sheeting around the formers and onto the stringers. **HINT:** This requires about 5 sets of "hands," so use several long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

☐ 8. Trim and sand the sheeting flush with the front of the backrest and the rear of F-6T.



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

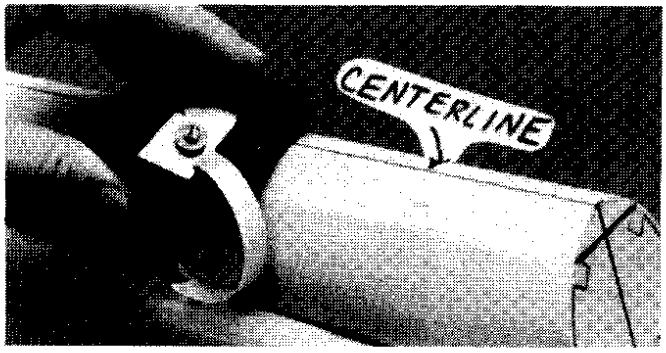
☐ 10. Sight down the top edge of the sheeting from the front, looking for any waviness in the stringers and sheeting (this will most likely occur between the backrest and F-5T). If there is, you may install a couple of cross-braces between the stringers to straighten things out.



☐ 11. Bevel one end of the 3/8" x 1-5/8" x 23-7/8" balsa **aft**

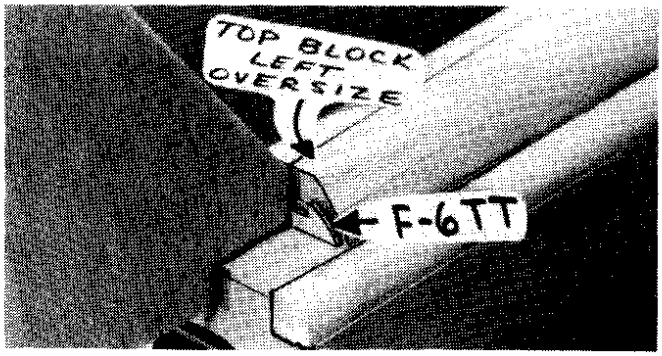
deck top block to fit snugly against the fin, then glue it to the tops of the formers, stringers and sheeting, then trim the ends of the top block flush with the backrest and F-6T.

HINT: In the next step it will be helpful in keeping the top block symmetrical if you first mark a **fuselage centerline** on the top of the top block from front to back (this is a line from the centerline of the backrest to the centerline of the fin).

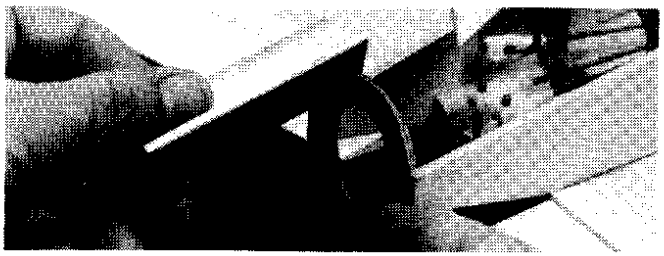


☐ 12. Carve and sand the top block to blend smoothly with the sheeting (see the cross-sections on the plan). **HINT:** Use a razor plane and a sanding block with 50-grit sandpaper for rough shaping the top block. **Leave the top block slightly oversize near the aft end, for now.**

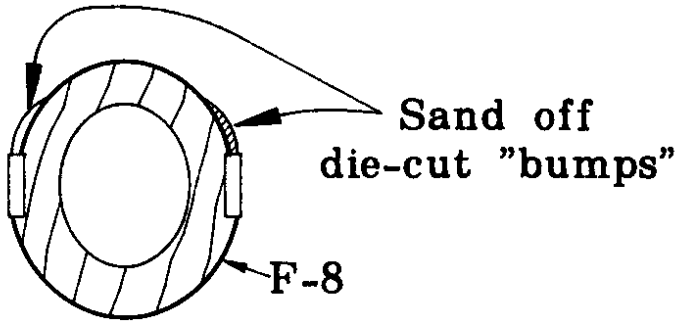
FIN FAIRING

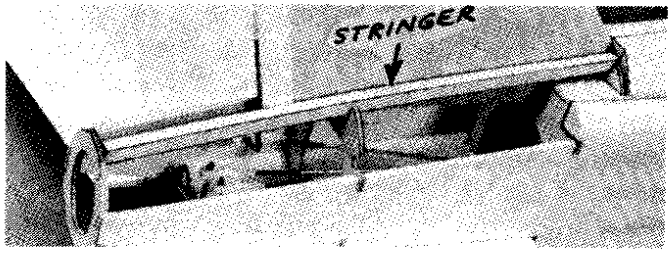


☐ 1. Glue the two **F-6TT** formers to the rear of F-6T and to the fin.

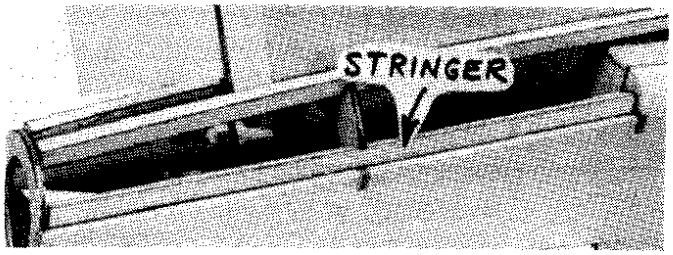


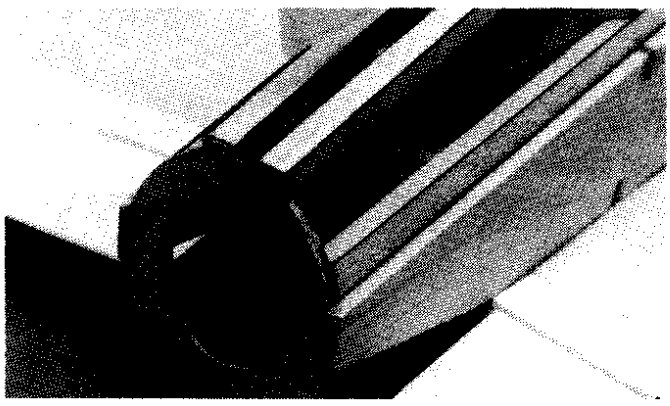
☐ 2. Former F-8 has two die-cut "bumps" which must be sanded off before proceeding. The following sketch shows the original and final outlines. Use a small sanding block, and use care to avoid damaging the rudder.





☐ 3. From the remaining 1/4" x 1/4" balsa sticks, cut stringers to fit along the sides of the fin, running from the front of F-6TT to the front of F-8, and glue in place.



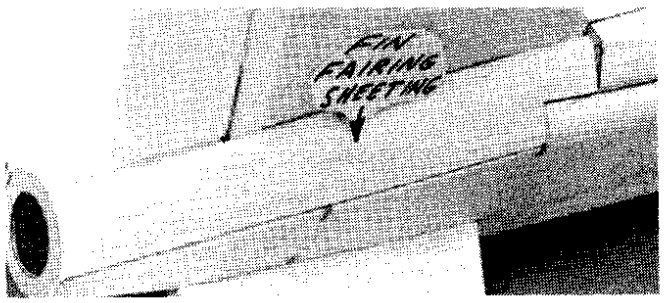


☐ 4. Also cut and install 1/4" x 1/4" stringers to run from F-6 to F-8 just inside the top edge of the fuse sides. **CAUTION:** Check the rudder torque rod for possible binding, and carve away part of the stringer as required.

☐ 5. Fill the area between the top stringers (under the rudder) with another piece of 1/4" x 1/4".

☐ 6. Use a small sanding block to contour the stringers to blend with the formers.

☐ 7. Make a **final** check of the internal rudder and elevator linkages: The elevators must be lined up with each other, the pushrods must operate freely without binding and provide the recommended control surface throws.



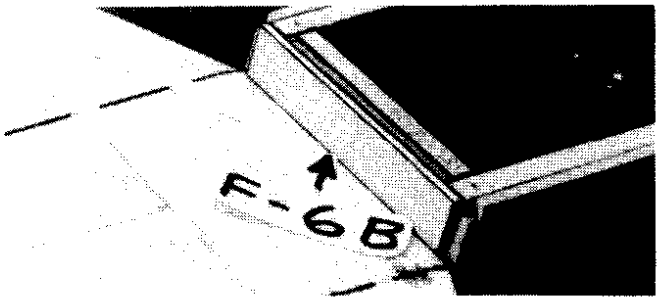
☐ 8. Trial fit the die-cut 1/16" balsa **fin fairing sheeting** and trim as necessary to cover the stringers from F-6TT to F-8. It will be necessary to wet the outside surface of the sheeting to permit bending without breaking. Once you have achieved a reasonably good fit, glue the sheeting in place. After the sheeting has dried, follow with medium or thick CA around the perimeter of the sheeting to insure that it has been securely glued.

☐ 9. Apply lightweight balsa filler to any voids, and sand the aft deck to **blend smoothly** with the fin fairing.

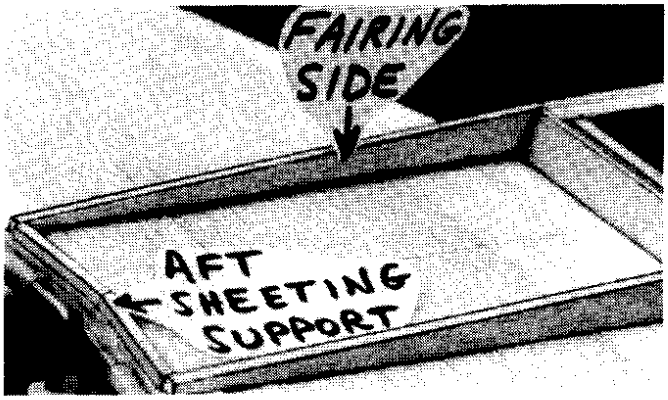
SUGGESTION: From this point on, we recommend using a padded "cradle" such as a Robart Super Stand to protect the fuselage from dents and dings.

BOTTOM STAB FAIRING

NOTE: Remove the hatch during the following steps, to avoid gluing it down.



☐ 1. Glue the die-cut 3/32" balsa **F-6B** to the rear of F-6 on the bottom of the stab, centering it between the fuse sides.

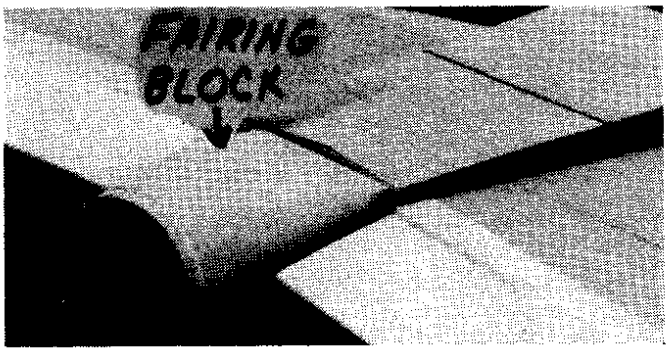


☐ 2. Glue the die-cut 1/8" balsa **stab fairing sides** to the bottom of the stab. The idea here is to position these pieces even with the fuse sides on the other side of the stab.

☐ 3. Cut the 1/8" x 1/8" x 2-1/2" balsa **aft sheeting support** in half, and fit these pieces between the fairing sides at the aft end. Glue in place.

☐ 4. From the remaining 1/16" x 3" balsa sheeting, cut and glue pieces of **cross-grain sheeting** to the bottom of the stab fairing. **NOTE:** When installing this sheeting, leave a small gap (approximately 1/32") along the front edge to allow room for the covering material.

☐ 5. Re-install the hatch, then trim and sand the sheeting even with the stab fairing sides and to blend with the hatch.



☐ 6. Custom cut the 3/4" x 2-1/4" x 2-1/4" balsa **tail fairing block** to fit the opening between the stab and F-8. As you shape this block, you must provide clearance for the elevator torque rods. Also sand away that part of the block which covers the center hole of F-8 (to permit future inspection of the internal linkages).

☐ 7. Use additional balsa scrap to fill the opening below the elevator torque rods, and add lightweight balsa filler as needed, then sand to blend smoothly with F-8, the stab fairing and the fuse sides.

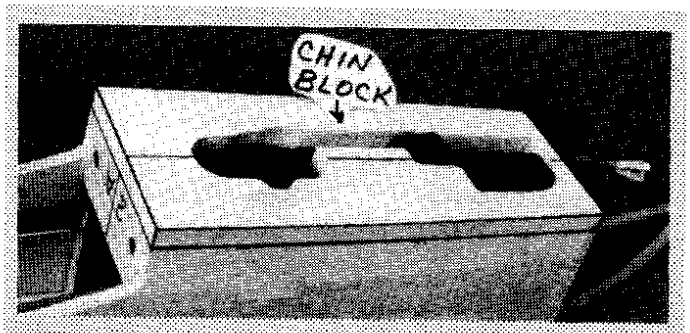
☐ 8. Trim the vacuum-formed ABS plastic **tail cone** at the trim lines, then trial fit it over F-8 and the fairings. Sand the fuselage as necessary until you are able to slide the tail cone onto the fuse approximately 1/4".

CHIN BLOCK

☐ 1. There are four identical 3/8" x 8-3/8" shaped balsa blocks in the kit. Glue two of these parts together along the long, straight edges to make the **chin block**.

☐ 2. Sand the bottom edges of the fuse sides, F-1 and F-2 to make a flat, even surface for the chin block.

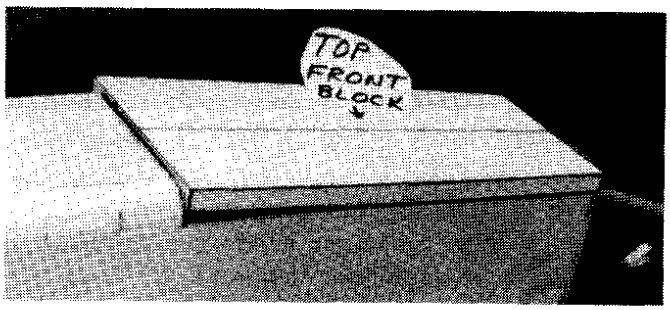
☐ 3. If you are using the standard fixed (non-retractable) nose gear, simply glue the chin block in place as shown on the plan, leaving a little excess protruding behind F-2A (thick CA or epoxy is recommended). Then sand the edges of the chin block even with the fuse sides, the front of F-1 and the aft edge of F-2A.



☐ 4. If you have installed a nose gear retract, you'll have to custom cut an opening in the chin block to permit the nose gear to retract. There is a sketch on the plan showing a typical nose gear cutout which can be used as a general guide for doing so. You'll want to make the opening large enough for access to the pushrod clevises, and to permit removal of the retract.

TOP FRONT BLOCK

☐ 1. Glue the other two 3/8" x 8-3/8" shaped balsa blocks together to make the **top front block**.



☐ 2. Trial fit the top front block on top of the fuse and note the gaps between the block and the top edge of the fuse sides. From scrap 1/4" balsa, cut pieces to fill these gaps, then sand the top edges of the fuse sides and the filler pieces to make a flat, even surface for the top front block.

☐ 3. Trial fit the top front block onto the fuse. Trim the aft edge of the block to a slight angle to fit snugly against the front of F-2. Note where the fuel tank contacts the block and carve out an area for fuel tank clearance, but **do not remove any more than necessary.** Glue a small piece of foam rubber to the inside of the block, so when you install the block it will compress the foam and hold the tank securely while providing a cushion from engine vibration.

☐ 4. Make a final check of the fuel tank compartment. There should be no bolts or screws protruding that could puncture the fuel tank. The fuel lines must be routed in such a way to prevent kinking. The fuel tank should be held securely in place and cushioned from vibration with foam rubber. The inside of the tank compartment should be fuelproofed with polyester resin, epoxy or fuelproof paint. The retract unit (if any) should be functioning smoothly.

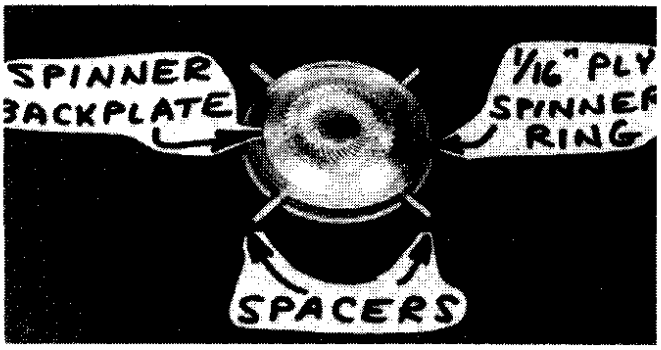
☐ 5. Securely glue the top front block to the fuse sides, F-1 and F-2 with thick CA or epoxy.

☐ 6. Sand the top front block even with the front of F-1, the fuse sides and to blend smoothly with the fuse top.

ENGINE COMPARTMENT

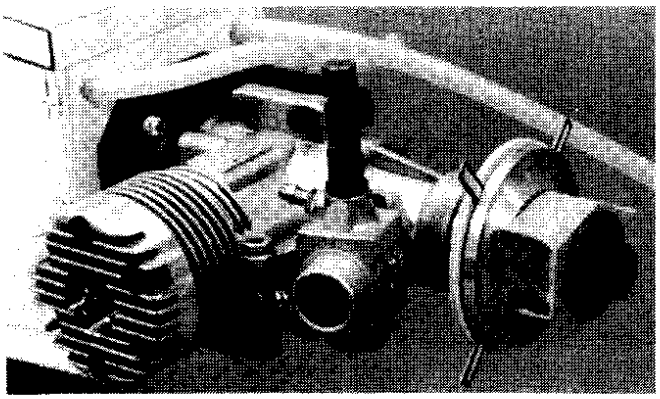
☐ 1. Attach the engine mount to F-1, and attach the engine to the mount. Remove the nose gear from the mount.

☐ 2. 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

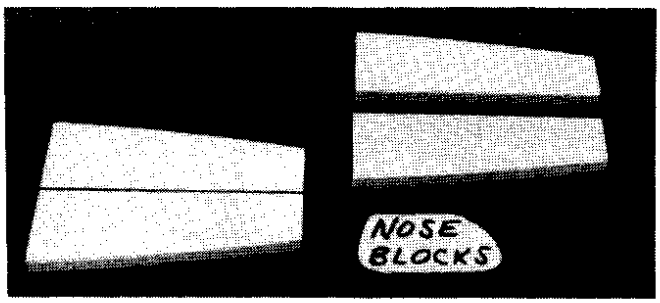


later). **IMPORTANT NOTE:** If you have chosen to use shock-absorbing rubber engine mounts, then you must provide more space between the spinner ring and the spinner backplate to allow for engine movement. (A space of approximately 1/8" is probably sufficient).

☐ 3. Now center your 2-3/4" diameter **spinner backplate** over the spinner ring, and tack glue it to the 1/32" ply spacers.

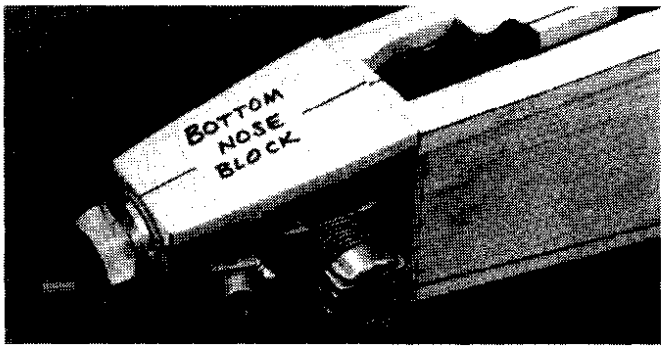


☐ 4. Slide the spinner ring / spinner backplate assembly onto the driveshaft and temporarily hold in place with the prop and prop nut. The hub cut from an old prop will help hold the spinner backplate in place.



☐ 5. There are four identical 1/4" x 4" shaped balsa parts in the kit. Glue these parts together along the long, straight edges to make the **top and bottom nose blocks**.

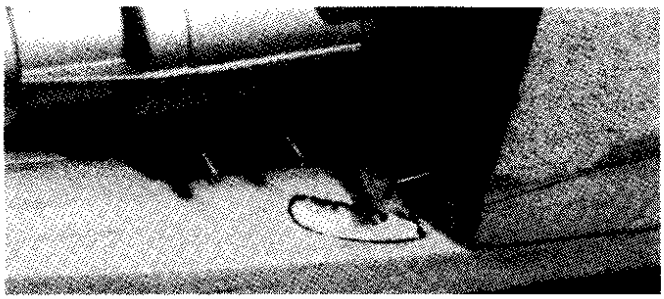
☐ 6. With the fuselage upside down, trial fit the **bottom nose block** in place on the bottom of the engine compartment. Study the plan to see the correct positioning of this part. Note how the front of the nose block meets the spinner ring. By



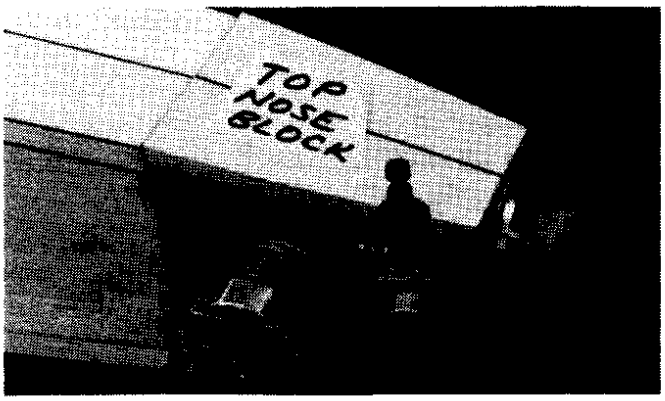
trial and error, sand a little at a time off the front and rear of the nose block until it mates at the proper angle with F-1 and the back of the spinner ring. Now glue the bottom nose block to F-1 and the spinner ring.

NOTE: If you have installed a retractable nose gear, skip steps 7 and 8.

☐ 7. 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 nose block for the nosegear wire. Insert the drill through the holes in the engine mount and drill down through the nose block.



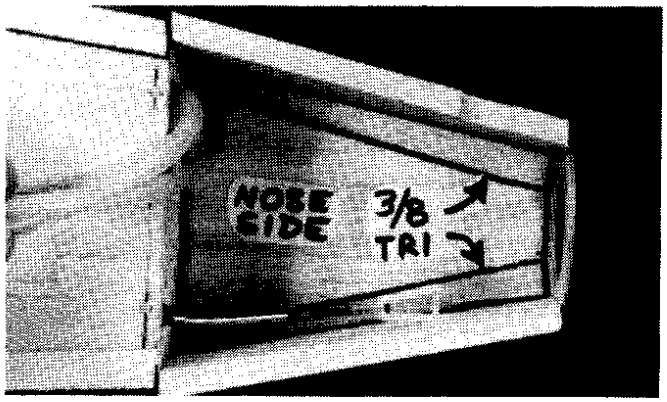
☐ 8. Temporarily install the nose gear, steering arm and nosegear pushrod wire. Notice that the steering arm and the pushrod wire will bind against the chin block, especially in a right turn. Carve out a **clearance slot** for the nosegear pushrod in the chin block. Now remove the nosegear parts.



☐ 9. Custom cut the **top nose block** to fit between F-1 and

the spinner ring, trimming as necessary for needle valve clearance (see the plan for positioning of this part). Then glue the top nose block in place.

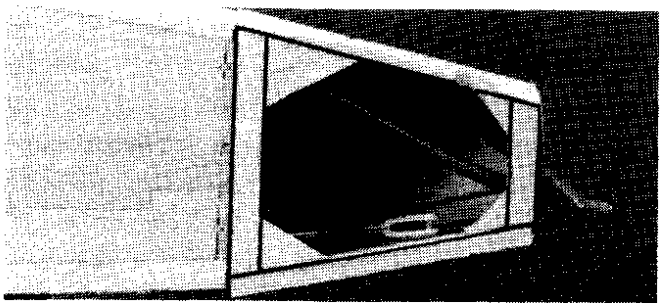
☐ 10. Remove the prop nut and propeller. Pop the spinner backplate loose with a screwdriver and remove the spacers. Remove the engine and mount in preparation for the next step. Mark the outline of the engine mount on F-1 with a pencil.



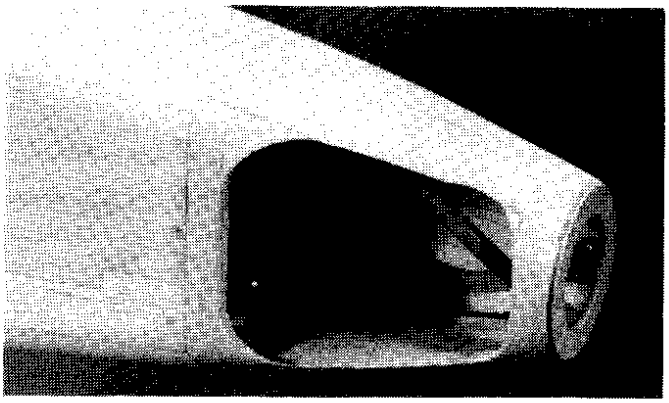
☐ 11. A 1/4" x 3" x 7-3/4" balsa sheet is provided for the **nose sides**. From this sheet, cut a piece to fit on the left side of the fuselage between the top and bottom nose blocks, F-1 and the spinner ring. To do this more easily you may remove the engine and mount, then lay the fuse on its left side on top of the 3/8" balsa sheet and mark the outline of the opening on the sheet. (When installing this block, make sure you stay clear of the engine mount outline).

☐ 12. If necessary, carve out an area of the nose side needed for nosegear steering arm and pushrod clearance, then glue the left nose side in place.

☐ 13. From the 3/8" balsa triangle stock, cut lengths to fit in the upper left and lower left corners of the nose, between F-1 and the spinner ring. Sand these balsa triangles to a **taper**, with the wide part at the front, and glue them in place.



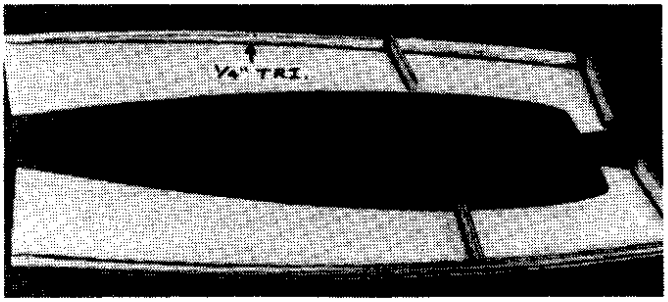
☐ 14. Temporarily re-install the engine and mount; then, from the remaining 1/4" balsa sheet and 3/8" balsa triangle, cut pieces to partially fill in the **right side** around the engine. Also, trim the balsa as necessary to clear your muffler. **SUGGESTION:** The temptation is to close up this area too much! We recommend that you leave large enough openings that you may easily remove the engine and mount, and so you will have convenient access to the throttle linkage.



☐ 15. Using a sanding block with coarse sandpaper, sand all the front blocks to blend smoothly. Check the cross-section drawings of F-1 and F-2 on the plan to get an idea of how much to round the corners.

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

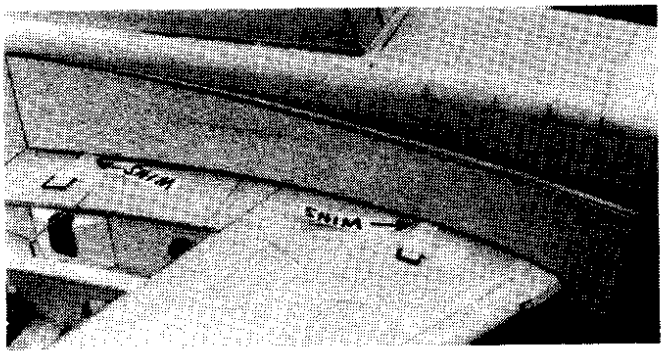
AIR INTAKES (SIMULATED)



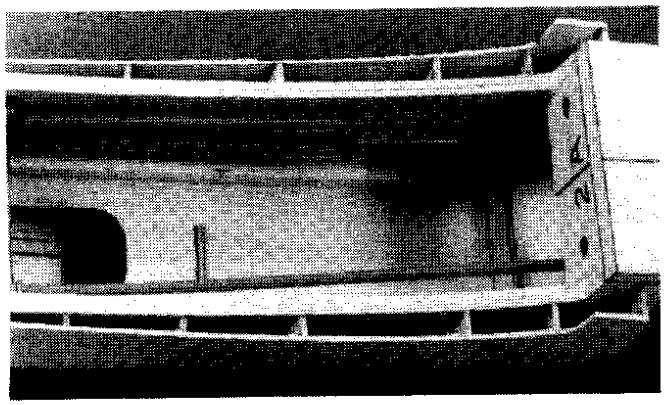
☐ 1. Cut the 1/4" x 30" balsa triangle in half, and glue these triangles along the top edges of the **air intake sides**, being careful to make a **right** and a **left** side. If the triangle stock is hard, making it difficult to bend, you may have to make several saw cuts with a razor saw.

☐ 2. Sand the balsa triangles to a taper, as shown on the plan top view, to allow the intake sides to gradually feather into the fuse sides.

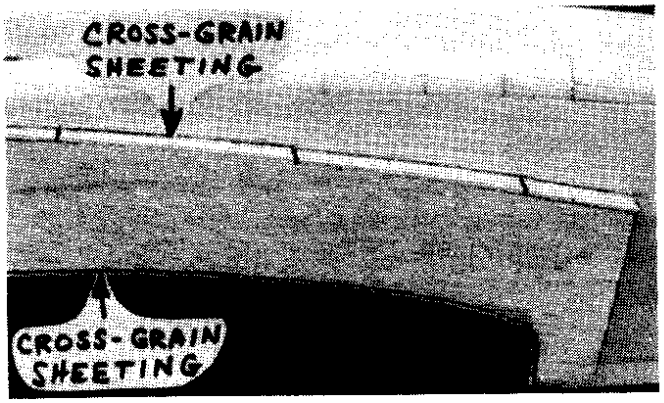
☐ 3. From the plan, determine where the die-cut 3/32" balsa **air intake formers** are to be located (the long former is located at the front, and the short former is approximately 5" back), and glue them to the air intake sides.



☐ 4. Attach the wing to the fuse, then carefully position the air intake assemblies on the fuse sides, holding them in place with tape while positioning. **IMPORTANT:** The **bottom** edge of the air intake side must be **1/16" above** the wing to leave room for the 1/16" cross-grain sheeting. Use 1/16" shims to hold the intake sides away from the wing.



☐ 5. The air intake sides do not offer much resistance to squeezing; therefore, you should now remove the wing and install extra formers (with fuse inverted) between the air intake sides and the fuse sides to make the sides more resistant to damage as a result of improper handling. Use scrap 3/32" balsa for these formers.



☐ 6. From the remaining 1/16" balsa sheeting, cut and install **cross-grain sheeting** on the top and bottom of the air intake sides.

☐ 7. Spread a generous amount of lightweight balsa filler on the fuse sides in the area behind the air intake sides. After the filler has thoroughly dried, sand it to blend the air intake sides smoothly into the fuse sides.

☐ 8. Sand the top edge of the air intakes to a slightly rounded shape as shown on the cross-sections of F-2 and F-3.

WING FAIRING

You'll need the following parts:

7/8" x 3-1/2" x 5-7/8" balsa **front fairing block**
7/8" x 3-1/2" x 9-3/8" balsa **rear fairing block**
balsa scraps.

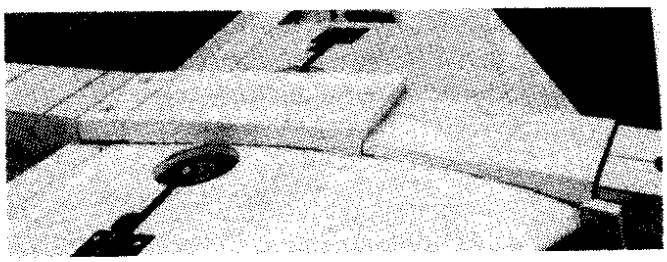
☐ 1. Mount the wing to the fuselage with the nylon bolts.

☐ 2. Draw **centerlines** on the blocks.

☐ 3. Sand the aft edge of the 7/8" x 3-1/2" x 9-3/8" balsa **rear fairing block** to an angle to match F-4, then position it on top of the nylon bolts, centered between the fuse sides,allowing approx. 1/32" space in front of F-4. Push down on this block to make imprints of the nylon bolt heads in the fairing block.

☐ 4. Make holes in the fairing block large enough to clear the heads of the nylon bolts.

☐ 5. Again hold the fairing block in position, pushing down to imprint the location of the 1/16" ply wing hold-down plate on the fairing block. Carve the fairing block to clear the wing hold-down plate



☐ 6. Carve and sand the fairing block to mate with the bottom of the wing. **NOTE:** It is difficult (and not necessary) to carve this block to mate <u>exactly</u> with the wing; therefore, you should just "rough it out", then later you can fill any gaps with balsa filler.

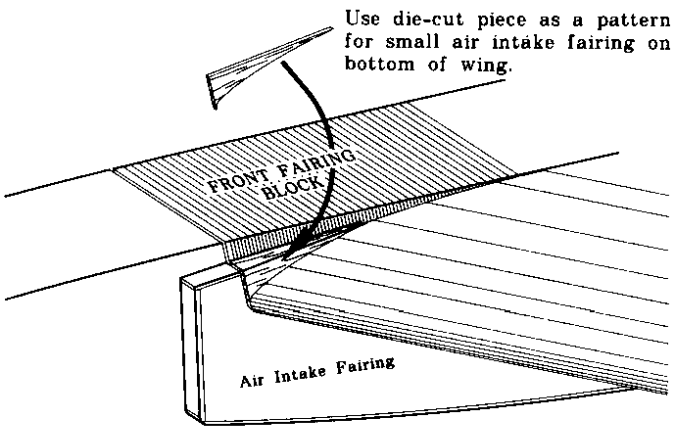
☐ 7. Hold the rear fairing block in place, leaving a slight (1/32") gap between the back of the block and the front of

F-4, and apply a couple drops of thin CA to tack it in place. Remove the wing bolts and remove the wing from the fuse, then glue the block securely in place.

☐ 8. Carve and sand the 7/8" x 3-1/2" x 5-7/8" tapered balsa **front fairing block** to fit the front portion of the wing. **NOTE:** It is difficult (and not necessary) to carve this block to mate exactly with the wing; therefore, you should just "rough it out", then later you can fill any gaps with balsa filler.

☐ 9. With the wing in place on the fuse, hold the front fairing in place (allow 1/32" gap between the fairing front and the rear of F-2A) and tack glue it to the wing. **CAUTION: Use extreme care to avoid gluing the wing to the fuselage!**

☐ 10. Remove the wing and securely glue the front fairing block to the wing. Fill all gaps with balsa filler. After the filler has dried, replace the wing on the fuse and sand the fairing blocks to smoothly blend the wing to the fuselage.



☐ 11. In the same manner, cut scraps of balsa to blend the air inlets into the wing. **NOTE:** There are small die-cut pieces on Die Sheet No. PAT4F07 that can be used as a pattern for the air inlet fairing on the bottom of the wing.

☐ 12. Sand the corners of the fairings to a rounded shape as shown in the cross-section drawings on the fuselage plan. This completes the assembly of the basic structure.

FINISHING

ADDITIONAL FUELPROOFING

If you have not already done so, make sure the entire engine compartment is completely fuelproof. Also fuelproof any wood that will not be covered and which may be exposed to glow fuel residue, such as the landing gear block slots and the wing saddle. Use polyester finishing resin, fuelproof paint, or epoxy thinned with alcohol

INSTRUMENT PANEL & CONSOLE.

You will find the instrument console parts on the 1/16" balsa die-cut sheet PAT4F08. Glue these parts together as shown on the plan, and glue them to the fuse top.

SEAL OFF COCKPIT

If you leave any openings through the fuse top into the cockpit area, there is the possibility of getting dust on the inside of the canopy, which is almost impossible to remove. Therefore, you should seal all openings to the inside of the cockpit, and paint all exposed balsa to prevent loose wood particles.

PREPARE THE CANOPY

NOTE: Some modelers prefer to tint their canopies for a more subtle and realistic effect. You may tint your canopy by immersing it in a concentrated mixture of Rit Liquid or powdered 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.

☐ 1. Using a scissors, carefully cut the **canopy** just below the trim line.

☐ 2. **Trial fit** the canopy onto the fuse, pressing into place. Trim as necessary for a good fit. **NOTE:** The trim line on the canopy is approximate. Your canopy trim will vary, depending on how you sanded the fuselage.

☐ 3. Sand the edges of the canopy with 320 grit sandpaper. It is important that the canopy does not have any cracks along the edges, as the engine vibration could cause them to spread.

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:

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

☐ 2. With the wing level, lift the model by the engine propeller shaft and at the centerline of F-8 (this may require two people). Do this several times.

☐ 3. If one wing always drops when you lift, it means that side is heavy. Balance the airplane by gluing weight to 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.

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.**

NOTE: When covering the fin and stab, begin by applying 1/2" wide strips of covering in the corners between the fin and the fin fairing, between the stab and the fuse sides, on the bottom of the stab between the stab and the stab fairing, and on all other "inside corners". Next cover the fairings with pre-cut pieces of covering. Finally, cover the major areas with pre-cut pieces that have a straight edge to overlap (1/8"+ overlap) the strips you previously applied. **DO NOT, under any circumstances, attempt to cut the covering material after it has been applied to the fin and stab, except around the leading and trailing edges and the tip.** Modelers who do this often cut through the covering and part-way into the balsa stab. This can weaken the stab to the point where it may fail in flight!

Recommended Covering Sequence:

1. Strips as described in above note
2. Stab bottom
3. Stab top
4. Fuse bottom
5. Fuse sides
6. Fuse top
7. Fin left side
8. Fin right side
9. Ends of ailerons
10. Bottom of ailerons
11. Top of ailerons
12. Aileron openings in wing
13. Wing fairings (on bottom of wing)
14. Bottom of left wing panel
15. Bottom of right wing panel
16. Top of left wing panel (overlap covering 1/4" at wing LE)
17. Top of right wing panel (overlap covering 1/2" at the center and 1/4" at the LE)

GLUE THE AILERON HINGES

☐ 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 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. In the same manner, slit the covering at the hinge locations in the wing. Also cut the covering away from the torque rod slots.

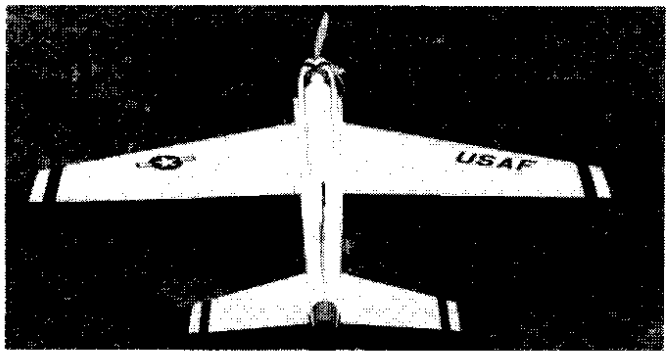
☐ 2. Using coarse sandpaper, roughen the part of the aileron torque rods that will be glued into the ailerons, then clean off the sanded portion of the rods with alcohol or a degreasing solvent. Using a toothpick, apply a small amount of Vaseline where the torque rods enter the nylon bearing tubes (to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

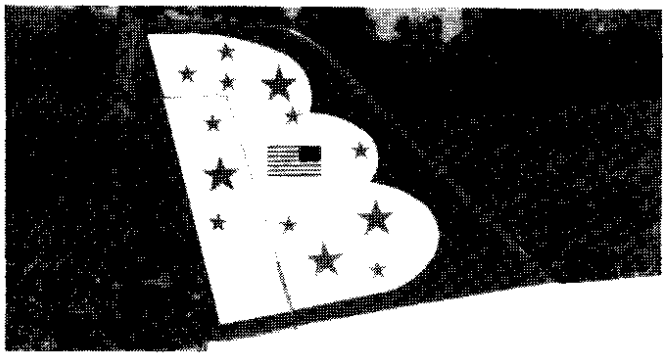
☐ 3. Using a small stick, work a generous amount of **epoxy** (30-minute epoxy is recommended) into the aileron torque rod holes. Push the ailerons and aileron hinges into place and **wipe off all excess epoxy**. Now carefully position the ailerons with respect to the wing, and glue the hinges with thin CA, in the same manner as the elevator hinges.

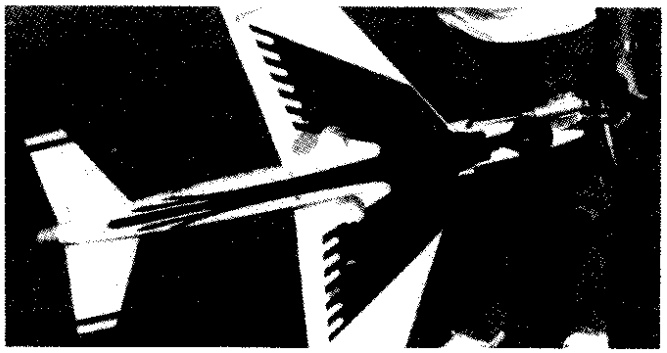
DECALS AND TRIM

Although the Patriot is not a scale model of any real jet, you will recognize many familiar jet-like outlines and shapes, and you can adapt virtually any trim scheme to this model.

The prototype trim scheme (shown on the box cover) was adapted from the various trim schemes used by the Thunderbirds show team. We recommend that you visit your local public library and look at the many colors and trim schemes that have been used on jets, to get some ideas. We recommend you choose a trim scheme that makes the top and bottom of the airplane quickly identifiable.







NOTE: The decal sheet does not give you everything you need to completely trim your model; but it may be helpful, depending on the trim scheme you have chosen. **The complete trim layout of our prototype is shown on the back of the fuselage plan.**

☐ 1. Study the plans and the photos on the box to determine where to place the decals.

☐ 2. Thoroughly clean your airplane before applying decals.

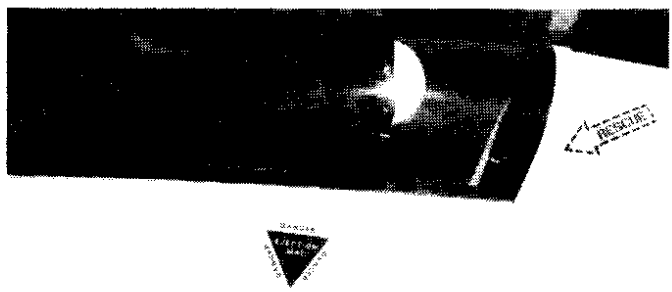
☐ 3. Cut out the individual decal items and apply them in the locations shown on the plan or wherever you prefer.

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.

☐ 4. Chevron spray paints were used for some of the trim, and were sprayed right onto the Super Monokote, after masking off with Great Planes "E-Z Mask".

☐ 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.

INSTALL PILOT (not included)



Assemble and paint your pilot figure, and glue it to the fuse top in the location shown on the plan. **NOTE:** To avoid the possibility of the pilot coming loose inside the canopy, we recommend that you drill up through the cockpit floor and pilot base, and use two #6 sheet metal screws (not included) to lock the pilot in place.

GLUE CANOPY IN PLACE

☐ 1. Lightly sand the inside of the canopy around the aft edge (sand a strip approximately 1/8" wide). **NOTE:** To avoid sanding more than you want, it is helpful to first apply a strip of masking tape on the inside of the canopy, 1/8" in from the edge.

☐ 2. Poke **pinholes** (1/8" apart) through the covering material in the area where the canopy will be glued to the fuselage.

☐ 3. Hold the canopy in place on the fuselage and very carefully apply 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 which is 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 clear canopy.**

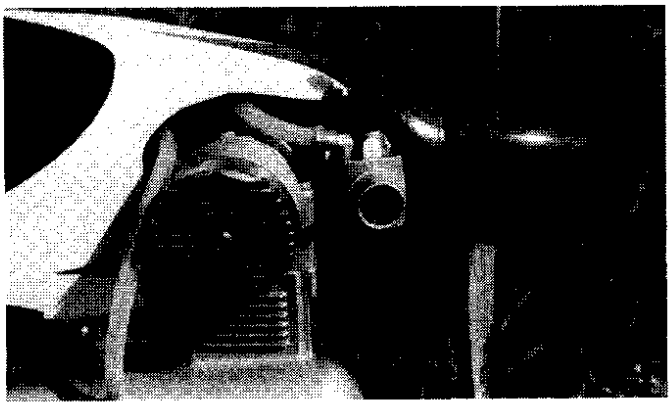
☐ 4. To hide the canopy glue joint, you can use 1/4" wide striping tape as a border around the canopy.

WING SEATING

☐ 1. Apply 1/4" or 3/8" wide foam **wing seating tape** to the wing saddle area 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 top 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 of the fuselage. 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



Re-install the engine, propeller, battery, receiver, servos, control horns, pushrods, main LG, nose gear and **wheels**. Attach the wing to the fuselage.

We recommend the following
CONTROL SURFACE THROWS:

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

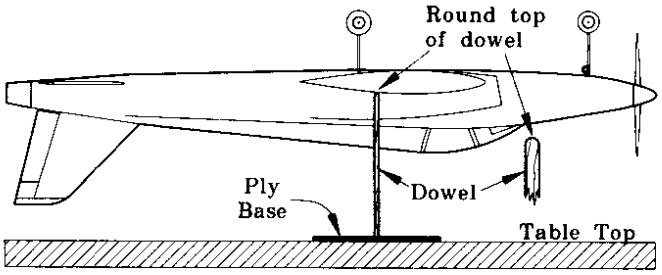
ELEVATOR:	1/4" - 5/16" up, 1/4" - 5/16" down (if balanced at the aft CG limit).
	5-16" - 3/8" up, 5/16" - 3/8" down (if balanced in the middle of the CG range).
	3/8" up, 3/8" down (if balanced at the front CG limit).
RUDDER:	5/8" right, 5/8" left (This should be enough to hold knife edge. More rudder throw will be helpful for spins and snaps).
AILERONS:	3/16" up, 3/16" down (normal roll rate)
	1/4" up, 1/4" down (fast roll rate)

NOTE: These control surface "throws" are approximate and provide a good starting point for the first flights with your Patriot. You may wish to change the throws slightly to provide the smoothness or quickness you prefer.

BALANCE YOUR MODEL

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

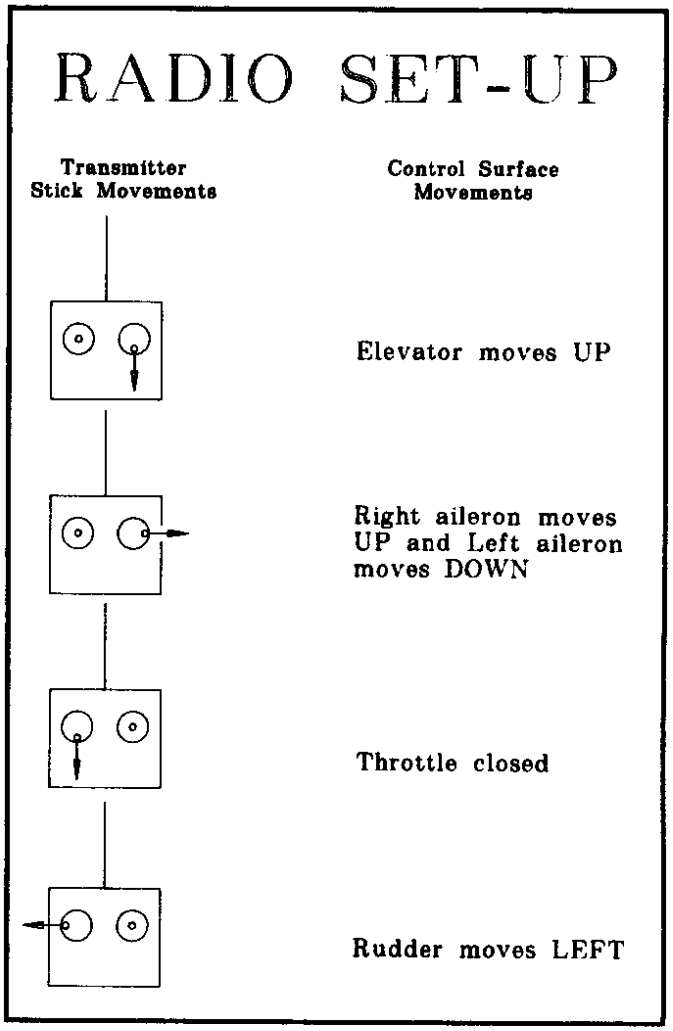
☐ 1. Accurately mark the balance point on the TOP of the wing on both sides of the air intakes. The balance point is shown on the plan (**CG**), and is located approximately **8-1/2 inches** back from the leading edge at the root. This is the balance point at which your model should balance for your first flights. Later, you may wish to experiment by shifting the balance up to **3/8" 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" and often improves knife-edge capabilities. If you move the balance aft, the elevator will have more authority, possibly resulting in tip stalls. If this happens, you should reduce the maximum elevator throw slightly. In any case, **do not balance your model outside the recommended range.**



☐ 2. The best way to balance your Patriot is to make a **balancing stand** from a square of 1/4" plywood and two 3/8" dowels approximately 5" apart. Mark the fore and aft limits of the balance range on the **top** of the wing (on both sides of the fuselage), and place the airplane **upside down** on the balancing stand as shown in the sketch (**empty** fuel tank). 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 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, and, later, if the balance proves to be OK you can open the fuse bottom and glue these in permanently.

FINAL HOOKUPS AND CHECKS

☐ 1. Make sure the control surfaces move in the proper direction as illustrated in the following sketches:



☐ 2. **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 flight.**

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** 1/2 degree at the tips (this means that the trailing edge is 1/16" 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.

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 for at least two tanks of fuel. **Follow the engine manufacturer's recommendations for break-in.** Check to make sure all screws remain tight, that the hinges are secure and that the prop is on tight.

RANGE CHECK YOUR RADIO

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

Repeat this test **with the engine running** at various speeds with an assistant holding the model. If the control surfaces are not 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 material in your face or eyes.

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

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

pockets into the prop.

Use a "chicken stick" device or electric starter; follow instructions supplied with the starter or stick. Make certain the glow plug clip or connector is secure so that it will not pop off or otherwise get into the running propeller.

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

The engine gets hot! Do not touch it during or after operation. Make sure fuel lines are in good condition so fuel 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.

AMA SAFETY CODE

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

GENERAL

1. I will not fly my model aircraft in competition or in the presence of 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, burns, or propels a projectile of any kind) . . .

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 . . .

FLYING

The Great Planes Patriot 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 crosswind. Although the Patriot 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 "jerk" it off into a vertical climb!), and climb out gradually.

FLYING: We recommend that you take it easy with your Patriot for the first several flights and gradually "get ac-

quainted" with this fantastic ship as 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. If you notice any "sluggishness" in the way your Patriot handles, such as an inability to maintain knife edge flight, it is probably the result of not enough speed, in which case you should install a propeller with increased pitch or tune your engine for higher RPM. **Speed** is the key to good knife-edge performance. 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. If it fluttered once, it will probably flutter again under similar circumstances unless you can eliminate the slop or flexing in the linkages. Here are some things which can result in flutter: Excessive hinge gap; Not mounting control horns solidly; Sloppy fit of clevis pin in horn; Elasticity present in flexible plastic pushrods; Side-play of pushrod in guide tube caused by tight bends; Sloppy fit of 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, fly a normal landing pattern and approach. It is normal for an airplane of this type to become slightly less stable and responsive to the controls when slowed down for landing; therefore, you should try to make smooth course corrections, maintaining a straight approach with a constant rate of descent, and a moderate flare just prior to touchdown. If you find that it lands a little fast, you might try dialing in a few clicks of up elevator when you cut the throttle on the downwind leg of the landing pattern. This will automatically help to bleed off some of the speed.

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!

NOTES

Kit Purchase Date _____

Where Purchased _____

Price _____

8-Digit # on End Flap of Box _____

Date Construction Started _____

Date Construction Finished _____

Date of First Flight _____

Finished Weight (ounces) _____

Wing Loading (Weight ÷ 3.64) _____

Comments _____

FLIGHT LOG

FLIGHT NO.	DATE	FLIGHT TIME	COMMENTS

FLIGHT LOG

FLIGHT NO.	DATE	FLIGHT TIME	COMMENTS

FLIGHT TRIMMING

. . . A model is not a static object. Unlike a car, which can only hunt left or right on the road (technically, a car does yaw in corners, and pitches when the brakes are applied), a plane moves through that fluid we call air in all directions simultaneously. The plane may look like it's going forward, but it could also be yawing slightly, slipping a little and simultaneously climbing or diving a bit! The controls interact. Yaw can be a rudder problem, a lateral balance problem or an aileron rigging problem. We must make many flights, with minor changes between each, to isolate and finally correct the problem.

The chart accompanying this article is intended to serve as a handy field reference when trimming your model. Laminate it in plastic and keep it in your flight box. You just might have need to consult it at the next contest! The chart is somewhat self-explanatory, but we will briefly run through the salient points.

First, we are assuming that the model has been C.G. balanced according to the manufacturer's directions. There's nothing sacred about that spot -- frankly, it only reflects the balance point where a prototype model handled the way the guy who designed it thought it should. If your model's wing has a degree more or less of incidence, then the whole balance formula is incorrect for you. But, it's a good ballpark place to start.

The second assumption is that the model has been balanced laterally. Wrap a strong string or monofilament around the prop shaft behind the spinner, then tie the other end to the tail wheel or to a screw driven into the bottom of the aft fuse. Make the string into a bridle harness and suspend the entire model inverted (yes, with the wing on!). If the right wing always drops, sink some screws or lead into the left wing tip, etc. You may be surprised to find out how much lead is needed.

At this point the model is statically trimmed. It's only a starting point, so don't be surprised if you wind up changing it all. One other critical feature is that the ailerons must have their hinge gap sealed. If shoving some Scotch tape or Monokote into the hinge gap to prevent the air from slipping from the top of the wing to the bottom, and vice-versa, bothers you, then don't do it.

To achieve the maximum lateral trim on the model, the hinge gap on the ailerons should be sealed. The easiest way to do this is to disconnect the aileron linkages, and fold the ailerons as far over the top of the wing as possible (assuming they are top or center hinged). Apply a strip of clear tape along the joint line. When the aileron is returned to neutral, the tape will be invisible, and the gap will be effectively sealed. Depending on how big the ailerons are, and how large a gaping gap you normally leave when you install hinges, you could experience a 20 percent increase in aileron control response just by this simple measure.

. . . Your first flights should be to ascertain control centering and control feel. Does the elevator always come back to neutral after a 180-degree turn or Split-S? Do the ailerons tend to hunt a little after a rolling maneuver? Put the plane through its paces. Control centering is either a mechanical thing (binding servos, stiff linkages, etc.), an electronic thing (bad servo resolution or dead-band in the radio system), or C.G. (aft Center of Gravity will make the plane wander a bit). The last possibility will be obvious, but don't continue the testing until you have isolated the problem and corrected it.

. . . let's get down to the task of trimming the model. Use the tachometer every time you start the engine, to insure consistent results. These trim flights must be done in calm weather. Any wind will only make the model weathervane. Each "maneuver" on the list assumes that you will enter it dead straight-and-level. The wings must be perfectly flat, or else the maneuver will not be correct and you'll get a wrong interpretation. That's where your

observer comes in. Instruct him to be especially watchful of the wings as you enter the maneuvers

Do all maneuvers at full throttle. The only deviation from this is if the plane will be routinely flown through maneuvers at a different power setting. . .

Let's commence with the "engine thrust angle" on the chart. Note that the observations you make can also be caused by the C.G., so be prepared to change both to see which gives the desired result. Set up a straight-and-level pass. The model should be almost hands-off. Without touching any other control on the transmitter, suddenly chop the throttle. Did the nose drop? When you add power again, did the nose pitch up a bit? If so, you need some downthrust, or nose weight. When the thrust is correct, the model should continue along the same flight path for at least a dozen plane lengths before gravity starts to naturally bring it down.

Do each maneuver several times, to make sure that you are getting a proper diagnosis. Often, a gust, an accidental nudge on the controls, or just a poor maneuver entry can mislead you. The thrust adjustments are a real pain to make. On most models, it means taking the engine out, adding shims, then reassembling the whole thing. Don't take shortcuts. Don't try to proceed with the other trim adjustments until you have the thrust line and/or C.G. correct. They are the basis upon which all other trim setting are made.

Also, while you have landed, take the time to crank the clevises until the transmitter trims are at neutral. Don't leave the airplane so that the transmitter has some odd-ball combination of trim settings. One bump of the transmitter and you have lost everything. The trim must be repeatable, and the only sure way to do this is to always start with the transmitter control trims at the middle.

The next maneuver is somewhat more tricky than it looks. To verify the C.G., we roll the model up to a 45-degree bank, then take our hands off the controls. The model should go a reasonable distance with the fuse at an even keel. If the nose pitches down, remove some nose weight, and the opposite if the nose pitches up. The trick is to use only the ailerons to get the model up at a 45-degree bank. We almost automatically start feeding in elevator, but that's a no-no. Do the bank in both directions, just to make sure that you are getting an accurate reading of the longitudinal balance.

We now want to test the correct alignment of both sides of the elevator (even if they aren't split, like a Pattern ship's, they can still be warped or twisted). Yaw and lateral balance will also come into play here, so be patient and eliminate the variables, one-by-one. The maneuver is a simple loop, but it must be entered with the wings perfectly level. Position the maneuver so that your assistant can observe it end-on. Always loop into the wind. Do several loops, and see if the same symptom persists. Note if the model loses heading on the front or back side of the loop. If you lose it on the way up, it's probably an aileron problem, while a loss of heading on the way back down is most likely a rudder situation.

After you get the inside loops going correctly, do the same maneuver to the outside, entering from an inverted position . . . Before you make too many dramatic changes, glance at the remainder of the chart and note the myriad combination of things we can do just with the ailerons. Each change you make will affect all other variables!

Note that the Yaw test is the same looping sequences. Here, however, we are altering rudder and ailerons, instead of the elevator halves. We must repeat that many airplanes just will not achieve adequate lateral trim without sealing the hinge gaps shut. The larger you make the loops (to a point), the more discernible the errors will be.

The Lateral Balance test has us pulling those loops very tightly. Actually, we prefer the Hammerhead as a better test for a heavy wing. Pull straight up into a vertical and watch which wing drops. A true vertical is hard to do, so make sure that your assistant is observing from another vantage point. Note that the engine torque will affect the vertical fall off, as will rudder errors. Even though we balance the wing statically before leaving for the field, we are now trimming it dynamically.

The Aileron Coupling (or rigging) is also tested by doing Hammerheads. This time, however, we want to observe the side view of the model. Does the plane want to tuck under a bit? If so, then try trimming the ailerons down a small bit, so that they will act as flaps. If the model tends to want to go over into a loop, then rig both ailerons up a few turns on the clevises. Note that drooping the ailerons will tend to cancel any washout you have in the wing. On some models, the lack of washout can lead to some nasty characteristics at low speeds.

The effects noted with the Aileron Coupling tests can also be caused by an improperly set wing incidence. The better test for this is knife-edge flight . . . If the model tends to pull upward, i.e., it swings toward a nose up direction, then reduce the wing incidence. If the model tries to go off heading toward the bottom side of the plane, then increase incidence.

Again, we reiterate that all of these controls are interactive. When you change the wing incidence, it will influence the way the elevator trim is at a given C.G. Re-trimming the wing will also change the rigging on the ailerons, in effect, and they may have to be readjusted accordingly.

The whole process isn't hard. As a matter of fact it's rather fun -- but very time consuming. It's amazing what you will learn about why a plane flies the way it does, and you'll be a better pilot for it. One thing we almost guarantee, is that your planes will be more reliable and predictable when they are properly trimmed out. They will fly more efficiently, and be less prone to doing radical and surprising things. Your contest scores should improve, too.

We wish to acknowledge the Orlando, Florida, club newsletter, from which the basics of the chart presented here were gleaned.

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

FLIGHT TRIMMING CHART

TRIM FEATURE	MANEUVERS	OBSERVATIONS	CORRECTIONS
CONTROL CENTERING	Fly general circles and random maneuvers.	Try for hands off straight and level flight.	Readjust linkages so that Tx trims are centered.
CONTROL THROWS	Random maneuvers.	A. Too sensitive, jerky controls. B. Not sufficient control.	If A, change linkages to reduce throws. If B, increase throws.
ENGINE THRUST ANGLE[1]	From straight flight, chop throttle quickly.	A. Aircraft continues level path for short distance. B. Plane pitches nose up. C. Plane pitches nose down.	If A, trim is okay. If B, decrease downthrust. If C, increase downthrust.
CENTER OF GRAVITY LONGITUDINAL BALANCE	From level flight roll to 45-degree bank and neutralize controls.	A. Continues in bank for moderate distance. B. Nose pitches up. C. Nose drops.	If A, trim is good. If B, add nose weight. If C, remove nose weight.
SPLIT ELEVATORS (Also Yaw and C.G.)	Into wind, pull open loops, using only elevator. Repeat tests doing outside loops to inverted entry.	A. Wings are level throughout. B. Plane tends toward outside when right side up, and to inside when inverted. C. Plane goes in on regular loops, and out on inverted. D. Plane goes out on both types of loops. E. Plane goes in on both types of loops.	If A, trim is fine. If B, add weight to right wing, or add right rudder. If C, add weight to left wing, or add left rudder. If D, raise right half of elevator (or lower left). If E, raise left half of elevator (or lower right).
YAW[2]	Into wind, do open loops, using only elevator. Repeat tests doing outside loops from inverted entry.	A. Wings are level throughout. B. Yaws to right in both inside and outside loops. C. Yaws to left in both inside and outside loops. D. Yaws right on insides, and left on outside loops. E. Yaws left on insides, and right on outside loops.	If A, trim is correct. If B, add left rudder trim. If C, add right rudder trim. If D, add left aileron trim. If E, add right aileron trim.
LATERAL BALANCE	Into wind, do tight inside loops, or make straight up climbs into Hammerheads. Do same from inverted entry.	A. Wings are level and plane falls to either side randomly in Hammerhead. B. Falls off to left in both inside and outside loops. Worsens as loops lighten. C. Falls off to right in both loops. Worsens as loops tighten. D. Falls off in opposite directions on inside and outside loops.	If A, trim is correct. If B, add weight to right wing tip. If C, add weight to left wing tip. If D, change aileron trim.[3]
AILERON RIGGING	With wings level, pull to vertical climb and neutralize controls.	A. Climb continues along same path. B. Nose tends to go to inside loop. C. Nose tends to go to outside loop.	If A, trim is correct. If B, raise both ailerons very slightly. If C, lower both ailerons very slightly.
WING INCIDENCE	Knife edge flight.	A. Models tends to veer in nose up direction. B. Model veers in nose down direction.	If A, reduce wing incidence. If B, increase wing incidence.

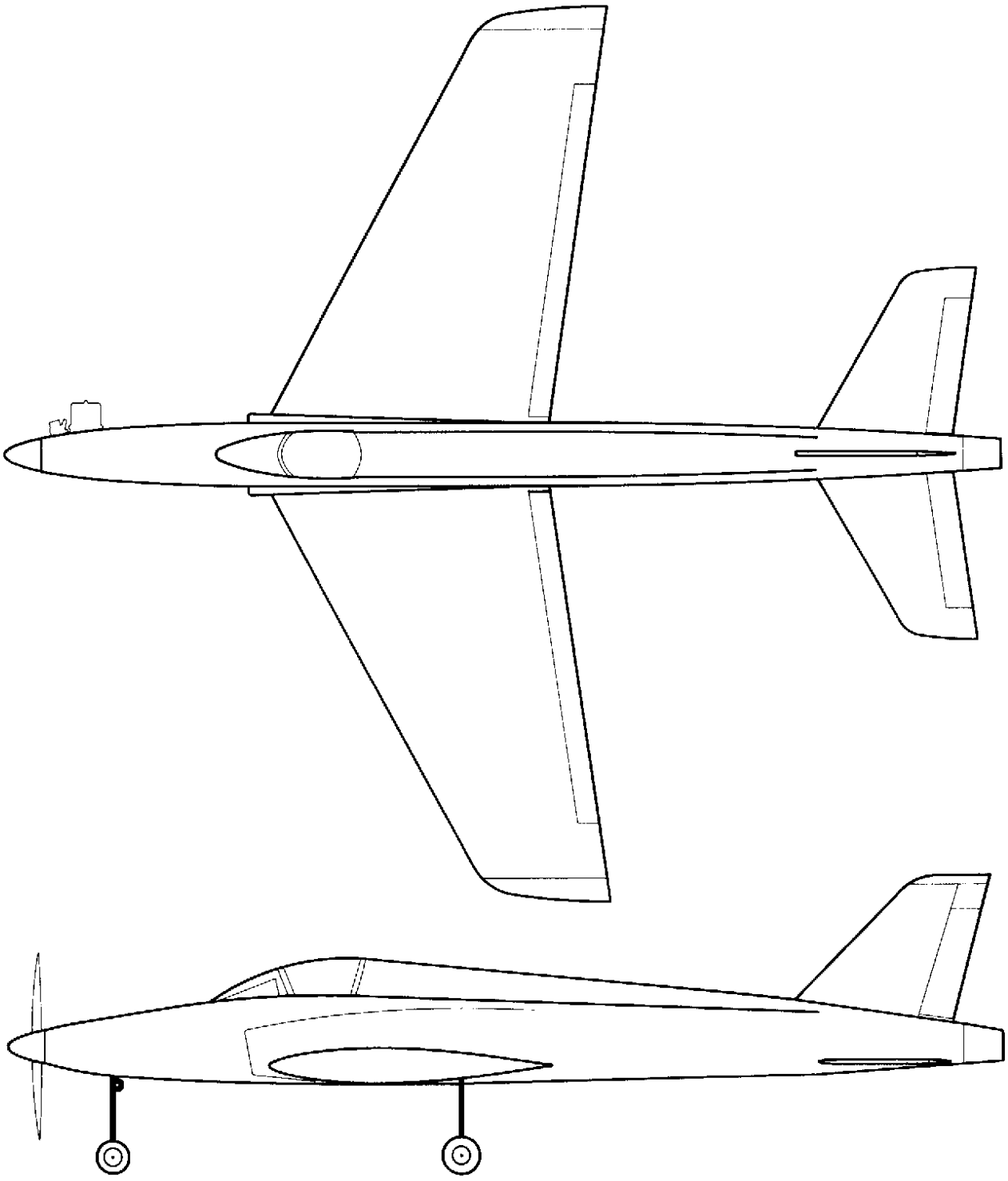
1. Engine thrust angle and C.G. interact. Check both.
2. Yaw and laterai balance produce similar symptoms. Note that fin may be crooked. Right and left references are from the plane's vantage point.
3. Ailerons cannot always be trimmed without sealing the hinge gap.

Parts List

Part #	Qty.	Description
ITEMS PACKED INDIVIDUALLY		
BAL144	1	1/4" X 30" Balsa Triangle
CANPY050	1	Clear Canopy
MM90D90	1	Engine Mount
PAT4DCAL	1	Decal Sheet
PAT4F14	1	Molded ABS Tail Cone
PAT4F17	1	1/4" x 3" x 7-3/4" Balsa Nose Side
PAT4F18	3	1/8" x 1/4" x 15" Basswood Bottom Stringers
PAT4F19	1	3/8" x 23-7/8" Balsa Triangle
PAT4P01	1	Fuselage Plan
PAT4P02	1	Wing Plan
PAT4P03	1	Instruction Book
PAT4W05	1	7/8" x 3-1/2" x 5-7/8" Balsa Front Wing Fairing
PAT4W06	1	7/8" x 3-1/2" x 9-3/8" Balsa Rear Wing Fairing
PAT4W10	2	1-1/8" x 1-1/4" x 6-7/8" Balsa Wing Tip
PAT4W12	4	3/32" x 3/8" x 30" Balsa Cap Strip
PAT4W13	16	1/16" x 2-13/16" x 1-3/4" Balsa Shear Web
PLTB002	2	Plastic Pushrod Tube
WIRES16	6	12" Threaded Pushrod Wire
WIRES66	2	42" Threaded Pushrod Wire
PAT4A01	**1**	**LONG WING PARTS SUB-PACK**
PAT4W11	4	3/32" x 1-3/8" x 24" Balsa TE Sheeting
PAT4W21	2	3/8" x 23" Balsa Tapered Aileron
PAT4W26	1	1/4" x 23" Balsa Wing TE Jig
PAT4W27	1	1/2" x 24-3/4" Balsa Notched LE Set
PAT4W28	1	7/16" x 23-1/2" Balsa Notched TE Set
PAT4W29	4	3/32" x 3" x 30" Balsa LE Sheeting
PAT4A02	**1**	**WING SPAR SUB-PACK**
PAT4W07	4	1/8" x 3/8" x 24-1/2" Balsa Long Spar
PAT4W08	4	1/8" x 3/8" x 17-3/4" Balsa Medium Spar
PAT4W09	4	1/8" x 3/8" x 8-3/4" Balsa Short Spar
PAT4A03	**1**	**BALSA FUSE PARTS SUB-PACK**
PAT4F15	1	3/8" x 1-5/8" x 23-7/8" Balsa Turtle Deck Top
PAT4F16	1	1/16" x 2-5/8" x 25-1/8" Balsa T.D. Side Sheeting
PAT4F23	1	1/2" Balsa Upper Fuse Corner Molding
PAT4F28	1	1/16" x 3" x 24" Balsa Bottom/Scoop Sheeting
PAT4S02	5	1/16" x 2-5/8" x 18" Balsa Stab Sheeting
PAT4W20	1	1/4" x 18" Balsa Tapered Elevator
PAT4A04	**1**	**LONG BALSA STICK SUB-PACK**
PAT4F27	4	1/4" Sq. x 24" Balsa Fuse Stringers
PAT4S01	2	1/8" x 3/4" x 30" Balsa Stab Framework
PAT4A05	**1**	**WING CENTER SHEETING SUB-PACK**
PAT4W14	5	3/32" x 3" x 3-7/8" Balsa Top Center Sheeting
PAT4W15	5	3/32" x 3" x 8-7/8" Balsa Bottom Center Sheeting
PAT4A06	**1**	**BALSA BLOCK SUB-PACK**
PAT4F24	4	3/8" x 2" x 8-3/8" Balsa Top Front Chin Block
PAT4A07	**1**	**BALSA FIN PARTS SUB-PACK**
PAT4F26	1	1/8" x 1-5/8" x 5-7/16" Balsa Servo Tray Support
PAT4R02	1	1/4" Balsa Shaped Fin Middle
PAT4R03	1	1/4" Balsa Shaped Fin Rear
PAT4R04	1	1/4" Balsa Shaped Rudder
PAT4A08	**1**	**DIE-CUT WING RIBS SUB-PACK**
PAT4W01	2	3/32" Balsa Ribs - W1, W5 & W10
PAT4W02	2	3/32" Balsa Ribs - W2, W6 & W9
PAT4W03	2	3/32" Balsa Ribs - W3, W4, W7 & W8

Part #	Qty.	Description
PAT4A09	**1**	**DIE-CUT LONG FUSE PARTS SUB-PACK**
PAT4F01	2	1/8" Balsa Front Fuse Side
PAT4F04	2	1/8" Balsa Lower Front Fuse Doubler
PAT4F05	1	3/32" Balsa Front Fuse Top
PAT4F07	2	1/16" Balsa Air Scoop Side
PAT4F09	1	1/8" Balsa 4T, 5T & Stab Core
PAT4A10	**1**	**DIE-CUT BALSA FUSE PARTS SUB-PACK**
PAT4F02	2	1/8" Balsa Aft Fuse Side
PAT4F03	2	1/8" Balsa Lower Aft Fuse Side
PAT4F06	1	3/32" Balsa Fuse Top Rear
PAT4F08	1	1/16" Balsa Fin Fairing Sheet
PAT4A11	**1**	**DIE-CUT PLYWOOD SUB-PACK**
PAT4F10	1	1/8" Ply Fuse Aligner, F8 & F2A
PAT4F11	1	1/8" Ply F3, F6, F7 & Servo Tray
PAT4F12	1	1/8" Ply F2, F4 & F5
PAT4F13	1	1/16" Ply Hatch, & Spinner Ring
PAT4W04	2	1/8" Ply L6 Doubler, DP & Tripler
PAT4A12	**1**	**SMALL WING PARTS SUB-PACK**
HRDWD005	2	5/8" Hardwood Landing Gear Gusset
PAT4W16	4	1/4" x 3/4" x 2-3/4" Ply Retract Rails
PAT4W17	2	1/4" x 2-7/8" Hardwood Wing Dowel
PAT4W18	1	1/8" x 3/8" x 6" Ply Servo Rail Stock
PAT4W19	1	1/2" x 1-1/4" x 3-1/4" Balsa Center LE Block
PAT4W22	2	3/8" Balsa Tapered, Grooved Center TE
PAT4W23	1	1" x 1-1/4" x 3" Balsa Wing Center Filler
PAT4W24	2	1/8" x 7/8" x 3" Ply Wing Center Brace
PAT4W25	1	1/4" x 1-7/16" x 4" Ply Wing Hold Down Plate
US40W27	2	Hardwood Grooved Long Landing Gear Block
US40W28	2	Hardwood Short Landing Gear Block
PAT4A13	**1**	**SMALL FUSE PARTS SUB-PACK**
PAT4F20	1	1/8" sq. x 2-1/2" Balsa Aft Sheeting Support
PAT4F21	1	3/4" x 2-1/4" sq. Balsa Tail Cone Fairing
PAT4F22	1	1/4" x 2-5/8" sq. Ply F1 Firewall
PAT4F25	4	1/4" x 1-7/16" x 4" Balsa Top & Bottom Nose Blocks
PAT4R01	1	1/4" x 1-1/4" x 2-1/2" Balsa Fin Front
PAT4S03	2	1/4" x 1" x 4-1/4" Balsa Stab Tip
PAT4S04	1	1/4" x 1/2" x 4-1/2" Balsa Fin Tip
PAT4M01	**1**	**HARDWARE SUB-PACK**
GLTP013	1	3" x 34" Fiberglass Tape
NUTS003	4	6-32 Blind Nut
NYLON13	2	1/4-20 x 2" Nylon Bolt
NYLON16	1	5/32" Nylon Steering Arm
NYLON17	1	Nylon Clevis
NYLON20	5	Nylon Swivel
NYLON21	5	Nylon Swivel Clevis
NYLON36	1	Flat Nylon Landing Gear Strap
SCRW005	1	6-32 Socket Head Set Screw
SCRW018	4	#6 x 3/4" Sheet Metal Screw
SCRW020	1	6-32 x 1/4" Round Head Screw
SCRW024	16	#2 x 3/8" Sheet Metal Screw
SCRW033	4	6-32 x 3/4" Sheet Metal Screw
WBNT117	1	Aileron Torque Rod Set
WBNT153	1	Elevator Torque Rod Set
WBNT157	1	Rudder Torque Rod
WHCL005	2	5/32" Wheel Collar
WBNT158	2	5/32" Main Gear
WBNT159	1	5/32" Nose Gear

2-VIEW DRAWING



2-VIEW DRAWING