TF TOP FLITE

NOBLER

GOLD EDITION

Wingspan: 51 in [1295.4 mm]
Wing Area: 550 sq in [35.5 sq dm]
Weight: 3-1/2 to 5-1/2 lb. [1588-2495g]
Wing Loading: 14.7 - 23.0 oz/sq ft.
[44.8-70.2 g/sq dm]
Fuselage Length: 42-3/8 in [1076 mm]

MADE IN USA

Top Flite Models   P.O. Box 788   Urbana, Il 61803   **Technical Assistance Call (217)398-8970   productsupport@top-flite.com**

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

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PROTECT YOUR MODEL, YOURSELF & OTHERS FOLLOW THESE IMPORTANT SAFETY PRECAUTIONS

Your R/C Nobler is not a toy, but a sophisticated working model that functions very much like an actual airplane. Because of its realistic performance, if you do not assemble and operate your R/C Nobler correctly, you could possibly injure yourself or spectators and damage property.

To make your R/C modeling experience totally enjoyable, get assistance with assembly and your first flights from an experienced, knowledgeable modeler. You'll learn faster and avoid risking your model before you're truly ready to solo. Your local hobby shop has information about flying clubs in your area whose membership includes qualified instructors.

You can also contact the Academy of Model Aeronautics (AMA), which has more than 2,500 chartered clubs across the country. We recommend you join the AMA which will insure you at AMA club sites and events. AMA Membership is required at chartered club fields where qualified flight instructors are available.

Contact the AMA at the address or toll-free phone number below.

Academy of Model Aeronautics
5151 East Memorial Drive
Muncie, IN 47302
(800) 435-9262
Fax (765) 741-0057

or via the Internet at: http://www.modelaircraft.org

INTRODUCTION

Congratulations and thank you for purchasing the **Top Flite** *Gold 30th Anniversary Edition* **R/C Nobler**. We are sure you are eager to build and fly your R/C Nobler, just as we were eager to build and fly our prototypes.

The original R/C Nobler was popular in the early 1970's and had a reputation for being highly maneuverable and aerobatic. It was a short coupled model, which enhances snap rolls and tumbling type maneuvers.

The new Gold 30th Anniversary Edition R/C Nobler retains all of the original flight characteristics, and builds on them with the use of today's computer radio

systems. The model has been engineered to allow the installation of up to 7 servos, as well as retractable landing gear.

Well, this should be enough to get your juices flowing, so get your other projects off your workbench, say goodbye to your significant other for a while and...keep reading!

NOTE: We, as the kit manufacturer, 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.

Please inspect all parts carefully before you start to build! If any parts are missing, broken or defective, or if you have any questions about building or flying this model, please call us at

**(217) 398-8970 or e-mail us at:
productsupport@topflite.com.**

We'll be glad to help. If you are calling for replacement parts, please look up the part numbers and have them ready when you call.

PRECAUTIONS

1. You must build the plane **according to the plan 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 plan and instructions may differ slightly from the photos. In those instances the plan and written instructions are correct.**

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

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

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

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

6. If you are not already an experienced R/C pilot, you must **fly** the model **only with the help** of a competent, experienced R/C pilot.

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

DECISIONS YOU MUST MAKE

ENGINE SELECTION

Recommended engine size:

.25 to .46 cu. in. [4.1 to 7.5cc] **2-stroke**
.40 to .52 cu. in. [6.5 to 8.5cc] **4-stroke**

Your Top Flite Gold 30'th Anniversary Edition R/C Nobler will perform well with any of the engines within the recommended range, but will handle best with engines closer to the higher end of the recommended size range. The inexpensive O.S. .40 LA has more than adequate power to perform even the most demanding aerobatic maneuvers.

The included Great Planes Adjustable Engine Mount will hold a range of engines from .25 cu. in. 2-stroke through .52 cu. in. 4-stroke.

RETRACTABLE LANDING GEAR

You may build your R/C Nobler either with fixed or retractable landing gear. All the hardware you need for fixed gear is supplied with this kit. We also provide detailed instructions on how to install retractable landing gear available from Great Planes. The Great Planes mechanical retractable landing gear recommended and shown in this manual is light, inexpensive and strong. You may choose to use another type of retract but it is up to you to make modifications required to fit them.

For Retractable Landing Gear you will need these items (not included):
Great Planes Retracts (GPMQ2905)
Retract servo (FUTM0670 or HCAM0160)
(2) 2-1/4" [57mm] wheels (GPMQ4222)
(2) Nylon Clevis (GPMQ3800)
(2) 2-56 x 12" [305mm] pushrod, threaded one end (GPMQ3750)
(2) Screw-Lock connectors (GPMQ3870)
(8) #4 x 3/8" [9.5mm] flat head sheet metal screws

FLAPS

Your R/C Nobler is designed to incorporate flaps. You must build these flaps, but you do not have to make them operational. If you do not want operational flaps simply glue them into place. As the wing is removable, the flaps cannot be mechanically coupled to the elevator as the original R/C Nobler could.

For normal (independent) flap operation, only one servo is required. This allows the flaps to be used as normal flaps as well as for elevator to flap mixing with a computer radio system.

Slight trim changes are needed when flaps are extended. The trim corrections are discussed later in the control surface throws section and you will find more information on the flaps in the *Flying* section and the radio installation section.

For Flaps, you will need the following additional item:

one standard servo.

NOTES FROM THE DESIGNER

When I became interested in modeling as a kid the Top Flite Nobler was a very popular control line model. I built and flew several of them and still have many fond memories from that time, almost fifty years ago.

When the Top Flite R/C Nobler was introduced I just had to have one. That was thirty years ago, and it was a great flying model in its day. Now I design models for Top Flite and jumped at the chance to redesign the model for the anniversary re-release of this classic model. Isn't this hobby great!

While the original R/C Nobler was a great flying model, it did have a number of problems. It was difficult to build, had terrible die-cutting and required a lot of sanding and shaping. It also had some structural problems. We have tried hard to correct these problems. You will note that the aft section of the model and the tail feathers have been changed to improve the flying characteristics.

The original R/C Nobler had a D-tube wing construction, but the spar was just a 1/16" balsa web - with nothing else, no spars. It was not uncommon for the wing to fail during snap rolls. The new version of the model also has a D-tube wing construction, but it has top and bottom basswood spars with a die-cut 3/32" I-beam type web. The original model had balsa block wing tips that needed to be carved and sanded. The new version of the model has wing tips built from die-cut parts, much like the control line model did.

The fuselage of the original R/C Nobler was built from die-cut sides with many balsa blocks added. These blocks required considerable carving, shaping and sanding. The turtle deck had an annoying habit of cracking, causing the tail feathers to loosen. The new version of the model has no blocks at all. The model has die-cut sides and formers that are then sheeted. The turtle deck and tail section have been redesigned and strengthened.

The tail feathers on the original R/C Nobler were made from 1/4" sheet balsa and were a bit heavy. On hard landings the weight of the tail feathers would cause the turtle deck to crack at various glue joints. The tail feathers on the new version are built-up for lightness and strength from sticks that are then sheeted with 1/16" balsa.

I did not enjoy building the original version of the model. The die-cutting was bad, parts fit was poor and it required a lot of carving and sanding. I hope you find the new version fun to build. The die-cutting is great and the parts fit is right on, thanks to modern computer CAD design systems. And it takes only about 15 minutes to sand the entire model! If you are a quick builder it would be possible to build the model and have it ready to cover in a long weekend.

The original R/C Nobler had a fixed wing that could not be removed from the fuselage, and could be a bit difficult to transport and store. The new version of the model has a removable wing held in place with three nylon bolts.

While the original model required only four servos to operate ailerons, rudder, throttle and elevators with coupled flaps, the new version requires six servos. You can also add a seventh servo for retractable landing gear. That's right, you can now build the model with retractable main landing gear.

Our prototype models, with seven full size servos and retractable landing gear weighed 5 lbs 8 oz, almost exactly the same weight of the original model. The structure of the new version is much lighter due to the elimination of all the balsa blocks and also the built up tail feathers. At the same time, it is also much stronger.

Radio installation

The radio installation can be as simple as five standard servos - or as challenging as seven servos that must be fitted in a confined space. Pay very close attention to the instructions and it will all fit easily. Drift off on your own if you want, but be prepared to spend a lot of time getting things to fit properly.

Nose heavy/Tail heavy

Most models require some nose weight to balance properly. This one requires tail weight! The built up tail feathers are light yet very strong. The tail is also very short, resulting in a model that is slightly nose heavy. If you power the model with a .46 size glow engine you will need about 1 oz of lead on the tail.

Engine size

This model can be flown on a .25 size engine, but - why. With an O.S. .46 FX, nine servos and retracts the model weighs close to 5-1/2 lbs. That gives a wing loading of 23.0 oz/sq ft. The engine will produce more than six lbs of thrust if it is properly broken-in.

Think about those numbers for a minute.

Start building!   Build light!!

OTHER ITEMS REQUIRED

These are additional items you will need to complete your R/C Nobler that are *not included* with your kit. Order numbers are in parentheses (GPMQ4130). Our exclusive brand is listed where possible: **TOP** is the Top Flite brand, **GPM** is the Great Planes® brand, and **HCA** is the Hobbico® brand.

❏ 4 to 6 channel radio with 5 to 7 servos
❏ 5 standard servos for Ailerons (2), Elevator, Rudder, Throttle (Stationary flaps).
　　　　　　　　or:
　　6 standard servos for ailerons (2), Elevator, Rudder, Throttle, Flaps (Electronic Elevator to Flap coupling)
　　　　　　　　or:
　　7 servos gives above plus retractable landing gear. (**Note**: Recommend 6 standard and 1 retract servo)

❏ (1) 'Y' Connector for aileron, (if only one aileron channel is used)
　Note: 'Y' connector not needed if ailerons, are mixed to separate receiver channels.
❏ (2) 12" [305mm] Servo extensions for aileron servos
❏ (1-4) 6" [152mm] Servo extensions (1 or 2 for ailerons, 1 for flaps, 1 for retracts)
　(Simplifies wing installation at flying field - optional)
❏ Switch/charge plug mount (GPMM1000)
❏ (2) 2-1/2" [63.5mm] Main Wheels (GPMQ4223)
　　　　　　　　or:
　(2) 2-1/4" [57mm] Main wheels (GPMQ4222) with retracts
❏ 1-1/4" [31.8mm] Tail wheel (GPMQ4242)
❏ Optional retracts (GPMQ2905)
❏ 10 oz. [300cc] Fuel tank (GPMQ4104)
❏ Silicone fuel tubing (GPMQ4131)
❏ Fuel filler valve (GPMQ4160)

❏ 2-1/2" [63.5mm] Spinner (GPMQ4521, black)
❏ 1/4" [6.4mm]R/C Foam rubber padding (HCAQ1000)
❏ 2 rolls Top Flite Super MonoKote® covering, see *Finishing* on page 43
❏ 1 roll Top Flite Super MonoKote trim color
❏ Paint, see *Finishing* on page 43
❏ Propellers (see engine instructions)

BUILDING SUPPLIES

Here's a list of supplies you should have on hand while you're building. Some of these are optional. Use your own experience to decide what you need. We recommend Great Planes Pro CA and Epoxy.

Glue/Filler

❏ 2 oz. [60g] Thin CA (GPMR6003)
❏ 2 oz. [60g] Medium CA+ (GPMR6009)
❏ 1 oz. [30g] Thick CA- (GPMR6014)
❏ CA Accelerator (GPMR6034)
❏ CA Debonder (GMPR6039)
❏ CA Applicator Tips (HCAR3780)
❏ 30-minute (GPMR6047) or 45-minute (GPMR6048) epoxy
❏ 6-minute epoxy (GPMR6045)
❏ Pro™ Wood Glue (GPMR6161)
❏ Microballoons (TOPR1090)
❏ Milled Fiberglass (GPMR6165)
❏ Lightweight Hobby Filler (Balsa Color, HCAR3401)
❏ Auto body filler (Bondo® or similar)
❏ Denatured or Isopropyl Alcohol (to clean up excess epoxy)

DIE-CUT PATTERNS

IMPORTANT
Do not remove the wing ribs or other wing parts from the die-cut sheets until instructed to do so.

RCN4W01   2 REQ.

RCN4W01   W2   W9   W1   W10

1/16" X 3" X 24" BALSA

RCN4W02   2 REQ.

RCN4W02   W4   W8   W3   W7   W7D

1/16" X 3" X 24" BALSA

RCN4W03   2 REQ.

RCN4W03   W9   W1R   W5   W6D   WING TIP

1/16" X 3" X 24" BALSA

RCN4W04   2 REQ.

RCN4W04   T2 T1   T6   T3 T2 T1 T4 T5   T6   T3 T4 T5

1/16" X 3" X 18" BALSA

RCN4W05   2 REQ.

TE SPAR/JIG
RCN4W05

1/16" X 3" X 24" BALSA

RCN4W06   1 REQ.

SPAR WEB   UP
RCN4W06   UP   SPAR WEB

3/32" X 3" X 24" BALSA

RCN4W07   2 REQ.

W3TD W3R W2TD RCN4W07 W4TD W4R

1/8" X 3-1/2" X 8-1/2" LITE PLY

RCN4W08   1 REQ.

AILERON HATCH AILERON HATCH   SPAR JOINER   RCN4W08

1/16" X 4-1/2" X 7-1/2" PLY

CONTROL HORN MOUNTS

- 6 -

DIE-CUT PATTERNS

RCN4F01   ELEVATOR TIP   ELEVATOR HORN BASE   2 REQ.

UPPER FUSELAGE SIDE

F3TX   RCN4F01

STAB TIP PART   1/8" X 3" X 36" BALSA   STAB TIP PART

BELLY PAN PARTS

RCN4F02   1 REQ.

FRONT LOWER FUSELAGE SIDE   BELLY PAN SIDE   REAR LOWER FUSELAGE SIDE   F1TR

F2TX   RCN4F02   REAR LOWER FUSELAGE SIDE   BELLY PAN SIDE   FRONT LOWER FUSELAGE SIDE

1/8" X 3" X 36" BALSA

RCN4F03   1 REQ.

LEFT FUSELAGE TOP DECK   LEFT FUSELAGE BOTTOM SHEETING

RCN4F03

3/32" X 3" X 36" BALSA

RCN4F04   1 REQ.

RCN4F04   RIGHT FUSELAGE BOTTOM SHEETING

RIGHT FUSELAGE TOP DECK

3/32" X 3" X 36" BALSA

RCN4F05   1 REQ.

RCN4F05

BELLY PAN SHEETING   BELLY PAN SHEETING

3/32" X 3" X 24" BALSA

RCN4F06   2 REQ.

RCN4F06

WING   FUSELAGE SIDE DOUBLER   WING   F1   FUSE

WING   FUSE

BELLY PAN DOUBLER

1/8" X 4-3/8" X 30" LITE PLY

RUDDER PUSHROD BRACE

RCN4F07   1 REQ.

F3TF   F4   F2BPD   F2   F3

F3T   F4TB   RCN4F07   F5T   F5TR

F4T

1/8" X 4-3/8" X 16" LITE PLY

RCN4F08   1 REQ.

F3TC   F3BPD   RCN4F08   F6   F4TR

F2T   F3BP   F5   STAB CENTER

F2BP   F1T   F3IR

1/8" X 4-3/8" X 16" LITE PLY   FUEL FILLER MOUNT PARTS

Tools

- ❏ #11 Blades (HCAR0311) -100 qty.
- ❏ Single Edge Razor Blades (HCAR0312) -100 qty.
- ❏ Razor Plane (MASR1510)
- ❏ Hobbico Builder's Triangle (HCAR0480)
- ❏ T-Pins (HCAR5100) small, (HCAR5150) medium, (HCAR5200) large
- ❏ Drill Bits: 1/16" [1.6mm], 3/32" [2.4mm], 1/8" [3.1mm], 5/64" [2mm], 7/64" [2.8mm], 9/64" [3.6mm], 5/32" [4mm], 11/64" [4.4mm], 3/16" [4.8mm], 7/32" [5.6mm], 1/4" [6.4mm]
- ❏ 1/4-20 Tap and drill (GPMR8105)
- ❏ 10-32 Tap and drill (GPMR8104)
- ❏ 6-32 Tap and drill (GPMR8102)
- ❏ Tap wrench (GPMR8120)
- ❏ Kyosho® curved plastic cutting scissors (KYOR1010)
- ❏ Great Planes Plan Protector (GPMR6167) or waxed paper
- ❏ Masking Tape
- ❏ Easy–Touch™ Bar Sanders*
- ❏ Precision Z-Bend pliers (GPMR8025)

Recommended Covering Tools/Accessories

- ❏ 21st Century Sealing Iron (COVR2700)
- ❏ 21st Century Cover Sock (COVR2702)

or:

- ❏ Top Flite Sealing Iron (TOPR2100)
- ❏ Top Flite Hot Sock™ (TOPR2175)

and

- ❏ Top Flite Heat Gun (TOPR2000)
- ❏ Top Flite Trim Seal Tool (TOPR2200)

EASY-TOUCH™ BAR SANDER

A flat, durable, easy to handle sanding tool is a necessity for building a well finished model. Great Planes makes a complete range of **Easy-Touch Bar Sanders** (patented) and replaceable **Easy-Touch Adhesive-backed Sandpaper**. While building the R/C Nobler we used two 5-1/2" Bar Sanders and two 11" Bar Sanders equipped with 80-grit and 150-grit Adhesive-backed Sandpaper.

Here's the complete list of Easy-Touch Bar Sanders and Adhesive Backed Sandpaper:

```
        5-1/2" Bar Sander (GPMR6169)
         11" Bar Sander (GPMR6170)
         22" Bar Sander (GPMR6172)
         33" Bar Sander (GPMR6174)
         44" Bar Sander (GPMR6176)
         11" Contour Multi-Sander (GPMR6190)
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12' roll of Adhesive-backed:

```
        80-grit sandpaper (GPMR6180)
       150-grit sandpaper (GPMR6183)
       180-grit sandpaper (GPMR6184)
       220-grit sandpaper (GPMR6185)
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Assortment pack of 5-1/2" strips (GPMR6189)

We also use Top Flite 320-grit (TOPR8030, 4 sheets) and 400-grit (TOPR8032, 4 sheets) wet-or-dry sandpaper for finish sanding.

IMPORTANT BUILDING NOTES
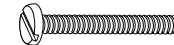
There are two types of screws used in this kit:

Sheet metal screws are designated by a number and a length.

For example #6 x 3/4" long [19.1mm]

Machine screws are designated by a number, threads per inch, and a length.

For example 4-40 x 3/4" long [19.1mm]

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

- Whenever the term **glue** is written you should rely upon your experience to decide what type of glue to use. When a specific type of adhesive works best for that step, the instructions will tell you what glue is recommended.

- Whenever just **epoxy** is specified you may use **either** 30-minute epoxy **or** 6-minute epoxy. When 30-minute epoxy is **specified,** it is **highly recommended** that you use only 30-minute (or 45-minute) epoxy because you will need the working time and/or the additional strength.

- Occasionally we refer to the *top* or *bottom* of the model or *up* or *down*. To avoid confusion, the *top* or *bottom* of the model is as it would be when the airplane is right side up and will be referred to as the top even if the model is upside-down during that step, *i.e.* the top main spar is always the top

main spar even if the wing is upside-down when you are working on it. Similarly, *move the former up* means move the former toward the top of the fuselage even if the fuselage is upside-down when you are working on it.

- When you get to each step, read that step **completely through to the end** before you begin. Frequently there is important information or a note at the end of the step that you need to know before you start.

- **Photos** and **sketches** are placed **before** the step they refer to. Frequently you can study photos in following steps to get another view of the same parts.

GET READY TO BUILD

1. Unroll the plan sheets. Roll them inside out so they lie flat.

2. Remove all the parts from the box. Use a ballpoint pen (not a felt tip pen) to lightly write the **name** or **size** on each piece so you can identify it later. Use the *die-cut patterns* on pages 6 and 7 to identify and mark the die-cut parts **before** you remove them from their die sheets. Many of the parts already have numbers stamped on them, but in some cases the number is located alongside the parts or only on the die drawings in the manual. Do not remove the die-cut parts until instructed to do so. If a part is difficult to remove, don't force it out but cut around it with a hobby knife and a #11 blade. After you remove the parts from their die sheets, lightly sand the edges to remove slivers or die-cutting irregularities. Save some of the larger scraps of wood.

3. Separate the parts into groups such as **stab, fin, wing,** and **fuse.** Store smaller parts in zipper-top food storage bags.

BUILD THE TAIL SURFACES

Use the *Hot Tip* that follows to cut the 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] sticks for the framework of the stab, elevators, fin and rudder. This framework will then be sheeted with 1/16" x 3" x 24" [1.6 x 76 x 610mm] balsa.

HOW TO CUT THE STICKS

There are ten 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] sticks supplied for building the stab, elevators, fin and rudder. There are ample sticks supplied for building these parts. Do not use the 30" [762mm] sticks that are used for building the wing.

Use the hardest sticks for building the framework of the stab and fin. The softer sticks can be used for the ribs and diagonal pieces, and for the elevators and rudder.

Cut the longest parts from the sticks first, using the remainder for the shorter pieces. We have found that a new single edge razor blade makes the best cuts with a minimum of crushing.

We found it fastest to cut all of the required parts at one time. Others may prefer to cut each part as it is needed.

BUILD THE STABILIZER

❏ 1. Cut the stab plan along the dashed line and tape it to your building board. Cover the plan with Plan Protector or wax paper.
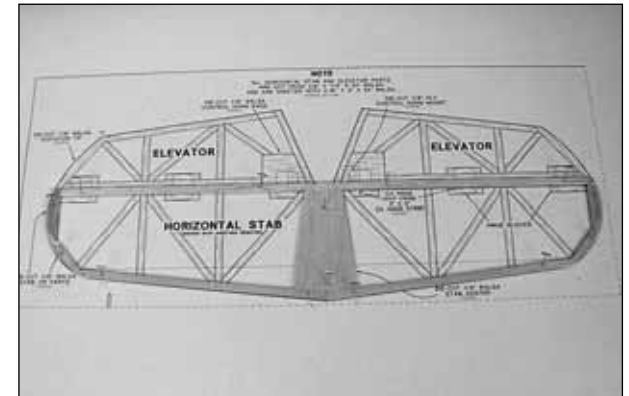
❏ 2. Cut the **stab TE** from a hard 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] balsa stick and pin it in position over the plan.

❏ 3. Pin the die-cut 1/8" [3.2mm] ply **stab center** in position. Similarly, pin the die-cut 1/8" [3.2mm] balsa **stab tip parts** in position. Do not glue until later.

❏ 4. Cut both **stab LE** pieces from another hard 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] balsa stick and pin them in position. Do not glue until later.
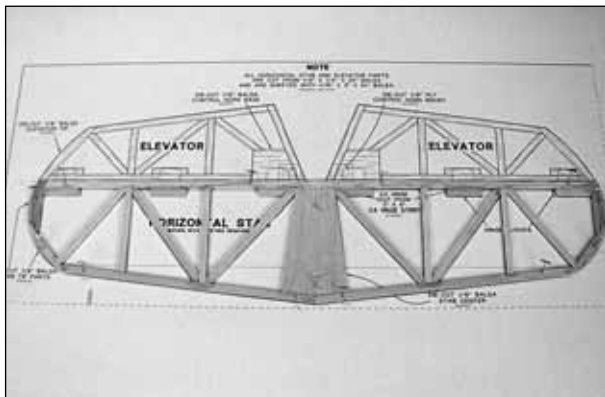
❏ 5. Cut the **stab ribs, diagonals and hinge blocks** from soft 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] balsa sticks and place them into position. Glue all of the parts together with thin CA where they join each other - refer to the *Hot Tip* that follows.

It can be difficult to control the application of thin CA adhesives and get that one small drop that is needed to glue a part. We have found a CA applicator tip, available from Hobbico, to be very useful. Frankly, we wonder how we ever got along without them.

With these tips you will no longer have large blobs of CA that needs to be sanded away. Your supply of CA will also last much longer. As the tip clogs simply snip the clogged part off and keep using it.

Two of these tips are supplied with this kit. If you like them their part number is HCAR3780 (6) and are available in bulk BUKR0307 (200).

When you install the tip on the end of the CA bottle, cut the large end of the tip to a depth of about 1/4" [6.4mm]. Doing so will prevent the tip from splitting and leaking when it is pressed onto the bottle.

❏ 6. After the CA has cured, remove the pins from the stab. Use a sanding block with 150-grit sandpaper to sand the stab flat.

❏ 7. Use the *Hot Tip* that follows (or your own method) to glue two 1/16" x 3" x 24" [1.6 x 76 x 610mm] balsa sheets together to make a 1/16" x 6" x 24" [1.6 x 152 x 610mm] sheet for one of the **stab skins**. Use the two hardest sheets supplied in the kit.
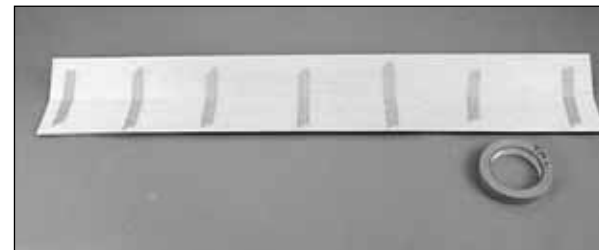
Top Flite selects balsa that is intended for sheeting. Occasionally, a few of these sheets may have a small nick or split near the ends. If your kit contains a few of these sheets, arrange them and glue them together so the defects will not interfere with the final shape of your skin.

HOW TO MAKE THE STAB SKINS

A. Use a straightedge to true one edge of two balsa sheets.

B. Use masking tape to tightly tape the trued edges of the sheets together.

C. Turn the sheets over and apply slow drying glue like Great Planes Pro aliphatic resin to the joining edges. Some prefer to use CA, but it is not recommended in this *Hot Tip* because CA does not allow enough working time to align the sheets and it is much harder than the balsa, making sanding difficult.
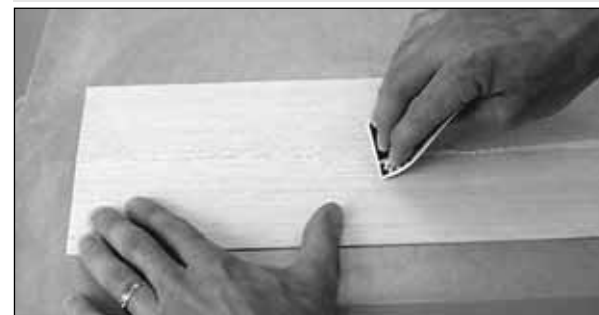
D. Lay the sheets on your workbench covered with wax paper. Use a credit card or something similar as a squeegee to simultaneously press the sheets flat as you wipe the glue from the seam.
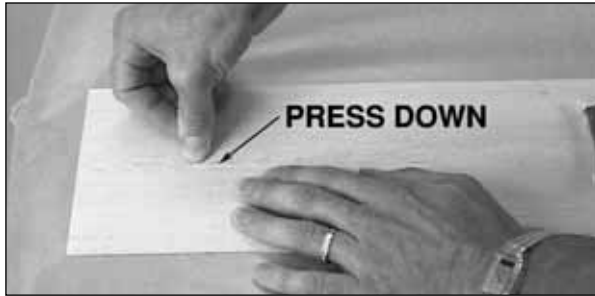
PRESS DOWN

CROSS SECTION OF GLUE JOINT

**INCORRECT: SHEETS
NOT FLAT AND EVEN**

**CORRECT: SHEETS ARE
FLAT AND EVEN**

E. Press the joining edges of the sheets down to make sure they are even. This is important. Little sanding will be required if the sheets are even.

F. Place weights on top of the sheet to hold it flat while the glue dries.
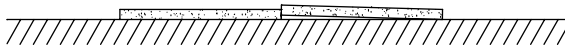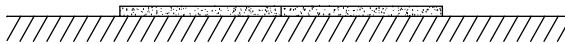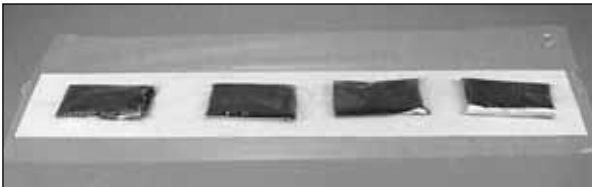
G. After the glue dries, sand the sheets flat and even.

Note: Some modelers tend to sand the sheeting too much after it is applied to the structure, making thin spots where fingers can easily go through. By following the procedure above (specifically, by aligning the joined edges of the sheets as shown in step E), little sanding should be required. Most of the sanding

that *is* required should be done **before** the sheeting is glued in place. The only sanding that should be required after the sheeting is glued to the structure is final sanding with 320 or 400-grit sandpaper.

Here are a few other things to keep in mind while sanding balsa sheeting:

1. Make sure you sand the sheets on a flat work surface that is free from hardened drops of glue or other imperfections that will damage your sheeting.

2. Sand the sheeting only as much as required. The inside of the sheeting needs to be sanded just enough to remove excess glue and doesn't have to be perfectly flat or smooth.

3. Though more material can be removed by sanding **across** the grain, this leaves scratches in the balsa. Balsa sheeting should be sanded **with** the grain—especially when finish-sanding.

4. If some of the glue joints are uneven, it may be best just to leave them that way, rather than to sand the sheets too thin. A slightly uneven glue joint is preferable to paper-thin balsa.
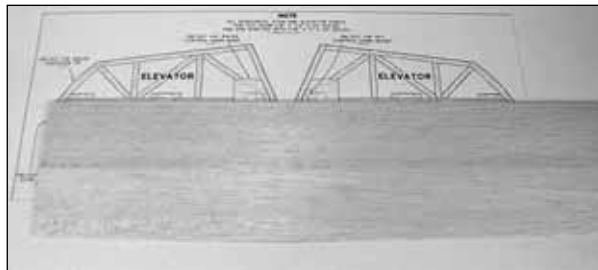
❏ 8. Use medium CA or aliphatic resin to glue the stab skin to the top of the stab. Align the skin even with the TE of the stab. Note that the sheeting is positioned so that it overhangs one end of the stab.

❏ 9. After the glue dries, remove the stab from the building board and trim the sheeting along the LE and both tips. Save the leftover sheeting for use in the next step.

❏ 10. Locate another hard sheet of 1/16" x 3" x 24" [1.6 x 76 x 610mm] balsa. Use this sheet and the leftover sheeting from the above step to make another stab skin.

❏ 11. Turn the stab over and use a sanding block to sand the un-sheeted side of the stab flat. Use medium CA or aliphatic resin to glue the stab skin to the stab. Align the skin even with the TE of the stab. The sheeting is positioned so that it overhangs one end of the stab.

❏ 12. After the glue dries, remove the stab from the building board and trim the sheeting along the LE and both tips. Save the leftover sheeting for use in a later step.

BUILD THE ELEVATORS
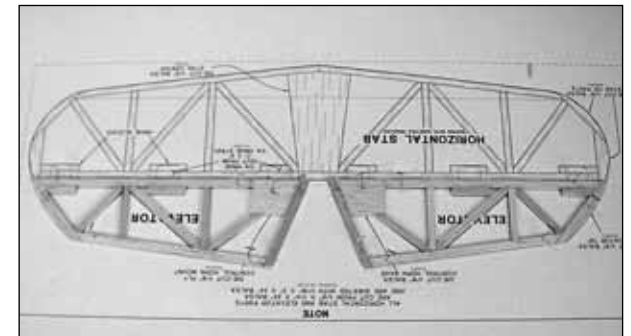
❏ 1. Pin the die-cut 1/8" balsa **control horn base** into position. Use 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] soft balsa sticks to cut all of the parts for both elevators. Pin them into position and glue the parts together with thin CA where they join.

❏ 2. After the CA has cured, remove the pins from both elevators. Use a sanding block with 150-grit sandpaper to sand the elevators flat.

❏ 3. Use a soft 1/16" x 3" x 24" [1.6 x 76 x 610mm] sheet of balsa to sheet the top of both elevators. Cut a piece from the sheet for each elevator. Then, glue it in place with medium CA or aliphatic resin. Save the leftover sheeting for use later.

❏ 4. After the glue dries, remove both elevators from the building board and trim the sheeting along the TE, LE and tips.

❏ 5. Turn the elevators over and use a sanding block to sand the un-sheeted side of them flat. Locate another soft sheet of 1/16" x 3" x 24" [1.6 x 76 x 610mm] balsa and cut a piece from the sheet for each elevator. Use medium CA or aliphatic resin to glue the sheet to the elevators.

❏ 6. After the glue dries, remove the elevators from the building board and trim the sheeting along the TE, LE and tips.
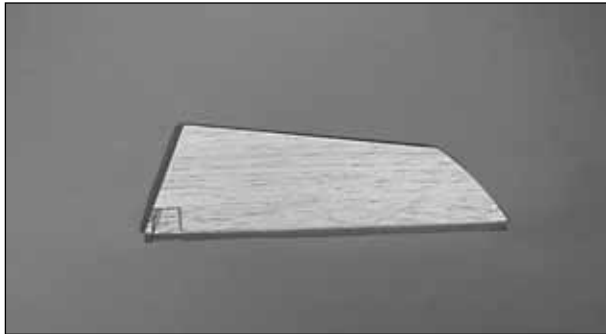
❏ 7. Locate a die-cut 1/16" [1.6mm] ply **control horn mount**. Using the plan as a reference, position the control horn mount on the bottom of the right elevator and mark its location. Cut along the lines you marked and remove the balsa to inset the mount. Glue the mount into the elevator.

NOTE: Be sure to make a right elevator as shown in the above photo.
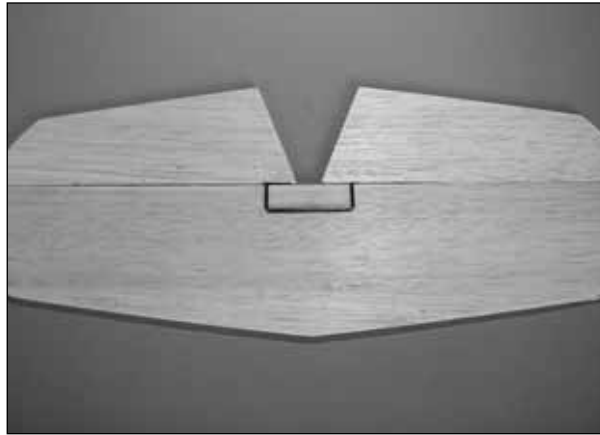
❏ 8. Use a file or a rotary tool with a cut-off wheel to remove sharp edges or burrs on the ends of the **elevator joiner wire**. Position the elevator joiner wire on the top of the stab as shown in the photo. Align the elevators with the stab and mark the leading edge of the elevators where the *arm* portion of the joiner wire will enter the elevators. The joiner wire should be centered between the elevators as shown on the plan.

❏ 9. Drill a 3/32" [2.4mm] hole into the leading edge of both elevators at the marks you made. Be sure to drill the hole on the centerline of the leading edge. Cut a groove in the leading edge of both elevators to accommodate the joiner wire.

Hint: Use a 3/32" [2.4mm] brass tube sharpened at one end to cut the grooves.

BUILD THE VERTICAL FIN

❏ 1. Cut the vertical fin plan along the dashed line and tape it to your building board. Cover the fin plan with Plan Protector or wax paper.
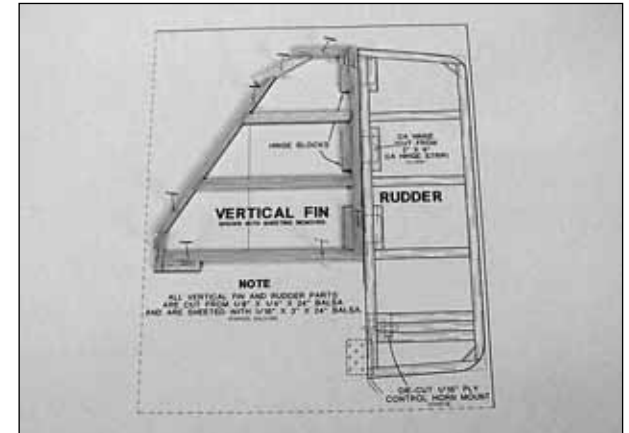
❏ 2. Cut the **fin TE** from a hard 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] balsa stick and pin it in position over the plan.

❏ 3. Cut the **fin LE and the top and bottom parts** from the remainder of the balsa stick and pin them in position. Do not glue until later.

❏ 4. Cut the **fin ribs and hinge blocks** from soft 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] balsa sticks and place them into position. Glue all of the parts together with thin CA where they join each other.

❏ 5. After the CA has cured, remove the pins from the fin. Use a sanding block with 150-grit sandpaper to sand the fin flat.
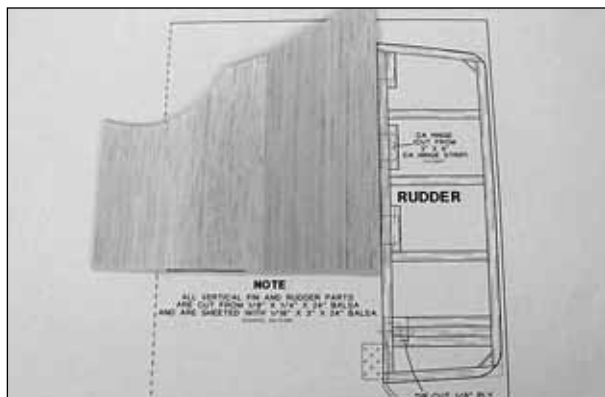
❏ 6. Locate the leftover 1/16" [1.6mm] balsa sheeting used to sheet the stab and elevators. Use this material to make two **fin skins** similar to the above photo.

❏ 7. Use medium CA or aliphatic resin to glue one of the fin skins to the left side of the fin. Align the skin even with the TE and bottom of the fin.

❏ 8. After the glue dries, remove the fin from the building board and trim the sheeting along the LE, TE, bottom and top.

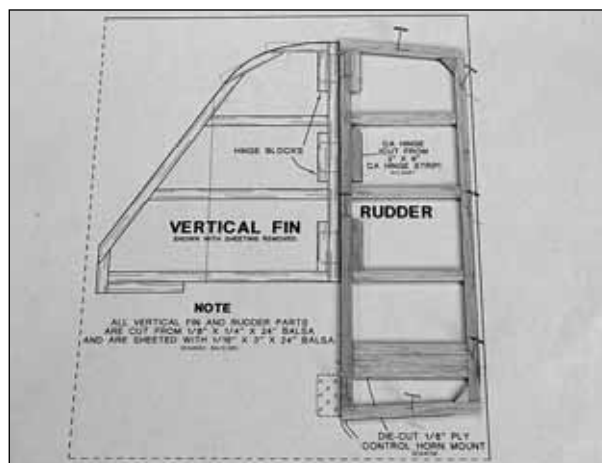❏ 9. Turn the fin over and use a sanding block to sand the un-sheeted side of the fin flat. Use medium CA or aliphatic resin to glue the second fin skin to the fin. Align the sheet even with the TE and bottom of the fin.

❏ 10. After the glue dries, remove the fin from the building board and trim the sheeting along the LE, TE, bottom and top.

BUILD THE RUDDER

❏ 1. Use 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] soft balsa sticks to cut all of the parts for the rudder. Pin them into position and glue the parts together with thin CA where they join.

❏ 2. After the CA has cured, remove the pins from the rudder. Use a sanding block with 150-grit sandpaper to sand the rudder flat.

❏ 3. Use a soft 1/16" x 3" x 24" [1.6 x 76 x 610mm] sheet of balsa to cut a piece to sheet the left side of the rudder. Glue this sheet in place with medium CA or aliphatic resin. Save the leftover sheeting for use later.

❏ 4. After the glue dries, remove the rudder from the building board and trim the sheeting along the TE, LE and tips.

❏ 5. Turn the rudder over and use a sanding block to sand the un-sheeted side flat. Use the remainder of the sheeting to cut a piece for the other side of the rudder. Use medium CA or aliphatic resin to glue this sheet to the rudder.

❏ 6. After the glue dries, remove the rudder from the building board and trim the sheeting along the TE, LE and tips.

❏ 7. Locate a die-cut 1/16" [1.6mm] ply **control horn mount**. Using the plan as a reference, position the control horn mount on the left side of the rudder and mark its location. Cut along the lines you marked and remove the balsa to inset the mount. Glue the mount into the rudder.

HINGE THE ELEVATORS AND RUDDER

IMPORTANT NOTES ABOUT CA HINGES

This kit is supplied with a CA hinge material consisting of a 3-layer lamination of Mylar and polyester. It is specially made for hinging model airplane control surfaces. When properly installed, this type of CA hinge provides the best combination of strength, durability and easy installation. We trust all of our Gold Edition warbirds to these hinges, but **it is essential to install them correctly**. Carefully follow the hinging instructions in this manual for the best result.

The most common mistake made by modelers when installing CA hinges is making the hinge slots too tight, restricting the flow of CA to the back of the hinges; or not using enough glue to fully secure the hinge over its entire surface area. This results in hinges that are only *tack glued* into the hinge slots. The techniques for cutting the hinge slots and gluing in the CA hinges (near the end of the manual) have been developed to ensure thorough and secure attachment.
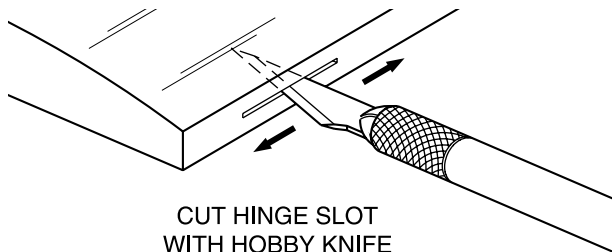
CUT HINGE SLOT
WITH HOBBY KNIFE
AND #11 BLADE

❏ 1. Use a straightedge to mark the centerline of both elevators and the stab with a ballpoint pen. Mark the location of the hinge slots on the elevators and stab where shown on the plan. Cut the hinge slots in the elevators and the stab along the centerlines with a #11 blade.

HOW TO MAKE THE HINGE SLOTS

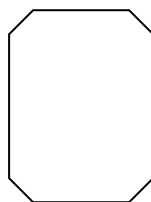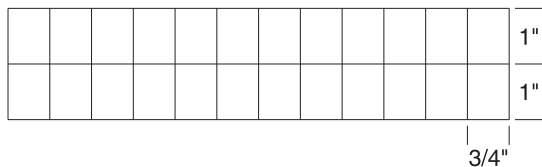We HIGHLY recommend that you use the Great Plans Slot Machine™ for cutting your hinge slots. This motorized hinge slotting tool makes clean slots of the exact size needed for CA hinges. Once you use this tool, you will never cut your hinge slots any other way.

❏ 2. Using the sketch above, cut nine hinges to a size of 3/4" x 1" [19 x 25.4mm] from the **CA hinge strip** supplied with this kit. Snip the corners off so they go into the slots easier.

❏ 3. Test fit the hinges into the slots. If the hinges do not slide into the slots easily, work your knife blade back and forth in the slot a few times to provide more clearance (it is really the **back edge** of the blade that does the work here in widening the slot).
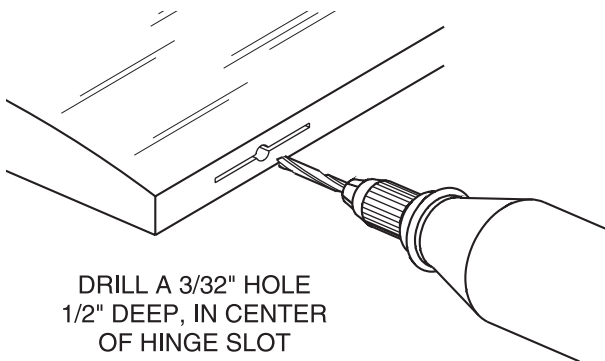
DRILL A 3/32" HOLE
1/2" DEEP, IN CENTER
OF HINGE SLOT

❏ 4. Drill a 3/32" [2.4mm] hole, 1/2" [12.7mm] deep in the center of the hinge slots. Use a rotary tool with a 3/32" [2.4mm] drill bit or a carbide cutter for the best results. Reinsert your knife blade to *clean out* the slot after you drill the holes.

❏ 5. Test fit the elevators to the stab with the hinges. If any hinge slots are not wide enough or are misaligned, make adjustments so the elevators accurately fit the stab.

❏ 6. Bevel the leading edges of the elevators to a "V" as shown on the cross section of the plan. Use the centerline on the elevator leading edges as a guide. Test fit the elevators to the stab with the joiner wire and the hinges. (If necessary, remove the joiner and *tweak* it so both elevators are in the same plane.)

Note: Make sure you can obtain the control throws indicated in the back of the manual. If you cannot, increase the "V" on the leading edge of the elevators.

❏ 7. Test hinge the vertical fin and rudder in the same manner.

DO NOT glue the hinges until the model has been covered.

This completes the construction of the tail surfaces.

BUILD THE FUSELAGE

PREPARE THE FUSELAGE SIDES

Note: The fuselage parts interlock together, so you do not need to put the fuselage plan on your building board. You should, however, cover your building board with plan protector or wax paper.

❏ 1. Locate the die-cut 1/8" [3.2mm] balsa **upper fuselage side, front lower fuselage side** and **rear lower fuselage side** parts. Also locate the **belly pan** parts. There are two sets of parts for the left and right sides.
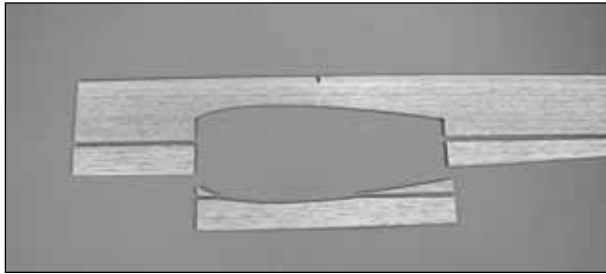
❏ ❏ 2. Use your bar sander to sand the edges flat and straight where the parts join. Using one set of parts, edge glue the upper fuselage side, front lower fuselage side and rear lower fuselage side parts together using either thin CA or aliphatic resin. Align the front lower fuselage side even with the front of the upper fuselage side. Align the rear lower fuselage side even with the wing saddle cutout. When the glue dries, use your bar sander with 150-grit sandpaper to sand the assembled fuselage side flat and smooth.

❏ ❏ 3. Edge glue the three parts for the belly pan side together and sand the completed assembly flat and smooth.

❏ 4. Return to step 2 and make a second set of parts.
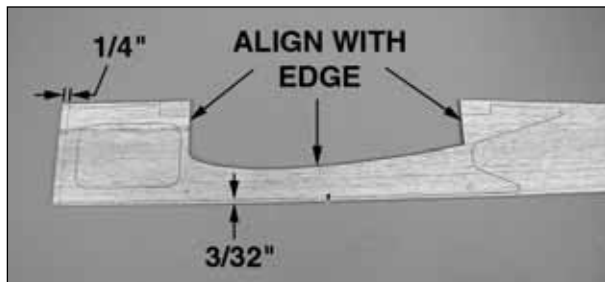
❏ 5. Position one of the sides on your building board as shown in the photo. Position the die-cut 1/8" [3.2mm] ply **fuselage side doubler** on the fuselage side. Align the doubler with the wing saddle and trace the outline of the doubler onto the fuselage side with a ball point pen.

Note: It is important that the doubler be accurately positioned on the fuselage side. Check that the fuselage side extends 1/4" [6.4mm] beyond the doubler at the front end of the assembly. Also check that the fuselage side extends 3/32" [2.4mm] beyond the doubler along the edge of the assembly as shown in the photo.

❏ 6. Glue the doubler to the fuselage side using aliphatic resin glue or epoxy, aligning it accurately in position. Do not use CA as it will not allow you to reposition th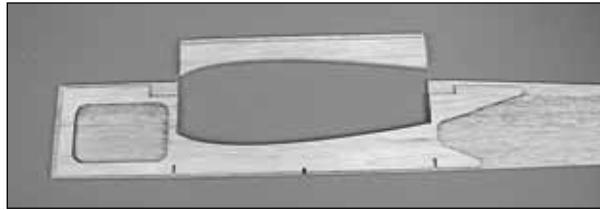e parts. Use weights to hold the parts together until the glue dries, making sure the parts remain accurately positioned.

❏ 7. When the glue has dried, remove the side from the building board. Label this side "L".

❏ 8. Glue the **belly pan doubler** to the belly pan side. Align the doubler with the wing saddle and with the ends. The belly pan side should extend 1/4" [6.4mm] beyond the doubler along the straight edge. Label this assembly "L".

CUT ALONG
EMBOSSED LINE

FUSELAGE DOUBLER
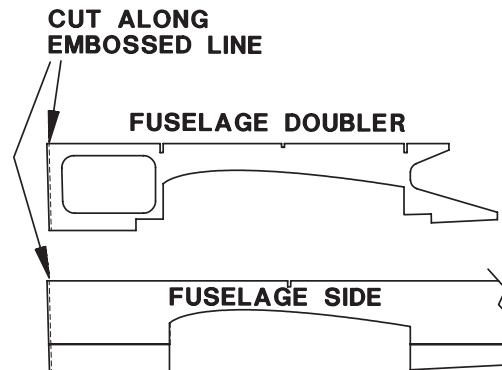
FUSELAGE SIDE

❏ 9. Locate the remaining fuselage side assembly and fuselage side doubler. Note that the front edge of these parts have an embossed cut line that is about 3/32"

[2.4mm] from the edge. Use a straight edge and your knife with a sharp #11 blade to cut and remove the material along the embossed line. This will establish the proper right thrust for the engine.
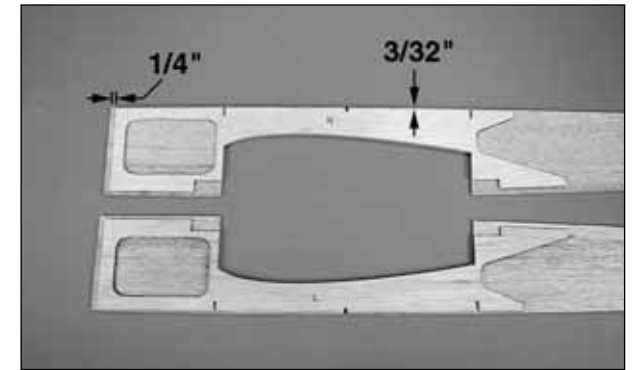
❏ 10. Position this side on your building board as shown in the photo. BE SURE IT IS POSITIONED AS SHOWN (unless you want two left sides)! Position the die-cut 1/8" [3.2mm] ply **fuselage side doubler** on the fuselage side. Align the doubler as you did in steps 5 and 6 and glue it in position with aliphatic resin or epoxy. Use weights to hold the parts together until the glue dries, making sure the parts remain accurately positioned.
**Note**: It is important that the doubler be accurately positioned on the fuselage side. Check that the fuselage side extends 1/4" [6.4mm] beyond the doubler at the front end of the assembly. Also check that the fuselage side extends 3/32" [2.4mm] beyond the doubler along the edge of the assembly as shown in the photo.

❏ 11. When the glue has dried, remove the side from the building board. Label this side "R".

❏ 12. Glue the **belly pan doubler** to the belly pan side. Align the doubler with the wing saddle and with the ends. The belly pan side should extend 1/4" [6.4mm] beyond the doubler along the straight edge. Label this assembly "R".

Caution: Be sure you are building a right side, not another left.

FRAME THE FUSELAGE

11/64" HOLES

3/16" HOLE

F1

1/8" HOLES
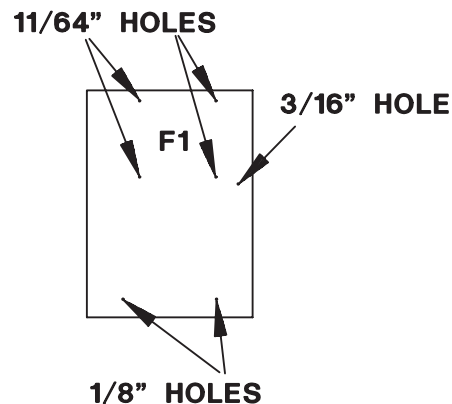
❏ 1. Locate both die-cut 1/8" [3mm] ply **F1 firewalls.** Glue them together using 6-minute epoxy.

Note: Make sure the pin point punch marks are facing out on one side. Label this side F1.

❏ 2. When the epoxy has cured drill 1/8" [3.2mm] and 11/64" [4.4mm] holes where shown in the sketch above. The 3/16" [4.8mm] hole is for the throttle pushrod for an OS .46 FX.

❏ 3. Install four **6-32 blind nuts** in the 11/64" [4.4mm] holes. Put some epoxy on the blind nuts as you install them to hold them in place. Be careful not to get any epoxy in the threaded holes in the blind nuts.

Note: The blind nuts are installed on the aft side of F1.

❏ 4. Referring to the former drawings on the fuselage plan, drill 3/16" [4.8mm] holes for the pushrods in formers **F2, F3, F4, F5 and F6** at the pin point punch marks. Label the front of each former.

❏ 5. Refer to the **"**pushrod exit locations" drawing on the plan and the **HOT TIP** below. Drill 3/16" [4.8mm] holes in the fuselage sides for the pushrods. The left side has one hole for the rudder pushrod. The right side has one hole for the elevator pushrod.

Note: The drawing shows where the holes should enter and exit the fuselage sides on the inside and outside. This allows you to judge the angle at which the holes should be drilled.

TF HOT TIP

HOW TO DRILL ANGLED HOLES

A. Mark the fuselage side with pins where the hole enters and exits the fuselage side.

B. Start by drilling a 3/16" [4.8mm] hole at the exit point on the outside of the fuselage side.

C. Turn the side over and use a rotary tool with a cutoff wheel to cut a trough in the interior of the fuselage side. The trough should extend from the pin mark at the entry point to the hole you drilled at the exit. MAKE SURE you are cutting the trough on the inside of the fuselage side.

D. Dress the angled hole up by using the 3/16" [4.8mm] drill at an angle and sliding it in and out of the hole to shave the hole clean. Any imperfections at the exit can be filled and sanded after the pushrod is installed.

ALIGN AT THIS EDGE

❏ 6. Locate the die-cut 3/32" [2.4mm] balsa **left and right fuselage top deck** parts. Use your bar sander to sand the edges flat and straight where the parts join. Edge glue the left and right fuselage top deck parts together using either thin CA or aliphatic resin. Align the parts even at the front edges. Use your bar sander with 150-grit sandpaper to sand the assembled fuselage top deck flat and smooth.
Note: The front edge is cut at a 2 degree angle to establish the engine right thrust angle.
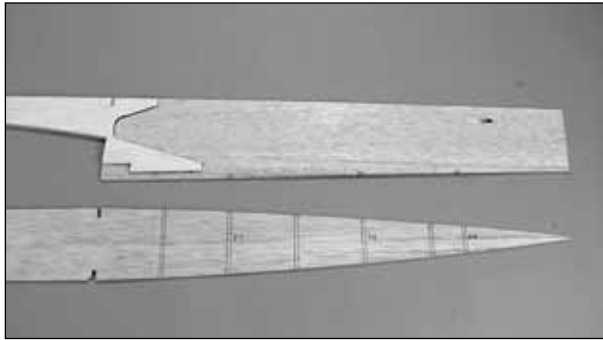
❏ 7. Place the fuselage top deck over the top view of the fuselage plan. Align the cutouts in the top deck with formers F2, F3TC and F3. Mark the location of former F1TR and all of the formers aft of F3. Transfer the marks for F4, F5 and F6 to the bottom of the top deck.

❏ 8. Place the right fuselage side over the side view of the fuselage plan. Align the fuselage side with the wing saddle. Mark the location of formers F4, F5 and F6 at the lower edge on the inside of the fuselage side. Align the left fuselage side with the right side and transfer these marks to the inside of the left fuselage side.

❏ 9. Without using any glue, assemble the fuselage top deck, left and right fuselage sides, F2 and F3. Use rubber bands to hold the assembly together. Align F2 even with the front of the wing saddle cutout and align F3 even with the rear of the wing saddle cutout. Be certain that the forward (marked) sides of F2 and F3 are facing the front of the fuselage.

IMPORTANT: Check that the front edge of the top deck is exactly aligned with the front edge of the ply fuselage doublers. View the fuselage assembly from the top and insure that the firewall will have RIGHT thrust.

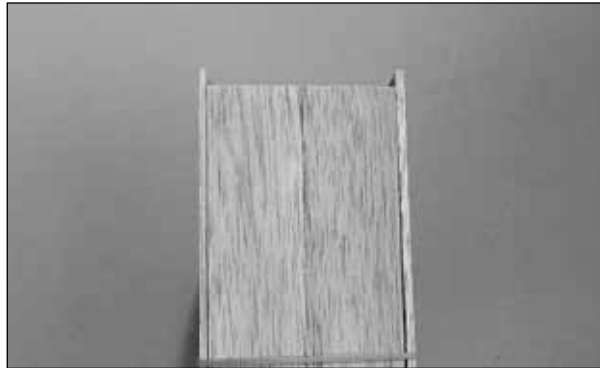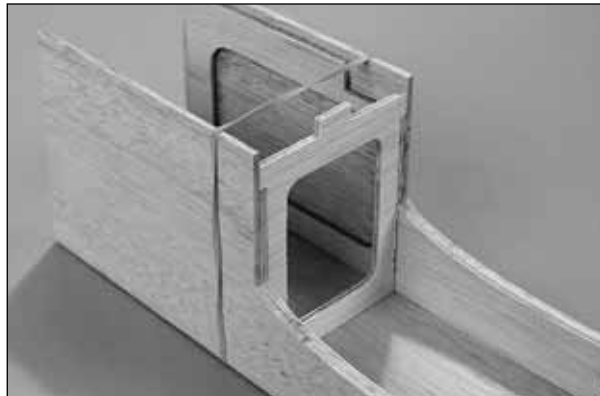❏ 10. Cover your building board with plan protector or wax paper. Place the fuselage assembly upside down on the building board. With the assembly properly aligned, glue F2 to the top deck and fuselage sides with thin CA. Be sure that the top deck is firmly seated against the ply fuse doublers and that F2 is aligned with the wing saddle cutout. Squeeze the fuselage sides together against F2 until the CA cures.

❏ 11. Glue F3 to the top deck and fuselage sides with thin CA. Be sure that the top deck is firmly seated against the ply fuse doublers and that F3 is aligned with the wing saddle cutout. Squeeze the fuselage sides together against F3 until the CA cures.

❏ 12. Glue the top deck to the fuselage sides between F2 and F3 with thin CA. Be sure the top deck is firmly seated against the ply fuse doublers.

❏ 13. Glue the **firewall F1** in place to the front of the fuselage using 30 minute epoxy. You will need to cut two notches in the top deck to clear the 6-32 blind nuts. Align F1 with the top of the top deck. F1 will extend below the bottom of the fuselage by about 3/32" [2.4mm]. Check that the sides and top deck are square.

❏ 14. Reinforce the joint between F1 and the fuselage sides and top deck with some balsa triangular sticks cut from a 1/4" x 1/4" tri x 30" [6.4 x 6.4 x 762mm] stick. Glue in place with epoxy. Do not let any epoxy get into the blind nuts.

Hint: Put some vaseline on the two blind nuts near the top deck.

❏ 15. Glue the top deck to the fuselage sides between F1 and F2 with thin CA.

❏ 16. Fit former F4 into position. Note the curve of the sides. Then, remove F4 and sand the edges of F4 to match the curve. Glue F4 to the top deck and fuselage sides with thin CA. Be sure that the top deck is flush with the top edge of the fuselage sides. Align F4 with the marks you made earlier on the bottom of the top deck and on the fuselage sides. Squeeze the fuselage sides together against F4 until the CA cures.

Note: Be certain that the forward (marked) side of F4 is facing the front of the fuselage.

❏ 17. Glue the top deck to the fuselage sides between F3 and F4.

❏ 18. In similar fashion, glue F5 and F6 into position.

❏ 19. Glue the tail end of the fuselage sides together where they meet. Trim the top deck slightly if needed.

❏ 20. Locate two die-cut 1/8" [3.2mm] ply 1" x 2-7/8" [25.4 x 73mm] **fuse hold down blocks**. Glue these together with medium CA to form a 1/4" [6.4mm] thick block. Using 30-minute epoxy, glue this block to the front of F2, between the fuselage sides. Trim the block to fit as needed. Make sure the block fits into the cutout in the fuselage doublers.

❏ 21. Locate two more fuse hold down blocks and glue them together. Using 30-minute epoxy, glue this block to the rear of F3, between the fuselage sides. Make sure the block fits into the cutout in the fuselage doublers.
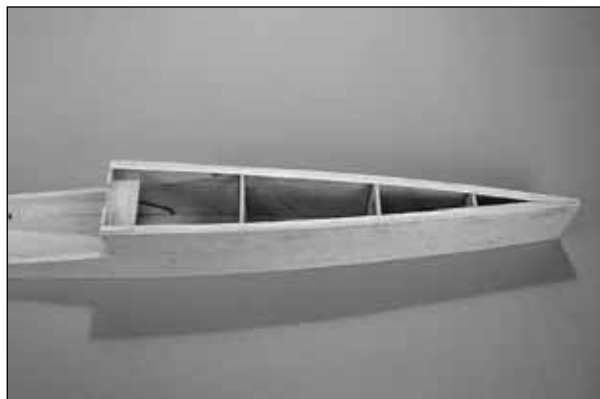
❏ 22. Locate two 1/4" x 1/4" x 36" [6.4 x 6.4 x 914mm] triangular balsa sticks. Trim them to fit along the bottom of the fuselage sides between F3 and the rear end of the fuselage. Glue them into position.

❏ 23. Sand the top of the fuselage lightly to remove any glue bumps. Sand the bottom of the fuselage flat and level. Sand the front and rear ends flat and smooth.

INSTALL THE PUSHRODS AND SERVOS

The elevator servo is installed on the left side of the fuselage and the pushrod for that servo exits from the right side of the fuselage.

❏ 1. Locate the two **36" [914mm] plastic pushrod tubes**. Cut one of these tubes to a length of 16" [406mm]. Cut the remaining tube to a length of 21" [533mm]. Save the remainder of the tubes for use later. Use some 150-grit sandpaper to lightly roughen the outside of the tubes.
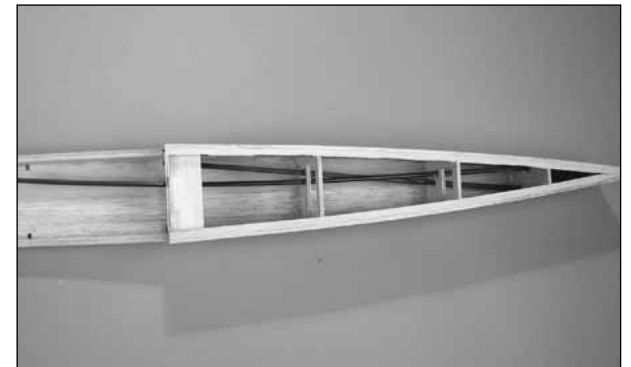
❏ 2. Install the 16" [406mm] tube in the proper holes in the fuselage side and formers for the elevator pushrod, inserting it from the rear. The tube should extend 1/8" [3.2mm] beyond F3. Install the 21" [533mm] tube in the proper holes for the rudder pushrod. This tube should extend 4-1/2" [107mm] beyond F3. Glue the tubes in position with some medium CA at each former and the fuselage sides.

❏ 3. Use a razor saw to trim the pushrods flush with the fuselage sides. Fill any irregularities with balsa filler.

IMPORTANT NOTES ABOUT SERVOS

The following steps show the installation of three full size servos in the fuselage; one each for the elevator, rudder and throttle. The wing also has two aileron servos and one flap servo, plus a retract servo if you are installing retractable landing gear. If you have a computer radio and want to use some of its mixing capabilities, there is adequate room in the fuselage for a second elevator servo. The wing also has room for a second flap servo. If you do install additional servos it is recommended that you use mini servos for their smaller size and lighter weight.

You MUST install your servos so that the servo arm is located in the position shown on the plan. Install the servo rails so that the servos you use will be in the proper location.

Servo output torque is a consideration when you select the servos that you will use. Standard size servos have adequate torque for any control function. If you are using mini servos you should use two servos for the elevators that have at least 35 oz in of torque each. The rudder servo should have at least 42 oz in of torque. This will insure that the control surfaces can reach full deflection at maximum flying airspeeds.

We recommend Z-bends be used for the pushrods where they connect to the servo arms. This results in the most compact installation possible and will reduce the possibility of a pushrod contacting something close to it. As an alternative you can use an L-bend with one of the supplied nylon Faslink keepers. For making Z-bends we highly recommend the Precision Z-bend Pliers from Great Planes (GPMR8025). This tool makes very precise Z-bends in tight areas and is one of those tools you wonder how you ever got along without.
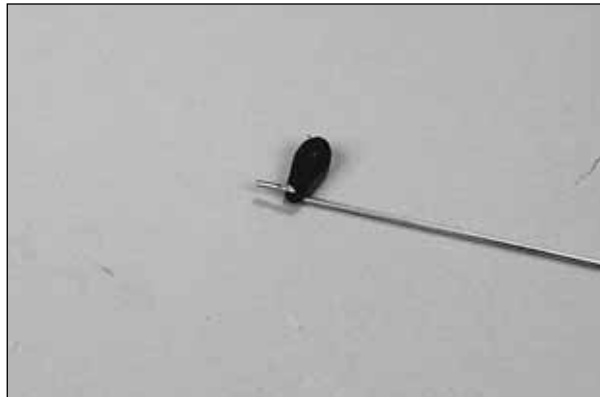
❏ 4. Locate a **.074 x 36" [1.6 x 914mm] pushrod wire**. Bend a Z-bend (or L-bend) in the unthreaded end of the wire. Make this bend close to the end of the wire. Install a servo arm on the Z-bend. You may need to drill the servo arm with a 5/64" [2mm] drill. Insert this wire into the elevator pushrod tube where the tube exits F3. DO NOT cut off the excess wire where it exits the rear of the fuselage. This pushrod wire will be used as locating jig for the elevator servo.
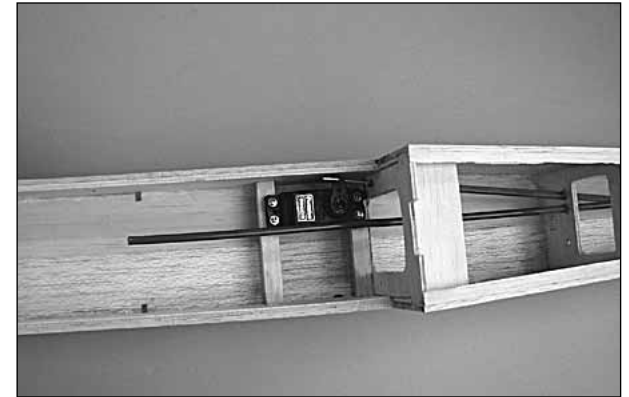
❏ 5. From the 1/4" x 3/8" x 36" [6.4 x 9.5 x 914mm] basswood stick, cut two **servo mounting rails** to a length of 2-5/8" [66.7mm]. These rails should be a tight fit against the fuselage sides so that they can hold the servo in position during the following steps.

❏ 6. Install one of the servo rails against F3. Place the elevator servo in position on the rail and install the second rail at the forward end of the servo. Install the servo arm, with the wire attached, on the servo. Refer to the note and photo below if you are using full size servos. DO NOT glue the rails at this time.
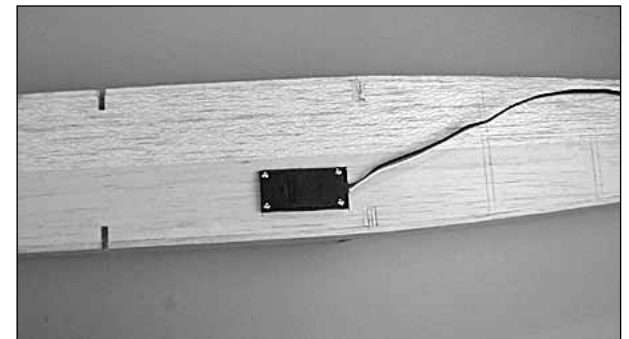
Note: If you are using a full size servo, you will need to cut a hole in the fuselage deck for the servo before you can install the servo arm. Mark the deck from inside the fuselage where you need to cut the hole. Then, remove the servo. Transfer the location of the hole to the top of the deck by pushing a pin through the deck at the corners of the hole. Cut out the hole from the top of the deck.
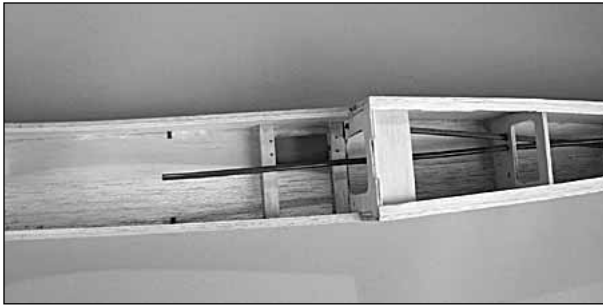
❏ 7. Position the servo and rails so that the pushrod wire lines up properly with the pushrod tube. Tack glue the rails to the fuselage sides. After the CA has cured, mark the location of the servo mounting holes. Then, remove the servo and pushrod wire. Securely glue the rails to the fuselage sides and the face of F3 with epoxy.

❏ 8. Drill pilot holes for the servo screws and mount the servo to the rails with the screws, grommets and eyelets that came with the servo. Remove the servo and harden the mounting holes with a drop of thin CA. After the CA has cured, remount the servo to the rails.
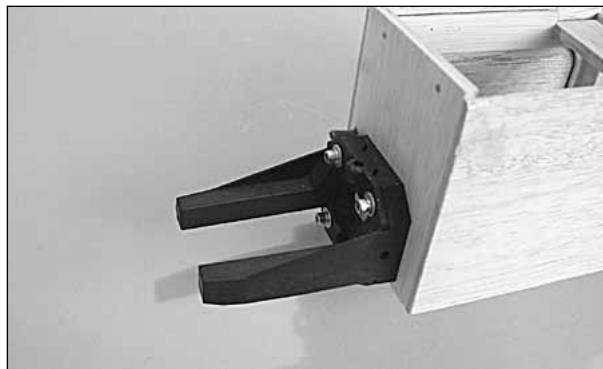
❏ 9. Cut the *spacer bar* off both **engine mount** halves and trim off any *flashing* so they fit together. Temporarily mount the engine mount to F1 using four 6-32 x 3/4" [19.1mm] socket head cap screws, #6 lock washers and #6 flat washers. Place your engine on the mount, adjusting it for the width of the engine. Mark the location of the hole for the throttle pushrod.

If you are using an O.S. .46 FX the location is already marked. Remove the engine but leave the engine mount in place.
Note: To allow as much room as possible for the fuel tank, the throttle pushrod should be placed as close to the fuselage side as possible. See the photo at step 10.
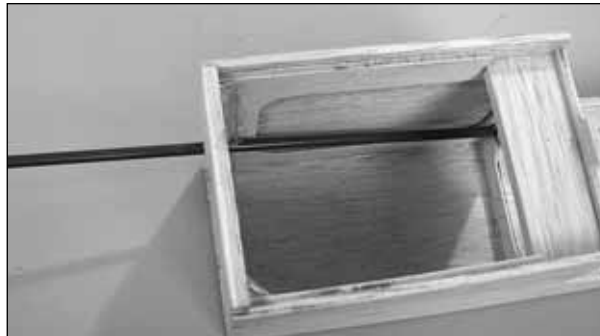
❏ 10. Drill a 3/16" [4.8mm] hole for the throttle pushrod at the location you marked. Using a piece of leftover plastic pushrod tube, install the **throttle pushrod tube** in the hole you just drilled in F1 and into the hole in F2. Trim the tube to length so that it extends about 1" [25.4mm] beyond F1. Remove the tube and roughen the ends where it will be glued in place later. Reinstall the tube.

❏ 11. Note the position of the throttle servo on the plan. You will need to cut a hole in the deck for the servo. If you are using a full size servo, this hole must be close to the centerline of the model. A mini servo can be placed close to the side of the fuselage, allowing room for the switch mount on the other side. Cut a hole for the servo you will be using, using the plan as a reference. The photo shows a full size servo.

❏ 12. From the 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] basswood stick, cut two servo mounting rails to a length of 2-5/8" [66.7mm]. Glue these rails to the top deck on the inside of the fuselage. Install the throttle servo, drill pilot holes for the mounting screws and install the screws, grommets and eyelets that came with the servo. Remove the servo, harden the mounting holes with a drop of thin CA and remount the servo when the CA has cured.
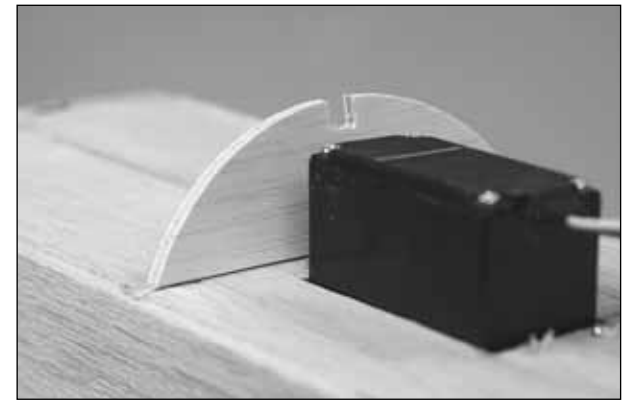
❏ 13. Turn the fuselage over and hold former F2T in position. Make sure the throttle servo will clear the sheeting that will be glued to F2T.

Note: You may need to trim some of the 3/16" [4.8mm] sq. stringer that will be glued to the notch in F2T.

❏ 14. Install a **Screw-Lock connector, nylon retainer** and **4-40 x 1/8" [3.2mm] socket head cap screw** on the outside hole of the servo arm. Install this arm on the throttle servo. Install a .074 x 12" [1.6 x 305mm] throttle **pushrod wire** into the throttle pushrod tube. If needed, adjust the location of the hole in F2 so that the pushrod lines up with the screw-lock connector.

Note: You may need to put a small bend in the wire as shown in the photo. Note also that there will be minimal clearance between the pushrod linkage and the wing when it is installed. It may be necessary to trim a small hole in the wing to clear the linkage.

❏ 15. Note the position of the rudder servo on the plan. It is mounted in the same manner as the throttle servo. You will need to cut a hole in the deck for the servo. This hole must be close to the centerline of the model for either a full size or mini servo. Cut a hole for the servo you will be using, using the plan as a reference.

❏ 16. From the 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] basswood stick, cut FOUR servo mounting rails to a length of 2-5/8" [66.7mm]. Glue two of these rails to the top deck on the inside of the fuselage. Glue a second set of rails on top of these rails. This will space the rudder servo 1/8" [3.2mm] further from the deck than the throttle servo. Install the rudder servo, drill pilot holes for the mounting screws and install the screws, grommets and eyelets that came with the servo. Remove the servo, harden the mounting holes with a drop of thin CA and remount the servo when the CA has cured.

❏ 17. Locate the die-cut 1/8" [3.2mm] ply **rudder pushrod brace**. Carefully drill a 3/16" [4.8mm] hole in one end of this brace at the pin point punch mark. Slide the brace onto the rudder pushrod tube but do not glue it into place until after the receiver is installed.

❏ 18. Locate the 36" [914mm] wire pushrod, with a Z-bend in the end, that you used earlier for the elevator servo installation. Temporarily install the wire pushrod in the rudder pushrod tube and install the rudder servo arm on the wire pushrod. Install the servo arm on the rudder servo. Note the location of the ply rudder pushrod brace.

❏ 19. Remove all of the pushrods. Leave the engine mount in place.

INSTALL THE RECEIVER

The photos that follow show the installation of the large Futaba 7-channel FM receiver. There are several other 7, 8 and 9 channel receivers that are smaller.
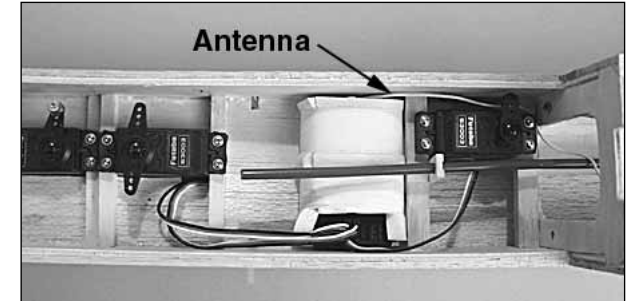
❏ 1. Using the plan as a guide, cut a hole in the top deck for the receiver. Make sure the hole is large enough for the 1/4" [6.4mm] foam that the receiver will be wrapped in. The receiver should fit firmly in this hole.
Note: A slot has been cut beside the servos to allow the servo wires to be neatly routed to the receiver. Note also the routing of the receiver antenna.
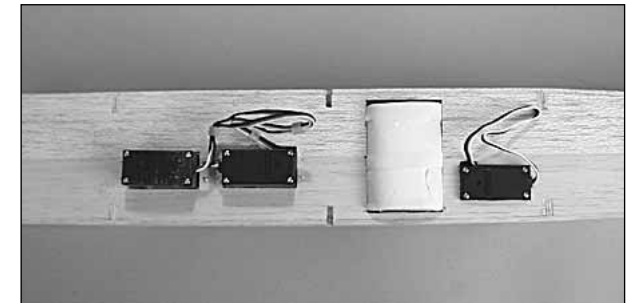
❏ 2. Turn the fuselage over. Note also how the servo wires have been routed and that tie wraps are used to keep the installation neat. The tie wraps are short lengths of fuel line.

Caution: Once the top of the fuselage has been sheeted, be careful not to push the receiver firmly into its cutout. This could cause the receiver to contact the top sheeting and cause it to split the sheeting.

FINISH THE FUSELAGE
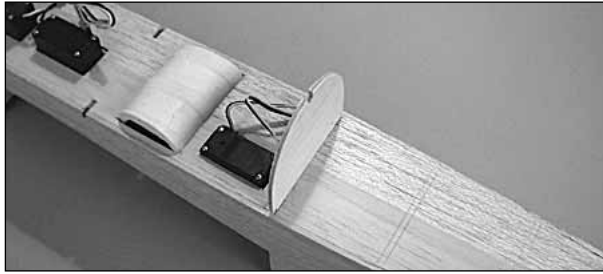
❏ 1. Glue the die-cut 1/8" [3.2mm] ply former **F3T** into place on the top deck using thin CA. Make sure that it is perpendicular to the top deck and that it is centered between the sides, directly on top of F3.
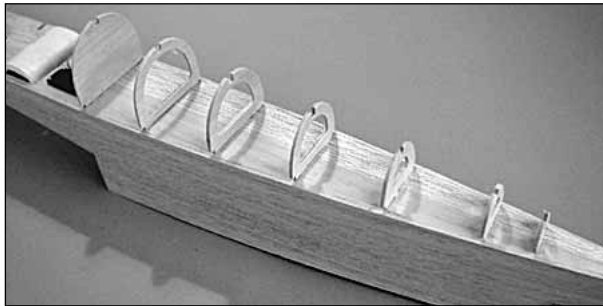
❏ 2. Glue die-cut 1/8" [3.2mm] ply formers **F3TR, F4T, F4TR, F5, F5TR and F6** into position using the marks you made earlier. Make sure the formers are perpendicular to the top deck and are centered between the sides.
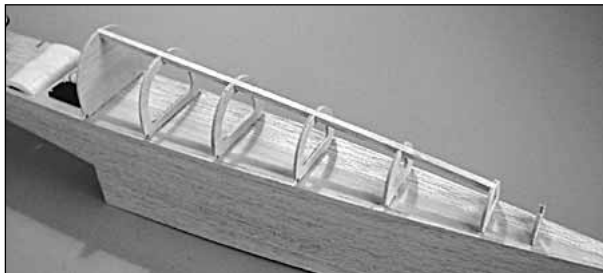
❏ 3. Glue a 3/16" x 3/16" x 24" [4.8 x 4.8 x 610mm] balsa stick from F3T to F5TR. As you glue the stick to each former make sure the former is perpendicular to the top deck. Trim the stick even with F3T and F5TR.
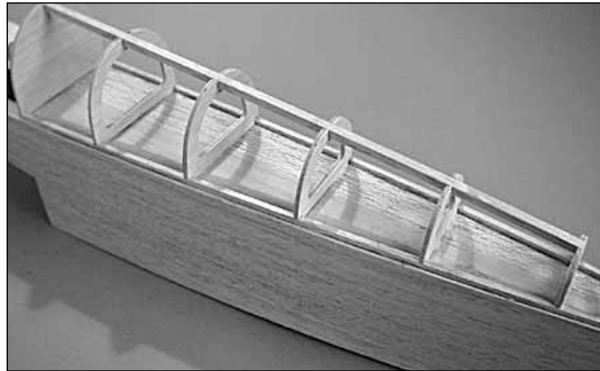
❏ 4. Glue two 1/8" x 1/8" x 24" [3.2 x 3.2 x 610mm] balsa sticks from F3T and F6T along the top of the top deck. Trim the sticks even with F3T and F6T.

❏ 5. Use a bar sander with 150-grit sandpaper to blend the sticks with the shape of the formers.
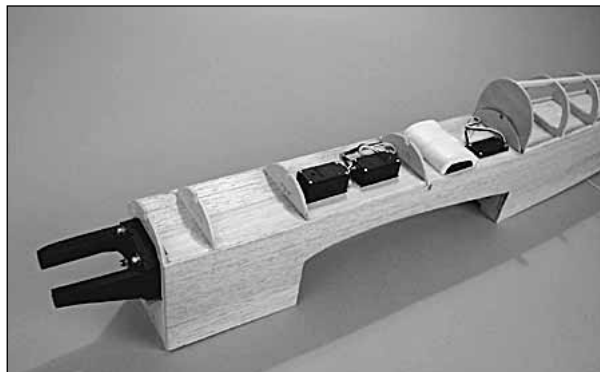
❏ 6. Glue die-cut 1/8" [3.2mm] ply formers **F1T, F1TR, F2T, F3TC and F3TF** in place to the top deck. Make sure the formers are perpendicular to the top deck and are centered between the sides.

❏ 7. There are three other formers that are supplied and are shown in the next photo. These are F2TX and two F3TX. These formers are shown on the side view of the fuselage plan. The location of these formers depends on the location of your servos and receiver. They are used to prevent the top sheeting from sagging between the other formers. Glue F2TX and both F3TX formers in place as desired.
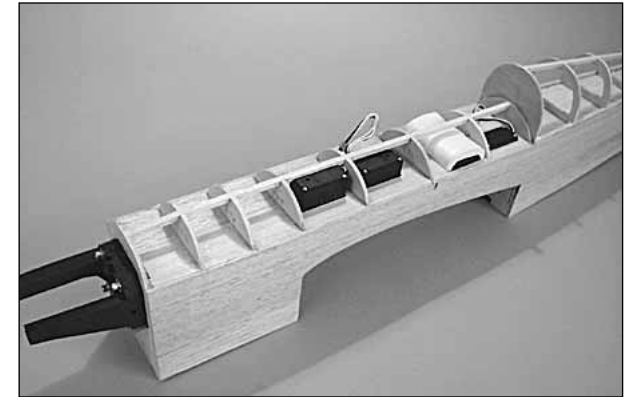
❏ 8. Glue a 3/16" x 3/16" x 24" [4.8 x 4.8 x 610mm] balsa stick from F1T to F3TF. As you glue the stick to each former make sure the former is perpendicular to the top deck. Trim the stick even with F1T. Use your bar sander to blend the stick with the shape of the formers.

Note: If you installed full size servos you will need to trim the stick where it crosses the servos.
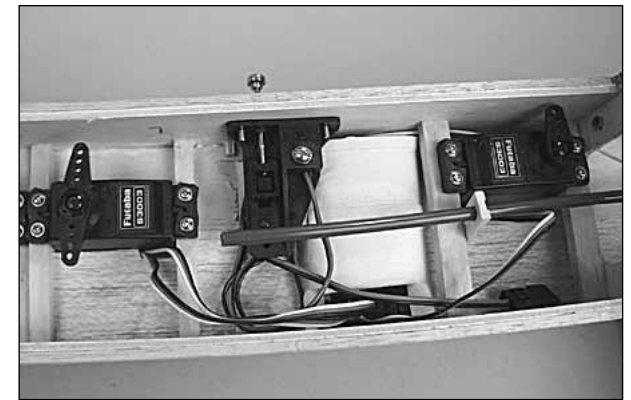
❏ 9. Mount your switch to the side of the fuselage. We used a Great Planes Switch/Charge Mount (GPMM1000). You will need to cut a hole in the top deck for the switch. We installed the mount on the left side of the fuselage as it is easier for a right handed person to reach it. You may want to mount it on the left side to keep it away from the engine exhaust. Make sure the mount and switch will clear the wing when it is mounted to the fuselage.

❏ 10. Locate the four 3/32" x 3" x 24" [2.4 x 76 x 610mm] balsa sheets. Set the two softest sheets aside for use later. Use the remaining two to sheet the front of the fuselage in the following steps.
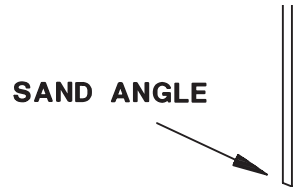
SAND ANGLE

❏ 11. Cut both sheets to a length of 15-1/2" [394mm]. Sand an angle along one long edge of both sheets as shown in the sketch. Fit a piece of sheeting to the area to be covered between F1T and F3TF on the left side of the fuselage. See the photo at step 12 below.

Note: There will be a 1/32" [0.8mm] lip where the fuselage side overhangs the top sheeting. This will be sanded away later.

🔧 TF HOT TIP

HOW TO FIT SHEETING

A. Mark the center of the 3/16" [4.8mm] stringer onto F3T.

B. At formers F2T and F3T, hold the angled edge of the sheeting in place along the top edge of the fuselage side. Carefully roll the sheeting along the former until it is resting on the stringer. Mark the location of the center of the stringer on the sheeting at F3T.

C. In the same manner, mark the sheeting at F1T.

D. The sheeting is straight from F3T to F2T and then slowly slopes to F1T. Mark the sheeting where it crosses F2T. Transfer the mark at F3T to F2T. Our F3T mark showed the sheeting needs to be 1-15/16" [49.2mm] wide at F3T. It should also be 1-15/16" [49.2mm] wide at F2T as well.

E. Cut the sheeting in a straight line between the marks from F3T to F2T. Cut the sheeting at an angle between the marks at F2T to F1T.

❏ 12. Using thin CA, glue the angled edge of the sheeting to the top of the fuselage side and the bottom of the formers.

❏ 13. Moisten the outside of the sheeting so that it will bend easier. Most modelers use a mixture of water and ammonia. We prefer rubbing alcohol with a spray nozzle attached to the bottle. It soaks into the balsa easily and dries very fast.

❏ 14. Bend the sheeting against the formers, one at a time. While holding it in place, glue it to the former and stringer with thin CA. Do not become concerned if the sheeting splits at one end as ours did. Glue the split together and then glue it to the formers. It can be filled and sanded later.

❏ 15. Fit the second piece of sheeting to the other side of the fuselage. Be sure the angled edge is resting properly on the top of the fuselage side. Cut the sheeting 1/16" [1.6mm] oversize.

❏ 16. Carefully hold the sheeting in position along the top edge of the fuselage and then roll it along the former until it meets the sheeting on the other side. Note how much must be sanded off to get it to fit properly. Remove the sheeting and sand as needed. Do not sand off too much. Refit the sheeting and check it again. Go from former to former and sand a little off each time. You will quickly have a perfect fitting piece.

❏ 17. Glue this piece of sheeting in place in the same manner as you did the first piece. It is easier to use medium CA on the formers and thin CA on the stringer.

The rear turtle deck of the fuselage is sheeted in exactly the same manner as the top front. Fitting the balsa sheeting is a bit more difficult as the slope and curvature are greater.
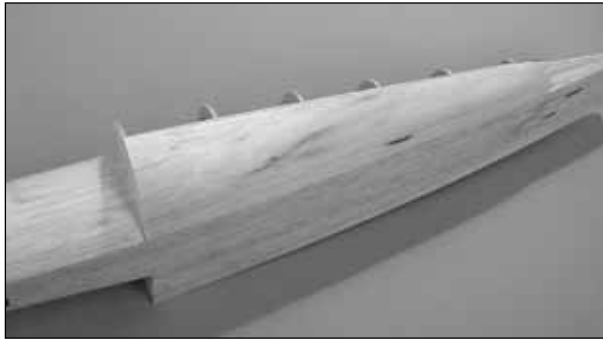
❏ 18. Locate the two soft 3/32" x 3" x 24" [2.4 x 76 x 610mm] balsa sheets you set aside in step 10. Cut both sheets to a length of 14" [356mm]. Fit a piece of sheeting to the area to be covered between F3T and F6T on the left side of the fuselage. Glue the sheet into position with thin CA.
Note: There is a small area of the sheeting at the top near F3T that needs to be filled in. Use a corner of the piece you just cut off and glue it to the sheeting.

❏ 19. Fit the second piece of sheeting to the other side of the fuselage. Glue it into position with medium and thin CA.

❏ 20. Trim and sand all of the sheeting flush with F1T, F3T and F6T.
Note: A 1/4" [6.4mm] notch will be cut in the top of the sheeting between F5TR and F6T when the vertical fin is installed.

This completes the assembly of the fuselage. The bottom sheeting will be added when the wing is mounted to the fuselage.

BUILD THE WING

BUILD THE RIGHT PANEL

❏ 1. Remove all of the **ribs** from the die-cut 1/16" [1.6mm] balsa sheets. When doing so, do not remove any of the lightening hole cutouts in W2, W3 and W4. Remove **the spar webs** from the die-cut 3/32" [2.4mm] balsa sheet. Remove the **TE spar/jigs** from the die-cut 1/16" [1.6mm] balsa sheet. Be very careful not to let any of the jig tabs split off of the jig. If any do, glue them back on. Remove all of the ply wing parts from their die-cut sheets.

LEADING EDGE SKINS
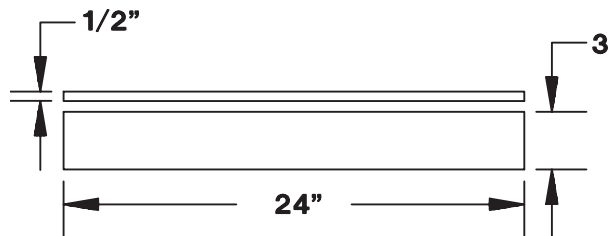
❏ 2. Prepare four leading edge skins as shown in the sketch above. Locate five pieces of 1/16" x 3" x 24" [1.6 x 76 x 610mm] sheeting. From one sheet cut four strips that are 1/2" [12.7mm] wide. Glue a 1/2" [12.7mm] strip to each of the other four pieces of sheeting, making sheets that are 3-1/2" [89mm] wide. Sand each sheet flat and smooth on one side with your bar sander and 150-grit sandpaper. Sand any glue bumps from the other side of each sheet.
Caution: Avoid over sanding the sheets, making them too thin.

Note: Portions of this manual that apply only to fixed landing gear begin with an "F". For example: Step F3 is for **fixed gear** only. Steps that apply to **retract landing gear** are shaded and begin with an "R", such as step R6. It is assumed that most modelers will be installing fixed tail dragger landing gear (with a tail wheel), so just skip the shaded steps that begin with an R. If you are building your model for retracts, make sure you read the steps that are shaded and skip steps that begin with an F.

Remember:

"R-steps" are for retracts only;

"F-steps" are for fixed gear;

Note: Use a colored marker to highlight the steps for your landing gear option.

Retracts go to step R9.

FIXED GEAR
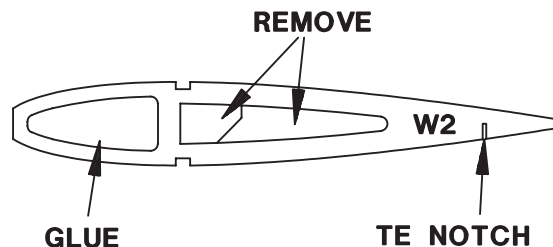
❏ F3. If you are installing fixed gear on your model, prepare both **W2 ribs** as shown in the above sketch. Glue the lightening hole forward of the spars back into the rib. Remove the two pieces from the lightening hole aft of the spars.
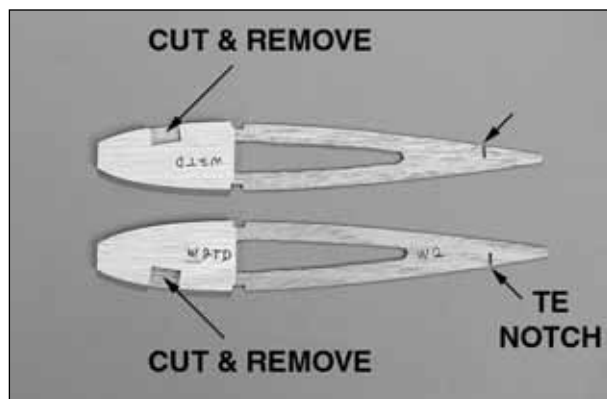
❏ F4. Glue a die-cut 1/8" [3.2mm] ply **W2TD doubler** to each W2 with 6-minute epoxy. Make sure to make a left and right assembly. Cut and remove the balsa from the rib where there is a notch in W2TD for the landing gear rail.

Important: Notice the orientation of the **TE notch** in relation to the **W2TD notch**.

❏ F5. In the same manner, prepare the W3 and W4 ribs. Continue with step 9.

RETRACTABLE GEAR
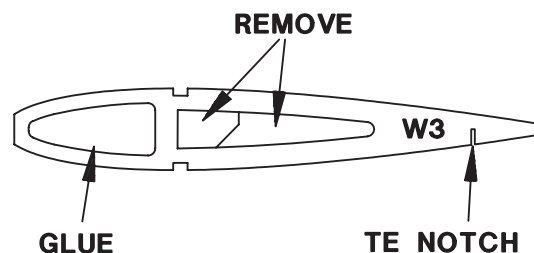
❏ R6. If you are installing retracts (retractable landing gear) on your model, prepare both **W3 ribs** as shown in the above sketch. Glue the lightening hole forward of the spars into the rib. Remove the two pieces from the lightening hole aft of the spars.
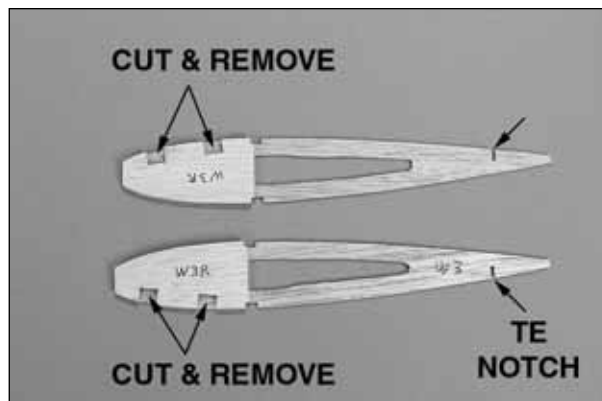
❏ R7. Glue a die-cut 1/8" [3.2mm] ply **W3R doubler** to each W3 using 6-minute epoxy. Make sure to make a left and right assembly. Cut and remove the balsa from the rib where the notches are in W3R for the landing gear rails.

Important: Notice the orientation of the **TE notch** in relation to the **W3R notches**.

❏ R8. In the same manner, prepare both W4 ribs. Remove the lightening holes from both W2 ribs.

❏ 9. Cut the **right wing plan** along the dashed line and tape it to your building board. Cover the plan with Plan Protector or wax paper.
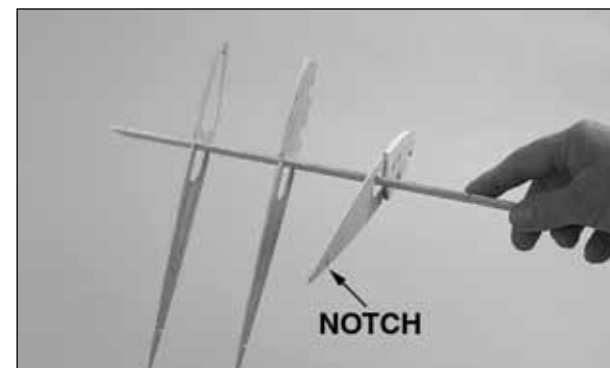
❏ ❏ 10. Locate a die-cut 3/32" [2.4mm] balsa **spar web**. Working from the narrow end of the web, slide ribs W2 thru W9 into position on the web. Twist each rib so that it seats properly in the web. Be sure that the ply doublers on W2, W3 and W4 are on the correct side. Also be sure that the notch for the TE web/jig is facing down when each rib is twisted into position.
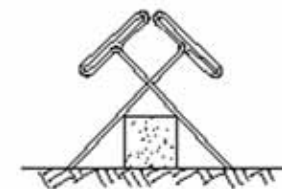
❏ ❏ 11. Position a 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] basswood **bottom spar** over its location on the plan, aligning the spar so that a little overhangs each end. Pin the spar to the plan at the ends. Don't stick your pins through the spar as it will split the spar. Instead, stick them into your building board over the spar in a

crisscross fashion. Place an additional pair of pins beside the spar between ribs W5 and W6. Do not crisscross these as it would interfere with the spar web. Stick them into your building board vertically so that they keep the spar in position.
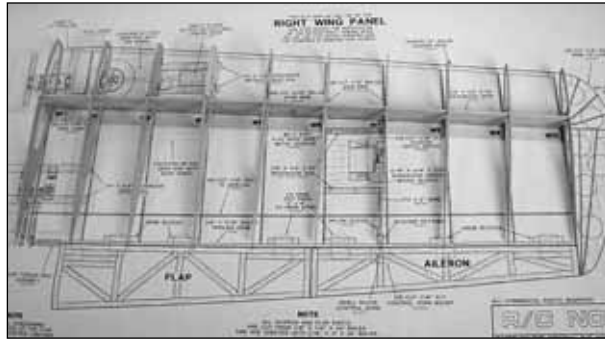
❏ ❏ 12. Position the spar web, with ribs, onto the bottom spar. Align the ribs over their locations on the plan. Install W1 and W10 on the spar and spar web. Make sure each rib is seated onto the bottom spar and that the spar web is against the forward part of the cutout in each rib. DO NOT apply glue until instructed to do so.
Note: Do not be concerned if the ribs do not exactly align spanwise with the plans. Paper plans can expand and contract as much as 1/8" [3.2mm] due to moisture.
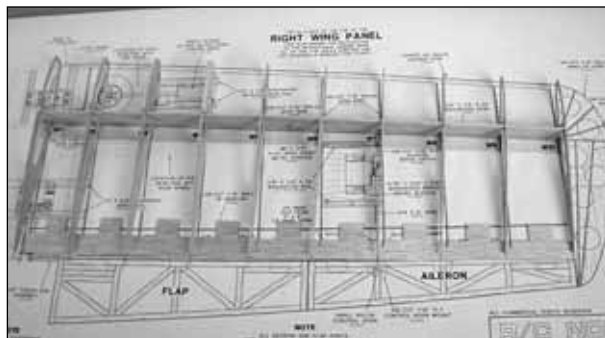
❏ ❏ 13. Position the **TE spar/jig** flat on the building board, under the TE notches in the ribs. **The jig tabs must be facing the bottom spar and the widest part of the TE spar/jig must be at W1.**
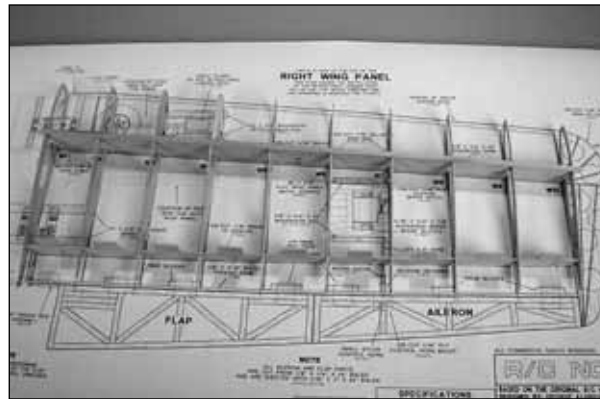
❏ ❏ 14. Carefully rotate the TE spar/jig so that the jig tabs are facing up, while also sliding each rib into the slot in the TE spar/jig. Make sure that each rib is seated in the notch in the TE spar/jig and that the TE spar/jig is seated in the notches in the ribs. Pin the TE spar/jig in location over the plan. DO NOT glue yet.

❏ ❏ 15. Put the 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] basswood **top spar** into position on the spar web, seating it in each rib. DO NOT glue yet.

❏ ❏ 16. Time to get the thin CA. Starting with W3 and working towards W10, glue each rib to the bottom spar and the spar web. While doing so, press the rib and spar web firmly onto the bottom spar until the CA cures. Make sure the rib is firmly seated against the front face of the spar web and also that the TE spar/jig and rib remain in place.

Important: For maximum wing strength it is essential that the joint between the spar web and the top and bottom spars, as well as the joint between the spar web and each rib, be securely glued with no gaps. When you remove the wing panel from the building board in a later step, be sure to touch up any joints that need additional glue.

❏ ❏ 17. Tack glue W1 and W2 in place to the spar web. There is a 1/16" [1.6mm] gap between the spar web and the top and bottom spars. Do not get any excess glue into this gap as the 1/16" [1.6mm] ply spar joiners fit into the gap.

❏ ❏ 18. Remove the top basswood spar. Spread a bead of medium CA along the top of the spar web between W2 to W10 and on each rib where the top spar will contact them. Re-install the top spar and hold it firmly in place against the spar web until the CA cures.

❏ ❏ 19. Glue each rib to the TE spar/jig with thin CA. Make sure each rib is properly seated in the TE spar/jig. The top of each rib should be even with the top of the TE spar.
Note: Use the CA sparingly. If you apply an excessive amount of CA it will be difficult to remove the bottom of the jig under the ribs. Use the included CA applicator tip.
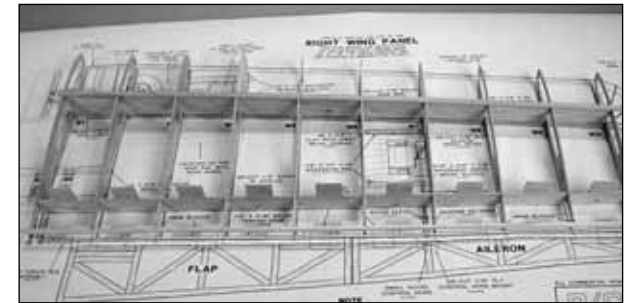
❏ ❏ 20. Glue the 1/8" x 3/16" x 24" [3.2 x 4.8 x 610mm] balsa **trailing edge** to the rear of the ribs with thin CA. The top of the trailing edge should be even with the tops of the ribs.
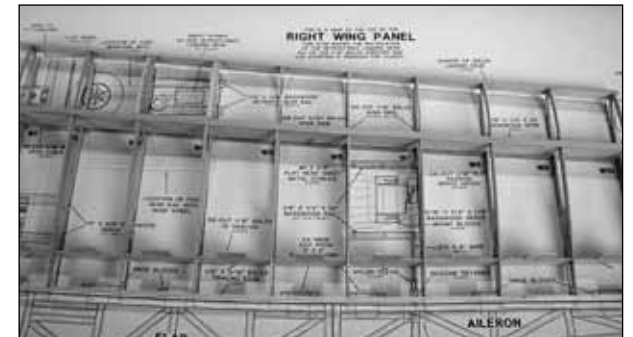
❏ ❏ 21. Glue the tapered 5/32" to 1/2" x 1/4" x 24" [4 to 12.7 x 6.4 x 610mm] balsa **leading edge** to the

front of each rib with thin CA. The top of the leading edge should be even with the tops of the ribs. Use a straight edge along the sides of W1 and W10 to insure that they are straight.

Note: You will need to carefully sand the front of W2, W3 and W4 at an angle to match the sweep of the LE if those ribs have a ply doubler installed.

❏ ❏ 22. Use your bar sander with 150-grit sandpaper to lightly sand the top of the leading edge to blend it evenly with the tops of the ribs.
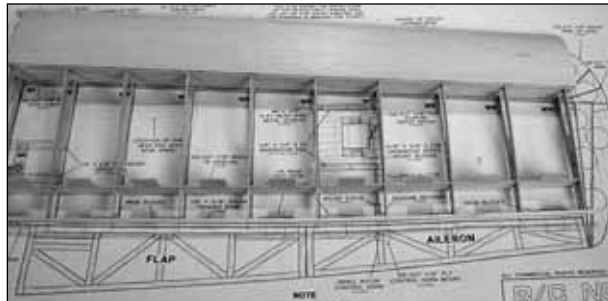
❏ ❏ 23. Using medium CA, glue one of the leading edge skins that you prepared in step 2 into place on the ribs and the top spar. The skin should extend forward from the center of the spar. Refer to the *HOT TIP* that follows.

Note: Make sure you glue the skin in place with the smooth side facing out. Position the 1/2" [12.7mm] strip that was glued to the sheeting at the spar.
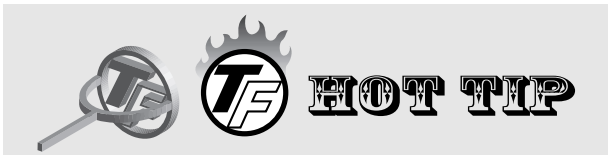
It can be difficult to get a tight glue joint between the leading edge skin and the tapered balsa leading edge while the wing panel is still on the building board. Do not apply any CA to the tapered leading edge until after you remove the wing from the building board in the next step.

After you remove the wing from the building board, use thin CA to glue the skin to the tapered leading edge. Working one section at a time between two ribs, hold the skin to the tapered leading edge and wick in some thin CA. Firmly hold the skin in place until the CA cures.

❏ ❏ 24. Remove the wing panel from the building board. Glue the wing skin to the tapered leading edge with thin CA. Checking from the bottom of the wing panel, insure that the leading edge skin is securely glued to the tops of all the ribs.

❏ ❏ 25. Carefully check all of the glue joints between the spar web, top and bottom spars and the wing ribs. Fill in any glue joints that don't look solid with thin CA.

❏ ❏ 26. Trim the leading edge, leading edge sheeting, spars and trailing edge even with W1 and W10. Trim the leading edge sheeting even with the front of the tapered leading edge.

❏ ❏ 27. Snap the bottom of the TE spar/jig off even with the bottom of the ribs. The TE spar/jig has an embossed cut line where it is to be snapped off. OK, so you got too much CA on the TE spar/jig when you glued the ribs in place. Use a razor saw to cut along the embossed line.

Important: Use caution not to break any of the short jig tabs off of the top of the TE spar/jig.

❏ ❏ 28. Use your sanding bar to sand the bottom of the tapered leading edge even with the bottom of the ribs, following the contour of the ribs. Do not change the shape of the ribs. Also sand the trailing edge, TE spar/jig and bottom spar even with the ribs.

❏ ❏ 29. Turn the wing panel upside down and place it on your building board. Pin the TE spar/jig to the board and use weights to hold the front of the wing panel on the building board.

Retracts go to step R33.

Use the following photo for the next two steps.
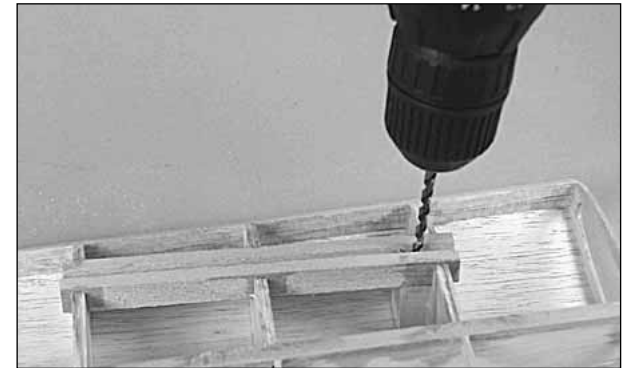
❏ ❏ F30. If you are installing fixed landing gear on your model, glue the 7/16" x 5/8" x 5-5/8" [11.1 x 15.9 x 142.9mm] basswood **grooved landing gear rail** into the notches in W2, W3 and W4 using 6-minute epoxy. The groove in the rail should face the bottom surface of the wing. Glue the 7/16" x 5/8" x 7/8" [11.1 x 15.9 x 22.2mm] maple **torque block** to the top surface of the rail against W2, as shown on the plan.

Note: Before gluing the rail in place check the fit of the rail in the notches. The rail should protrude 1/16" [1.6mm] from the bottom of the ribs so as to be level with the 1/16" [1.6mm] balsa sheeting when the wing is sheeted.

❏ ❏ F31. Mark the bottom of the groove in the landing gear rail 3/16" [4.8mm] from the edge of W2. Drill a 5/32" [4mm] hole through the landing gear rail and the torque block at the mark. As you drill, make sure you hold your drill at a 90 degree angle to the landing gear rail.

Note: The hole should go into the middle of the torque block. Be careful not to drill through the top skin.

❏ ❏ F32. Chamfer the inside edge of the hole in the landing gear rail to accommodate the bend of the landing gear wire. This will allow it to fully *seat* in the groove. Test fit the 5/32" [4mm] **landing gear wire** in the landing gear rail. Make adjustments where necessary for a good fit. Continue with step 36.

❏ ❏ R33. If you are installing retracts (retractable landing gear) on your model, cut two 3" [76mm] rails from the leftover 1/4" x 3/8" [6.4 x 9.5mm] basswood stick. Glue these rails into the notches in W3 and W4 using 6-minute epoxy.

❏ ❏ R34. Fit and temporarily install the **right retract landing gear** to the rails. You will need to trim W3

and the retract mounting rail(s) to fit the retract unit. The best tool for this is a rotary tool with a 1/2" [12.7mm] sanding drum. Do not trim W2 for the wheel. The wheel will be fitted after the sheeting is installed. Drill pilot holes for the #4 x 3/8" flat head sheet metal screws. You will note from the photo that we have marked the position of the retract unit on the rails. This will be useful later when the sheeting is trimmed to fit the retract unit.

Note: This model was specifically designed for the .40 size retracts from Great Planes (GPMQ2905). These units are strong, compact and inexpensive. They are relatively easy to fit and install.

DRILL PUSHROD HOLE
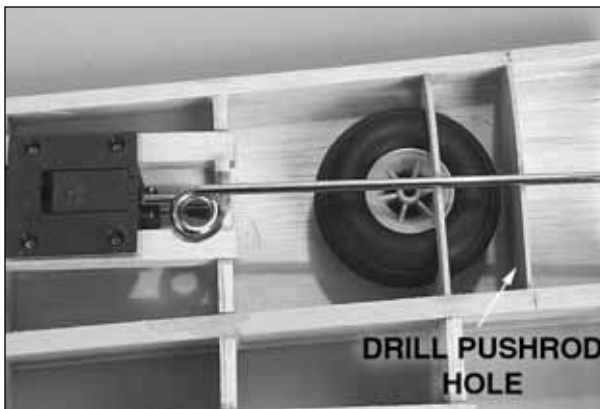
❏ ❏ R35. Glue the die-cut 1/16" [1.6mm] balsa **partial rib W1R** into position. Make sure that it is positioned so that the wheel will clear W1R by 1/16" [1.6mm] when it is retracted. Less clearance will cause the wheel to jam while more clearance will make the retract servo hard to fit. On our prototype model W1R is 1-9/16" [39.7mm] from W1. This is also a good time to drill a hole for the pushrod to the servo in W1R. Ours was 7/8" [22.2mm] (1-7/8" [47.6mm] left panel) forward of the spar web and close to the top sheeting.

Note: In the photo, W2 was trimmed slightly to put the wheel into position.
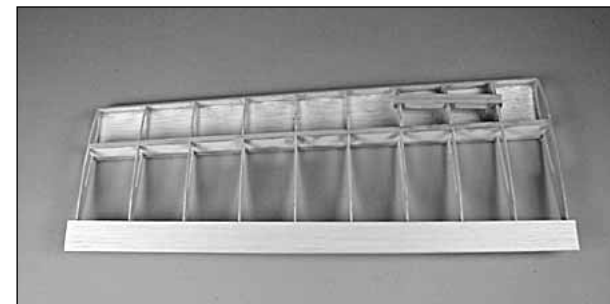
❏ ❏ 36. Glue the bottom 1/16" x 1-7/16" x 24" [1.6 x 36.5 x 610mm] balsa **trailing edge sheet** into place with medium CA.
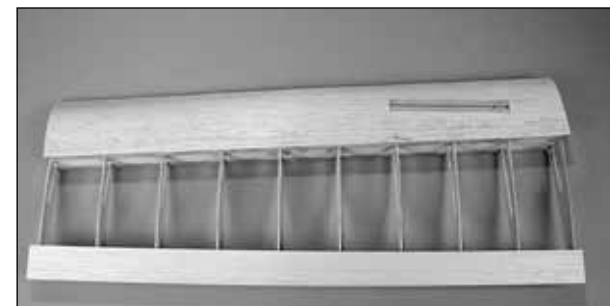
❏ ❏ 37. Using medium CA or aliphatic resin, glue one of the leading edge skins that you prepared in step 2 into place on the ribs and the bottom spar. The skin should extend forward from the center of the spar. Refer to the *HOT TIP* that follows.

Note: If you are installing retracts, do not glue the skin to the rails until later.

Note: Make sure you glue the skin in place with the smooth side facing out. Position the 1/2" [12.7mm] strip that was glued to the sheeting at the spar.

Note: If you are installing fixed landing gear, cut the *Fixed Gear Rail Template* from the wing plan and use it as a guide to cut the sheeting for the landing gear rail.

If some of the glue joints were loose when you glued the first leading edge skin on, you may want to use aliphatic resin glue for this skin. Most aliphatic resin glues can be heat activated after the glue has dried, allowing a loose skin joint to be ironed back into place.

❏ ❏ 38. Cut, fit and glue **cap strips** for the bottom of ribs W4, W5, W8, W9 and W10 from a 1/16" x 1/4" x 30" [1.6 x 6.4 x 762mm] balsa stick.
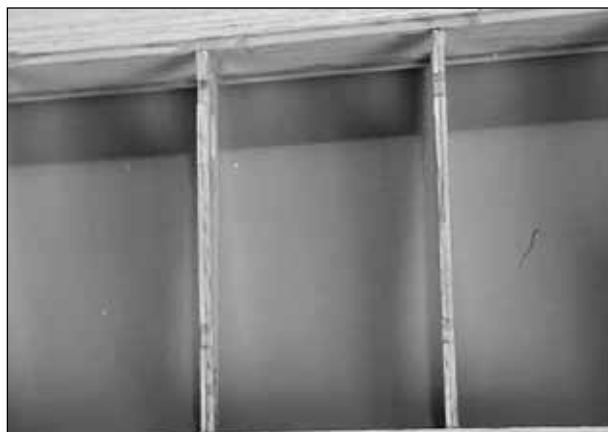
❏ ❏ 39. Glue die-cut 1/16" [1.6mm] balsa **W6D** and **W7D** into position on ribs W6 and W7. W6D is glued to the root side of W6 and W7D is glued to the tip side of W7.

❏ ❏ 40. Cut two 2-3/4" [70mm] **servo hatch mounting rails** from a leftover 1/8" x 1/4" [3.2 x 6.4mm] basswood stick. Glue them to the notches in W6 and W7 with 6-minute epoxy. Do not use the two 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] basswood spars left for the other wing panel.

❏ ❏ 41. Center the die-cut 1/16" [1.6mm] ply **aileron servo hatch** on the servo rails. Make sure the hatch is centered on W6 and W7 and that the cutout in the hatch is closest to the tip. Drill 1/16" [1.6mm] holes through the hatch and servo rails at the six punch marks. Remove the hatch and enlarge the holes *in the hatch only* with a 3/32" [2.4mm] drill. Use a countersink, or a 3/16" [4.8mm] drill, to countersink the holes in the hatch, for the #2 x 3/8" [9.5mm] flat head sheet metal screws. Mount the hatch to the rails with six #2 x 3/8" [9.5mm] screws. Remove the hatch and harden the holes with a couple of drops of thin CA. After the CA has cured mount the hatch to the rails.

❏ ❏ 42. Cut, fit and glue **cap strips** to W6D and W7D using a 1/16" x 1/4" [1.6 x 6.4mm] balsa stick. Be careful not to get any glue on the hatch. Fit and glue cap strips at the front and rear of the hatch as well.

❏ ❏ 43. Remove the aileron servo hatch. Remove the wing panel from the building board. Securely glue any of the cap strips to the ribs if any require it. Trim the sheeting even with W1 and W10.

❏ ❏ 44. Turn the wing panel over. Snap the jig tabs off of the TE spar/jig. Use your sanding bar to sand the trailing edge and TE spar even with the ribs. Be careful not to alter the shape of the ribs.

❏ ❏ 45. Using the plan as a guide, cut seven TE hinge blocks for the aileron and flap hinges from a 1/8" x 1/4" x 24" [3.2 x 6.4 x 610mm] balsa stick. Glue the hinge blocks into place with thin CA.

❏ ❏ 46. Glue the top 1/16" x 1-7/16" x 24" [1.6 x 36.5 x 610mm] balsa **trailing edge sheet** into place with medium CA or aliphatic resin glue. Trim the sheet even with W1 and W10.

❏ ❏ 47. Cut, fit and glue **cap strips** for the top of ribs W4 thru W10 from 1/16" x 1/4" x 30" [1.6 x 6.4 x 762mm] balsa sticks.

❏ 48. Cut the **left wing plan** along the dashed line and tape it to your building board. Cover the plan with Plan Protector or wax paper. Build the left wing panel starting with step 10.

That completes the construction of the wing panels. You can rough sand them now or wait until they are joined and the center sheeting is installed.

BUILD THE WING TIPS

It is easiest to build the wing tip as a separate assembly and then glue it to the wing. All of the tip ribs are slightly oversize in length to allow them to be blended and rounded at the tip. T5 and T6 are slightly tall as well.
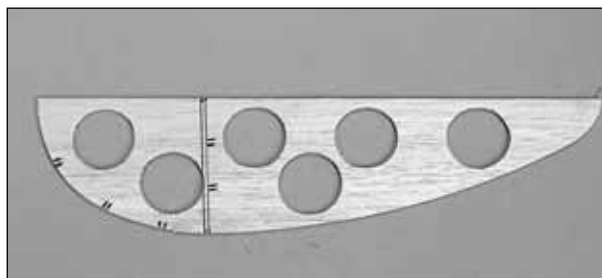
❏ ❏ 1. Locate a die-cut 1/16" [1.6mm] balsa **wing tip core** and two each of tip ribs **T1** thru **T6**. Place the tip core over the plan and mark the location of all the tip ribs.

Use the following photo for the next four steps.
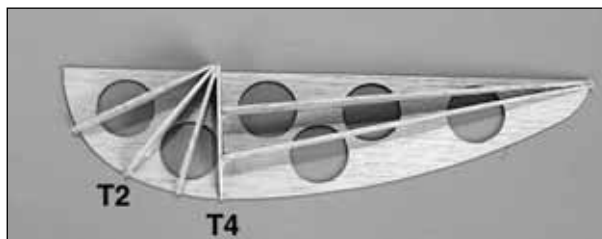
❏ ❏ 2. Use thin CA to glue the parts together. Work on one side of the tip at a time. Start by gluing T4 in position, making sure that it is perpendicular to the wing tip core.

❏ ❏ 3. Next, glue T2 in position, making sure T4 is perpendicular. Refer to the plan to see how angles are sanded onto T2 where it joins T4.

❏ ❏ 4. Glue T1 and T3 into position.

❏ ❏ 5. Glue T5 and T6 into position.

❏ ❏ 6. Turn the tip over and glue a second set of tip ribs into position.

❏ 7. Return to step 1 and build a second wing tip.

The wing tips will be glued into place during final assembly.

BUILD THE AILERONS

❏ 1. Place the right aileron plan on your building board. Cover the plan with Plan Protector or wax paper.

Note: All aileron parts are cut from 1/8" x 1/4" x 30" [3.2 x 6.4 x 762mm] balsa sticks.
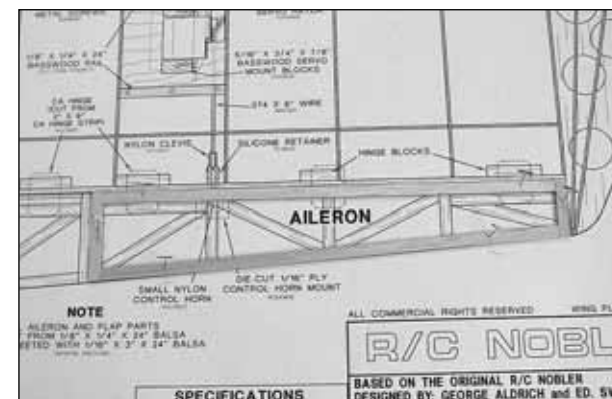
❏ ❏ 2. Cut the **aileron TE and LE** from a 1/8" x 1/4" x 30" [3.2 x 6.4 x 762mm] balsa stick and pin them in position over the plan.

❏ ❏ 3. Cut the aileron ends from the remainder of the stick and pin them in position. DO NOT glue until later.

❏ ❏ 4. Cut the **aileron ribs, diagonals and hinge blocks** from a soft 1/8" x 1/4" x 30" [3.2 x 6.4 x 762mm] balsa stick and place them into position. Glue all of the parts together with thin CA where they join each other.
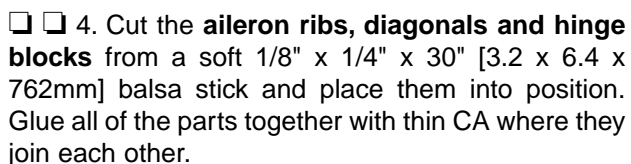
❏ ❏ 5. After the CA has cured, remove the pins from the aileron. Use a sanding block with 150-grit sandpaper to sand the aileron flat.
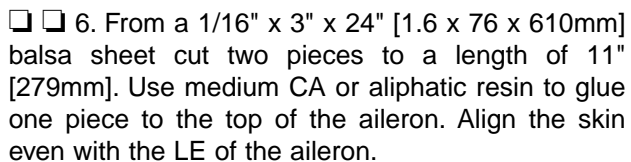
❏ ❏ 6. From a 1/16" x 3" x 24" [1.6 x 76 x 610mm] balsa sheet cut two pieces to a length of 11" [279mm]. Use medium CA or aliphatic resin to glue one piece to the top of the aileron. Align the skin even with the LE of the aileron.

❏ ❏ 7. After the glue dries, remove the aileron from the building board and trim the sheeting along the TE and both tips.

❏ ❏ 8. Turn the aileron over and use a sanding block to sand the un-sheeted side flat. Use medium CA or aliphatic resin to glue the second skin to the aileron. Align the skin even with the LE of the aileron.

❏ ❏ 9. After the glue dries, remove the aileron from the building board and trim the sheeting along the TE and both tips.

❏ ❏ 10. Locate a die-cut 1/16" [1.6mm] ply **control horn mount**. Using the plan as a reference, position the control horn mount on the aileron and mark its location. Cut along the lines you marked and remove the balsa to inset the mount. Glue the mount into the aileron.
NOTE: When you build the second aileron, be sure to make a left and right aileron. The second aileron will need to have the mount glued to the other side.

❏ 11. Build a second aileron starting at step 2 above. The ailerons are symmetrical so you can build the second one over the same plan.

BUILD THE FLAPS

❏ 1. Place the right flap plan on your building board. Cover the plan with Plan Protector or wax paper.

Note: All flap parts are cut from 1/8" x 1/4" x 30" [3.2 x 6.4 x 762mm] balsa sticks.

❏ ❏ 2. Cut the **flap TE and LE** from a 1/8" x 1/4" x 30" [3.2 x 6.4 x 762mm] balsa stick and pin them in position over the plan.
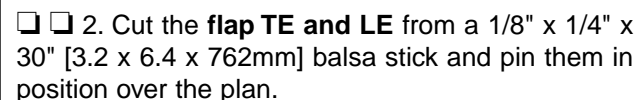
❏ ❏ 3. Cut the flap ends from the remainder of the stick and pin them in position. DO NOT glue until later.

❏ ❏ 4. Cut the **flap ribs, diagonals and hinge blocks** from a soft 1/8" x 1/4" x 30" [3.2 x 6.4 x 762mm] balsa stick and place them into position. Glue all of the parts together with thin CA where they join each other.
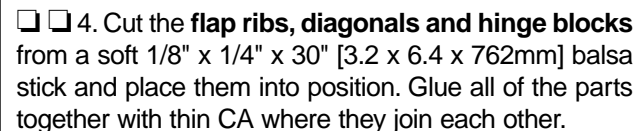
❏ ❏ 5. After the CA has cured, remove the pins from the flap. Use a sanding block with 150-grit sandpaper to sand the flap flat.
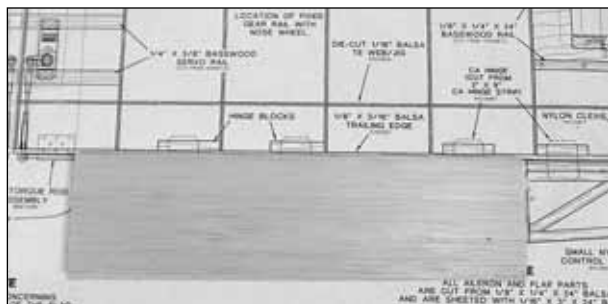
-31-

❏ ❏ 6. From a 1/16" x 3" x 24" [1.6 x 76 x 610mm] balsa sheet cut two pieces to a length of 11" [279mm]. Use medium CA or aliphatic resin to glue one piece to the top of the flap. Align the skin even with the LE of the flap.

❏ ❏ 7. After the glue dries, remove the flap from the building board and trim the sheeting along the TE and both tips.

❏ ❏ 8. Turn the flap over and use a sanding block to sand the un-sheeted side flat. Use medium CA or aliphatic resin to glue the second skin to the flap. Align the skin even with the LE of the flap.

❏ ❏ 9. After the glue dries, remove the flap from the building board and trim the sheeting along the TE and both tips.

❏ 10. Build a second flap starting at step 2 above. The flaps are symmetrical so you can build the second one over the same plan.
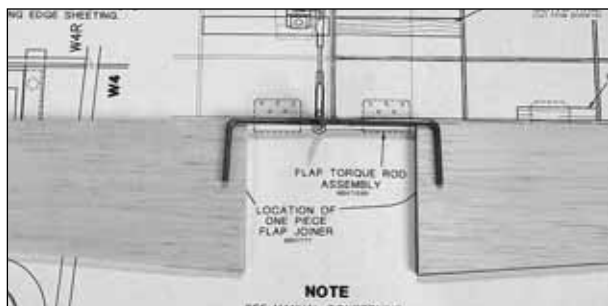
❏ 11. Use a file or a rotary tool with a cut-off wheel to remove sharp edges or burrs on the ends of the **flap joiner**. Position the flap joiner on the top of both

flaps as shown on the plan and in the photo. Mark the leading edge of the flaps where the *arm* portion of the joiner will enter each flap. The center of the hole will be about 3/8" [9.5mm] from the end.
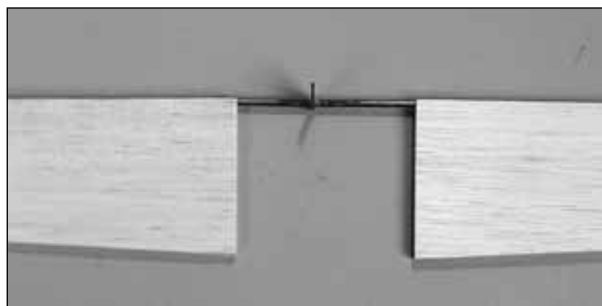
❏ 12. Drill a 1/8" [3.2mm] hole 1-1/4" deep into the leading edge of both flaps at the mark you made. Be sure to drill the hole on the centerline of the leading edge. Cut a groove in the leading edge to accommodate the flap joiner. If necessary, remove the joiner and *tweak* it so both flaps are in the same plane. **Hint:** Use a 1/8" [3.2mm] brass tube sharpened at one end to cut the groove.

HINGE THE AILERONS AND FLAPS
Hinge the ailerons and flaps in exactly the same manner as you did the elevators and rudder.

❏ 1. Use a straightedge to mark the centerline of the ailerons and flaps as well as the TE of the wing with a ballpoint pen. Mark the location of the hinge slots on the ailerons, flaps and wing TE where shown on the plan. Cut the hinge slots in the ailerons, flaps and wing TE along the center lines with a #11 blade or the Great Planes Slot Machine.

❏ 2. Cut twelve hinges to a size of 3/4" x 1" [19 x 25.4mm] from the **CA hinge strip**. Snip the corners off so they go into the slots easier.

❏ 3. Test fit the hinges into the slots. If the hinges do not slide into the slots easily, work your knife blade back and forth in the slot a few times to provide more clearance.

❏ 4. Drill a 3/32" [2.4mm] hole, 1/2" [12.7mm] deep in the center of the hinge slots. Use a rotary tool with a 3/32" [2.4mm] drill bit or a carbide cutter for the best results. Reinsert your knife blade to *clean out* the slot after you drill the holes.

❏ 5. Test fit the ailerons and flaps to the wing with the hinges. If any hinge slots are not wide enough or are misaligned, make adjustments so the ailerons and flaps accurately fit the wing.

❏ 6. Bevel the leading edges of the ailerons and flaps to a "V" as shown on the cross section of the plan. Use the centerline on the leading edges as a guide. Test fit the ailerons and flaps to the wing. **Note**: Make sure you can obtain the control throws indicated in the back of the manual. If you cannot, increase the "V" on the leading edges.

DO NOT glue the hinges until the model has been covered.

JOIN THE PANELS
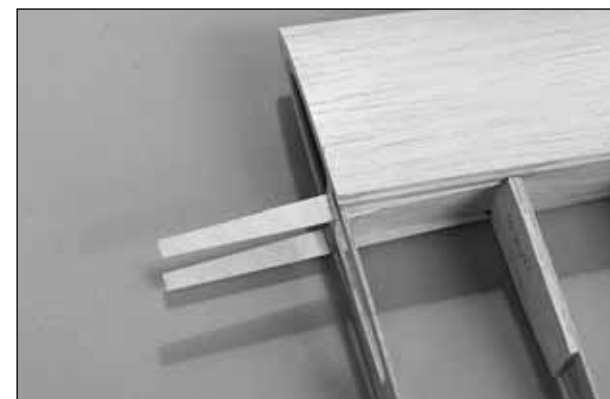
❏ 1. Locate both die-cut 1/16" [1.6mm] ply **spar joiners**. Trial fit them in the right wing panel, cleaning any excess glue that may be in the way. The joiner should go all the way to W2. The angled edge points to the front of the wing. DO NOT apply any glue.

❏ 2. Mark the joiners where they protrude from the right wing. Remove them and trial fit them in the left wing panel, making sure that they can be inserted at least as far as the marks. If they can't, find out why. If they are slightly long, trim them as needed. DO NOT apply any glue.

❏ 3. Now join the right wing panel to the left, inserting the joiners into the right panel. Place the joined wing upside down on the building board (this will give a small amount of dihedral). The wing panels should fit as in the photo above. You may need to use a long flat sanding bar to sand the side of W1 flat. Adjust each panel so they fit together properly. The photo above shows how ours fit with NO sanding.

❏ 4. When you are satisfied with the fit, get the 30-minute epoxy and mix 1/2 oz. [14g]. Liberally coat the side of both W1 ribs and the basswood spars, balsa web and ply spar joiners where they join together. Slide the joiners and wing panels into place. Use a paper towel and alcohol to clean any epoxy that seeps out. Place the assembly on your workbench upside down. Hold the assembly together with pins and masking tape.

Note: The wing joint depends on three things for its strength; the epoxy joint between the ply spar joiners and the basswood spars, the epoxy joint between the balsa web and the ply joiners and the center sheeting that will be installed in the following steps.

❏ 5. Use a sheet of 1/16" x 3" x 24" [1.6 x 76 x 610mm] balsa to cut and fit the **bottom center sheeting**. Fit the first piece to the trailing edge. Use a single strip of balsa to sheet from one W3 rib, across the center W1 ribs to the other W3 rib. Glue this piece of sheeting in place with medium CA.

❏ 6. Use the remainder of the sheet to fit a piece between the leading edge sheeting and the piece you just installed.

The top center section of the wing will be sheeted after the flap servo is installed.

MOUNT THE SERVOS IN THE WING
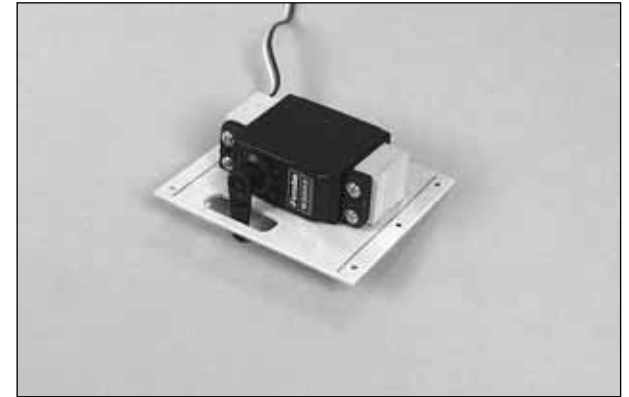
❏ ❏ 1. Mount an aileron servo to two 5/16" x 3/4" x 7/8" [7.9 x 19.1 x 22.2mm] **servo mount blocks** with the screws, grommets and eyelets included with your servo.

❏ ❏ 2. Mark the edge of the aileron servo hatch rails on the inside of the hatch. Remove the hatch from the wing and use 30-minute epoxy to glue the servo mount blocks, with the servo attached, to the servo hatch where shown on the plan. Position the servo within the lines you marked inside the hatch indicating where the rails are. The servo arm should be located in the center of the cutout in the hatch.

Note: Roughen the hatch with sandpaper where the blocks will be glued so the glue will adhere better.
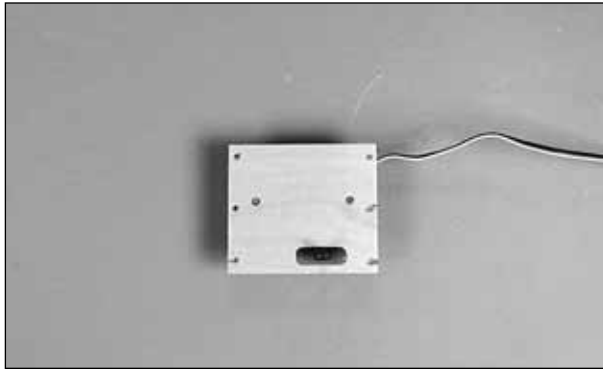
❑ ❑ 3. Drill a 1/16" [1.6mm] hole through the servo hatch into each servo mount block. Countersink the hole and install a #2 x 3/8" [9.5mm] flat head sheet metal screw.

❑ ❑ 4. Mount the aileron servo hatch back onto the wing. The wire will be connected after the flap servo is mounted.

❑ ❑ 5. Make an **aileron control rod** from a nylon clevis, clevis retainer and .074" x 6" [1.6 x 152mm] threaded on one end rod. Thread the clevis on about 15 turns.

Note: The photo above shows the control rod after the Z-bend is made in step 7.

HOLES ALIGN WITH PIVOT POINT

CONTROL HORN MOUNTING BASE
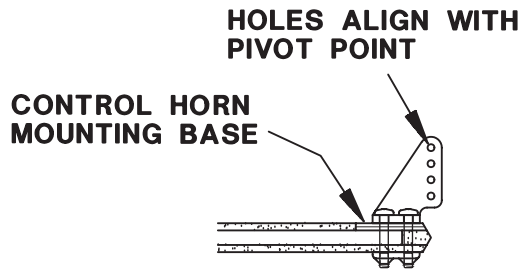
❑ ❑ 6. Mount a **small nylon control horn** to the ply control horn mount on the aileron with two 2-56 x 1/2" [12.7mm] screws and the nylon backing plate. Use a 5/64" [2mm] drill for the holes.

❑ ❑ 7. Connect the clevis on the control rod to the control horn and mount the aileron on the wing with the hinges. With the aileron centered and the servo arm at 90 degrees to the servo, make a Z-bend in the control rod where it will connect to the servo arm. Connect the control rod to the servo arm.

Note: You can also use an L-bend and one of the supplied Faslink nylon keepers.

❑ 8. Return to step one for the other aileron.

In the following steps you will mount the flap servo. It is important that the servo linkage be mounted in the exact position shown on the plan as there is very little clearance with the servos and pushrods mounted in the fuselage. Use the flap servo mounting template on the plan as a guide in positioning the servo.

The flap servo should be installed on the left side as the flap joiner pivot arm is offset to the left. If you are installing electric power you MUST use a mini-servo for the flaps as a full size servo would extend into the battery compartment in the wing belly pan.

The fuselage bottom sheeting has not yet been installed. This allows you to mount the wing and check clearance with the servo and pushrods.
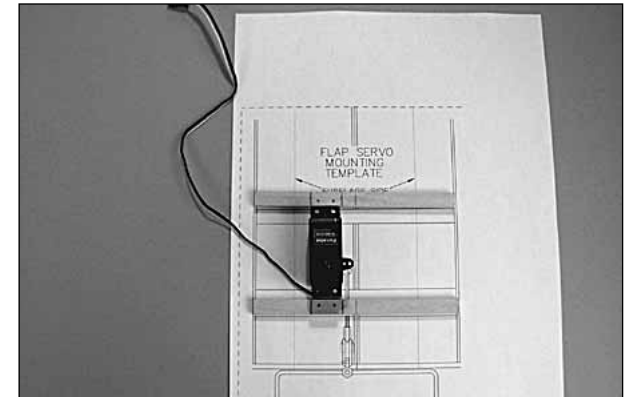
❑ 9. Cut two **servo rails** to a length of 5-1/8" [130.2mm] from the leftover 1/4" x 3/8" [6.4 x 9.5mm] basswood stick. Make a mark at the center of each rail. Make another mark on the left side of the center mark where the inside edge of your servo will be. For our full size servo, the marks are 3/8" [9.5mm] to the side of the center mark. Position your servo on each rail and mark the location of the required mounting holes. Drill 1/16" [1.6mm] holes at these points. Harden the holes with a drop of thin CA.

Note: Remember, it is important that the flap **linkages** be placed in the correct location.

❏ 10. Using the FLAP SERVO MOUNTING TEMPLATE as a guide, mark the location of the basswood rails for the flap servo on the top of rib W1 and both W2 ribs. Fit the servo rails in the wing. The rails extend from one W2 rib, across both W1 ribs, to the other W2 rib. It will be necessary to notch the W1 ribs for the rails. The bottom sheeting must also be cut to fit the servo as it will extend below the sheeting. The top of the servo arm should be 3/8" [9.5mm] above the top sheeting. Use the side view of the fuselage as a guide in positioning the rails.

❏ 11. Make a **flap control rod** from a nylon clevis, clevis retainer and .074" x 6" [1.6 x 152mm] wire threaded on one end. Install your flap servo on the left side of the wing with the screws, grommets and eyelets supplied with the servo. Install the flap joiner in the flaps and fit the flaps to the wing. Connect the joiner to the control rod you just made. With the flaps

centered and the servo arm at 90 degrees to the servo, make a Z-bend in the control rod where it will connect to the servo arm. Connect the control rod to the servo arm. Note that the control rod is installed into the top of the servo arm.

❏ 12. Position the wing on the fuselage and check the clearance of the flap servo and linkage with the other servos and linkages in the fuselage. There should be adequate clearance with no conflicts between any of the servos and their linkages. Make any adjustments needed now while you can still see the servos and linkages. You may need to shorten the flap joiner arm.
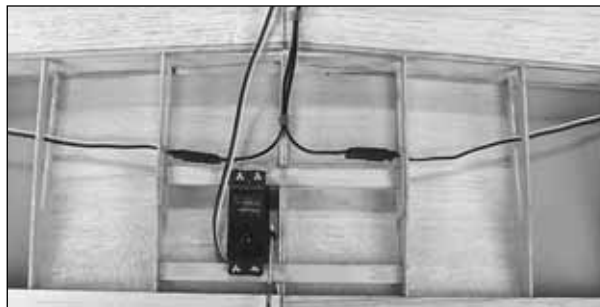
❏ 13. Install 12" [305mm] servo wire extensions on each aileron servo. Secure the connection with tape or heat shrink tubing. Route the servo wires for each servo through the wing ribs and out the flap servo area.
 Note: For a neater installation, use short lengths of fuel tubing to tie-wrap the servo wires together.
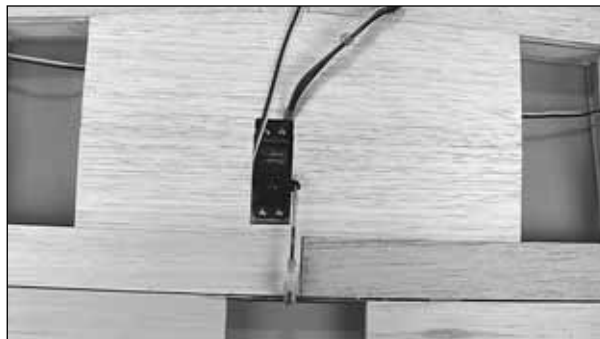
❏ 14. Sand any epoxy that seeped from the joint between the panels on the top of the wing. Remove

the flap linkage. Sheet the top center section using a piece of 1/16" x 3" x 24" [1.6 x 76 x 610mm] balsa in the same manner that you sheeted the bottom center section, going from one W3 rib across the center W1 ribs to the other W3 rib. Cut the opening for the flap servo close to the servo. Otherwise, the opening will extend beyond the fuselage side.

FINAL CONSTRUCTION

MOUNT THE WING TO THE FUSELAGE

The following steps will be easier to do if you remove the ailerons and flaps.
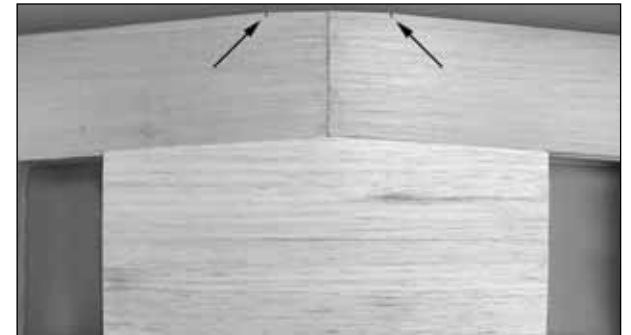
❏ 1. Measure the width of the fuselage at the leading edge of the wing. It should be close to 3-1/8" [79.4mm]. Mark the LE and TE of the wing on both sides of the centerline exactly 1/2 this amount (1-9/16" [39.7mm]). Do this on the top and bottom of the wing.
 Note: The photos in this section do not show the flap servo.

❏ 2. Trial fit the wing to the fuselage, centering it between the marks you just made. The wing should be slightly shorter than the opening in the fuselage. When the flaps are hinged to the wing, the flap joiner rod will be located on the TE of the wing. Slide the wing forward in the opening and see if there is room for the flap joiner. You may need to sand the leading edge of the wing flat, as shown on the plan, to get the proper spacing.

Note: In the following steps you will build the belly pan for the wing. Once you tack glue the parts into position you will remove the wing from the fuselage. If you are not known for your neat gluing technique, you may want to put some plan protector or wax paper between the wing and fuselage to prevent them from being glued together.
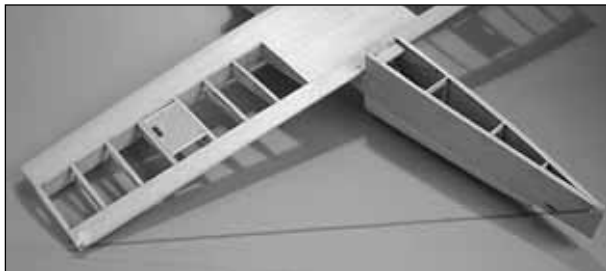
❏ 3. With the wing properly positioned, pin the leading edge of the wing to the fuselage placing the pins so they will clear the fuselage sides. Use a tape measure or string to check that the wing is aligned properly. To use a string, insert a pin in the aft end of the fuselage on the centerline. Tie a small loop at one end of a 36" [914mm] length of string and slip it over the pin. Fold a piece of masking tape over the other end of the string and draw an arrow on it. Slide the tape along the string and align the arrow with one of the wing tips. Now, swing the string over to the other wing tip. If the arrow does not align with the tip, adjust the wing and try again. When the wing is centered and square with the fuselage, pin the trailing edge into place so that it cannot shift.

❏ 4. Pin die-cut 1/8" [3.2mm] ply former **F2BP** to F2 with a 1/32" [0.8mm] spacer between them. A piece

of 1/32" [0.8mm] ply or some cardboard from a cereal box can be used. You may need to trim F2BP where it fits to the wing.

❏ 5. In the same manner, Pin **F3BP** to F3.

❏ 6. Fit the left and right belly pan sides that you made earlier into place. Make any adjustments needed for a good fit. Make sure the belly pan sides are centered in the wing saddle opening. Tack glue both belly pan sides to the wing with medium CA.

❏ 7. Carefully glue the belly pan sides to F2BP and F3BP.
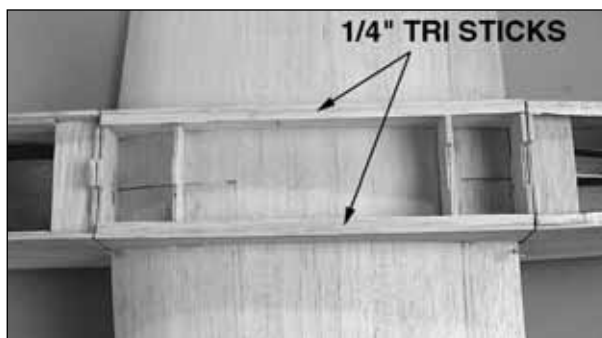
❏ 8. Fit and glue die-cut 1/8" [3.2mm] ply former **F2BPD** in place 1-5/8" [41.3mm] aft of F2BP. Fit and glue **F3BPD** in place 1-5/8" [41.3mm] forward of F3BP. The bottom of both formers should be even with the bottom of the belly pan sides.
Note: The photos do not show the flap servo that has already been installed. If you installed the servo correctly, F3BPD should be just aft of the servo.

❏ 9. From leftover 1/4" [6.4mm] balsa triangular sticks, cut and glue filler strips on the bottom of the belly pan sides.

❏ 10. Remove the wing from the fuselage. Securely glue all of the belly pan parts to the wing. Sand the bottom and both ends of the belly pan flat and smooth.

❏ 11. Locate the six die-cut 1/8" [3.2mm] ply 1" x 3" [25.4 x 76mm] **wing hold down blocks**. Using 6-minute epoxy, glue them together to form three 1/4" [6.4mm] thick hold down blocks.

Note: The pin point punch marks should face out on both sides.
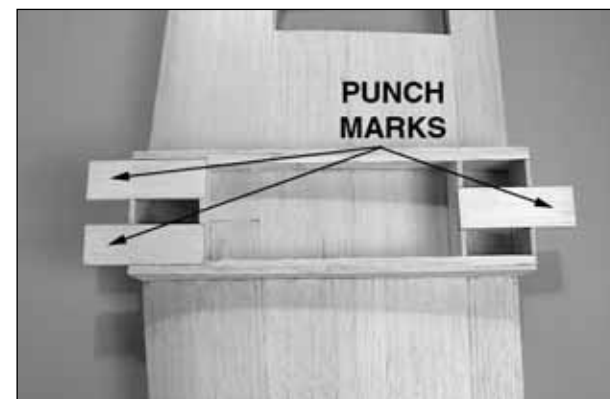
❏ 12. Using 6-minute epoxy, glue the three wing hold down blocks into place on the belly pan. The ends of the wing hold down blocks should be even with F2BPD and F3BPD and the other ends should extend 1-1/8" [28.6mm] beyond F2BP and F3BP. You will need to trim the 1/4" [6.4mm] tri balsa between F2BP and F2BPD.

Note: Position the pin point punch marks as shown in the photo.
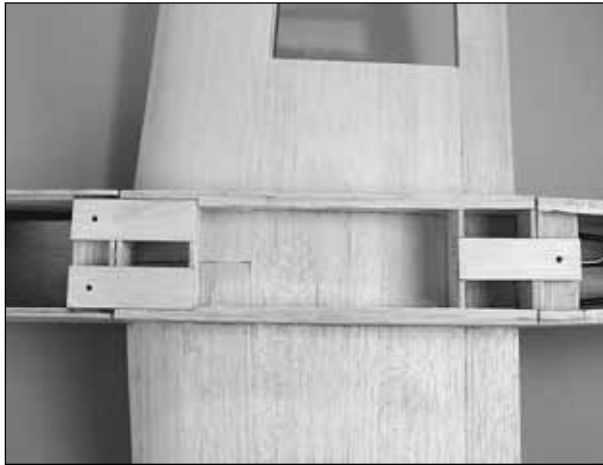
❏ 13. Reposition the wing on the fuselage making sure it fits properly and that the belly pan sides are even with the fuselage sides. Drill a tap hole for the 1/4-20 nylon bolts in the three wing hold down blocks. Drill the holes at the pin point punch marks. The holes go through the wing hold down blocks and also through the fuse hold down blocks under them.

❏ 14. Remove the wing from the fuselage. Drill the holes in the *wing hold down blocks* ONLY with a 1/4" [6.4mm] drill bit. Harden and fuel proof the area with some thin CA.

❏ 15. Tap the holes in the fuse hold down blocks with a 1/4-20 tap. Harden the tapped holes with a few drops of thin CA. When the CA cures tap the holes again.

❏ 16. Cut the three 1/4 -20 x 2" [51mm] nylon bolts to a length of 7/8" [22.2mm]. This is necessary to clear the fuel tank.

❏ 17. From a leftover 1/8" x 1/4" [3.2 x 6.4mm] basswood stick cut three pieces 1" [25.4mm] long. Glue these pieces to the ends of the wing hold down blocks as shown in the photo.
Note: When the wing is mounted there is a 1/8" [3.2mm] gap between the wing hold down block and the fuse hold down block. This allows the 1/4-20 wing bolts to flex a bit should you catch a wing tip on landing. The 1" [25.4mm] sticks stop the wing hold down blocks from being deformed when the wing bolts are tightened.

❏ 18. Install the control linkage on the flap servo. Plug the flap and elevator servos into the receiver, turn the transmitter on and temporarily plug a battery into the receiver. Mount the wing to the fuselage and check the clearance of the flap servo and linkage with the other servos and linkages in the fuselage. Operate the flap servo throughout the full range of motion. If there are any conflicts you may need to shorten the flap joiner arm slightly. Remove the wing from the fuselage and unplug the battery and flap servo. Turn the transmitter off.

If you are installing an electric motor on the model for power, you will want to build a battery access hatch in the belly pan. If you are installing a glow engine then just skip the steps for the hatch and glue the bottom sheeting into place.
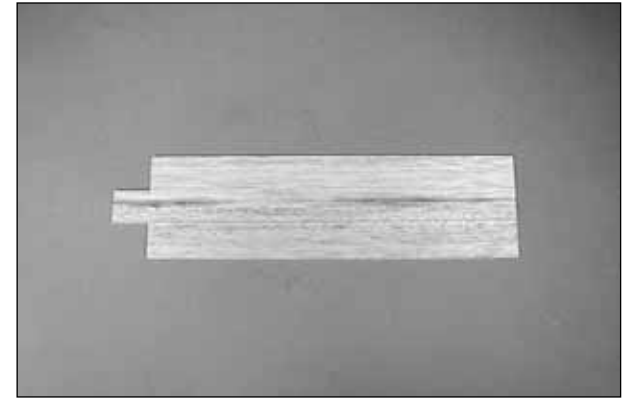
❏ 19. Locate the two die-cut 3/32" [2.4mm] balsa **belly pan sheeting** parts. Use your bar sander to sand the edges flat and straight where the parts join. Edge glue both parts together using either thin CA or aliphatic resin. Align the parts even at the front edges. Use your bar sander with 150-grit sandpaper to sand the assembled belly pan sheeting flat and smooth.

❏ 20. Glue the belly pan sheeting to the bottom of the belly pan with medium CA. Drill 1/4" [6.4mm] holes through the sheeting for the wing bolts.

MOUNT THE STAB AND FIN

❏ 1. Mount the wing to the fuselage with the wing bolts. Make any adjustments to be sure the wing seats properly in the wing saddle.
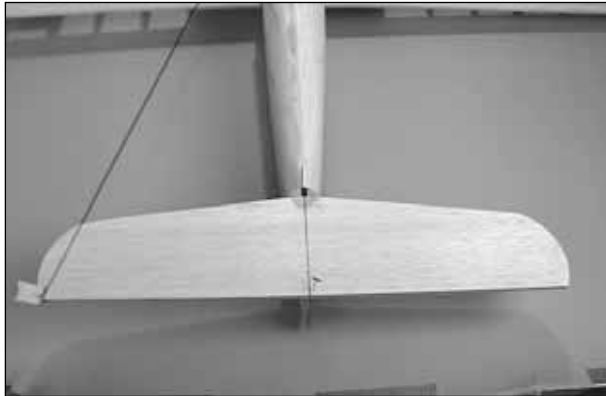
❏ 2. Measure the TE of the stab to find the exact center. Draw a line to the LE from this mark, perpendicular to the TE of the stab. Position the stab on the stab mount on the fuselage and align it with the centerline of the fuselage. Pin the rear of the stab to the fuselage. Use the pin and string technique to make sure the stab is properly aligned. View the stab/fuselage from the rear to make sure the stab is aligned parallel with the wing. If it is not, use a bar sander to carefully sand the stab mount so that the stab is parallel to the wing. Mark the stab where it meets the fuselage sides.

❏ 3. Use 6-minute epoxy to glue the stab to the fuselage. Use the pin and string to double check the alignment. View the stab/fuselage from the rear and check the alignment with the wing.
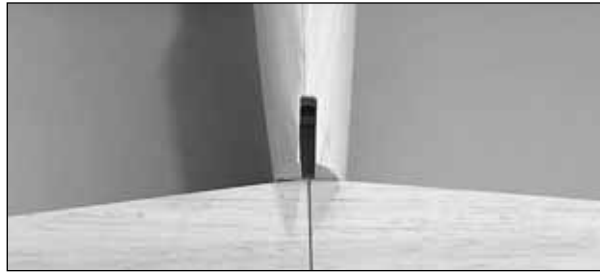
❏ 4. Cut a 1/4" [6.4mm] wide notch in the top of the fuselage for the leading edge of the vertical fin. Fit the fin to the fuselage and check its alignment. It should be perpendicular to the stab and aligned with the centerline of the fuselage and stab.
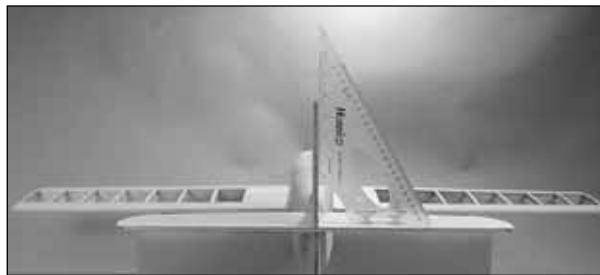
❏ 5. Use 6-minute epoxy to glue the fin to the fuselage. Double check that it is perpendicular to the stab. Sight from the front and rear of the model and make sure the fin is aligned along the centerline of the fuselage.

❏ 6. Cut the 3/4" x 9" [19.1 x 229mm] balsa triangular stick into two 4-1/2" [114.3mm] pieces. Cut and sand these pieces to fit them as filler blocks between the fin and stab. Glue them in position with medium CA.

❏ 7. Locate the two die-cut 3/32" [2.4mm] balsa **fuselage bottom sheeting** parts. Use your bar sander to sand the edges flat and straight where the parts join. Edge glue both parts together using either thin CA or aliphatic resin. Align the parts even at the front edges. After the glue dries, use your bar sander with 150-grit sandpaper to sand the assembled sheeting flat and smooth.

❏ 8. Glue the fuselage bottom sheeting to the bottom of the fuselage with medium CA.

❏ 9. Remove the wing from the fuselage. Use leftover balsa to fill the area around the bottom sheeting and the rear fuselage hold down block.

❏ 10. Glue the wing tips to each end of the wing. They should be centered on the LE and TE. Glue a piece of leftover 1/16" balsa on the TE of the tip as shown on the plan.

MOUNT THE FUEL TANK

❏ 1. Assemble your tank using the instructions that came with the tank. If your tank has a 90 degree fitting, use it pointing to the left side of the tank.

❏ 2. Insert the tank into the tank compartment and confirm that the tank will fit properly. When the tank is installed later you will use some 1/4" [6.4mm] foam rubber on the sides and bottom of the tank to pad it and hold it in place. Most 10 ounce tanks will fit, but if yours is a bit too long it is ok to trim former F2 and the wing leading edge as needed.

❏ 3. Remove the tank. Cut two **hatch mount rails** to a length of 2-5/8" [66.7mm] from leftover 1/4" x 3/8" [6.4 x 9.5mm] basswood. Fit these rails to the front of the fuse hold down block as shown in the photo and on the plan. Glue the rails into place with 6-minute epoxy.
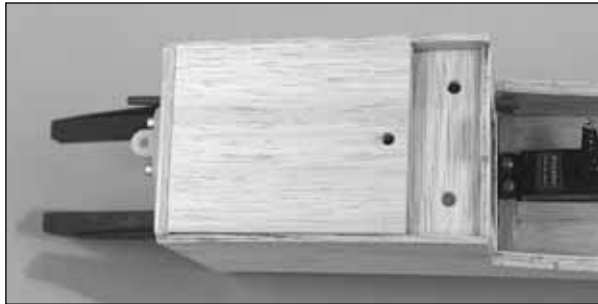
❏ 4. Fit the 1/4" x 2-7/8" x 3-5/8" [6.4 x 73 x 92.1mm] **balsa hatch** to the tank compartment opening. You will need to angle the front end to fit the right thrust of the firewall. Hold the hatch in position and drill a tap hole for a 10-32 tap through the hatch and the 1/4" x 3/8" [6.4 x 9.5mm] basswood rails under it. Enlarge the hole *in the hatch only* with a 3/16" [4.8mm] drill and harden the hole with some thin CA. Tap the hole in the basswood rails with a 10-32 tap. Harden the hole with some thin CA and tap the hole again when the CA has cured.

❏ 5. Cut one of the 1/8" x 1-1/4" [6.4 x 32mm] **dowels** in half. Round one end of each dowel. Insert the rounded end of each dowel in the 1/8" holes in the firewall (F1). Clean and enlarge the holes as needed for the dowels to have a loose fit.
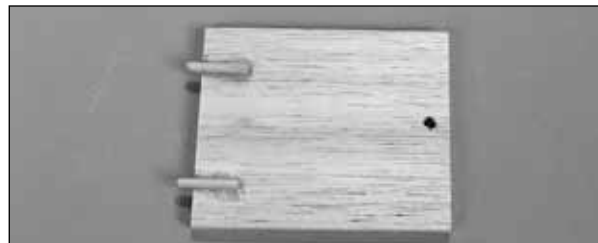
❏ 6. Put a drop of medium CA on the non-rounded end of each dowel where it will contact the hatch. Do not get any glue on the dowels where they insert into the firewall. Place the hatch into position and hold it until the CA cures. Remove the hatch with the 1/8" [3.2mm] dowels attached. Reinforce the glue joint as needed to be secure.

❏ 7. Cut a 10-32 x 2" [51mm] nylon bolt to a length of 1/2" [13mm].

ROUGH SAND THE MODEL

Time to get the long sanding block with 80-grit sandpaper and start sanding, but there is good news. This model was designed for a minimum of sanding. About all that is needed is to round the leading edge of the wing, round the corners on the bottom of the fuselage and round the edges of the tail feathers. Use the cross sections on the plans as a reference. You may find it easier to use a small razor plane to knock off the corners first.

After you have finished the rough sanding, put some 150-grit sandpaper on the sanding block and smooth the model as needed.

INSTALL THE LANDING GEAR

If you are installing retractable landing gear go to step R7.

Use this photo for the next three steps.

❏ ❏ F1. Install the main landing gear wires in the wing. The wires have a 90 degree bend on each end. One end is 1-1/2" [38mm] long and the other end is 1-3/8" [35mm] long. The shorter 1-3/8" [35mm] end is inserted into the wing.

❏ ❏ F2. Install two nylon **landing gear straps** on each wire. Use four #2 x 3/8" [9.5mm] sheet metal screws to hold the straps in place. Note that the straps are angled so that the screws will fit on the rails properly. Harden the holes for the screws with some thin CA.

❏ ❏ F3. Install your wheels on the main landing gear wires using two 5/32" [4mm] wheel collars and 6-32 x 1/8" [3.2mm] set screws for each wheel. Tighten the set screws to mark their location on the wires. Then, remove the wheel collars and wheels. Grind flat spots on the wires at the marks. Reinstall the wheels and collars. Use thread locking compound to secure the set screws.

Use this photo for the next three steps.
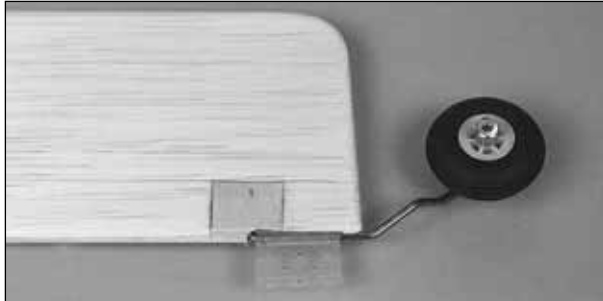
❏ F4. Install the tail wheel on the 3/32" [2.4mm] tail gear wire with two 3/32" [2.4mm] wheel collars and 4-40 x 1/8" [3.2mm] set screws. Grind flat spots on the wire and use thread locking compound on the set screws.

❏ F5. Place the rudder over the plan and mark the location of the tail wheel wire. Note that it is inserted in the rudder along the centerline of the 1/16" [1.6mm] ply control horn mount that was inset in the left side of the rudder. When the control horn is mounted the screws will go on either side of the wire. Drill a 3/32" [2.4mm] hole in the rudder for the wire at the location you marked.

❏ F6. Cut a groove in the LE of the rudder for the tail gear wire and the nylon hinge. Cut a slot in the rear of the fuselage for the nylon bearing on the tail gear wire. Trial fit the rudder to the vertical fin and fuselage with the tail gear wire installed in the rudder. Do not glue. Continue with 'MOUNT THE ENGINE'.

Use this photo for the next four steps.
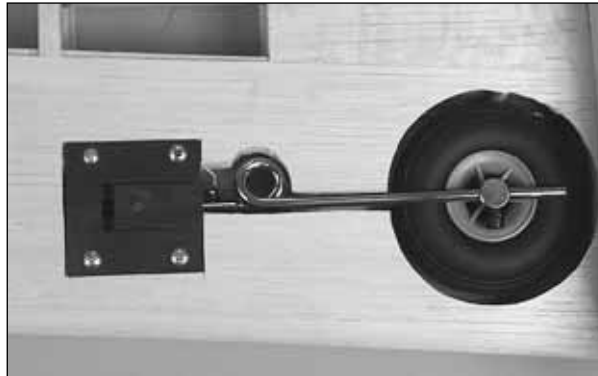
❏ ❏ R7. Using the 'Retract Rail Template' as a guide, mark the location of the retract landing gear on the LE sheeting of the wing. Cut an opening for the body of the retract gear 1/4" [6.4mm] inside the marks. Look for the marks you made on the retract rails when you mounted the retract units earlier. If you cannot see them, cut another 1/16" [1.6mm] from the opening. Continue until you can see the marks. Then, trim the sheeting even with the marks. Glue the sheeting to the ribs.

Note: If you proceed slowly in the above step and the steps that follow, you will have neat fitting openings for your retracts.

❏ ❏ R8. Install the retract unit in the wing with #4 x 1/2" [12.7mm] flat head sheet metal screws (not included with the model or retract units). Do not install the wheel until called for.

❏ ❏ R9. Lower the landing gear wire a little at a time, marking and cutting the sheeting to fit the wire.

❏ ❏ R10. Install the wheel on the axle included with the retract units according to the directions for the retract units. It is recommended that you use the 5/32" wheel collars included in the kit, not the spring clips included with the retract unit. Place the axle on the gear wire and position the wheel in the proper location. The wheel should clear the belly pan by 1/8". Mark the gear wire for the proper length. Mark the sheeting for the wheel.

Note: The photo at step R7 shows the wire before it has been cut.

❏ ❏ R11. Cut the gear wire to length at the mark. Carefully cut the sheeting 1/16" [1.6mm] inside the marks. Continue trimming the opening to fit the wheel. Harden the edges of the opening with some thin CA. **Note**: The final opening should be at least 1/16" [1.6mm] oversize.

❏ ❏ R12. With the wheel in the proper location and the wheel at the correct angle to fit inside the wing, tighten the mounting screw. Remove the wheel and axle and grind a flat spot at the mark made by the screw. Reinstall the axle on the gear wire and tighten it securely using thread locking compound on the screw.

❏ R13. Install the retract servo in the wing referring to the plan for the proper location. Cut an

opening in the top sheeting for the servo being careful not to go beyond where the fuselage side will be. Mount the servo, using the screws, grommets and eyelets supplied with the servo, to basswood blocks (not included) that are glued to the bottom sheeting. Install screw lock connectors on the servo arm. Fit, adjust and install pushrods to the retract units.

❏ R14. Go back to page 41 step F4 and install the tail wheel.

MOUNT THE ENGINE
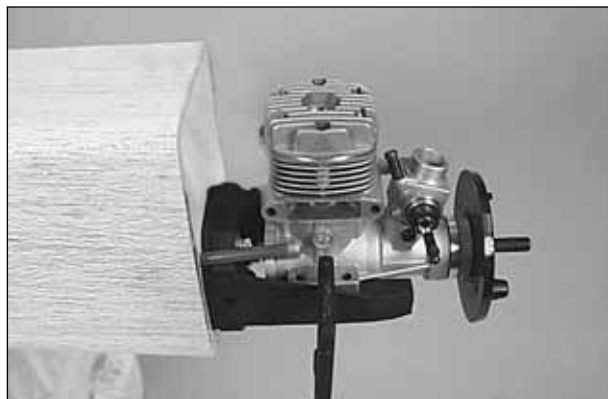
❏ 1. Install the engine mount on the firewall, if it is not already in place. Position your engine on the engine mount with the spinner backplate in position firmly against the engine drive washer. The rear of the spinner backplate should be 4" [102mm] from the firewall. Clamp the engine in position and mark the locations of the mounting bolts.

Hint: The Great Planes Dead Center™ tool makes marking the mounting holes fast, easy and accurate.

❏ 2. Drill tap holes in the mount for the included 6-32 mounting bolts. Tap the holes with a 6-32 tap. Mount the engine to the mount with four 6-32 x 1" socket head cap screws, #6 lock washers and #6 flat washers.

INSTALL THE ENGINE COWL
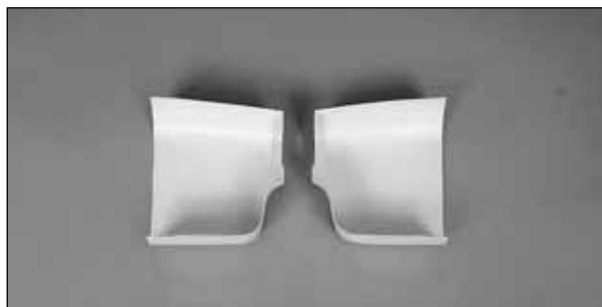
❏ 1. Cut the molded right and left ABS **cowl halves** along the cutlines. Hobbico (HCAR0667) or Kyosho® (KYOR1010) curved plastic cutting scissors work well for this. True any jagged edges with a bar sander and 80-grit sandpaper.

❏ 2. **Thoroughly** sand the inside and the outside of the joining edges of both cowl halves with 150 to 240-grit sandpaper. Basically, you should sand everywhere you want glue and filler to adhere, including a 1" [25.4mm] wide strip along the inside joining edges of both cowl halves.
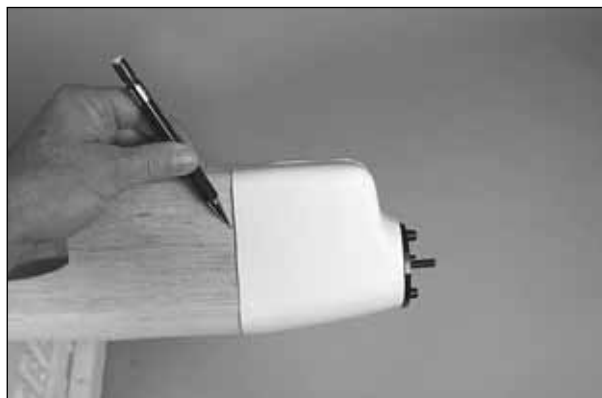
❏ 3. Join the cowl halves and hold them together with masking tape. Trial fit the cowl on the front of the fuselage. Put your spinner backplate on your engine. Align the front of the cowl with the spinner backplate. The cowl should fit the front of the fuselage without being loose. If it is loose, remove the cowl and trim the edges where the left and right sides join together.

Trial fit the cowl in place again and continue trimming until it fits properly. Use a pencil to lightly mark the location of the rear of the cowl on the fuselage. Remove the cowl and note the amount of overlap on the fuselage, it should be at least 1/4" [6.4mm].

❏ 4. Glue the cowl halves together with thin CA or epoxy and the included 1" [25.4mm] wide fiberglass tape. Glue the tape along the joining seams on the inside of the cowl. Thoroughly sand these areas first for a good bond. If you use thin CA, make sure you do this in a **well ventilated area** and avoid inhaling the fumes. Avoid using accelerator as it may soften the plastic.
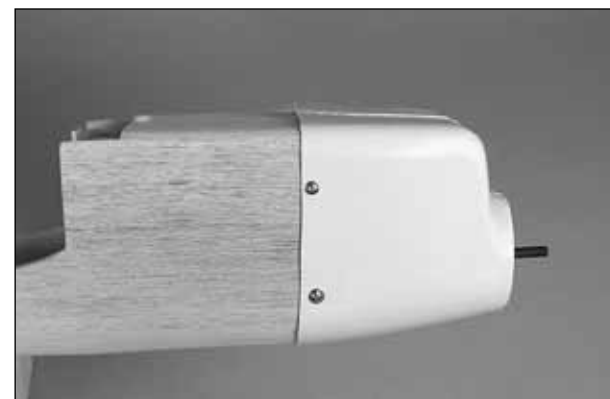
❏ 5. Using the amount of overlap as a guide, mark four locations on the cowl sides for the cowl mounting holes. Place the holes so that the screws will go into the center of the 1/4" [6.4mm] firewall. Drill 1/16" [1.6mm] holes in the cowl at the hole locations. Position the cowl on the fuselage and mark the location of the four holes on the fuselage. Remove the cowl and insure that the holes will go into the center of the firewall. Adjust the holes in the cowl as needed.

❏ 6. Drill 1/16" [1.6mm] holes in the side of the fuselage at the marked locations. Enlarge the holes in the cowl with a 7/64" [2.8mm] drill. Mount the cowl to the fuselage using four #4 x 3/8" [9.5mm] sheet metal screws and #4 washers. Remove the cowl and harden the holes in the fuselage with a few drops of thin CA.

❏ 7. Use epoxy or thin CA to glue a 1" [25.4mm] wide strip of glass cloth over the screw holes inside the cowl. Thoroughly sand these areas first for a good bond. If you use thin CA, make sure you do this in a **well ventilated area** and avoid inhaling the fumes. Avoid using accelerator.

❏ 8. Mount the cowl to the fuselage and check the fit. Make any needed adjustments and then remove the cowl.

❏ 9. Install the fuel filler valve on the firewall, if you are using one, using the included die-cut 1/8" [3.2mm] ply parts. We used a Great Planes Fuel Filler Valve (GPMG4160).
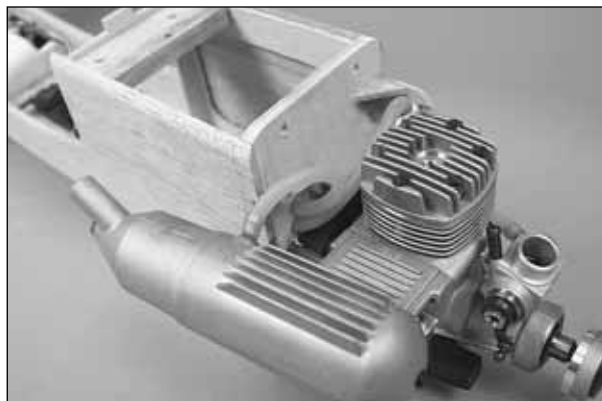
❏ 10. Drill two 7/32" [5.6mm] holes in the firewall for the fuel lines. Install the fuel tank in the fuselage and connect the fuel lines to the engine and muffler. If you have installed a fueling valve route the tank pickup line to the fueling valve. You may need to route the fuel line to the carburetor across the top of the engine mount to prevent the line from being kinked.
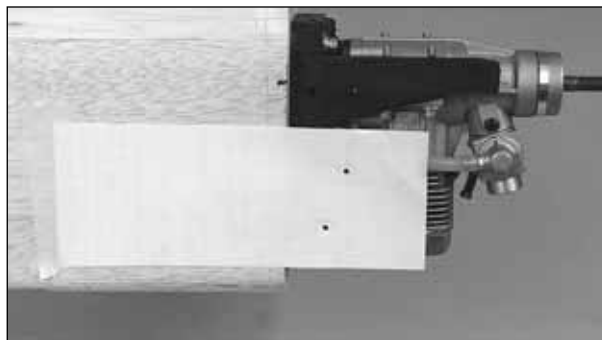
❏ 11. Tape a strip of paper to the fuselage side. Mark the location of the needle valve and fuel filler valve (if installed). Slip the cowl into position behind the paper. Transfer the marked locations to the cowl. Drill the appropriate sized holes in the cowl at the marked locations.

❏ 12. Using the same technique, mark the locations for the muffler, muffler mounting screws and the glow plug. Drill/cut the appropriate sized holes in the cowl. Note: You may be able to reach one of the muffler screws through the needle valve hole, depending on which engine you are using.

❏ 13. Cut a cooling hole in the front of the cowl for the engine. Cut an exhaust hole in the bottom of the cowl for hot air to exit the cowl. The exhaust hole should be at least twice the size of the cooling hole.

Note: A rotary tool with a sanding drum works well for this.

❏ 14. Fill the seams in the cowl with Bondo or other suitable filler. Use an expired credit card or a piece of plastic as a spatula to apply the filler. Bend your spatula as you apply the filler to build up a slight mound over the seams.

❏ 15. After the filler has fully cured, wet-sand with progressively finer grits of sandpaper. When you're done, your cowl should look something like the one in the photo - just enough filler left to fill in the low spots near the seams.

BALANCE THE AIRPLANE LATERALLY

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

Now that the basic airframe is complete, it's time to balance the airplane laterally (side-to-side).

❏ 1. Mount the wing to the fuselage. Make sure the engine and muffler are installed.

❏ 2. With the wing level, **carefully** lift the model by the nose and the aft end of the fuselage under the stab (this may require two people). Do this several times.

❏ 3. If one wing always drops when you lift the model, that side is heavy. Balance the airplane by gluing weight inside the other wing tip with epoxy. **An airplane that has been laterally balanced will track better in loops and other maneuvers**.

PREPARE THE MODEL FOR COVERING

❏ 1. At this stage, there shouldn't be much left to do. We've installed the radio system along the way, all the hinge slots are cut and the control surfaces are all temporarily installed, the engine is mounted and the retracts (if you are installing them) have been fitted. If there are any areas left that you haven't fuelproofed, now is the time to do it. We recommend taking off the engine, landing gear and any other systems that may get in the way of painting or fuel proofing. Make sure you fuelproof the inside of the wheel wells (if you installed retracts), the fuel tank compartment, the wing saddle and the front of the wing, etc. For fuelproofing, you can use any kind of fuelproof model airplane paint but, of course, we prefer Top Flite LustreKote®. See the Hot Tip that follows on how to use LustreKote to fuelproof these important areas. You can also use epoxy thinned with rubbing alcohol for fuelproofing.
Note: You should always fuelproof the model **before** you cover it.

If you plan to cover your model with Top Flite MonoKote film and you will be using Top Flite LustreKote spray paint for parts that require painting and/or fuelproofing, you may find it easier to apply LustreKote® to some of those areas with a paint brush instead of spraying it from the can. To apply LustreKote with a brush, hold a tube (such as a drinking straw) to the spray nozzle, with the other end of the tube emptying into a container. Depress the spray nozzle until you have enough paint in your container to do the job. Spraying LustreKote into a tube will keep most of it from becoming airborne. Allow the paint to stabilize for about ten minutes before you brush it on. This is a handy method for painting visible areas on the outside of the model that require fuelproofing and must match your MonoKote finish (such as the wheel wells).

❏ 2. Inspect all surfaces for uneven glue joints and seams that require filler. Apply lightweight balsa filler (HCAR3401) where needed. Many small dents or scratches in balsa can be repaired by applying a few drops of water or moistening the area with a wet tissue. This will swell the wood so you can sand it when it dries.

❏ 3. Final sand your entire model with progressively finer grits of sandpaper, finishing with 320 or 400-grit sandpaper.

❏ 4. Use a large brush, compressed air or a Top Flite Tack Cloth to remove dust from the model.

FINISHING

COVERING WITH MONOKOTE

It is assumed that you are an intermediate to advanced modeler, so we won't go into many details on covering techniques, but here are some tips you should consider:

❏ 1. Most importantly, **NEVER CUT THE COVERING DIRECTLY ON THE SHEETING.** The R/C Nobler depends upon the wood sheeting for some of its strength. Modelers who cut through the covering tend to cut into the sheeting and this will weaken the structure.

❏ 2. Use a Top Flite Hot Sock™ for your Top Flite covering iron or a Cover Sock if you are using a 21st Century® iron to minimize dents in the wood from your covering iron. You'll probably go through two socks by the time you finish covering your R/C Nobler. The 21st Century iron is highly recommended for this model due to the curved lines and fillets in the fin area.

❑ 3. Some modelers have three irons going at once: one on high heat without a Hot Sock for stretching the covering around curves like wingtips; one on medium heat with a Hot Sock for bonding the covering to large sheeted areas like the wing and stab; and a Trim Iron for small areas.

❑ 4. When you cover large sheeted surfaces such as the wing, bond the covering in the middle and work outward, pushing out air as you proceed. Do not move the iron in a circular motion, but move it span-wise with the grain of the wood.

❑ 5. When you cover smaller parts with square edges such as the elevators and ailerons, cover the ends first with separate pieces of covering. Then, all you have to do is wrap the covering around the top and bottom and iron it down.

COVERING SEQUENCE

Fuselage

1. Stab bottoms, then stab tops
2. Fin
3. Aft fuse bottom
4. Forward fuse bottom
5. One fuse side, then the other (with the two halves joining in the middle of the top)
6. Bottom, then top of elevators
7. Rudder

About the wing tips

Before covering the wing you need to consider the wing tips. The wing tips are designed for lightness and are tricky to cover. As you cover the tips, especially the forward part of the tips, have your iron set to a high heat. This will allow you to pull and stretch the covering as you proceed. As you stretch the covering, make sure you allow it to cool for few seconds while still holding it before you move to another section. When covering the rear section of the tip, bend the balsa slightly while you iron the covering on so that when you let the balsa go it will pull the covering tighter.

IRON BOTTOM COVERING
ONTO TOP OF TIP CORE

This is important. After the bottom of the tip is covered, cut the covering with a 1/4" [6.4mm] overlap. Iron the overlap to the top of the tip core. This will prevent the bottom covering from loosening when you cover the top of the wing tip. The covering on the bottom of the tip will be loose until the top is covered and shrunk.

Wing

1. Bottom of one, then the other panel
2. Top of one, then the other panel
3. Bottom, then top of ailerons
4. Bottom, then top of flaps

PAINTING

We used Top Flite LustreKote for everything that needed to be painted or fuel proofed. This included the engine cowl, engine compartment and the wheel wells. To do this, first roughen the plastic parts with 320-grit sandpaper and then spray on a coat of primer. After the primer dries, sand with 400-grit. Wet sanding works best because it keeps your sandpaper from becoming clogged. The primer will insure a good color match with the MonoKote. Now spray on your primary color.

For masking fine lines, use Great Planes 1/8" [3.2mm] E-Mask Flexible Masking Tape (GPMR1000) and use Kyosho Masking Cover Sheet (KYOR1040) for masking large areas. Use a Top Flite Tack Cloth (TOPR2185) to remove dust just before you paint.

JOIN THE CONTROL SURFACES

❑ 1. Locate the two .074 x 36" [1.6 x 914mm] wire pushrods. Cut the Z-bends that you made earlier from the wires when the elevator servo was installed. Assemble a nylon clevis and clevis retainer on the threaded end of both pushrods. Thread the clevis on about 15 turns. Clean each pushrod wire with a paper towel and some alcohol.

3-3/4"

3" 3" 3" 3"
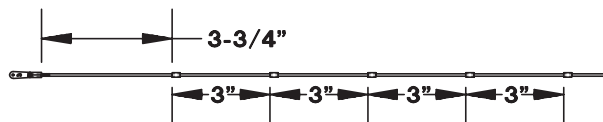
1/4" SPACERS

❑ 2. Cut ten 1/4" [6.4mm] long pieces from the 6-1/2" [165mm] white plastic pushrod material. Slide five of these spacers onto each of the pushrods. Position the spacers as shown in the above sketch. Wick a drop of thin CA between each spacer and the wire. Soak up any excess CA with a paper towel. Make sure the CA has cured before proceeding.

Important: Make sure you position the spacers that are at the ends of the wire so they will not protrude from the guide tube when the servo is at its full travel, or the control could become jammed during flight.

❑ 3. Insert one of the pushrods into the elevator pushrod tube. Install the elevators on the stab with the hinges and joiner wire in place. DO NOT glue the hinges yet.
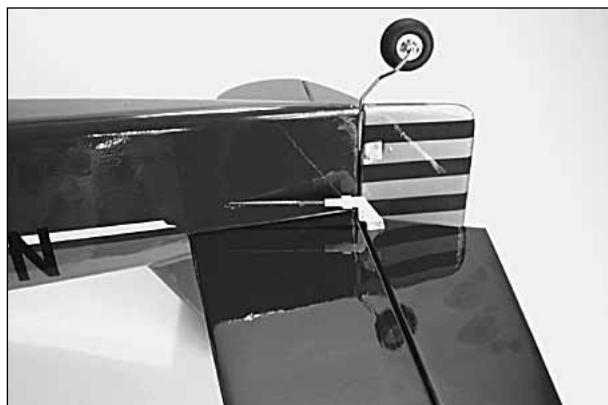
❑ 4. Mount a **small nylon control horn** to the ply control horn mount on the right elevator with two 2-56 x 1/2" [12.7mm] screws and nylon backing plate. Use a 5/64" [2mm] drill for the holes. Use the pushrod wire as a guide in locating the control horn.

❑ 5. Connect the clevis on the elevator pushrod wire to the elevator horn. With the elevators neutral, mark the pushrod wire at the servo arm where you will make a Z-bend. Make sure that the elevator is centered and that the servo arm is at 90 degrees to the servo.

❑ 6. Make a Z-bend on the wire at the marked location. Cut the excess wire from the pushrod. Insert the wire into the servo arm and connect the clevis to the elevator horn. Adjust the clevis as needed so that the elevator is centered with the servo arm at 90 degrees to the servo. **Hint**: It will be easier to make the Z-bend if you disconnect the clevis from the control horn and push the pushrod wire further into the fuselage.
Important: The elevator pushrod wire is inserted into the bottom of the servo arm.

❑ 7. Make and install the rudder pushrod wire in the same manner.
Important: The rudder pushrod wire is inserted into the top of the servo arm.

❑ 8. With the receiver installed and all of the servo wires connected to the receiver, glue the rudder outer pushrod tube brace to the front elevator servo rail. The tube should rest on the servo rail. Plug in any 6" extension wires you plan on using for the servos mounted in the wing. Route the receiver antenna, being sure to install a strain relief on the wire.
Note: If it becomes necessary to remove the receiver you will need to cut the brace.

CUT THE COVERING
AWAY FROM THE SLOT
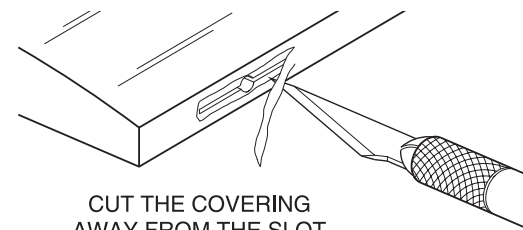
❑ 9. Start installing the hinges with the stab and elevators. Remove a small strip of covering from the hinge slots.

Before you glue in the hinges, apply a few drops of household oil to a tissue. Wipe the tissue over the trailing edge of the stab and the leading edge of both elevators coating them with a fine film of oil. This will prevent excess CA you use for gluing in the hinges from sticking to the elevator and stab at the hinge gap.

❑ 10. Fit the hinges in only the stab or elevators, without glue. Fill the joiner wire holes in the elevators with 30-minute epoxy. Immediately proceed to the next step.

TEMPORARY PIN
TO KEEP HINGE
CENTERED
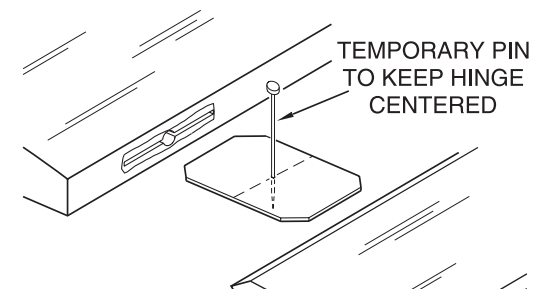
❑ 11. Join the elevators to the stab with the hinges, simultaneously installing the joiner wire in the elevators. If the hinges don't remain centered as you

join the elevators to the stab, remove the elevators and insert a pin in the center of the hinges to keep them centered. Make sure there is approximately a 1/64" [0.4mm] gap between the elevators and the stab so you do not glue them together. Use a tissue dampened with alcohol to remove excess epoxy that comes out of the elevator joiner holes. Use tape or clothes pins to hold the elevators in alignment with each other until the epoxy has fully cured.

Do not use CA accelerator on any of the hinges and do not glue the hinges with anything but thin CA. Do not attempt to glue one half of the hinge at a time. The hinges will not be properly secured and could come out while the model is in flight.

ASSEMBLE, THEN APPLY 6 DROPS
OF THIN CA TO CENTER
OF HINGE, ON BOTH SIDES
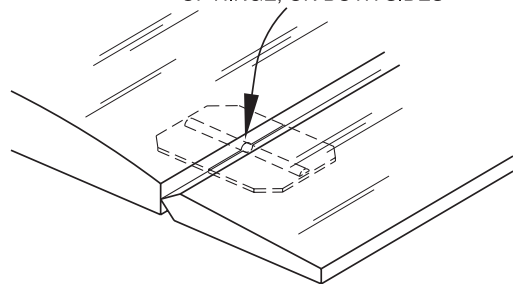
THE CA WICKS
ALONG THE "TUNNELS"
TO THE ENTIRE
HINGE SURFACE
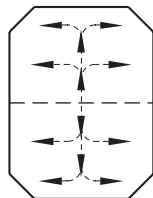
❏ 12. Cut a paper towel into approximately 2" [51mm] squares. Add six drops of thin CA to the center of the hinges on **both the top and bottom**. The *tunnels* you drilled earlier will *wick* the CA into the entire hinge surface. Use the paper towel squares to absorb excess CA from the hinge gap before it cures.

❏ 13. Use the same hinging method to join the rudder to the fin and the ailerons and flaps to the wing. Use 30-minute epoxy to glue the flap joiner wire and tail wheel wire to the flaps and rudder.

❏ 14. Reinstall all the pushrods and mount the control horns to the ailerons, elevators and rudder. Connect all of the pushrods to the control horns. Install retainers on all of the clevises.

FINISHING TOUCHES

❏ 1. Reinstall any hardware and other components you may not already have in place such as the engine and muffler, landing gear (or retracts), fuel tank, servos, on/off switch, fuel filler valves, pushrods, etc.

❏ 2. Install 2-1/2" [64mm] wheels (2-1/4" [57mm] with retracts) on the landing gear and secure them with 5/32" [4mm] wheel collars and a drop of thread lock. Note: Did you file flat spots on the landing gear wires?

❏ 3. Cut the canopy along the cut lines and smooth the edges with some sandpaper. Glue the canopy into position with canopy glue such as RC-56. Three #2 x 3/8" sheet metal screws are also provided so you can also screw the rear of the canopy to the fuselage at the top and corners.

❏ 4. Route the receiver antenna to the outside of the model. We installed ours so that it exited just after the canopy and then to the top of the fin. Install a strain relief so that the antenna will not be pulling on the solder joint in the receiver.

❏ 5. Study the photos on the box to decide where to place the decals. Thoroughly clean your airplane with rubbing alcohol before you apply the decals.

❏ 6. Trim the decals as close as practical and carefully apply them to your model. While these are self-adhesive decals, you can *float* the decals into position by first applying soapy water to the model's surface (just a teaspoon of dish detergent to a quart of water), then *squeegeeing out* the water and soap with a piece of soft balsa or a credit card wrapped with a tissue. Blot the surface dry and let the decal adhesive cure for at least 12 hours before running the engine.

GET YOUR MODEL READY TO FLY

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. See the **Expert Tip** that follows to accurately mark the balance point on the **top** of the wing on both sides of the fuselage. The balance point is shown on the plan **(CG)** and is located **3-1/2" [88.9mm] back from the leading edge of the center of the wing** as shown in the sketch below and on the plans. This is the balance point at which your model should be balanced for your first flights. Later, you may experiment by shifting the balance up to 1/2" [12.7mm] forward or back to change the flying characteristics. If you move the balance point **forward** it may improve the smoothness and tracking, but your R/C Nobler may then require more speed for takeoff and become more difficult to slow for landing. If you move the balance **aft** it may make your R/C Nobler more agile with a lighter *feel* and allow you to slow the model more for landing. In any case, **please start at the location we recommend and do not at any time balance your model outside the recommended range.**

How to mark the balance point

The balance point is measured from the **leading edge of the center of the wing.** Mark the balance point outward a few inches so you can see where to lift the wing when it's bolted to the fuse. To do this, mark the balance point with a felt tip pen or tape on **both sides** of the center section. Place a straightedge across the marks. Mark the balance point along the straightedge further out on the wing. Mount the wing to the fuselage.

❏ 2. All components should be in the model and it should be ready-to-fly but with an empty fuel tank.

3-1/2"
[88.9mm]
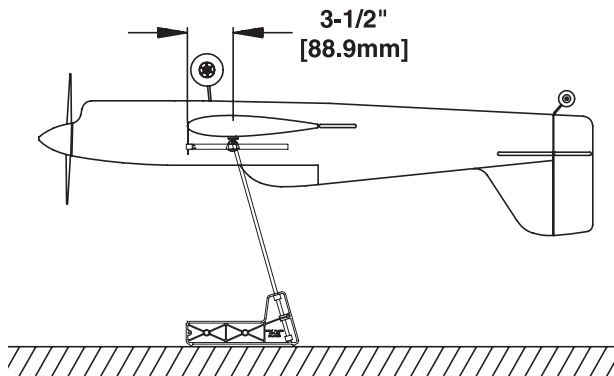
❏ 3. With the wing attached to the fuselage, the landing gear extended (if you have retracts) and an **empty** fuel tank, lift the model at the balance point or place it on your C.G. Machine (shown in the sketch). If the tail drops, the model is tail heavy and you must relocate your battery pack or other components

forward or add weight to the nose. If the nose drops, it is nose heavy and you must relocate your battery pack or other components aft or add weight to the tail. In order to save weight, relocate your battery pack and/or other components before you add additional weight to arrive at the correct C.G. You may install nose or tail weight by gluing lead weights inside the fuselage where necessary.

Note: The amount of weight required will depend on the engine you are using and how heavily or lightly you built the tail. Our prototype with the O.S. .46 FX two-stroke required 1-1/2 oz. [42.5g] of lead on the tail.

FINAL HOOKUPS AND CHECKS

❏ 1. Install the receiver battery at the location determined when you balanced your model. Wrap it in 1/4" [6.4mm] foam and hold it in place with some basswood sticks, glued to the fuselage sides. Our battery was mounted aft of the elevator servo on the fuselage bottom.

❏ 2. Take the servo arms off your servos, turn on your transmitter and receiver and center all the trims. Set the flaps to the center of their travel. Reinstall all the servo arms and secure them with the screws. Turn off the transmitter and receiver.

❏ 3. Double-check all the servos and make sure the servo arms are secured with screws and all the clevises have a **silicone retainer**.

❏ 4. Make sure the control surfaces move in the proper direction as illustrated in the following sketch.

4-CHANNEL RADIO SETUP
(STANDARD MODE 2)
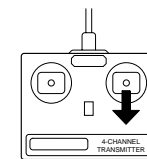
ELEVATOR MOVES UP
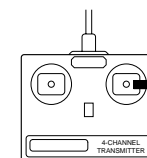
RIGHT AILERON MOVES UP
LEFT AILERON MOVES DOWN
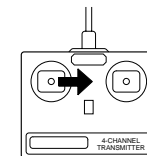
RUDDER MOVES RIGHT
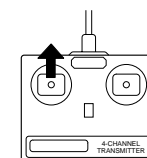
CARBURETOR WIDE OPEN

❏ 5. Adjust your pushrod hookups and set up your radio to provide the control surface movements as follows. Use a ruler or a Great Planes Accu Throw™ Control Surface Deflection Meter (GPMR2405) to measure the throws.

CONTROL SURFACE THROWS

We recommend the following control surface throws:

NOTE: Throws are measured at the **widest part** of the control surface.

ELEVATOR:

High Rate	Low Rate
5/8" [16mm] up	1/2" [13mm] up
5/8" [16mm] down	1/2" [13mm] down

RUDDER:

High Rate	Low Rate
1-3/8" [35mm] right	1" [25mm] left
1-3/8" [35mm] left	1" [25mm] right

AILERONS:

High Rate	Low Rate
1/2" [13mm] up	5/16" [8mm] up
1/2" [13mm] down	5/16" [8mm] down

FLAPS:

Takeoff/half-flap	Landing/full-flap
1/2" [13mm]	1" [25mm]

When flaps are lowered there is a moderate pitch up tendency. If your transmitter has elevator-to-flap mixing, his can be trimmed out.

The balance point and control surface throws listed in this manual are the ones at which the R/C Nobler flies best. Set up your aircraft to those specifications. If, after a few flights, you would like to adjust the throws or C.G. to suit your tastes, that is fine. However, too much control surface throw can make your model difficult to control or force it into a stall, so remember...More is not better.

PREFLIGHT

Identify your model
No matter if you fly at an AMA sanctioned R/C club site or if you fly somewhere on your own, you should always have your name, address, telephone number and AMA number on or inside your model. It is **required** at all AMA R/C club flying sites and AMA sanctioned flying events. Fill out the identification sticker located at the rear of this manual and place it on or inside your model.

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

Balance your propellers
Carefully balance your propeller before you fly. An unbalanced prop is the single most significant cause of vibration that can damage your model. Not only will engine mounting screws and bolts loosen, possibly with disastrous effect, but vibration may also damage your radio receiver and battery. Vibration can also cause your fuel to foam, which will, in turn, cause your engine to run hot or quit.
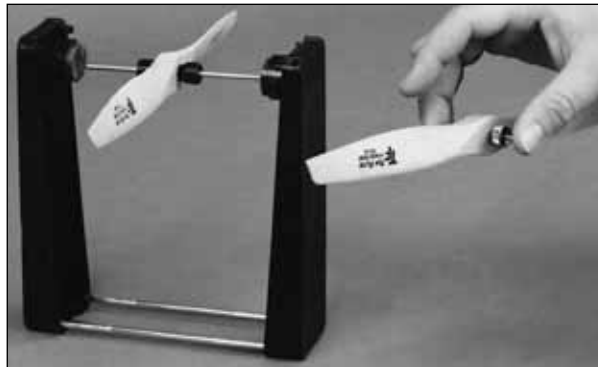
We use a Top Flite Precision Magnetic Prop Balancer™ (TOPQ5700) in the workshop and keep a Great Planes Fingertip Prop Balancer (GPMQ5000) in our flight box.

Find a safe place to fly
The best place to fly your model is an AMA chartered R/C club flying field. Contact the AMA (their address is on page 2) or your hobby shop dealer for the club in your area and join it. Club fields are intended for R/C flying, making your outing safer and more enjoyable. The AMA also provides insurance in case of a flying accident. If an R/C flying field is not available, find a large, grassy area at least six miles from buildings, streets and other R/C activities. A schoolyard is usually not an acceptable area because of people, power lines and possible radio interference.

Ground check your model
If you are not thoroughly familiar with the operation of R/C models, ask an experienced modeler to inspect your radio installation and control surface set-up. **Follow the engine manufacturer's instructions to break-in your engine.** After you run the engine on your model, inspect your model closely to make sure all screws remain tight and your pushrods and connectors are secure.

Range check your radio
Ground check the range of your radio before the first flight of the day. With the transmitter antenna collapsed and the receiver and transmitter on, you should be able to walk at least 100 feet [30m] away from the model and still have control. Have an assistant stand by your model and, while you work the controls, tell you what the control surfaces are doing.

Repeat this test **with the engine running** at various speeds with an assistant holding the model, using hand signals to show you what is happening. If the control surfaces do not respond correctly, **do not fly!** Find and correct the problem first. Look for loose servo connections or broken wires, corroded wires on old servo connectors, poor solder joints in your battery pack or a defective cell in your battery pack, or a damaged receiver crystal from a previous crash.

❏ 1. Fuelproof all areas exposed to fuel or exhaust residue such as the firewall/engine compartment, fuel tank compartment, wing saddle area, trailing edge of the wing and the flap area and wheel wells (if your model has flaps and retracts), etc.

❏ 2. Check the C.G. according to the measurements provided in the manual.

❏ 3. Secure the battery and receiver with a strip of balsa or plywood. Simply stuffing them into place with foam rubber is not sufficient.

❏ 4. Extend your receiver antenna and make sure it has a strain relief inside the fuselage to keep tension off the solder joint inside the receiver.

❏ 5. Balance your model *laterally* as explained in the instructions.

❏ 6. Secure critical fasteners with thread locking compound (the screws that hold the carburetor arms, set screws on wheel collars, screw-lock pushrod connectors).

❏ 7. Add a drop of oil to the axles so the wheels will turn freely.

❏ 8. Make sure all hinges are securely glued in place.

❏ 9. Reinforce holes for wood screws with thin CA where appropriate (control horns, hatches, etc,).

❏ 10. Confirm that all controls operate in the correct direction and the throws are set up according to the manual.

❏ 11. Make sure there are silicone retainers on all the clevises.

❏ 12. Fasten all servo arms to the servos with the screws included with your radio.

❏ 13. Secure connections between servo wires and Y-connectors or servo extensions and the connection between your battery pack and the on/off switch with vinyl tape or heat shrink tubing.

❏ 14. Make sure any servo extension cords you may have used do not interfere with other systems (servo arms, landing gear, pushrods, etc.).

❏ 15. Make sure your fuel lines and pressure line are properly connected and are not kinked.

❏ 16. Use an incidence meter to check the wing for twists and correct before flying.

❏ 17. Balance your propeller (and spare propellers).

❏ 18. Tighten the propeller nuts.

❏ 19. Place your name, address, AMA number and telephone number on or inside your model.

❏ 20. Cycle your receiver battery pack (if necessary) and make sure it is fully charged.

❏ 21. If you wish to photograph your model, do this before your first flight.

❏ 22. Range check your radio when you get to the flying field.

ENGINE SAFETY PRECAUTIONS

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

Store model fuel in a safe place away from high heat, sparks or flames. Do not smoke near the engine or fuel as it is very flammable. Engine exhaust gives off a great deal of deadly carbon monoxide so **do not run the engine in a closed room or garage**.

Get help from an experienced pilot when you learn to operate engines.

Use safety glasses when you operate model engines.

Do not run the engine near loose gravel or sand; the propeller may throw loose material in your face or eyes.

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

Always be **aware** and very **conscious** of hand movements and be **deliberate** in your reach for the needle valve, glow plug clip, or other items near a spinning propeller.

Keep loose clothing, shirt sleeves, ties, scarfs, long hair or loose objects away from the prop. Be conscious of pencils, screw drivers or other objects that may fall out of your shirt or jacket pockets.

Use a *chicken stick* or electric starter and follow their instructions to start your engine.

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

Ask an assistant to hold the model from the rear while you start the engine and operate the controls.

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

The engine gets hot! Do not touch the engine during or immediately after you operate it. Make sure fuel lines are in good condition so fuel will not leak onto a hot engine and cause a fire.

To stop the engine, close the carburetor barrel (rotor) or pinch the fuel line to discontinue the fuel flow. Do not use your hands, fingers or any body part to stop the engine. Never throw anything into the prop of a running engine.

AMA SAFETY CODE (excerpt)

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

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

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

3. Where established, I will abide by the 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.

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

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

RADIO CONTROL

1. I will have completed a successful radio equipment ground check before the first flight of a new or repaired model.
2. I will not fly my model aircraft in the presence of spectators until I become a qualified flier, unless assisted by an experienced helper.
3. I will perform my initial turn after takeoff away from the pit or spectator areas and I will not thereafter fly over pit or spectator areas, unless beyond my control.
4. I will operate my model using only radio control frequencies currently allowed by the Federal Communications Commission...

FLYING

If you have not already done so, read the designer note section. It has important notes about the flying characteristics of this model.

Takeoff

With most tail draggers, engine torque will cause the nose to turn to the left as you initially accelerate and roll down the runway for takeoff. If necessary, use rudder to keep your R/C Nobler on the centerline of the runway. The rudder is very effective and you should have positive ground control, even in moderate crosswinds. If you have dual rates on your transmitter, set the switch to "high rate" for takeoff, especially when taking off in a crosswind. Although this model has excellent low speed characteristics, you should always build up as much speed as your runway will permit before lifting off, to give you a safety margin in case of a "flame-out". If you have installed an engine at the lower end of the power range, lift off by smoothly applying up elevator and climb out gradually. If you have installed an OS .46 FX, you are in for a real treat.

Flight

We recommend that you take it easy with your R/C Nobler for the first several flights, gradually getting acquainted with this highly aerobatic model as you gain confidence in your engine and it gets fully broken-in. Adjust the trims so your R/C Nobler will fly straight and level at cruise speed. Climb to a comfortably high altitude and fly at different throttle settings to see how your model will behave and to see what kind of trim changes are required at different speeds. Still at altitude, try some practice landing approaches, seeing how your R/C Nobler handles at low speeds. Do the same with the flaps extended so you know what to expect when you're in a real landing approach. If you've got retracts, cycle the gear a few times to make sure everything operates okay and to see if there are any trim changes required. Try flying around and executing various maneuvers, making mental notes (or having a friend standing by with a note pad) on how she behaves. Note what might be required to fine tune your R/C Nobler so it handles just the way you like. The R/C Nobler has no bad characteristics and you should feel comfortable with the model quickly.

Landing

Don't forget to extend your landing gear! When you throttle back for landing, the R/C Nobler slows relatively gradually and the sink rate is shallow if your speed is too high. To initiate your landing approach, make your final turn toward the runway (always into the wind if possible). The R/C Nobler has excellent low speed handling so you can fly landings slower than you are accustomed to with other models. When your R/C Nobler reaches the threshold of the runway, raise the nose slightly to level her flying attitude. When you're over the runway and just a foot or so off the deck, apply more elevator and make your flare. When you're ready to land with flaps, extend them on the downwind leg after you've reduced throttle and lost a little air speed. If you extend your flaps at too high an airspeed, the nose may pitch up. With the flaps

extended, you'll need to add a little more throttle than usual to overcome the increased drag and maintain airspeed. Mind your fuel so you can make as many attempts as required so you can bring your baby home safely.

CAUTION (THIS APPLIES TO <u>ALL</u> R/C AIRPLANES): If, while flying, you notice any unusual sounds, such as a low-pitched "buzz," this may indicate control surface *flutter*. Because flutter can quickly destroy components 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 may indicate which surface fluttered) and make sure all pushrod linkages are secure and free of play. If the control surface fluttered once, it probably will flutter again under similar circumstances unless you can eliminate the free-play or flexing in the linkages. Here are some things which can cause flutter: Excessive hinge gap; Not mounting control horns solidly; Poor fit of clevis pin in horn; Side-play of pushrod in guide tube caused by tight bends; Poor fit of Z-bend in servo arm; Insufficient glue used when gluing in the elevator or flap joiner wire; Excessive *play* or *backlash* in servo gears; and Insecure servo mounting.

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

GOOD LUCK AND GREAT FLYING!

2-VIEW
Use this layout to plan your trim scheme.

PUSHROD EXIT LOCATIONS

THIS IS A VIEW OF THE
FUSELAGE TOP
SHOWN WITH TOP DECK, TOP AND BOTTOM
SHEETING REMOVED FOR CLARITY.

THIS IS A VIEW OF THE
FUSELAGE LEFT SIDE
SHOWN WITH LEFT AND RIGHT SIDE
SHEETING REMOVED FOR CLARITY.

NOTE
THERE ARE TWO F3TX AND ONE F2TX
FORMERS. POSITION THEM AS NEEDED
TO CLEAR INSTALLED RADIO EQUIPMENT.

R/C NOBLER

BASED ON THE ORIGINAL R/C NOBLER
DESIGNED BY: GEORGE ALDRICH and ED. SWEENEY
RE-DESIGNED AND DRAWN BY: ERNEST LECLAIR
INSTRUCTIONS BY: ERNEST LECLAIR

TF TOP FLITE

TOP FLITE MODELS

B   C

D

DIE-CUT 1/8" PLY STAB CENTER

1/16" BALSA SHEETING TOP AND BOTTOM

DIE-CUT 1/8" BALSA STAB TIP PARTS

HINGE BLOCKS

HORIZONTAL STAB
(SHOWN WITH SHEETING REMOVED.)

CA HINGE (CUT FROM CA HINGE STRIP)

ELEVATOR

ELEVATOR

ELEVATOR JOINER

DIE-CUT 1/8" BALSA ELEVATOR TIP

DIE-CUT 1/8" BALSA CONTROL HORN BASE

DIE-CUT 1/16" PLY CONTROL HORN MOUNT

NOTE
ALL HORIZONTAL STAB AND ELEVATOR PARTS ARE CUT FROM 1/8" X 1/4" X 24" BALSA AND ARE SHEETED WITH 1/16" X 3" X 24" BALSA.

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WING PLAN No. RCN4P01

R/C NOBLER

BASED ON THE ORIGINAL R/C NOBLER
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TOP FLITE MODELS

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FLAP SERVO MOUNTING TEMPLATE

FUSELAGE SIDE LOCATION

RETRACT GEAR TEMPLATE

FIXED GEAR RAIL TEMPLATE

W1R

W1 W2 W3 W4

W4TD W3TD W2TD

W4 W3 W2 W1

CUT OUT THIS PATTERN AND USE IT TO CUT OPENINGS FOR THE RETRACTS IN THE LEADING EDGE SHEETING.

CUT OUT THIS PATTERN AND USE IT TO CUT OPENINGS FOR THE MAIN GEAR RAIL IN THE BOTTOM LE SHEETING.

CROSS-SECTION AT W7

DIE-CUT 1/16" PLY AILERON HATCH

Z-BEND

.074" X 6" THREADED ROD

NYLON CLEVIS

2-56 X 1/2" SCREW

DIE-CUT 1/16" PLY CONTROL HORN BASE

SMALL NYLON CONTROL HORN

CROSS-SECTION AT W1

SHAPED 24" BALSA LEADING EDGE

RETRACT SERVO

DIE-CUT 1/16" PLY SPAR JOINER

Z-BEND

.074" X 6" THREADED ROD

NYLON CLEVIS

TRIM END AS NEEDED

FLAP JOINER

CUT NOTCH IN TE TO CLEAR JOINER HORN

LEFTOVER BASSWOOD MOUNTING BLOCK

1/8" X 1/4" X 24" BASSWOOD SPAR

DIE-CUT 3/32" BALSA SPAR WEB

DIE-CUT 1/16" BALSA TE WEB/JIG

VERTICAL FIN
(SHOWN WITH SHEETING REMOVED.)

RUDDER

HINGE BLOCKS

CA HINGE (CUT FROM CA HINGE STRIP)

1/16" BALSA SHEETING BOTH SIDES

NOTE
ALL VERTICAL FIN AND RUDDER PARTS ARE CUT FROM 1/8" X 1/4" X 24" BALSA AND ARE SHEETED WITH 1/16" X 3" X 24" BALSA.

LOCATION OF CONTROL HORN

LOCATION OF TAILWHEEL ASSEMBLY

DIE-CUT 1/16" PLY CONTROL HORN MOUNT

LEFT WING PANEL
THIS IS A VIEW OF THE TOP OF THE LEFT WING PANEL.
THIS PLAN SHOWS THE INSTALLATION OF FIXED LANDING GEAR.

SHAPED 24" BALSA LEADING EDGE

DIE-CUT 1/16" BALSA WING TIP CORE

DIE-CUT 1/16" BALSA WING TIP RIBS

T1 T2 T3 T4 T5 T6

W9 W10

W7 W6 W5 W4 W3 W2 W1

W7D W6D

1/8" X 1/4" X 24" BASSWOOD SPAR

1/16" X 1/4" BALSA CAP STRIPS (CUT FROM 24" BALSA)

#2 X 3/8" FLAT HEAD SHEET METAL SCREWS

DIE-CUT 1/16" PLY AILERON SERVO HATCH

5/16" X 3/4" X 7/8" BASSWOOD SERVO MOUNT BLOCKS

DIE-CUT 1/16" BALSA WING RIBS

DIE-CUT 1/16" BALSA TE WEB/JIG

1/4" X 3/8" BASSWOOD SERVO RAIL (CUT FROM SCRAP)

7/16" X 5/8" X 7/8" MAPLE TORQUE BLOCK

LOCATION OF 7/16" X 5/8" X 5-5/8" BASSWOOD FIXED GEAR RAIL

SAND TO FIT FUSELAGE

FUSELAGE SIDE LOCATION

.074" X 6" WIRE

CA HINGE (CUT FROM CA HINGE STRIP)

HINGE BLOCKS

SILICONE RETAINER

NYLON CLEVIS

DIE-CUT 1/16" PLY CONTROL HORN MOUNT

SMALL NYLON CONTROL HORN

1/8" X 3/16" BALSA TRAILING EDGE

AILERON

FLAP

CENTER SHEETING EXTENDS TO OTHER WING PANEL.

FLAP JOINER

NOTE
ALL AILERON AND FLAP PARTS ARE CUT FROM 1/8" X 1/4" X 30" BALSA AND ARE SHEETED WITH 1/16" X 3" X 24" BALSA.

NOTE
SEE MANUAL CONCERNING THE INSTALLATION OF THE FLAP SERVO AND CONTROL LINKAGES.

TF TOP FLITE

RIGHT WING PANEL
THIS IS A VIEW OF THE TOP OF THE RIGHT WING PANEL.
THIS PLAN SHOWS THE INSTALLATION OF RETRACTABLE LANDING GEAR. ALL OF THE 1/16" BALSA SHEETING AND CAP STRIPPING ARE REMOVED FOR CLARITY.

SAND TO FIT FUSELAGE

FUSELAGE SIDE LOCATION

2-1/4" WHEEL (NOT INCLUDED)

LOCATION OF FIXED GEAR RAIL

GREAT PLANES .40 SIZE RETRACTABLE LANDING GEAR (NOT INCLUDED)

SHAPED 24" BALSA LEADING EDGE

DIE-CUT 1/16" BALSA WING TIP CORE

DIE-CUT 1/16" BALSA WING TIP RIBS

W1R

W1 W2 W3R W4R

1/4" X 3/8" BASSWOOD RETRACT GEAR RAIL (CUT FROM SCRAP)

DIE-CUT 3/32" BALSA SPAR WEB

DIE-CUT 1/16" PLY SPAR JOINER

DIE-CUT 1/16" BALSA WING RIBS

W3 W4 W5 W6D W6 W7 W7D W9 W10

#2 X 3/8" FLAT HEAD SHEET METAL SCREWS

DIE-CUT 1/16" PLY AILERON SERVO HATCH

1/8" X 1/4" X 2-3/4" BASSWOOD SERVO RAIL (CUT FROM SCRAP)

DIE-CUT 1/16" BALSA TE WEB/JIG

5/16" X 3/4" X 7/8" BASSWOOD SERVO MOUNT BLOCKS

1/8" X 1/4" X 24" BASSWOOD SPAR

.074" X 6" WIRE

CA HINGE (CUT FROM CA HINGE STRIP)

SILICONE RETAINER

HINGE BLOCKS

NYLON CLEVIS

1/8" X 3/16" BALSA TRAILING EDGE

FLAP

FLAP JOINER

SMALL NYLON CONTROL HORN

DIE-CUT 1/16" PLY CONTROL HORN MOUNT

AILERON

LEFTOVER 1/16" BALSA FILLER

NOTE
ALL AILERON AND FLAP PARTS ARE CUT FROM 1/8" X 1/4" X 30" BALSA AND ARE SHEETED WITH 1/16" X 3" X 24" BALSA.

A