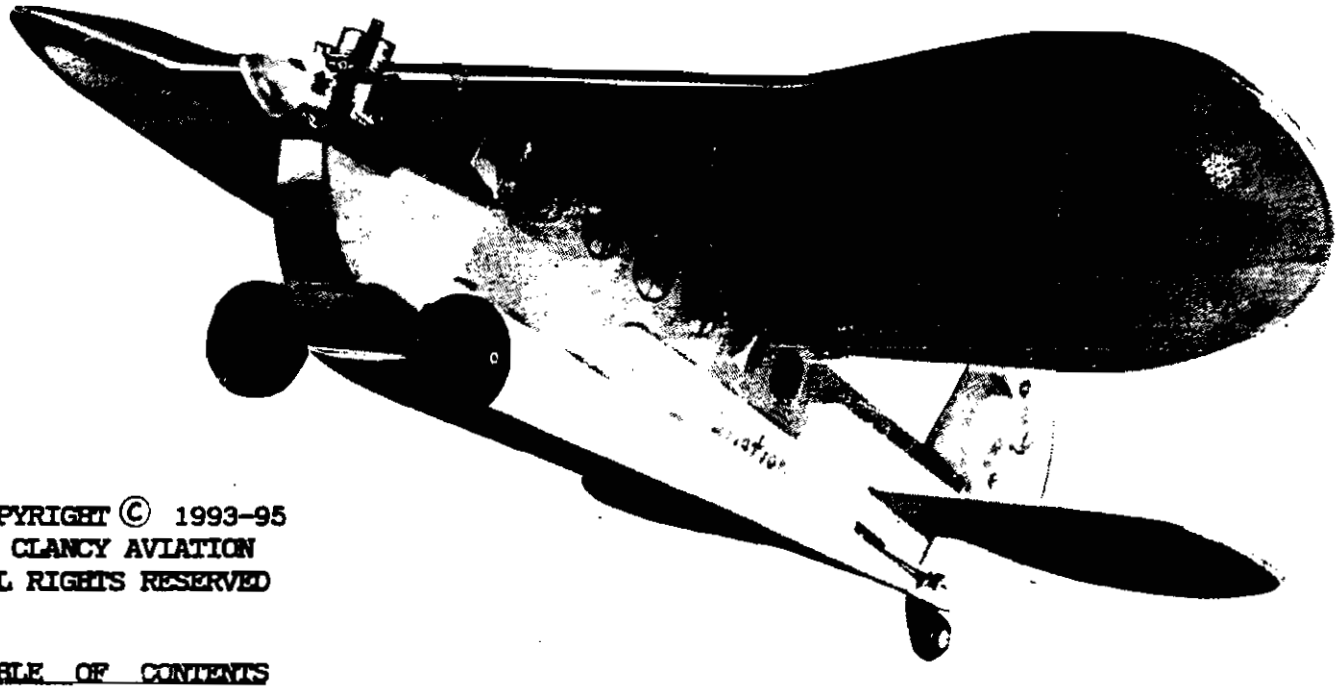
TO BUILD A BEE

LAZY BEE INSTRUCTION MANUAL
BY
ANDY CLANCY



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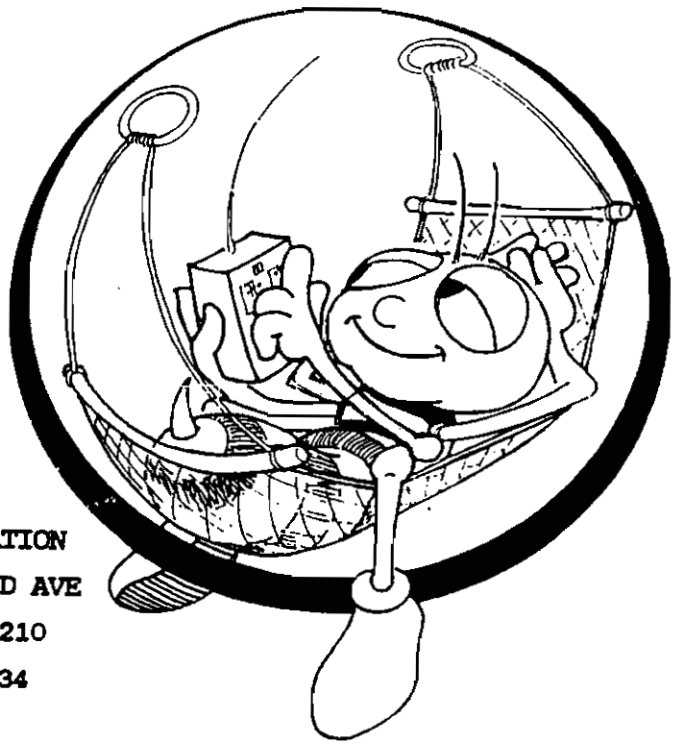

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LAZY BEE SHOPPING LIST

1	Radio, 2 or 3 channel. Microservos recommended
1	Motor and Propeller
1	Motor Mount (If required)
1	Fuel Tank, 1 to 4 oz; 2oz is standard. I use Sullivan Flex Tanks.
*	Fuel Tubing, 2 feet long. Use sections as mounting washers/bushings.
1	Small Flex Cable for throttle (If needed)
1	Brass Tube for throttle linkage, (6 inches, if needed)
6	E-Z Connectors (Or 4, if no throttle)
2	Control Horns (Large)
4	Wheel Collars (3/32")
2	Wheels (front), 3" diameter. I use Trexler Balloon Wheels, size 9G.
1	Wheel Collar (1/16" diameter), for tail wheel
1	Wheel (tail), 3/4" to 1 1/4" diameter. I use a size 1 Trexler Wheel.
1	ON/OFF Switch
6	Flexible plastic hinges. This is the best type for the Lazy Bee.
1	Sheet of foam core board (or substitute) for laminating templates
1	Piece of 1/16" music wire or Sullivan Nyrod - for tail control

CONSUMABLE ITEMS

*	Cyanoacrylate (CA) type glue	*	Sandpaper
*	Box of #19 rubber bands	*	5-Minute epoxy
*	Razor blades (or X-acto blades)	*	Thread (small roll)
*	Box of push pins (Modela, etc.)	*	Glue tips (for thin CA)

ADDITIONAL ITEMS FOR ELECTRICS

1	Block of balsa for motor mounting block (see templates)
1	Velcro for mounting battery pack
1	Wiring harness (Motor-Battery-Speed Control)
1	Electric Motor .035 to .075 (direct or reduction drive) and prop
*	Battery Pack for Motor
1	Speed controller for electric motor
1	Battery Charger

ADDITIONAL ITEMS FOR FLOAT PLANE

1	Can of clear spray dope or Black Baron clear epoxy paint

RECOMMENDED COVERING SUPPLIES

3	Large Sheets (72" x 20") of Litespan covering (4 sheets for ext. wing)
1	Jar (3.9 oz) of Balsaloc

INTRODUCTION

The Lazy Bee has grown steadily in popularity since I first began offering kits for sale in 1993. This popularity is due in part to the incredible versatility of the design. The Lazy Bee has flown successfully with two-stroke and diesel engines (.049 to .15), four-stroke engines (.20 to .26), and as an electric (.035 to .075) plane. It also makes an excellent float plane (Lazy Sea Bee.)

I have learned that the Lazy Bee can support a much higher wing loading than I initially thought practical. I have seen Lazy Bees that weighed less than a pound, and others as heavy as three pounds. My original intent with this plane was to use it to fly in my backyard (which is too small for control line flying!). I accomplished this with a Cox Texaco .049, Ace throttle, and micro-radio gear. I successfully flew this plane indoors, inside a small hangar built to hold two Cessnas. The delightful flight characteristics of the Lazy Bee are due in part to the very low wingloading. I have introduced an extended wing Lazy Bee to reduce the wingloading on heavier planes. It was developed with the electric Lazy Bee in mind, but it works just fine with gas powered Lazy Bees.

There are, of course, a lot of possibilities for the Lazy Bee that have yet to be explored. I have heard of tri-motor versions, 1.5 scale, double scale (we will have plans available soon), triple and even quadruple - scale. I have heard of ultra light projects, half-scale versions, and Lazy Bees modified for payload contests. They are used as glider tugs and glider launchers, some have ailerons, some have dive brakes. There are two-channel and rudder only versions flying with the Cox Fail-Safe radio.

I cannot possibly cover all of these variations in this instruction book, but I can address the most common variations and answer some of the more frequently asked questions.

Four-Cycle Lazy Bee

The Four-Cycle Lazy Bee requires a "soft mounted" engine. This is because the engine vibration can cause structural cracks if mounted without any dampening. The details of the "soft mount" are covered in Chapter Eight - Final Assembly. In addition, the stab should not have lightening holes and the radio gear will have to be moved as far aft as possible, in order to achieve the proper balance.

Extended Wing Lazy Bee

This option is available in kit form directly from Clancy Aviation. Special plans are included. The only change is to the center section of the wing. There is no other change to the plane. The building procedure is the same; there are just two more ribs in the wing. I decided not to add a special section and draw a bunch of new assembly diagrams. Just use a little imagination or cross your eyes a little bit while looking at the wing assembly drawings.

Lazy Bee Float Plane (Lazy Sea Bee)

The floats are designed for fast installation and will allow the Lazy Bee to fly from water, snow, and even wet grass. You can convert the Lazy Bee from a land plane to a sea plane (or vice-versa) in less than 5 minutes! The floats come with detailed plans which include installation details. There is nothing special that needs to be done while building the plane. If you plan on using your Lazy Bee as a float plane, I recommend that you seal the wood before covering. You can use clear dope, Black Baron Clear Epoxy, or similar products. This will help protect the wood from the moisture. You should also check the prop clearance to be sure that the prop will not strike the water. This is more likely to occur with heavy planes which ride lower in the water and with props over 10" in diameter. One solution is to switch to a 3-bladed prop, which lets you reduce the prop diameter by an inch or so. The pitch should stay about the same.

Electric Lazy Bee

There is a wide range of possibilities for electric powered Lazy Bees. Generally, geared motors work better, but are not required. No modifications need to be made to the plane in order to build as (or convert to) an electric. The gas tank shelf is a structural member and should not be removed. There is ample room inside the fuselage for a good sized battery pack, and the motor mount shelf can accept a wide range of motors as well. I recommend that you attach the battery pack to the plane with velcro so you can swap battery packs quickly. You may want to build an extended shelf in the first couple of fuselage sections (to improve access.) You can do this by placing 1/16" plywood on top of the balsa sticks which are right above the bottom longerons. A hinged door can be added, too. For details, see the "Electric" section following the "Options" section.

Other Options

Two popular options for the Lazy Bee are the Bolt-On Wing and the Removable Tail Feathers. The Bolt-On Wing is covered in the next section. The Removable Tail Feathers are covered in Chapter 6. If you think you may want a Bolt-On Wing on your Lazy Bee, read the instructions first, as it changes how the fuselage and the wing are built!

OPTIONAL BOLT-ON WING

We developed a Bolt-On Wing mounting for the Lazy Bee in response to numerous requests. Many flyers prefer Bolt-On Wings because they look better and require no rubber bands. The drawback is that they are usually less durable. In a crash your plane will be less flexible, and more damage will occur. We do hope that you will use the Bolt-On Wing, this will help boost our sales of replacement parts!

WING CONSTRUCTION

1) Build the wing as shown in chapter 4, except omit the compression braces and gussets on the center rib (W1) and the shear webs next to the rib (W1).

2) Cut spruce blocks and glue (CA) them to the center rib (W1) and trailing edge. Be sure to do a very good job; if the glue joint fails in flight, you'll need a large bag to carry all the pieces of your plane home.

3) Install the center rib (W1) compression braces and glue (CA) the plywood wing hold-down fingers to the center rib (W1).

4) Install the shear webs and the center rib (W1) gussets (omitted in step 1).

5) Install the strips of balsa next to the center rib (W1) and fill in the space between wing hold down finger with scrap balsa.

FUSELAGE CONSTRUCTION

1) Build as shown in chapter 5, but Do Not install the front or rear wing hold-down dowels.

2) Fill-in groove for front hold-down dowel with scrap balsa and cut the notch for the wing hold-down finger.

3) Install the spruce or hardwood block at the rear of the fuselage. This should pass through part F-5 and be cut off flush with the outside of the fuselage.

4) Drill undersize holes through the wing and fuselage wing hold-down blocks with the wing in position. To ensure proper alignment use a tap to cut the bolt threads in the fuselage block. Then coat the threads in the hole with CA and let dry. When dry, run the tap through again. Drill out the hole in the wing hold-down block so that it is large enough for the wing hold-down bolt to pass through.

ADDITIONAL PARTS NEEDED

FOR OPTIONAL

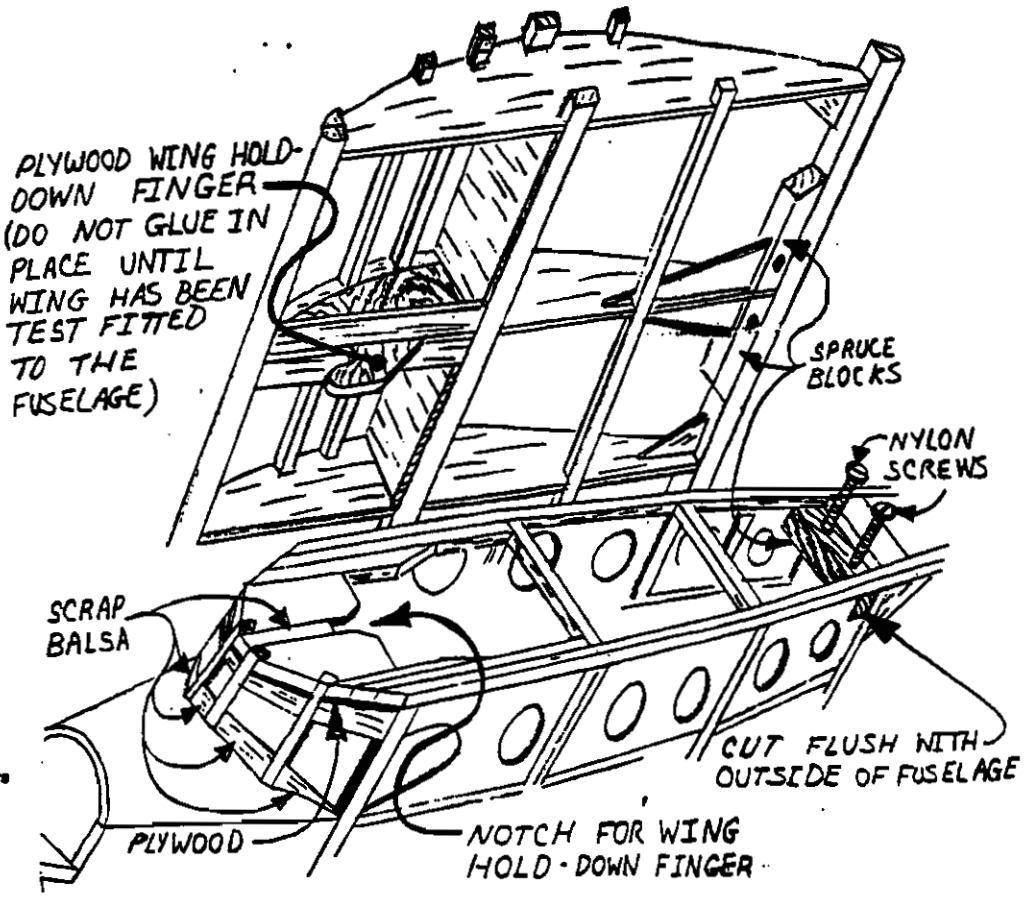
BOLT-ON WING

ORIGINAL LAZY BEE (40"& 48" WINGS)

1	1/4" sq X 6" Spruce
2	8 - 32 X 1" Long Nylon Screws
1	8 - 32 Tap & Drill Set

BIG LAZY BEE (60" & 72" WINGS)

1	3/8" sq X 9" Spruce
2	1/4 - 20 X 1.25" Long Nylon Screws
1	1/4 - 20 Tap & Drill Set

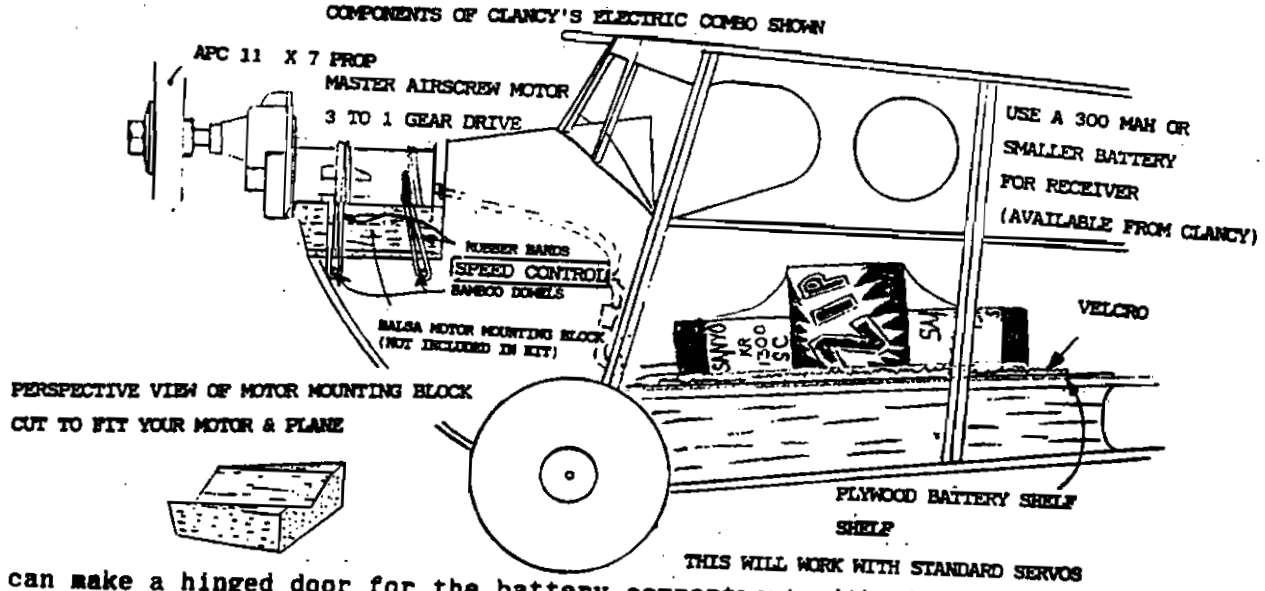


ELECTRIFYING THE LAZY BEE

The Lazy Bee has flown with a wide range of motor and battery combinations. If you've plenty to spend, an Astro Flight .035 Cobalt gear drive motor, APC 10 X 6 prop and a 6-cell battery pack works great. Cobalt motors are very efficient which helps keep the weight down. My Astro .035 planes weigh around 2 lbs, which gives a wing loading of 7.2 oz/sq ft for the extended wing Lazy Bee.

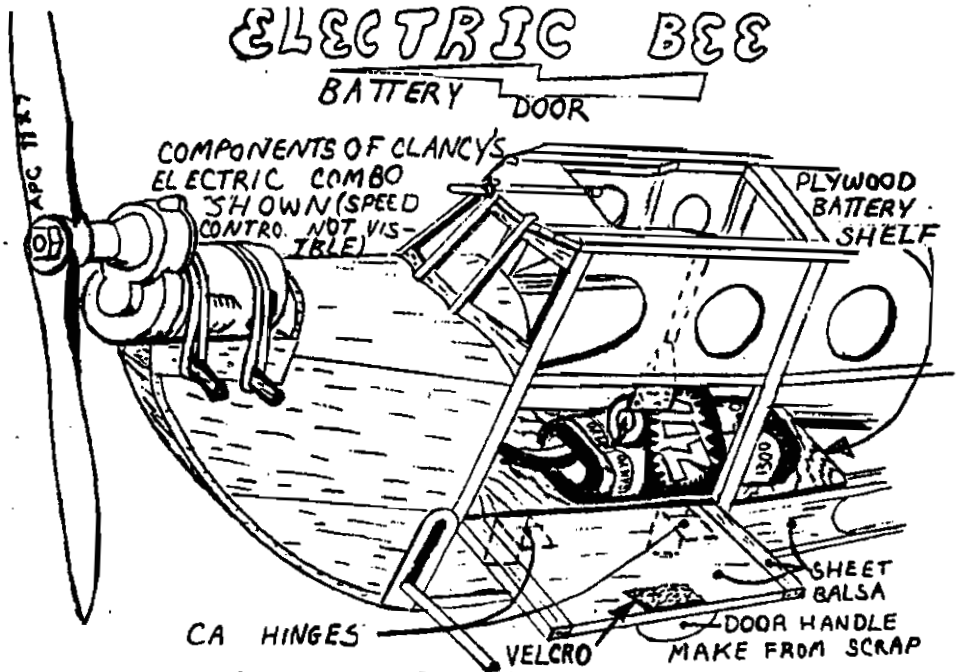
Of course, you can get a very good set-up for a lot less money. For $86 we have a Master Airscrew .05 motor with 3:1 gear drive, Astro Flight 217 speed control, 7-cell Sanyo battery pack, and an APC 11 X 7 prop. This is the set-up I use most. It works great with steep climbs, short take-offs from grass or water, plenty of power for aerobatics, and around 6 minutes full throttle duration.

The extended wing Lazy Bee usually weighs 37 to 42 oz with this set-up, which gives a wingloading of 8.4 to 9.5 oz/sq ft! This is why so many people think I have a glow engine (with a super-quiet muffler) when I fly my electric Lazy Bee. I get lots of questions about that muffler! My standard set-up is shown below.



You can make a hinged door for the battery compartment with sheet balsa. This way you don't have to take off the wing to change battery packs.

Buy some extra battery packs! Our Sanyo 7-cell hump packs. which are already a great deal at $25. Our "Stock up Special" price is: 3 packs for just $69!



Why Electric?

There are a lot of good reasons, here are a few: 1) Because it's reliable, more reliable than the car I take to the flying field. 2) Less frustration. 3) It's clean, no need to coat a beautiful plane with oil. 4) It's quiet and has plenty of power (Seeing is believing, check out our video!)

I have 6 battery packs; each one gives 6 minutes at full throttle. I can change the battery pack in 1/4 the time it takes to refuel and restart a glow engine. The cost is comparable - A .10 motor, mount, prop, glow plug, a micro-servo for the throttle, throttle cable, and a can of fuel costs more than our Electric Combo deal and a cheap battery charger!

CHAPTER ONE - ENGINE AND RADIO SELECTION

ENGINE AND RADIO SELECTION

The Lazy Bee has flown with a wide range of engines and radio gear. It was designed to use 2 or 3 channel micro-gear and two-stroke or diesel engines in the .049 - .15 cubic inch range. I have used engines as large as the O.S. four-cycle .26 and as small as Cox's Texaco .049, and the Lazy Bee flew very well with all of them. Full size radio gear has been used with success in some installations also. Micro-servos have enough power to operate the control surfaces effectively at all speeds, so there is no need for the larger radio gear. It just adds excess weight to the airframe.

One important rule of building and flying any type of aircraft is to keep the aircraft as light as possible. Reducing the weight of an aircraft will: Reduce take off and landing speeds, reduce the stall speed and stall recovery time, reduce the turning radius, improve low speed performance, and improve the crash survivability (except midair collisions).

The first Lazy Bee had a Texaco .049 with an Ace exhaust throttle, 3 channel Futaba micro-radio gear, and Litespan covering. It had incredible low speed performance and could take off from grass with ease! With the smaller engines the radio equipment must be placed as far forward as possible.
Important Note: If you use an .049 size engine, you must use micro-radio gear!

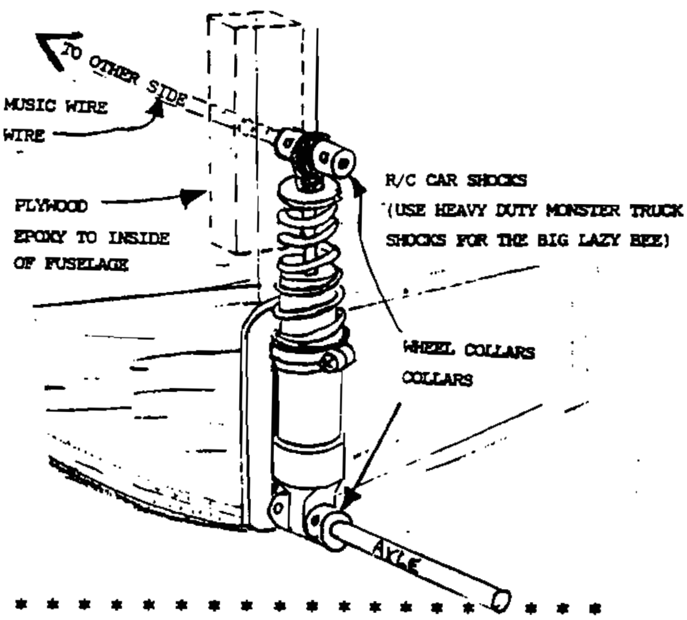
With a .10 size engine the Lazy Bee is comfortably overpowered. With a .15 it should have nearly unlimited vertical performance. With the larger engines you may need to cut away part of the engine mount in order to route the fuel lines through the firewall (See the drawing in the Final Assembly section).

If the performance of your plane seems inadequate, you may want to experiment with different propellers. I have found that simply changing the pitch and/or diameter of the propeller can make a big difference in performance.

If you have never used electric power before, you might want to consider trying it on your Lazy Bee. Electric power is a lot cheaper and more efficient than it used to be. The Lazy Bee performs so well as an electric that people often ask me what kind of muffler I'm using! Consider the advantages: No mess, No noise, No trouble starting the motor, great reliability, and you can fly when and where you want!

HEAVY DUTY SUSPENSION

A few guys have done this modification to their Lazy Bee and are very happy with the results. This provides better shock absorption than the standard Lazy Bee set-up. I think it is such a good idea that I am testing it out on my Lazy Bee. When I find out what works best I may make a conversion kit available (call or write if you are interested). In the meantime, here's a sketch to show the general idea.



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CHAPTER TWO - TIPS AND TOOLS

USING THIS MANUAL

Before you begin building your Lazy Bee you should study the plans carefully. You should also read through this instruction book. It is always a good idea to read the map before you start on a long journey.

I recommend that you build the plane in the same sequence as presented in this instruction book. The drawings and instructions in this book are based on the Lazy Bee plans. So, if there is ever a conflict between the instructions or drawings in this book and the Lazy Bee plans, follow the plans.

Unless I explicitly state otherwise, the terms "glue" and "CA" are both interchangeable and mean any cyanoacrylate type "super" glue. I use UFO thin, but you should use whichever type works well for you.

BUILDING THE BEE

One of the first things that you'll need to locate is a good building board. This can be any smooth, flat surface larger than the wing of the Lazy Bee that you are building. It must also be suitable for sticking pins into. Examples of building boards are flat pieces of plywood or particle board, slabs of balsa, or even corrugated cardboard laid flat over a work table. You will also need pins that can hold the balsa pieces together while pinning them to the building board. Dressmaker's pins work well and are easy to find. The best modeling pins that I've used are made by Modela in the Czech Republic. They are made of hardened steel and are very sharp. If you want to try them, we carry them in our catalog.

To prevent the parts from becoming glued to the plans you should use either clear plastic wrap or wax paper to cover the plans while building. This will protect the plans so that you can refer to them after the plane is built.

NOTE: This manual accompanies both the kits and plans packets, so there will some sections that apply to one, but not both. For example, if you bought the kit, you don't need to know how to make a balsa stripper or a circle cutter. But if you bought the plans this should be useful. Some of this information may come in handy if you ever need to make replacement parts for your Lazy Bee.

SOME TOOLS YOU CAN MAKE

If you bought a plans packet or need to make some replacement parts, this section should be useful. The tools are good for a wide range of modeling projects.

BUILDING THE BALSA STRIPPER

The tool I use for cutting balsa into strips takes me about two minutes to make and costs around 25 cents. You can save a lot of money by cutting your own balsa strips with this simple tool instead of buying those expensive precut pieces.

To make your balsa stripper you will need a piece of balsa to be the spacer block. This piece needs to be about 2" long and 1" tall. The thickness of the spacer determines the width of the strips that you will cut, so use good precut balsa for the spacer. If the thickness of the spacer varies, the stripper will not cut consistently.

The other items that you will need are (refer to full size drawing):

* A single edge razor blade
* A piece of spruce or plywood for the guide block (over 1/16" thick)
* Sandpaper
* Glue (CA type)

STEP ONE

Trace the spacer block template outline onto the piece of precut balsa and then cut the wood to shape.

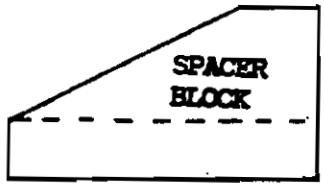
STEP TWO

Use the sandpaper to rough up one side of the razor blade. This will provide a better bonding surface for the glue. Be careful not to dull the cutting edge of the razor with the sandpaper.

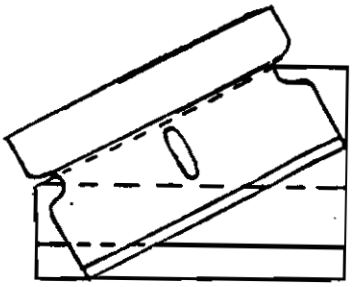
STEP THREE

Hold the rough side of the razor against the spacer block so that the crimped metal top of the razor is pressed up against the angled side of the spacer. The bottom edge of the crimped top should be flush with the angled edge of the spacer. A small corner of the cutting edge of the razor should protrude about 3/16" below the flat bottom of the spacer block. Once everything is aligned, apply CA between the spacer and the razor. Hold in position until the bond is secure.

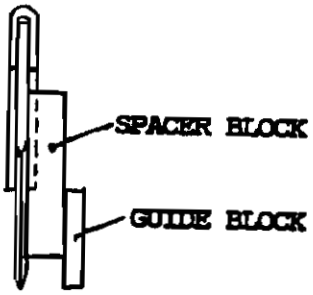
FULL SIZE PATTERNS



SIDE VIEW



FRONT VIEW



STEP FOUR

Trace the outline of the guide block template onto your piece of spruce or plywood and then cut to shape.

STEP FIVE

Take the joined razor and spacer and rest the exposed razor corner on a flat surface. Now take the guide block and press it flush against the spacer while keeping it flat against the surface that the razor corner is touching. Align the guide block ends with the spacer and apply CA between the guide block and spacer. Hold until the bonding is complete. Now you have a low budget balsa stripper.

To use the stripper, take a balsa sheet and rest the guide block against the edge of the sheet. Now pull the balsa through the stripper blade. You should get a cleanly cut balsa strip of the same width as your spacer. This stripper will work on balsa sheets 3/16" thick and under.

The other useful tool you can build is the balsa circle cutter. This will be very useful for cutting out the windows in the Lazy Bee.

BALSA CIRCLE CUTTER

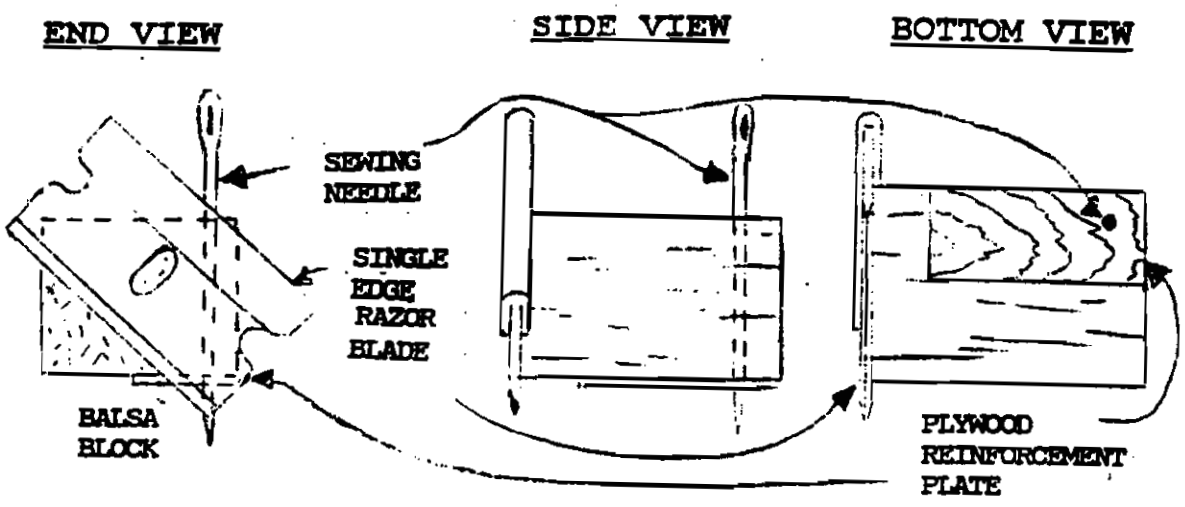
To build your balsa circle cutter you will need these items:

- A sewing needle
- A block of balsa(1" x 1 1/8" x 1 1/4")
  (You may also use several smaller pieces glued together)
- A single edge razor blade
- Thin sheet of plywood (1/32"x 1/2" x 1")
- Sandpaper
- Glue (CA type)

STEP ONE

Take a razor blade or X-ACTO and cut the relief for the razor crimp in the top corner of the balsa block. The crimp extends down for 1/4" , so the triangle cut out should have a height just over 1/4". The relief only needs to be 1/16" deep.

BALSA CIRCLE CUTTER



STEP TWO

Rough up one side of the razor blade with some sandpaper. Be careful not to dull the blade. Glue the rough side of the razor into the relief notch as shown in the drawing.

STEP THREE

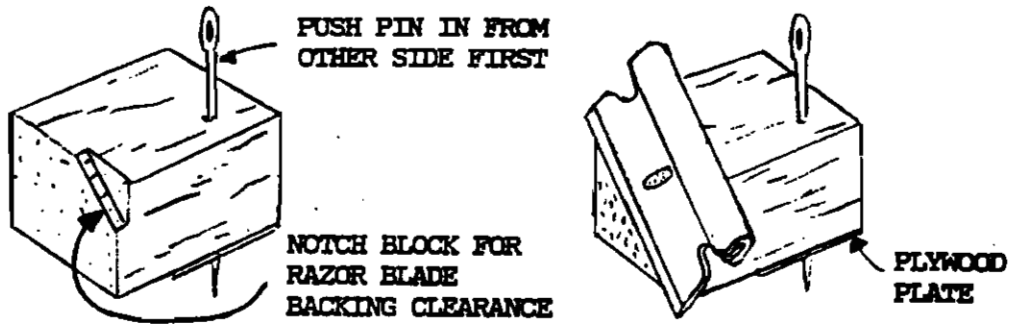
Measure the radius (half the diameter) of the circle that you want to cut. The Lazy Bee windows have a 3/4" radius. Now poke a hole for the needle to go through at that radius length from the side of the block with the razor attached.

STEP FOUR

Poke a hole in the plywood piece and glue it in place on the bottom of the block. Be sure to line up the holes for the needle.

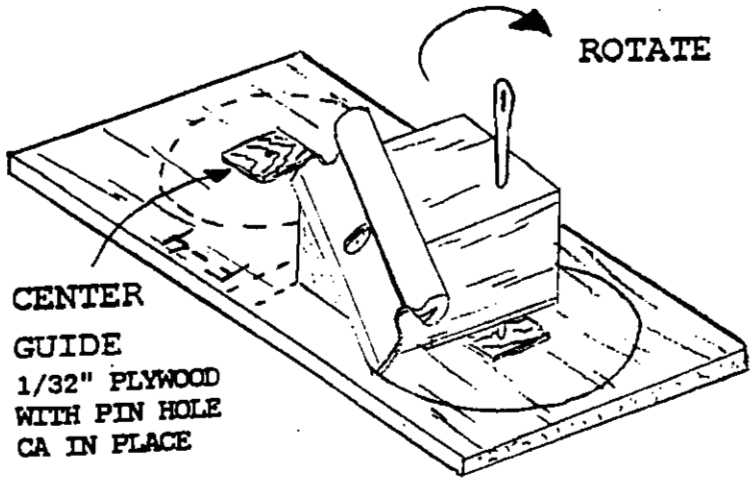
STEP FIVE

Push the needle into position in the hole in the block. Make a couple of centering guides with small scraps of 1/32" plywood. Force a pin through the plywood scraps near the center of the piece. These centering guides will act as the anchoring point for the circle cutter.



STEP SIX

Cut out the circular hole by rotating the cutter through the balsa. Use the plywood centering guides as the pivot point. Don't try to cut the complete circle in a single pass. Make several light passes, cutting deeper with each revolution of the cutter. Continue until the circle has been cut out.



CHAPTER THREE - LAMINATION

LAMINATION

Laminating balsa strips together is the lightest and strongest way to build the curved edges of the wingtips and control surfaces of the Lazy Bee. I have tried a lot of different laminating methods, and the one I explain here works the best.

The first step is to make the laminating forms. I often make mine out of corrugated cardboard because it is available at no cost (cardboard boxes from the grocery store). Some more expensive, but better materials are: plywood, particle board, and foam core board (available from office or art supply stores). The foam core board is the easiest to cut.

Cut out the paper laminating templates (included with each kit or plans packet) and trace the outline onto the laminating form material (i.e. foam core board). Cut out the laminating form carefully. Use a sanding block to sand the edges smooth and square. Then cover the outside edge of the form with a strip of transparent packing tape (non-sticky side out) or iron a thin strip of Monokote or similar product around the outside of the form. This keeps the laminated balsa from sticking to the laminating form.

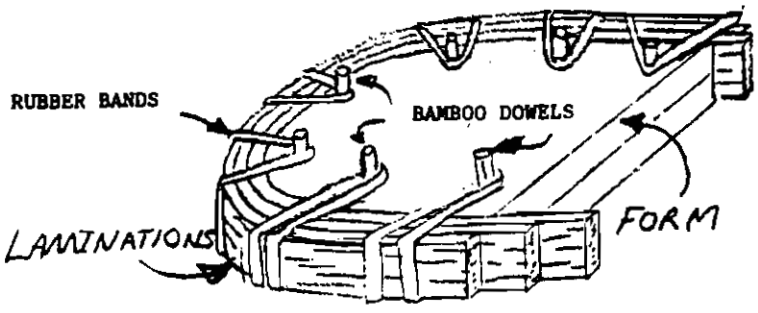
Take the balsa to be laminated and soak it in hot water for 30 minutes. You should soak a few extra pieces in case some of the sticks break during the procedure. While the sticks are soaking, collect the following items:

* A bowl of thinned white glue (about 75% glue, 25% water) and a sponge
* String or thread, rubber bands, and pins
* A pickle jar or similar container with 5 or 6 inch outside diameter.

As you remove each balsa strip from the water, slowly and carefully bend the strip around the pickle jar while pulling on both ends of the strip. The key to preventing breakage is to keep tension present in the strip by pulling on it as if you were stretching a rubber band while bending it slowly around the curve of the jar. Once each strip has been bent around the jar, apply the thinned glue to the still moist strips using the sponge. Stack the strips on top of each other and wrap this stack of strips tightly around the laminating form. The strips need to be pinned to the edge of the form.

Once the strips are pinned in place tightly wrap string, thread, or rubber bands around the form so that the stack of strips are held flush against the form at all points. Wipe off the excess glue from the strips and let them dry overnight. When dry, remove the laminated strips from the form and trim to length. The finished lamination should match up with the plans. See drawing Below.

NOTE: Drying times vary with the weather, so if your lamination does not appear dry after setting overnight, you can dry the lamination in the oven on "Warm" (the lowest setting) for around 20 minutes. You can also do this if you are in a hurry. Just be sure to Check Frequently!!



CHAPTER FOUR - WING

WING

The wing is built directly over the plans. Pin or tape the wing plan to your building board. Cover the top view wing plan with clear plastic wrap or wax paper, whichever you prefer. Laminate the wing tips as explained in Chapter 3. Once the wing tip laminations are dry, use a sanding block to sand the bottom side of each lamination until it is flat and smooth. Be sure to make a left wing tip and a right wing tip; don't make an identical pair!

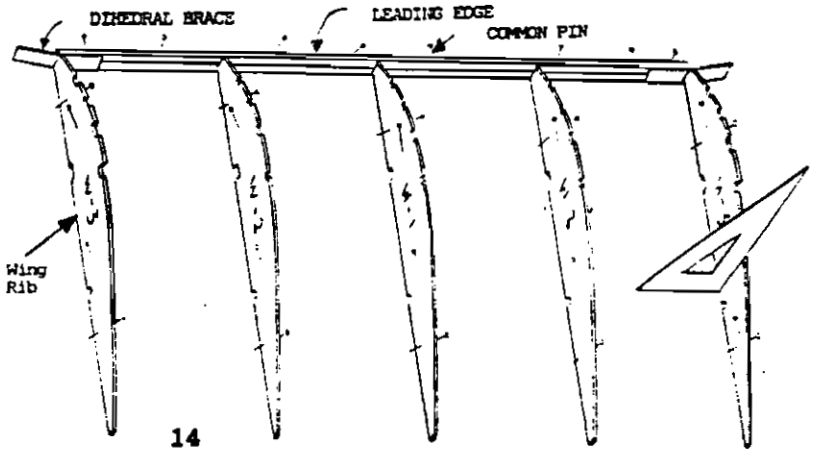
Trim the wing tip laminations to the correct length shown in the plans. Use the wing front view plan as a guide in cutting the angle needed for dihedral at the ends of the wing tip laminations. Set the trimmed wing tips aside.

STEP ONE

Clear off the top of the wing plan. Inspect the three 1/4" square hard balsa sticks and use the straightest one for the trailing edge of the wing. Cut to length directly over the plan so you can use the straightest section of the stick for the trailing edge. Glue on the trailing edge dihedral braces and set aside.

Take the two remaining 1/4 " square sticks and cut each to the length of the wing center section in the plans. Be sure to use the straightest portion of each stick, as this will be your leading edge. Laminate the two sticks together using white glue. Position the sticks so that the warps in one stick are opposed or mirrored by the warps in the other stick. This may make the laminating more difficult, but the wing's leading edge will be straighter. Pin this assembly in place on the plans and attach the leading edge dihedral braces with some CA.

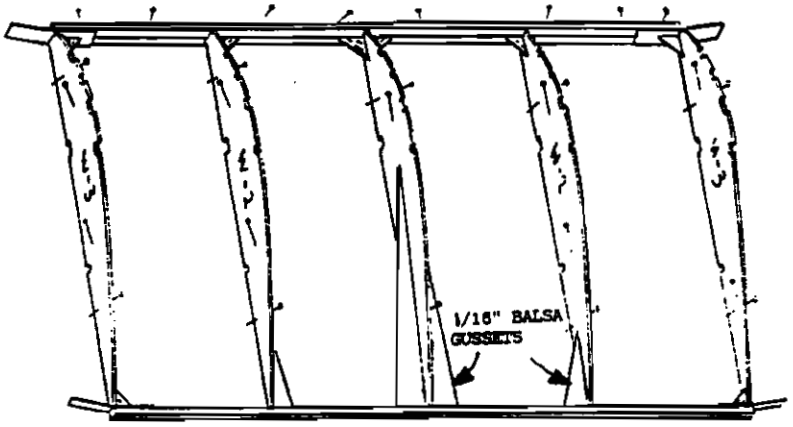
Pin the center section wing ribs (W1, W2, and W3) in place on the plans. Make sure the wing ribs are pressed tightly against the leading edge. Use a drafting triangle or square to ensure that each rib squares up properly with the leading edge. Put a drop of CA on each joint.



STEP TWO

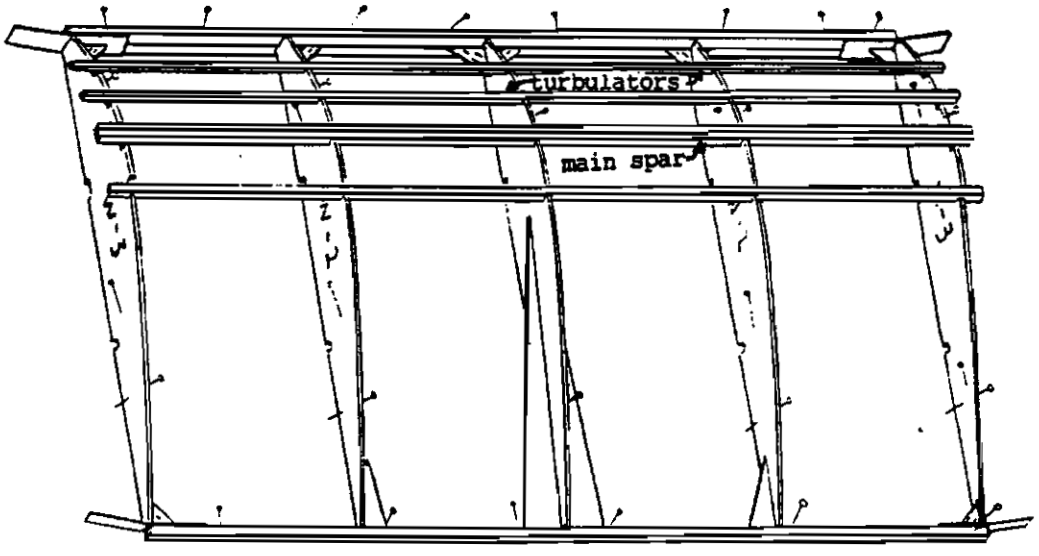
Pin the trailing edge assembly into place on the plans. It must be flush against the wing ribs. Place a drop of CA at the contact points between each rib and the trailing edge.

Now hold the triangle shaped gussets in place on each rib. As you hold each gusset tightly in place, squeeze a drop of CA into each contact point. Repeat for each of the wing gussets until they are all in place.



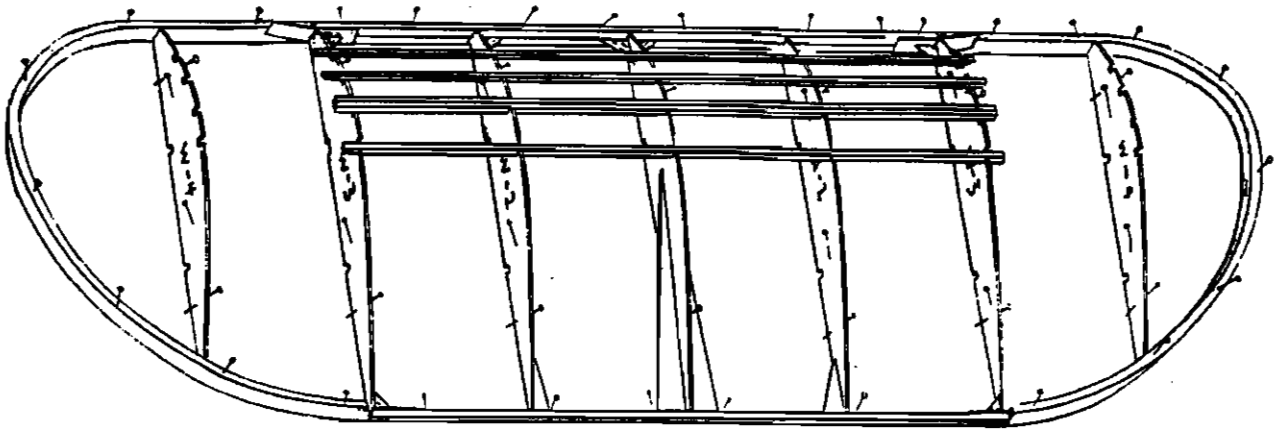
STEP THREE

Gather up the sticks needed to form the main spar and turbulators for the center wing section and cut them to length. Insert the sticks into place on the center wing section and glue them into the notches on the wing ribs. Remember to dribble some CA between the two sticks that form the main spar.



STEP FOUR

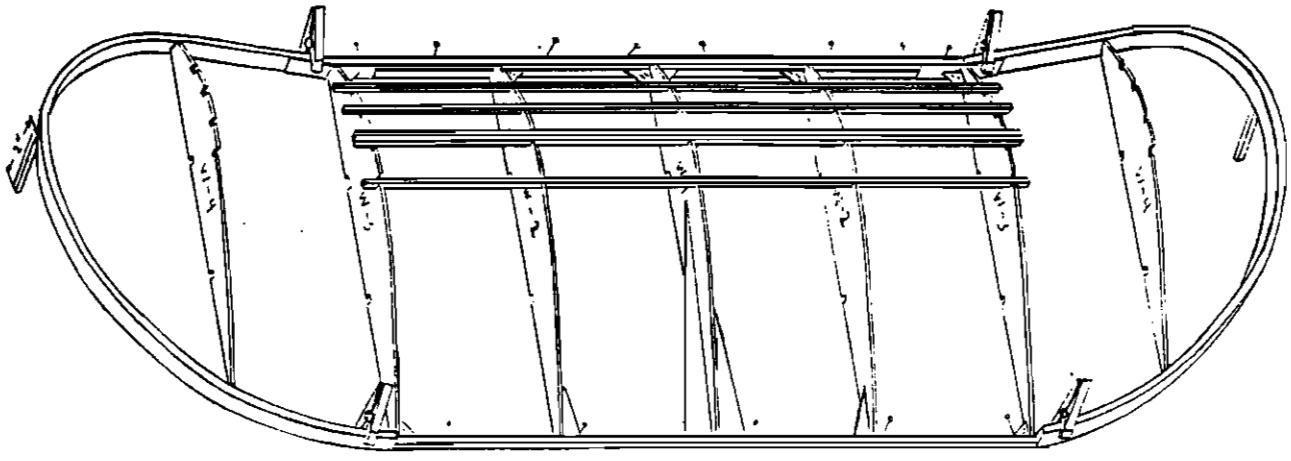
Pin the wing tip laminations onto the plans and let them lie flat. The dihedral will be added later. Pin the W4 wing ribs into place. The trailing edges of the ribs may need to be beveled for them to fit. Squeeze a few drops of CA into each wing rib glue joint. Do not glue the dihedral braces.



STEP FIVE

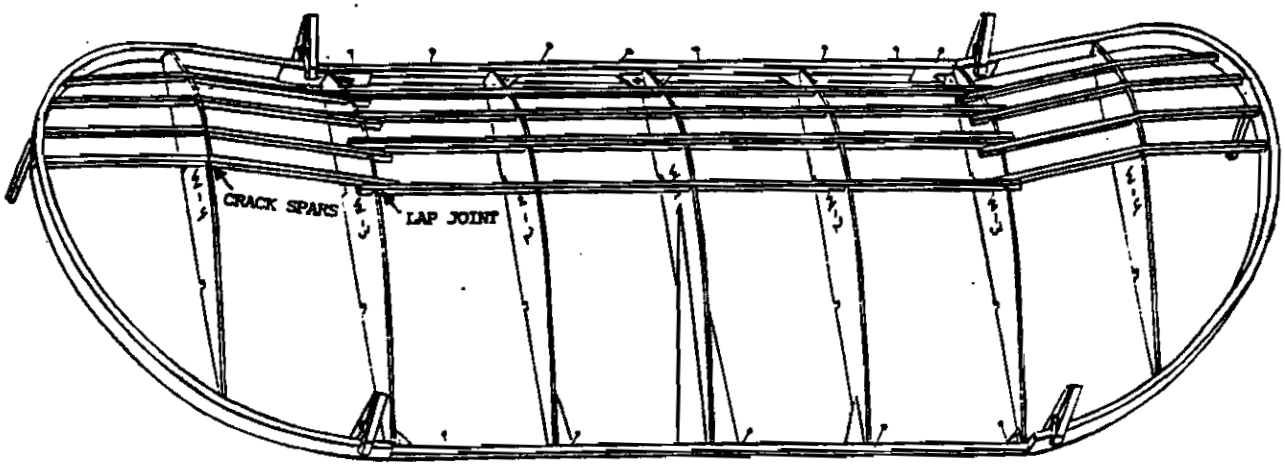
Carefully remove the pins from the wing tip frames. Sometimes twisting the pins before pulling them out helps to unstick the stubborn ones. Use your fingers to hold the frame down in the area next to the pin you are removing. This will help prevent the frame from being damaged.

Cut two pieces of scrap 1/8" square balsa sticks into 2" lengths. Use these sticks to prop up the ends of the wing tips. Then you will need to clamp the wing tips to the leading edge and trailing edge dihedral braces. A clothespin makes a good clamp for this purpose. Be sure that the leading and trailing edges of the center section and the wing tips are pressed together tightly. Flow CA into the joints.



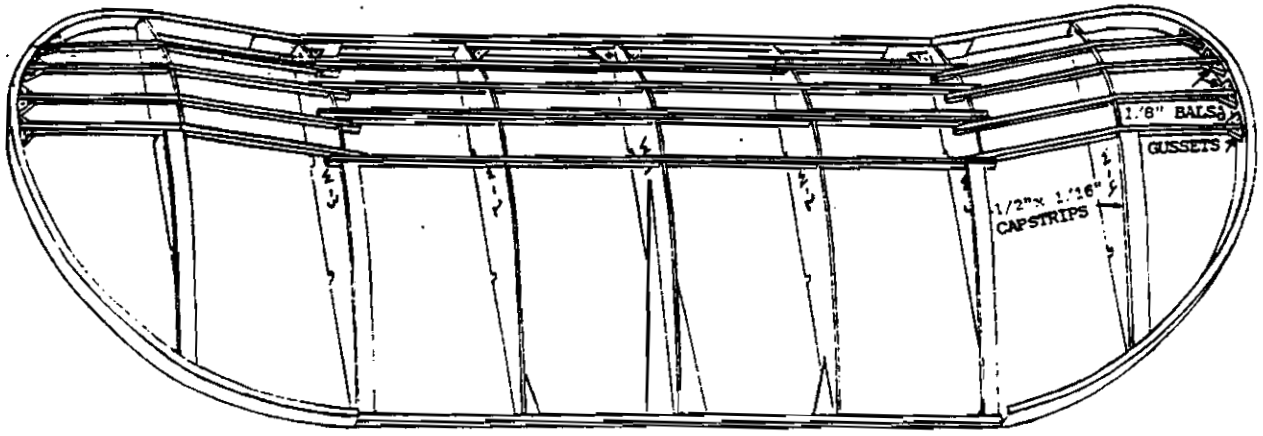
STEP SIX

Cut the spars to length for the wing tips. You will need to crack the spars in order to make the bend over wing rib W4. Then glue the spars into place.



STEP SEVEN

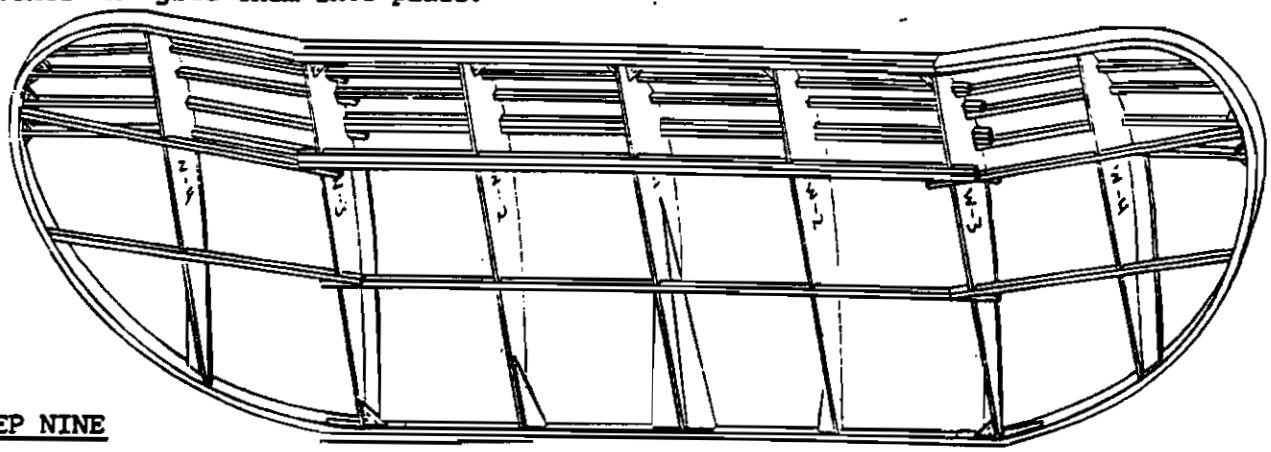
Cut out the 1/8" gussets from scrap sheet balsa. Glue them into place at the wing tips. Carefully remove all of the remaining pins. Cut the 1/2" x 1/16" balsa cap strips to length and glue them into place. This may be easier to do from the bottom side of the wing.



STEP EIGHT

Turn the wing frame bottom side up on your building board. Cut the balsa sticks to length for the lower spars of the center section of the wing. Fit them into the notches in the wing ribs and glue in place.

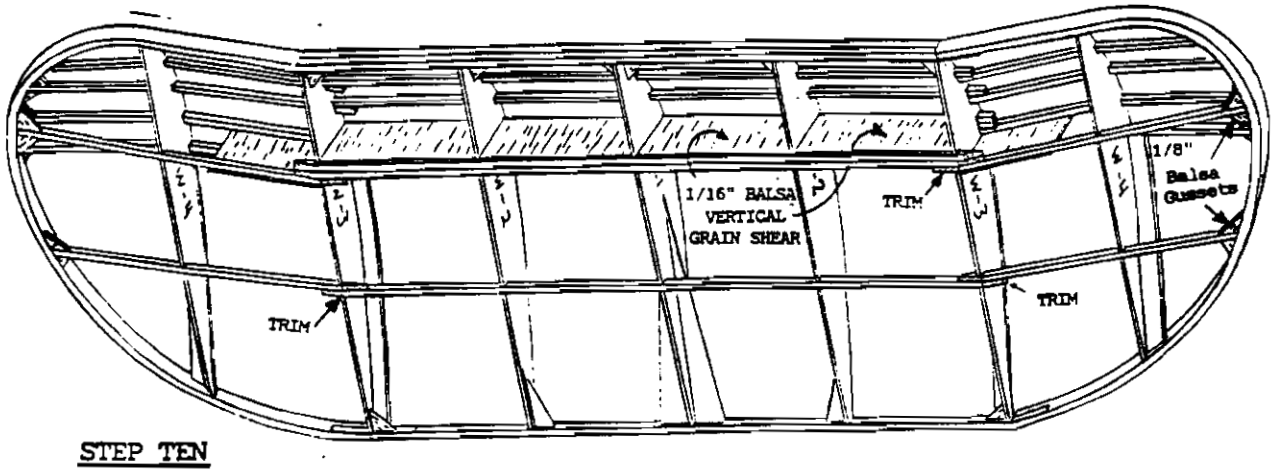
Cut the two lower spars for each wing tip. Fit the spars into the rib notches and glue them into place.



STEP NINE

Carefully trim off the portion of the lower spars that extend below the wing surface at the dihedral lap joints. Then cut out the gussets that go where the lower wing spars meet the wing tip laminations. Glue the gussets into place.

Add the vertical grain shear webs between the upper and lower main wing spars. It is not important for the webs to fit tightly against the wing ribs. It is important that they don't protrude beyond the spars, though.



STEP TEN

Take a modeling knife or razor plane and carve the leading edge, trailing edge, and wing tips. The cross sections of each should match the shapes shown in the plans. Then use a sanding block and sandpaper to sand all of the wing surfaces smooth that will contact the covering.

CHAPTER FIVE - FUSELAGE

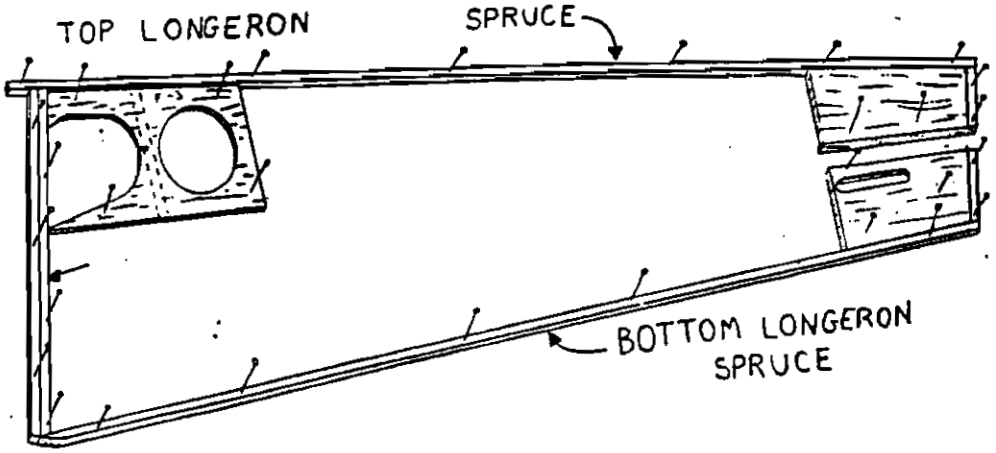
PREPARATION FOR BUILDING THE FUSELAGE

The fuselage is built using the side frame method. You will build two side frames - a left side and a right side. The right side is built first, directly over the plans. Then the left side is built over the right side. Collect all of your fuselage parts from your kit, or if you bought the plans, cut out all of the sheet balsa fuselage parts. The sticks should be cut to length directly over the plans. It saves time to cut the sticks for both the left and right side frames at the same time. Cover the plans with clear plastic wrap before you begin.

BUILDING THE RIGHT SIDE FRAME

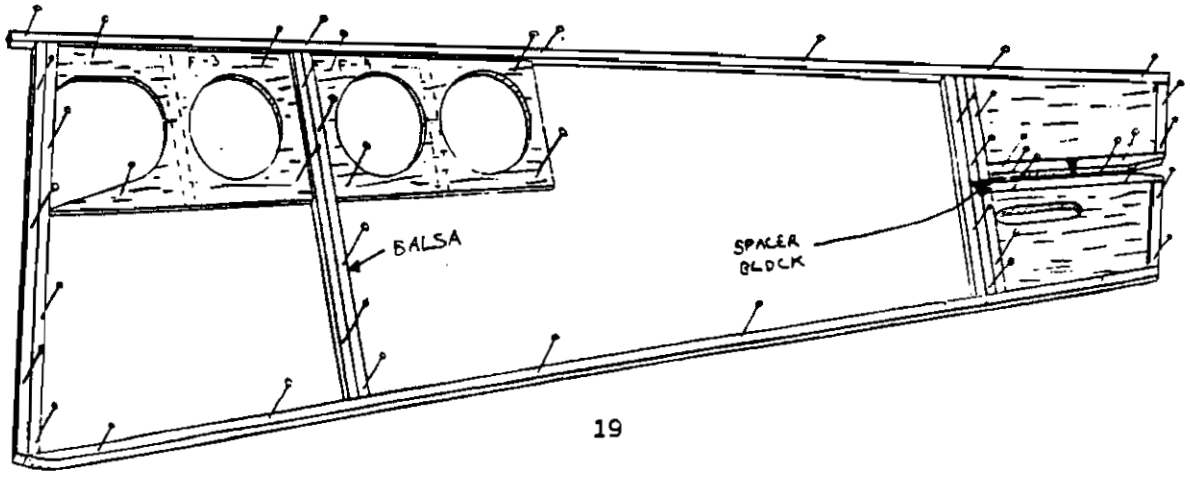
STEP ONE

Begin by cutting the spruce (or basswood) longerons to length and pinning them in place over the plans. Cut the four balsa sticks shown in the drawing to length and pin in place. Pin F-3 (front window section) in place. Cut the sheet balsa parts for the tail area and glue into place as shown. You may need a sanding block to sand the edges of the parts for a perfect fit. Make all of these parts for both side frames.



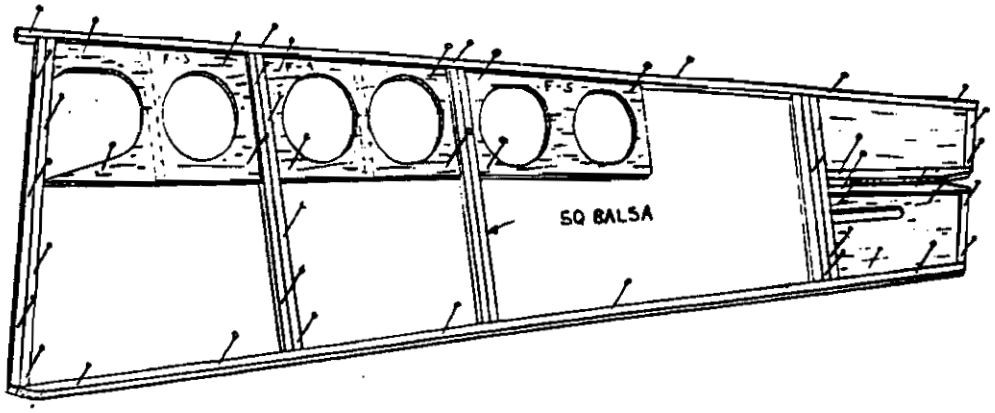
STEP TWO

Cut the additional balsa sticks to length and pin in place on plan as shown. Pin F-4 (middle window section) in place.



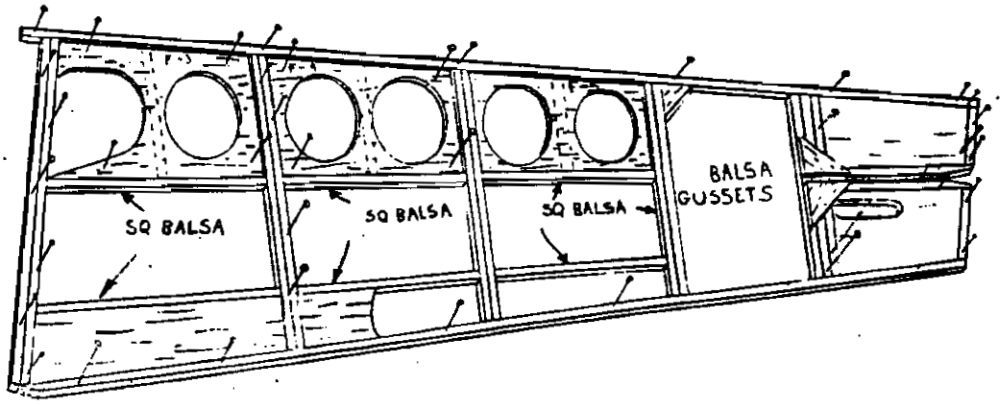
STEP THREE

Cut the next two balsa sticks to length and pin in place. Pin F-5 in place.



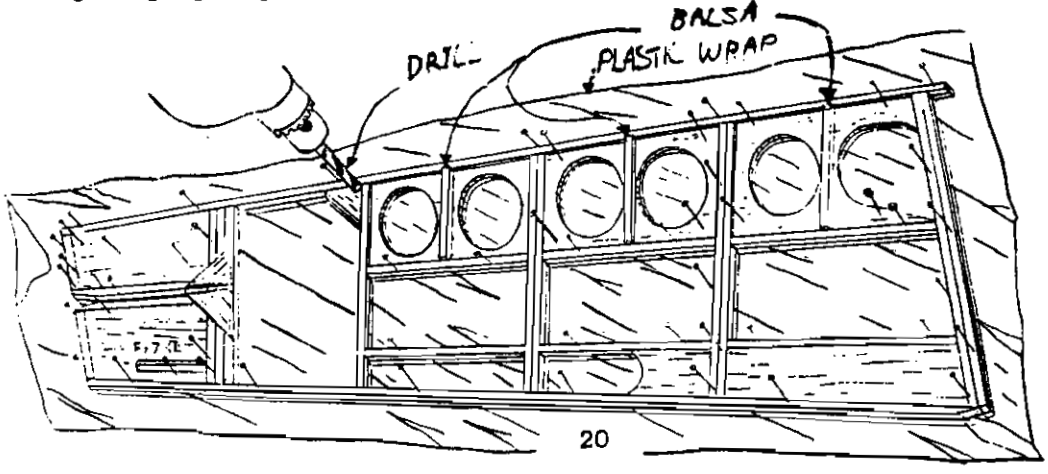
STEP FOUR

Cut the balsa sticks to length for the remaining spaces and pin in place. Squirt a drop of CA into each glue joint. Cut and fit the sheet balsa pieces and pin in place. Then glue in place. Cut the sheet balsa gussets and glue in place. Allow glue to dry and remove from plan.



STEP FIVE

Flip the completed right side frame over and cover with clear plastic wrap. Build the left side frame over the flipped-over right side frame by repeating steps 1 - 4. Before you separate the two side frames, make sure both side frames are aligned properly, then drill the holes for the rear wing hold-down dowel.

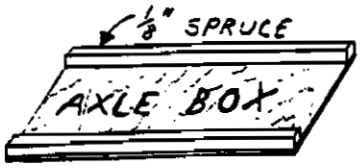


STEP SIX - PART A

Laminate three plywood B-1 parts together with 5 minute epoxy. Set this on a flat surface covered with plastic wrap and place a flat, heavy object (like a big phonebook or dictionary) on top.

* Note: (Optional) You can use four plywood B-1 pieces if you want.

Assemble the Axle Box. Start by cutting the two spruce (or basswood) sticks to length. Use 5 minute epoxy to glue them to one of the plywood axle box pieces and let dry.

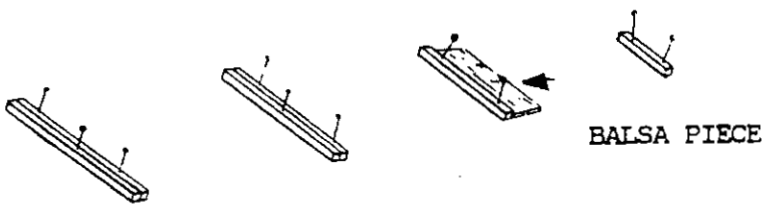


STEP SIX - PART B

Using 5 minute epoxy, coat one side of the remaining plywood axle box piece and the inside surfaces of the other one, including the attached spruce sticks. Now join the two with the epoxied surfaces facing inwards. Clothespins make excellent clamps to hold this assembly together while it is drying.

STEP SEVEN

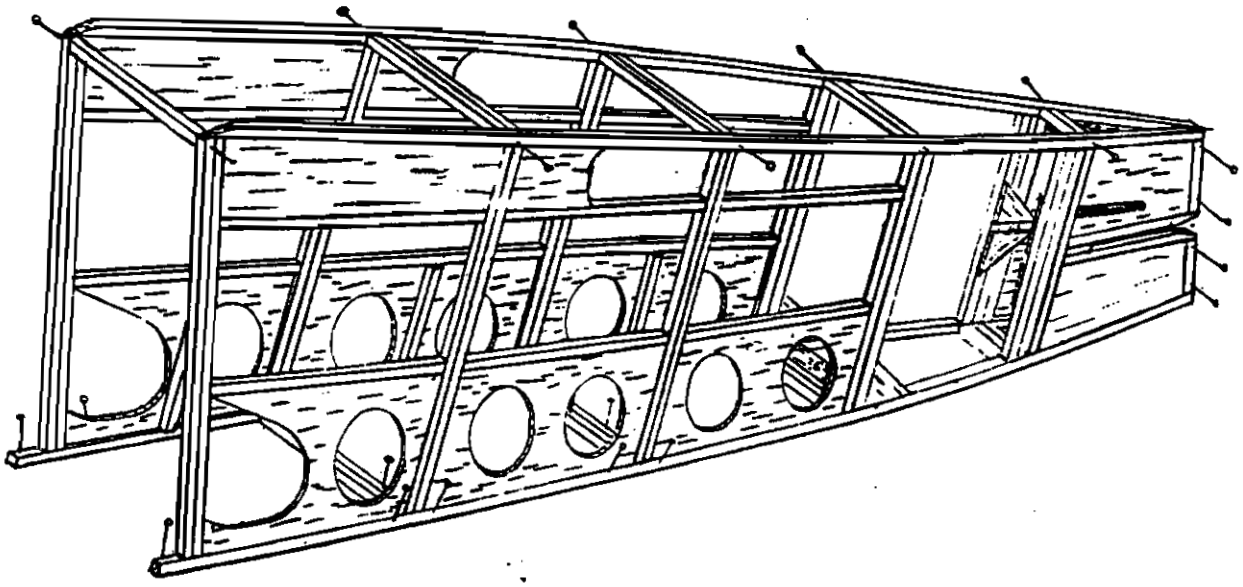
Pin the top view over your work board. You will need at least six inches of smooth, flat surface on each side of the top view. Cut all the sticks needed for cross pieces at each station. Use the top and cross sectional views of the plans to find out the lengths and quantities that you need to cut. Cover the top view with clear plastic wrap. Pin the sticks in place over the top view as shown in the drawing, and glue the sheet balsa piece to the appropriate stick.



FUSELAGE - BOXING UP

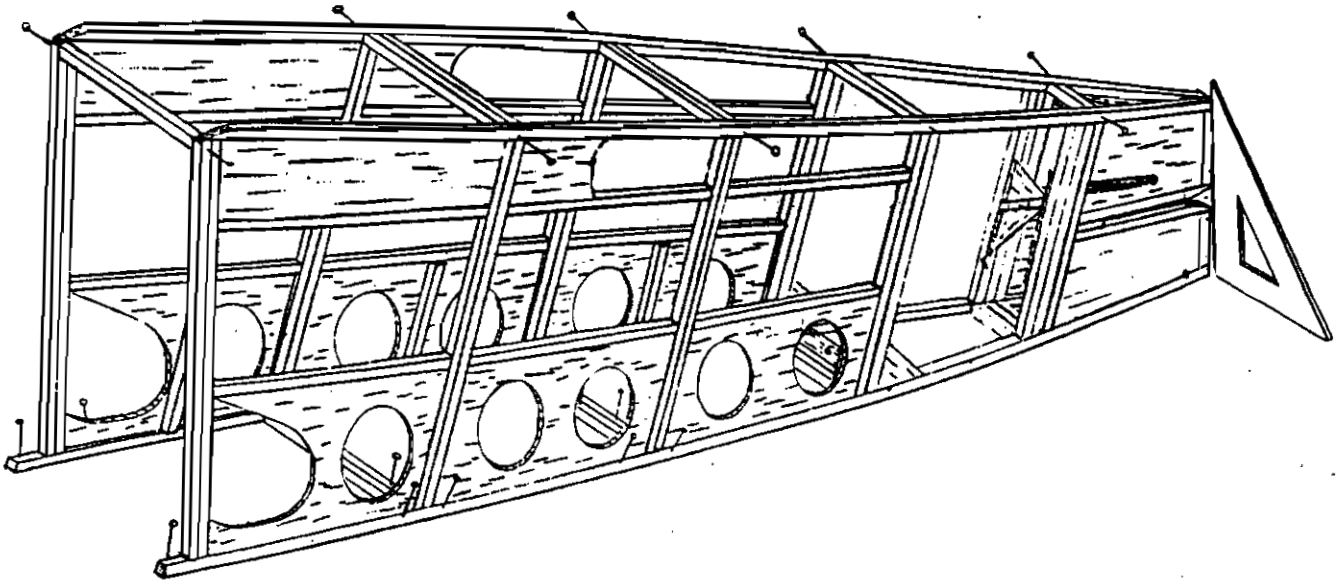
STEP EIGHT

You may need a helper for this step. Pin each side frame (upside down) to the plan standing up vertically. Pin the tail posts together. Pin the cross pieces in place between the two bottom fuselage longerons. Don't glue anything yet. Don't let your helper leave yet.



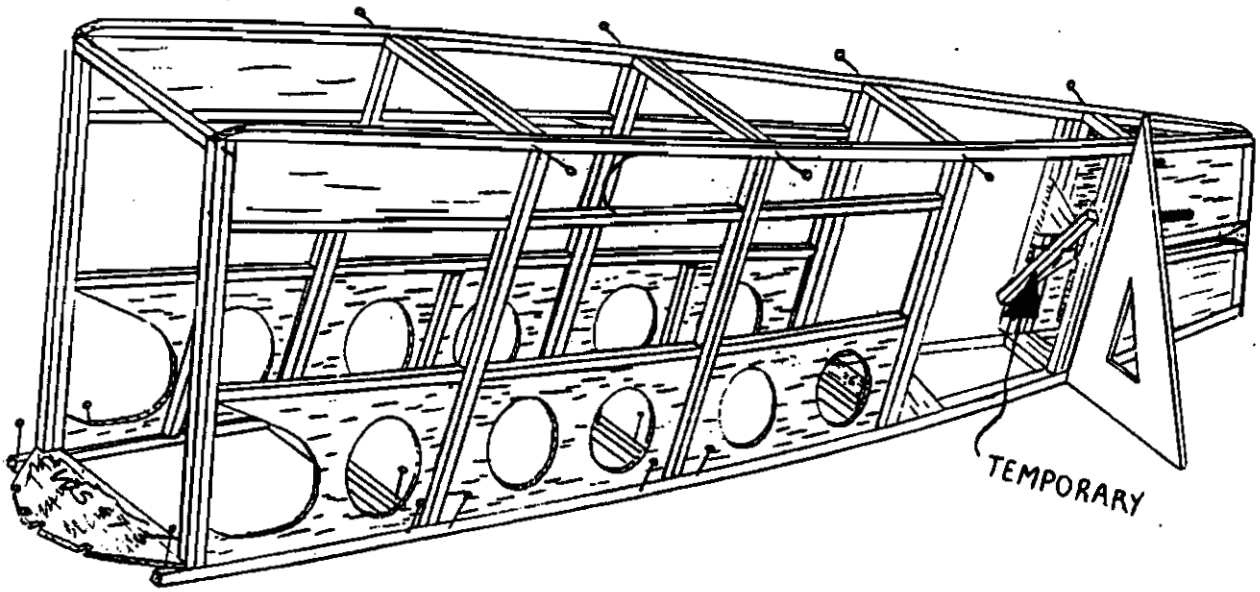
STEP NINE

Use a drafting triangle or a square to hold the two tail posts tightly together and at a right angle to the plans. You may need to remove the pins from the tail posts. Flow a couple of drops of CA into the joints and hold until dry. Also CA WS-1 into place. Note: WS-1 is now 2 pieces of plywood, don't use the balsa pieces.



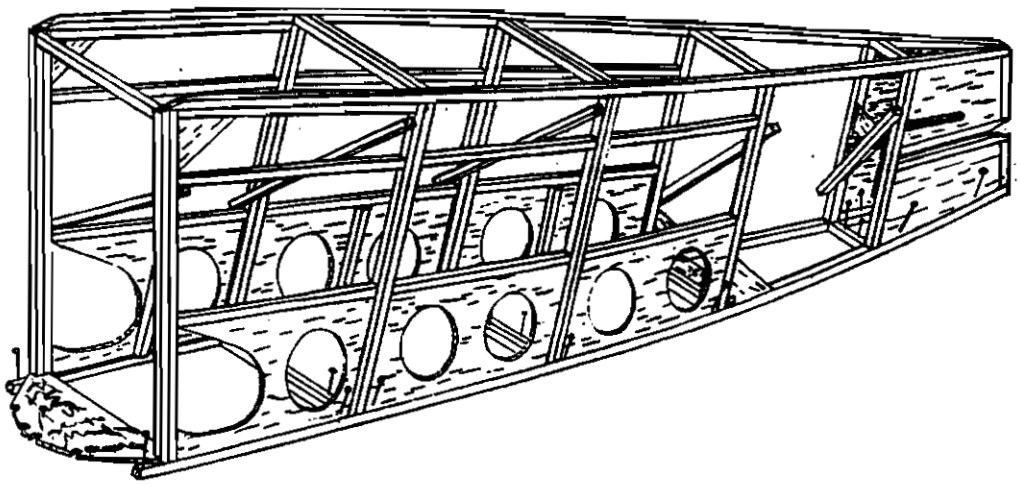
STEP TEN

Glue in a temporary 1/8" square diagonal brace while holding section E-E square. Hold until the glue dries and then squirt a drop of CA into the top and bottom cross piece joints.



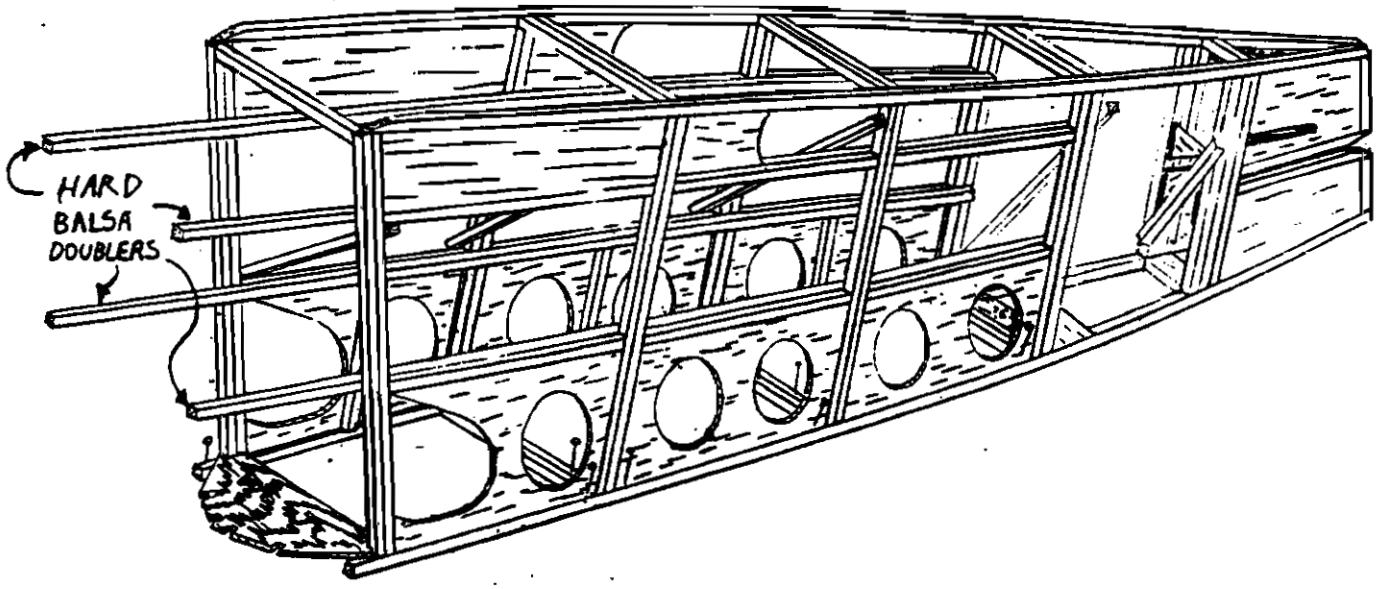
STEP ELEVEN

Repeat the procedure of installing temporary diagonals at all of the remaining cross sections and squirt a drop of CA into the remaining cross piece joints. You should start at the tail and work toward the nose. When you are done with this step the fuselage should look like the drawing.



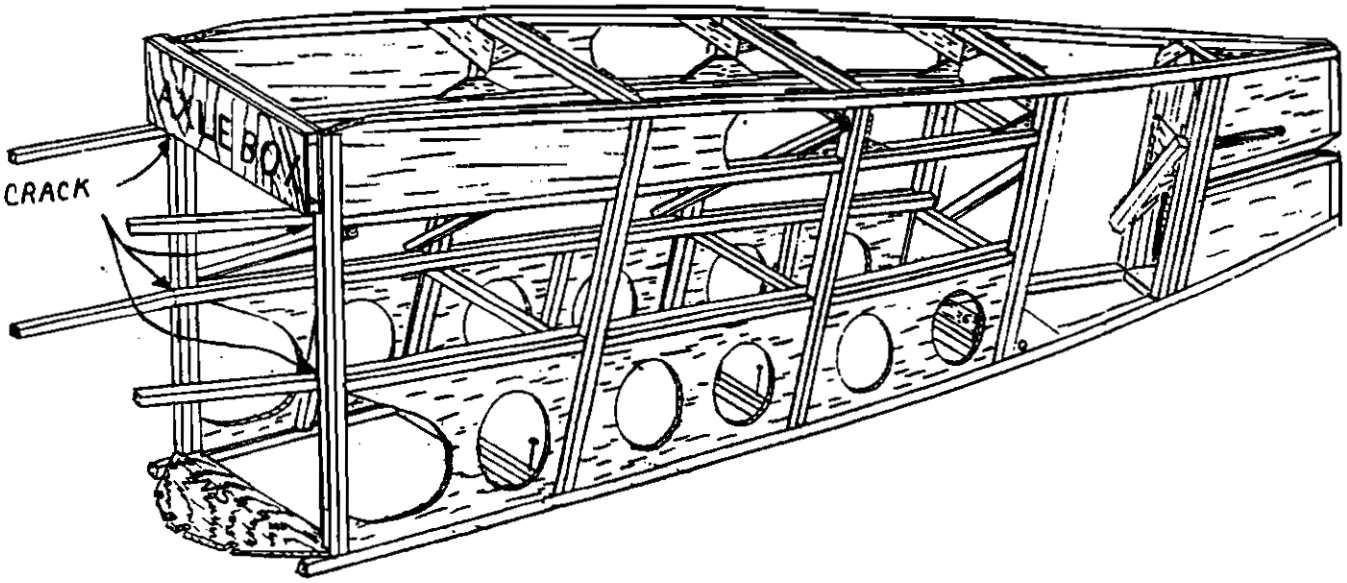
STEP TWELVE

Cut the four 1/8" square hard balsa stick doublers to length using the fuselage plan side view as a guide. Make the front ends of these 1/8" shorter than the side view shows. This is to account for the taper of the nose. Clamp or pin the sticks in place and flow CA into their joints. Install the additional cross pieces using CA.



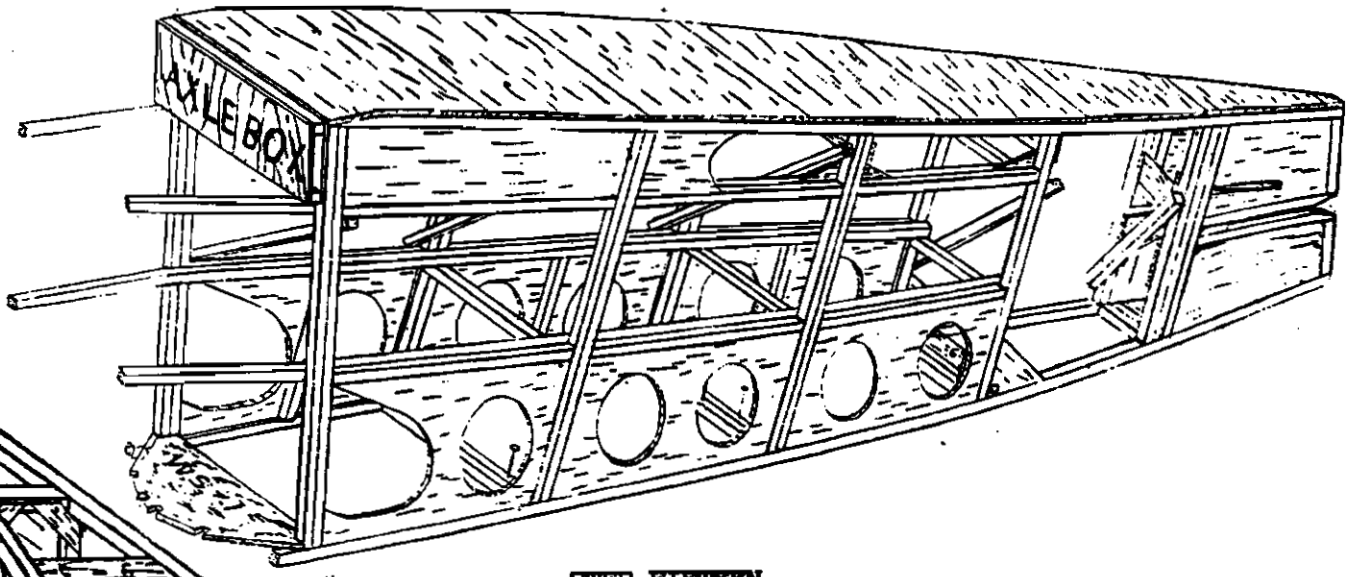
STEP THIRTEEN

Glue the 1/16" scrap sheet balsa gussets in place as shown in the side, top, and cross sectional drawings. CA the axle box in place, making sure that it hangs over the bottom of the fuselage frame 1/16" as shown in the side view of the plans.



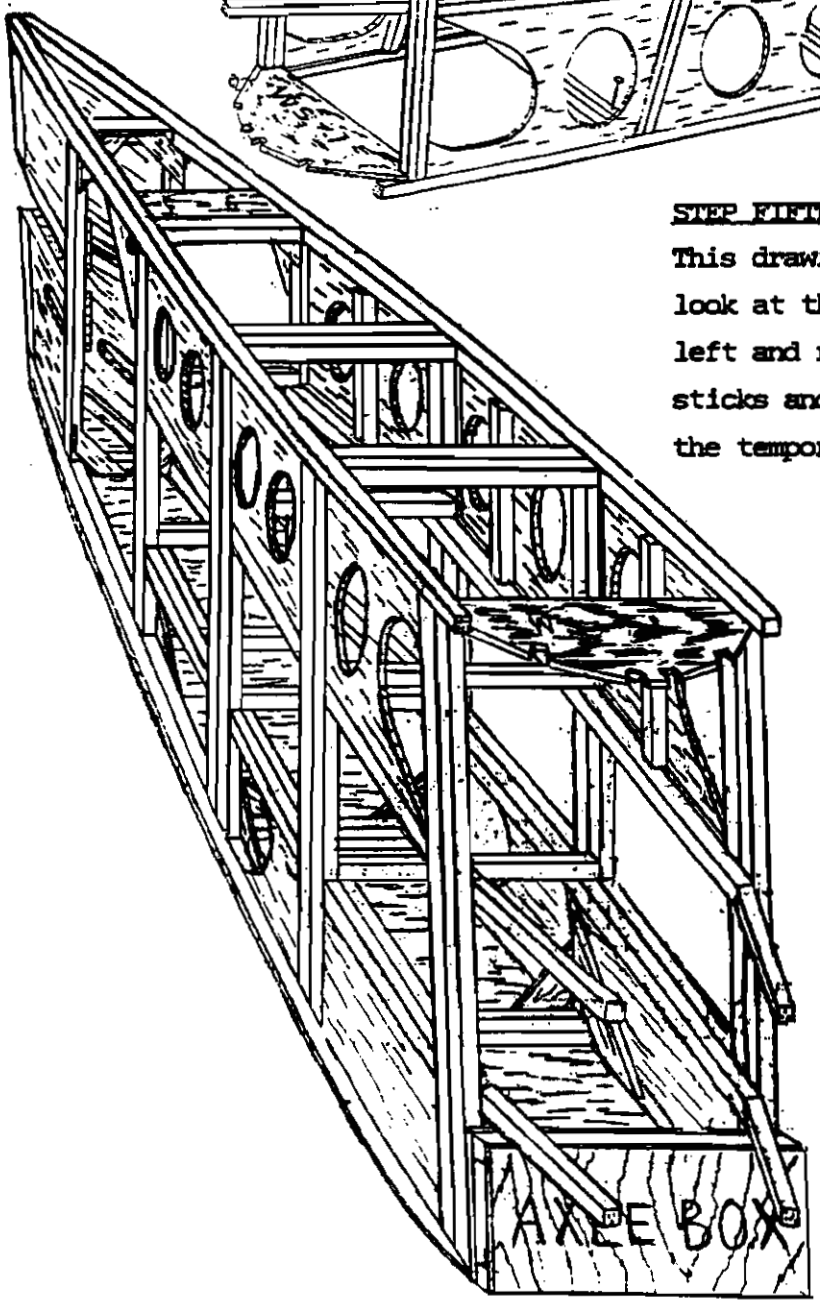
STEP FOURTEEN

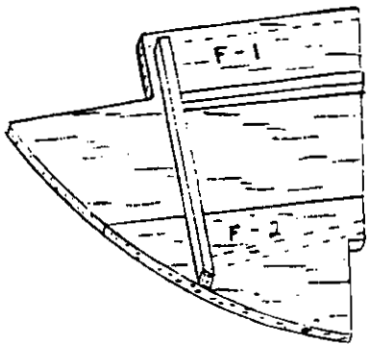
Carefully remove all pins from the fuselage frame and remove the fuselage from the plans. Cover the bottom of the fuselage from front to rear with hard 1/16" sheet balsa cross grain. (grain runs from side to side)



STEP FIFTEEN

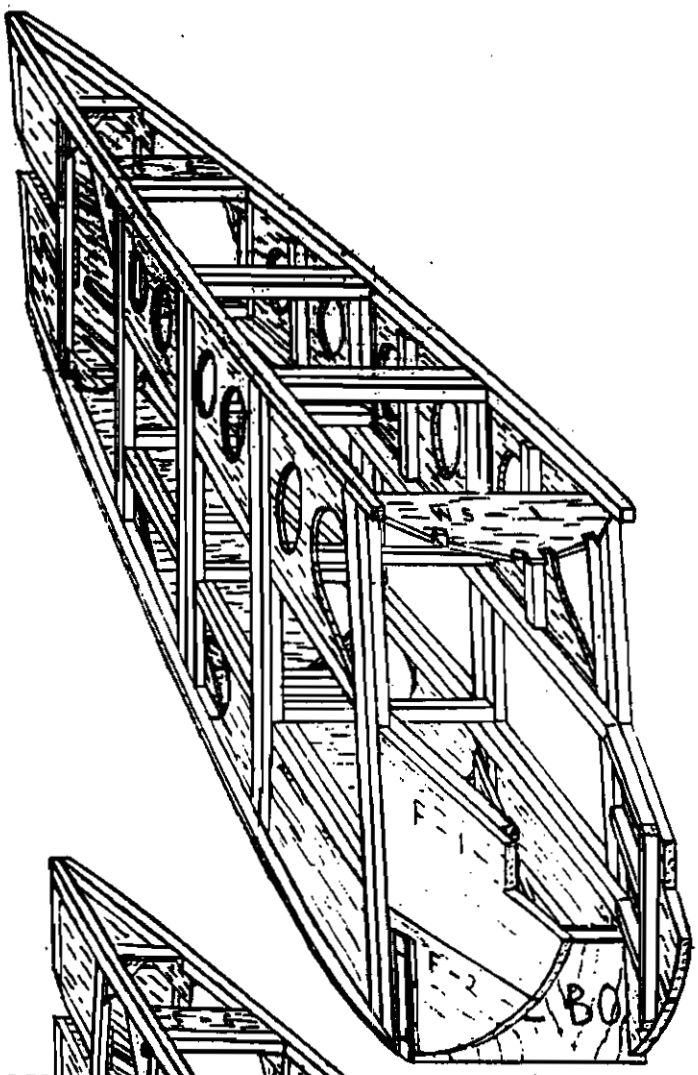
This drawing shows how the fuselage frame should look at this stage in the construction. Make the left and right nose cheek assemblies using balsa sticks and the parts F-1 and F-2. Remove all of the temporary diagonal braces.





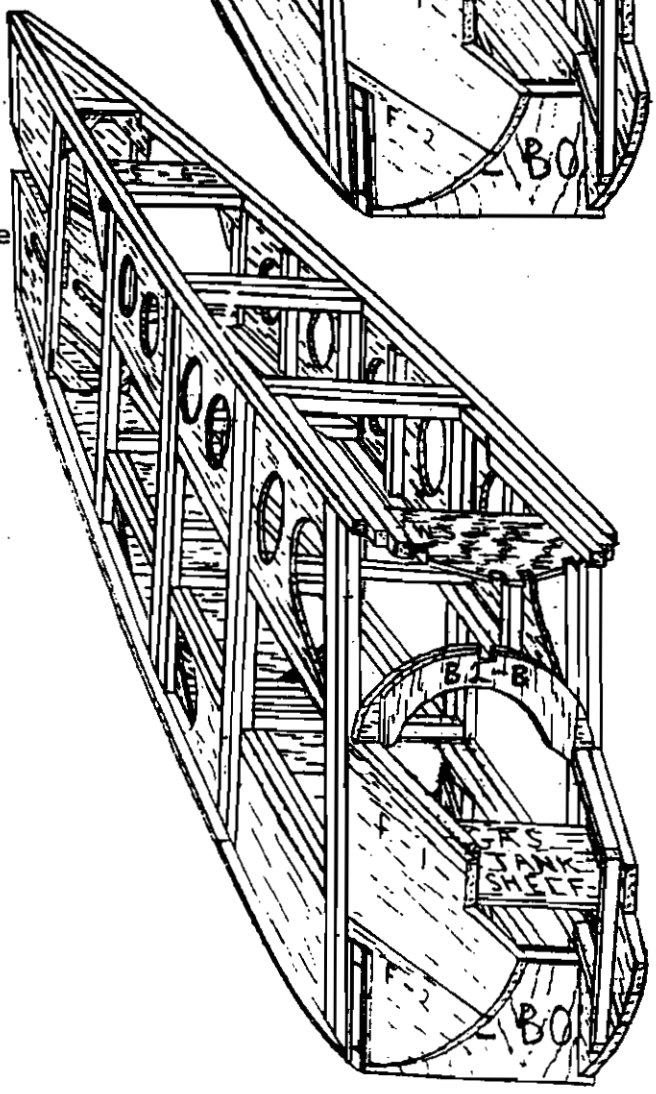
STEP SIXTEEN

Bevel the rear edges of the nose cheek assembly with a sanding block and glue them into place. Glue the gas tank shelf in place. This will give the cheek assembly the correct angle.



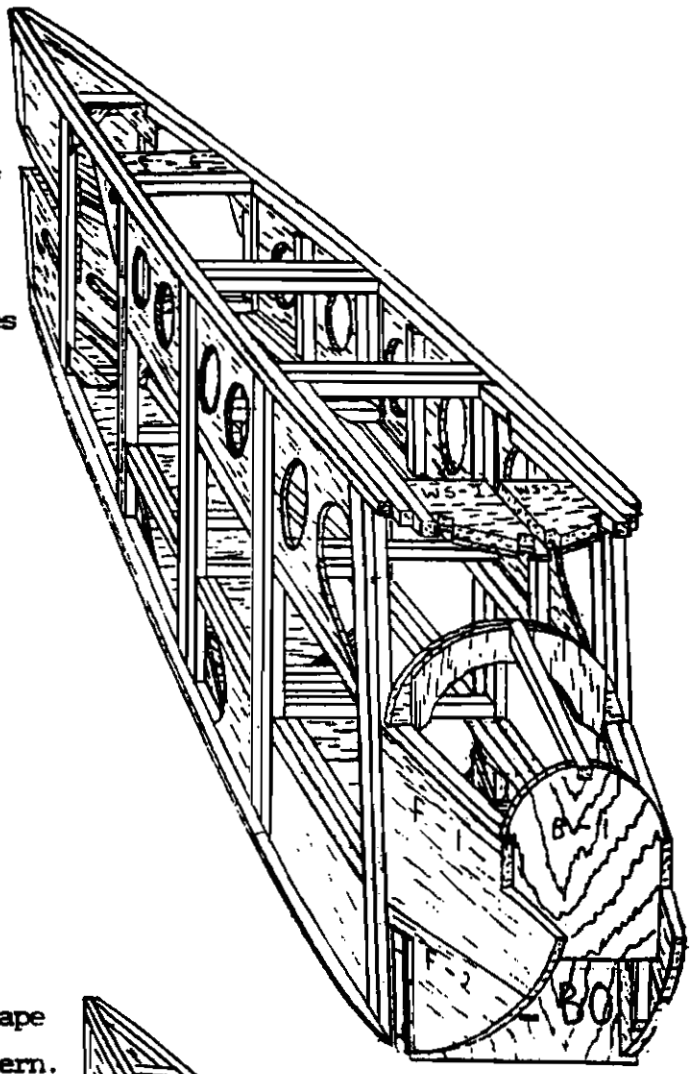
STEP SEVENTEEN

Laminate B-2A and B-2B together and glue in place Cut and glue 1/8" square balsa sticks in place in the top front cabin area of the fuselage.



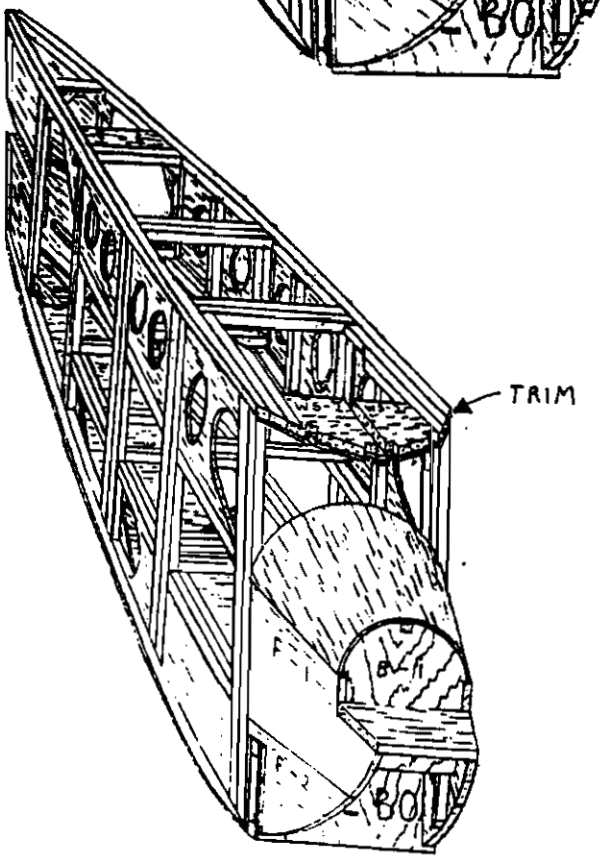
STEP EIGHTEEN

Using 5 minute epoxy, glue B-1 in place and let dry. Cut the stick that connects B-1 to B-2 to length. Use the side view of the plans to get the right length. Glue it in place with CA. This should set B-2 to the correct angle. Glue the WS-2 pieces into place.



STEP NINETEEN

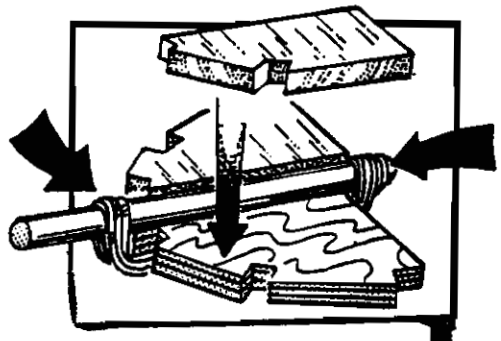
Apply the sheet balsa to the area between B-1 and B-2. You may want to trace the shape onto a piece of paper and use it as a pattern. If you have trouble bending the curve into the wood, soak it warm water. Use white glue to glue it in place wet. Secure with pins until dry. Otherwise, just use CA. Trim the ends off the square balsa sticks that protrude where the top corners of the windshield will be.



To make the firewall extra strong you should fillet the inside corners where the firewall meets the fuselage sides and curved top. To do this push a pile of balsa sawdust up into these corners and pack it down. Repeat until the packed sawdust is as wide as your thumb. Then dribble in some thin CA (be generous) and let dry. (Or you could use epoxy by mixing it with the sawdust and using it like putty.)

STEP TWENTY

Apply two layers of 1/16" hard sheet balsa to the bottom of the fuselage. Soak in warm water if necessary. Cut and fit the 1/8" square balsa sticks that form the windshield frames. CA in place.

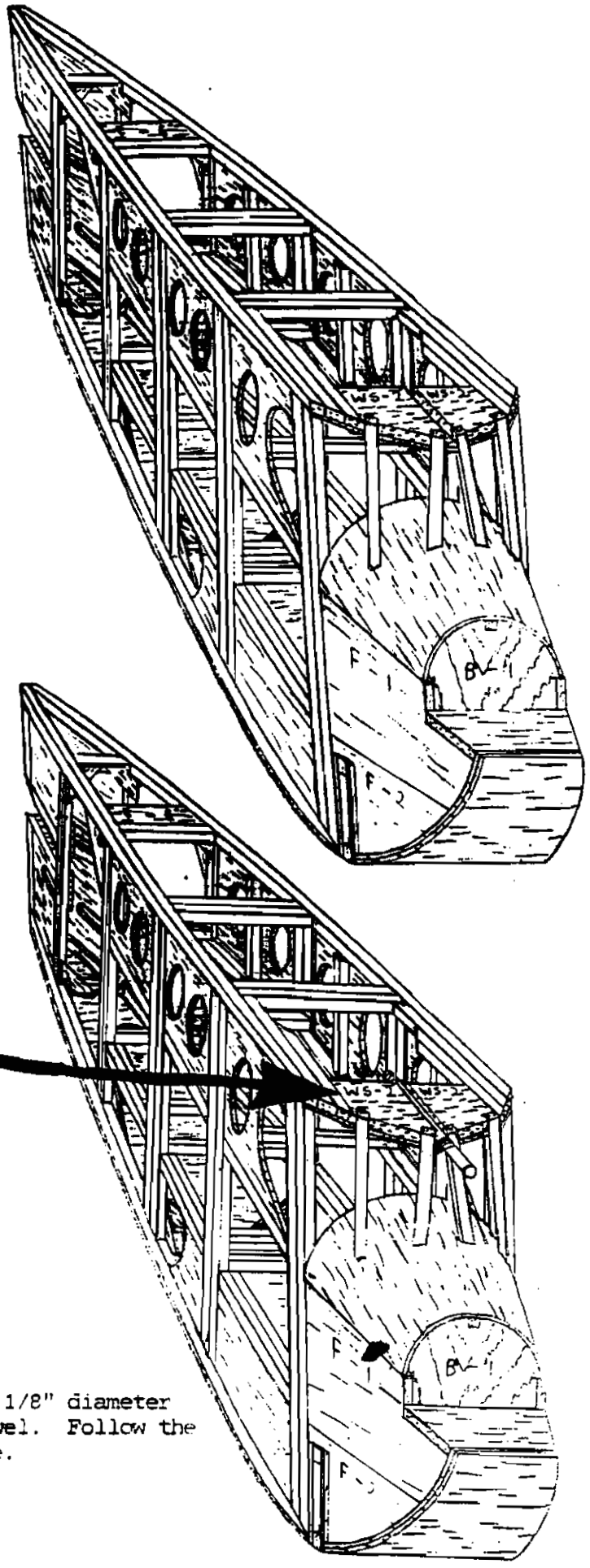


VERY IMPORTANT STEP!

STEP TWENTY ONE

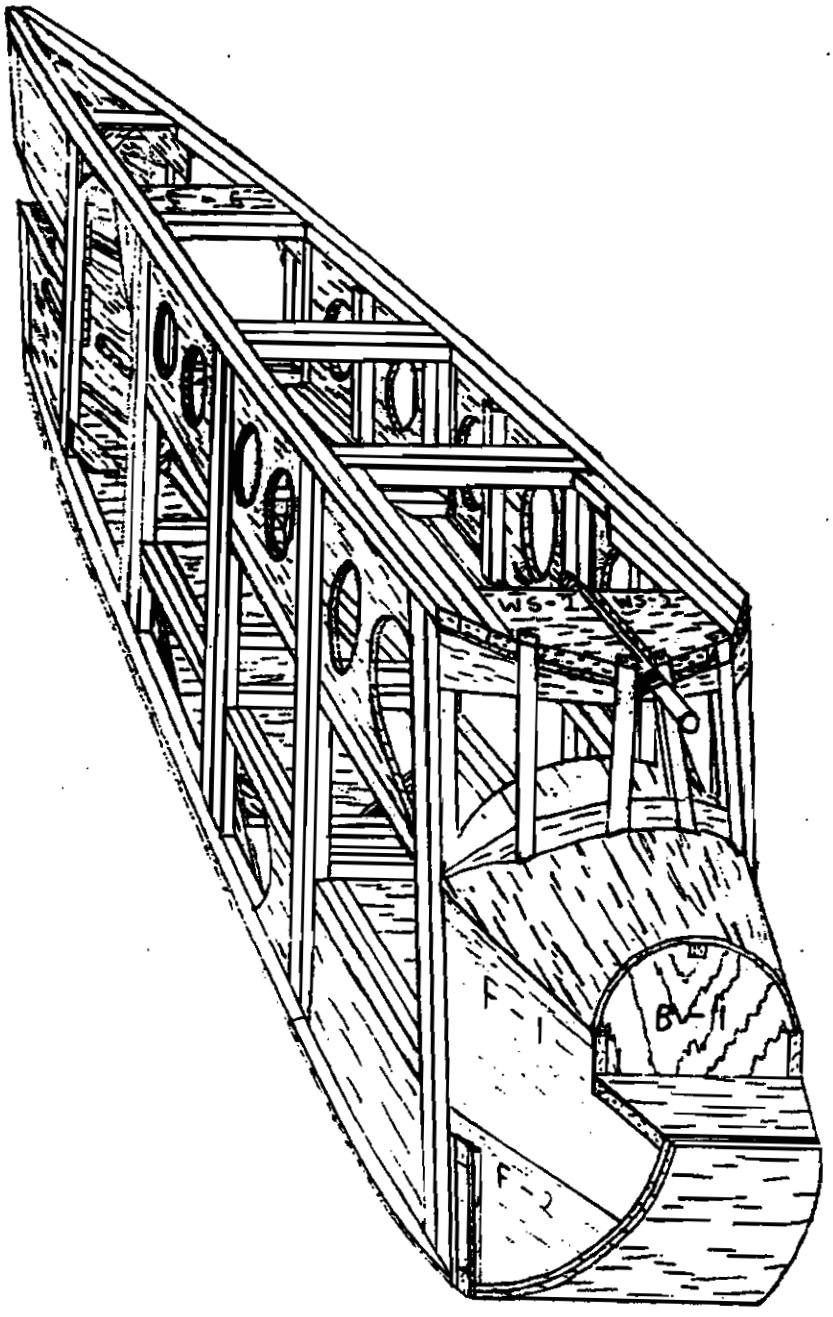
Cut to length the 1/8" diameter bamboo dowel for the front wing hold-down. Epoxy the dowel in place between the WS-2 pieces. It should protrude about 1/8" inside the fuselage. Wrap sewing thread around each end of the dowel and under WS-1 about 20 times and then soak with CA and let dry.

NOTE: For extra heavy duty use, sustitute a 1/8" diameter piece of music wire for the bamboo dowel. Follow the same wrapping procedure outlined above.



STEP TWENTY TWO

Cut and fit into place the sheet balsa pieces at the top and bottom of the windshield. Glue them into place. Carefully sand all outer surfaces of the fuselage using a sanding block. Emery boards or fingernail files work well for sanding in tight spots like the windshield area. You may also paint the inside of the cabin area with colored dope. Dope the windshield frames with a color that matches your planned color scheme.



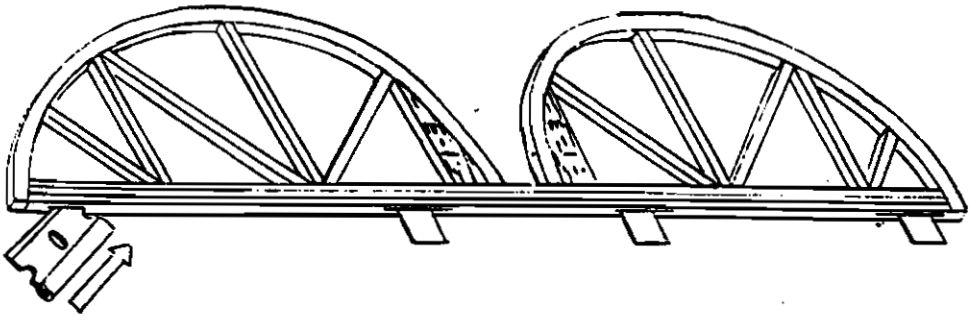
CHAPTER SIX - BUILDING THE TAILFEATHERS

HORIZONTAL STABILIZER

Sand until smooth and the leading edge corners are rounded. The lightening holes are optional. If you install a large engine, like a .15 or .26, you probably do not want any lightening holes. If you use a lightweight engine, like an .049, the lightening holes may help keep the plane from being tail heavy.

ELEVATOR

The elevator is built directly over the plans the way the fuselage side frames were built. Make the laminated parts as explained in Chapter 3. Use medium weight balsa sticks for the spar. All of the remaining sticks should be the lightest ones available. The drawing shows how the completed elevator should look. Use a sanding block to smooth all of the outer edges. The leading edge of the spar should be rounded off and smooth.



NOTE: The razor is pushed *backwards* to make a wider slot for the hinges.

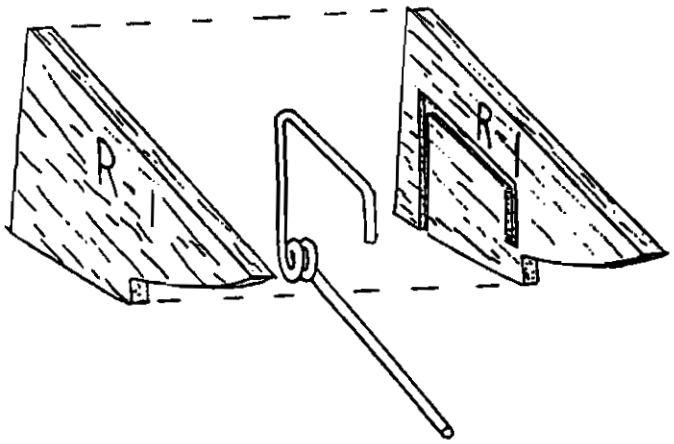
RUDDER

Begin by making the laminated outer edge of the rudder; the procedure is outlined in Chapter 3. While you're waiting for the lamination to dry, you can work on the first two steps.

STEP ONE

Take an R-1 piece and align it in place under the plan. Carefully trace over the dotted line with a pencil so that the pencil makes an indentation in the wood under the plans. Turn the plan upside down and repeat the procedure with the other R-1 piece. Cut a groove about 1/32" deep along the outline made by the pencil, then gouge out the area between the outlines. You should have a 1/32" deep groove that is 1/16" wide mirrored on each of the R-1 pieces.

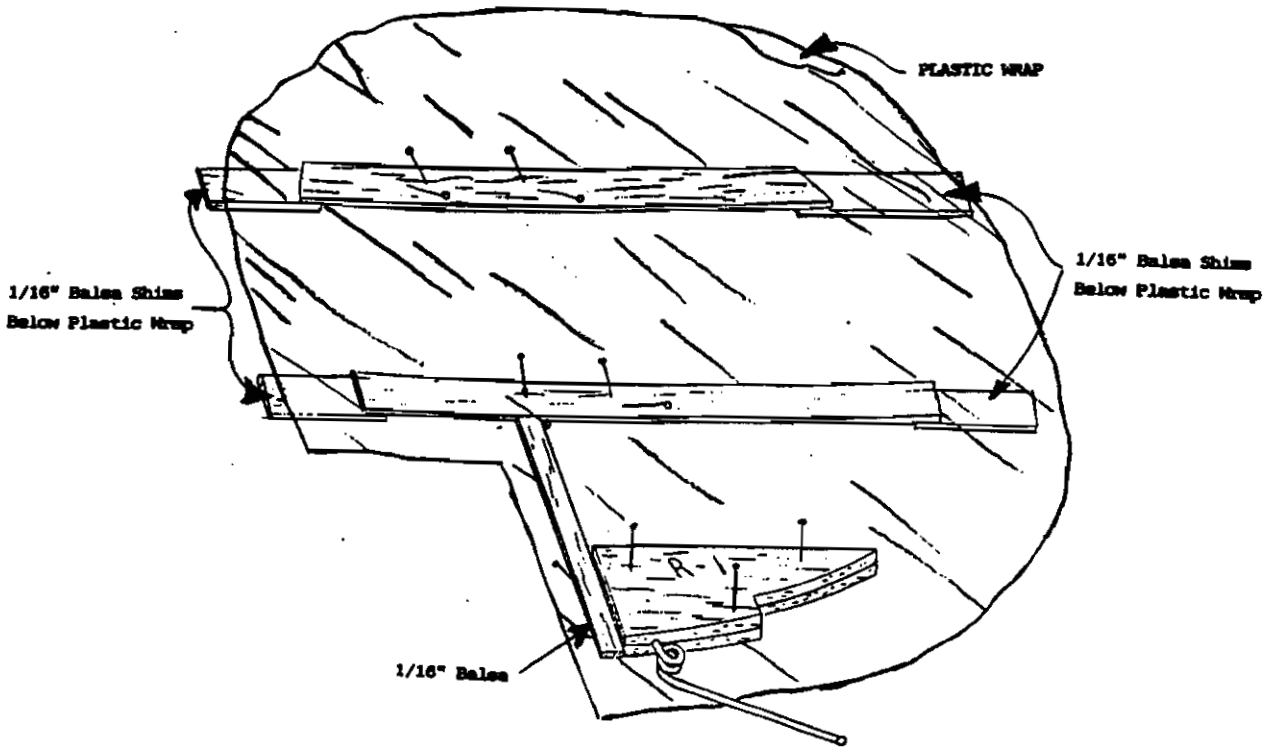
Bend the tail spring so that the upper portion of the spring matches the R-1 groove. Trim off any excess length with wire cutters. Trim the lower portion of the wire to three inches. Do not make the bend for the wheel axle yet.



Test fit the tail wheel spring by sandwiching it inbetween the R-1 pieces. It should fit into the groove when both pieces are touching. You may need to enlarge the groove to get a good fit. Once the fit is good, use 5-minute epoxy to bond the spring inbetween the two R-1 pieces.

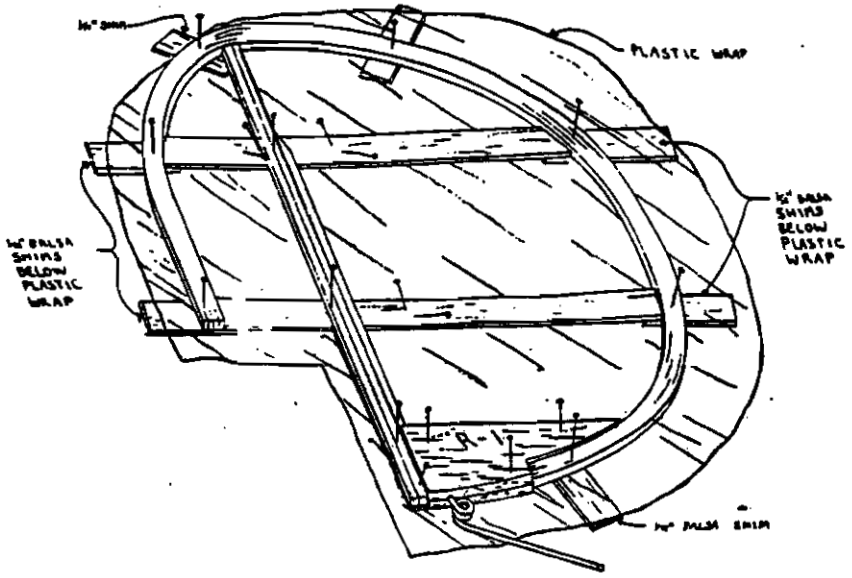
STEP TWO

Cover the plans with clear plastic wrap and pin the completed R-1 assembly in place over the plans. Cut both pairs of the 1/16" x 1/2" balsa strips to length per the plans. Pin one strip from each pair in place on the plans. Place a piece of 1/16" thick scrap balsa under each of the two balsa strips. Be sure to place them under the plastic wrap as well. Then pin the 1/16" sheet balsa in place on top of the plans.



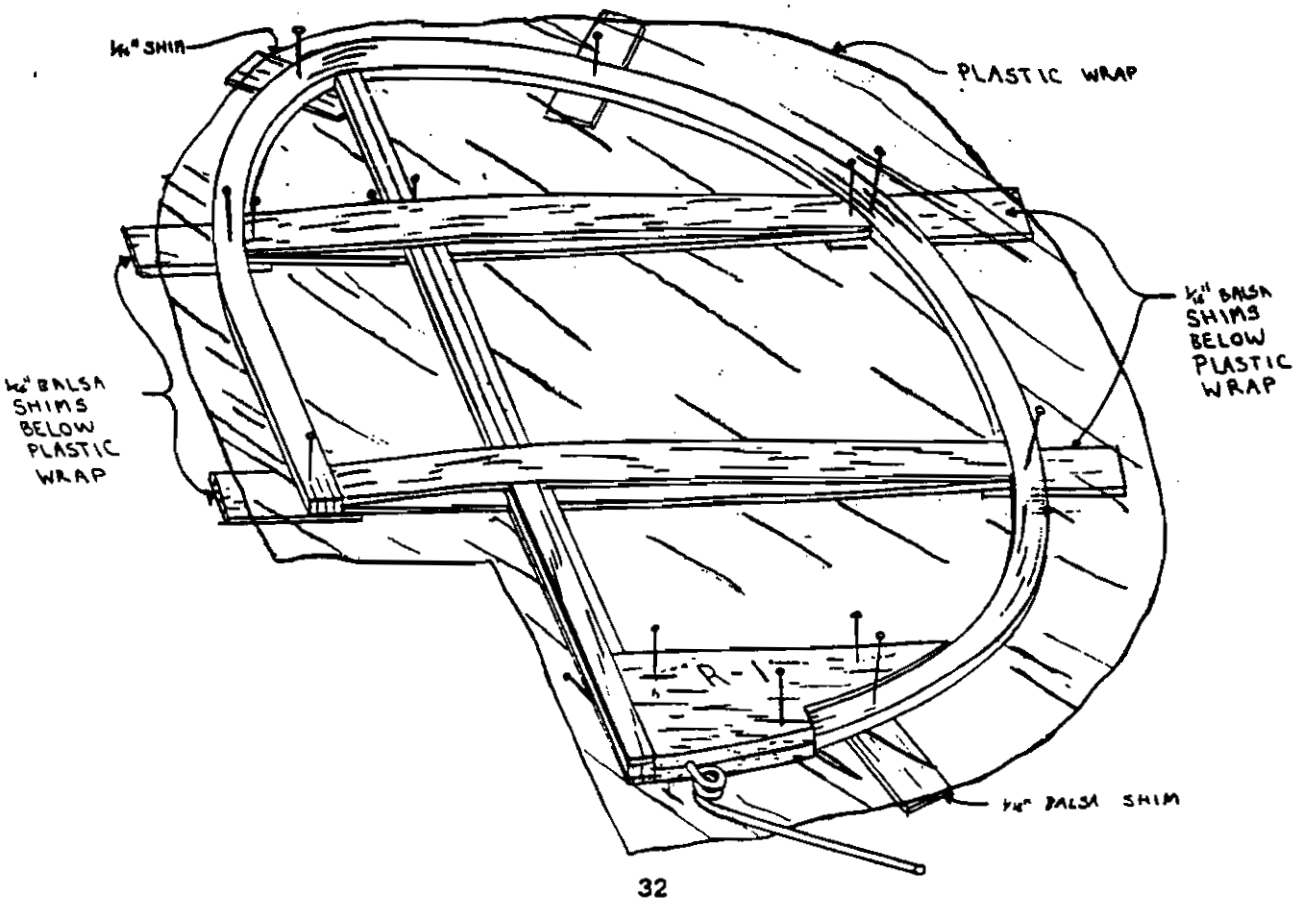
STEP THREE

Cut the 1/8" square balsa sticks to length for the rudder spar, glue them together, and then pin the assembly into place on the plans. Pin the laminated rudder outline into postion over the plans. Place 1/16" sheet balsa under the plastic wrap so that the laminated piece is raised 1/16" above the plans.



STEP FOUR

Pin the two remaining 1/16" x 1/2" balsa strips into place and put a drop of CA into each joint. Once the glue is dry, glue the 1/16" sheet balsa fill-in piece into place above the rudder spar as shown. Remove the rudder assembly from the plans.

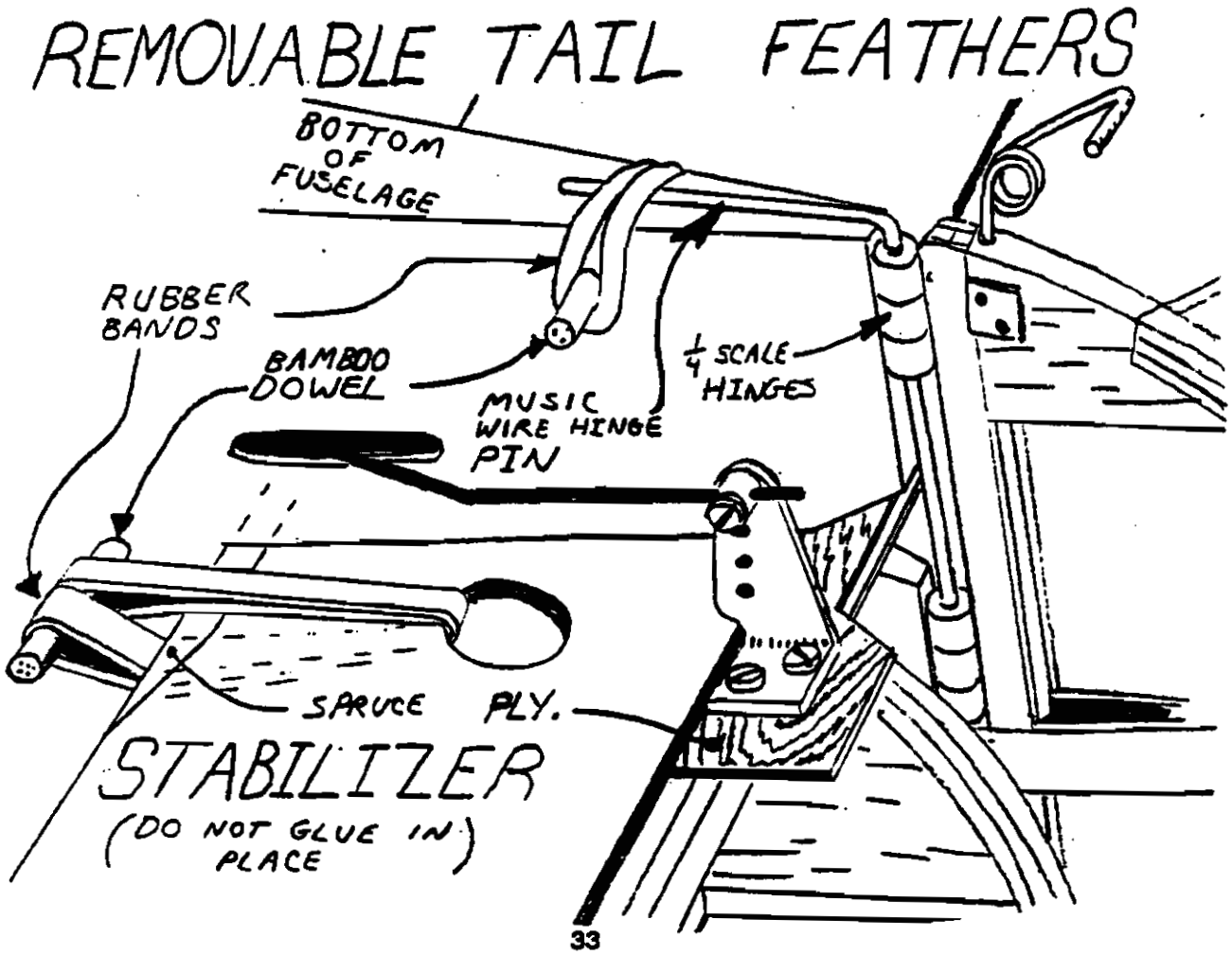


Bend the axle portion of the tail wheel spring. The axle should extend about 1/4" beyond the edge of the tail wheel. Trim off any excess length. Cut the hinge slots in the fuselage and rudder spar, then test fit the hinges in the slots. Drill the 1/16" screw holes to mount the control horn and then temporarily mount the control horn and check the fit. Remove the control horn and the hinges and sand all the outer surfaces until they are smooth.

REMOVABLE TAIL (OPTIONAL)

A removable tail on your Lazy Bee make storage, transport, and repairs easier to accomplish. In addition, the rubber band mounting for the stabilizer makes it less likely to be damaged in a crash. I use 2 #30 rubber bands per side to attach the stab for the Lazy Bee (40" & 48" wing); I use 3 #30 rubber bands per side of the stab for the Big Lazy Bee (60" & 72" wing.) The rudder hingepin is held in place by 2 #30 rubber bands for both Lazy Bee sizes.

Refer to the drawing below for installation details. The plans show where to position everything. When you glue the rudder hinges in place, you should have the covered stab in place.



CHAPTER SEVEN - COVERING WITH LITESPAN

COVERING WITH LITESPAN

Litespan is an iron-on, heat-shrink covering that looks like heavily doped tissue paper. It is by far the lightest weight iron-on covering available. Unlike most coverings, Litespan is not pre-glued - you add the glue (Balsaloc) yourself. This is more work, but it saves considerable weight since you only put glue where it is needed.

Litespan has a clear plastic backing on its outer (top) side. This is to prevent glue from getting on the wrong side of the covering. Leave this backing on until just before you apply the covering to the model.

We have provided patterns for the more difficult pieces of covering in the two tone covering scheme used on the Lazy Bee prototypes. Note that some of the patterns are only half patterns and that some patterns are for the base color and some are for the trim color. You will need three large sheets of Litespan (72 inches long): two in the base color and one in the trim color. If you don't have much covering experience or patience, you may wish to use a simpler covering scheme such as single color wing and tail with another color for the fuselage.

USING THE PATTERNS

Begin by cutting out the covering patterns that we have provided; a razor, X-ACTO, or sharp scissors will work fine. The easiest way to cut out the pieces of covering is to unfold a sheet of Litespan and spread it out over your work table with the plastic backing side down. Tape it down tightly with Scotch tape at about 12" intervals along the edges. If you don't have a large enough area to unfold a full sheet of Litespan, just tape down a portion as large as the biggest pieces you need to cut.

Cut the bigger pieces of covering first and cut the smallest last. Place the patterns on the taped down sheet of covering and cut around the pattern with a sharp razor. Use a steel straight edge as a guide for cutting along straight lines.

Litespan has a grain which runs lengthwise through each sheet. The patterns indicate which way the grain should run for each piece.

Covering patterns are not provided for the base color pieces of the stabilizer, rudder, and elevator. You can just lay the parts down directly onto the covering and cut out their outlines. You'll need to cut about 3/4" out from the edge of each part to be sure that you have enough material to cover the part properly.

Once all the covering is cut out, use a small sponge to apply Balsaloc to the back of each piece. Spread Balsaloc on the outer 1 1/2" of each piece. You should also apply the Balsaloc to the outer surfaces of all frames.

Now it is time to start covering the plane. A good general rule is to cover the lower surfaces before covering the upper ones. This ensures that overlapping pieces of covering will act like shingles - spilled fuel will run down and over the seams, not down and into them!

When applying the trim don't coat the entire backside of the Litespan trim pieces with Balsaloc; this will trap air bubbles, not look good, and add unnecessary weight. You should coat only the outer 1/4" of the back on the trim pieces.

You should allow the Balsaloc 10 or 15 minutes to dry before ironing to plane. Litespan can still be ironed down several days, or even weeks after applying Balsaloc, although the longer you wait after it's dry, the less effective it becomes. The Litespan ironing temperatures given in the instructions which come with each Litespan sheet are too low. Just start with a low iron temperature and gradually increase the temperature until the Litespan sticks down properly. Litespan shrinks best with a heat gun. It does not shrink during the application of the heat; it shrinks as it cools down after being heated.

When you cover the fuselage, cover the windows as if they aren't there. Shrink the covering tight. Dribble CA around the inside edge of each window frame and allow to dry. Then, cut the covering out from each window hole.

WINDOWS

Make the windows from the clear Mylar (provided with kit & plans). The Mylar is a heat-shrink, iron-on film, with the adhesive on the matte (dull) side. There is no backing to remove, the adhesive is heat activated. It loses its slightly foggy appearance and clears up when the iron reaches the right temperature. If it turns yellow, the iron is too hot. The lid from the Balsaloc jar makes an excellent template for cutting out the porthole windows. Use the patterns to cut the Mylar for the windshield and cockpit side windows.

NOTE: Here is a useful tip for using Balsaloc. When you reseal the jar, place a piece of plastic wrap between the lid and the jar, and then tighten normally. This prevents the lid from bonding to the jar. I save the plastic backing from Monokote and Litespan for this purpose.

CHAPTER EIGHT - FINAL ASSEMBLY

LANDING GEAR AND BELLY SKID

The belly skid is optional, but recommended for use on rough terrain. It is made from a 12" piece of 1/32" or 1/64" plywood. Hold it in place against the bottom of the fuselage and use a sharp pencil to trace the fuselage outline onto the plywood. Use scissors to cut the outlined shape and then CA it onto the bottom of the plane. Glue the two axle slots into place on the fuselage. Fuel proof the slots by coating them with CA or dope. Install the axle and wheels using wheel collars, fuel tubing, and four #19 rubber bands as shown in the plans.

ENGINE MOUNTING

Use the engine mount as a template to drill the mounting holes. Temporarily attach the mount to the firewall with wood screws. Remove and squirt a drop of CA into each hole to strengthen the threads that the screw cut in the firewall. Drill the holes for the fuel lines and squirt a drop of CA into these holes to prevent the wood from becoming fuel soaked.

NOTE: Motor mounts for .10 and larger engines may need to be modified to provide enough room for the fuel lines to pass through the firewall. See drawing below.

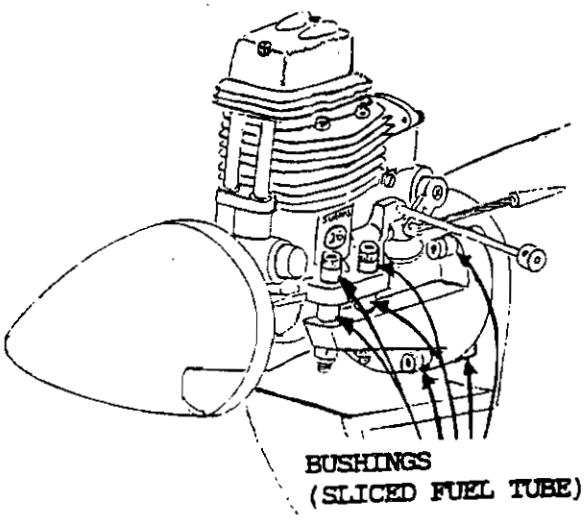
DOWNTHRUST & SIDETHRUST

The Lazy Bee should climb at full throttle. Only increase the downthrust if the plane stalls at full throttle. With all but the smallest motors it should climb at a steep angle at full throttle. Two degrees of sidethrust is a good starting point. Adjust so that the plane flys straight at cruise throttle.

Soft Mount

Four-Cycle engines require "soft" mounting to reduce the vibration transferred to the fuselage. It is a good idea for all engines and it makes the plane quieter, too. A simple soft mount using fuel tubing pieces for bushings is shown below. There are also shock absorbing motor mounts available from several manufacturers.

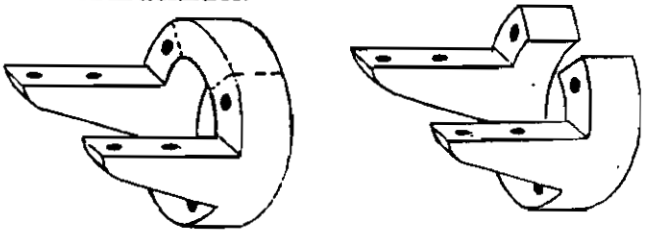
SOFT MOUNTED ENGINE



BUSHINGS
(SLICED FUEL TUBE)

ENGINE MOUNT MODIFICATION

CUT OUT DOTTED SECTION



File inside of engine mount to give 1/16" clearance between the mount and crankcase. This will give the engine some room to rock back and forth. I recommend using Loctite and/or locking nuts to secure the engine and mount. You should ensure that the mount is secure as part of your regular pre-flight inspection.

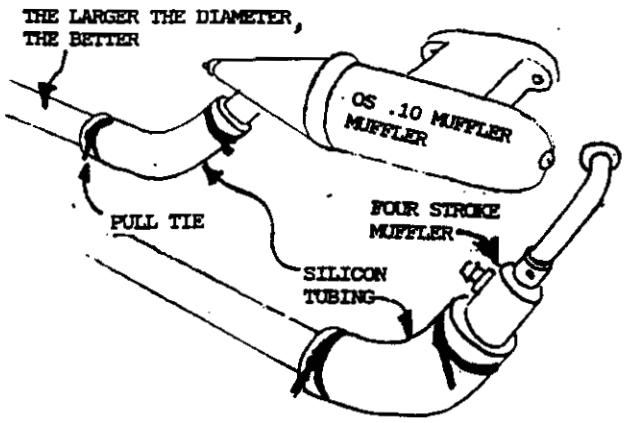
Lazy Bee with Extended Exhaust Pipe

Many Lazy Bee builders have noticed the long exhaust pipe on the yellow and black Lazy Bee in our video. This plane is powered by an MVVS .12 diesel R/C engine and has an exhaust pipe that runs from the muffler out to the stabilizer. This way the oily exhaust is dumped out below the elevator instead of getting sprayed all over the covering. All that is needed is some aluminum tubing, a small automobile hose clamp, and a clamp to attach the exhaust tube to the stabilizer.

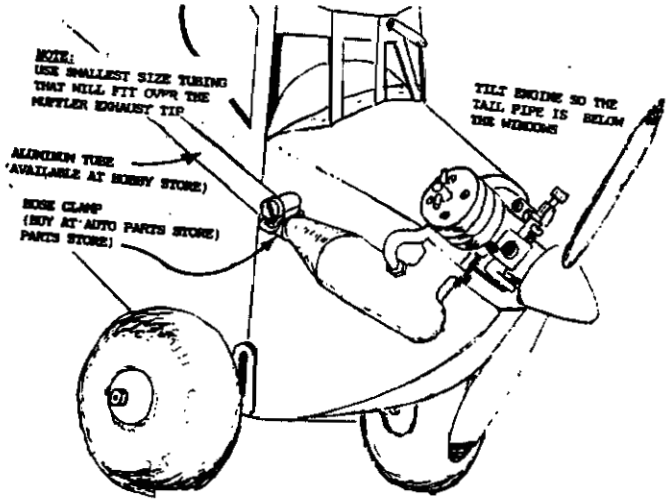
Note: We have now heard from several Lazy Bee Builders that this extended exhaust tube works fine with the OS .10 & .15 2-cycles and the OS .26 4-cycle. If you find other engine that this works with, let us know. We also have tuned pipes for the OS .10 & .15.

EXHAUST TUBE FOR THE LAZY BEE

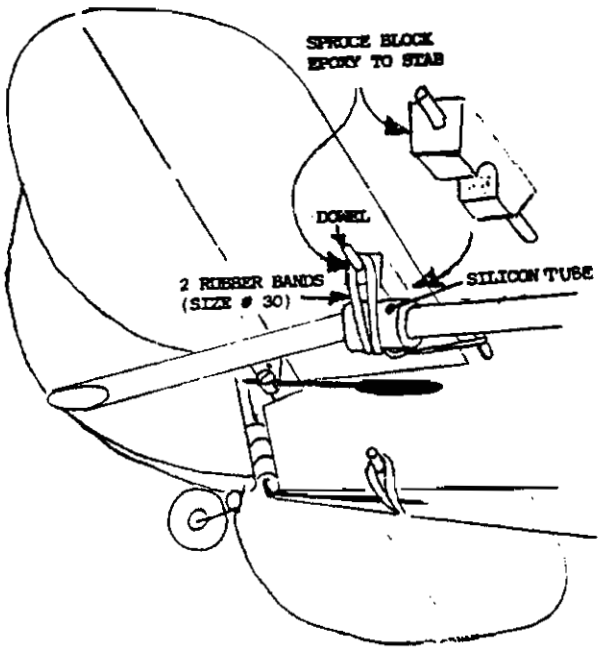
EXHAUST TUBE FOR GLOW ENGINES



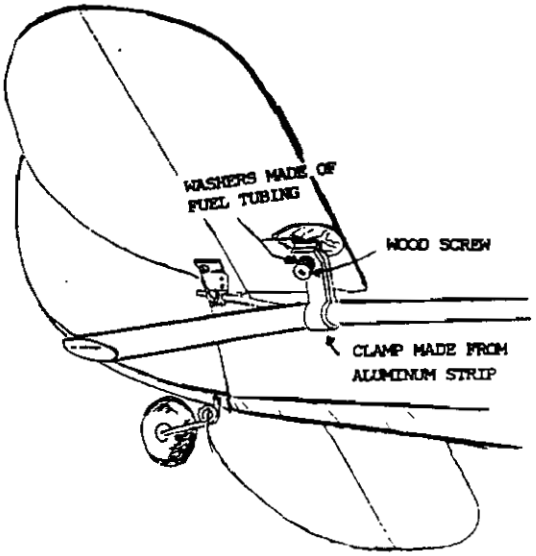
DIESEL EXHAUST TUBE FOR THE LAZY BEE



REMOVABLE TAIL



FIXED TAIL



FUEL SYSTEM

Assemble the gas tank. To install, feed half of a 2 ft long piece of fuel line through one of the fuel holes in the firewall. Now feed the other end of the fuel line in through the other hole in the firewall. Reach inside the fuselage, grab the fuel lines and attach them to the gas tank. Push the tank into place while pulling the fuel lines out through the firewall. Mount the engine. Cut the fuel lines to length and attach to engine.

TAILFEATHERS INSTALLATION

Mount the control horn to the elevator. Connect the elevator to the stabilizer using thin CA to glue the plastic hinges in place. Use 5-minute epoxy to mount the stabilzer into the slot in the fuselage. Align carefully. Mount the control horn on the rudder. Connect the rudder to the fuselage with hinges. Secure the tail wheel using a 1/16" diameter wheel collar.

RADIO INSTALLATION

Place all radio gear on the fuselage floor in the approximate position shown in the plans. Mount the wing on the fuselage using #19 rubber bands and check the balance point. Reposition the radio gear as needed to get the correct balance as shown in the plans. Use 5-minute epoxy to mount the servo rails where needed to keep proper balance. Make the rudder and elevator push rods. Adjust the length of the balsa part of each push rod (if needed) and install using E-Z connectors. Use two-sided mounting tape (servo tape) to secure the battery pack and receiver to the floor (Note: Coat floor with CA first to give the servo tape a surface it can grab.) Mount the ON/OFF switch on the opposite side of your fuselage from your exhaust outlet. This reduces the chances of getting fuel in the switch.

Whatever you do with the receiver antenna, DON'T wrap it up, tie it, or shorten it. Keep it as far from the servos and wiring as possible. Install the throttle cable as shown in the plans. Use an E-Z connector to make adjustments easy.

FLYING THE LAZY BEE

Test run the engine a few times before flying. If the engine is new, complete the break-in process before you fly. Make sure all screws are tight - especially the control system screws. Use eight new #19 rubber bands to attach the wing (If you have a bolt-on wing, make sure it is securely attached.) Always use new rubber bands - it's a shame to lose a plane because an old rubber band breaks in flight. Make sure the plane is balanced properly. Check everything twice and do a "preflight" inspection before every flight. Test fly on a calm day.

For your initial flights make sure you don't have too much rudder or elevator throw. It should only be 1/2" each way at the trailing edge for the original (40" or 48) Lazy Bee. The throw should be 3/4" each way for the Big Lazy Bee (60" or 72").

To take off, point the nose into the wind, give full throttle, and don't touch the rudder until airborne. Staying off the rudder and flying from grass helps prevent ground looping.

Toto, I Don't Think We're In Kansas Anymore!

Although you should only fly on calm days at first, the Lazy Bee can fly when it is windy. For the best results, the plane should be overpowered and have lots of control throw. The pilot should have lots of experience and be "quick between the ears". The take-off is easy, just point the nose into the wind and it's flying. Landings are tricky because the plane never stops flying - you need to set it down as close to you as possible, shut the engine down, and grab the plane quickly. Do this at your own risk! Also note that the standard wing Lazy Bee does better in the wind than the extended wing version.

Aerobatics

The Lazy Bee is surprisingly aerobatic, especially in the standard wing version. It does tight loops and quick rolls, including snap rolls - you should only use as much power as is required to complete the manuever. **Never power dive!** Use full throttle **ONLY** for climbing! If things start to flutter, the plane is going too fast (or poorly built). It is not designed to go fast.

To make it roll quickly, use lots of throw on the rudder and give full rudder and full down at the same time.

Inverted flight is tricky. Lots of power helps and the extended wing does better at this than the standard version. A common mistake is to give too much down elevator and then stall. So take it easy on the down elevator. I have seen the Lazy Bee flown inverted for several minutes at a time, so it can be done!

A great trick that the Lazy Bee does on the ground (on calm days) is a ground spin. To do it, just taxi out to the middle of the field, give a little down elevator, full rudder (with lots of throw), and full throttle and the Lazy Bee will spin like a top! Some call this the "Dizzy Bee" maneuver.

I hope these tips help. Good Luck! - And remember to **HAVE FUN!**