Big Old Bipe

Giant Scale Sport Bipe For 1.20-1.80 4-Stroke or 25cc Gas Engines

BIG OLD BIPE
Designed by:
D.B. (Doc) Mathews
TYPE AIRCRAFT
Sport Biplane
WINGSPAN
74.5" Top, 67" Bottom
WING CHORD
12.5 Inches
TOTAL WING AREA
1750 Sq. In.
WING LOCATION
Biplane
AIRFOIL
Modified Semi-Symmetrical
WING PLANFORM
Constant Chord/Rounded Tips
DIHEDRAL, EACH TIP
Lower Wing 1", Top Wing 1/2"
OVERALL FUSELAGE LENGTH
54.5 Inches
RADIO COMPARTMENT SIZE
14" (L) x 4.5" (W) x 4" (H)
STABILIZER SPAN
28 Inches
STABILIZER CHORD (inc. elev.)
9.5 Inches (Avg.)
STABILIZER AREA
285 Sq. In. (Approx.)
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
12 Inches
VERTICAL FIN WIDTH (inc. rud.)
9 Inches (Avg.)
REC. ENGINE SIZE
1.20-1.80 Cu. In. 4-Stroke or 25cc Gas
FUEL TANK SIZE
16 Oz.
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
4 (6 Servos) Interconnected Ailerons
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail.
C.G.
1/2" Aft of Lower Wing L.E.
ELEVATOR THROWS
Low Rate 1" Up & Down
High Rate 2" Up & Down
AILERON THROWS
Low Rate 1/2" Up, 1/4" Down
High Ratge 3/4" Up, 1/4" Down
RUDDER THROWS
Low Rate 1-1/4" Right & Left
High Rate 2" Right & Left
SIDETHRUST
To Suit Power Used
DOWNTHRUST
As Above
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage .. Balsa, Ply, Basswood/Spruce
Wing ..... Balsa, Basswood, Spruce
Empennage ..... Balsa & Hardwood
Wt. Ready To Fly ..... 224 Oz. (14 Lbs.)
Wing Loading ..... 18.44 Oz./Sq. Ft.

By D.B.(Doc) Mathews

In the 1920's and 30's, civilian and military biplanes could often be seen at airshows and were always crowd pleasers. Their pilots were dashing heroes in the eyes of the spectators, particularly young kids. The air of adventure, daring, glamour, and independence associated with these biplane pilots was the stuff of newsreels, newspaper articles, and radio shows.

As kids we would dash to the local grass strip whenever a Swallow, Waco, Travel Air, Eaglerock, etc., flew in. Just to spot one in the air was a thrill, but to actually see one up close (airports had no fences and we could actually touch the airplanes) and to watch the dashing pilots walk around was a thrill beyond compare.

That era of aviation was marked by a fierce independence. No flight plans or limited air spaces, no multiple page forms to fill out, no electronic gadgets to fool with, no worries about liability suits, and no (or at least very few) nit-picking rules or regulations to mess with. Navigation was entirely I.F.R. (I Follow Railroads). These heroes of the air were free to fly when they wanted and where the freedom of flight took them.

Aviation was an activity that attracted free spirits who loved to fly

simply because they were free. That they were people of unusual daring possessed by over-active egos is also rather obvious considering some of the audacious flying feats the media fed on in those days. Seemingly, the common denominator for pilots of that long ago era was their freedom.

We're speaking of an era when biplanes were fabric-covered and brightly colored. They were big and powered with large engines of limited power but unlimited noise-making ability. Funny thing, the restorations and reproductions of these old favorite biplanes don't seem nearly as large when we see them now. Today's tiny aerobatic, highly overpowered biplanes are not part of this macho hero image.

You must admit, big biplane models retain some of that spirit of the 20's and 30's, at least that is what we have attempted to capture in the "Big Old Bipe." There is something very special about seeing this model in the air or on the ground. It's not fancy or particularly aerodynamically clean, but it most certainly recalls that wonderful long-ago era.

The guys at my flying field kept asking me what I was going to call this model. Frankly, I hated to call it a "Bandito Bipe" to avoid repetition and confusion. I noticed that, lacking a name, they would refer to it as that "big old bipe." Sounded good to me; so I decided that was the name. However, that is a bit of a mouthful, so the model finally became simply "B.O.B." I sort of like that; it's not a bit pretentious or fancy and neither is the model -- somehow the name fits.

Much of the aerodynamic layout for B.O.B. is historically linked to the "4-120 Bipe" kit I designed for Ace many years ago. That it is a good one is attested to by the large number of those kits built and how many of them are still flying. Esthetically, there is more than a little "Bandito Grande" (RCM July '01) in B.O.B. as well.

Materials and Tools

All wood used for B.O.B. is standard hobby shop supply. Try to choose even-grained straight stock with as little warp as possible. Hardware is also standard and certainly nothing exotic. As always, if your local dealer does not have the wood or hardware, most any of the mail-order firms will.

Basswood may be substituted for spruce if it is not available. The term "lite ply" as used in this project is poplar plywood, not mahogany door skins. The term "plywood" refers to 5-ply aircraft grade, do not substitute lite ply for these pieces. Both are easily obtainable from most any firm selling model aircraft wood.

The primary adhesive used is CA (Hot Stuff, etc.) in thin, medium, and thick viscosities. A spray accelerator is helpful. Some areas of construction and finish call for epoxy, this should be Hobby Poxy II or equivalent, not "5-minute." A few areas are best assembled using Aliphatic resin: this is commonly known as Titebond or Sig-Bond.

We usually build out of a scrap box using a good balsa stripper (Master Airscrew) to create the smaller pieces left over from cutting out larger ones. As an example, the diagonal strips in the stab and fin can be easily stripped from scrap sections left over from other parts of the construction. Simply put: toss all the scrap generated into a box, you'll likely use much of it as construction goes along.

One possible problem in locating hardware might be the Solid Strand Un-insulated solder terminals used to run the top wing bolts through. They are Mouser catalog number 571-34124. Locally at a store that sells electrical supplies, they should, obviously, have a 1/4" hole and fit over 16-14 gauge wire. You will need eight of them. Mouser's phone number is (800) 346-6873.

The tail wheel bracket is at the builder's option, but we have been very impressed with the Sullivan unit we used. This bracket transfers forces into a wire coil much like a nose wheel wire. Most damage to the tail wheel unit occurs in transportation and storage not in landings. This unit is designed to absorb those sort of forces without placing them on the rudder hinges or tiller.

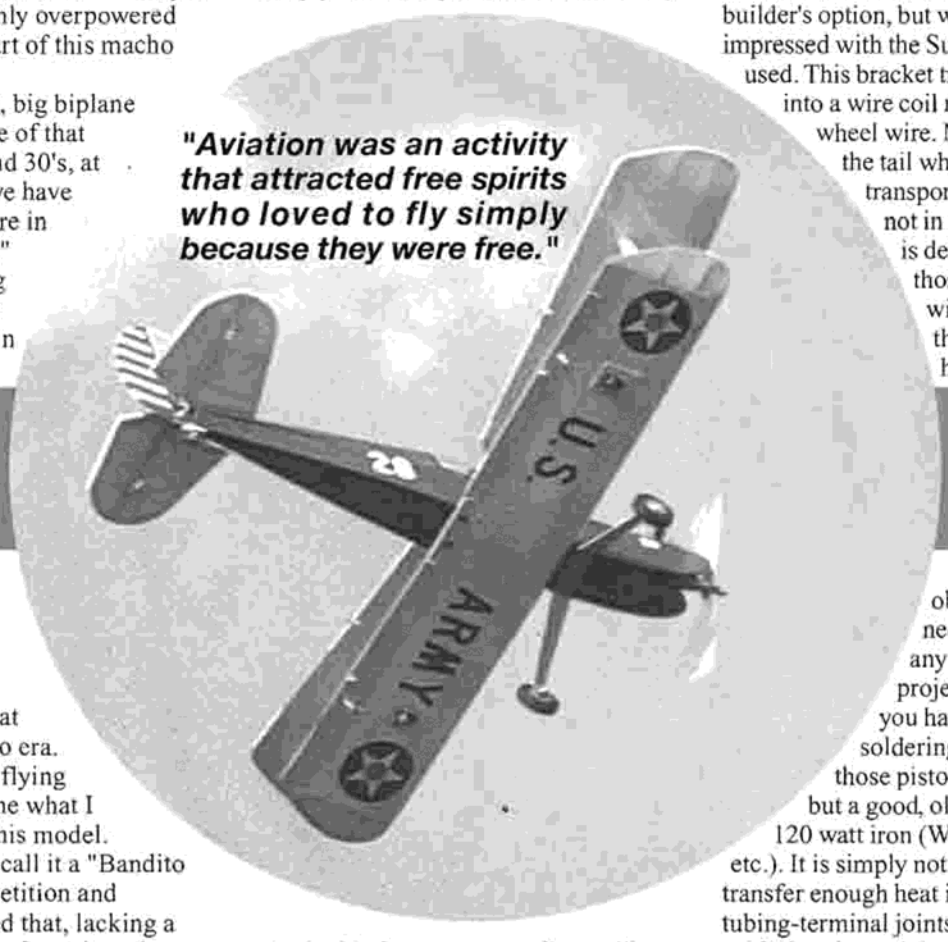
Beyond the obvious usual tools needed for this or any other similar project, it is imperative you have a heavy duty soldering iron. Not one of those pistol grip numbers, but a good, old-fashioned 120 watt iron (Weller SP-120, etc.). It is simply not possible to transfer enough heat into the wire-tubing-terminal joints without a wide soldering tip, and don't even consider using a torch!

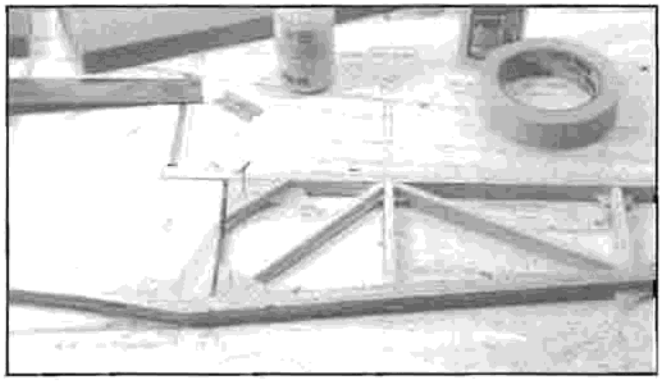
We also recommend Sta Brite solder for this project, although well-fluxed acid core could be used. Always be sure any joints to be soldered are sanded with #220 paper, then wiped with alcohol just before fluxing.

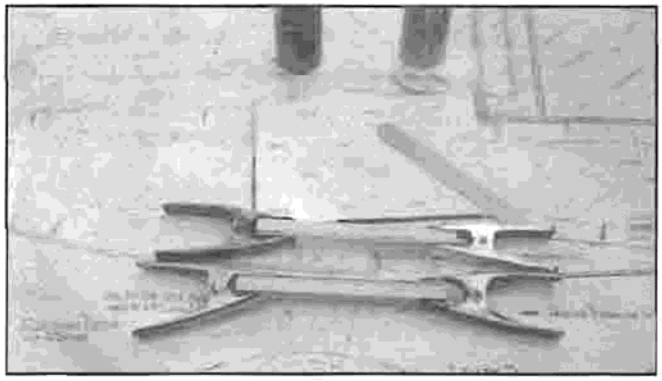
The other essential tool that you might not have is a quality wire bender. We use a K&S "Mighty" wire bender and recommend it highly, and they are not terribly expensive. Of course to use a wire bender, one needs a bench vise as well.

Another essential tool in constructing the Big Old Bipe is also

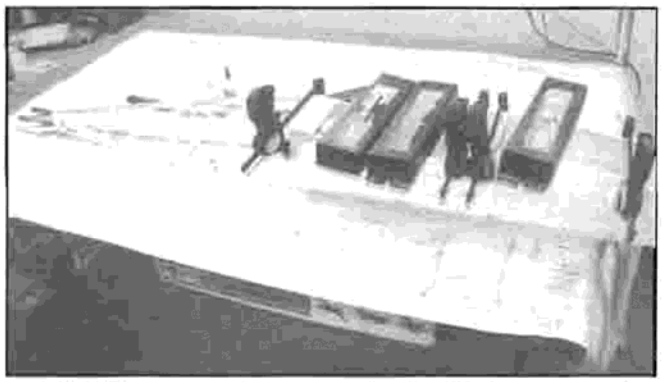
"Aviation was an activity that attracted free spirits who loved to fly simply because they were free."







LEFT: Close-up view of second fuselage side being built over first. Note use of masking tape to avoid parts sticking at glue joints. Notice space between gussets and doubler for former "C". RIGHT: Sig trunion blocks being epoxied to 1/8" plywood doublers. Units require clamping while adhesive cures.



LEFT: Method of fabricating fuselage formers of hardwood and plywood. RIGHT: Fuselage sides clamped and weighted over top view with top of firewall hanging over edge of table and tail post pulled together.

the cheapest. You absolutely owe it to yourself to have a selection of sanding blocks with various grades of aluminum oxide paper attached to them. Most building supplies have a selection of cut ends at very reasonable prices. Look through them to find flat pieces of about 11" x 3" x 3/4". These are just right for attaching a full sheet of paper by wrapping it around three sides and securing it on the fourth with thumb tacks. We are convinced that dull razor blades and worn-out sandpaper are the same thing.

Additional, smaller, specialty sanding blocks can be made by adhering appropriate sizes and shapes of paper with CA to scrap hardwood.

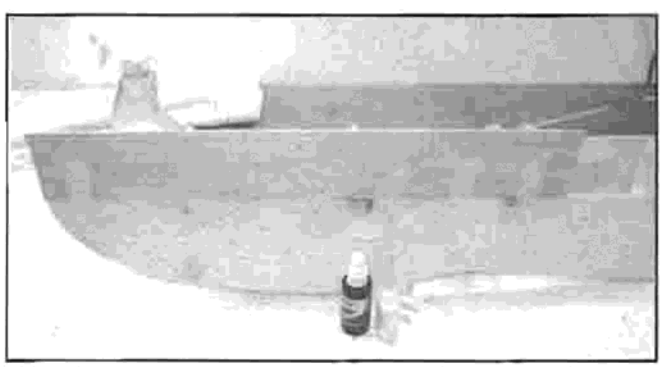
When drilling the lower wing hold-down dowel holes through the fuselage formers into the wing, a 12" drill bit is very handy, though not totally critical. However, once you own one, you'll wonder how you ever got along without it.

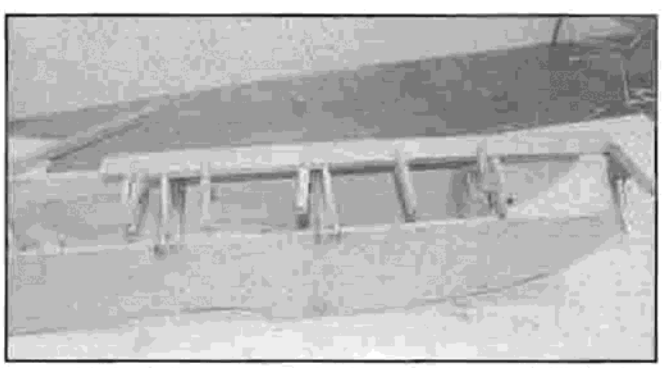
Creating the Cut Parts

There are several techniques for transferring part patterns from the plans to the appropriate wood sizes. All seem to work, but our personal favorite is to make a copy of the parts using an open-top copier (like those at supermarkets), rough-cut the copy pattern with scissors, then adhere it to the proper piece of wood using a glue stick. The part can then be cut and sanded to exact outline, then the pattern peeled off.

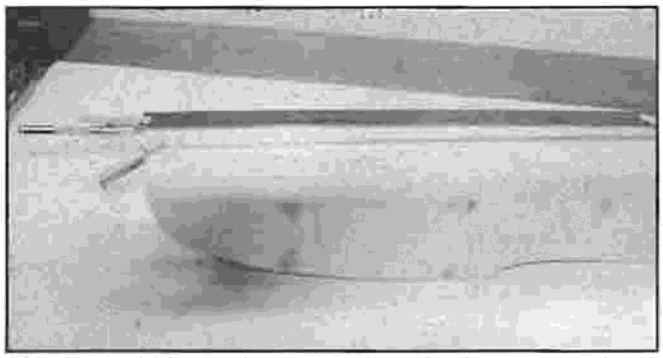
The wing ribs can best be created by transferring the patterns onto 1/8" plywood and cutting them out. These plywood ribs then are pinned or nailed onto a stack of rib blanks and used to cut them with a jig or band saw. Spar slots can be cut undersize, then sanded to a snug fit using the "sandpaper glued to scrap wood" technique. B.O.B. actually only uses two types of ribs with some minor modification to a few.

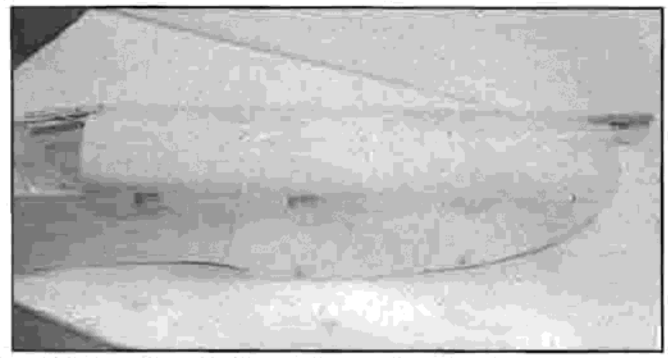
The lite ply fuselage side pattern can be developed by placing carbon paper between the drawing and the wood, then carefully tracing over the drawing with a straightedge and pencil. Once one side has been cut, the other three can be created by using the first as a pattern to draw around.



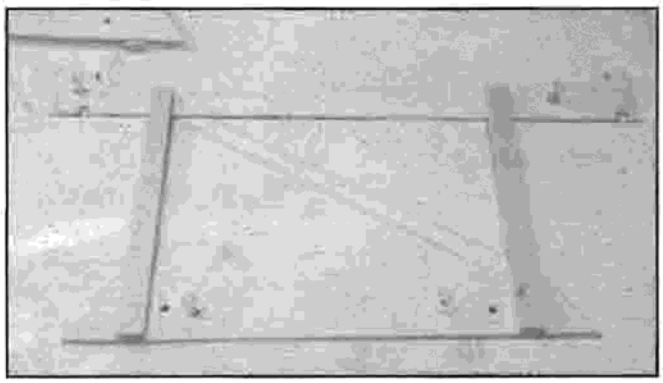


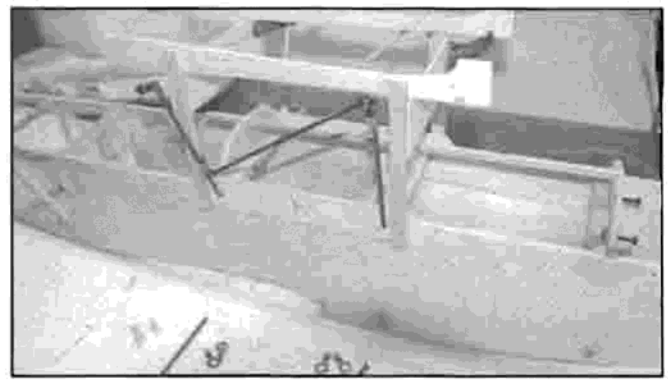
LEFT: Balsa sheet has been soaked with diluted ammonia/water, adhered with thick CA to edge of fuselage doubler, and held in place with masking tape. RIGHT: Sheet has been slowly pulled down over formers to take a set, held to center strip with clothespins, then adhered with medium CA.





LEFT: Second half of sheet treated like first except edge that mates to first half of mid-line is trimmed for a flush fit using a steel straightedge. RIGHT: Satisfactory joint has been created between two halves, then glued to formers, center strip, and joint with medium CA.





LEFT: Wing positioning fixture assembled over drawing, developing a left and right side. These will be separated and held together with plywood cross sections. RIGHT: Fixture held in place with horizontal portion of wire running through it into trunion blocks. Cabanes and hardware installed temporarily with fixture in place. Ready to invert structure with top wing on workbench surface.

The doublers are the same as the exterior panels with the exception of the lightening holes. It is a good idea to nail all four pieces together and sand the edges uniform with #100 paper on a block. Use a section of scrap wood with sandpaper CA'd to the appropriate edge to create tight-fitting notches for the formers.

Fuselage

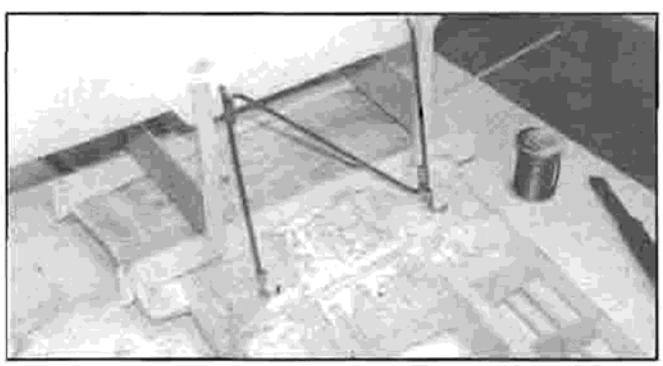
Using the aforementioned techniques, cut out all the required parts including all necessary holes and slots. Note that only formers T1 and T4 have been notched for the stringers at this point.

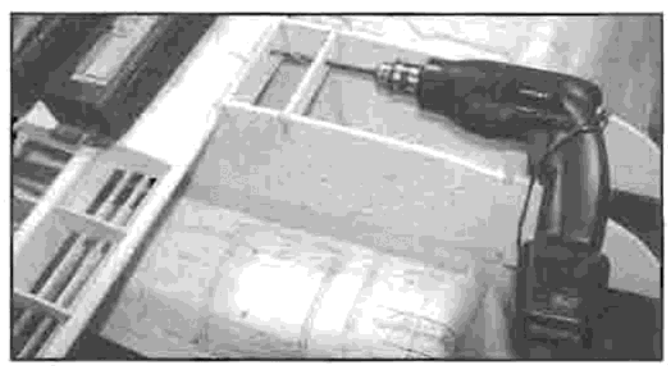
Mark a mid-line on the firewall to position the engine left and right, and another mark at the thrust line. Position the engine mount over these marks, then mark and drill the holes (including those for the throttle and the fuel lines); install the mount temporarily. A few drops of CA will safety the blind nuts after they are installed. Repeat this method for the landing gear block and the tail wheel bracket platform.

The cabane wire retainers are fabricated of Sig SH-125 grooved landing gear blocks epoxied to 1/8" aircraft ply. These should be clamped together during curing. They will be a bit over length, so cut off the excess. This technique allows the cabane wires to be removed for painting and during covering of the fuselage.

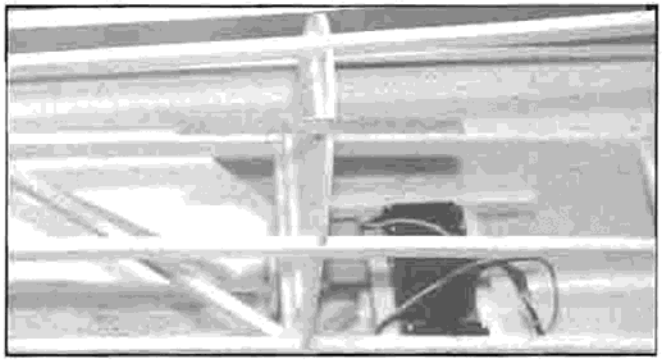
Join the ply sides and doublers using epoxy, nails, and lots of weights. Be absolutely sure you are creating a left and a right side! When cured, pin one side over the drawings, add the top and bottom stringers and then the vertical sections. It is a good idea to always cut the longest piece first; in that way if it would be cut short, it can be used for the next longest section. Cut the pieces slightly over-length, then block-sand them to a perfect fit with #100 sandpaper.

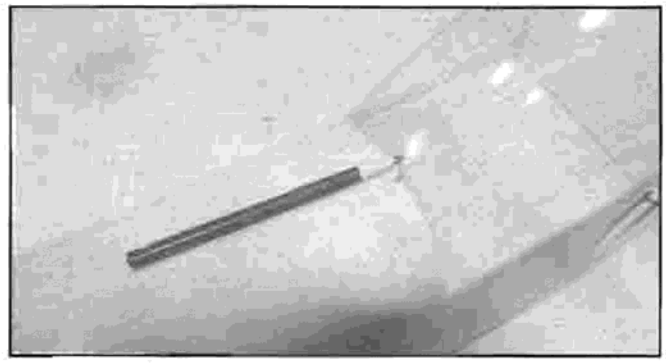
This assembly can be done with either thick CA or aliphatic resin. Once the vertical members are in place, cut and glue the diagonals with medium CA. Block-sand but do not remove from the plans. Place sections of masking tape over any areas that will



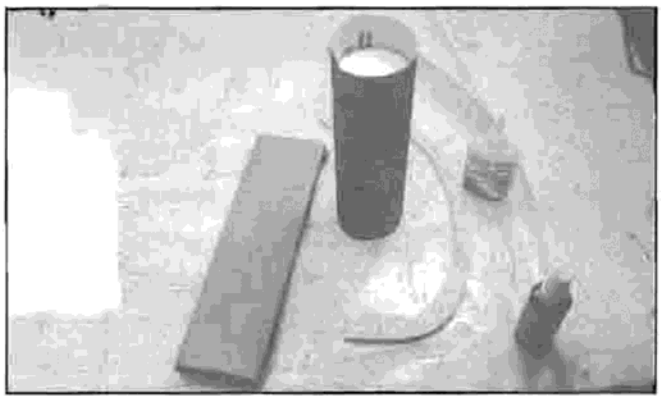


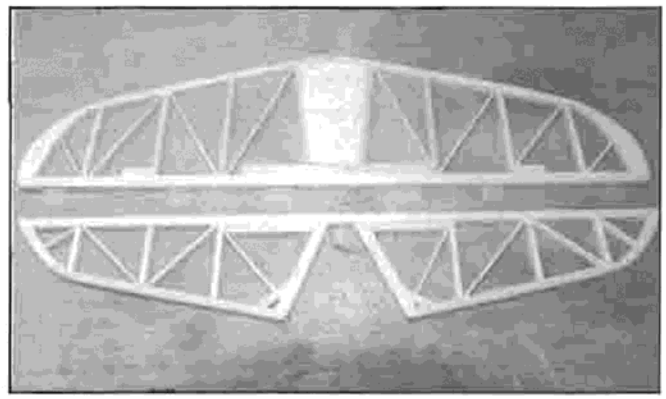
LEFT: Wire connectors bolted to previously drilled and tapped wing mounts ready to be soldered. Acid core shown but Sta Brite solder preferred. RIGHT: Lower wing being drilled for dowels using predrilled holes in F-2 and DM as a drilling guide. Notice the firewall has been removed temporarily.





LEFT: Turtledeck formers installed and stringers being attached. A "tool" made of a 1/4" x 1/4" strip with aluminum oxide sandpaper glued to one side is used to create stringer notches. RIGHT: Canopy positioned slightly below edge of top front sheeting and marked to trim line with china marking pencil. Notice cockpit side sections have not yet been installed.





LEFT: Inner edge of radiused parts are sanded smooth with a "drum" type sander. RIGHT: Horizontal stabilizer built directly over drawings. Tips have been precut and sanded to final shape on inside of curve. Notice blocks for tail wire braces.

be touched by adhesives when building the second fuselage side over the first.

After the glue has cured, remove the sides from the plan (while still stuck together), block-sand to exactly match each other. Separate the halves by running a table knife along the joints. Notice the gusset at station #3 is not attached to the forward edge at this time, just the longerons.

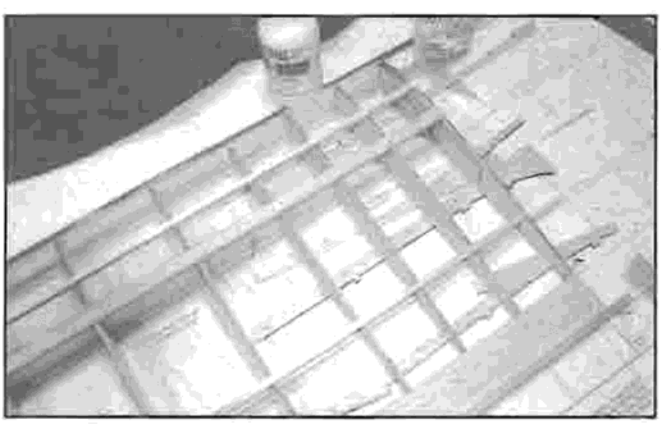
Since the fuselage top is flat, prior to adding the rear formers, it can be pinned upside-down over the top view using the front three formers to square up the front section. Temporarily install the front formers with clamps and masking tape. When perfectly aligned in all planes, adhere the formers but not the firewall or its triangular braces.

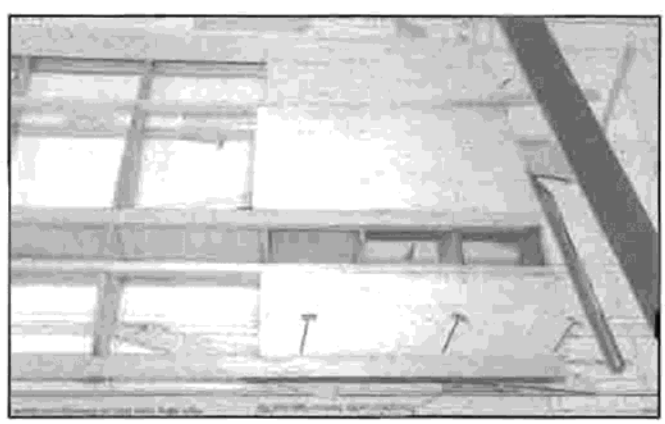
Cut matching pairs of 1/4" x 1/2" cross members. Bevel the inside faces of the tail post slightly with a sanding block. Pull together the rear of the fuselage using clothespins, adjusting so that the front section and the tail post are exactly in the mid-line of the drawing. Trial-assemble the entire unit using masking tape and clamps, making sure everything is square with the building board in all planes. When satisfied, run medium CA along all joints on both sides.

Glue in the ply tail wheel bracket mount and its inset piece. Sheet the bottom rear with cross-grain. This sheet should be cut into appropriate lengths, hinged with masking tape, and assembled flat on the board using medium CA. Lift the sheet and adhere it to the fuselage bottom. Trim the overhang with a knife, then sand to match the fuselage sides.

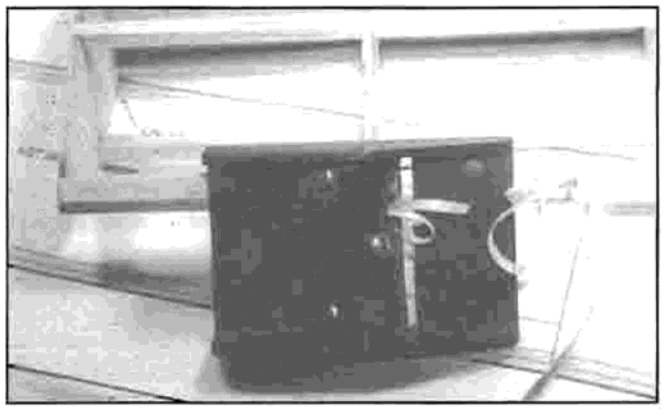
LGM should be positioned with triangular stock, reinforcing the joint between it and the fuselage sides. Once flush and level, glue it in place with epoxy. The cross-grained lite ply nose bottom area is not installed until the wing hold-down dowel holes have been drilled into the wing. This provides access for a straight-on alignment when using a 12" bit.

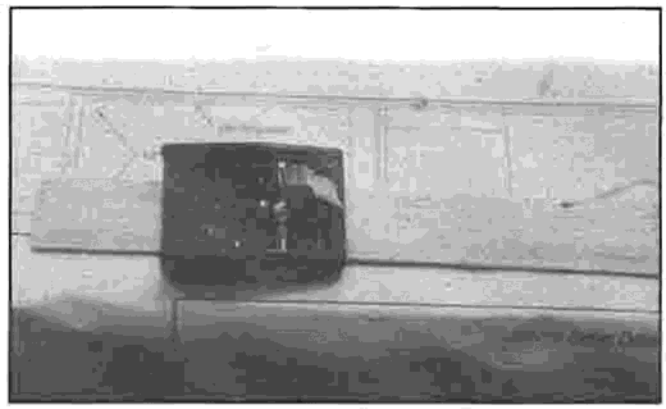
Do not permanently glue the firewall and its triangular corner braces



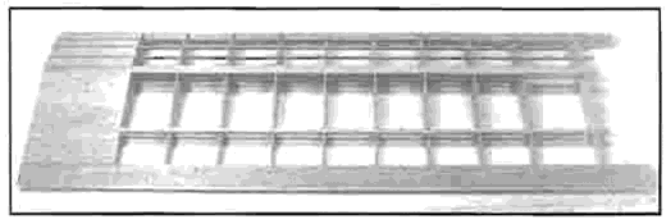


LEFT: Wing under construction using scraps of 1/8" sheet to hold center section ribs above surface. RIGHT: Top center section sheeting being added. A steel straightedge used to true the ends.





LEFT: Razor plane being used to shape leading edge. RIGHT: Aileron sheet being rough-shaped using a razor plane followed by sandpaper blocks.



ABOVE: Wing panel awaiting installation of tips.

LEFT: Center sections being joined using epoxy and clamps. A strip of masking tape is placed over the joint to prevent epoxy from running out.

in place until the wing has been drilled. Hold it place with masking tape. This will provide room for the body of the drill.

Fill the stab mount area with cross grained 1/4" sheet.

At this point, set the fuselage aside and proceed with building the wings and tail feathers.

Tail Feathers

Wood selection for this area of the model is somewhat a function of the engine to be used. With a Saito 150 4-stroke (850 grams), the model will turn out nose heavy, so select heavy wood; if a gas burner is to be used, one might even consider solid sheet for the tail group or shortening the nose one inch. On the other hand, if a lighter engine is chosen, select lighter wood.

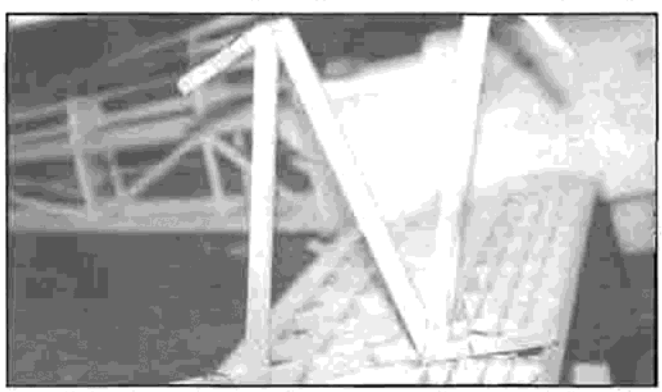
Mark and cut the curved sections using carbon paper, then cut them out on a jig saw. The inside curves can be easily sanded by wrapping paper around a Pringles can, etc., after gluing them together over the plans. On the other hand, do not final-shape the exteriors until the structure has been completed.

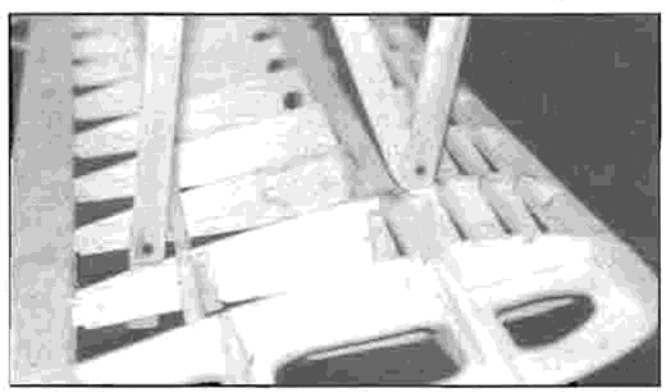
At a minimum, a razor saw should be used to cut the various strip pieces to length. A miter box and saw would be even better if you have one. Note the grain directions and that the base of the fin sets on top of the stabilizer. Don't forget the scrap sections that will be used to mount the wire braces later.

The wood joints in these units are rather deep and wide; if using one of the CA's, limit yourself to medium viscosity or even thick. I used an aliphatic resin (Sig Bond, etc.) just to be more comfortable.

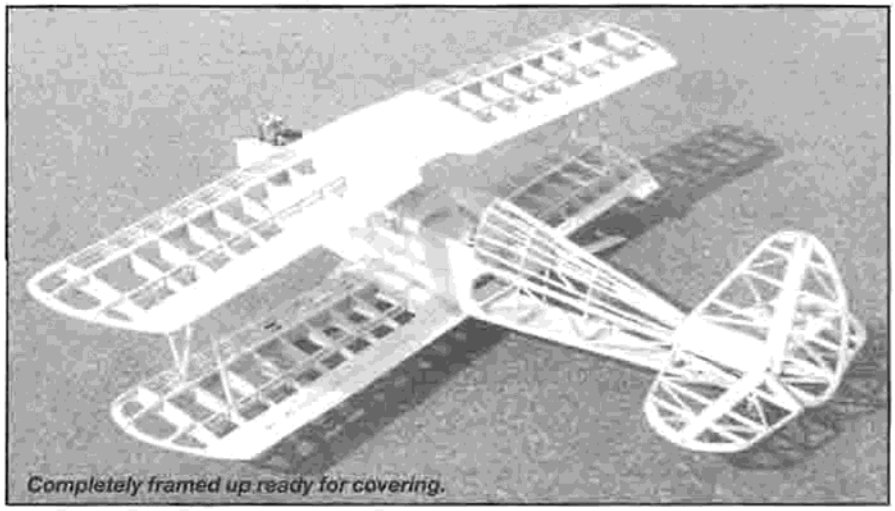
Tape the hinge joints together, sand everything flat, then shape the contours and round all the outside edges. Mark hinge locations on each half of the hinge line, then separate, run a centerline down the facing surfaces and slot for the hinges. Finally, sand the hinge line joints to angles on the elevator leading edge, and temporarily install the hinges to check for a smooth flip-flop.

The tail filler blocks are fabricated using the fixture shown on the drawings. Cut out the pieces and assemble. Tack glue two blocks into the fixture. Rough-carve with an X-Acto XA 227 blade or a good knife; then,





LEFT: Interplane struts positioned on ply tabs using clothespins to assist in adjusting for a neat fit. RIGHT: Interplane struts have been used to mark tabs, then drilled for 4-40 blind nuts. Struts are bolted into tabs with 4-40 x 1/2" Allen head bolts. Tabs are then adhered to wing ribs with epoxy.



Completely framed up ready for covering.

using successively finer grades of sandpaper, sand the blocks to match the outlines of the fixture. Some slight additional sizing may be needed before covering them.

Wings

These wings build flat on the building surface from the main spar back. No jigs are required, just a flat building board. The wings are built from the bottom up. No capstrips or "D" tube leading edge is used for this wing construction system that I've used with great success many times. However, this structure derives part of its strength from its covering; use only MonoKote or UltraCote.

Using ply templates, stack-cut and sand the ribs. Note that there are two kinds: those that will be covered top and bottom with 3/32" sheet for the center sections and the outer ribs. More accurate spar slots can be created by cutting the slots undersized with the jig saw, then enlarging them to full dimension with sandpaper adhered to scraps of the spar stock. Cut the holes in the appropriate lower wing ribs for the aileron extension cords.

Notches need to be cut in two ribs to clear the 1/4" ply plates on the top wing. Measure and mark over the plans and cut out. These can be mounted to the wing in one of two ways: either flush with the outside, sanding them to match the enclosing sheeting, or on the inside of the sheeting, covering them with glass cloth on the sheet on the outside.

If placing them inside the wing sheeting, push through the interior dimension of the threaded hole in the "T" nuts with a series of pin holes to mark where the sheeting will need to be cut out for the wing bolts after covering over with glass cloth. Obviously, this should be done before adding the top sheeting to the center section.

Fabricate the vertical grain sheer webs by stack-cutting them, using strips of masking tape to hold the multi-sheet sandwich together, then cutting them on the jig saw and sanding their edges with a block.

Pin the bottom main spar, rear spar, and trailing edge sheet over the wax paper protected plans. Check for alignment using a few ribs. Cut the bottom center section sheeting to length and width using a metal straightedge. Alternately, the center section ribs can be held off the drawing with scraps of 1/8" balsa, then the bottom sheeting added after removing the panel from the building board. Install the trailing edge sheeting, the 1/4" x 1/4" trailing edge cap on top of it. Add the top sheeting which is 1/4" narrower with a butt edge against the cap. Block-sand the strip to contour, using masking tape to protect the balsa sheet while sanding the cap.

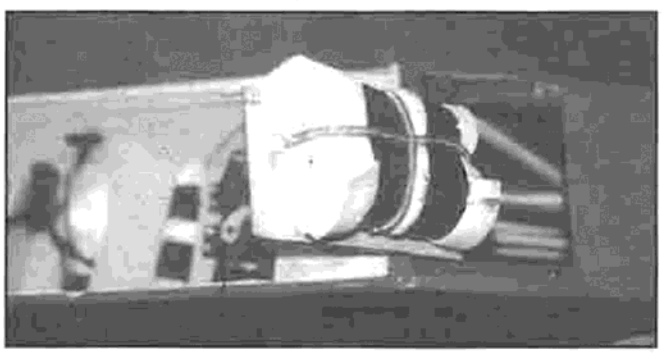
Tilt the center section rib using the jig, and glue to the bottom sheeting and spars. Using the sheer webs, position the remaining ribs. Notice the inside sheer web on the bottom wing is 1/8" ply to support the wing dowels. Install all the other ribs to the tip. Cut the ply top wing mount plates from plywood, then drill and install 1/4-20 "T" nuts. Epoxy these onto the sheeting and other structures.

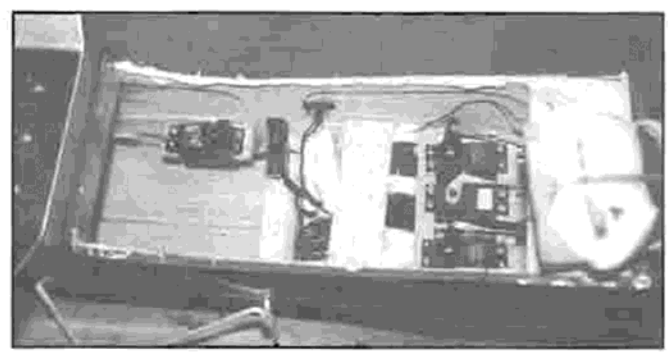
Add the top spars, turbulator spars, leading edge, and rear sheeting. Repeat the procedures used on center section sheeting to obtain tight fits on the top surface. The wing has 1/4" sheet stock glued to the back edges of the center section and the tip ends. This aileron/filler material can be left flat or planed and sanded to an airfoil. A cut-out is used only on the upper wing.

Sand the leading edge to a rounded contour. Smooth the center section sheeting joints with blocks. Remove any glue knobs, etc. Cut the ply tips using the carbon paper technique and install them running from the mid-line of the leading to the mid-line of the trailing edges and level in the horizontal plane.

Filler blocks are used as drawn to create a smoother covering job. The 1/4" sheet aileron material can be sanded to match the airfoil by using a razor plane (Windsor, etc.) and a series of sanding blocks. Use the blocks to shape the tips and center section as well.

Block up each panel the specified amount and sand the center rib using a flat table edge and sanding block. Trial-fit the panels with twice the dihedral in one tip and the other panel flat. When the joint looks acceptable, wrap the bottom with masking tape and epoxy





LEFT: My model with a heavy engine required the battery pack to be placed aft of the trailing edge. A plywood tray was constructed using metal springs from local hardware store to hold pack. Unit then is screwed to rails in fuselage structure. RIGHT: The B.O.B. uses two elevator servos and one each for rudder and throttle.

the two halves together.

After the joint has cured, use 6" glass tape (Sonic Tronics, etc.); adhere one end in the center of the bottom sheeting with CA. Mix regular epoxy (Formula 2, etc.), spread it on the wood with a tongue depressor or wood scrap to the outline of the area the cloth will cover. Start pulling and smoothing the cloth at the pre-glued area and trowel in the epoxy a little at a time until you have wrapped the cloth completely around the wing. Epoxy should work up through the weave to completely moisten it. On the other hand, you do not need huge amounts of excess epoxy on the outer surfaces. Smooth all this with a finger moistened with water, then set aside for curing.

Another layer of glass and epoxy should be used over the bolt holes on the bottom of the top wing.

Hinges

Block-sand all surfaces that will move to a 45 degree angle. The leading edges of the horizontal stabilizer and vertical fin should be sanded to a pleasant 1/2 round. Use a pencil mark along the centerline to guide this sanding.

Aileron hinges on this design should be of the medium duty pinned type, there is not really enough surface for successful use of the CA adhered type. Use a hinge slotter and epoxy to install these hinges. On the other hand, the elevator and rudder can be hinged with heavy duty CA hinges or of course molded nylon units.

Cabane Wires

These may appear a bit intimidating at first glance, but notice they have only one bend on the uprights and two on the diagonals. As previously mentioned these wires can be bent up rather easily with a good wire bender. Cut lengths of 5/32" wire with a Robart cut-off wheel in a Dremel. Carefully plan each bend and mark the apex on the wire with a felt-tip pin. Use this mark to position the wire in the bender.

Do not attempt to bend out an error, it is virtually impossible! If you mess up a section of wire, start over with a new piece.

Gently squeeze the copper tubing to an oval shape using pliers, trial-fit to be sure two sections of wire will pass through them without binding.

The electrical connectors need to be doubled. The inner half that fits over the wire will require some spreading for a snug fit, it also has an approximately 80 degree bend. This bend should be right at the shoulder of the lug. A second lug is opened using an ice pick or nail until it will fit over the shoulder of the first lug, it is then bent to lay flat with the inside lug with the holes matching. Solder the doubled lug together, smooth up with a file if necessary.

Installing Wings

Place the lower wing into the fuselage saddles using weights to hold it steady. Measure and mark the exact centerline of both the wing and fuselage. Align the wing center relative to the marks, check the tail post/wingtip reference, then drill through the pre-drilled holes in F-2 and F2-WB. Be certain the drill extends all the way through the plywood sheer web. Remove wing from fuselage.

Run one end of the dowel sections through a pencil sharpener to create a point. Epoxy the dowels into the wing using a section of coat hanger wire, etc., to work the epoxy onto all interior surfaces. Coat the dowel with epoxy, then use the pointed end to tap the dowels into the wing. Repeat for the second dowel. Wipe away any excess epoxy with an alcohol-soaked paper towel.

Return the wing to the saddle, recheck the positioning marks, then drill (3/16" dia.) down through the wing center section into and through the wing mount and its doubler. Remove the wing and tap the mount holes 1/4-20, then flow thin CA into the threads and re-tap. Drill the wing holes to 1/4" for the hold-down bolts.

Fabricate the temporary wing support fixture using the drawings as patterns. Be sure to fabricate a left and right unit. Carefully join the two halves with the lite ply cross braces and CA. It will be held in place with masking tape and rubber bands.

Be sure the cabane wires run parallel to the marks made on the fixture; that is, center the marks over the holes. Measure and use a 90° plane. In theory, the thickness of this fixture should leave the cabane wires 1/8" short of full seating into the trunion blocks, but they don't. Apparently, the slight spring built into the unit takes care of any such problem. However, if yours don't turn out flush with the fuselage sides, a slight bend of the electrical connectors should cure it.

Rubber-band the top wing onto the fixture with the leading edge up against the front end of the cutout. Make sure it is centered relative to the midline of the fuselage and tip to tail post. Adjust the wing until it is.

Prepare the wire parts for assembly by sanding all areas that will be soldered, and wiping with alcohol. Round off the short ends to aid in insetting them into the fuselage channels.

Insert the short end of each vertical section of wire into the fuselage. The shorter struts go in front and the longer in back. Slip one of the brass tubes onto each strut. Using 1/4-20 x 1/2" steel bolts from the hardware store, screw down the lugs to the wing through the blind nuts. These steel bolts are only temporary; they will be replaced with 1/4-20 x 1/2" Allen head nylon units once there is no danger of melting them.

You may need to increase or decrease the angle of the lug bend to get them to lay flat against the wing bottom. It might also be necessary to adjust the length or angle of the wire struts by re-bending them a bit or cutting off any excess. For those using an incidence meter, the lower wing is at 2° positive and the top is set at 0°, as is the stab.

Position the cross braces so the bend is toward the top of the front strut and the bottom of the rear strut. Slip the brass tube over each joint, positioning the cross braces so that they are equidistant from the top and bottom. At this point re-check everything to be absolutely certain the alignment of all pieces is correct. It is possible the length of the wires may need to be shortened in order to get the top wing to sit flat and full in the fixture.

Carefully lift the fuselage/upper wing assembly and place it upside down on the work surface. Recheck all alignments.

Using a hot 120 watt soldering iron, flux all joints then heat them to the point the solder flows freely from top to bottom. There will be some scorching of the balsa and this is okay. If you would like, cut some pieces of aluminum can, drill 1/4" holes to place between the lugs and the wing sheeting as heat sinks.

Remove the top wing and the wire units from the fuselage, and clean the excess flux off the metal with alcohol. The wires can be spray painted with Rustoleum very easily if you would like.

"N" Struts

This model will fly very well without any struts between the wings; however, for the sake of a more realistic appearance, you will want "N" struts.

Using the drawings as a pattern, cut

sections of 1/4" x 1/2" basswood to length and angle; these are not shaped until final assembly. Sand the angles carefully to obtain a tight joint, then join with epoxy. The holes for the bolts are drilled to allow reinforcement with sections of thin wall aluminum tubing or inner nylon rod to be CA'd into them.

With both wings mounted to the cabane wire and fuselage, position the plywood tabs onto the respective wing ribs holding them with clothespins. Use another set of clothespins to hold the "N" struts to the tabs.

Adjust everything by moving the tabs around until the struts are in the same position on both wings. Remove and epoxy each tab separately while the others are still in position and hold them with clothespins while the adhesive cures. Once all tabs are epoxied in place, either mark through the strut holes or drill through them into the tabs. Install 4-40 blind nuts onto the back of the tab away from the strut. Safety the blind nuts with CA. Bolt the struts to the tab units with 4-40 x 1/2" Allen head bolts.

Remove the struts and sand them to a tear drop shape using first a razor plane and then successively finer sandpaper on blocks. They can be finished with a few coats of Rustoleum spray. Build scrap boxes around the tabs flush with the rib top or bottom, these will provide area for adhering the covering.

Completing The Fuselage Assembly

Temporarily install the engine. The tank floor on B.O.B. is removable and slides between two pieces of 1/4" square spruce strips adhered to the back of F-2 and rests against another strip CA'd to the inside of the firewall. The tank floor is held in position by the tank and its surrounding foam rubber. This method allows removal of the tank from inside the fuselage if needed. Trial-fit the fuel tank and its tubing.

Since the tank tubing is a loose fit for large fuel line with danger of having the fuel line slip off, install either Du-Bro barbed fittings or wrap the tubing with copper wire and solder it on. In the latter case, file all points and edges off the solder before applying the tubing.

Install the throttle pushrod. We use Du-Bro 665 4-stroke throttle links and recommend one for this model. Connect the braided cable pushrod to the servo using an EZ connector. When satisfied that the tank hook-up has no pinches or kinks and the throttle pushrod set-up works freely, remove everything from the model. Sand the fuselage to remove any roughness, then complete the fuselage top by adding the turtledeck formers. Install the top spruce stringer, making sure the formers are at right angles to the fuselage frame, then use the notches in T-1 and T-4 to position and mark the location of the other stringers. Hold the stringer in place, then mark its location with a pencil onto the formers. Some of the stringers will butt against the face of T-4 rather than fit in slots.

Construct a "tool" of 100 grit sandpaper CA'd to one edge of a scrap of spruce. Trim the paper flush, then use this tool to file in the required stringer notches. In this way the angle of the notch to the former can be controlled as well as its depth. Trial-fit the stringers on left/right in pairs, adjusting them for a smooth flow from front to back. Repeat this process until all stringers are in place, then CA the whole bunch to the formers. Correction-sand the formers, and if you would like, add a concave to the area of the former between the stringers to avoid having the formers show through the covering.

The sheet covering for the forward deck is easily fabricated by adhering the bottom edge of the balsa to the ply fuselage side with CA and accelerator. Spray this half with diluted ammonia/water, allow it to soak all the way through, then gently pull it down onto the formers and the center strip. Release, then flow thick CA onto the formers and strip and pull the sheet down onto them. After curing, trim the centerline splice to the midline with a steel straightedge and a sharp knife. Repeat for the opposite half, then trim it in small increments for a tight fit against the first half, and glue the second half in place.

The sheeting does not extend to T-1, rather it ends at the instrument panel (F-2B) and the space that will be the cockpit side is filled with 1/4" sheet scrap sanded to match the outer contour. When thoroughly dry, cut out the front to clear the engine and muffler, then reinforce this area on its inside with glass and epoxy.

Flow thinned epoxy inside the entire tank compartment after installing the cross-grained lite ply nose bottom. Also flow the epoxy mix into all areas of the engine compartment. The holes for the landing gear can be located by positioning it properly and using its holes as a drilling guide. The "T" nuts can be installed from inside the fuselage.

The canopy is a stock item available from Fiberglass Specialties. It will require some trimming for a snug fit, which can be easily done using a canopy scissors. Fine-trimming should be gradual and deliberate to reach a pleasing joint between the canopy and the fuselage.

Equipment Installation

The following is not the only way to do things, nor for that matter possibly not even the best, it is simply how we install radio equipment over and over again.

We mount the fuselage servos on 3/8" x 3/8" basswood rails cut to a snug fit against the ply fuselage sides with secondary reinforcements at the fuselage/rail joint. Everything is then adhered with medium CA. In this instance, two elevator servos are used and one for the rudder. If your transmitter will not mix elevator servos, several nice electronic devices such as the Electrodynamics EDR-106 are available to operate split elevators without transmitter mixing.

In our technique the servos are temporarily mounted to the rails, the pushrods installed and then the control horns. In this way the horns can be positioned to match the angle of the pushrods for improved accuracy. We use Du-Bro DU-173 30" rods running inside the outer portion of Sullivan SU-505 Gold-N-Rods. The threaded (clevis) end is used on the horns and solder links on the servo arms. This produces very rigid, free-running rods with minimal temperature change. They are actually easier to install than conventional nylon tube in tube systems.

Before the solder links are installed we slide sections of lite ply (drilled with 1/8" dia. holes) down the outer nylon tube. We also rough-sand the portion of the rod that exits the slots at the tail for improved adhesion with CA. Finish the soldering, then adjust these supports to a relatively straight shot from servo to horn. Once properly positioned, the supports are CA'd to the vertical fuselage sections, then trimmed to fit flush.

The ailerons are interconnected with Sig SH-755 horns with 4-40 pushrods. Solder links are used on one end and threaded clevises on the other. After the first few flights and you've found the exact movement you want between upper and lower ailerons, solder the threaded part shut. Also, mark the right side with a drop of paint

to distinguish it from the left pushrod.

Several tail wheel bracket choices are available and all will work fine. Our personal preference is for the Sullivan unit mentioned earlier. The bracket is screwed to the ply support with the tiller wire stuck into a scrap section of inner nylon tubing which is then CA'd into a hole drilled in the bottom of the rudder.

Covering And Finish

B.O.B.'s wings need the torsional strength of high heat, low flex covering materials such as MonoKote, UltraCote, or Oracover. Too much flexibility will result from the use of other materials including the iron-on fabrics.

When covering the fuselage, start with the turtledeck. We like to adhere one edge, pull the covering tight against it around the stringers to the other side, then adhere that edge. One can adjust the covering section to avoid any wrinkles if it is cut well oversize to allow "handles" to pull with.

Fuselage sides can be covered in one piece from nose to tail by cutting a straight line in the covering with a steel straightedge, then carefully positioning that cut edge against the previously applied turtledeck covering.

Tail filler blocks are covered separately, then epoxied to covering cleared areas of the fin and stabilizer.

Wings are covered in four sections, bottom first. The tips are not difficult to cover smoothly if one heats and stretches the covering as it is pulled down over the tips. In other words, heat, pull, stretch, then adhere.

One of the most commonly omitted steps in covering with a heat shrink material is failing to run a cloth behind the sealing iron to push the adhesive into the wood. This greatly increases the total adhered area and strength of the structure as well as preventing blistering and wrinkles from the heat of the sun. In the case of MonoKote, punch small pin holes in the bottom of each wing and empennage bay to allow expanded air to escape. UltraCote is more porous, allowing the trapped heated air to escape through it.

The wheels should be installed with collars set in notches filed into the Goldberg 5/32" axles. The wheel covers are from Du-Bro and are held to the rims with small screws.

The canopy can be adhered to the coaming with RC-56 or equivalent. We like to mark the canopy's outline onto the covering with a grease pen, then carefully cut and remove a thin strip of covering. The canopy is then seated in RC-56 that has been beaded onto the cutout and is held in place with masking tape and pins while the adhesive cures. Excess adhesive and any smears can be removed with a rag and water before the glue sets. Hide the seam with tape or a strip of UltraCote Plus.

B.O.B. would look a bit silly flying around without a pilot. Ours is a 1/4 scale D.G.A. cut off at the shoulders. Several other latex or styrene choices are available. The interior of the cockpit area needs a coat of black or gray paint.

The horizontal rudder stripes were created by covering the whole unit with white UltraCote, then applying strips of flame red and dark blue UltraCote Plus cut with a Smart Stripe; but could be done with a metal straightedge. They are applied over a light mist of detergent and water, squeegeed off, then allowed to dry. Run over the edges with low heat to seal them.

The "V" on the upper wing center section was done in the same way. Numbers and letters are die-cut sticky-backed vinyl from an office supply. Stars are Sig DCM403 applied like the stripes.

The 2-56 pushrod tail braces are attached with clevises to Sig SH-709 nylon landing gear retainer straps that have been bent in the middle to match the angle. These are bolted in place with 4-40 x 3/4" Allen head bolts, washers, and elastic nuts. Threaded clevises are used on one end and solder links on the other. They are adjusted for a snug but not guitar string tightness. One of these nylon straps is passed between the tail wheel bracket and the fuselage.

Trim And Flying

We have not shown any engine down or right thrust on the drawings. The reason being these will vary greatly depending on the power plant/prop combinations used, and the specific characteristics of a given model's alignments.

A strong engine with a large prop will need more right and down thrust than a smaller power plant and prop. We would suggest twisting the engine on the engine mount for 2° or so of right thrust at the time the mounting holes are drilled.

As your particular model is flown a bit, you may find it needs more right thrust if the model veers too sharply to the left on take-off or requires right rudder trim in high throttle. If your model lifts its nose up when full throttle is advanced, requiring down elevator trim, add some down thrust by shimming between the firewall and the engine mount face.

With its own individual collection of warps and misalignments, my B.O.B. powered with a Saito 150 4-stroke turning a 14 x 8 prop required 2° of right thrust and no down.

All this is not to imply bad or nasty flight characteristics, only to show ways to trim your personal "Big Old Bipe" for hands-off tracking. Actually the model is a wonderfully forgiving design that is a joy to fly.

The model should balance at the point shown with the tank empty. Some of this balance can be obtained by locating the battery pack. With the heavy Saito 150, ours needed the battery pack aft of the lower wing trailing edge. Under no circumstances should this model be flown tail heavy!

The well located and wide set landing gear creates gorgeous take-off runs and landing rolls. With all that drag and lift, the B.O.B. lands very slowly without a tendency to suddenly quit flying. This model does not drop like a stone when the power is cut, but it has an ample share of built-in head wind and does slow down accordingly.

My shop space is such that I store fuselages on their noses. As a consequence every once in a while I arrive at the flying field with the tank's clunk stuck to the front of the tank. This carelessness on my part has caused five dead stick landings with the B.O.B. All that is required is to get the nose down enough to maintain some flying speed (and that is slow), make a gentle turn to get lined up with the runway, and let the model land.

Aerobatics with the surface throws in low rate are certainly not "flip and flop" but rather very stately and wonderfully well controlled. If you have ever been fortunate to see Bob Lyjak fly his aerobatic Waco you will understand our description. This bipe is capable of the most beautiful big slow, horizontal eights and Cubans you could ask for.

In high rates, snaps and spins can be rather spectacular as well. Recovery is nearly instantaneous when the surfaces are returned to neutral.

There is some undeniable attractiveness to a big biplane in the air. That attraction may well be nostalgia for that long ago time when full scale pilots had that freedom and sense of adventure we mentioned. So build a "Big Old Bipe" and enjoy that feeling.

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