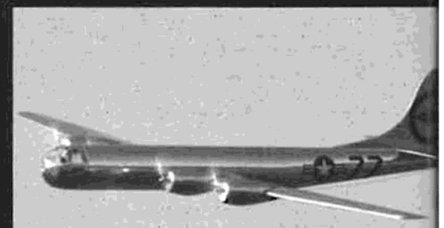
ELECTRIC B-29

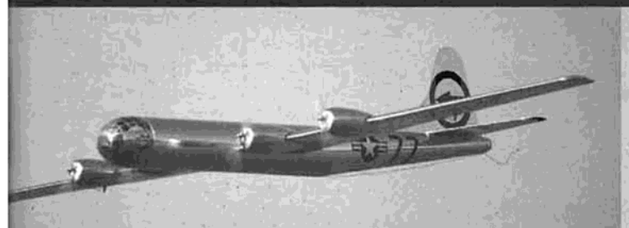


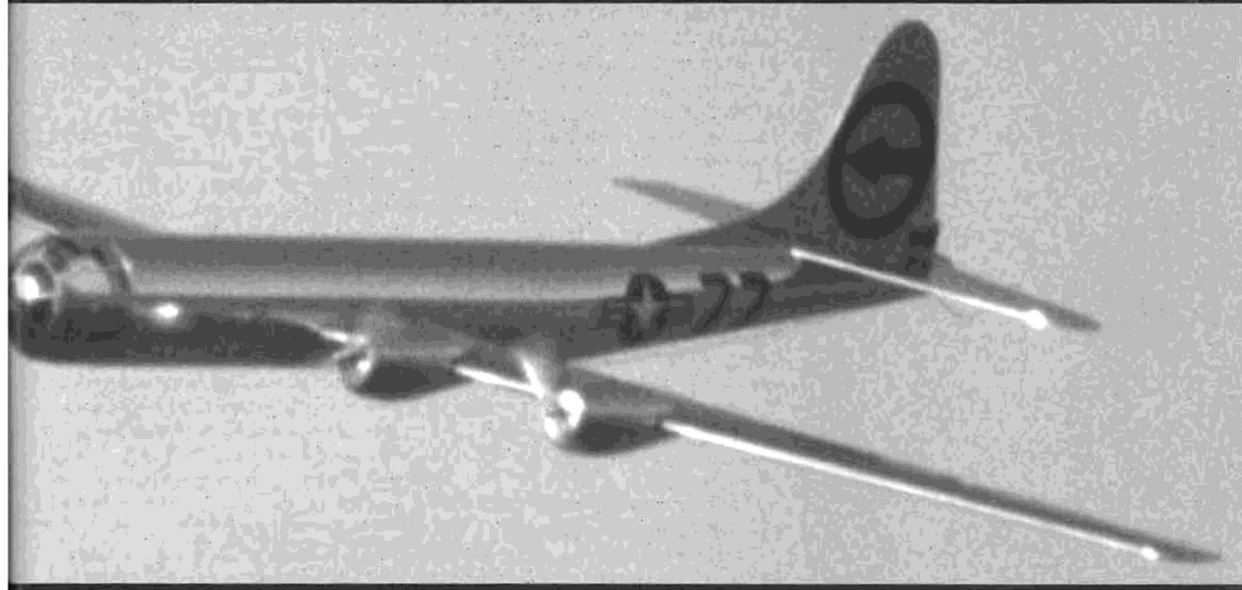
Sport-Scale WWII Bomber For 4 Speed 400 Motors

By Jim Young

ABOUT THE AUTHOR

Jim Young has been modeling and flying R/C for 19 years. He built his first model on the desk in his college dorm room. He started with glow power and transitioned over the years to primarily electric power. Jim has designed several models and has had three plans and other articles published in various magazines. He has won five awards at the annual Toledo R/C show, including 3rd place in Non-Military Sport Scale at the 2004 show.





The reliability of electric power lends itself to multi-engine aircraft. You don't have the trouble of synchronizing multiple engines and worrying about flame-outs. So if you don't have these problems, why stop at just two motors? The four engine Boeing B-29 is a perfect subject.

The Boeing B-29 had many new features for its time, including remote controlled guns and pressurized crew areas. It was the heaviest production plane of its time due to its ambitious range and payload requirements. Boeing, Bell, and Martin built over 3500 B-29's before production ended in 1946. The former Soviet Union used three captured B-29's to jump start their long range bomber program and produced a rivet for rivet copy of the B-29, the Tupolev Tu-4.

B-29s saw action in World War II primarily in the Pacific theater. As many as 1,000 Superfortresses bombed Tokyo at one time. The most famous B-29, The Enola Gay, dropped the first atomic bomb on Hiroshima, Japan on Aug. 6, 1945. B-29's saw service beyond the war including aiding the quest to break the sound barrier.

The Model:

Construction of the Electric B-29 is greatly simplified by the use of foam core wings and fuselage, and to keep it simple, the landing gear has been omitted in favor of belly landings. For power, a relatively low cost power system using Speed 400 motors keeps this project in reach of most modeler's budgets. So, if you love the sound of four motors beating as one, let's get started.

CONSTRUCTION

Tail Feathers:

The tail feathers are built from 1/8" balsa sheet. Edge glue several pieces of sheet together and cut and sand the fin to shape using the plans as a guide. Add the 1/8" balsa doublers to form the tail gunner turret. The prototype flies fine without a rudder, but feel free to add one if you like.

Bockscar nose art.

ELECTRIC B-29

Designed by:
Jim Young

TYPE AIRCRAFT
Sport Scale Electric

WINGSPAN
80.5 Inches

WING CHORD
7 Inches (Avg.)

TOTAL WING AREA
560 Sq. In.

WING LOCATION
Mid-Wing

AIRFOIL
Flat Bottom

WING PLANFORM
Double Taper

DIHEDRAL, EACH TIP
1 Inch

OVERALL FUSELAGE LENGTH
54.5 Inches

RADIO COMPARTMENT SIZE
18" (L) x 3-1/4" (W) x 3" (H)

STABILIZER SPAN
24 Inches

STABILIZER CHORD (inc. elev.)
5-1/4 Inches (Avg.)

STABILIZER AREA
125 Sq. In.

STAB AIRFOIL SECTION
Flat

STABILIZER LOCATION
Top of Fuselage

VERTICAL FIN HEIGHT
9 Inches

VERTICAL FIN WIDTH (inc. rud.)
6-1/2 Inches (Avg.)

REC. MOTOR SIZE
6V Speed 400 (4)

BATTERY SIZE
8-Cell 2000+ mAh

LANDING GEAR
None

REC. NO. OF CHANNELS
3

CONTROL FUNCTIONS
Elev., ESC., Ail.

C.G. (from L.E.)
3 Inches

ELEVATOR THROWS
3/8" Up – 3/8" Down

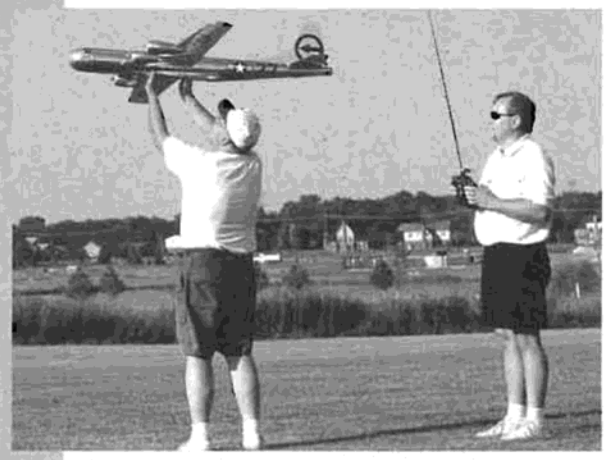
AILERON THROWS
3/8" Up – 1/4" Down

SIDETHRUST
–

DOWNTHRUST/UPTHRUST
5° Downthrust

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage ..... Foam & Balsa
Wing ..... Foam, Balsa & Ply
Empennage ..... Balsa
Wt. Ready To Fly .... 72 Oz. (4 Lbs. 8 Oz.)
Wing Loading ..... 18.5 Oz./Sq. Ft.



Flying buddy Ron McHale helps the author prepare the B-29 for flight.

Cut and glue 1/8" balsa sheet for the stabilizer. The grain on the stabilizer tips should run perpendicular to the span. Bend a 1/16" music wire joiner according to the plans. The elevators are cut next and positioned between the stabilizer tips. Mark the location of the joiner wire and carefully drill a 1/16" hole in each elevator half and bevel the leading edge as shown on the plans. For an internal control linkage, silver solder a piece of threaded rod to the middle of the joiner wire. Then thread a ball link onto the rod for a slop free connection. Cut and fit a piece of 1/8" balsa to go between the elevators, this will be attached when the stabilizer is mounted to the fuselage. Sand all the outer edges round and set the tail feathers aside.

Motor Mounts:

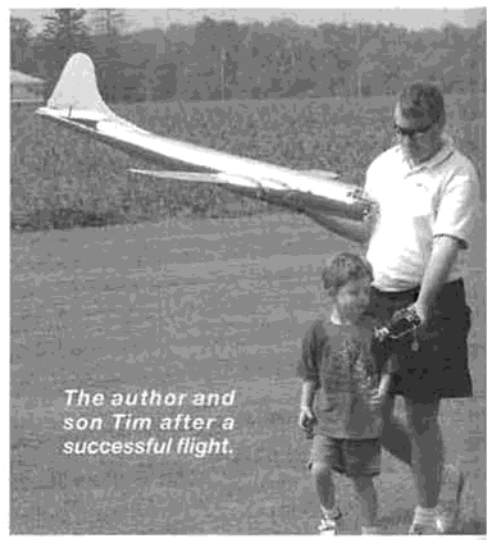
The motor mounts consist of 1/16" plywood and balsa triangle stock. Cut out eight sides and four bottoms. The bottom of the motor mount is parallel to the top edge of the sides. This gives several degrees of down thrust. Mark each side with a line that starts at the lower front corner and runs parallel to the top edge. Tack glue the bottoms and the sides together with the bottom lined up on the marks. Add the balsa triangle stock and the motor mounts are done.

Fuselage:

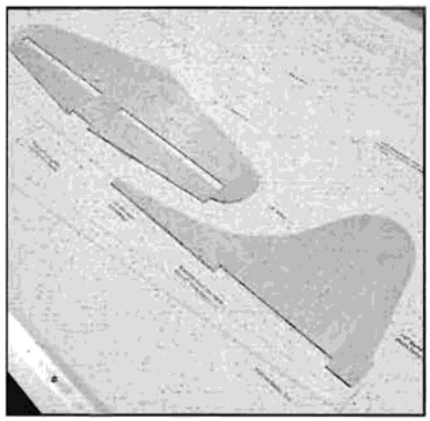
Next it's time to cut some foam. I cut the prototype with a homemade hot wire set-up, but I also have made arrangements with a friend, Dennis Buno, who has a CNC foam cutter and will cut all the foam parts at a very reasonable price. His contact information is at the end of this article.

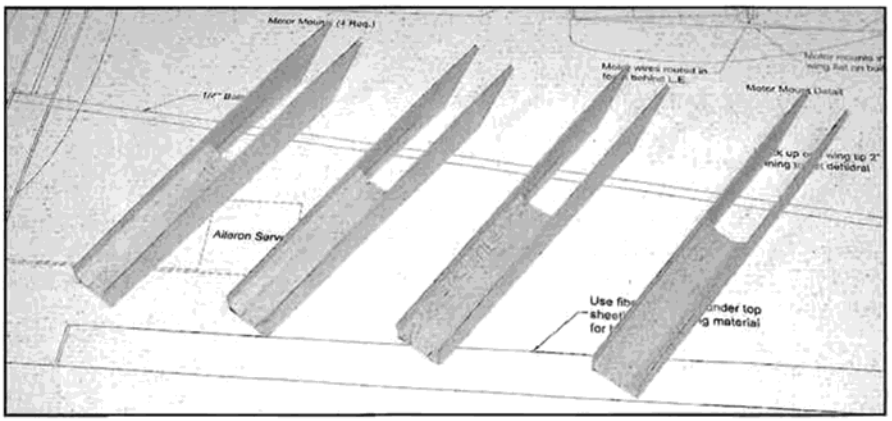
If you choose to cut the foam yourself, the wing is a single taper and should not be a big problem. The fuselage is cut in two sections. The main section is a simple tube and the tail is a cone. I started with a 6" x 6" x 25" blank for the main section and a 6" x 6" x 24.5" blank for the tail. Finding 6" thick foam can be a problem, but I was able to find 2"x4'x8' sheets of white foam at the local home improvement store. I made the blanks by tack-gluing three pieces together with some foam-safe spray contact cement. Just mist a very light coat on the pieces and immediately press them together. This will hold them together well enough to cut and the hot wire will not get hung up on this type of glue.

Make a set of templates for the fuselage. I use Formica for my templates because the edges can hold a very smooth finish. If there are any rough edges on the templates, the hot wire can get hung up and cause problems. Pin the templates to the ends of the foam blank. Position the blank over the corner of a table so the ends of your cutting bow can hang down on each end. Position the cutting wire down the top center of the blank and turn on the power. When the wire hits the template, nudge it to one side and let gravity pull it down around the template. When the wire gets to the 3 o'clock position, turn off the power and rotate the blank 90 degrees. Start the wire cutting again and let gravity take over. Again let the wire cut 1/4 of the way around the template and then stop and rotate the blank. Repeat this procedure two more times and you'll have a nice tube. If there is some burnout or bumps, a few seconds with some sandpaper or light filler should true it up. (Save the cutoff blanks and cores. You will need them later!) Hollowing the inside of the tube is much easier. Poke a piece of music wire though the center of the tube and use this to fish the cutting wire though and reconnect it to the bow. Now, just hold the tube and rotate it as the hot wire cuts. Next, place the fuselage tube back in the blank and use the wing saddle templates to cut out the location for the wing. If you temporarily tack-glued

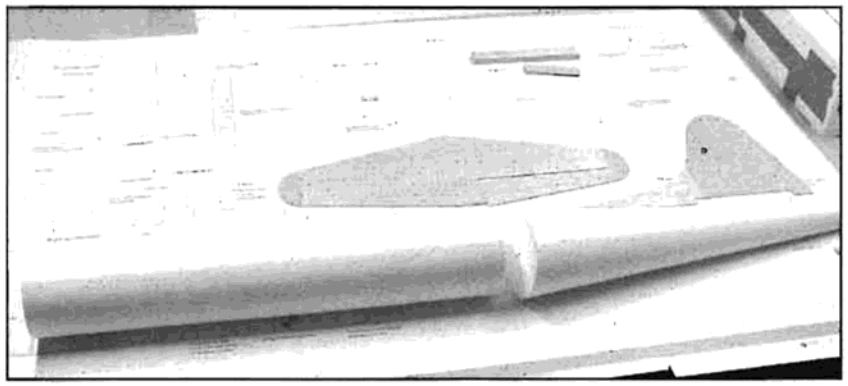


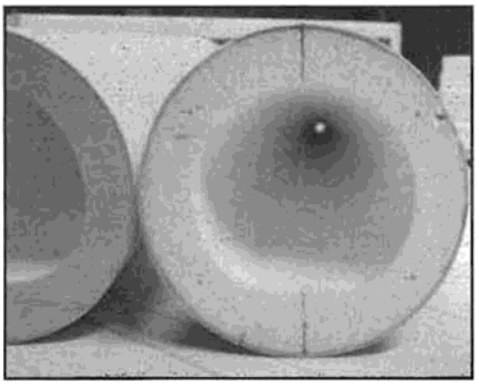
The author and son Tim after a successful flight.



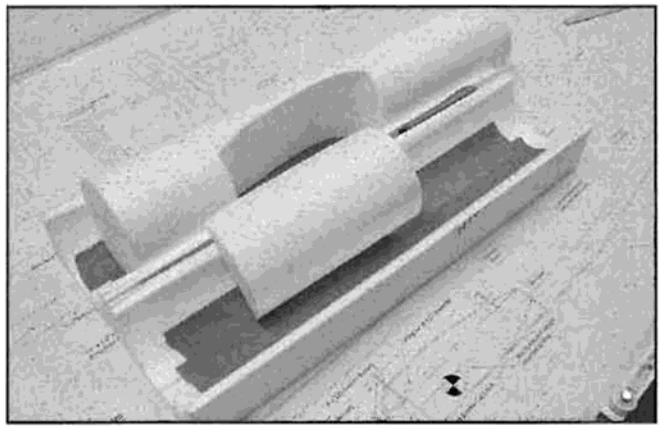


LEFT: The "tail feathers" are cut from 1/8" sheet balsa. Note grain directions. RIGHT: Four motor mounts are built up from 1/16" birch ply and balsa triangle stock. The required down-thrust is built in.

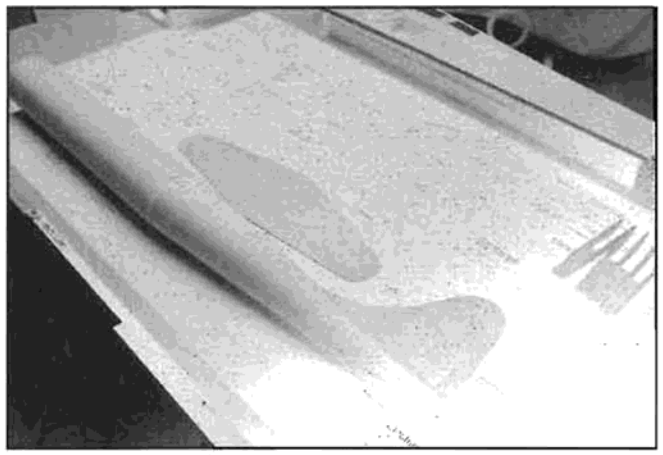


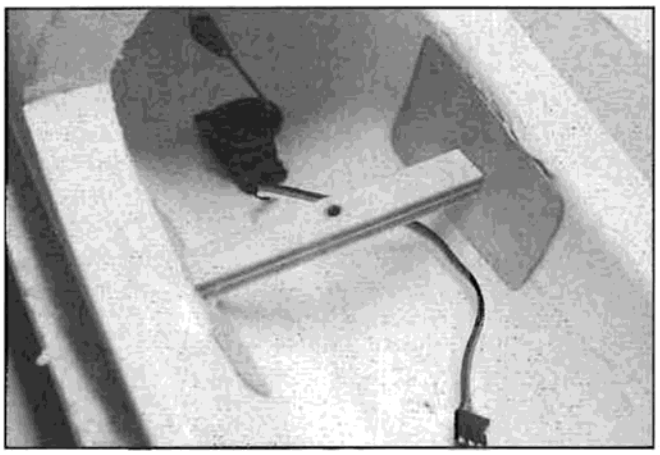


LEFT: The fuselage starts with a foam cylinder and a cone. The foam components can be cut by the builder or purchased from a supplier listed in the text. RIGHT: Both are hollowed out. (Saving the cores for later use.)

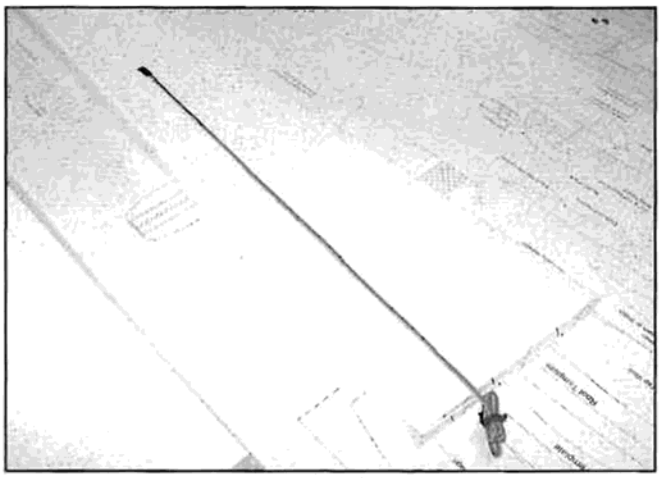


LEFT: The wing saddle/hatch is cut from the cylinder and the core. RIGHT: Here the fuselage is being sheeted with 1/16" balsa. A "Food Saver" vacuum-bagging system assures a good bond of the balsa to the foam.

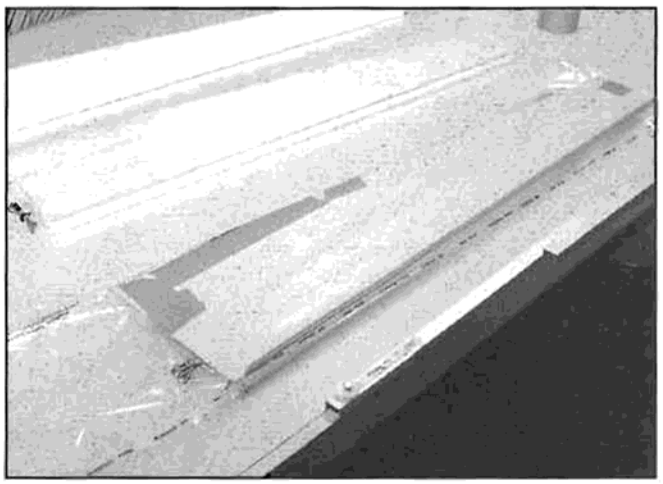


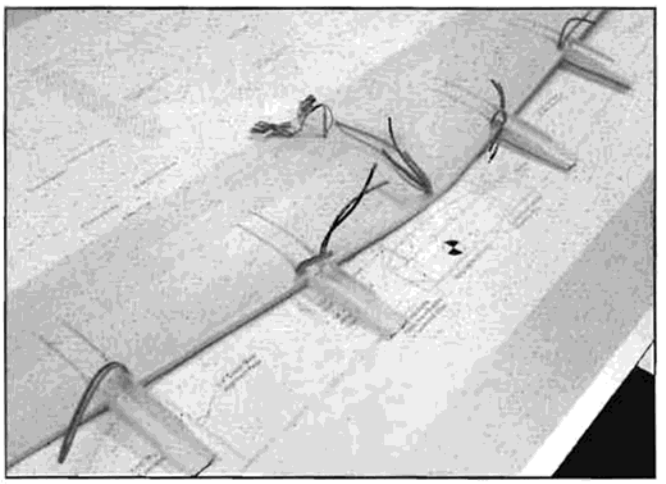


LEFT: The sheeted fuselage cores, ready to join together. RIGHT: After the sheeting is trimmed away from the wing saddle, the hardwood wing mounts and their 1/32" plywood reinforcements are added. Note the elevator servo, glued into the foam at the top of the fuselage.



LEFT: Here are the basic wing cores. The author used a home-made cutting bow to make all the required cuts. RIGHT: The aileron wire leads are imbedded in the foam before sheeting the wings.





LEFT: The wings are also sheeted with 1/16" balsa and vacuum-bagged. The traditional method of replacing the sheeted cores in the blanks and weighting them will also work. RIGHT: Heavy gauge wire is run behind the leading edges for motor power. The motors are wired in parallel.

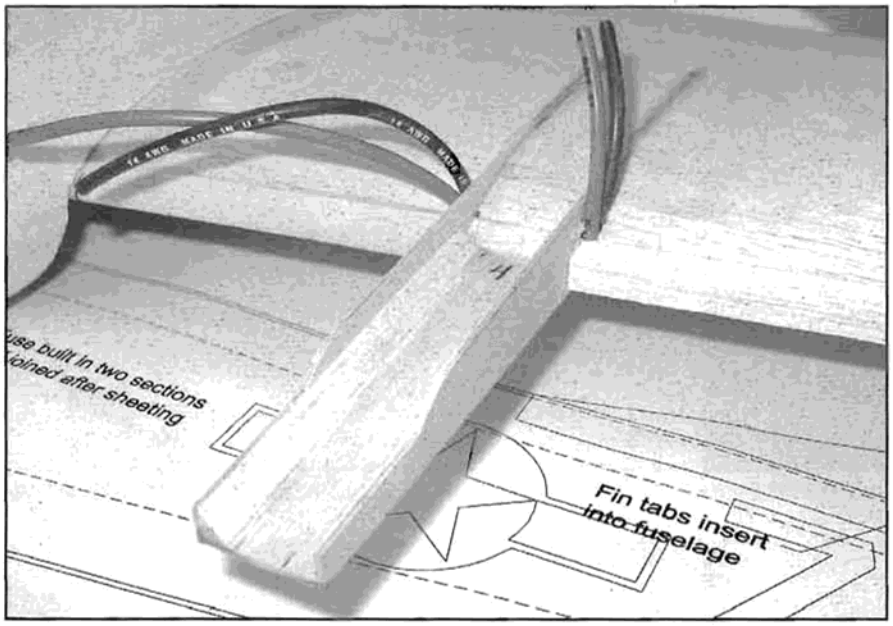
the foam for the fuselage, take time now to permanently glue them together. Add the 1/16" plywood plate to the front of the main section.

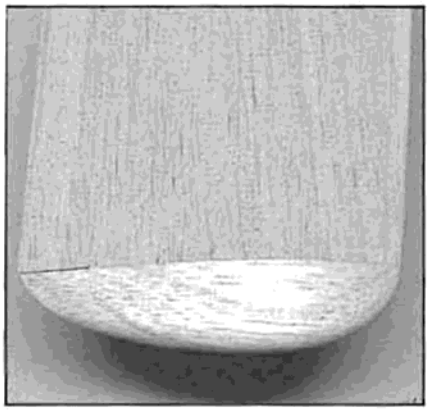
The fuselage is fully sheeted with 1/16" balsa. Start by preparing 1/16" balsa sheeting for the main fuselage by edge gluing four sheets of 4" wide sheet together. It will make it easier to sheet the tail section if the skin is made up from tapered sheets. This way the grain of the balsa will follow the taper of the tail cone. Cut four sheets of 1/16" balsa that taper from 4" to 1-1/2" and glue them together for the tail sheeting. Sand the sheeting smooth and vacuum off the dust.

Mark a centerline on each of the sheets and along the top center of each fuselage section. I used spray contact cement to laminate the sheeting to the foam. Temporarily tape the inside of the main tube and the cutout for the wing saddle back into the main fuselage section to help keep the foam tube from deforming. You only get one chance at this, so it may make sense to practice a few times before applying the glue. The foam tube will be placed on the middle of the skin and is rolled onto the skin. You will need to apply slight pressure to avoid forming a bubble between the balsa and foam. Apply contact cement to the balsa skin and foam tube, and allow for the recommended drying time. Position the balsa skins on a smooth flat surface and carefully position the top center of the tube along the center line on the skin. In a smooth motion, roll the foam tube onto the skin, first in one direction and then the other. Trim the balsa skins where they overlap on the bottom and secure the seam with odorless CA. Repeat for the tail section.

Probing with a pin from the inside of the main section, you should be able to find the edges of the wing saddle. Cut through the balsa sheeting and remove this section. Trim the balsa sheeting and true up the ends of the fuselage sections. The main and tail sections are joined upside down on a flat board. Once the fit between the two sections is satisfactory, glue them together with aliphatic glue or epoxy. Make sure there is a good bond between the balsa sheeting. The tail is finished with a block of balsa, carved and sanded to shape. Cut a battery cooling inlet and exit in the bottom of the fuselage as shown on the plans.

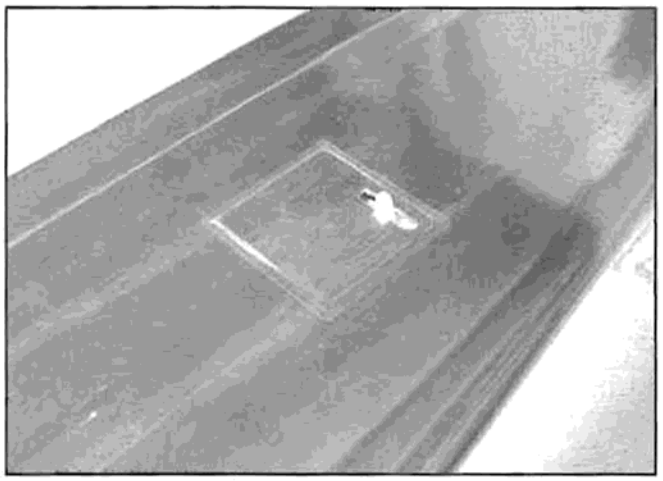
Mark the locations for the 1/4" x 1/2" spruce wing mounts on one side of the fuselage. Cut holes through the balsa sheeting and foam so the wing mounts can be inserted. Remove the

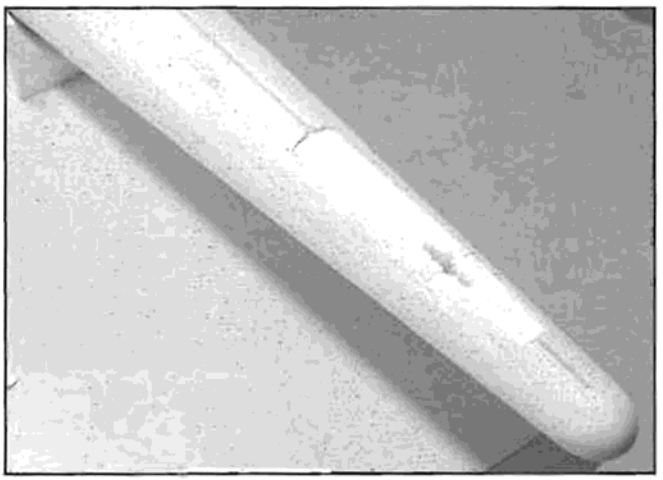




ABOVE: Carved balsa wingtips finish the wing.

LEFT: Motor mounts are set into slots in the wing. The flat bottom wing and the flat bottom of the mounts line up, making the proper amount of down-thrust automatic.





LEFT: The aileron servos are glued into the foam core and the balsa aileron covers are held in place by the covering. RIGHT: A slot is cut into the top of the fuselage for the vertical fin/rudder and a flat surface sanded to fit the horizontal stabilizer.

foam on the opposite side of the fuselage down to, but not through, the balsa sheeting. Cut the four wing mount reinforcements from 1/32" ply, making the holes for the wing mounts a tight fit. Cut the wing mounts to length and insert them through the side of the fuselage. Thread two wing mount reinforcements on each wing mount and glue everything in place with 5-minute epoxy. If the holes in the wing mount reinforcements are tight enough, they should hold themselves in place and conform to the inside of the fuselage. Patch the holes in the fuselage side with scrap balsa. Set aside the fuselage for now.

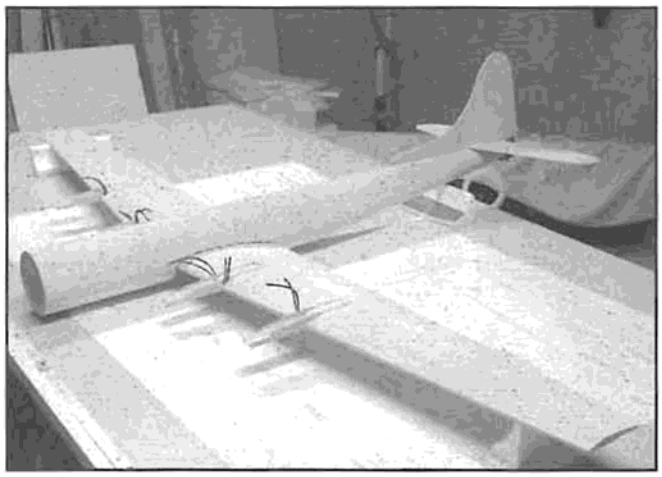
Wing:

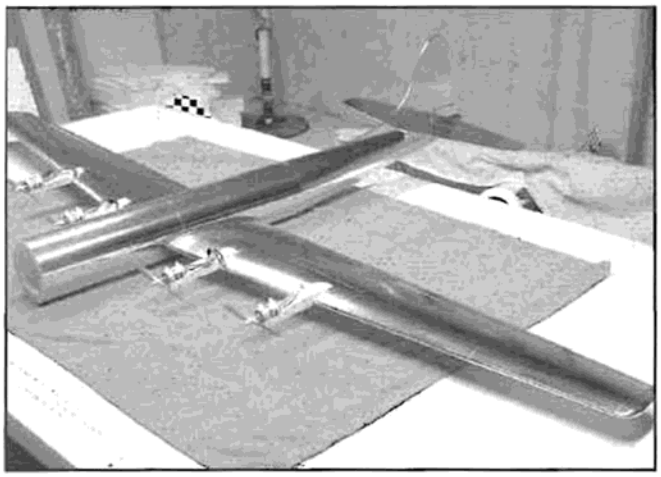
The wing is fully sheeted with 1/16" balsa. Prepare the wing cores by marking the location of the aileron servos. Cut a shallow channel in the bottom of the core for the aileron servo lead as shown on the plans. Do NOT run the servo leads next to the motor wires. Glue the servo leads in place and fill in any gaps with light filler. Make a paper template so you can find the end of the lead after the wing is sheeted. The ailerons are hinged with a fiberglass hinge under the top wing skin. Simply cut a 2" wide strip of 0.5 oz. cloth on the 45-degree bias. Lay this on the inside of the top skin across where the aileron hinge line will be and squeegee on the laminating epoxy. I used epoxy to skin the wing and vacuum-bagged it in my wife's FoodSaver. If you don't have a vacuum bagging system, just make sure you sheet the wings in their original blanks and pile on enough weight to get a good bond.

After the wings have set up overnight, trim the wing sheeting and true up the trailing edge. Sand the trailing edge down to 1/16" thick. You can toughen the T.E. with some foam-friendly, thin CA.

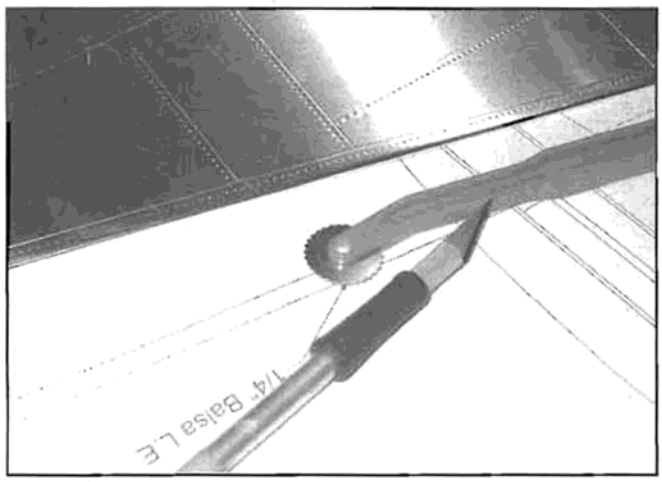
The ailerons are cut free as follows. Mark the outline of the aileron on the top and bottom of the wing. Cut the inboard end of the aileron free from the top and bottom sheeting. Cut a 1/16" wide channel in the bottom sheeting along the leading edge of the aileron. Remove the bottom sheeting and dig out the foam core down to the fiberglass hinge. Using the back edge of a hobby knife, crease the top sheeting along the leading edge of the aileron. You should now be able to flex the hinge. This hinging method is very strong, permanent, and provides a hidden sealed hinge line.

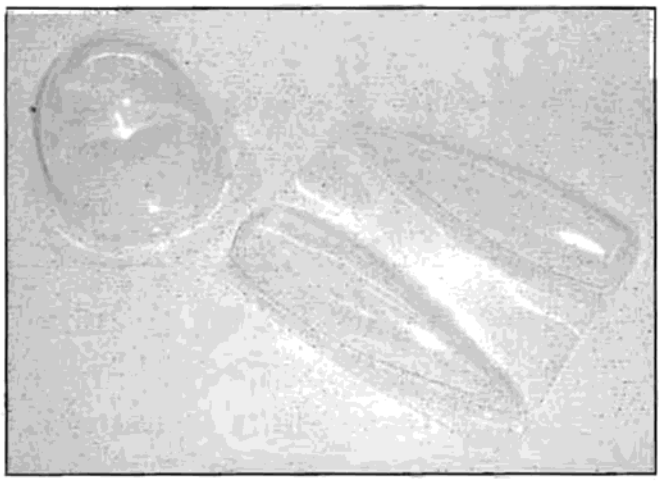
Along the leading edge of each wing panel, route out the foam for the motor wires. There will be approximately 20A going into each wing, so I would recommend using good 14AWG or 16AWG wire. Using the plans, mark the locations of the motor mounts. Put a new blade in your hobby knife and carefully cut slots through the top and



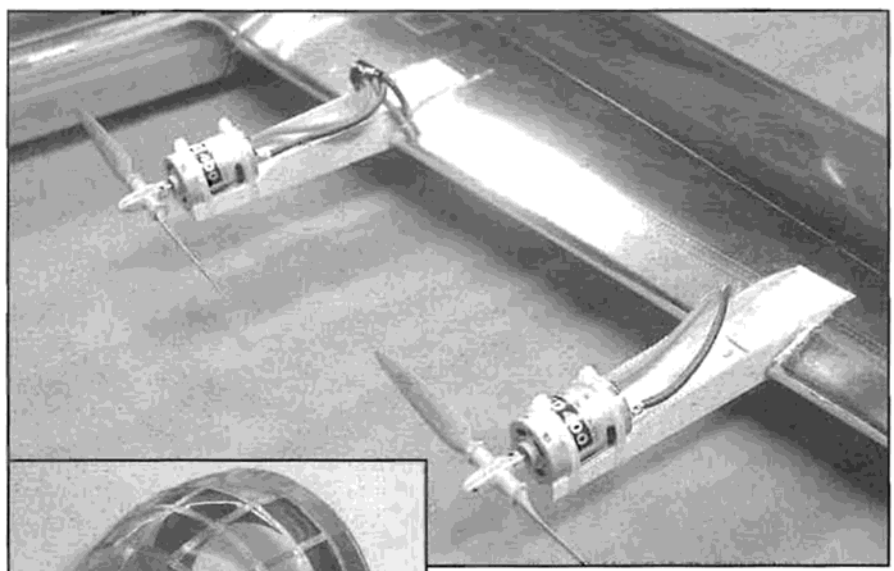


LEFT: Here's the basic structure ready for covering. RIGHT: And covered with chrome UltraCote.

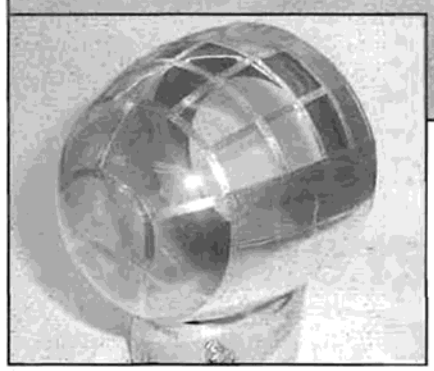




LEFT: Panel lines and rivet detail was added with a dress maker's wheel and the back of a #11 blade. RIGHT: The nose and nacelles can be carved from balsa or purchased in molded plastic from the author (see text).



Motors mounted and wired. Note Graupner 6.5 x 4 two-blade flying props.



Aluminum tape intended for sealing sheet-metal ductwork was used to cover the nose and nacelles.

bottom sheeting for the motor mounts. Work slowly and keep the slots as tight to the motor mount sides as possible. The tops of the motor mount sides will need to be trimmed to blend into the tops of the wings. Number each motor mount and mount location to keep them organized. Run the motor wires through the leading edge of each wing panel. The motors will be wired in parallel. In each wing panel run two wires from the wing root to the first motor mount, and two wires from the first motor mount to the second motor mount. Make small cutouts for the wire in the top sheeting next to each of the motor mounts. Leave enough extra wire hanging out for the motor hookup.

Remove the motor mounts and cut and glue into place the 1/4" balsa leading edge. Rough sand the leading edge to shape and cut slots in it for the motor mounts. Reinstall the motor mounts. Both the wing panel and the bottom of the motor mounts should be flat on the building board. Use the plans to line up the motor mounts, as it is easy to twist them left or right. Once they are lined up, use odorless, thin CA to glue them in place. Add the balsa block wingtip and carve and sand it to shape.

With one wingtip blocked up 2" to set the dihedral, sand the joint between the two wings to get a tight fit. Cut exit holes for the aileron servo leads and the motor wires. When satisfied, glue the two wing panels together with epoxy. When the center joint has cured, test fit it to the

Dave Grife launching the B-29 on its maiden flight.

fuselage. The center portion of the leading edge will need to be sanded down to fit properly. Once the wing will fit into the wing saddle, wrap the center joint with 2 oz. fiberglass cloth and secure with a good quality finishing epoxy. You will get a stronger joint if the cloth is applied on the 45-degree bias. This way all of the fibers cross the joint, not just half of them. After the epoxy has cured, cut two 1/16" plywood plates to reinforce the wing mount bolt areas of the wing.

Align the wing to the fuselage, center it left and right, and square it to the fuselage. Mark the locations for the wing mount bolts and drill two 3/32" holes through the wing and into the wing mounts. Tap the holes in the wing mounts for a 6-32 thread and open up the holes in the wings to 5/32". Harden the threads with thin CA and then re-tap.

Locate the aileron servo locations with your template and cut the bottom sheeting away. Be careful not to cut through the servo leads, it is very difficult to solder them back together and not melt the foam cores (don't ask me how I know about this). Cut out the foam core to fit your servos and glue them in place. Make 1/16" balsa covers to size and cut holes for the control arms. Make aileron control horns from 1/16" ply. Cut a tight fitting slot in the aileron and use odorless thin CA to glue the control horn in place. The servo covers are held in place with the iron-on covering.

Final Assembly:

With the wing mounted to the fuselage, cut and fit the wing saddle cutout to the bottom of the wing. Before permanently attaching it to the wing, cut two 5/8" holes to access the wing mount bolts. Glue the fuselage section to the bottom of the wing. Line the bolt access holes with 1/32" balsa to help guide your screwdriver to the bolts.

Mark the location of the fin slots and the stabilizer position on the fuselage. Cut the slots for the fin through the balsa sheeting and all the way through the foam. Slowly cut away the sheeting from the area where the stabilizer mounts. The top of the stabilizer should sit even with the top of the fuselage sheeting. Bolt the wing to the fuselage, and use it to line up the stabilizer. Assemble a control rod for the elevator and install the elevator servo. The servo is just glued into the foam in the top of the fuselage. Cover the tail feathers before permanently attaching them to the fuselage.

Vacuum-formed canopies and nacelles are available from me; my contact information is at the end of the article. If you choose to make the nose and nacelles yourself, there are outlines on the plans. The nosepiece could easily be made from foam turned in a drill press and glassed. The nacelles could be made from foam or balsa and glassed as well. The vacuum-formed nose only needs to be trimmed to fit, and then install the 1/16" ply former and 1/4" alignment dowels. It is held in place with a rubber band mounted inside the fuselage. Trim the nacelles and tape together the two halves. Use the plans as a guide to cut and fit the nacelles to the wing profile. When satisfied with the fit, scuff up the inside of the joint, and use fiberglass tape and epoxy to join them. On the front of each nacelle, cut holes for the motor shaft, cooling holes, and mounting holes. The nacelles are held in place by two screws through the front into the motors.

Finishing:

Most B-29's saw service in polished aluminum. I found some aluminum "duct" tape (not the cloth variety) at the local home improvement store that worked great for finishing the nose and nacelles. Some brands have printing on the tape, but it is easily removed with alcohol. Cut the tape to size and use a wooden stick to burnish it down. Working from the center of the tape outwards and not trying to cover too much with one piece helps to avoid wrinkles. The fuselage and wing are covered in chrome UltraCote. Panel lines are added with a straightedge and the back of a hobby knife. To really knock their socks off, add rivet detail. This may sound hard, but it's not. Pick up a "dress maker's wheel" at the sewing store for a few dollars. This is a small, serrated wheel for tracing dress patterns. Tape a straightedge in position, and run the wheel along the edge for a perfect row of rivets. Start with the tail feathers to get some experience, and always use a straightedge. You will be amazed at how fast you can detail a model this way. The turrets and markings shown on the plans are optional. The "Bockscar" that I modeled didn't have turrets.

Install your radio gear, battery, and ESC. The control throws should be elevators +-3/8", ailerons +3/8" -1/4" for the first flight. Your ESC should be able to handle at least 40 Amps and I would recommend an 8-cell CP2400 battery pack. Graupner 6.5 x 4 scale props running on direct drive 6V Speed 400 motors are a good combination. Four-bladed props would be nice, but you'd be landing on their tips. The motors are

simply taped to the fronts of the motor mounts using fiber-reinforced packing tape. Add three noise suppression capacitors (1uF ceramic) to each motor. A capacitor should run from each motor terminal to the motor case, and a third between the two terminals. Connect the motor wires. Reference the plans for the balance point and move the battery pack around for the proper balance. The pack is held in place with Velcro strips. The finished weight of the B-29 should be around 4.5 lbs.

Flying:

Before flying, take some time to do a thorough range check with the motors on and off. There is a lot of current flowing through this model and it can affect the radio reception. I have not had any problems with Chrome UltraCote affecting radio reception, but I cannot vouch for other brands. The first few flights were done with the antenna taped to the tip of the stabilizer. Since then, it runs down the bottom of the fuselage and I have had no problems. The B-29 needs a basic hand launch. You don't need to heave it, but just give a solid, level toss. Allow it to build some speed and gain some altitude, then throttle back. Remember, this is not a sport model, so try to resist the urge to play airshow pilot. The first time I took mine out, everyone stopped flying and just enjoyed watching it cruise around the field at half throttle. For landings, set up low and keep some power on until you're over the field, then cut the power and flair before touch down to keep the nose out of the dirt.

My "Bockscar" B-29 flew several times at the 2004 Mid-America Electric Fun Fly, and won the CD's choice and "Most Beautiful" awards. I hope you enjoy flying your piece of history as much as I do.

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