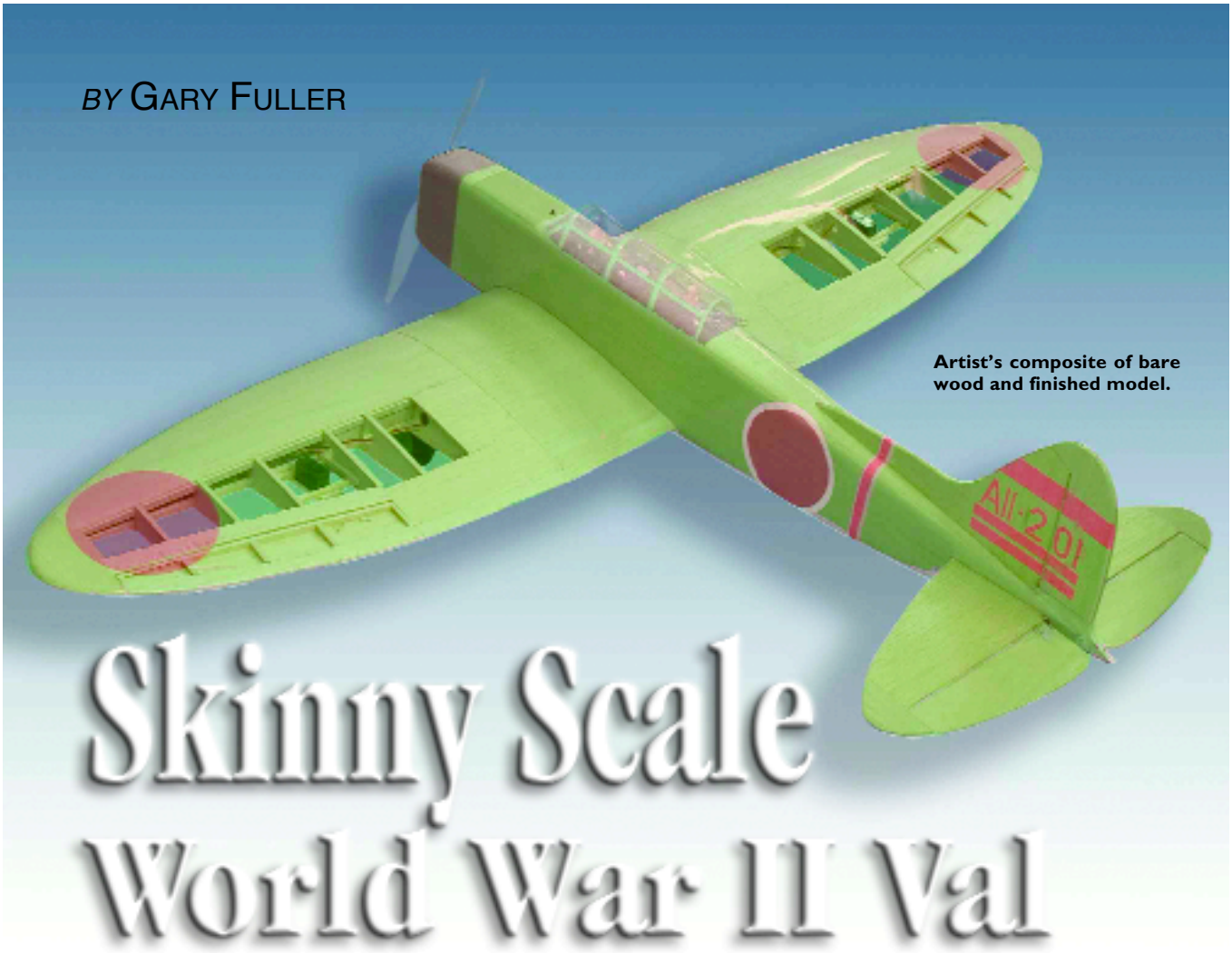
BY GARY FULLER



Artist's composite of bare wood and finished model.

Skinny Scale World War II Val

I WAS DISCUSSING with a friend my effort to try to come up with an interesting model that would be fun to build and fly, and the Japanese Val was mentioned. All I really knew about it was that it was a low-wing, fixed-landing-gear dive-bomber the Japanese used during World War II.

Part of what I enjoy about modeling is researching the various airplanes I build, so I started researching this aircraft. Did you know that a Val dropped the first bomb during the attack on Pearl Harbor in Hawaii in 1941?

Gary covered his Val with MonoKote. Although the colors are not authentic, the markings were used on a Val during the attack on Midway Island in 1942. This color scheme is easy to see in the air. Erin Fuller photo.

After looking at a three-view drawing I decided the Val looked like it might make a good-flying model. It had a generous amount of wing area; the landing gear was fixed, which would keep modeling costs down; and I could have the added fun of a droppable bomb.

The elliptical wing was the only thing I could think of that would make the Val slightly more difficult to design and build than any other low-winged sport model. However, the wing turned out to be fairly easy to build.

Since I like my sport-scale models to be easy to construct, the fuselage is built with flat sides like most other sport models. I also like to keep the weight down, so I made the fuselage as skinny as I could but wide enough to hide the radio and engine.

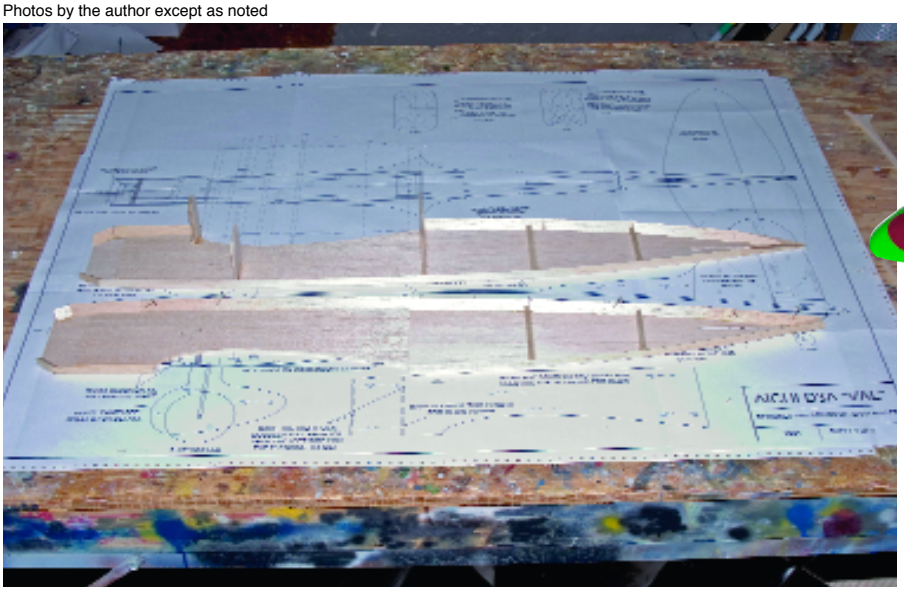
To make the horizontal and vertical stabilizer simple to build I used 1/4 balsa sheet. The wheel pants were the only things that gave me any trouble, and that was only when it was time to cover them with MonoKote.

I put 2° of washout in the wingtips to help during low-speed flight. With a ready-to-fly weight of approximately 6 pounds and a wing area of 680 square inches, the wing loading is only approximately 20 ounces per square foot; that's close to the wing loading of most trainers.

The electric bug has bitten me, so I used a MaxCim motor, gearbox, and controller in my Val. I think any motor that can put out at least 350 watts will work. If you want to use glow power, I recommend a .40-.60 two-stroke or a .52-.70 four-stroke engine.

Drop the complex rounded fuselage and almost any sport model becomes scale-looking enough to impress

Photos by the author except as noted



The left and right fuselage sides are almost ready to join; all that is needed is to taper the 1/2 balsa triangle stock at the rear end.

Before gluing the tail end of the fuselage together, place scrap wood in the horizontal stabilizer slot and on the wing saddle. Sight down the fuselage and get the two scrap wood pieces parallel with each other by adjusting the fuselage sides, which are held together with the clothespin.

Skinny Scale World War II Val

Type: RC semiscale

Wingspan: 63 inches

Wing area: 680 square inches

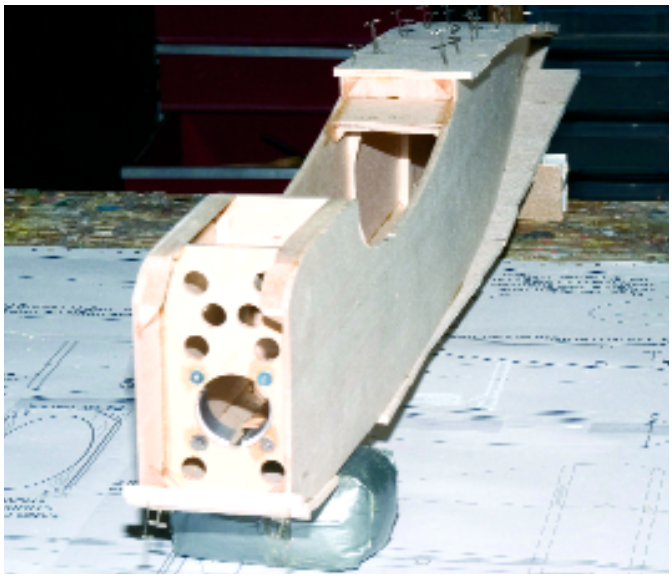
Flying weight: 6 pounds

Wing loading: 20.25 ounces per square foot

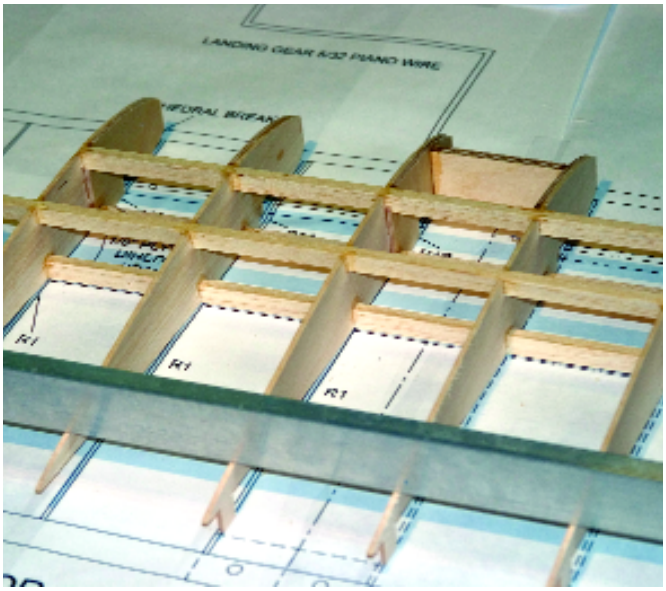
Power: .32-.50 two-stroke or .40-.65 four-stroke engine or MaxCim MaxN32-13Y motor geared 2.2:1, using a 15-volt 4000 mAh battery

Construction: Balsa and plywood

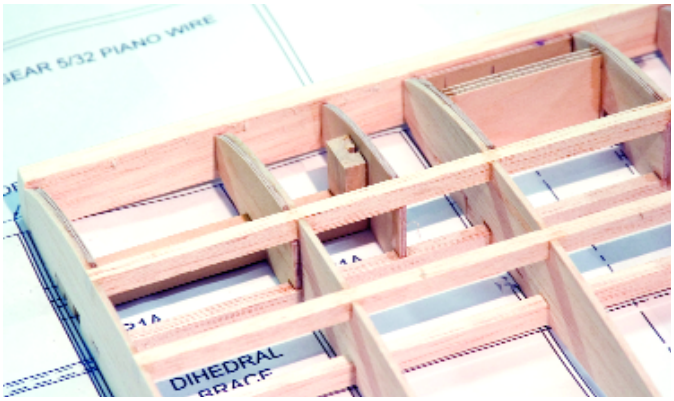
Covering/finish: MonoKote



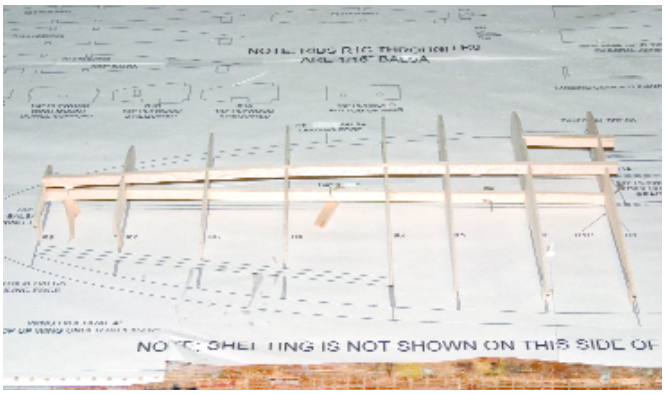
The author prefers Sig-Ment or Ambroid to glue the top and bottom 3/16 balsa sheeting in place. Holes are drilled in the firewall to cool the batteries and motor.



The center-section of the wing. Use a piece of aluminum angle to hold the TE of the ribs in alignment.

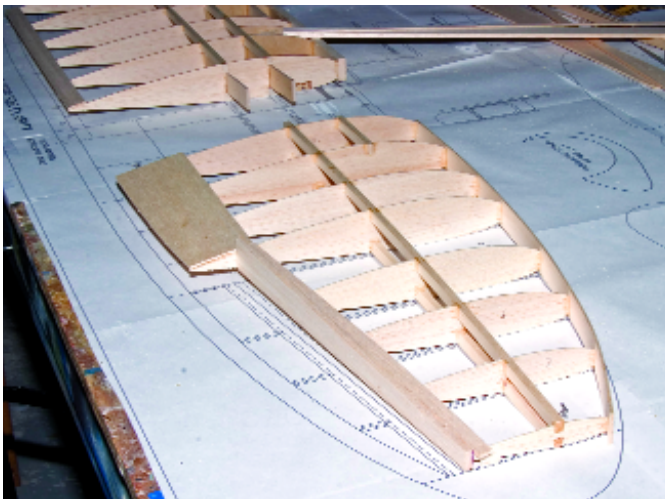


The landing-gear mount block in the wing center-section.

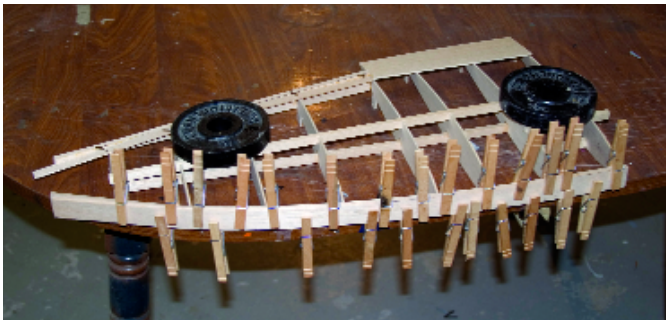


After the top spar is glued to the ribs the bottom spar is lifted into the lower spar slots, and then the spar is blocked up and glued to the ribs.

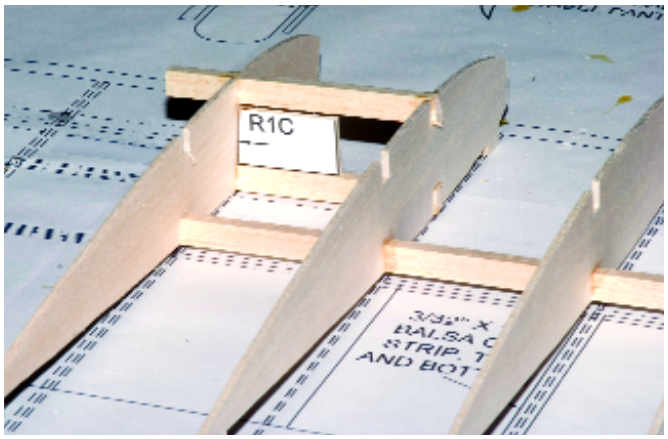
Before sheeting the top of the wing center-section, drill the holes for the landing-gear wires through the landing-gear mounting blocks using the vertical piece of grooved block as a guide.



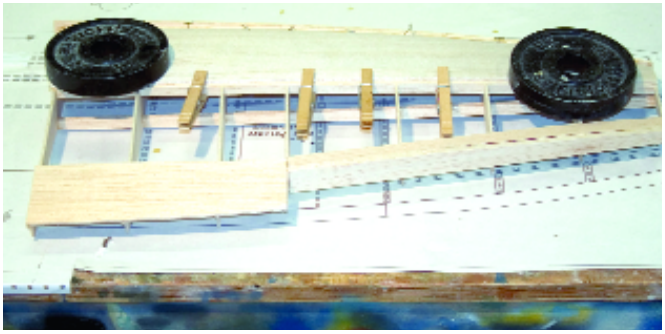
Before the LE is installed, glue the top TE sheeting in place. The first of the laminations are shown glued to the LE.



Many clothespins are used to hold the LE laminations together while the glue dries.

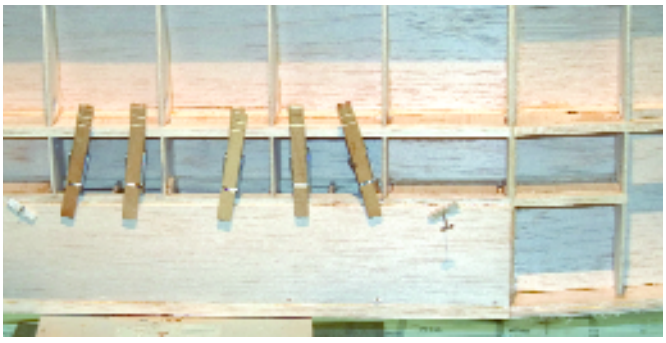


The R1C angle guide is being used to set rib R1C to the correct angle. Don't glue the rib to the spars until all the spars are in place.



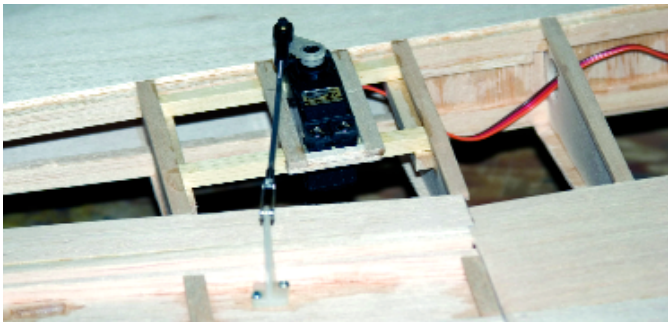
Glue the top sheeting to the LE only first. After the glue dries, wet the top sheeting with water and ammonia to make it more flexible.

Clothespins and clamps are used to hold the outboard section of the wing to the inboard section while the glue dries.

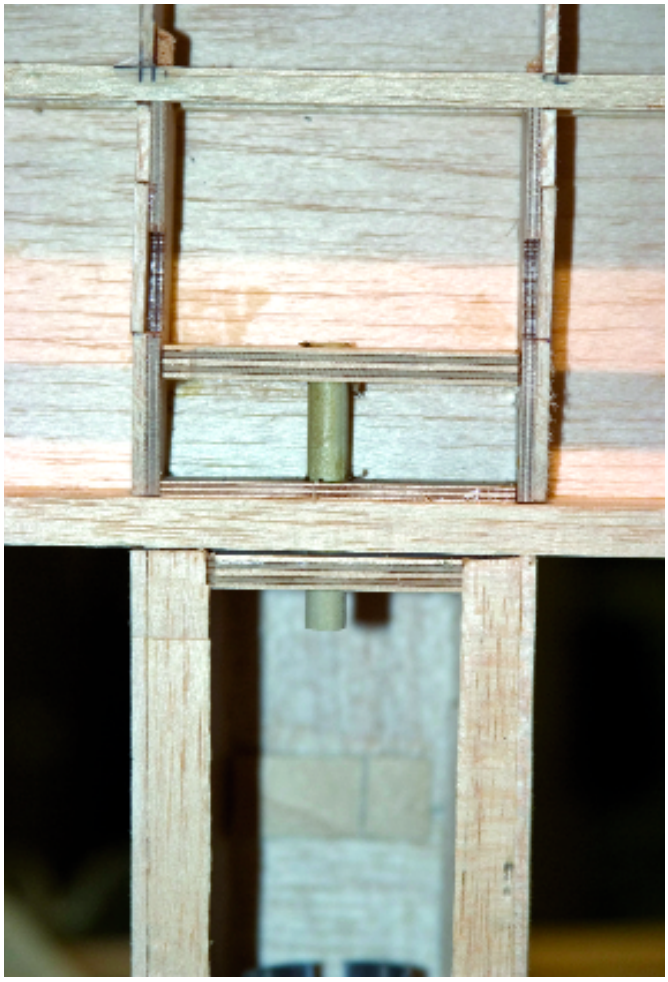


Clothespins and regular T-pins are used to hold the wing sheeting in place as the glue dries.

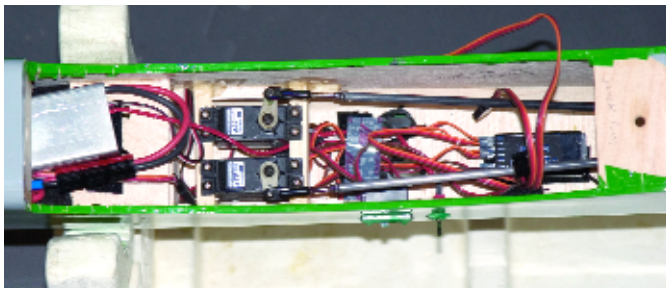
Drill a 1/4-inch hole in a large block of wood and insert the 1/4-inch wing-mounting dowel. This holds the wing in a vertical position, aiding in construction.



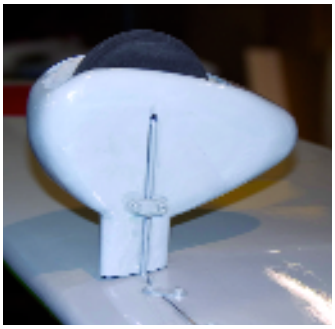
Aileron servos are mounted on the bottom of the wing. The ailerons need more up travel than down to reduce adverse yaw at low airspeeds.



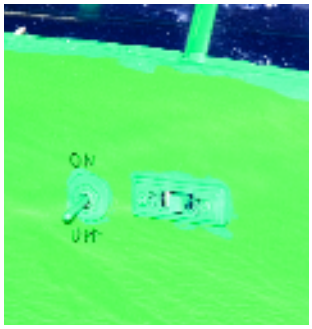
It makes it easier to drill the hole for the 1/4–inch-diameter wing-mounting dowel if you delay the sheeting of the bottom of the forward fuselage.



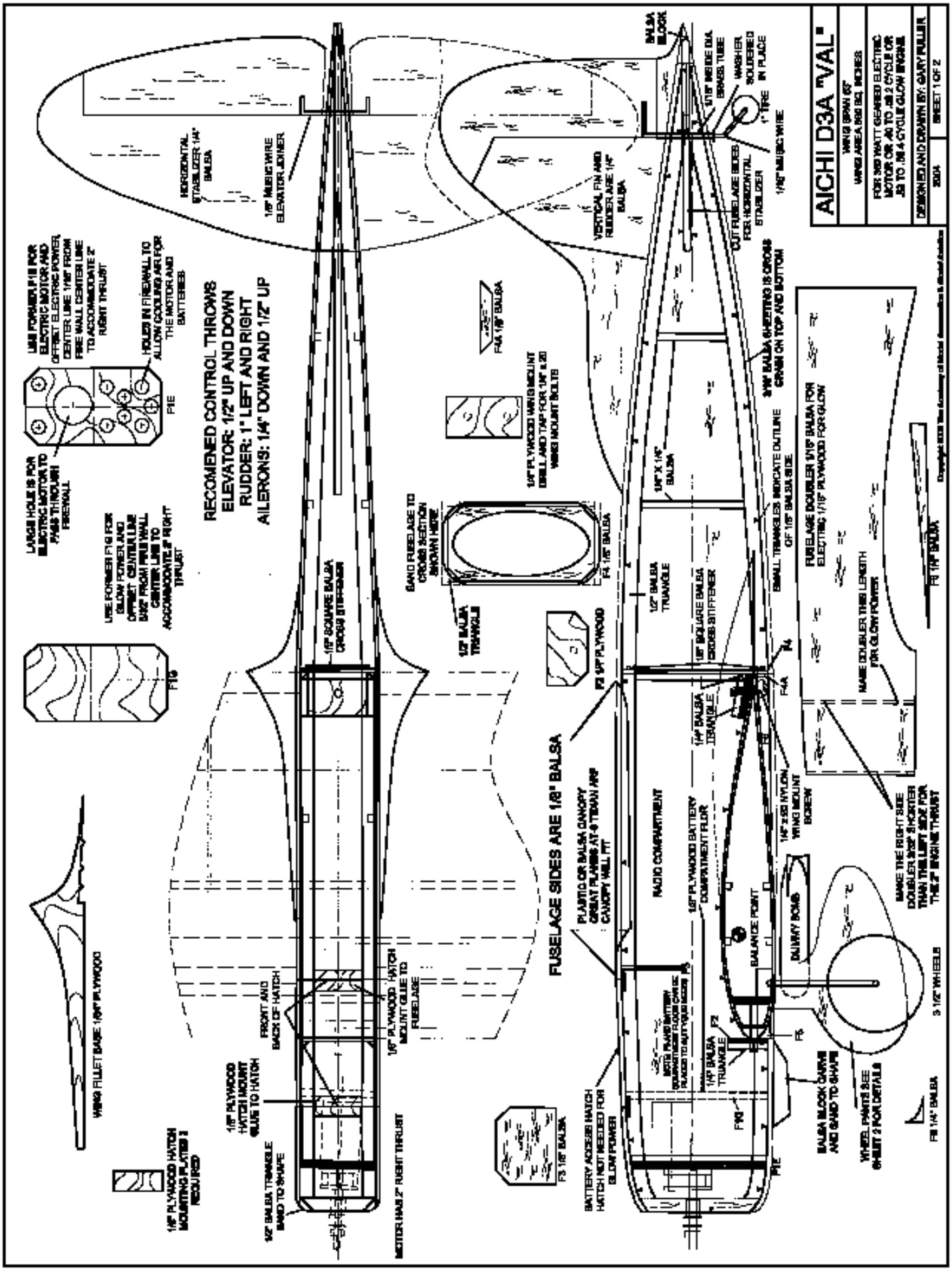
The motor speed control and receiver are mounted with hook-and-loop material. Other pieces of hook-and-loop are used to hold the wiring.

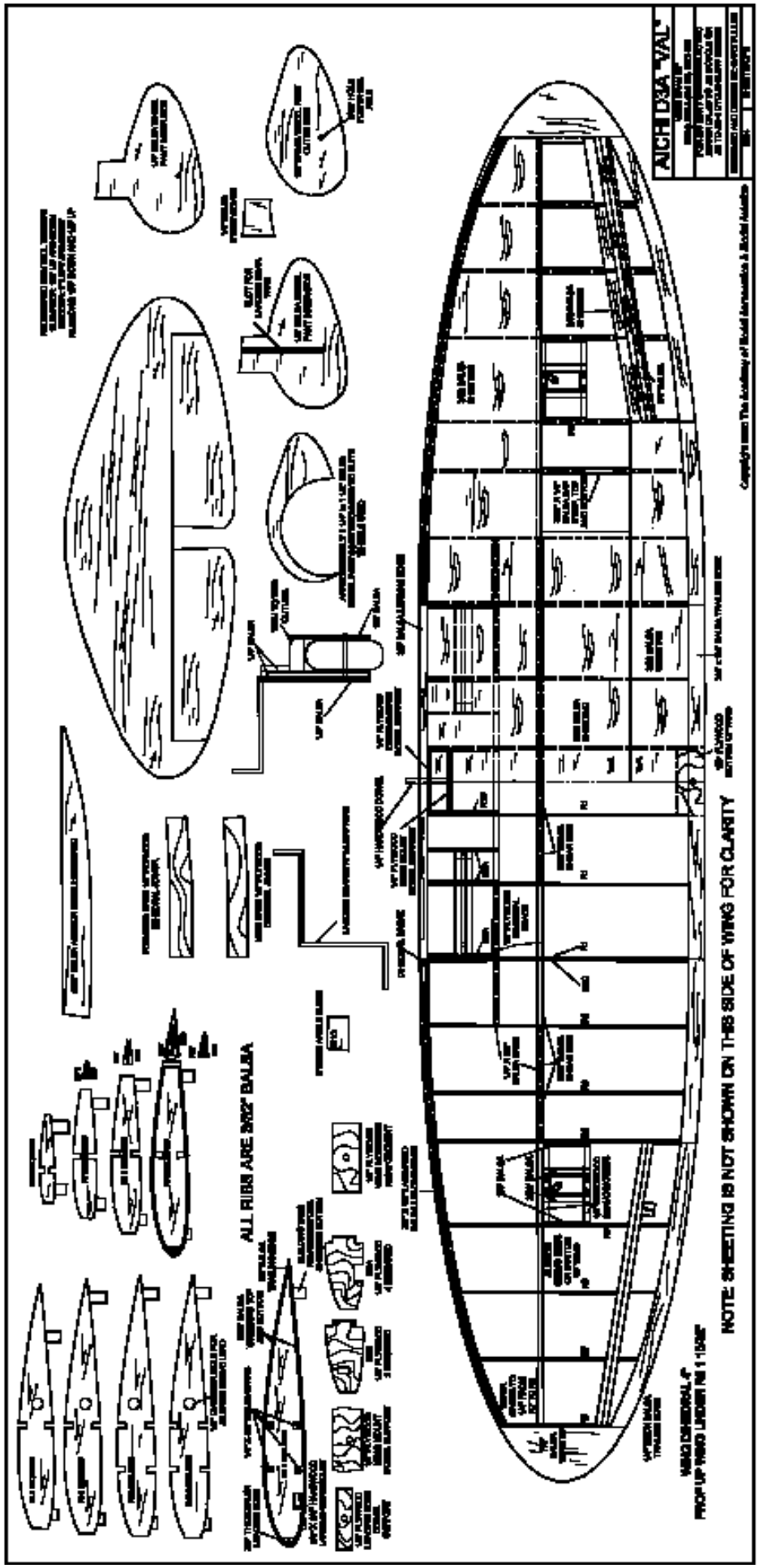


Only one nylon landing-gear strap is needed to mount the wheel pants to the landing gear.



The motor and radio switches are painted to match the covering.


AICHI D3A "VAL"
WING SPAN 65"
WING AREA 868 SQ. INCHES
FOR 3S9 WATT GEARED ELECTRIC MOTOR OR .40 TO .46 2 CYCLE OR .53 TO .56 4 CYCLE GLOW ENGINE
DESIGNED AND DRAWN BY: GARY FULLER
2004
SHEET 1 OF 2
RECOMEND CONTROL THROWS
ELEVATOR: 1/2" UP AND DOWN
RUDDER: 1" LEFT AND RIGHT
AILERONS: 1/4" DOWN AND 1/2" UP
FUSELAGE SIDES ARE 1/8" BALSA
RADIO COMPARTMENT
BALANCE POINT
DUMMY BOMB
WHEEL PANTS SEE SHEET 2 FOR DETAILS
Copyright 2006 The Academy of Model Aeronautics & Model Aviation



CONSTRUCTION

I like to cut most of the parts for my models before I begin building. There are numerous ways to transfer the shape of the part to the wood, but my favorite is to cut the plans for the separate parts and then use low-tack glue to adhere the plans part directly to the wood. I have had good luck using Elmer's glue sticks.

Use a band saw to cut the wood to shape. After the part is cut, remove the paper from the wood. Drill the holes for the motor mount when you cut the firewall.

Fuselage: Start with the fuselage by laying the left and right sides on my workbench so that they are top to top; that way you won't make two left or right sides as you glue the various pieces to the sides.

Glue the 1/16 balsa (or plywood if you plan to use glow power) doublers to the sides. Make sure you glue the shorter of the two doublers to the right side; this is for the 2° right thrust for the engine.

Adhere the 1/2 balsa triangle stock to the edges of the side as shown on the plans. Once the glue has dried, taper the triangle stock at the back end of the fuselage. Glue the 1/4 square balsa side stiffeners to the sides as shown on the plans.

Glue formers F2, F3, and F4 to only one side of the fuselage at this time. Former F2 can be positioned to suit your needs whether you use a glow engine or an electric motor. Make sure they are 90° to the side.

Glue the 1/8 square balsa to F4 as shown on the plans. Glue the other side to the formers. I did this by rubber banding the sides to each other, and using a square and my eyeballs I aligned the sides to each other. Glue the formers to the other side. Glue the firewall in place.

Set the fuselage on the workbench so it is sitting on its top. Place some 1/4 balsa sheet scraps in the wing saddle and the horizontal stabilizer slots on the fuselage, and then bring the aft end of the fuselage sides together and hold in place with a clothespin.

Sighting from the front or back end of the fuselage, the sides are adjusted at the back end so the 1/4-inch sticks are parallel with each other and the fuselage is straight. Once these are aligned, glue the back end of the fuselage together. Sheet the top of the fuselage with 3/16 balsa.

If you plan to use electric power, build the hatch on the top forward part of the fuselage. Sheet the bottom of the fuselage aft of the wing with 3/16 balsa. The sheeting's grain should be crosswise on the top and bottom sheeting.

The bottom forward of the wing will be sheeted after the wing has been mounted to the fuselage. Glue in the 1/4 plywood wing-mount plate and set the fuselage aside to allow the glue to dry.

When the glue has dried on the top and bottom sheeting, sand the fuselage to shape. I used a large C-clamp to support a sheet of 1/2 plywood on its edge. Then I carefully secured the fuselage to the plywood with part of the fuselage hanging over the edge of my workbench.

On the part of the fuselage that was hanging over the edge of the bench I draped the sandpaper across the top and pulled it down and back and forth in a method similar to that you would use to shine your shoes. When you're satisfied with the shape of your fuselage, set it aside and start the wing.

Wing: Start with the center-section. Glue the R1A and R1B ribs to the R1 ribs as shown on the plans. Pin the forward spar to the workbench. Place the rear spar on the plans, but don't pin it down; it will need to be raised up into the ribs after they are in place. Fit but don't glue the 1/4 plywood wing dowel support to the ribs that have the R1Bs glued to them, and glue them on the forward spar.

I used landing-gear mounts that Sig sells. They are 6 inches long, and you need to cut an inch for the end of each mount. After the landing-gear mounts are glued in place, these 1-inch blocks will be glued to the top of the landing-gear mounts at the inboard end up against the R1A rib, so don't throw them away.

Place the landing-gear mounts on the plans and adhere the remaining R1 and R1A ribs to the forward spar. Glue the top forward and rear spars to the ribs. Pull the lower rear spar up into the ribs and glue the ribs to it. Pull the landing-gear mounts up into the ribs and glue these in place, and then glue the 1-inch blocks on top of the landing-gear mount against the inboard R1A rib.

Glue the 3/8 balsa LE to the center-section and then glue the 1/8 plywood wing dowel support to the LE. Glue a 1 x 3/32-inch strip of balsa to the top of the ribs at the TE.

Mounting the 1/8 plywood dihedral supports is next. I did this by drilling some 1/8-inch-diameter holes in the outermost R1 ribs between the top and bottom spars. Then I joined the holes to form a 1/8-inch-wide slot from the top spar to the bottom spar by using a small file.

Install the dihedral joiner into the slot and glue it to the top and bottom spars. Make sure the dihedral joiner is at a 90° angle to the R1 rib before you glue it to the spars. Do this for the forward and aft dihedral joiners.

For the outboard wing panels I placed the forward and main spars on the plans and then pinned ribs R2-R8 in place on the plans. I placed rib R1C on the spar but did not pin it down.

I lifted the main spar up into all the ribs and placed shims under the spar in various locations along the spar to hold it off the workbench and into the ribs. Then I pinned the spar to the workbench.

Keep the spar straight along the wingspan and make sure the rib building tabs are still in contact with the workbench. Glue all the ribs except R1C to the spar. Lift the forward spar into rib R1C and R2 and glue to R2.

Place the top spar on all the ribs and glue it to all the ribs except R1C. Glue the forward spar to R2.

Cut the R1C angle guide from the plans and glue to some scrap plywood, and then cut the plywood to the shape of the R1C guide. Place the R1C guide on the bottom main spar between the top and bottom spars against R1C.

Adjust R1C so that it is against the guide, and glue it to the top and bottom spars. Be careful not to glue the guide to the rib or the spars, and make sure R1C is in the proper place on the plans. Move the R1C guide to the forward spar and adjust rib R1C, and then glue R1C to the top and bottom spars.

Glue the 1/4 balsa TE to the aileron cutout. Make sure you have the cutout at least 3/32 inch wider than the ribs for the 3/32 balsa sheeting. Glue the top 1 x 3/32-inch balsa sheeting to the TE at the aileron cutout. Glue the 3/32 balsa sheeting to the TE, inboard of the aileron.

I decided to use a laminated balsa LE on my Val, but you could use a solid balsa LE if you wanted. For a laminated LE, glue the first lamination to the ribs' LEs with some cyanoacrylate-type glue while the wing is still pinned to the workbench.

Use a Sig-Ment or Ambroid type of wood glue to adhere each successive lamination to the LE. You will need a bunch of clothespins or clamps to do this; clothespins may not be long enough to clamp on the laminations properly.

I worked around this by removing the wing from the workbench and placing it on a table with a curved end, with the LE overhanging the edge of the table. I weighted down the wing so it would not move and was held flat on the table. Then I used the clothespins from the top and bottom of the LE to hold the laminations on as the glue dried.

Glue the 3/32 balsa LE sheeting to the top of the outboard wing section. You may need to spray some water on the sheeting to make it easier to bend. Once the glue and sheeting has dried, sand the wing sheeting flush with rib R1. Cut the slots in R1 for the dihedral braces.

Once you are satisfied with the fit of the outboard section to the inboard section, glue them together. I used numerous clothespins to hold ribs R1 and R1C together from the bottom.

To increase the strength of the plywood dihedral joint to the top and bottom spars I added 3/32 balsa to fit between the top and bottom spars, and then I glued these to the plywood dihedral braces and the top and bottom spars.

Build the other outer wing panel in the same manner as you built the first panel.

Round off the top of the center-section's LE so the center-section will fit in the wing saddle on the fuselage. Center the wing on the fuselage and then drill the hole for the 1/4-inch wing-mounting dowel through F2 and the wing's LE. Remove the wing from the fuselage and glue the 1/4-inch-diameter dowel in place on the wing.

Sheet the bottom of the wing. Glue the 1/4 balsa TEs to the wing and sand them to match the contour of the airfoil.

The ailerons are fairly simple to build. They are 3/32 sheet balsa with half ribs glued to the top and bottom.

Glue the 1/4-inch-wide balsa capstrips to the ribs. Use 1/8-inch-thick balsa for the capstrips. Glue the 1/4 balsa TE to the ailerons. Cut the slots for the hinges in the ailerons and in the wing, and then temporarily mount the ailerons to the wing and sand the ailerons to match the wing.

Install the aileron-servo mount blocks as shown on the plans. The 3/32 balsa is to form a lip around the servo mount hole for the covering to stick to.

Adhere the wingtip blocks in place and sand them to shape. Glue the 1/8 plywood wing-bolt reinforcing plate to the bottom of the wing on the center-section.

Mount the wing to the fuselage and drill a 13/64-inch hole in the wing and fuselage for the wing-mounting screw. Tap the hole in the fuselage with a 1/4-20 tap. Enlarge the hole in the wing to 1/4 inch.

Glue F4A and F6 to the bottom of the wing and then sheet over it with 3/16 balsa. Use a sharpened brass tube to cut the hole for access to the wing mounting screw. Sheet the lower forward part of the fuselage with 3/16 balsa. Glue the 1/4 balsa F5s in place. Sand the lower wing fuselage fairing to match the contour of the fuselage shape.

Flip the fuselage over and secure it to the worktable so you can mount the horizontal stabilizer. Slide the horizontal stabilizer into the slot in the rear of the fuselage. Make sure the stabilizer is centered on the fuselage. Sight down the length of the fuselage from the front or rear and make sure the stabilizer and wing are parallel to each other horizontally.

Make sure the stabilizer is square to the wing by measuring from the wing TE to the stabilizer TE on both sides of the fuselage, and make sure these measurements are the same. Check the horizontal stabilizer's incidence to the wing; it should be approximately 1/2° LE down. When you're satisfied that the stabilizer is mounted correctly, glue it to the fuselage.

Mount the vertical stabilizer to the fuselage with pins. To align the vertical stabilizer so that it is not offset to one side or the other, sight down the top of the fuselage from the front and pin it in place. Adjust the vertical stabilizer so it is 90° to the horizontal stabilizer and then glue the

vertical stabilizer to the fuselage.

The tail-wheel bracket is 1/16-inch-diameter music wire bent to shape and mounted to the fuselage with 1/16-inch-inside-diameter brass tube. I built mine by bending the bottom of the bracket for the axle and slipping on a small washer to keep the tail wheel from pushing the rudder up. Then I soldered the washer to the music wire.

I sharpened the end of the 1/16-inch brass tube and used it to drill the hole in the fuselage for the bracket. Then I glued the brass tube in place on the fuselage and cut it to length. The music-wire bracket was slipped into the brass tube and the top of the bracket was then bent over to fit into the rudder.

The full-scale Val has a rather large wing-to-fuselage fillet; this has been drawn on the plans, but I opted not to install the fillet on my model. If you want to make a fillet for yours, I will describe how I was going to build it.

Cut the fillet base from 1/64 plywood. Loosely mount the wing to the fuselage and slip the fillet base in place between the wing and fuselage. When you are satisfied with the location of the fillet, tighten the wing to the fuselage and glue the fillet to the fuselage only.

Cut some soft balsa blocks and glue them to the fuselage. Carve and sand them to the shape of the fillet.

Bend the elevator joiner from 1/8-inch music wire, and then temporarily mount the elevator using your favorite hinging method. Temporarily mount the rudder.

Set the model aside and then bend the main landing gear from 3/16-inch music wire. The wheel pants are made from various thicknesses of balsa. The thickness of the main core of the wheel pants is determined by the thickness of the wheels you use and the addition of the wheel collars.

If you fly from a grass strip, cut the bottom of the pants so that more of the wheel is exposed than shown on the plans. I have seen pictures of a full-scale Val's wheel without wheel pants, so you may not want to build them for your model. Once you have cut all the parts for the wheel pants, glue them together and sand them to shape.

Final-sand the fuselage and cover it with your favorite covering material. I used MonoKote. Although the colors I used are not exactly accurate, I loosely based the color scheme on a Val that was aboard the aircraft carrier Akagi during the battle of Midway. I got the red "meatballs" from a set of decals I had from an old Top Flite Zero kit.

The canopy I used is from the Great Planes AT-6 Texan ARF that is available from Tower Hobbies. I decided early that I would have cooling holes cut in the fuselage in the cockpit area and I would leave the rear of the canopy open for the air to escape.

I cut the excess plastic from the canopy as if I was going to mount it on the model for which it was designed. Then I placed the canopy on the top of the fuselage and pressed it down until the front of the windscreen touched the top of the fuselage. I used a dry-erase marker to indicate the side of the canopy on which I needed to cut it to make it fit the fuselage.

After I cut the canopy to fit the fuselage I used a rag to remove the marks left on the canopy. I taped the canopy in place on the fuselage and marked the fuselage so I could remove the green MonoKote from the cockpit area and replace it with black MonoKote.

Once I had re-covered the cockpit area with the black MonoKote, I carefully cut a small strip away from the black for the canopy to be glued to bare wood on the fuselage. I used a sharpened brass tube to cut the cooling holes in the cockpit area.

Since I wanted to keep my model simple but still wanted a pilot and gunner in it, I decided to use a simple, flat version. I found a picture of a pilot and gunner and scanned it into my computer. Then I enlarged the picture to the correct size. I created a mirror image of the picture, and then I printed the mirror image and the original image of the picture.

I glued one side of the pilot and gunner to a piece of 1/64 plywood. Then I cut the plywood to the shape of the pilot and gunner and glued the mirror image to the other side

of the pilot. To make the plywood blend into the figures, I darkened the edge of the wood with a black magic marker.

I glued the pilot and gunner figures into slots cut in the cockpit area. When I was happy with the cockpit area, I glued the canopy to the fuselage with some Formula 560 canopy glue.

I mounted an old Vortac bomb release to the bottom of the wing near the CG. If you want to mount a bomb release, be careful not to cut the wing spars as you make the cutout for the release. I used a T-pin to poke through the wing sheeting to locate the spars. I mounted the bomb-release servo upside down in the wing so that a servo arm would actuate the release.

The Val's nose is rather short, so I mounted the radio gear as far forward in the fuselage as I could. I still ended up adding lead to the nose to get the CG where I wanted it.

The aileron servos are mounted to the bottom of the wing and are connected to the receiver by a Y harness. I like my models to be fairly responsive, so I set my control throws as follows: rudder, 1 inch left and right; elevator, 1/2 inch up and down; ailerons, 1/4 inch down and 1/2 inch up.

The ailerons need more up than down travel, and this is achieved by mounting the servo arm on the servo at roughly a 45° angle toward the front of the airplane. These are good starting points for the first few flights. After that you may want to increase or decrease the throws to suit your flying style.

Flying: If you are like I am, you probably skipped most of the article and came right to this point to see how the Val flies. It flies exactly like an advanced trainer. If the only models you have ever flown are high-wing trainers and you want to move on to a low-wing trainer, this may be the airplane you're looking for.

The first flight with my Val took place early on a cool, windless Saturday morning. After range checking my radio with the motor on, I taxied the model to the far end of the runway. I slowly advanced the throttle and let the Val roll down the runway. It wanted to pull to the left, but I had no problems keeping it headed down the runway with the rudder.

After roughly 150 feet I started to feed in up-elevator and the Val became airborne in a nice, realistic manner. As I gained some altitude I realized the Val needed some up-elevator trim and a little right aileron trim to keep it level.

Once I had the Val trimmed out, I made some low passes so my daughter Erin could take some pictures of it in flight. I was exceptionally pleased with how the model flew. I took it up high to see how the Val handled in slow flight; I was quite pleased to see how slow it was able to fly before it stalled.

The right wing had a tendency to drop when the model stalled, but it was easy to control right up to the stall. After a few more low passes I tried a few touch-and-gos.

The big propeller windmilling created quite a bit of drag, and I found that I needed to keep a little power on during the approach or make steep approaches to keep up the airspeed. There is no tendency for the Val to float too much once the power has been pulled all the way back, but it doesn't drop like a brick either.

When I took my airplane home I checked the wings for warp and found a slight one in the right wing. Twisting the wing and reheating the MonoKote removed the warp. I also redrew the plans to show 1/2° incidence in the horizontal stabilizer.

On subsequent flights I was able to see how aerobatic the Val is. It will fly upside down by my holding a little down-elevator with no problem. Rolls are nice and crisp. There is little roll coupling with the rudder. Landings are a breeze; you can wheelie it on, and three point it on, or if you're careful you can one-point it on the tail wheel!

If you want a model that can do all the fancy stuff, the Val will probably make you yawn. But if you're looking for an advanced trainer that looks like a full-scale airplane or if you want to try flying in a Fun Scale contest or two, this may be a great fit for you. *MA*

Gary Fuller