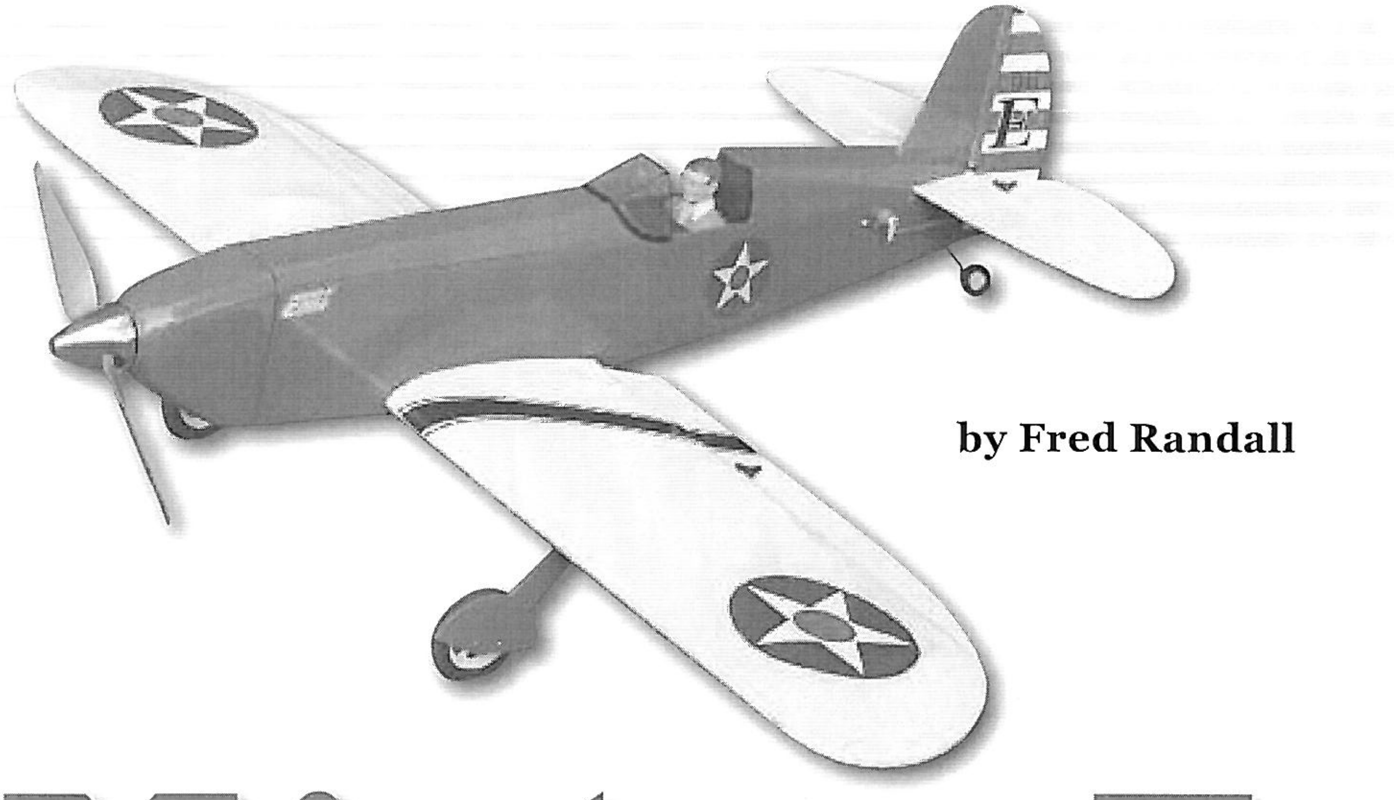


by Fred Randall

Mister-E

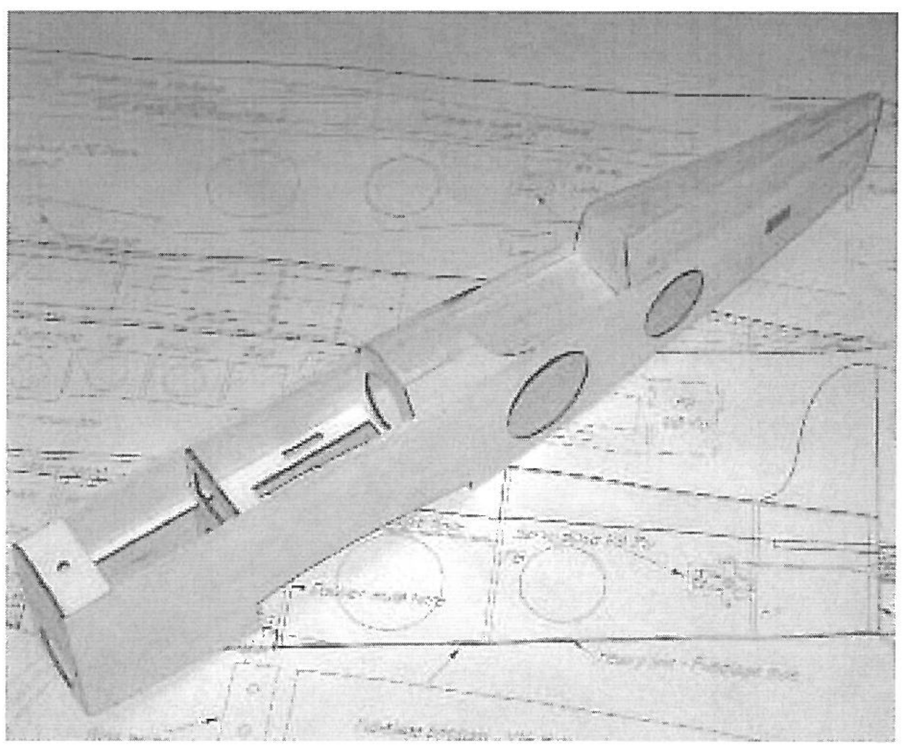
I WANTED A small electric-powered model that would fit—completely assembled—in my Honda coupe so I could go flying without mighty preparation and a ton of ancillary equipment.

Although many ARF and RTF candidates are capable of fulfilling this requirement, I am very much a scratch builder. Thus I set to the task of creating a design. In addition to being able to fit in my car, it had to be rugged, capable of tolerating wind, and able to take off and land on a grass field.

I decided to build a pseudo-1930s-style pursuit aircraft—something that Smilin' Jack might have flown. Do a Google search for "Smilin' Jack," which was Zack Mosley's comic strip that ran from 1933 to 1973.

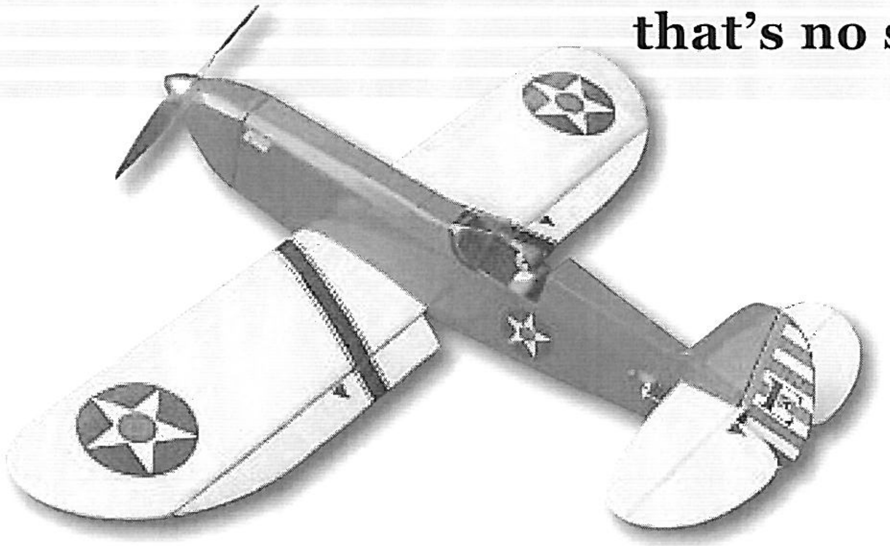
Jack was always flying something cool, whether it was an original from Mr. Mosley's mind or a J-3 Cub that was completely detailed and recognizable as such. And then there was "Fat Stuff," but I digress.

After making several pencil sketches of my proposed project, I set to work. DesignCAD has become the tool I normally use for design. It has limitations, but I've learned to work around them.



The fuselage structure employs a tab-and-slot design for easy alignment.

A racy-looking sport model
that's no secret to build



The completely assembled Mister-E should fit in almost any vehicle.

Besides, I enjoy using DesignCAD to draw scale motors, servos, and pilots. Better still, I can make patterns to have my model parts laser-cut at Creative Hobbies, which is only 4 miles from my house.

Another bonus is that the company sells a laser-cut kit for this aircraft, including most plywood and balsa parts. The only unusual item I used in construction was a .317 fiberglass composite main spar.

You can buy inexpensive fiberglass composite tubing from Goodwinds LLC and Kite Studio, which have no minimum-order requirements. I have included their contact information in the "Sources" listing.

The accompanying photos show variations in the Mister-E design, because I built two models and each had slightly different details. The plans set is for the final version. Feel free to make your own alterations; that's what scratch-building is all about.

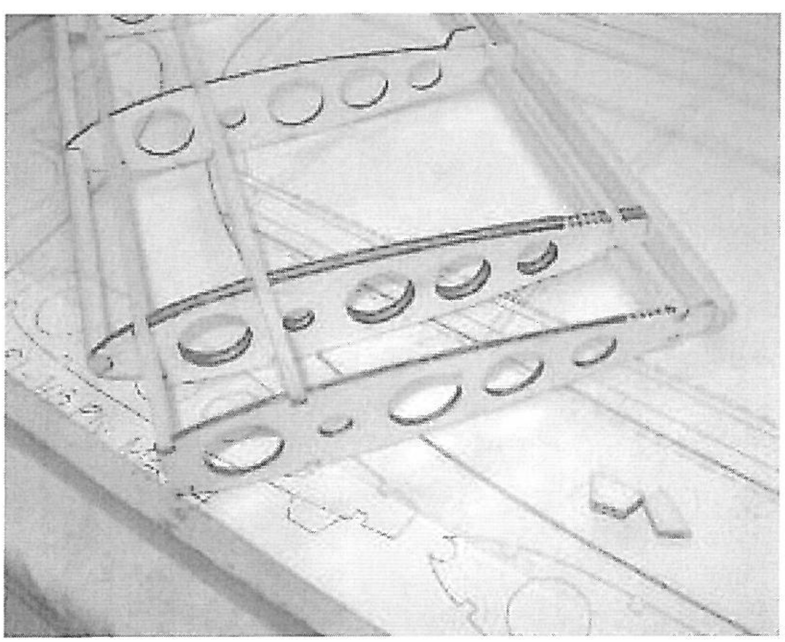
Because I had planned to share this project with *MA* readers from the outset, I put the battery compartment on the balance point. This allows the builder to use different-size batteries without affecting balance.

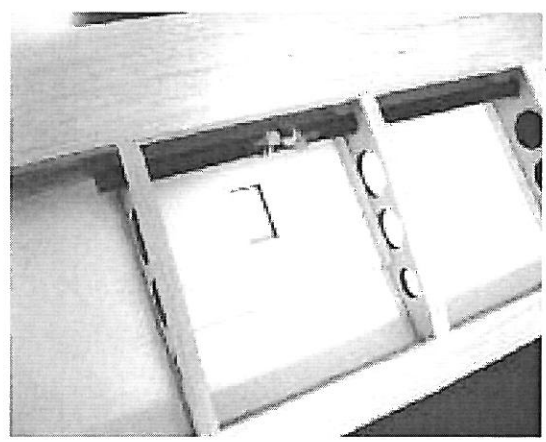
I used short pushrods to the tailplane and separate servos for the ailerons, providing positive control and allowing the builder to program flaperons if desired. The control surfaces are large enough for all but the most advanced aerobatics.

Plans show an E-flite Park 480 1020 Kv motor. I consider that a minimum for good performance. The model is rugged enough to use anything up to a Power 10. The maximum battery size is probably a three-cell, 2500 mAh Li-Poly. Modifications to the motor-mount box and cowl are necessary to accommodate larger motors.

Depending on the motor you use, some nose ballast might be required to properly balance the airplane. A good place to put ballast is within the motor-mount cube.

When using the Park 480, a polished aluminum spinner provides proper ballast. It's attractive, and no additional ballast is necessary.

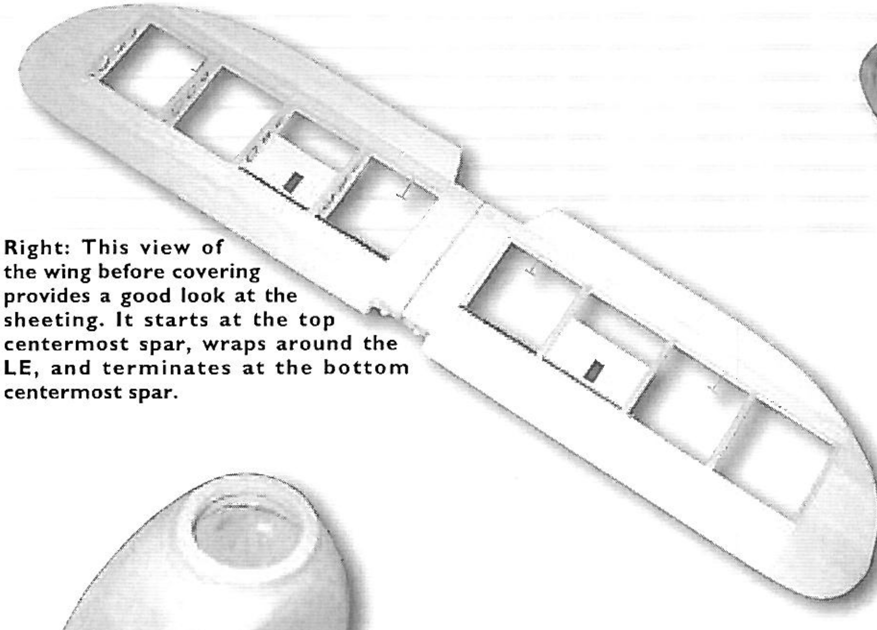




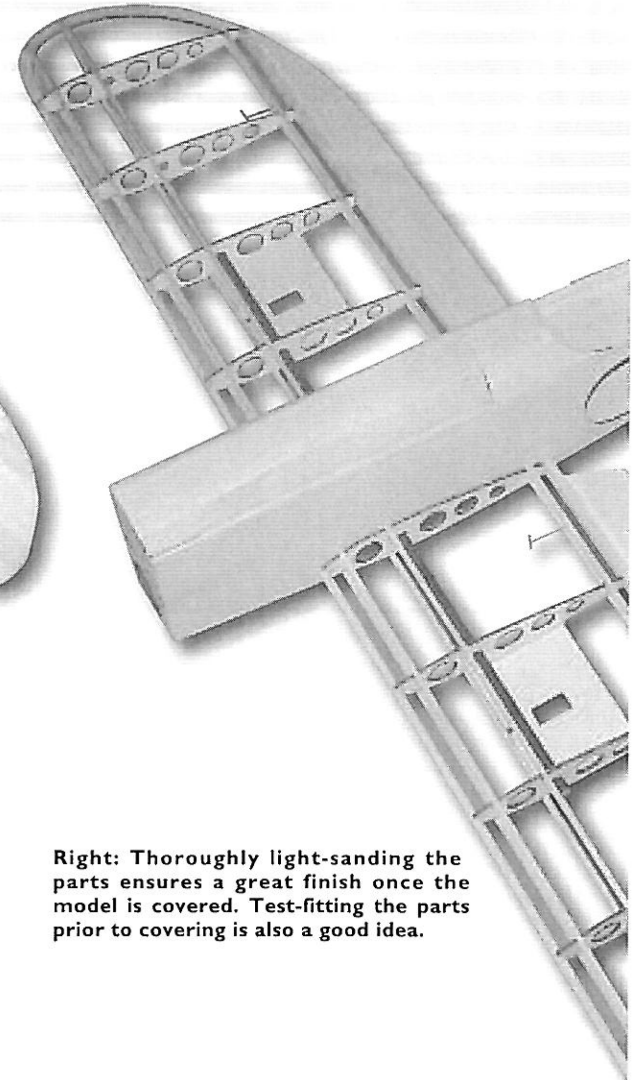
Photos by the author

Above: The LG wire attaches directly to the spar for additional strength.

Left: Rib stubs, used while building the wing, have been trimmed flush.

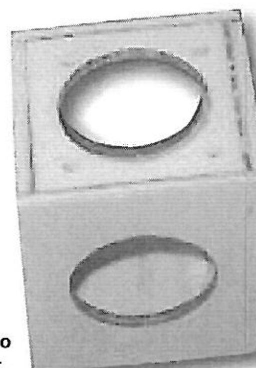


Right: This view of the wing before covering provides a good look at the sheeting. It starts at the top centermost spar, wraps around the LE, and terminates at the bottom centermost spar.

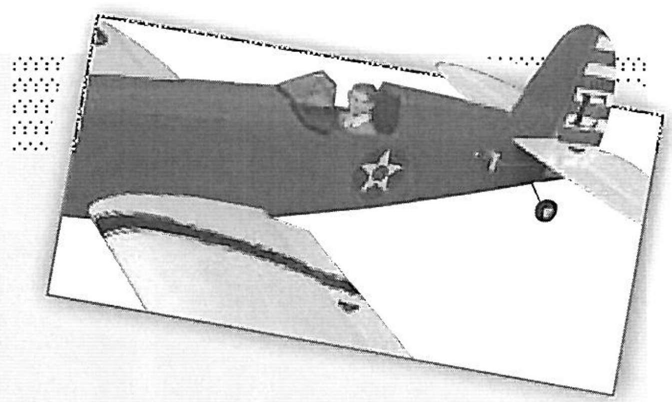


Above: Fred used several pieces of 3/8 balsa sheet to make the cowl, and then he shaped it into the final form using a razor plane and a sanding block.

Right: Thoroughly light-sanding the parts ensures a great finish once the model is covered. Test-fitting the parts prior to covering is also a good idea.



Right: The assembled motor box is designed to give the motor 3° right thrust and downthrust



Mister-E

Type: RC electric sport/aerobatic

Skill level: Intermediate builder; intermediate pilot

Wingspan: 39 1/2 inches

Wing area: 290 square inches

Length: 32 inches

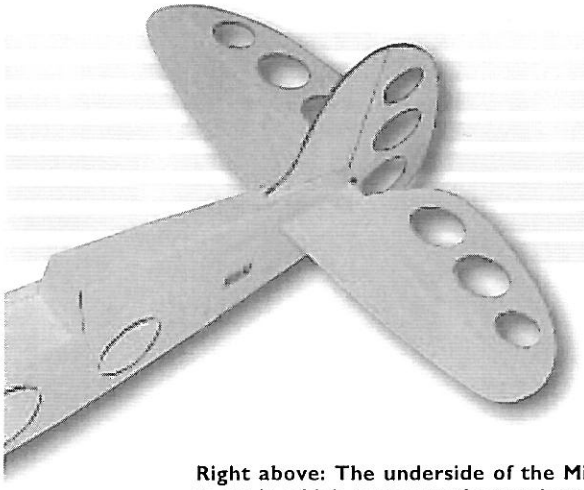
Weight: 31 ounces

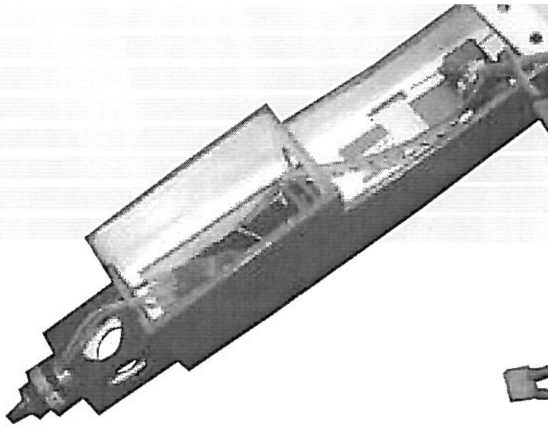
Power: E-flite Park 480 outrunner; three-cell, 2100-2500 mAh Li-Poly battery

Construction: Balsa

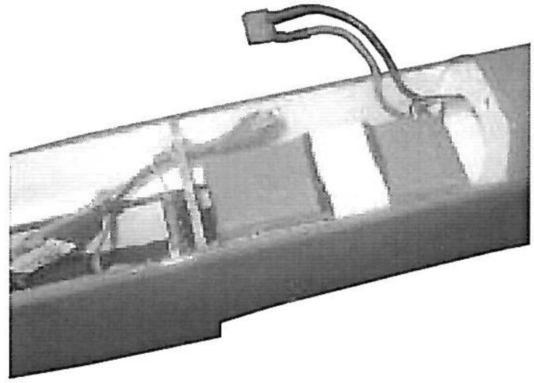
Covering/finish: LighTex iron-on film

Propeller: APC 11 x 6

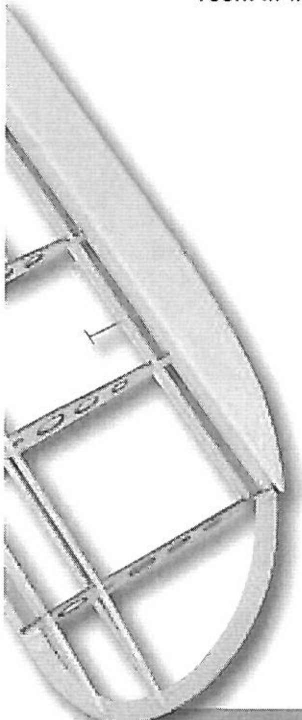




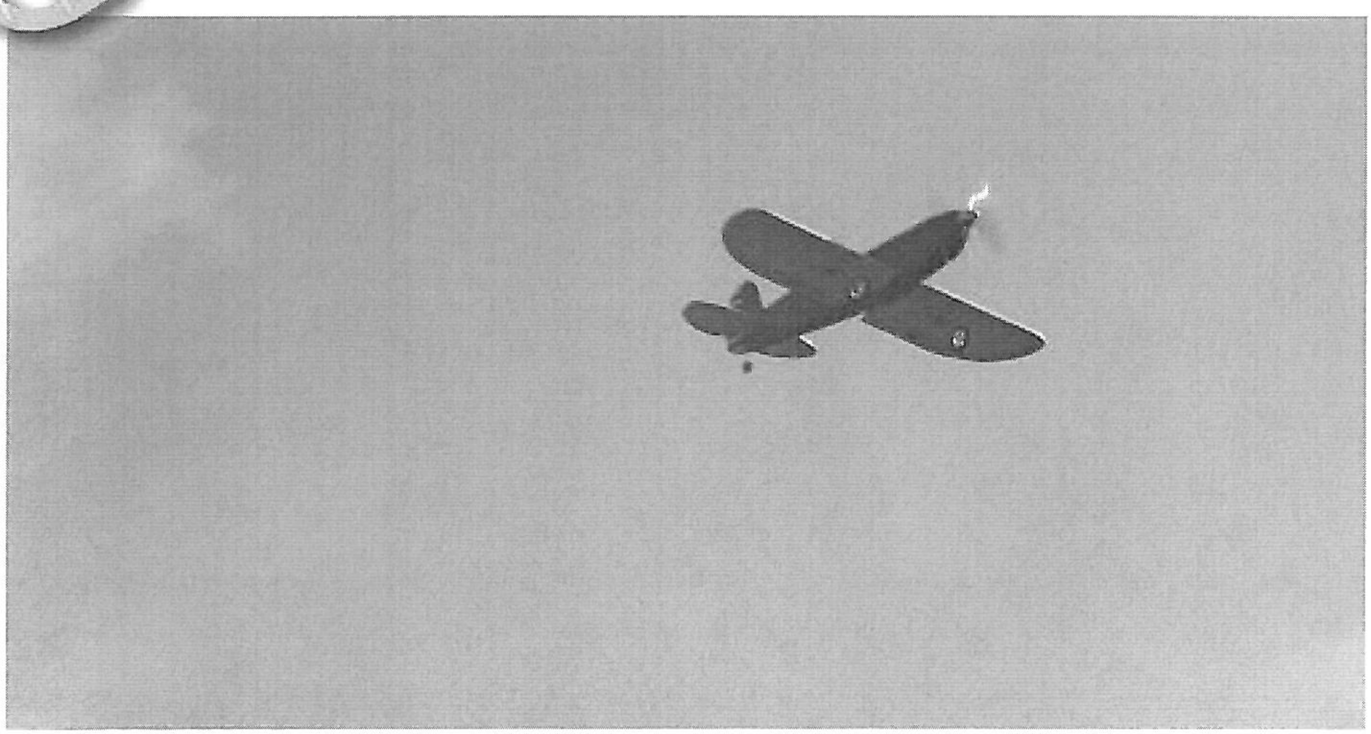
Right above: The underside of the Mister-E has plenty of room in which to mount the receiver.



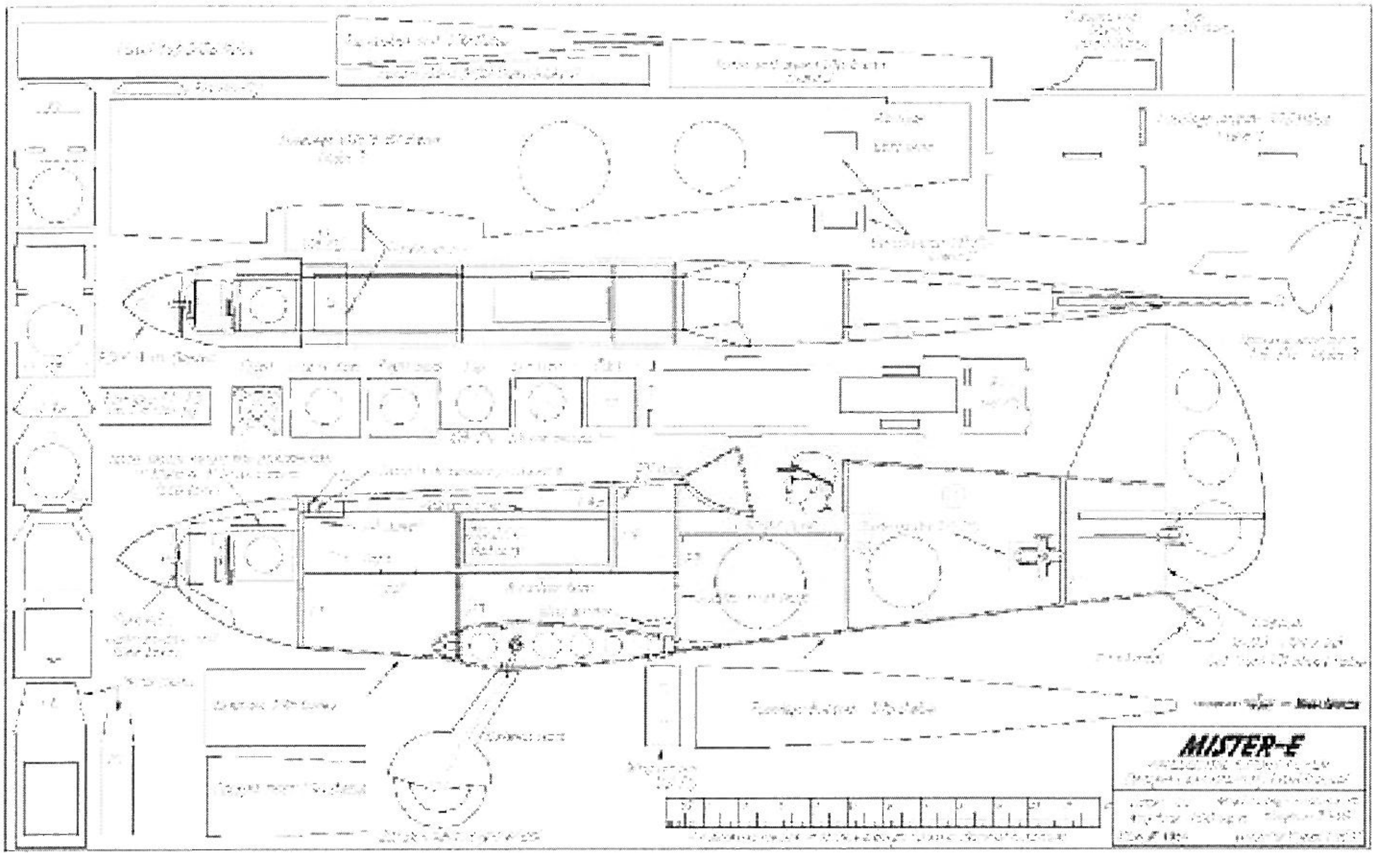
Right: The battery and ESC are easy to access through the hatch.

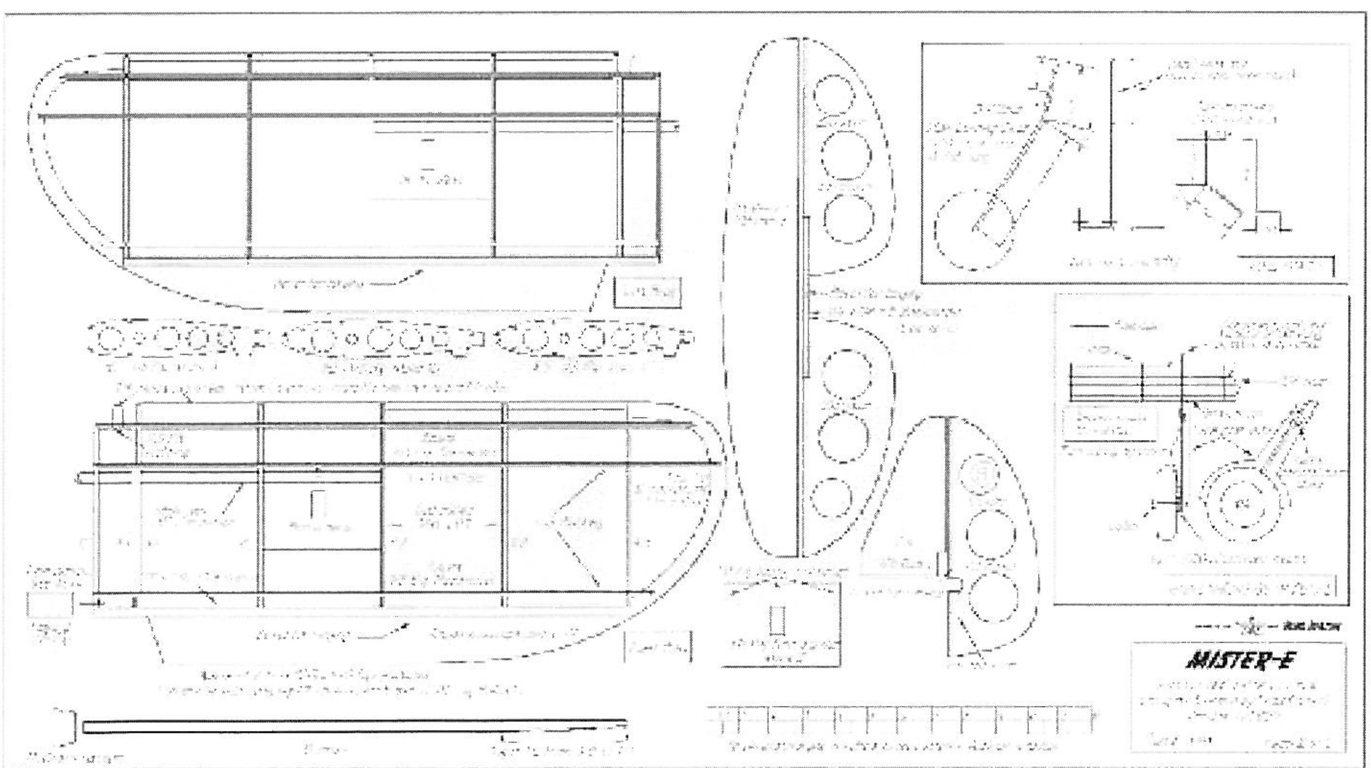


Left: The LG wire enters the wing through a small slot at the front of the servo plate and then a hole in the main spar. This provides a two-point mounting that is inherently very strong.



Full-Size Plans Available—See Page 167





Before you begin, bear in mind that the Mister-E is not a park flyer (unless the park is huge). It flies fast and needs room. It is designed to fly from a club field or equivalent space.

CONSTRUCTION

Fuselage: If you are not building from the laser-cut kit, fabricate all parts before you start construction. Once you have the parts at hand, assembly goes rapidly. Use medium CA unless otherwise noted.

The fuselage is based on a snap-together box featuring tab-and-slot design, for automatic alignment. Snap together F1, F2, F3, F4, F5, and the wing anchor plate, and then snap on the 1/16 balsa fuselage doublers. Then apply thin CA to all joints for permanent assembly.

The inside of the 3/32 balsa sides should be marked with the locations of F6 and F7. Test-fit the sides for alignment, being careful to ensure that the aft ends of both sides will mate properly when they are joined later during the build.

Adhere the two 1/8 plywood servo-reinforcement pieces inside the fuselage sides.

Carefully assemble the six-piece motor-mount box using CA. All of the parts are designed to give the motor 3° right thrust and downthrust, so it is important that you assemble the box correctly.

Adhere the box to F1 using epoxy, ensuring that it is offset as indicated on the fuselage drawing. This sets the propeller shaft on the model's centerline.

There is a hole in the back of the box. You can use a small screw or put more epoxy in it to ensure that the box is permanently attached to the firewall. While you're at it, apply epoxy fillets to the inside joints of the motor-mount box to ensure strength.

Fashion a tail post as plans show. Notice that it extends up to the top of the turtledeck.

Pull the fuselage sides together, and use T-pins to temporarily sandwich the tail post. Using the fuselage top view as a guide, ensure that the tail post is centered and square with the sides. When you are satisfied that it is, apply a couple drops of thin CA to the joint.

Position F6 and F7 at their stations within the fuselage. When they are aligned, use thin CA to permanently install them. Apply more CA to the tail post/fuselage side joint.

Fabricating the hatch requires care to ensure a good fit. Pin F1a and F4a against F1 and F4 respectively. Make sure that they are flush with their counterparts.

Patterns for the 3/32 balsa hatch sides are slightly oversized. Position them on the fuselage over F1a and F4a. There will be a slight twist in the hatch sides when attached to the formers. The sides should overlap F1a and be flush with the front of F1.

Carefully sand the bottoms of the hatch sides so that they mate flush with the fuselage along their lengths. Use CA to adhere the hatch sides to F1a and F4a (only). The twist in the hatch sides necessitates that they be held in place long enough for the CA to set.

Remove the pins from F1a and F4a. Lift the hatch assembly off of the fuselage and, using a long sanding block, sand the tops of the hatch sides so that they are flush with the tops of the formers.

When the job is finished, the hatch top, which is also slightly oversized, should lay flat on the top of the hatch assembly. Use CA to adhere the hatch top in place, and then block-sand it so that it mates with the hatch sides along its length. If fabricated correctly, the hatch will fit the fuselage well.

Cement in the hatch locating dowels. They should align the hatch and enable a small rare earth magnet, or magnets, to secure the hatch at the front.

Continue planking the fuselage, including the cockpit surround and the turtledeck. Again, judicious use of the sanding block is required.

Install the 1/16 cockpit floor, along with the fuselage bottom from the wing TE to the tail post. Leave the bottom open, ahead of the wing LE, at this time. Notice that the cockpit forward area is open to the fuselage interior, providing an exit for cooling air.

This completes the initial fuselage assembly, and we can turn our attention to the wings.

Wing: As a preliminary operation, cement together the 1/16 balsa wingtip laminations using thin CA. They should be cross-grained to each other for maximum strength.

Secure the right wing plan to your building board. After cutting a length of 1/8 square basswood to size, use T-pins to attach it in position as the centermost bottom spar. You will use this spar as a reference for building the entire wing.

Using a small square to keep it vertical, position an R1 root rib in place and use CA to adhere it to the spar. The break-off tab at the aft bottom of the rib should lay flat on the plans, and the rib should be held in alignment until the CA sets.

Follow suit with the rest of the ribs. Ensure that the bottoms of all break-off tabs are flat on the plans.

Cut a piece of 1/4 hardwood dowel LE to length, mount it to the front of the ribs, and secure it with CA. Cut all upper spars to length and glue them in place.

Using a 9/16-inch-high piece of scrap balsa as a support, attach the wingtip extending straight outward from the LE and TE, bisecting the airfoil.

Cut a length of 3/8 x 1/4 balsa to form the wing TE. Shape it, to match the drawing, using a razor plane and a sanding block.

Remove the partially completed wing from the building board and adhere the TE in position. Install the remaining 1/8 square spars. Lay the completed wing frame on the building board; all break-off stubs should be flat against it.

Remove the right wing plan from the building board and secure the left wing plan in its place. Heed this instruction; it is easy to find yourself with two complete wings for one side of the model. That would be a blow to your patience, if not your self-esteem. Follow the right-wing instructions to build the left wing.

Next is the servo-plate installation. Cut several 1/8 square basswood sticks to length and adhere them to the servo plates using CA, as the plans show. These provide additional surface for bonding the plates to the ribs. Use CA to secure the servo plates to the wings, as close to flush with the bottoms of the ribs as possible.

It's time to fit the 1/8 light-plywood webbing that provides a mount for the front wing pegs. These measure approximately 1/2 x 13/32 but should be cut slightly oversize and sanded so that they are a push fit between the R1 ribs and the front upper and lower 1/8 square spars on each wing.

Apply CA to the webbing to hold it in place. Don't spare glue here; this webbing needs to stay put!

Plank both wings with 1/16 balsa, as shown on the plans. The front planking starts at the top centermost spar, wraps around the LE, and terminates at the bottom centermost spar.

If you use thin CA to bond a 4-inch-wide sheet and a 3-inch sheet, you can avoid buying wing skins. Simply match the sheets for hardness. One 36-inch sheet of each width will cover both LEs.

Employing Windex facilitates making the sharp bend around the LE. Liberally spray both sides of the balsa and wait at least five minutes before attempting the bend.

Recheck the wings, ensuring that the break-off stubs are still flat. If everything checks out, break off the stubs and sand the area smooth.

I chose to entirely plank both sides of the wingtips. It's a builder's option. I'm not the best at covering, and the planked tips work well.

The remaining wing planking and capstrips require one sheet of 1/16 x 4 x 36 balsa.

Wing Fitment: Cut and predrill the composite spar. The holes *must* be properly positioned at both ends. I used a piece of pine strapping with a finishing nail driven vertically into it, making a simple fixture to ensure that the second hole is parallel to the first when positioned in my drill press.

When you have completed the planking, use the .317 composite spar to assemble the wings. *Do not permanently join them at this time.* Hold the root ribs together tightly using masking tape on the bottom of the wings.

Position the wings in the fuselage wing-mount recess. If necessary, you can remove material from the balsa TEs so that the wings seat properly.

Looking through the peg holes in F3, use a pencil to mark the position of the dowels on the webbing that you installed in the wings. This is why the forward fuselage planking was not installed previously.

Remove the wings from the fuselage and drill the webbing for the $^1/_4$ x $^1/_2$ wing-mounting dowels. Cut the dowels to size and then slightly bevel the fronts.

Use CA to adhere the dowels to the webbing. They should extend approximately $^3/_8$ inch from the front of the mounting plate.

When the CA has set, test-fit the wings. If you've done the job right, they should be seated properly, with the pegs inserted into the holes in F3. Now you can install the $^1/_{16}$ balsa fuselage bottom piece.

Carefully measure the location of the holes in the rear mounting plate. Mark the corresponding hole locations on the joined wings. Drill them out with a $^1/_{16}$- and then a $^1/_4$-inch drill bit.

Ensure that the path to the rear wing-anchor-bolt locations is clear. These holes might seem large, but the $^1/_8$ light-plywood reinforcements have smaller holes and will be applied next. The hole through the wings should allow easy passage of the wing mounting bolts.

Ailerons: There are two options for making the ailerons; they can be built up using a $^3/_{16}$ square LE and $^1/_{16}$ balsa sheet or simply shaped from $^5/_{16}$ x $1^1/_2$-inch tapered balsa aileron stock.

I doubt that either method offers a weight advantage, but in both cases the aileron LE should be shaped to mate with its respective wing TE. You might choose the built-up route because of materials you have on hand. I opted to use the shaped stock.

Empennage: The first order of business is to join the elevator halves. I am not a fan of joiner wires, because they tend to be flexible enough to allow flutter at high speed. For that reason I used a 5-inch piece of $^1/_8$ x $^1/_4$ basswood as a joiner. (If you don't have the correct-size basswood in stock, you can adhere two pieces of $^1/_8$ square basswood spar stock to make it. I won't tell if you don't!)

Secure the elevator plan to the building board. Secure the elevator halves and the joiner to the plans, to ensure proper span and alignment. The joiner's LE should be shaped for hinging before you adhere it with medium CA to the elevator halves.

Test-fit the fin and stabilizer at this time. Cut the tail post away from the stabilizer slot, and then find the centerline of the $^1/_8$ balsa stabilizer and insert it into the fuselage. Ensure that it is straight and that the TE is flush with the back of the fuselage. Shim or trim the slot as necessary to align the stabilizer.

Insert the fin into its slot. It should be vertical, and its bottom should seat against the stabilizer. After making it so, remove the fin and stabilizer until after you have covered the model.

Landing Gear, Etc.: Remaining tasks include beveling and hinging the control surfaces, covering and installing the empennage, and installing equipment. The only item that needs a bit of clarification is mounting the landing gear (LG).

The procedure I'll describe results in a wide-track LG that has proven to be nearly unbreakable. Follow the steps in sequence. The technique is a bit unusual but not difficult.

The main composite spar is used as an inner anchor for the LG wire. Before installation, cut the spar to length and drill $^1/_8$-inch holes in both ends. The holes must be parallel with each other and positioned directly over the small slot at the front of the servo plates. Use the plans as a guide to position the holes.

Bend the LG wire to shape using the diagram on the plans. Do not make the bend where the wire attaches to the spar, but mark the wire where the bend will be made.

The LG wire enters the wing through the small slot at the front of the servo plate and then through a hole in the main spar. This provides a two-point mounting that is inherently extremely strong.

Wing and LG assembly should proceed as follows.

Cover both wing bottoms (only), and then clear the small slot in the servo plate. Insert the predrilled composite main spar into position in one wing, with the drilled hole directly above the slot.

Insert the LG wire through the slot and through the hole in the spar. Push the wire through far enough to provide easy access to the top so you can make the 90° bend.

Using the appropriate tools, make the bend at the position you marked. It should be parallel to the wheel mount bend at the bottom.

Lower the LG wire until the bend rests on the spar. Use two small tie-wraps to secure the LG wire to the spar. Ensure that the mounted wheel will track straight. Small wheel-tracking errors can be compensated for at the spar.

Mix a batch of 30-minute epoxy, and use it to join the wings. Employ clamps or masking tape to hold the wings while the epoxy cures.

Install the LG wire on the remaining side using the same procedure that you previously followed. Secure the LG wires to the spar with 30-minute epoxy. This completes the LG mounting procedure.

Make small holes in the wing planking, adjacent to the root ribs, for passage of the servo wires. Install the wing servos and run the wires. Now you can cover the tops of both wings.

The faux gear doors are optional, but they add much to the overall appearance of the model. The doors are attached using Sig wheel pant mounts (item SIGSH726). Spacers cut from fuel tubing provide a fore and aft shock mount.

The top part of the gear doors are secured using backing plates from a pair of small control horns. Fuel-tubing spacers are also used here. This arrangement allows the LG wire to flex considerably without stressing the $^1/_8$ plywood gear doors.

I sprayed the inside of the gear doors with Flat Black Krylon before covering the outside with LighTex that is the same color as the fuselage.

Cowl: The balsa cowl must accommodate the motor you use, so I haven't provided dimensions for it. See the article "Cowl Making 101" in the November 2008 *MA* to see my method of making this part.

The cowl was produced with several pieces of $^3/_8$ balsa sheet. But first I used a hole saw to make a balsa disc to fit the spinner I used—a $1^3/_4$-inch aluminum unit—then cut a large-enough hole in the disc to accommodate a small drum sander.

I opened the resulting balsa "doughnut" to be slightly larger than the motor diameter. In the case of the Park 480, that is slightly bigger than $1^3/_8$ inches.

I cut two pieces of $^3/_8$ sheet to form the sides of the cowl and another to form the top. I adhered those pieces to the cowl ring after I carefully shaped them to form a flush fit against the ring and the firewall.

A short bottom piece extends from the cowl ring halfway to the firewall. The resultant gap provides cooling-air intake for the ESC and battery.

I used a razor plane and a sanding block to shape the assembly into its final form, and then I applied balsa filler to any gaps. After the filler hardened, I finish-sanded the assembly with 400-grit paper.

I applied several coats of Top Flite white primer to the cowl. After wet-sanding it, I gave it several coats of Krylon True Blue. The color matches the covering almost exactly.

Finishing: I used LighTex blue for the fuselage, fin, and rudder, and I used cadmium yellow for the wings, stabilizer, and elevator.

I applied homemade water-slide decals to the rudder. Along with the 13 alternating red-and-white stripes, it is emblazoned with the name that I gave the little model: "MR E."

Early World War II insignia was applied to the wings and fuselage, and a black multistripe "V" pattern was applied to the top side of the wings.

Hinging was accomplished using CA-type cloth hinges—full sized on the wings and half width on the empennage.

Setup: It is incredibly important, particularly in a short-coupled design such as this, that the parts alignment is accurate—particularly the wing/stabilizer angle of incidence. If you don't have an incidence gauge, try to borrow one. The acceptable angle of incidence is between 0° and $^1/_4$°.

Ensure that the stabilizer, elevators, fin, and rudder are not warped. If they are, you can rectify the problem with clamps and a heat gun.

Proper balance is important, and the balance point should be 2-$2^3/_8$ inches behind the wing LE. Make first flights with the balance nearer to the 2-inch mark.

Flying: Mister-E has large control surfaces and a short tail-moment arm, making it extraordinarily sensitive to control inputs. You should provide no more than 1/4 inch of deflection on the ailerons and elevator (in each direction), at least to begin.

The rudder is equally sensitive, and it's a good idea to limit deflection to 3/8 inch on both sides until you are used to flying the airplane.

If you have a computer radio, program approximately 40% exponential. High rates can be double the stated low rate deflection, but exponential programming is the way to go. It is also good to program flaperons if your transmitter is capable.

The noted sensitivity suggests that this model is better suited for an experienced pilot. In any event, a light touch on the sticks is best when learning to fly Mister-E.

Takeoff, particularly from a grass field, requires the use of full up-elevator until flying speed is achieved, usually in 20 or fewer feet!

This model is a joy to fly, once you get comfortable with it. With greater control deflection, it is capable of the tightest loops this side of a foamie and the roll rate can be dizzying.

Make landing approaches with some power applied. That being noted, the airplane tends to float in. It's merely a matter of setting up a glide slope and applying a bit of up-elevator upon touchdown to keep the tail planted.

Have fun building and flying Mister-E. It's great to have a unique model to bring to the field.

Keep 'em flying! **MA**

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Sources:

Creative Hobbies
(508) 473-8259
www.creativehobbies.net

Goodwinds LLC
(206) 632-6151
www.goodwinds.com

Kite Studio
(610) 395-3560
www.kitebuilder.com

Balsa and light plywood:
Balsa USA
(906) 863-6421
www.balsausa.com