Mooney Mite

BY EDWARD MORGAN

Fabulous scale of famous lightplane in ¼ scale. Detailed and fitted with a Ross 4-cylinder engine, it should win any scale event that is worth the winning!

PHOTOS BY WILLIAM ROOT

Eddie, the fabulous Mooney and Nevada desert in beautiful color. A longtime exponent of ¼ scale, he hopes the Mooney will get it going.

• First let me introduce myself. Those of you who don't know me might remember a ¼-scale, 9-ft. J-3 Cub that flew in many contests across the country and at the Dallas, Texas, Nats in 1969. I have always enjoyed building larger airplanes and hope that sometime in the near future we can have a ¼-Scale event, set up by the A.M.A., with standard guidelines for building in this scale. I feel that this would bring about a whole new concept of building such as happened with Pylon racing because it will encourage manufacturers to make standard ¼-scale parts such as kits, spinners, wheels, cowlings, pants, canopies, brakes, etc.

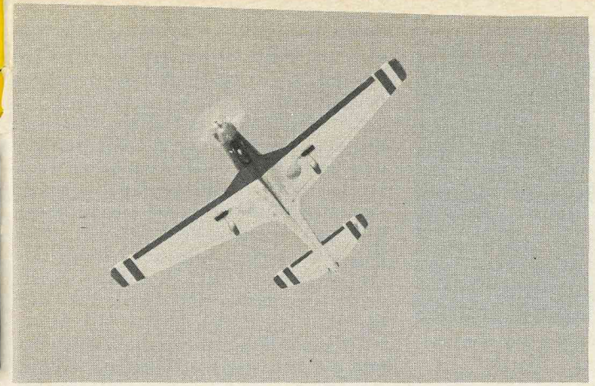
Now let me tell you about my newest ¼-scale plane. It's a Mooney Mite M-18. Some of you might be wondering why I picked the Mooney Mite for a ¼-scale project. Well, there are many reasons. Let me point out some of them.

First, I spotted a cover shot of the Mite on an August, 1955, edition of *Hobbies for Young Men* magazine. The angle from which the picture was taken made it apparent that the plane would make an unusual project. I had been looking for a scale plane that would give me a full house in scale points if it were to be entered in a contest, one for which I'd be able to build the areas and surfaces to exactly ¼ scale. It would have retractable gear, flaps, brakes, a working canopy that slides back, lights that work from the dashboard—a plane that could carry a 17″ pilot that would be connected to the controls to make him look as if he were flying the plane. It must have tricycle gear for good ground handling. The Mite meets all these criteria and had a 4-cylinder engine that was exposed. This would enable me to make it look like the real thing.

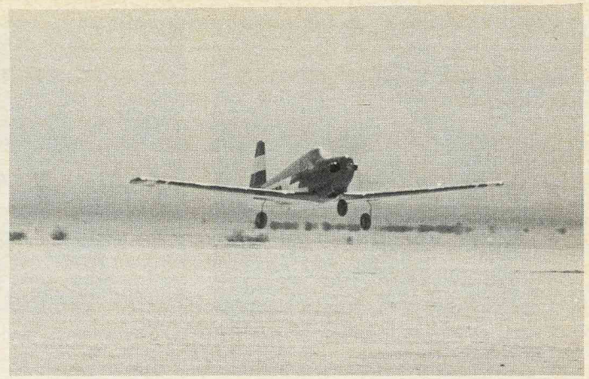
There was just one hang up. What about the power plant? In 1963 a friend of mine gave me an Elf 4 to start the Mite, and at the same time the wheels started to turn in my head. My first thought was to scale the plane to the engine. I did so, drew up the plans and started the fuselage, but in the middle of the project I stopped. To put all this work into a plane and have an engine that could not be replaced was building myself into a corner that I couldn't get out of should the Elf 4 go bad. The outcome was that this Mite was scratched. Not only was it scratched, but I stopped building for ten years. I guess, like all modelers, I was burnt out. But always in the back of my mind I kept saying to myself that I had to build this airplane.

And then it happened. In 1973 some friends told me about the Ross 4-cyclinder engine, an engine designed to a scale modeler's dream. The best part about it was a 1.20 displacement—a true ¼-scale power plant—and a chance to make dummy cylinders that would fit right over the Ross cylinders and could be removed when flown.

Well, enough talk of the past, let's get busy and build the ¼-scale Mooney Mite. Here's how it goes.



This flyby, overhead shot shows the retract system in good detail.



On a landing approach through the famous Las Vegas desert haze.

Here, the man and all the tools of the trade, the Mooney, the Texaco fuel truck and the transmitters that make it all an incredible project.

Before I start, a note to the modeler who would like to use a hot .60 instead of a Ross 4. Mooney Mite was also built with a Crosley Cobra engine that was cowled in (see March, 1975, issue of *American Aircraft Modeler* for photos), but a word of caution if you go this route, watch your tail weight in construction.

In building the Mooney Mite you'll find the most simple construction that I could come up with. I've always felt that most scale planes and kits are over-engineered and confuse the builder. Other than the scale detail, you should have about the same time in the Mite as you would have in a good, balsa-built Pattern plane.

The sides of the fuselage are the first step. Try to find sheet ¼″ x 4-⅝″ x 48″ long or build up from ¼″ sheet. Follow the dark line on fuselage sides to make side panels. Then put both sides flat on bench, bring them together and mark bulkhead positions straight across sides. Make sure that both sides are exactly the same length. Use 5-Minute epoxy for entire fuselage construction. Glue A and B bulkheads together; then glue sides to B, and add C and E bulkheads. When dry, add cockpit floor. When completely dry, pull back end together and glue; then add F, G, H and I bulkheads.

Take 2″ heavy fiberglass cloth and form glass corner between bulkhead B and sides. Now you are ready to make the top back of fuselage. Use super-light ¾″ sheet (this is a must). Cut top and bottom angles on wedges running from E to I. Tack them in place; then add on top ¾″ sheet. Let dry and shape with 80-grit sandpaper. Then remove it, hollow out to ¼″ thickness and do the bottom the same way. You can add ¼″ x ¼″ sq. crossways (three of them) for support on the inside.

Now add retract side panels and panel blocks to side panels.

At this time, make gas tank compartment hatch out of block and carve to ¼″ thickness. Add 1/16″ ply to front, back and bottom to make hard edge so that your hatch won't get nicks on edges and will be a good fit. At this point, you should be getting a good idea of the shape of the fuselage, and I suggest that you start the wing, elevator and rudder which are all cut out of foam with a hot wire. I recommend that you have someone do this so that you get good straight panels.

Cover wing, elevator and rudder with 1/64″ ply using slow dry epoxy No. 2 or regular core contact cement. Epoxy can be heated with a heat gun to thin it before brushing it on. Don't brush epoxy on foam. After applying 1/64″ ply, let panels set over night in core casings that are weighted. Note: Don't forget ⅜″ washout in wing tips. You can use a ⅜″ wedge 0″ to 40″ long or cut it in the wing panels when you use a hot wire.

Make sure that all surfaces are sanded even to edges of foam and 1/64″ plywood before putting on tips, leading edge and hinge spars. This is very important when

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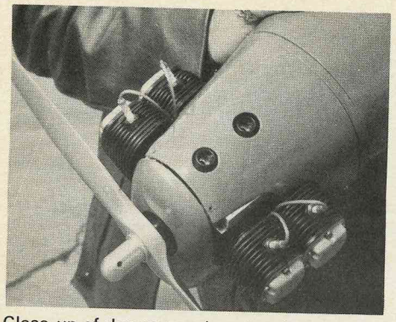
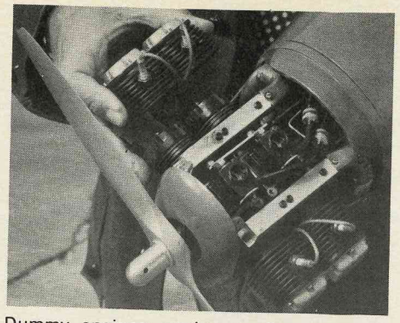
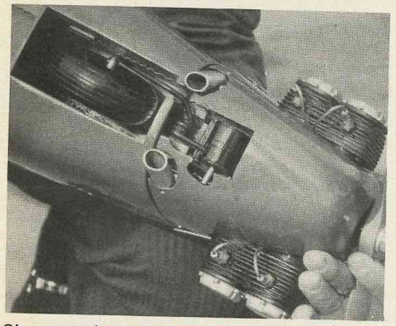


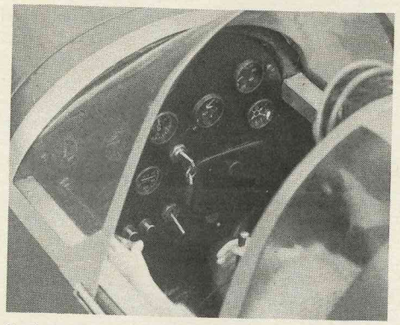
Close-up of dummy engines/engine cowling.



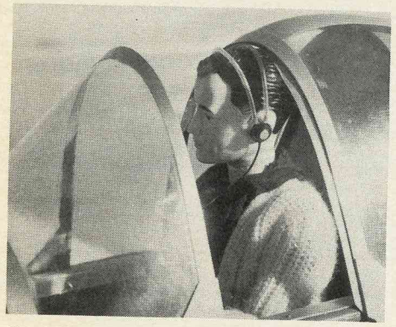
Dummy engines; engine cowling removed.



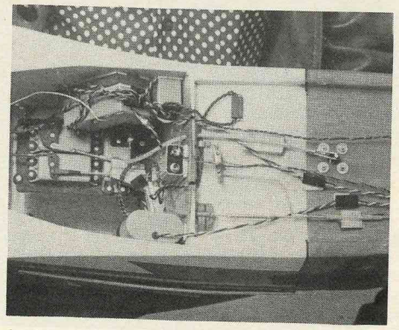
Close-up of nose wheel/exhaust installation.



Cockpit details. Note the engine starting key.



How about that pilot, with headset and all.



And here's what makes it all happen.

MOONEY MITE . . . CONTINUED

you use fiberglass resin because gaps will permit resin to seep down into the core and leave a hole inside.

All trailing edges on wing elevator and rudder are faced with ⅛" dowel, sanded or planed in half. This will keep you from getting uptight from nicks on trailing edges.

Now, install stabilizer. Set it at 0°, align and epoxy in place. Don't forget your 3-3/16" dowel in center for added strength.

You are now ready to put the vertical fin on. Cut bottom to fit elevator and put 3/16" dowel through elevator into fin for extra fin support. This is a *must!* When dry, add fin side blocks to front, shape and glue. While we are on the fin, let me tell you how to hook up your rudder arm and bracket. First get ⅛" steel rod. Sharpen one end to a point, bend into a 90° angle and epoxy to rudder with about 4" of steel wire hanging down. Install three Kraft hinges to rudder; then drill ⅛" hole through elevator. Connect hinges to rudder fin. Don't forget to pin all hinges on all surfaces. Use straight pins cut off.

Make rudder arms from plans and cut slot inside of fuselage. Important: Make sure that ⅛" steel wire is filed clean at bottom so that you will get a good solder joint. First, slip on ⅛" eyelet, then rudder arm through slot and eyelet on bottom. Solder together (use paste for a good job). When this is done, you can put in tail block as shown.

Now, back to the wing. First thing after the wing is covered, work in flaps and ailerons. On ailerons make sure that you test your torque rods or arrow shafts for stiffness. On the first Mite we found that we got aileron flutter at high speed. This can be corrected by filling arrow shaft with *heated* epoxy or fiberglass resin using a glue gun. When this is done, set aileron up with arrow shaft and check for stiffness. If you are not satisfied, go to bellcrank type of aileron hookup.

Before you join wing together, make sure that you have holes in panels for your landing gears, brakes and flying lights. These wires can be brought together in a hole in the center of the wing and taped together with masking tape to keep them clean. Now join wing together with No. 2 epoxy *slow dry,* checking to make sure that you have the correct dihedral beforehand. Raise each tip ¾".

Let's start fitting the wing to fuselage, but first put two layers of fiberglass cloth at midsection, one 4" and one 6" over the other. The large, 81" wing needs extra strength in the center section, so don't omit this. Now block in front fillet of wing. After they are carved and shaped, face front of fillet with 3/32" ply. This will make good support for wing dowels (use 5/16"). Now fit fuselage to wing, and when you have a good alignment, carve and fit in back fillets (use very light balsa for this).

This completes all wood work.

Now, lay out your motor mounts. Use stock Ross 4 T-type mounts. Make hardwood wedges that will be glued to firewall. These wedges are to be cut so that you get 2° down and 2° right thrust. You will also have one more hardwood wedge in front. This is for your Kraft nose gear mount; it will be 2" x 2½" x ⅝" thick tapering to zero. This will angle your nose wheel out and give you more prop clearance. Use Kraft plastic gear housing that comes with nose gear. Don't use stock nose gear wire because it is not strong enough.

Use 3/16" piano wire and grind ½" flat on top of the steel wire to fit ball and set screw at steering arm. You will have to redrill bottom of retract 5/32" to 3/16" in the plastic. For gear with wheel length, use total distance to bulkhead C. You need it all to get enough prop clearance.

While we are up in the front area, let's talk about the Ross 4 and how to mount it. The first thing of importance to me was to have the carburetors where I could get at them easily, so I mounted them upright instead of down, but in line with profile of the cowling. I put two ⅝" holes in top cowling with the carbs flush with the top. Once I had engine needle-valves set, I screwed top of cowl on, and the engine was easy to start by just putting my two fingers over the venturas and choking while starting.

Another thing to consider is your exhaust system. Use stock Ross 4 exhaust and attach ½" aluminum tubing; bring back and straight down along the sides of your motor mounts and out the bottom. This gives you an oily nose wheel, but the rest of the plane stays clean. This will be one of the hardest things to do on your Mite, so bear with the exhaust system.

If exhaust systems touch cowling, don't be alarmed; it won't hurt the fiberglass cowl. I sheet-metal screwed mine right to

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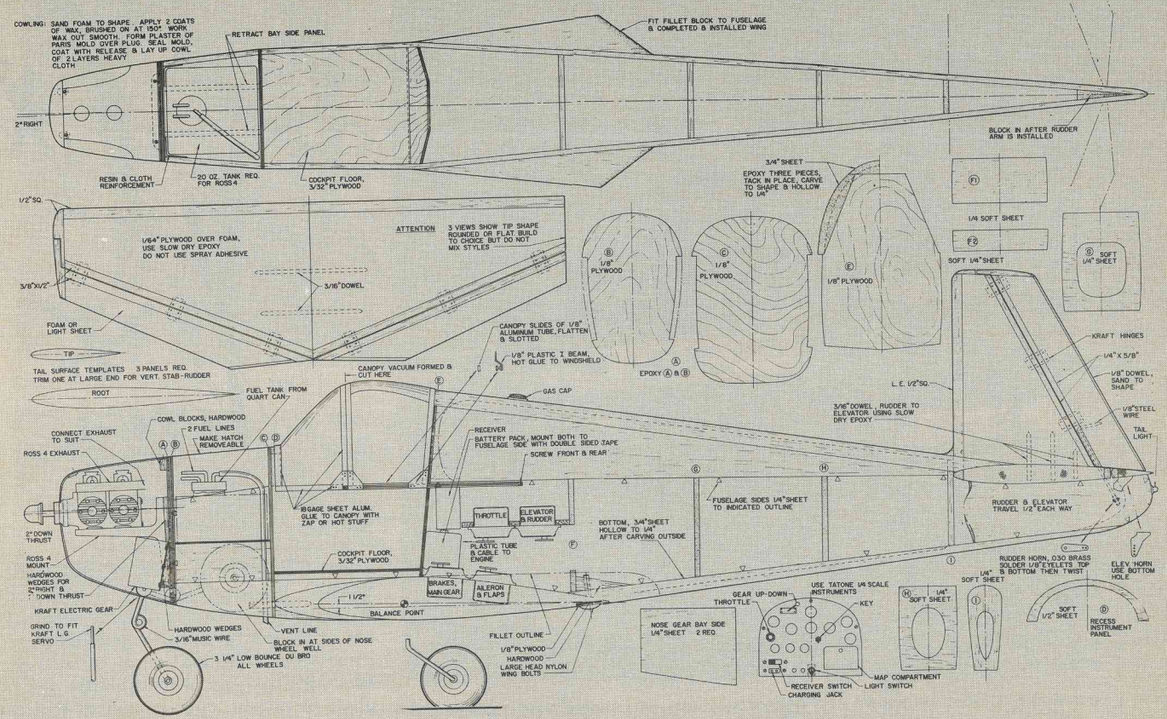

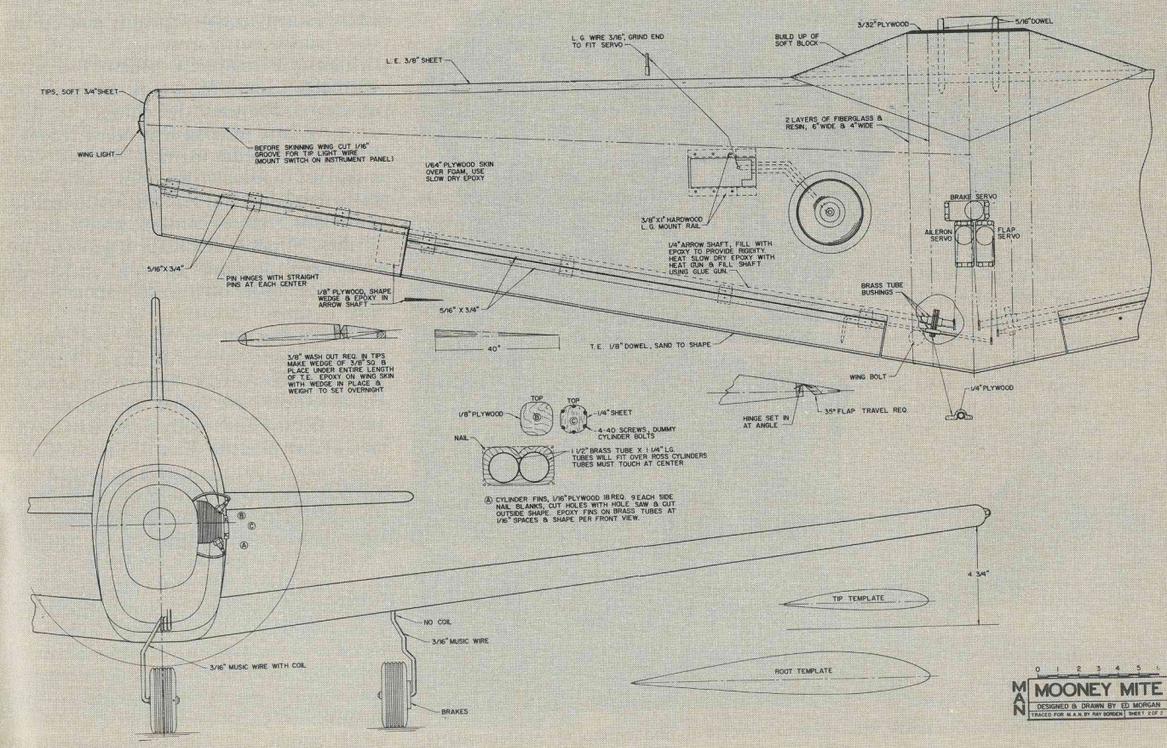

FULL SIZE PLAN AVAILABLE . . . SEE PAGE 102

plate. To attach aluminum, use cyanoacrylate hot glue. A good brand is Krazy Glue; it has a nice, fine tip that will help you.

Hold aluminum in place with clothespins, tack in place, remove pins when dry, and finish gluing. See plans for detail on how to get canopy to slide back. Note: Clean aluminum with steel wool before gluing in place. Clean canopy with Windex and make sure that your hands are free from oil. This will assure good bond for aluminum. If canopy has any scratches in it, they can be removed by using white rubbing compound and then finish with toothpaste and soft cloth.

Now the main gear. . . I used Kraft gears, and you will find that they work well. You will have to make new, main landing gear wires (5/32" with coil which is stock is not heavy enough). You need 3/16" with no coil (with light wire and coil, plane would be very wobbly). You must redo top end of landing gear wire just as you did nose gear. Use Goldberg axles so you can get good adjustment in wheel well. Use 3¼", low-bounce Du-Bro wheels with tread. When you buy them, pick the *harder* tires.

Make sure that you lay your gear wells out correctly. This will determine how your plane will set at scale angle.

When cutting wheel wells in wing, make sure that you have ¼" clearance around wheels; this is very important. Wheel well inserts can be built up with balsa or use plastic bowl or bottle bottom. It is very important that you use good wood for retract mounting block; plane is larger than average, and I don't want you to have any problems with this. Remember one thing, with electric gears there can be no binds at anytime to keep gear from going up or down. Binds can drain your batteries. On the main gear, you will find Allen-head set screws. Remove them and replace with regular flat-headed bolts, which you will have to cut to proper length.(Allen-head set screws will strip out before you can get your gear strut tight enough in housing. This can cause your wheels to get out of alignment.)

Start the finishing process by sanding down entire airplane with 320 grit. Then give it two coats of resin. In doing the entire finish, watch your tail weight. Sand resin down lightly with 220 grit. Then spray three coats of K&B primer and let set overnight. Then, before sanding, fill all dents and nicks with Formula 27 Filler; let dry and then sand both primer and filler at the same time. Start with 100 grit; finish with 320 grit. Formula 27 can be found at boat shops, it's a two-part filler and is compatible with K&B products. Tac cloth plane thoroughly. To obtain the best paint job, the room must be free of dust when painting.

Now it's time to enjoy putting the instrument panel together. From pattern on plans, cut two panels out of 1/16" sheet ply. Cut instrument holes in one. Use ¼-scale Tatone layout. Sand ply front with 400 grit and spray five coats of flat black paint. I put receiver switch and charging jack on dash, also light switch. For landing light, glue all instruments in place on back panel. Then use one sheet of celluloid instead of the ones that come with the Tatone layout. Screw together and set in instrument rings. They can be painted black for scale look. Wrap all wires from receiver switch, charging plug and light switch together with black tape and run them out of the bottom of the floor. This should give you a nice scale look when installed. Flying lights can be powered by a 9-V. transistor radio battery.

For those of you who like cockpit detail, line cockpit with lightweight black Naugahyde. Use contact cement to hold in place. Seat cushions can be made from ½" balsa and can also be covered with Naugahyde. Add seat belt and pilot if you want to go all the way.

Scale, dummy engine cylinder covers can be made from the plans. The nice thing about them is that they slip right over the engine cylinders, and if you don't look closely, you think that it's the real thing—especially if you can find some old Champion plugs and cut the bottom off at an angle, epoxy in and add spark plug wires and caps. If you want to get carried away, work in scale exhaust pipes and valve rods.

When starting dummy cylinders, it's important to stack and nail 1/16" plywood together in corners. This way you can cut all the cylinder fins for one side at a time. Use a circular saw to cut holes for 1½" brass tube, which can be found at plumbing stores. Make sure when you cut holes in plywood that the two holes cross in the middle because when 1½" brass tubing is epoxied in place to fins, they must *touch* in the center in order to fit in between Ross cylinders. Use scrap 1/16" plywood to space fins as you epoxy them on brass tubes. Once fins are set in place and thoroughly dry, shape with 100-grit sandpaper. Then epoxy ⅛" ply and ¼" balsa together to make up the cylinder cap covers. Paint cylinder fins with flat black; cylinder cap, silver; and add cylinder cap screws.

If you can't get old Champion plugs, use the next best thing, an old glow plug. Cut bottom off at angle, drill hole through brass tubing and epoxy in place. Make sure that bottom of plug is flush with brass tubing. If not, dummy cylinders will not pass over Ross cylinders. This completes the scale cylinders.

This also finishes the building of the Mite. I hope that I have been of some help in outlining the construction. I feel that if you're a scale builder, you'll find the Mite an easy plane to build, and when finished, you'll find it has a certain air about it that says that it's going to fly right off the bench, as mine did.

Now let's talk a little about flying and the test hop of the Mooney Mite M-18 and what to look out for.

First, the Ross-4 must be broken-in with bench time of at least one hour at five minutes a run at first. This will assure you of constant power on takeoff—which is a must. We found that one of the most important things with the Ross-4 was the nitromethane content in the fuel. If you use less than 20%, you will foul your glow plugs. From high to low speed, you will lose one of the four cylinders, and this can be fatal on takeoff. To overcome this, use between 24% to 26% nitro, 23% Klotz, 53% methyl alcohol. This will give you a smooth idle and keep your glow plugs from fouling.

The second most important thing to look out for is the starting batteries. Yes, I said *batteries*. You must have one No. 6, 1½-V. Eveready battery for each plug. This will assure you of a good, hot starting system. Without it, you are just wasting your time trying to start the Ross-4. When you have plug trouble, you're risking your plane—it's that simple!

Once you have your Ross-4 running dependably in idle and high speed, try your Mite out for ground handling. You'll find that ¼" travel each way in the nose wheel will give you a nice amount of steering. Once you have the feel of it on the ground, try short, high-speed runs in front of you and listen to your Ross-4 going from low speed to high speed. If it sounds steady and even in power, then you're ready for your first takeoff.

Let me suggest one thing on your test hop: Keep in mind that you have a 13-lb., full-scale model aircraft. Unlike some of the projects you've been flying, it's one-quarter the size of the real airplane, so I suggest you have ample runway for the test hop until you know your plane.

On our first flight, we found the Mite held to the ground for 400 ft. before becoming airborne, and this held true for all 11 flights thereafter. You'll find that the Mite will break ground all at once. It will only come off when it's ready, so *don't* try to force it off. Plane has good ground qualities, so it will give you time to feel the elevator for takeoff.

Once you are airborne, you'll find it takes only one-third of the power of the Ross to fly the Mite. The Mite will have a good, solid look when flying. When gears are retracted, it looks like the real thing. Keep one thing in mind on landings—don't underpower them. It takes more power to keep the Mite flying, so I suggest that you make three or four slow flight passes to get the feel of things. With the washout in tips, the plane will be nice and steady on landings, and by working the throttle you'll find a speed that will give you a nice landing.

Well, I guess that about winds it up for the Mooney Mite M-18. I hope that you're as lucky with yours as I was. I'm sure that you'll find that the Mite is easy to build and easy to fly. The best of luck on your project.

If I can be of any help, please contact me. I would also like to hear from you on the ¼-Scale event that I talked about earlier in the article. I feel that scale builders have many good ideas that could be put to good use. If you have any pictures or 3-views of any planes, that you think would make a good ¼-scale project, that would be 9 ft. and under in wing span, I would very much like to have a copy. I am planning to make up a ¼-scale book that modelers can use as a guideline for building a scale project.

Hope to see you at the Ohio Nats in August. If you ever come to Vegas for the bright lights and the urge to gamble, give me a call. I'm in the book. I can't promise you good luck at the tables, but we'll have a ball at the flying field. Hope to see you soon. Edward E. Morgan, 1244 Barnard Dr., Las Vegas, Nevada 89102. ■

Mooney Mite

(Continued from page 3 2)

the exhaust stacks and the heat from the engine didn't even raise the paint.

Gas tank is made from a quart fuel can. Cut off the end of the can with the cap, then cut can down to fit the fuel tank compartment. Cut the cap and body so it fits into tank compartment, and solder it to the bottom part of the can. Then solder two Sullivan type of fuel tubes and one overflow tube in cap. Use two clunks in tank. Be sure that you put the cap on tightly before you locate and solder the fuel pickup lines in place.

For the fiberglass cowl, take high-density foam and form to shape of cowling. Make it ¾" longer so that you have a good trimming edge, sand smooth and brush two coats of wax heated to about 115° onto foam. If wax is too hot, it will melt foam, so be careful. If you have rough spots in wax, you can sand them out, or use a knife and scrape them out. When you have the wax smoothed down, mix Plaster of Paris and make a mold. When foam is removed from Plaster of Paris, make sure that plaster casting dries for five or six days.

Before using, line the mold with Saran Wrap and laminate with two to three layers of fiberglass. Depending on weight of cloth you will not get a perfect finish on outside surface, but it can be sanded down with 100-grit sandpaper. When sanded, give the outside two coats of resin and sand smooth. The top part of the cowling will be cut so that you can remove it to get at the carburetor.

Canopy is made from built-up balsa blocks and set in place and shaped to contours of body. Remove; then add ½" front, back and bottom of balsa wood so you can have trim area. When sanded, give it four criss-cross coats of resin. When dry, finish-sand with 400-grit wet and dry paper. Do not sand through resin. Use mold to vacuum-form the canopy. Cut canopy as shown on plans. Detail the canopy by using .018 aluminum sheet or a discarded offset printing

Fabulous Curtiss Hawk

(Continued from page 18)

carved from basswood. Aluminum, brass, plastic and stainless steel were used elsewhere in the model engine, and it was assembled with 196 00-90 bolts. All accessories are included on the engine, such as the carburetor, coolant pumps, starter, magnetos, fuel pump, oil pump and full electrical system. Beautifully turned on a lathe, the prop shaft also had the splines milled so that the prop hub would fit over it. This shaft is set in four ball-bearing races to insure a smooth turning assembly for the prop. The coolant radiator below the engine contains 56 ft. of 1/16" dia. tubing; each core is 1⅛" in length.

Hauser carved the prop hub in two sections, front and back, plus one propeller blade. From this, aluminum castings were made, machined, filed and polished to a mirror finish.

The tail wheel assembly is fully shock absorbing, and steerable, yet has an overthrow on it so that it rotates completely. The tail surfaces are built from stainless steel and brass with the

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