The authors with their 1/2A racers, all powered by Cox Black Widows. Little Mike in center was built when incompatible paints on first Little Mike (right) ruined the finish.

SHOESTRING AND LITTLE MIKE

By JAMES and DAVID O'REILLY . . . Two attractive models designed for 1/2A Scale Racing. A good fun event for clubs.

• Shoestring and Little Mike are 1/2A Class I Scale Racers. They were designed for a building and flying contest conducted by the Wichita (Kansas) Wichihawks. The purpose of the contest was to keep the activity level up over the winter. Our rules specified that only reed-valve radial tank-mounted sport-type engines were permissible. While the AMA rules at the time allowed "any sport-type 1/2A engine", they were changed for 1978 to coincide almost exactly with the rules under which Shoestring and Little Mike were designed.

I fly more free flight than control line, but decided to play the game regardless. We attacked our supply of old magazines looking for Goodyear and Formula One designs. I chose Little Mike because of its pleasing lines and attractive but reasonably simple color scheme. Meanwhile, my fifteen-year-old son, David, had also become interested in the contest. He considers Shoestring the world's only aircraft. All the rest are just planes. So his choice was made.

We began by scaling up the plans. One of those small pocket calculators with a memory is invaluable for this job if you want to "roll your own". Dave found a very detailed plan of Shoestring, but Little Mike showed up in an ancient issue of *Air Trails*, in a tiny three-view with a wingspan of roughly two inches. To scale up any plan, divide the desired model wingspan by the wingspan of the available three-view. The resulting constant number is entered into the memory of the calculator. From that point on, scaling up consists of taking measurements of the three-view and multiplying them by the constant, yielding the desired dimension of the finished model.

DESIGN

The three-ply fuselage construction was chosen because the rules required profile construction, and we wanted to duplicate as many of the fuselage contours as possible within the limits imposed by the rules. Also, our woodbox contained a few sheets of 1/16 "ironwood" left over from the last time we bought a kit. The core of soft six-pound 1/8-inch balsa with hard 1/16 sheet faces gives a good combination of strength and lightness. If you wish to keep the appearance as close to scale as possible, the engine cutouts shown on the plans are recommended. However, if strength and practical considerations are more important to you, we suggest that the portion of the fuselage above the engine be eliminated, as it is rather fragile. Observe from the photos that Shoestring accomplished this job for us.

CONSTRUCTION

The wing is made from 1/4-inch medium-weight balsa. If you are using balsa in three-inch widths, you will have to splice by butt-gluing. If you are able to find six-inch wide balsa, you will discover that the splicing has been done for you. Carve and sand the wing to a symmetrical airfoil shape, as shown on the plans. For the least drag, the trailing edge should be thin and sharp. However, such trailing edges are very damage-prone, so a compromise is in order here. Being rather conservative by nature, David and I both left ours somewhat blunt, anticipating that we would need the added ruggedness. Before mounting the wing in the fuselage, note whether the wood on one side or the other is denser. Make certain the heavier tip is installed to the outboard side.

The fuselage may now be laminated. Note that the soft 1/8 sheet used for the core has vertical grain, except for areas like the front airscoop, which projects horizontally. Also, note that Shoestring's rudder has horizontal grain. The hard balsa fuselage faces have horizontal grain. The three layers should be laminated with Titebond or equivalent, and care should be taken to see that excess cement is not squeezed out into the area along the bottom of the canopy, headrest, and fin. Any excess cement squeezed out here will have to be picked out later. It will not sand out without damaging the surrounding balsa. The freshly laminated fuselage is placed between two flat boards with weight on top until the glue dries.

The horizontal stabilizer is cut out of medium or harder 1/8-inch sheet. Note that both models have an elevator on only one side. Small injection-molded nylon hinges are more attractive than fabric hinges, but fabric hinges are more durable, so take your choice. The plans show cut-down Klett hinges. Install them with nothing less than epoxy.

The model is assembled by carefully sawing out the cutout in the fuselage for wing and bellcrank clearance. The wing is then set into the fuselage at an exactly right angle and is securely glued into place with Titebond. For fillets, we used Hobbypoxy Epoxylite, but any suitable fillet putty would suffice. Shoestring's stabilizer is installed by cutting a slot big enough to pass the stab without the elevator. On Little Mike, the vertical surface is cut off even with the top of where the stab will be. The vertical is then notched further to accept the stab. After the stab is glued into place, the top part of the vertical is glued back into place.

The landing gear legs are made from .063 aluminum. It absolutely must be a hard alloy. See your local surplus store for a suitable material. Generally, the alloys sold in your neighborhood hobby shop are neither hard nor hardenable. The legs may be bent by clamping them along the bend line in a bench vise. However, this will leave unsightly tooth marks along the inside of the bend. A much better procedure is to make a bend block from steel or aluminum plate. One edge of the block must have a straight edge which is carefully radiused and smoothed. The part to be bent is clamped in the vise along with the bend block, in a position such that bending will occur over the radiused edge. Bending is accomplished by driving the

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landing gear leg by means of a wooden "driver" and a hammer. The wooden block is positioned next to the bend line such that the force is applied as close as possible to the bend.

Wheel pants serve no useful purpose whatever, but add a lot to the appearance. Obviously, if the model is being built only to fly, they are optional. Dave and I each built two sets of landing gear; a display set with pants, and a flying set without. For engine mounts, the plans illustrate sheet metal. Note from the pictures that Midwest nylon mounts work well if they are suitably cut down. For the control system, there are several suitable pre-packaged horns and bellcranks. We used Goldberg's. The bellcrank is mounted on a piece of 1/16 plywood, 1/2-inch square. The plywood mount is set in flush with the lower surface of the wing, in the position shown on the plans. It is epoxied in place, as it takes the entire line pull in flight and must pass a five-pound pull test. We did not use conventional lead-outs. Instead, we used the single loop of music wire illustrated on the plans. The lines are run through this loop and attached directly to the bellcrank. This is a little less trouble and a little lower drag. Before the finish is applied a 3/32-inch dia. hole should be drilled into the outboard wingtip and about 1/4 ounce of lead shot should be forced into the hole. A wooden plug glued into place completes the installation.

FINISHING

For finishing, we used epoxy paint (almost) all the way. I did not originally set out to build one flying model and one display model. The flying model resulted when we tried to finish the first model with butyrate-based sanding sealer with epoxy over this foundation. The friction from sanding would heat up the local area and it would promptly grow a bubble! After the fourth or fifth attempt to cut the bubble out down to the bare wood, I decided, reluctantly, that I had just made a good flight model and had better get started on a display version for the building contest. The second time around, we used white epoxy filler coat to fill the wood grain and finished off with two epoxy color coats. For masking, Scotch Magic Mending tape does an amazing job. It leaves a sharp, fine edge every time. Its drawback is that it cannot be coaxed around a corner or curve like masking tape. Instead, one must score the tape along the desired line with the point of a dead-sharp modeling knife. The tape will tear sharply along this score. After the color coats, draw on ailerons, elevators, and other details using a drafting pen and India ink. The India ink will rub right off, so a coat of clear is sprayed on last. After the clear coat, finish off with automobile polishing compound and a couple of coats of liquid car wax.

ENGINES

Cox Black Widows are receptive to good break-in and hop-up techniques. The most important single feature of a good engine is the right fit between the piston and cylinder. The fit is checked with both piston and cylinder clean and dry. A good fit is one where the piston will just barely fall from its own weight when released in the top dead center position. We lapped in our engines with auto polishing compound in the bore while turning the engine with an electric drill motor. Don't fail to thoroughly clean out all traces of compound before running the engine! We used the Cox high-compression head because it will increase power output without greatly increasing fuel consumption. Most of the usual hop-up techniques, however, will increase fuel consumption more than power. For example, to optimize the exhaust and bypass timing on our particular Black Widows, we would have had to raise the cylinders above the crankcase a few thousandths by shimming. Instead, we left it alone. Similarly, we did not port the cylinder for fuel consumption reasons. There are a number of things that can be done to the reed, but extreme care must be taken. My own advice would be to go easy on reed changes. It is important to lay in a supply of spares, even if you're running stock. We found that after numerous flights running wide open, the center portion of the reed would develop fatigue cracks and fall right out of the middle of the reed. The ultimate reed change is to get your hands on an obsolete reed from a Cox Space Bug. These are heavier and permit higher rpm before reed "float" occurs. To get the same effect, some troops use a double reed, with one or two ears tack-soldered together to keep them from shifting position. An easy, risk-free change is to reposition the backplate so that the pickup tube is on the outboard side, just below horizontal. The purpose here, of course, is to use every last drop of fuel from the stock tank.

FLYING

The pit man in Mouse Racing is fully as important as the pilot to the team's success. Obviously, he must launch the aircraft as soon as possible and pit it in as short a time as possible. Here are some of the techniques which have won in our area.

For starting, the Cox spring starter is well worth its weight. Not only does it give good, rapid starts, but more importantly, it heads off the tendency of a reed-valve engine to start and run backwards. Good, fresh batteries are obviously needed, but we've seen a lot of fliers show up with weak or marginal boosters. The starting procedure which works best for us is as follows: After fueling the engine, prime a few drops against the closed exhaust port with the piston up. This avoids flooding. Start the engine. Kill the engine by pushing the heel of your hand against the root area of the prop disc. Watch out for the tips!

Top up the tank and indicate that you're ready. Now, with the battery still connected, while waiting for the countdown, grasp the prop firmly and pull it through compression. You should feel an ignition "bump". Repeat this every five or ten seconds. If you lose the bump, prime and restart the engine. The object, of course, is to arrive at "go" with a ready engine and a wound starter that requires only releasing the prop, pulling the booster, and releasing the model. The model should be moving one-half second after "go!". Pit stops involve a bit of teamwork between pilot and pit. On most calm days, the pilot can whip the ship around to a pit area landing. Landing? Actually, we don't want a landing, but a deliberate high-speed overshoot. The pit man does his second-baseman routine and one-hands the model. Again, fuel it, prime it (don't flood!), start, and release it. Keep your eye on the pilot, but don't wait for him to indicate "ready". It's his job to *stay* ready. If he has a problem, he can give a "hold up" sign.

This kind of event can be a real winter shot in the arm for a club. Besides, a few weeks after the building contest, it's Spring and everyone can go flying. This event is a good place to start if you want to add control line flying to your activity. ●

The senior O'Reilly's Little Mike. Model uses the sheet aluminum landing gear and engine mount shown on the plans.