THE LEASTIE-BEASTIE

With ultra-light sub-subminiature equipment just around the corner, our radio control editor produces a timely 37 sq. in. buzzer for postage-stamp flying sites. On a derated .010 it might even be fun for the Class III drivers!

By HOWARD McENTEE

Like any other design, Leastie- Beastie is the end result of a series; it was preceded by two very similar planes of somewhat larger size. The original appeared in the Aug. '58 issue of this magazine and got its name Minnie-Missile from our fellow members of the NJRCC, who simply called it Mac's Minnie. It had a span of 24", weighed around 11 oz. and was considered quite a sensation at the time. Several years later we produced Minnie-Most (May '62 issue), which had shrunk to 18" span and about $6^{1}/2$ oz. weight. Both these planes are fine flyers and are still in existence—but both are now shelved since it's lots are more fun to fly this wee one.

All three planes came into being following technical advancements in the field of R/C equipment and model engines. Minnie followed a double advance; Cox had just introduced the tiny .02 Pee-Wee engine. And the very first

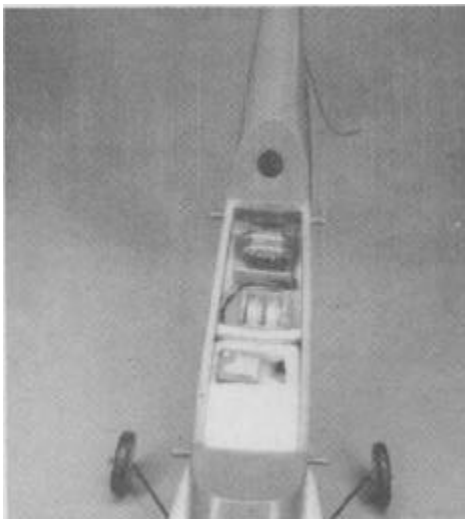
Mac seems mighty pleased—and he should be—with this latest product of the headshrinking art. It's a lively one!

all-transistor receiver had hit the market; this was the Deltron, a somewhat erratic performer, but it *was* quite small and light, and it eliminated the heavy filament battery. For its time, Minnie was a pretty hot performer, and it was felt that proportional steering would enable us to do the best flying job. So it proved. Most flying was accomplished with a rudder actuator made from a 5000 ohm Price relay (the Deltron operated from 22-1/2V).

Our manufacturers continued their miniaturization, and when Cox announced the .01 engine, and at almost the same time the tiny Otarion receiver came along, they triggered frantic drawing board scribbling, culminating in Minnie-Most (we named it thus, since we couldn't see at the time how a practical plane could be made much smaller!). Fuselages of both these planes were fairly fat and deep, to accommodate the receiver, batteries and what-not, with receiver mounted vertically against the front cockpit bulkhead in the most approved manner.

Minnie-Most has had hundreds of flights and is in almost as good condition as when it was first built (these tiny planes are amazingly tough—and are very easy to repair following a catastrophe). Real misgivings were felt over the actuator—which is a modified Gem 100 ohm relay, but due to careful work on the linkage this actuator has proven ample for violent stunting, including a few genuine spins (many tries at spinning have brought success only twice— but at least, the little plane doesn't execute sudden unwanted snap rolls when it gets into awkward attitudes).

While no new and smaller engines have come along, when we saw a sub-subminiature German R/C receiver and matching actuator, the urge again struck — there had to be a sequel to Most. Receiver and actuator together weigh only .4 oz, so here was a chance to really chop plane size, yet still have a "practical" flyer. That's in quotes, since like the earlier members of this plane series, we have to consider who the plane is practical *for*; it is certainly no beginner's project, for while easy to build, it is a screaming bomb in the air. The receiver and matching equipment were described in Radio Control Equipment News, Jan./Feb. '66 page 50. They have been available on a made-to-order basis, but by the time you read this, an importer



As size goes down, getting the CG forward ceases to be a problem. If anything, opposite is true. Roomy, tho.

expects to have them in stock, along with the matching transmitter.

Batteries are a problem, if we don't want to bog down a nice little flyer with excess weight. The German modelers use tiny disc cells which look like button nickel-cads, but are actually common 1.5V carbon-zinc cells. They are apparently intended for hearing aid use, but will stand the drain of the receiver quite well. Also, they are quite cheap, and the overseas users normally make ten or a dozen flights on a pair, then discard them for new ones. Sad to say, no exactly equivalent cells are sold in the States, but we have located a usable

A little bit smaller and Mac could use his Sterling Command Master for a carrying case. Mac got ten or more flights of 2-3 minutes each from Eveready #S76 silver-oxide cells substituted for the German carbon-zinc cells.

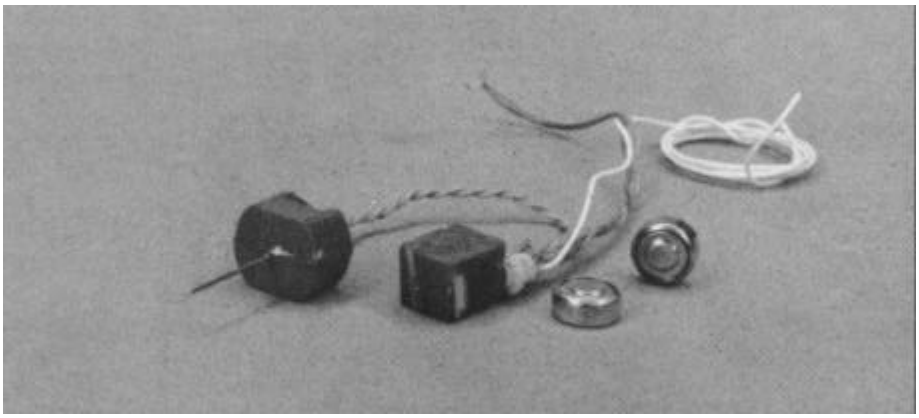
substitute; they are Eveready #S76 silver-oxide cells, which will also give ten or more flights of 2-3 minutes each, cost 30¢ each in lots of six at such outlets as Newark Electronic Corp., Chicago 60606 (their stock number is 49F398). You can also obtain these cells wherever hearing aids are sold and serviced (but the price will be higher). It's possible some of the tinier nickel-cad cells, such as Eveready B100T (which have soldering tabs) would work, but we haven't tried them, mainly because the receiver was designed for a little higher voltage.

The magnetic actuator that comes with the receiver is quite potent, and would handle a considerably larger plane. So this equipment solves the control problems. The engine problem is tougher—and Cox doesn't seem about to market a .005 engine in the near future. Running the .01 rich is no answer, nor is reversing the prop. But a complete solution to this dilemma comes from a Wisconsin modeler who has in the past made variable exhaust restrictors for the Cox .02 engines, and agreed to furnish same for the .01. With the restrictor, the engine can be slowed down to about half normal speed, if desired, which will give a large drop in rpm and thrust. The lower engine speed and use of a restrictor increases flight time on the Cox tank, and also quiets the engine whine to a considerable extent. You could fly this plane in most schoolyards with a few complaints from sensitive-eared neighbors.

With the prelims covered, we can get into actual construction. Since this is definitely not a building project for the average R/C novice, we won't do a stick-by-stick description. Needless to say, most parts of the plane should be made from the lightest balsa you can acquire, especially fuselage sides, top and bottom, wing and tail surfaces. A little heavier grades are used in a few key spots—per notations on the drawing. And real hard sheet is utilized under the nose to take the inevitable hard bumps in landing. The upper edge of fuselage sides from formers F4 back to the tail is considered the fuselage reference line, and all angles (such as that of the wing) are measured from this line. Ditto the angle of the firewall (former Fl) to produce downthrust.

Down and sidethrust angles may look excessive, but are those used on the prototype. Fl should be hard 3/32" thick ply, or softer 1/8" stock. We have long favored side-mounted engines (we note with some satisfaction that this trend is growing rapidly even in Class 3 stunters!) and find the little Cox engines handiest to run this way. Unfortunately, the Cox tank is not made for such mounting; when you turn the engine on its side, it's almost impossible to reach the engine mounting hole hidden back of the cylinder. Thus we use the one mount hole that can be reached, and a clamp made from thin sheet aluminum and held with two screws takes care of the engine right side. You can, of course, mount the engine upright and the plane will fly just as well, but it won't look as neat and trim with that "sore thumb" sticking up on the nose!

Triangular-shaped balsa along the bottom edges of the fuselage sides enables us to sand a nice rounded edge on the finished fuselage—for those who like such edges. The turtledeck formers atop F2 and F4 are shown on the drawing in approximate size they need to be when they are angled, per the side view. Former F3 is of cross-grain 1/16" med. balsa, with *(Continued on page* 76)



The airborne equipment. For its tiny size the pulse actuator is musclebound—and would handle bigger jobs. The article is packed with useful notes and a careful study is recommended before building.

The Leastie-Beastie

(Continued from page 16)

a 1/16" ply top brace; latter takes the strain of the batteries, which in the plane pictured here are carried in the - compartment just back of F3. F5 is not on the drawing as it can be cut to size by measuring dimensions. The five stringers shown starting at F4 and running rearward are of medium balsa; they prevent the soft 1/32" sheet from sagging between formers to give that "starved dog" look. One stringer on each side runs back only to former F5, the other three go all the way to the soft block under the fin and rudder.

The rather odd landing gear angle is there for a reason. It has been found a real aid in preventing noseovers on landings. It should be realized that this airplane isn't exactly a Nordic on the glide! It does sometimes come in rather steeply, but the landing gear seems to kick the nose up-ward on such landings, and so to prevent noseovers much of the time. The wheels are placed fairly far back, since it was hoped they would allow ROG takeoffs. It works—the little plane has no tendency at all to groundloop, and makes ROGs that the Class 3 flyers can envy! Landing gear on the original is .045" music wire, and the drawing shows the actual size (in dotted lines) of the wire "flat," before it is given the backward angle. Use the lightest wheels you can find.

In the two earlier planes, the engine compartment was always messy, since the tank is usually filled till fuel overflows, the runoff going into this area. A new trick was tried. One of the two filler tubes on the Cox tank was cut off and the hole enlarged to be a good tight press fit for 3/32" aluminum tubing. A piece of the latter is given a 90 degree bend (put it inside a close-fitting coil spring, to keep it from flattening at the bend) and pressed into the tank. Another piece of the same tubing is cemented into the fuselage, and the two connected with small fuel tubing. In flight, the remaining filler tube on the tank is kept plugged, so air to replace fuel drawn from the tank must enter through the under-fusel age tube.

Soft quarter-grain sheet forms the stab, which has two underside braces, and a pair of trim tabs (one tab works OK, but with two, many observers think you have elevators!). The same material forms the fin, and though not indicated on the plans, the bottom edge of the fin forward of the soft block is extended down and cemented to the stab upper surface. Rudder is hinged in the most dragless manner possible.

Not much need be said about the wing, except to search for *soft* sheet. The spar along the leading edge is shaped before cementing in place, after which wing halves are moistened and bent to approximate airfoil shape. When dry, the two wing halves are firmly cemented at the center. Then the ribs are fitted and attached; while they are drying, block the wings to produce the indicated tip washout. The spruce edging prevents unsightly nicks from small twigs, blades of grass and such! Silk or nylon reinforcement is applied at the trailing edge and also to strengthen the center joint.

The turtledeck was made by our favorite method—a soft balsa block carved to desired external shape, then hollowed out. It is cemented to the wing. The Williams 1" scale pilot is trimmed to fit on the upper wing surface, and is thus actually in a very realistic cockpit. The canopy was vacuum-formed over a balsa mold (grain well filled) by means of a Mattel Vac-U-Form, which does a fine job on anything less than 3-3/4" long.

The exhaust restrictor mentioned earlier may be had post-paid for $2 from Carl Vogt (4210 Dempsey Rd., Madison, Wis. 53716). It consists of two precision-turned aluminum half circles, and a music wire clip to hold them in place. Slots in the aluminum halves must correspond with exhaust ports in the cylinder, of course. Before attaching the restrictor, remove the cylinder from the engine, and smooth the surface between the lower cylinder fin and the flange below the ports with a very fine file; there are sometimes burrs here that prevent the restrictor from fitting snugly, and from rotating properly. We fastened a soft copper wire stop to the upper screw holding the engine to the firewall. This is bent to act as a stop for the restrictor arm, so you can cut the restrictor back to the same position every time.

Our restrictor is set (for flying) so that the exhaust ports are only open about 1/32". But the restrictor is opened fully to start the engine. Be sure to fit the engine with a Cox starter spring. We find the engine runs fine on Cox Blue label fuel (the hotter Red label might be preferable in cold weather, though). We feel it is well worthwhile to use Glo-Life additive in the fuel for these tiny engines, mixed in the fuel per recommendations on the Glo-Life bottle—one capful to a quart of fuel (a half pint of fuel will give you many dozens of flights with this plane).

The plans show locations of R/C parts. Because we wanted the entire radio installation removable for experimental purposes, the actuator and the World Engines # 1C-T slide switch were attached to 1/32" ply, the assembly held by a single 2-56 screw per drawings. This necessitated the slip joint at forward end of the torque rod seen on the drawing. Most builders will be content to fasten the actuator permanently in place; if so, the switch should be placed on the fuselage left side (so engine fuel residue won't seep into it). The receiver is mounted in front of F3, but most of the compartment between F2 and £3 is filled with polyfoam. The receiver rides in a bed of foam rubber about 3/16" thick.

On our plane, balance point was as indicated when the batteries were placed just to the rear of F3; they are mounted in a U-shaped holder with shim brass contacts, per drawing. The plastic U was cut from the end of a toothbrush box, and with batteries in place, the. holder sides are wrapped with a rubber band. The entire holder-battery assembly is then wrapped in foam to retain it in place.

To protect the soft balsa surfaces, and to fill pores, our entire plane was covered with the thinnest possible model tissue. This tissue gives the wing its color. One coat of 50-50 clear butyrate went on the wood surfaces first, sanded when dry. Then came the tissue, smoothed out with plenty of finger rubbing, with a coat of butyrate under it, and another on top. The fuselage then received two thin coats of colored butyrate, as did the wing L.E. and fin. Over this went two more thin coats of clear butyrate. This produces a nice light finish with a good shine.

We found the receiver needed most of the antenna that comes wired to the plug; the antenna is brought out just above the rear wing dowel on the left side, run back to the tail skid, from which 8" dangles free. This seems to be ample antenna, considering the transmitter employed, and the limited distance from the transmitter to which you can fly (you can't see what the plane is doing at any real distance!). While the receiver maker offers a matching transmitter, all our flying has been accomplished with the Sterling Command Master transmitter.

The receiver has a sharply tuned AF filter, at about 3400 cycles; it was found possible to bring the AF output of the Sterling transmitter to this range by adjustment of a tiny variable resistor located on the upper lefthand corner of the transmitter circuit board (such tinkering voids the transmitter makers' guarantee, of course—and also detunes the transmitter from the matching Sterling receiver; don't try it unless you know what you're doing!). Ed Manulkin will probably throw a fit when he hears this, but the transmitter pulser was also speeded up, since with the original pulse rate the hot little plane wobbled its way through the air, giving a wiggle with each pulse!

There's not a lot to be said about trimming and flying. Make sure the balance comes out as shown, and try some glides in the proverbial soft grass.

If you can heave the model off a hill, you'll have a better chance to observe glide path and to try the rudder. The trim tabs will allow you to set for the best possible glide. Then fire up the engine and cut it *way* back with the restrictor—you will probably *still* have too much power! We've never dared to open the engine up full—let us know what happens if *you* have enough nerve to try it!

In conclusion, we might express regret that we have to go overseas to find equipment small and light enough for a plane like this. Integrated R/C circuits are coming, and maybe it won't be too long. If you keep weight way down, leave off all the frills and most of the finish, you might cut weight enough so that the smallest present U.S. receivers, such as the Citizen-Ship Model MDL (or possibly the Jap versions of the Otarion imported by Polks and AHC) would be usable. You might try the "half-pencells" such as Eveready #904. We don't have any ideas on a suitable ready-made actuator (but the one described in the Minnie-Most story would do fine). But remember, that tiny 37 sq. in. wing will have to go a lot faster as you up the weight; the engine has plenty of reserve power to handle this extra speed. But can *you* handle it?!!