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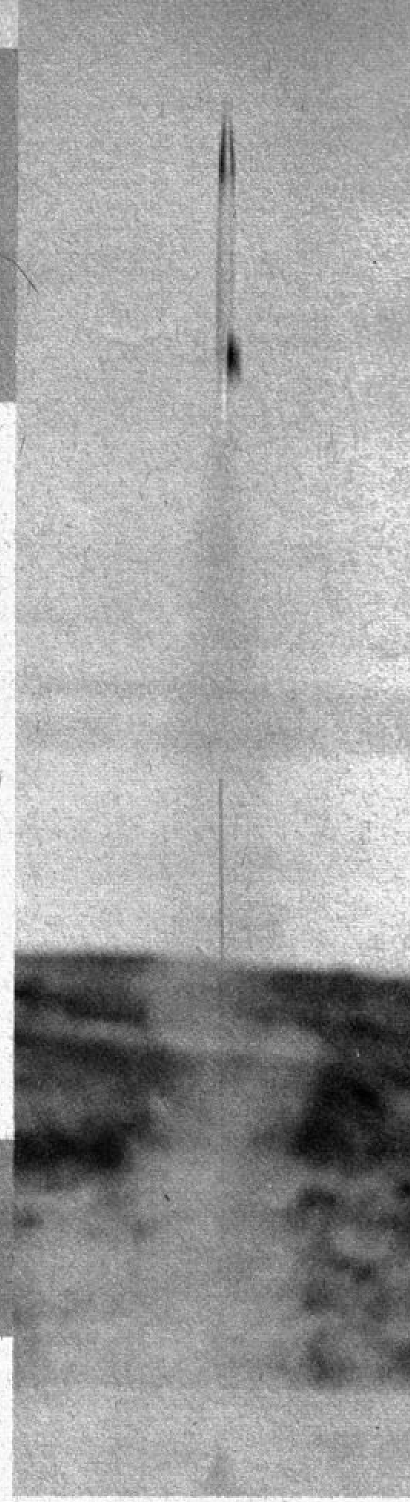
Manufacturing Model Missiles Sounds as Difficult As Turning Out Real "Birds"



By G. HARRY STINE

■ Last September, a little note regarding our desire to market a rocket-powered guided missile model appeared in the "Dope Can" section of *American Modeler*. Although an ad man might have labeled the item "hidden," it certainly brought response in the form of mail from AM readers. These stacks of letters convinced those of us working with model missiles that American modelers wanted this new hobby.

Since that time, the age of space has burst upon us. Un-manned satellites are whizzing around the earth, having been placed in their orbits by rocket-powered missiles. But the modeler was mostly concerned with conventional-power model aircraft.

Now, however, rocket power is finally available to send scale model missiles high into the air safely and bring them back by parachute recovery.

This particular advance in model rocketry was started by an inspired, persistent rocket enthusiast, Orville H. Carlisle of Norfolk, Nebraska, who developed and patented the solid-propellant rocket engine and parachute recovery system being produced by Model Missiles, Inc. Carlisle spent four years perfecting the system. When the word got around that he had this device, he was deluged by letters, phone calls, even money. Rocket buffs, modelers, schools, scientists, and engineers all wanted the Rock-A-Chute . . . and wanted it *now*! Unfortunately, Carlisle was in no position to personally fill the thousands of orders which poured in. It has taken us months to convert the system over to mass production machinery.

Briefly, this phase of modern model rocketry began in 1953. Carlisle's brother and business partner is an ardent modeler and Naval Reserve pilot who gives lectures on the history of flight, complete with U-control scale models. He wanted something to demonstrate rocket power in action for his little show, so he called on Orv.

Several thousand rocket motors later, Orv had learned how to make safe and reliable rocket motors which would take a model into the air, then pop a parachute so the miniature missile could float gently back to the ground. To pull off this little trick, Orv had to call upon a lifetime of experience with rockets and chemistry.

The result was the Mark I "Rock-A-Chute" missile. You might tend to laugh at it now, but we say it was the first model missile with a parachute recovery system. What is more important, it flew again and again and again.

Having perfected the basic hardware and system, complete with operating model missile, Orv Carlisle went on to improve the Mark I. He ran across a plastic item in the dime store that looked like a perfect rocket nose. It was part of a plastic crayon sharpener! With that ingenuity typical of American model builders, Orv designed a new missile around this readily-available plastic piece. The result—Mark II Rock-A-Chute, much simpler, cleaner, and neater. She flew better, too.

While the Mark II does not have the terrific performance of today's slick scale models, it was still a tremendous workhorse of a rocket, rugged as they come. One has flown over 250 times; it is still used to test new motors and parachutes.

About Mark II time, the author got into the act as a result of a letter from Orv Carlisle. We worked strictly by mail for six months, and I did not meet Orv until the summer of 1957!

We started on scale models in late Spring of 1957. You think developing tiny scale "birds" was easy?

It wasn't.

Not by a long shot. It took us months to figure out the score; it was not just the simple process of scaling down a missile from the plans. We ran into all kinds of new things. Weight distribution of the real missile was nowhere near that of our scale models, since we have most of the weight in the nose and tail in contrast to the nearly-equal distribution of the real birds. We also ran into effects that were the result of different Reynolds Numbers, for example. Now that we know the answers it looks simple, but it wasn't "back when!"

We went through a number of distinct steps. First, we modified Mark II in an attempt to approach the configuration of the big missiles. We replaced the plastic nose with a streamlined one turned from hardwood and chopped the fins to triangular shape. End result was a missile not quite new, so we dubbed it "Mark 2½." This was followed by a scale-like "Parabee-I" series patterned generally after the Aerobee research rocket.

Parabee-I would fly circles around the Mark series. With the Mark series, Carlisle had been happy to get tree-top altitudes. By the time we got through the Parabee series, we were putting them out of sight with no sweat. The Parabees required an entirely new different rocket motor; this Orv designed.

In the early part of 1957, we developed a two-stage Parabee. This took some research, too! In July we fired a two-stage Parabee to an altitude of 11,000 feet!

More designs came quickly. We formed Model Missiles, Inc. and incorporated four days after Sputnik I—October 8, 1957. Our first project was to be a mass-produced assembly kit. We believed that there were still model builders around who liked to put things together. We chose the Aerobee-Hi research rocket and developed a 1/20th scale model of it 13 inches long, ¾-inch in diameter. (The Aerobee-Hi is being used by all three armed services in the International Geophysical Year.)

Our missile would be patterned after

the Navy version; the Naval Research Laboratory said okay. The Aerojet-General Corporation, makers of the real Aerobee-Hi, licensed us to use the design and the name. So we got busy on the production kit, first of its kind.

We had run all kinds of strict tests on the solid propellant Rock-A-Chute motor. And the Bureau of Explosives, the agency which makes tests on all explosives, rocket motors, radioactive devices, etc., for the Interstate Commerce Commission, re-tested the motors and gave them a clean bill of health as "I.C.C. Class C Toy Propellant Devices," meaning that they threw no flame and were safe. The rocket motors are not "fireworks"; they provide propulsive push and parachute ejection, no Fourth-of-July star bursts.

Came next the problem of making these little rocket motors by mass production methods. We knew that we could not load each one individually by hand.

Finally, we found someone who could make the motors for us by machine—the Brown Manufacturing Company. Lawrence Brown and his son, Herbert, both flying enthusiasts, worked with us very closely. When we got through this phase, we had machine-loaded rocket motors with 50% more power and a 400% greater safety factor.

We contend that Aerobee-Hi model missile is just as safe as an engine powered model airplane. We've flown thousands of them, nobody has ever been hurt. We have tested and tested and tested. And we have incorporated every safety trick in the books. But nobody can out-guess the moron or know-it-all wise-acre modeler with no sense of responsibility or safety.

For example, we have received a lot of letters from a lot of people who just wanted the rocket motors to power their own missiles. This is okay with us, but the majority don't have the foggiest notion of how to design a flyable model or what materials to use in its construction. And until they get the experience and knowledge necessary, we suggest that they use the Rock-A-Chute rocket motors *only* for powering model missiles built from our kits. Reason: we've put a lot of time and effort into developing the right materials to do the job correctly and into careful design of the models. You can't sit down and whip out a high-performance free-flight design without knowing something about aerodynamics and construction materials. The same holds true for model missiles.

So we say again, when you get your hot little hands on the Rock-A-Chute rocket motors, use them only for model missiles designed for the Rock-A-Chute parachute system.

Sure, we'll be perfectly happy to tell you how to build a model missile to use the Rock-A-Chute motors. There are no secrets to it, perhaps you'd be surprised at how simple it really is! We'd rather see you fly a safe and reliable model missile than to withhold information and have you get hurt or be disappointed.

But we're not going to tell you how to make the rocket motors. The reason is simple, too. You shouldn't be doing that sort of thing without qualified, experienced hands directing the project.

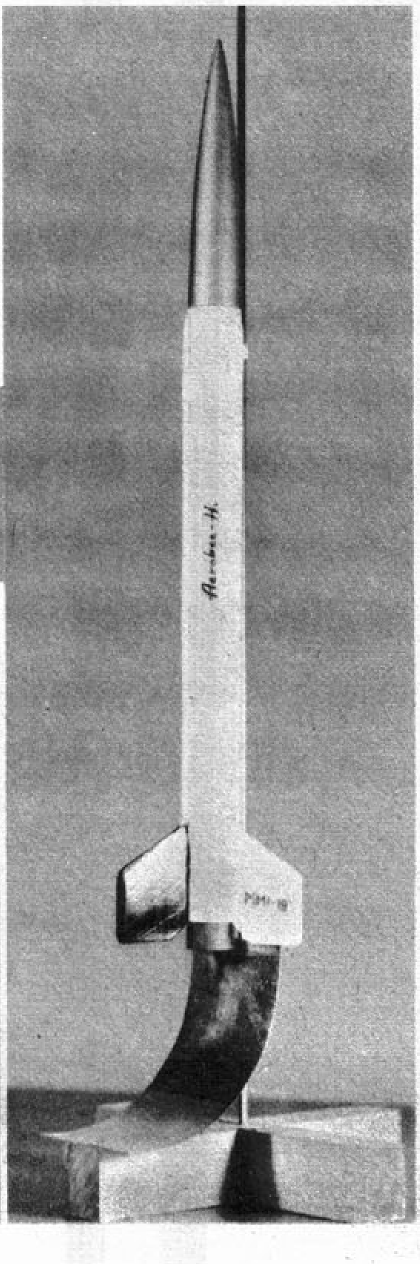
It took over 4 years to work out all the little tricks to give you our safe and reliable model rocket motor. Orv Carlisle has spent a lifetime working with little rocket motors; he knows what he is doing because he has lots of experience. Mr. Brown and his son also have years of experience in the production of similar units. As for myself, I've worked with the big rockets and have the technical training to supplement Orv experience and Brown's know-how. It took this combo months to work out some of the problems.

Look, when you want to build a model airplane, do you sit down and build the gas engine for it? Of course not, that's silly! It's cheaper and easier to go down and buy one. If you're willing to cough up a couple of hundred bucks for machine tools, you could probably build a Hong Kong copy of something like the Torp .35. In a similar vein, you too can build your own rocket motors if you've got a couple of hundred bucks kicking around for the necessary tools and materials. Even then, the chances are good that you will not get a workable rocket motor. Design and construction of rocket motors is not a true science; it is an arcane art.

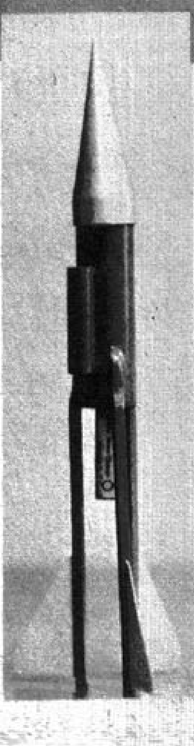
The specifications of the rocket motor are all you really need. The standard Rock-A-Chute "Safety-Proved" Rocket Motor is 2½" long and has an external diameter of 11/16". It produces 16 ounces of thrust for 1.5 seconds. It weighs just a shade over 0.5 ounces. It must be ignited with a hot-wire type of electrical igniter. It is safe to store and use as long as you keep it away from fire; it's a lot safer, actually, than glo-plug fuel.

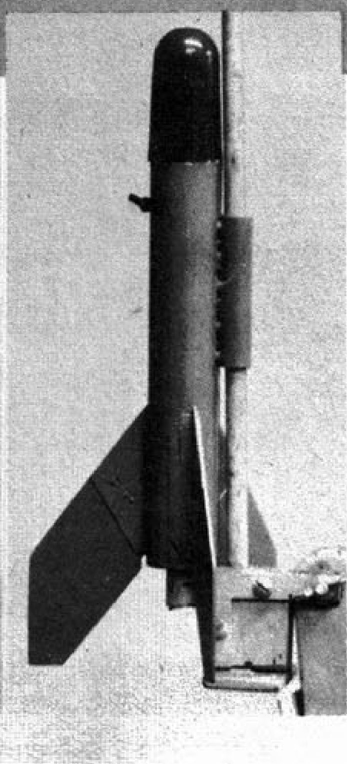
The "motors" are designed to be expendable. One is used up on each mis-

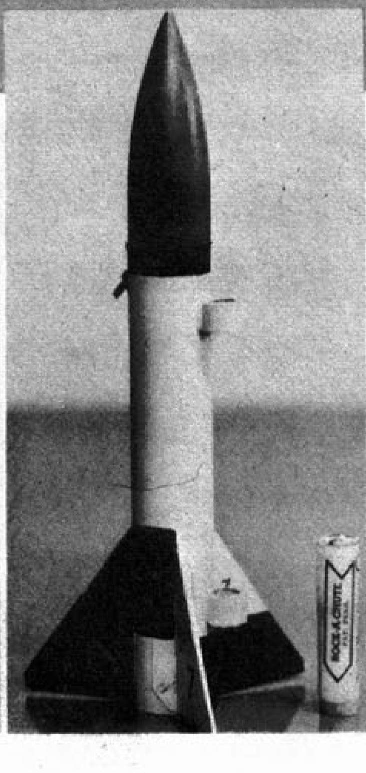
(*Continued on page* 56)

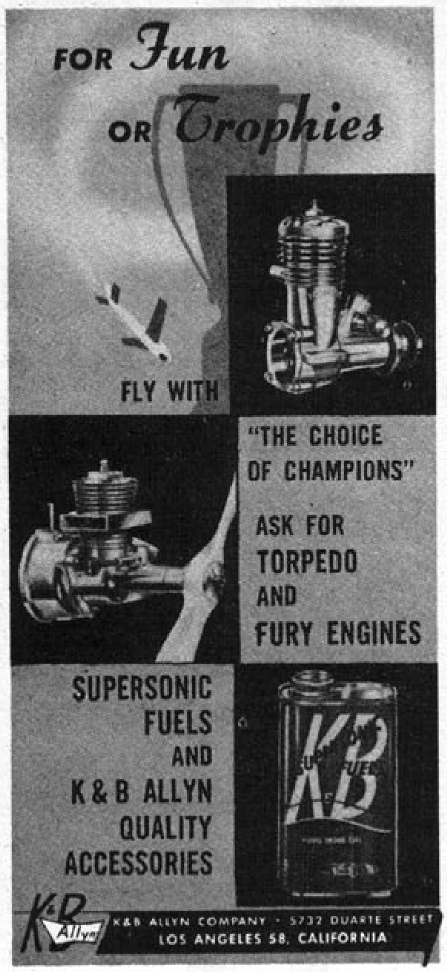


Aerobee-Hi model missile (left) speeds aloft to 1,000 ft. altitude. Below (from left): Mark I Rock-A-Chute, Mark II on adjustable launch ramp, Mark 2.5, and the 13" long Aerobee-Hi. Note jet deflector.









A happier way to end this on-the-spot broadcast is to give credit and thanks to all the people who make possible a model contest like the King Orange. Especially the Exchange Clubs in and around Miami. Their interest in youth and aviation is an outstanding example of what this country needs more of.

This is Larry Conover, for *American Modeler*, signing off.

Model Missiles

(*Continued from page* 23)

sile flight. Because of the high internal heat and pressure generated when the motor operates, don't use the paper case over again.

The motors come complete with the parachute ejection system built right into them. There are three types of powder loaded into the motor.

First comes the propulsion charge. This accelerates the missile up to speed by providing thrust. The manner in which the solid propellant is loaded into the rocket motor makes it impossible for the motor to explode. It can only produce thrust by slow burning of the propellant.

Once the missile has been launched and given the initial push by the motor propellant, the motor time delay is automatically actuated. This time delay is a very slow-burning mixture which produces no appreciable thrust at all, but merely allows the missile to coast freely upwards to the peak of its flight.

The amount of time delay in the motor has been calculated so that it actuates the parachute ejection charge when the missile is just at peak altitude. The parachute ejection charge produces gas whose pressure blows off the missile nose and forces the parachute package out.

All of these functions are performed by the Rock-A-Chute motor itself; there are no moving parts, timers, or other types of gadgetry in the missile to go wrong. This makes the whole system reliable.

As you can see, the Rock-A-Chute rocket motor was designed strictly for parachute-type missiles. You can't take the ejection mechanism out. In fact, the motors should not be tampered with at all. Just use them.

Now when it comes to building a model missile that can be powered by this motor, we get into a whole new field. Most people think that a missile has to be built out of metal in order to withstand the heat.

We make our missile out of wood and paper! Aerobee-Hi has a body made from a rolled paper tube ¾" in diameter with walls 1/32" thick. This tube is exceptionally strong and light. You can glue things to it and paint it easily.

Fins are medium-hard 3/32" balsa. Now, size and location of fins on a model missile are very important to achieve straight and stable flight. They should be as large as possible and as far back on the body as you can put them. Staying strictly scale with the Aerobee-Hi, we had some headaches. The real Aerobee-Hi, when shrunk, didn't have enough fin area for its new weight distribution characteristics. We licked it by adding weight to the nose.

These fins are glued to the body with

(*Continued on page* 60)

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See other POLK ad on page 47

Model Missiles

(Continued from page 56)

a butt joint that is plenty strong for the purpose.

The nose cone is another matter. The gefrontenparten of a fin-stabilized missile should be as heavy as possible. The more the merrier. This means that you must use pine, birch, poplar, maple, or some other semi-hard wood that has some heft. Balsa is too light. For experimental nose cones, we buy dowel from lumber yards and turn it down on a wood lathe. Several were not heavy enough even with the harder wood, so we had to gedrillinout the nose and gepouringin the lead!

Sure, you can put a payload into the nose cone. We've flown some. It's a challenge trying to making a transistor transmitter that will fit into one of the nose cones and weigh about an ounce! We have a camera that has flown. We lofted a mouse to an altitude of 760 feet and chuted him back alive and unhurt!

Our rocket motors fit into a cylindrical metal motor mount glued into the tail of the missile. The mount holds the motor tight and straight, but not so tight that you can't pull the expended motor out to install a new one . . . we've got to eat, you know.

The parachute is simply a square of 2-mil colored polyethylene film of the sort available in dime stores as table covers, clothing bags, etc. The bigger the chute, the more slowly the missile will float back to the ground. On windy days, a slow descent means you chase the missile into the next county. For work in high winds, we use a 6-inch square 'chute. Sometimes we fly without a parachute at all, just let the ejection charge blow the nose off the missile destroying its streamlining and allowing the missile to flutter to the ground like a leaf.

The Rock-A-Chute parachute lowers the entire model to the ground. Nose cone and missile body are attached to the shroud lines. To absorb opening shock, a 12-inch length of ⅛" contest rubber is between the body and shrouds. Without this shock cord, the body would tear loose when the opening parachute suddenly fills with air.

To protect chute and shrouds against the gas blast from the ejection charge in the motor, the parachute is wrapped in a layer of paper then fitted with a paper end cup on the aft end. This paper is stripped off by the breeze when the 'chute package is expelled from the missile. (Without the paper protection devices, the parachute comes out in smoldering shreds.)

To allow the chute package to slide out of the body easily, a manila paper lining is put into the missile body when repacking the parachute. This gives the package a smooth bore to slide in. Otherwise the few particles of carbon which deposit on the inside of the missile each time the ejection charge works could prove troublesome.

We always use a launcher. During the first few feet of flight, a model missile is not moving fast enough to allow the flow of air over the fins to keep the missile stable. Our standard model missile launcher is a 36" length of ⅛" music wire stuck vertically into a heavy wood base. Two small lugs made from tubing and glued to the missile body ride along the guide wire.

Without this launcher rail, the missile might go in any direction. The wire

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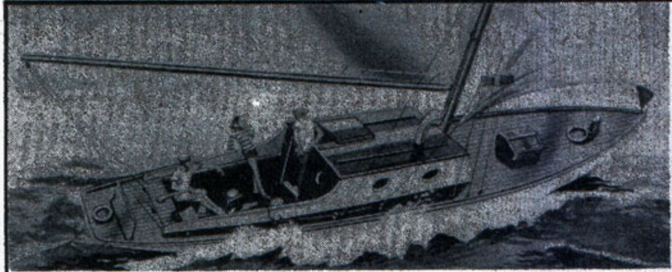
also determines the subsequent flight path of the missile.

We *always* fire vertically. Otherwise . . . *pow*! At 200 mph, too. A model missile can achieve that sort of speed without any trouble. Usually, it doesn't get going that fast until it is several hundred feet in the air. And, fired horizontally, it dives right into the ground. So fire these powerful little beasts straight up.

Performance? How high do you want to go? Out of sight? The Aerobee-Hi model will do that easily. But have a fast car or good track shoes for chasing the parachute! The Aerobee-Hi model can hit 1000 feet without any trouble, and we have clocked it at nearly 200 mph. Takeoff acceleration is 9-g, which means that you miss seeing it if you glance the other way!

So you see our model missiles were not just something we happened to stumble upon. On the contrary, we have



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Other missile kits and motor types to be available soon.

MODEL MISSILES, INC.

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done *engineering* on them. That is why we call them *model missiles* rather than model rockets. We've used guided missile techniques wherever we could. We've tackled the whole thing on an engineering basis, trying to bring model rockets up to the same level as model airplanes. The design process is sometimes long and complicated. And we test our missiles endlessly.

West of Denver, Colo. we have what we believe is the world's first and only miniature missile proving ground—the Model Missile Test Center. It's equipped with tracking stations, telephones, launching pads, everything needed to properly test our missiles. We have spent months testing our missiles at the Test Center. We know what they will do and what they won't do. We have reliable data on how high and how fast they go, how they perform in winds, and what effect temperatures have on them.

Although we had plenty of problems developing the model missiles, it was a lot of fun. Some days nothing went right, other days were better, days when the missiles went straight up . . . and up . . . and up to finally pop their parachutes at 1500 feet. We've fired over 2000 model missiles there, establishing altitude and speed records of our own, then breaking them, testing new equipment, re-testing the production models. Nobody has ever been burned, cut, or bruised . . . although we've been plenty pooped from chasing parachutes!

There is nothing quite like pressing the firing switch and seeing your pet missile roaring up into the sky, leaving a thin trail of white smoke behind it. It matches the real thing. There is also a thrill when the parachute ejects on schedule. You're pretty proud as your creation floats back to the ground again.

And . . . when things *do* go amiss, you've got fewer pieces to pick up than with model airplanes!

Chicago Caper

(*Continued from page* 15)

size R/C "Buster," and a new combat plane, the "Lancer."

Hanging from the exhibition hall ceiling were several new controliners by Aristocraft. These, all single engine airplanes, included a PT-17, Beechcraft, Grumman F3F1, and Curtiss Hawk F11C4. Wingspans average about 48";

Hobby Shop Directory

Model Builders! Here is a listing of nationally known hobby shops. You'll want to file it away—and when you're in the neighborhood, drop in and browse around. They're expecting you.

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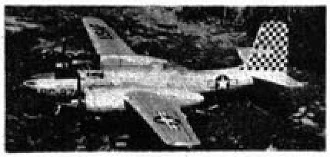

RB-26 INVADER

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43" Length
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