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THE FORMATIVE YEARS OF MODEL ROCKETRY,
1957 - 1962; A PERSONAL MEMOIR

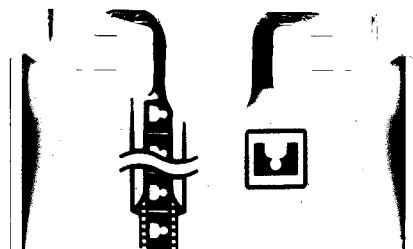
G. Harry Stine

14 October 1976

For Bill-

Do what you want with your life,
but try to make it count. You don't
have to carry on what I started—
but at least try to do something. I
know you will.

Dad.



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Author's Special Note: It is not often that an aerospace historian has the opportunity to participate in the making of history. Yet, such is the case here. Such a co-incidence makes historical objectivity impossible. Therefore, this is a memoir...but a memoir written by an aerospace historian in which every attempt has been made to report the facts as honestly as the author himself remembers them. Fortunately, the author documented as much as possible at the time, keeping in mind the fact that other historians might possibly be interested in what happened.

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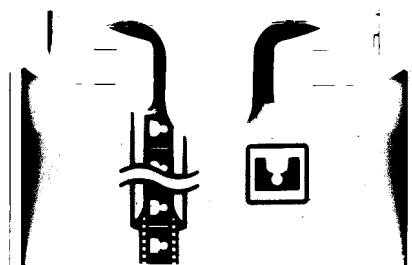
Model rocketry was a fortuitous synthesis of three technologies: (a) the ancient art of pyrotechnics, (b) model aeronautics, and (c) professional astronautics and rocketry. Although all three of these technologies existed in forms sophisticated enough to permit the development of model rocketry prior to 1957, and although many individuals had made partial syntheses before that time, a social need of sufficient magnitude did not exist prior to late 1957.

Sputnik-I provided the impetus that created the social need for model rocketry.

Fortunately for millions of young people, the technical elements responded to the prod of social need to create model rocketry as we know it today.

The world's first true model rocketeer is Orville H. Carlisle, a self-taught merchant who owns a shoe store with his brother, Robert, at 420 Norfolk Avenue, Norfolk, Nebraska. Orville was born on July 7, 1922. "This probably accounts for my life-long involvement with fireworks," he stated. Orville's hobby is pyrotechnics. He is one of the outstanding amateur pyrotechnicists in the United States today. He is a member of the Committee on Pyrotechnics of the National Fire Protection Association because of his extensive practical knowledge of pyrotechnics.

Robert Carlisle, his brother, also played a decisive role in the development of model rocketry. He is a former naval aviator and an ardent builder of flying scale model aircraft. In the early 1950's, he began giving lecture demonstrations about the history of flight using line-controlled model airplanes. He asked Orville to make a small rocket that could be used to show the future of flight into space.



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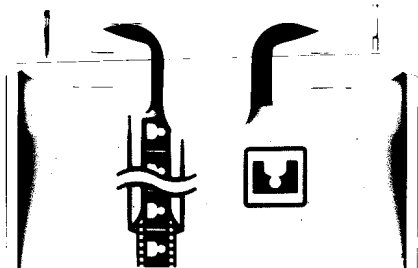
Orville and Robert Carlisle combined the art of pyrotechnics with the technology of model aeronautics. This produced the first true model rocket. By 1954 with Robert's help, Orville had developed the "Rock-A-Chute Mark I" using model airplane construction techniques and materials. It used a plastic parachute to bring the entire model gently back to the ground. It was propelled by a paper-cased, replaceable solid propellant rocket motor. On August 30, 1954, Orville filed for U.S. patent on the elements of his system. On July 1, 1958, U.S. Patent Number 2,841,084 was granted to Orville Carlisle. Today, an original Carlisle "Rock-A-Chute" Mark I and the improved Mark II are on exhibit in the National Air and Space Museum of the Smithsonian Institution in Washington, D.C.

One element remained to be added before model rocketry as we know it was born: the techniques of professional astronautics and rocketry.

In 1952, fresh out of Colorado College with a B.A. in physics, I went to work as a civilian scientist at White Sands Proving Ground, New Mexico. I learned about rocket motors as chief of the Controls and Instruments Section of the Propulsion Branch testing both solid and liquid propellant rocket motors for the U.S. Army. In 1955, I went to work for the U.S. Naval Ordnance Missile Test Facility at White Sands as head of the Range Operations Division and Navy Flight Safety Engineer. Thus, I became intimately familiar with flight operations and safety of rockets such as the Viking and Aerobee.

In the evenings, I wrote science-fiction and, in early 1955, began writing a series of monthly columns on astronautics for Mechanix Illustrated magazine. Because of this spare-time literary effort, I became acquainted with William G. Haggard and Gabriel J. Brilliante of the WSPG Public Information Office. Haggard and Brilliante discovered that I would gladly answer letters from young people wanting instructions on making and flying their own rockets. I also found myself talking to youth groups visiting the proving ground. Thus, I became acutely aware of the youth rocketry problem, as it was known in those days.

The youth rocketry problem revolved around a series of knotty questions. How do you tell a teen-ager how to correctly and safely mix toxic chemicals to obtain highly explosive rocket propellants? How do you instruct them concerning the loading of these propellants into rocket airframes? George S. James and others were hard at work trying to get answers to these questions and others that were involved as well. But there seemed to be very little communication between professional and amateur rocket makers. In fact, Andrew G. Haley had advised the American Rocket Society to stay clear of the problem because of potential liability problems.



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One of my responses to the urgency of the youth rocketry problem was to devote one of my Mechanix Illustrated articles to the safety rules practiced by the professionals with some safety rules for amateur rocketry that I derived from them. It was entitled, "The World's Safest Business," and it appeared in the February 1957 issue.

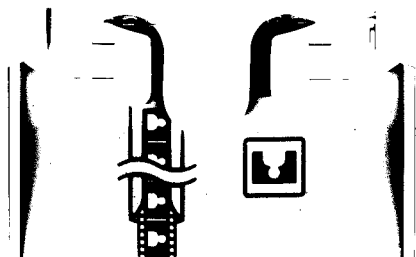
On January 28, 1957, I received a letter from Orville Carlisle telling me of his model rocket developments and offering to send me some samples to try out. I accepted his offer with some trepidation because, although I was intensely interested, I was also somewhat skeptical of non-professional rocket experiments and development by that time.

On February 5, 1957, Railway Express delivered to my home at 1100 Circle Drive, Las Cruces, New Mexico a large box from "Carlisle's Correct Shoes" in Norfolk, Nebraska. It was covered with big, red "fireworks" stickers. The model rockets were delightful! Carlisle had sent me three built-up Mark II Rock-A-Chute models, and three unassembled Mark II's in "kit form." He included several dozen replaceable solid propellant model rocket motors 1/2-inch in diameter and 2-1/4 inches long. I separated the rocket motors from the rest of the shipment and put them in a metal box in the farthest corner of my back yard. I assembled the two launch pads that Carlisle had sent along in the shipment. I read the instructions carefully. Then I took one of the built-up Mark II models, packed the parachute, installed a motor, and took it with a launch pad over the irrigation ditch to the west of Circle Drive into the middle of a 400-acre cotton field. I set everything up, lit the fuse (we had not yet developed electrical ignition), and ran about 20 yards back.

What I saw then I have seen at least 50,000 times since. And what I saw in that New Mexico cotton field on that bright morning in February 1957 has now been repeated more than 100 million times in the United States alone since that day.

The Mark II Rock-A-Chute took off with a woosh, leaving a thin trail of grey smoke. It climbed to about 250 feet and ejected a bright red plastic parachute. The whole assembly wafted gently back to the ground. I picked it up, took it home, installed a new motor, and repacked the parachute. I went over into the cotton field and flew it again. It was a repeat performance.

So was the next flight. And the next flight. And the next flight.



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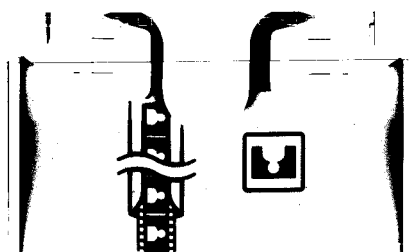
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I called some of my White Sands colleagues immediately. R. Gilbert Moore, Robert Daly, and Nathan Wagner were among those who gathered at my home to inspect these first model rockets. We took them into the cotton field and flew them. Later, at Daly's home at 109 E. Gallagher in Las Cruces, we carefully cut open a Carlisle model rocket motor and were surprised to discover that it was state-of-the-art pyrotechnics.

During the next six months, several of us engaged in a great deal of empirical experimentation with Carlisle's model rockets. I realized that ignition by means of a standard safety fuse was very "unprofessional." Carlisle and I independently developed electric ignition for model rocket motors in early March 1957; our letters to each other describing in detail how to do it crossed in the mails. Carlisle told me how to make multi-staged model rockets and sent some specially-loaded lower stage booster motors for me to try. I conducted some primitive static tests of the Carlisle motors, running them through a series of environmental stress tests as well. In no case did these little motors fail to work properly. And I could not get them to undergo spontaneous ignition under any condition that might normally be expected to occur. I was greatly impressed. It was difficult to believe that a shoe store owner from Nebraska had achieved the fabled nine-nines reliability that we professionals strove for but rarely achieved at White Sands.

Here was the obvious answer to the youth rocketry problem! Extend the field of model aviation into the space age. Market model rocketry through the hobby trade. Put the models out in kit form. Get somebody with pyrotechnic experience to make the model rocket motors, thus eliminating one of the most hazardous aspects of rocketry: propellant handling. Put every bit of professional astronautics and rocketry technique, safety, and charisma into model rocketry as possible. Make it a legitimate hobby alongside model railroading, model boating, and model aviation.

Lawrence Saunders -- later the famous author of "The Anderson Tapes" -- was editor of Mechanix Illustrated at the time and became as enthusiastic as I was about the Carlisle model rockets. He offered to publish a full-length article about the little models if I would write it and get some good photographs to go along with the text. So I wrote the article. Carlisle got some photos made in Norfolk. I got three young teen-agers together to build some model rockets from kit parts that Carlisle sent me. These very first young model rocketeers were Alden Tombaugh, son of the famous astronomer and now a bank vice-president in Las Cruces; James Post, who became a highly-decorated Army helicopter pilot in Viet Nam in later years; and his brother David Post who now owns and operates a medical



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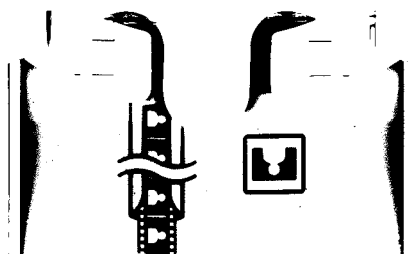
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laboratory in Las Cruces. With these young men, I went out on the desert of the Jornada del Muerto east of town accompanied by navy civilian photographer Albert G. Kniele on March 24, 1957. We launched about 50 models that afternoon, got some great photos of model rockets in action, and confirmed my gut feeling that this form of rocketry was indeed the answer to the youth rocketry problem.

Carlisle was supplying us with model rocket motors that he loaded by hand in his basement. Naturally, he would not be able to keep up with the demand if model rocketry really became established as a result of the Mechanix Illustrated article. Carlisle could make about 200 motors per night at home. If model rocketry was the sort of thing that I thought it might be, the manufacturing rate might eventually have to be 200 motors per minute!

It would take manpower, money, equipment, and organization to form a model rocket company to manufacture the kits, motors, and accessories, to market these products, and to promote them properly. My father-in-law, Willard E. Kauth, had asked me to let him know if I came on any little money-making idea. I wrote him on February 24, 1957 and told him about Carlisle's rockets. He expressed interest. Richard C. Mayes, the sales representative for Cook Electric in El Paso, Texas, became interested and offered to put up some capital. I tried to get some of my colleagues of the New Mexico-West Texas Section of the American Rocket Society interested, but they declined because of what they considered to be high risk factors.

One high risk factor was the fact that these model rockets might be classified as "fireworks" in a majority of the states. Webster defines a firework as a device which produces "a spectacular display of color, sound, light, or a combination of these." I did not think that a model rocket was a firework in 1957, and I still think that way today. I believed that we could solve the fireworks problem; that was simple compared to solving the problem of keeping young people from killing themselves with home-made rockets. Naive rocket engineer that I was, I honestly believed that any state or local fire marshal who would look at our model rockets would see that they obviously were not fireworks in the classic sense of the word. It took a mere 15 years to convince most fire marshals that model rockets were not fireworks. It is only fair to state that most fire marshals were honest professionals who understood what we were doing but who were forced to enforce the laws that were on the books, laws that pre-dated World War II when the only rockets around were fireworks rockets.



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Strangely enough, Carlisle and I did not meet until the summer of 1957 after we had corresponded and talked by telephone for about six months. We arranged to meet in Denver, Colorado in July 1957. I came up from New Mexico for an interview with the Martin Company. Carlisle, who does not like to fly, came to Denver in the old "City of Denver" streamliner, and I met him at Denver Union Station on the morning of 8 July 1957.

Carlisle had located a manufacturer for the model rocket motors. He has many friends in the pyrotechnic industry. One of his closest acquaintances was Lawrence W. Brown who owned both Brown Manufacturing Company and Zenith Fireworks Company in Clinton, Missouri. Brown arranged to come to Denver at the same time.

Willard L. Kauth also arranged to attend this initial meeting in Denver.

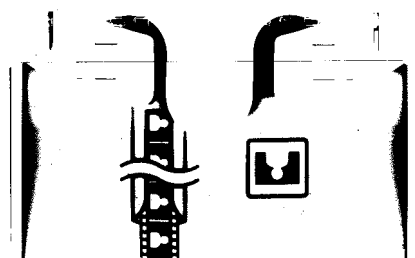
Our first business get-together was in the Brown Palace Hotel in Denver. I got on the elevator with Carlisle to go up to Kauth's room, and I was carrying a large, open box full of model rockets. With a straight face, I told the elevator operator, "Take us to the roof." The reaction was predictable and humorous.

We went out to Arapahoe County Fairgrounds west of Denver the next day to fly some models. And we decided that each of us would put in a couple of thousand dollars, make a trial run of 3000 kits with motors and launcher included, and then determine where we wanted to go from there. Kauth's son, Donald Z. Kauth, invested also and became interested in the possibilities of selling model rockets by direct mail. Don Kauth is an expert in this area, and his early ideas on direct mail turned out to be absolutely correct in the long run.

We decided to call the firm "Model Missiles, Inc." or MMI for short because we felt that the word "rocket" was too closely allied with fireworks. The word "missile" was a very catchy word at that time. Today, the words have diametrically opposite connotations.

I left Las Cruces in August 1957 and moved my family to 6180 Fairfield Drive, Littleton, Colorado where I went to work on advanced projects for the Martin Company. For that reason, model rocketry and MMI stayed in limbo until I was re-established. I had just started to get things unpacked in our new home when Sputnik-I went into orbit on October 4, 1957.

That day was the turning point for model rocketry. Without Sputnik, model rocketry would never have developed. Sputnik fired the imaginations of young people all over America. The youth rocketry problem became serious as thousands of young



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people began to make and fly their own rockets. And we were almost ready with the model rocket to satisfy that desire in safety.

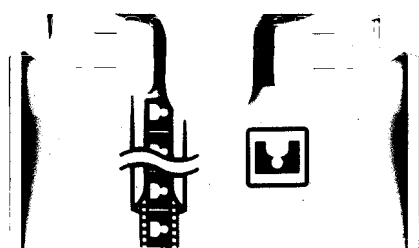
Sputnik also allowed me to devote my full time to model rocketry. To make a long story short, I was fired by the Martin Company on October 5, 1957 for telling United Press that the Soviets had used their ICBM as a launch vehicle (which they had), that Sputnik meant that the entire United States was open to nuclear ICBM attack (which it still is), and that the United States was not first in space because we did not have a serious space program (which we did not under the Eisenhower administration). I got a lot of newspaper publicity which I put to good use for MMI and model rocketry.

At just about that moment, my article on Carlisle's model rockets appeared in the October 1957 issue of Mechanix Illustrated magazine, complete with cover painting. Carlisle was deluged by over 10,000 letters within weeks. He had to return over \$5000 in cash that had been sent to him by readers who wanted to buy those model rockets and motors right away. It hurt to return that money, but we weren't ready to ship model rockets yet. MMI was officially chartered as a Colorado corporation on October 10, 1957 by my college friend attorney, Robert S. Appel.

But the response to the magazine article was so overwhelming that it convinced us that there was indeed a market for model rockets. We needed only to satisfy that market.

So I rented a store front office-factory at 1159 California Street in Denver and got busy establishing a business, doing the final product development, ordering parts and inventory, designing packaging, working out ad and promotion programs, and setting up the world's first model rocket production line. This was no small task for a technically-minded person who had spent his entire professional career in civil service with no free enterprise experience whatsoever!

An interesting facet of model rocketry revolves around a visit to Brown Manufacturing Company by Carlisle and me on 22 October 1957. Lawrence Brown told us, "I can make your lifting charges for your rockets the same size as Carlisle's, but I would have to order special tubes and make special fittings for my loading machines. I roll my own tubes here for my fireworks. I could make your lifting charges much cheaper if I could use the same tube that I use for my Buzz Bomb Helicopter firework." When I finally translated the pyrotechnic patois into professional rocketry terminology, I agreed. Brown's firework tube was 2.75 inches long and 0.69 inches in diameter. We settled on this size for our model rocket motors because they would be cheaper



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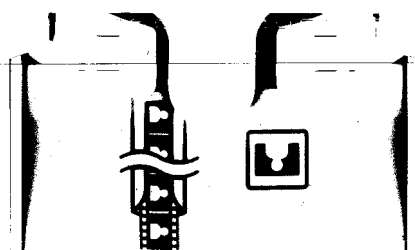
to make with existing tube supplies and production tooling. These bigger motors had more thrust, but Brown could tailor the amount of propellant to provide the total impulse we wanted.

Today, nearly twenty years later, the worldwide standard model rocket motor casing is 2.75 inches long (70 millimeters) and 0.69 inches in diameter (18 millimeters). On that October day in 1957, we had unknowingly established an invariable standard. Every model rocket motor manufacturer who came along later had to make model rocket motors that would fit into existing kits and models, except for some of the larger models and motors that did not follow this standard. Fully 99% of all model rocket motors made and used since 1957 have been the "standard" 18 x 70 millimeter size that was established on the basis of an existing firework!

These early Brown model rocket motors would be classed today as Type A3-3 under the NAR classification system. They cost MMI 13 cents each delivered on the dock in Denver.

An agreement was drawn up between MMI and Carlisle to pay him a royalty of 25 cents on each kit and 5 cents on each model rocket motor sold by MMI. Our shortsightedness in basing the royalties on fixed amounts of money rather than upon a percentage of the retail price or MMI selling price was a major mistake on my part. It sowed the seed of the eventual demise of MMI several years later.

One of my old college friends, J. Delano Hitch, was living in Denver at the time and became an ardent model rocket buff and one of the early empirical experts. I needed help in the product development and testing phase, and Del would meet me at the MMI office on Friday nights to build models. We would then go out on Saturday morning and fly them. We were soon joined by two Littleton teen-agers, Arthur H. Ballah and Grant R. Gray, who had been experimenting with zinc-sulfur rockets. Gray had burned his arm badly. I invited them to come down to the MMI office on Friday nights and to join us during the Saturday flight sessions. I felt that if our MMI models were to be assembled and flown by teen-age rocket buffs, we should work with teen-age rocket buffs during the production development to insure that we were on the right track. By word of mouth, the MMI Flight Test Crew grew rapidly. A dozen or so teen-aged rocketeers would show up on Friday night; we supplied all the parts and advice they wanted. We all went out to fly on Saturday at "Green Mountain Proving Ground," a 540-acre tract of land immediately west of the old Denver Federal Center. It had been an ammunition dump during World War II. I learned first hand about teen-agers and model rockets during that winter of 1957-1958. I learned what they would do with the parts and equipment. I learned how to design and write for them. And I learned that model rocketry was indeed the answer to the youth rocketry problem of the time.



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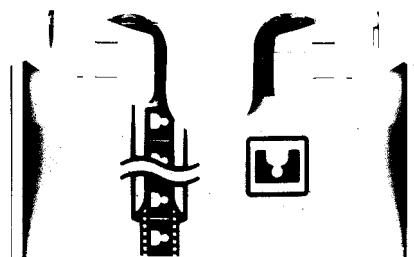
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It became obvious to me in November 1957 that the youth rocketry problem would not be totally solved just because MMI made safe, workable model rockets available in hobby shops and by direct mail to anyone who wanted them. Something else was needed.

That "something else" turned out to be, upon careful analysis, a non-profit educational organization to publicize and promote safety rules, establish and enforce standards, establish communication between model rocketeers, and eventually set up competition and record-setting activities. Every hobby and sport has such an organization. Model rocketry needed to have one also. There was no time to discuss the matter with other national organizations who were far away on the East Coast; the newspapers every day contained stories of young people being hurt or killed with home-made rockets. My previous experience with the American Rocket Society indicated that other established organizations would not have the total grasp of the problem and its solution. We had to "go it ourselves."

On December 7, 1957, the Model Missile Association was granted a charter as a non-profit organization in the State of Colorado, thanks again to my attorney friend, Robert S. Appel who never took a single penny for all the work he did for this non-profit organization. I wrote a basic safety code for non-professional rocketry based upon my White Sands experience. Adherence to the Safety Code would be mandatory for all members of the Model Missile Association (MMA). The first membership meeting of MMA was held on January 3, 1958 in the Hammond Organ Studio on Colorado Boulevard in Denver. Approximately 150 people showed up; about 100 charter members of the MMA were signed up that night. By this time, there were about 18 young men on the MMI Flight Test Crew, and they provided the nucleus of the MMA. On February 1, 1958, the first issue of "The Model Rocketeer," the newsletter of the MMA, was published and mailed to members.

It is nearly impossible to discuss the evolution of model rocketry in the United States by considering either the model rocket industry or the model rocket organizations separately. While the MMA was being formed, MMI was progressing toward market introduction of model rockets. Richard D. Keller, a college classmate, joined MMI in December 1957 to help me out. We wanted to introduce model rocketry into the established hobby trade because we believed that it would find its widest and safest distribution there. So MMI took a display booth at the Annual Trade Show of the Hobby Industry Association of America that was held in late January 1958 at the Sherman House in Chicago. MMI's modest booth was stuck in a corner and in a cul-de-sac, but this did not prevent people from seeking us out. There were four of us at the show: Orville Carlisle, Dick Keller, my wife Barabara, and myself. The response of the hobby industry was both



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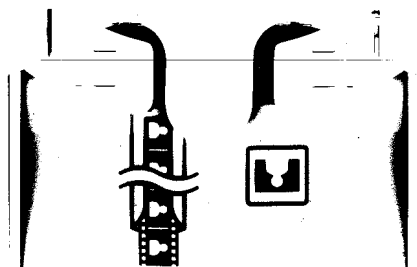
guarded and enthusiastic -- guarded because model rocketry was new and untried, and enthusiastic because model rocketry was really something new.

MMI's first model rocket kit was a semi-scale model of the Aerojet-General Aerobee-H1 RV-N-13a, roughly one-tenth scale. It came with six Type A Rock-A-Chute motors and a launch pad. William Gore of Aerojet paved the way for MMI's permission to use the Aerobee name. The model had a hardwood nose, a convolutely-wound paper tube body 0.75-inches inside diameter and 0.8125-inches outside diameter, die-cut 3/32-inch thick balsawood fins, a red plastic parachute 12 inches square, and two little aluminum tube launch lugs. The motor mount was embossed aluminum sheet because of the wide divergence in outside diameters of the Brown motors and the need to get a reasonably tight fit into the model. The package was long and skinny because of the one-piece 36-inch launch rod. The instruction booklet was designed along the lines of a Heathkit instruction manual with step-by-step illustrated instructions; we knew from our own experience by this time that the instructions had to be very complete because most young men building their first model rocket had had no previous experience whatsoever in building any sort of flying model.

Once we got back from the hobby show, we faced the problem of how to produce nearly 5000 model rocket kits that had been ordered at the hobby show and promised for delivery in April 1958. Somehow, we got that first model rocket production line set up and running, even though we had never done anything like that before. The first kit, MMI No. 001-A Aerobee-H1, rolled off the production line on the evening of April 14, 1958. Today, that kit is in the National Air & Space Museum of the Smithsonian Institution because we put it away for that specific purpose that night.

Once the Aerobee-H1 began to appear on hobby store shelves across the United States, some of the fire marshals and public safety officials began to act. Many of them had been unduly frightened by youth rocketry accidents in the newspapers. Many of them were honestly trying to enforce their fireworks laws. Some of them, sad to say, wanted a "testing fee" or "certification permit and fee" for allowing the Aerobee-H1 to be sold in their jurisdictions. In all such cases, MMI refused to pay such fees; it wasn't simply a matter of a shortage of cash to do it, but a matter of principle.

We believed that a model rocket was a logical outgrowth of the model airplane. This was reinforced by my friend Albert G. Lewis, then editor of Air Trails magazine, later to become American Modeler. Al Lewis saw what I saw and provided me with a national platform from which I could pass the word. I had a regular monthly column about model rocketry in both Air Trails



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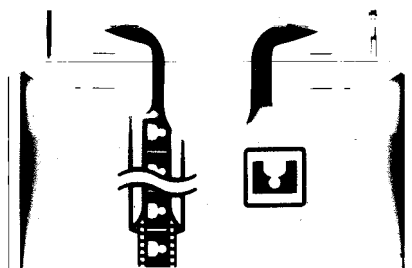
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and American Modeler until 1970. Without this platform from which to speak, we could not have gotten the word out about model rocketry on a national scale, and many young rocketeers would never have found their way into the hobby.

I got in touch with Russell G. Nichols, Executive Director of the Academy of Model Aeronautics. He invited me to bring a crew to the AMA Nationals at Glenview Naval Air Station near Chicago in July 1958 to demonstrate model rocketry and discuss the possibility of an AMA model rocketry division with the AMA officers and board of directors. I drew up a proposal outlining how model rocketry competition might be conducted, and proposed that once model rocketry competition was firmly established, we should approach the big rocket manufacturers with an advanced program to permit advanced rocketeers to fly piggy-back payloads on Aerobee's, Nike-Cajuns, and other rocketsondes. In July 1958, I drove to Glenview, Illinois with Melvin O. Johnson, an engineer who had joined us at MMI, and Norman G. Mains, a young rocketeer. The AMA board turned our model rocketry proposal over to a committee that was chaired by a man who had been injured by an experimental rocket in his youth. Because of this, the committee returned a negative report on the possibility of an AMA model rocketry division. So the MMA had to go it alone. Informal competition had already started among the young members of the MMI Flight Test Crew: "My model rocket will go higher than your model rocket!" We had to turn the AMA proposal into a real set of contest rules and continue to build the MMA all by itself. I believed that we had to prove our point; then and only then would model rocketry find acceptance.

And the MMA would not have been able to do it without William S. Roe of Colorado Springs, Colorado. He had a son who got interested in rockets. Sensing the hazards involved in making homemade rockets, Bill Roe formed the Rocket Advisory Council of the Pikes Peak Region to organize the activity and put it under supervision. He came to Denver with some of his young rocketeers to see what we were doing at Green Mountain Proving Ground on Saturdays, and he became a convert to model rocketry at once. When he attempted to get model rocketry started in Colorado Springs, he found both the police and fire departments ready to invoke a tough fireworks law. So he wrote and pushed through the Colorado Springs City Council the world's first permissive model rocketry legislation. This first law was adopted by Colorado Springs on August 12, 1958. We came down from Denver with a crew of MMA members on September 6, 1958 to help Bill Roe officially inaugurate Peak City Rocket Range in Memorial Park.

Because of the confusion between MMI and MMA, the name of the MMA was officially changed to the National Association of Rocketry (NAR) on October 25, 1958 although we began operating as the NAR several months earlier. Taking a cue from the American



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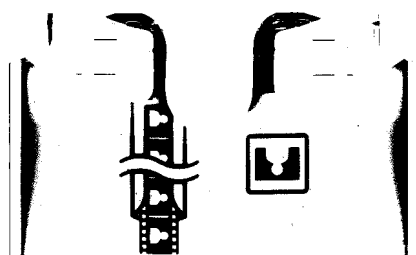
Rocket Society, upon whose By-Laws we patterned the MMA/NAR By-Laws in the first place, we set up a local chartered Section organization within the NAR. The first NAR Section was the Mile-High Section in Denver, chartered on September 18, 1958 and composed of the old MMI Flight Test Crew. Peak City Section under Bill Roe in Colorado Springs was chartered shortly thereafter.

The administrative functions of the NAR had been conducted by an advertising agency in Denver, the same one that was handling MMI's national advertising account. It was not the best arrangement. In October 1958, the NAR Headquarters moved into our basement at 6180 Fairfield Drive, Littleton, Colorado. My wife, Barbara, took over as the active Secretary-Treasurer, a post she held until August 1964. To handle the growing NAR membership list, Bill Roe found an ancient Addressograph Model #1 plate cutter and addressing machine; we used it until September 1964. I obtained a used mimeograph machine and began putting out The Model Rocketeer on a regular monthly basis. I felt that NAR members didn't care how the newsletter looked; they were interested in getting good information on a regular basis. I was right.

Bill Roe was in charge of the printing plant of Holly Sugar Corporation in Colorado Springs. Everyone knows that a printer always has some left-over paper lying around, or has a little corner of a bigger sheet that can be filled up with additional printed matter and later trimmed separately. So Bill Roe subsidized the printing of NAR membership blanks, brochures, technical reports, and other material for several years.

The first model rocket competition rules were drawn up by a committee consisting of Bill Roe, Del Hitch, and myself. The first edition of the Standards and Regulations of the National Association of Rocketry (now called "The United States Model Rocket Sporting Code") was printed by Bill Roe in early 1959. It immediately became known as "The Pink Book" because Bill Roe had some pink paper left over and used it for the cover. Today, it is still "The Pink Book" with the cover deliberately colored pink.

In the meantime, there was action in the model rocket industry as well. Brown was having difficulty making the quantity of model rocket motors we needed; his efforts to meet the quantity problem forced him into a quality problem. The quality control required for model rocket motors and the reliability requirements were far beyond anything previously experienced by the fireworks industry. As one example of what happened, we ran into trouble with the Department of Public Safety in our own home town, Denver. The fireworks law was



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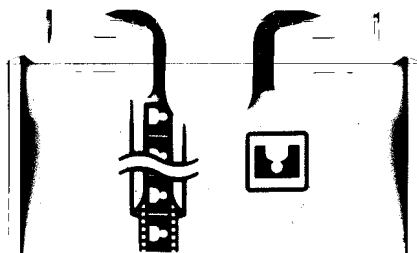
invoked against sales and use of model rockets within the city limits of Denver. We arranged for a demonstration to prove our point. Our first two demonstration flights experienced spectacular motor malfunctions. On this basis, the Department of Public Safety won the day. For many years, we could make and ship model rockets in Denver, but could not engage in retail sales or fly them inside the city limits.

The solution walked through the front door. On a hot July day in 1958, a young man with a crew cut and rimless glasses walked into MMI. "I'm Vernon Estes. I don't know who is making your rocket motors for you, but I can and will make them better and cheaper." When I asked him what his background was, he told me that he built garages for a living and his father was in the wholesale fireworks business. When I asked him how he was going to make model rocket motors for us, he said, "I'll learn how to do it." And he did.

In an old open steel shed behind his home at 5505 North Tejon Street in northwest Denver, Vern began to build a model rocket motor manufacturing machine. He had an old back-gearred lathe whose electric motor didn't have a starting capacitor, requiring him to turn it by hand to get it started. He had an old drill press and a gas welding outfit. Plus persistence and ingenuity. In the chilly fall and frigid winter of 1958-1959, Vern Estes designed, built, tested, worked the bugs out, and put into production the world's first fully automatic model rocket motor manufacturing machine, dubbed "Mabel." It produced a complete model rocket motor every 5 seconds. The first production model rocket motor popped out of Mabel on January 20, 1959. I still have it; it is slated to go into the National Air and Space Museum of the Smithsonian Institution eventually.

Estes' model rocket motors were much superior to anything that we had had before. And they were cheaper. We began paying 5 cents each for motors rather than 13 cents each. And this caused problems because we were committed by contract to pay Carlisle a royalty of 5 cents on each motor...and Carlisle would not renegotiate the contract. Trouble was brewing for MMI.

But not for the NAR. We were invited to participate in the First World Congress of Flight in Las Vegas, Nevada on April 12-18, 1959. The Air Force Association picked up the tab for the hotel rooms. I borrowed money from my brother-in-law, Donald Z. Kauth, who was selling our MMI Aerobee-HI kits like hot-cakes through Galaxy Models, Inc. in New York City. My wife and I went, chaperoning four teen-age NAR members: Arthur H. Ballah, John S. Roe, Norman G. Mains, and Robert A. Smith. Our NAR



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model rocket demonstrations appeared on nationwide NBC television. I was introduced to Jacqueline Cochran, the famous aviatrix who was then President of the National Aeronautic Association and the Federation Aeronautique Internationale. When Jacqueline Cochran later made a trip to Denver, Del Hitch and I gave her a full briefing on model rocketry, the NAR, and model rocketry competition. Because of Jacqueline Cochran, model rocketry was later introduced into the Federation Aeronautique Internationale as an international aerospace sport.

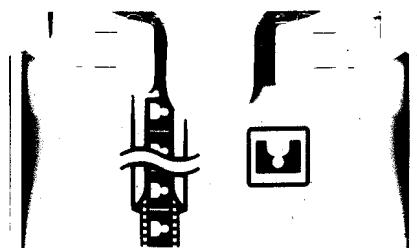
But we were just beginning to get started in model rocketry competition in the NAR. The world's first model rocket competition was flown on May 16, 1959 at Green Mountain Proving Ground with the NAR Mile-High Section pitted against the NAR Peak City Section.

We felt it was time to attempt to hold a national meet. Or at least, we felt we should get started on planning one. Maybe we would not get any model rocketeers from outside the State of Colorado for the first one (we didn't), but we would advertise the competition to all NAR members and accept entries from any NAR member.

Again, we ran into problems. A group of experimental rocketeers began using Green Mountain Proving Ground on the sly without permission. They blew a five-foot hole in the fence and frightened about 100,000 turkeys on a nearby turkey farm. The turkey farmer came on the range one day, threw us all off, and forced us to locate another model rocket flight area. Thanks to Officer Smith of the Denver Police Department, the NAR obtained written permission to use 15 acres of land off Alameda Avenue between Green Mountain and the hogbacks. It was called Hogback Rocket Range, and it is still there. Vern Estes supplied the lumber for the launch area facilities. A local junk dealer provided the permanent loan of an old house trailer in which we could store the range equipment. We buried a couple thousand feet of telephone wire to provide communications to the tracking stations.

The First National Association of Rocketry Annual Meet (NARAM-1) was then held at Hogback Rocket Range on July 16-19, 1959. I was contest director. There were 24 contestants. Norman G. Mains, Jr. won the title of National Champion with 26 contest points.

In the meantime, MMI got into deeper trouble. We had sold many times the 3000 model rocket kits we had originally capitalized to do. Yet, we had never recapitalized. Dick Keller and his father bought out Willard L. Kauth and put a couple of thousand more dollars into the firm. But we were still running on long credit and deferring the payment of salaries in some cases. We began deferring royalty payments to Carlisle because we didn't have the



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money and because Dick Keller felt that Carlisle's royalty rates were far out of line in terms of production costs and selling costs.

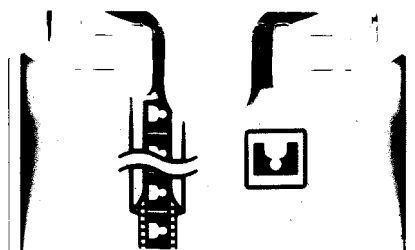
Meanwhile, "Mabel" was cranking out more model rocket motors than MMI could sell, and Vern wanted to amortize his investment. So he began selling model rocket motors by direct mail in 1959.

Dick Keller was running MMI at this time because I became deeply involved with the NAR. We needed to increase sales dramatically, and we came eyeball to eyeball on how to do it. Willard and Donald Kauth had convinced me that the way to do the job was by direct mail. Keller felt that MMI should continue to sell only through hobby jobbers and dealers in order to prevent antagonizing them by direct mail sales. At a meeting of the MMI Board of Directors on July 30, 1959, my direct mail proposal was voted down by the Board consisting of Dick Keller, his father, his mother, Melvin O. Johnson, and myself. The Board then voted Dick Keller as the new president of MMI. I walked out of that Board meeting with nothing but a minority share of MMI stock in my pocket. To pay the rent and feed my growing family, I went back to work in the aerospace industry locally. However, in July 1960, I moved to New Canaan, Connecticut to take the position of assistant director of research for an industrial firm there.

Moving the NAR Headquarters was more difficult than moving my family. Bill Roe took over Headquarters operations in Colorado Springs for two months in the summer of 1960. I set up an NAR Headquarters mail drop address at Donald Kauth's office at 11 West 42nd Street, New York, New York. The actual operating NAR Headquarters was re-established in my basement at 127 Bickford Lane, New Canaan, Connecticut.

NARAM-2 was held at a new Peak City Rocket Range northwest of Colorado Springs on August 18-21, 1960 with Bill Roe as contest director. This national meet was a little bigger and we drew one contestant from far-away Kansas (not counting me from Connecticut). The nearby Air Force Academy began to take notice at NARAM-2.

The model rocket industry was in the throes of great change at this time. After I left MMI, the Kellers reduced its activities and overhead, moved the firm into their Denver basement, and proceeded to liquidate a substantial stock of parts through hobby trade channels over the next few years, finally ceasing to do business in June 1966. Vern Estes began the fantastic growth of Estes Industries, Inc. by direct mail sales. He designed a simple kit, the Astron Scout, which sold for 75 cents and was packaged in the same shipping tube he developed for sending



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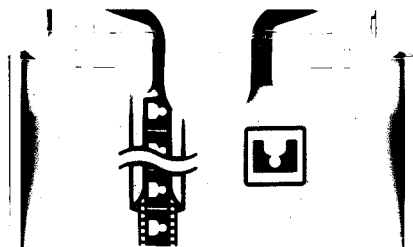
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three motors per package through the U.S. Mails. (In 1958, I had convinced the Denver postmaster of the complete safety of mailing three motors in one package through the mails.) Vern developed an automatic machine for making balsa noses. He began to build his product line. His first mail order catalog featured the Astron Scout kit, a simple launch pad, a selection of two body tubes, two nose cones, and sheet balsa for making fins, plus his line of model rocket motors -- Types A.8-3, A.8-4, B.8-4, B.8-6, and B.8-0, using the old nomenclature system based on pound-seconds of total impulse. The first Estes catalog was mimeographed and stitched together on his wife's sewing machine. In 1961, Estes Industries, Inc. outgrew the space available on North Tejon Street in Denver. Vern Estes bought some farm acreage in an obscure Colorado town named Penrose, moved his family to an old farm house there, and literally built Estes Industries, Inc. from the ground up on that old farm. His wife, Gleda, was as much a part of this growth as my own wife, Barbara, was in the NAR. We owe much to the hard-working ladies who have made model rocketry possible by their quiet work behind the scenes.

Then as now, several small model rocket companies sprung up only to disappear after a few months' confrontation with the free enterprise system in the American marketplace. Most firms don't make it; some do. One of the latter was Coaster Corporation in Euless, Texas, formed by Menford L. Sutton and Gene Dickerson. They manufactured and sold model rocket motors that were very large when compared to the MMI and Estes motors. Most MMI and Estes motors had maximum total impulses in the range of 5 Newton-seconds (1.12 pound-seconds). Coaster motors were available up to maximum total impulses of 56 Newton-seconds (12.6 pound-seconds). The NAR had established a Standards and Testing Committee to test and certify the total impulse and other performance parameters of model rocket motors for contest and record use. It was necessary to extend the NAR total impulse categories up to 80 Newton-seconds to accomodate the Coaster products. It is my feeling that the NAR total impulse categories would have extended only to 20 Newton-seconds if Coaster Corporation had not made their large motors available.

While the model rocket industry was growing, so was the NAR. In July 1960, an NAR team from Mile-High and Peak City Sections flew model rockets at the 1960 Boy Scout Jamboree. On September 20, 1960, I made a presentation on model rocketry before Colonel Russell G. Panky and his staff at United States Air Force Headquarters in the Pentagon, pointing out that model rocketry would make an excellent addition to the USAF special services hobby program along with model aviation. On July 3, 1961, the USAF published a letter to all commands endorsing model rocketry as a worthwhile activity for USAF personnel and dependents and naming the NAR as the USAF-approved organization



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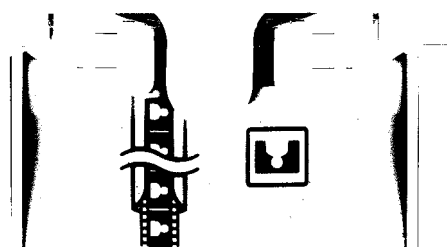
for model rocketry. The NAR Safety Code became mandatory for all non-military USAF rocket activities. The first USAF model rocketry competition was held at Langely Air Force Base, Virginia on July 16, 1961 to choose a USAF team to participate in NARAM-3 in Denver. Leading the USAF Team was Captain Bryant A. Thompson, later to become Vice President of the NAR.

NARAM-3 took place at Hogback Rocket Range near Denver on August 17-21, 1961 with J. Delano Hitch as contest director. It was the first true national competition, drawing 67 contestants from as far away as the East Coast.

NARAM-3 saw the introduction of a whole new area of model rocketry: boost gliders. These are either rocket-propelled gliders or glide-recovered rockets, depending upon their design. As early as 1958, I had tried to develop a glide-recovered model rocket; several members of the MMI Flight Test Crew flew gliders to which they had strapped MMI model rocket motors with the result that the skies were filled with balsa splinters in less than a second after launch. The first successful boost-glider was developed by Vern Estes and John Schutz, and it was demonstrated in flight many times at NARAM-3.

A young man from Phoenix, Arizona showed up at NARAM-3 to look over the field of model rocketry and determine how he was going to enter the marketplace with his own firm. He was Leroy E. Piester, and he returned to Phoenix after NARAM-3 to start Centuri Engineering Company in his garage at 340 West Wilshire. Centuri purchased their model rocket motors from Estes and developed a line of model rocket products of comparable size and performance to that of Estes. Later in the 1960's, Centuri purchased Coaster Corporation and merged its activities into the product line of Centuri. Today, Centuri is still active in the model rocket industry.

The twelve-month period between NARAM-3 and NARAM-4 saw growth in model rocket technology, mainly in the boost-glider area, as well as growth of programs in the NAR. The number of NAR Technical Reports available to members increased to 14. The NAR Plan Program provided plans of contest, scale, and sporting models of proven design to members. The current insignie was developed on my drawing board and made available to members in the form of both jacket patches and lapel pins for the first time. The Standards and Testing Committee began to use modern strain-gage test stands for the static testing of model rocket motors.



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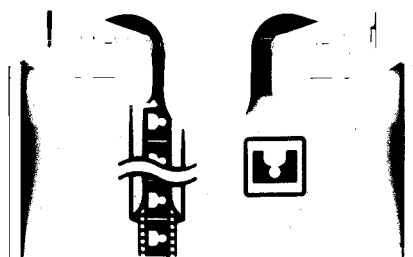
NARAM-4 was held at the United States Air Force Academy in Colorado with Captain Vernon Van Vonderen as contest director. It took place August 23-26, 1962. It was the first time that all model rocket manufacturers were present: MMI, Estes, Centuri, and Coaster, plus a new firm, Rocket Development Corporation run by Irving R. Waite of Seymour, Indiana; at a get-together in the back of Vern Estes station wagon on August 25, 1962, the Model Rocket Manufacturers Association was formed. This later merged into the Hobby Industry Association as the Model Rocket Division of HIA in 1969.

A teen-ager made his own way from Mankato, Minnesota to attend NARAM-4. Today, he has his doctorate in astronomy, teaches at the University of California, and is the 1976-1979 President of the NAR: Doctor Manning Butterworth.

By the end of August 1962, the NAR had grown to 1900 members. "The Model Rocketeer" had become a monthly printed newsletter of four pages with photographs and drawings. NAR Trustee Charles S. Hans of New York City produced a 15-minute 16-millimeter color-sound motion picture about model rocketry and the NAR entitled, "Model Rocketry: Space Age Hobby." It was previewed at NARAM-4.

On November 24, 1962 in Paris, France, the 51-nation Federation Aeronautique Internationale (FAI) officially recognized model rocketry as an international aerospace sport following my presentation to the Commission Internationale de l'Aeromodelisme. A model rocketry subcommittee was formed to write the international competition rules. I was elected the first Chairman of that Subcommittee and served as such until 1973.

Thus, in the first five years of its existence, the field of model rocketry grew from Orville H. Carlisle's basement in Norfolk, Nebraska to a world-wide aerospace sport. The model rocket industry was on firm ground with the two major firms of 1976, Estes Industries, Inc., and Centuri Engineering Company, producing a growing number of high quality products for a growing market. The market itself had started in the hobby industry, shifted to direct mail marketing, and had just started to re-enter the hobby industry again in 1962. The NAR had been formed and forged into a truly national educational organization for the hobby and sport. Four national meets had been conducted under nationally-available rules. Sections of the NAR had been formed and chartered from California to Connecticut. The first national model rocket records had been established and exceeded, and these had been recognized by the National Aeronautic Association. Recognition was beginning to come to model rocketry from prominent national organizations.



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One final thing needs to be said about the formative years of model rocketry: There was no accident more serious than a minor finger burn during this period; there were no deaths or serious injuries as a result of model rocketry; there was no property damage as a result of model rocketry. This outstanding safety record established during the raw beginnings of the hobby has continued to this day. Yes, there have been burned fingers and a couple of grass fires, but nothing more serious. The number of incidents resulting from mis-use of model rocket products has been surprisingly low, and even these have not been of serious nature.

In essence, model rocketry as it is known today in the United States and Canada, and "space modelling" as it is known around the world, had its firm foundations laid in the first five years of its existence, thanks to the fortuitous synthesis of pyrotechnics, model aeronautics, and astronautics and thanks to a continuing belief that people, young and old, want to experiment with rockets that are safe and that really work.

By 1962, there was still much work to be done. But model rocketry was with us to stay.

