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MODEL ROCKETRY

March 1970
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Model Rocketry

Vol. II, No. 6
March 1970

Cover Photo

This month's cover shows the liftoff of an Estes Saturn V during the model rocket demonstration in the Astrodome. Apollo-NASA Senior Advisor Forrest McDowell (in white jacket) looks on as Mark Evans (behind launcher) presses the firing button. Complete details on page 24. (Estes Industries photo)

From the Editor

In recent months many rocketeers have written describing the test equipment and instrumentation they have constructed. Others have written requesting plans for wind tunnels, transmitters, and other forms of scientific equipment. Sounds great. The hobby is developing, and rocketeers are taking on an active interest in the experimentation necessary to the advancement of the state of the art.

Or are they? We hear about a rocketeer building a transmitter, another making a wind tunnel, a third constructing an accelerometer, and many more. But what are they doing with these instruments? Is the *goal* the *construction* of a piece of equipment, or should it be the *use* of that new equipment in an experiment. We hear about the equipment, but how about some experimental results?

The construction of a new piece of equipment is indeed an accomplishment. Let's not degrade the efforts of a model rocketeer who invests the time and money involved in the construction, say, of a wind tunnel. But he should then be encouraged to use the wind tunnel in an experimental project. There are many unknowns in the rocket field today. How much *data* have you ever seen on optimizing the performance of a boost glider? Does a boat-tail really lower the drag on your rocket? Can you actually increase the altitude performance of your rocket by putting a finer finish on the body tube? Do we have any data, or only opinions, theory, and speculation?

Perhaps the experimenters really do exist in our hobby and they are just too busy experimenting to communicate the results to the rest of us. But even if there is a small group of experimentalists, there is still plenty of room for more. There are many topics open to investigation by experimenters. Almost any data you obtain will be a step in the direction of advancement of the hobby.

Regular Features

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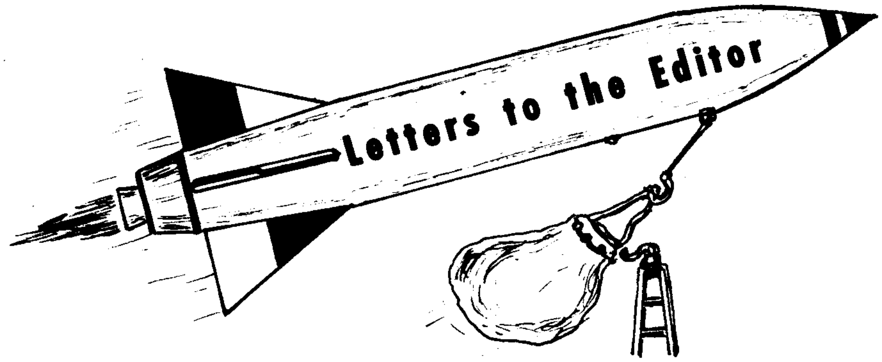


Transitor Flasher

The September issue of **Model Rocketry** published an article which captured my interest. The Transistorized Tracking Light seemed a worthwhile project, after losing three rockets in three days – all during the early evening.

A device of this sort should be as simple and cheap as possible. Perhaps I can offer some suggestions for those working on a small budget.

The transistors may be any general purpose or switching transistors. A good source is a Radio Shack store or one of the surplus parts mail order houses which offer used IBM circuit boards at six for a dollar. Each board contains at least six or eight transistors. They are not only dirt cheap but I have yet to find a bad one. The circuit boards also contain many resistors and frequently miniature electrolytic capacitors. I used some of these for my tracking light. Since the changes I made were extensive, I have included a circuit diagram.

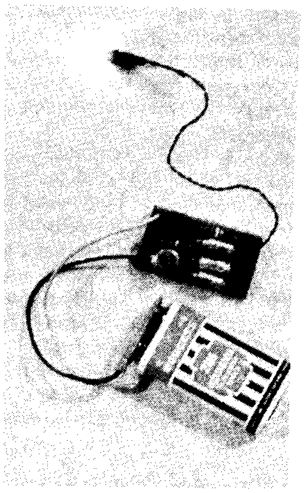
I eliminated the trimmer resistor because of its size, weight, and cost. The flashing rate can be determined in any experimental unit and I strongly recommend building an experimental unit to get the flashing rate and intensity of flash desired.

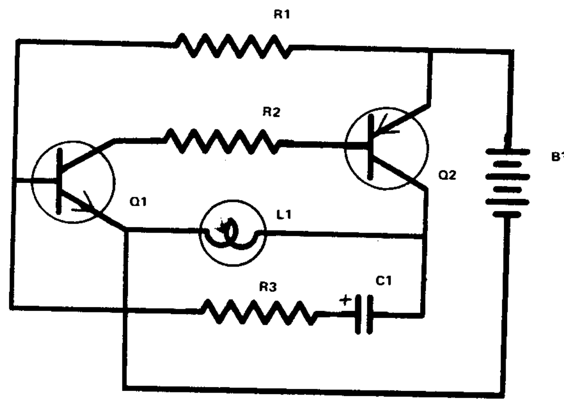
The bulb L1 may be a two volt, sixty milliampere unit. If a grain of wheat type is not available, some of the pilot light displays in the electronic stores include tiny Japanese assemblies which although slightly larger should be satisfactory. A number 49 pilot light has the proper current and voltage rating, but it's the standard size.

I chose a 9 volt transistor battery because it's cheap and long lasting. The round Burgess type is a snug fit in a 20 mm. body tube while the more common type can be used in a larger rocket.

For finished electronic projects I prefer to use etched circuit boards. They are light, neat, compact and the short leads of salvaged parts are no problem. The parts can be laid out on a small card in order to mark the lead loations. The card can then be taped to the copper clad board until the holes are drilled. I used a Dremel Moto Tool with a small drill bit. The conducting paths can be painted in the copper with a small brush and almost any paint or enamel. After the surplus copper has been removed by the etching solution, remove the enamel with fine steel wool. A pencil type soldering iron of low wattage is best for circuit boards. Too much heat may not only damage the transistors, but loosen the foil on the circuit board as well.

I found I could quite easily vary the flashing rate and intensity of the flash by changing the values of the electrolytic capacitor, the voltage of the battery and by





using a resistor in series with the capacitor.

My unit triggers about once per second with very brilliant flashes which continue for well over a half hour on one battery.

Parts List

B1	9 volt Transistor Battery
C1	1.5 mfd Electrolytic Capacitor
L1	2 volt, 60 ma Grain of Wheat Bulb
Q1	NPN Transistor
Q2	PNP Transistor
R1	820,000 ohms
R2	1000 ohms
R3	Optional, 1 to 20,000 ohms

John Frankosky
East Brunswick, N.J.

"Silent Majority"

I have followed your magazine from the very first issue. I've watched it progress, expand, and improve. I am very pleased with the quality and scope of the articles published in **Model Rocketry**. I believe I am one of the "Silent Majority" who enjoy your magazine without letting you know our appreciation of your magazine. I think I speak for all of us who enjoy your magazine in silence! "Your magazine is great. Keep up the good work!"

Scott Stanley
NAR 14773 JR
Phillipsburg, N.J.

Contest Announcements?

I have been reading your magazine since its inception and enjoy it tremendously. Overall, I think you are doing an excellent job, save in two areas: First, I am getting a little tired of reading about model rocket contests *after* they have happened! Why can't we know of them ahead of time so that we could attend if at all possible? In the past year there have been several meets within 100 miles or so that we could have attended if we had only known about them.

I would suggest you ask all model rocket organizations to keep you posted on any upcoming meets so you could publish them in a regular section. It certainly makes sense that the more model rocketeers can get together, the better chance we have to further our goals.

Second, sometimes your articles get overly technical. They are fine for Neil Armstrong, but how about simplifying some of them for us poor Earthbound laymen?

Again, many thanks for filling a definite need in one of the most exciting and educational hobbies today.

David L. Beecher
York, Pennsylvania

OK, Contest Directors, send in your contest announcements at least three months in advance and **Model Rocketry** *will be glad to bring your contest, competition, etc. to the attention of model rocketeers throughout the nation. Be sure to include date, site, events, and address or phone number of the Contest Director or Coordinator as well as any restrictions on participants.*

ERRATUM

A typographical error appeared in the article "Boost/Glider Performance" in the January 1970 issue of *Model Rocketry*.

In problem 1A, Part 3, the correct flight duration per 100 feet of altitude is t_{100} = 65 seconds.

Plastic Conversion

After purchasing a copy of the November issue of **Model Rocketry** and looking through it, the article on the Jupiter C caught my eye. Interested in rocketry as I am, I immediately hustled to the nearest hobby shop and bought a Jupiter C kit and the necessary parts for the conversion.

After completing the model, I tested it at the local school yard. At launch the bird wobbled and spun erratically for about ten feet, then flew fairly straight. The ejection was perfect, so I thought. The bird drifted gently back to earth. Rushing to examine it, I found that the Explorer satellite had broken off and the nose cone was chipped. Further examination showed orange smudges on the body. The satellite had been painted orange on my model, so I conclude that at the time of ejection the nose cone and satellite must have snapped back and hit the body tube, thus breaking the satellite off the nose cone.

I have bought another kit and am presently converting it for flight. I hope to see if the ejection problem will happen again. I was a defiant non-believer in plastic conversion before the first flight, but I have changed my mind and am now very enthusiastic about plastic conversion.

What have we here, a plastic Saturn V kit . . .

Harvey Rinehart
Norfolk, Virginia

To eliminate the problem of having the nose cone hit the rocket after ejection, you might try a longer shock cord.

There are a number of Saturn V plastic kits on the market. Both Revell and Monogram have large Saturn V kits, which might be suitable for conversion. Also, the smaller Saturn V in the AMT "Man in Space" kit should be suitable for flight. Other plastic rocket kits by many manufacturers have been successfully converted and flown by model rocketeers. Several other plastic kit conversions are presently being prepared for publication in **Model Rocketry.**

Rocket Transmitter

In the December *New Product Notes* you stated that MITS had the "first commercially available model rocket telemetry transmitter." With all due respect for MITS and its products, it is not the first to be made available. Several years ago, in July of 1967, Nytronics Instruments in Bozeman, Montana introduced a transmitter and receiver made especially for model rockets and other similar uses.

The transmitter was marketed for $10.00 and seemed to be similar to the one which you have described in your series of articles on the subject. The major difference is that it employed integrated circuits and weighed only 0.65 ounces. The receiver was sold for about $13.00, and could be used for tracking landed transmitters. Its output could be fed directly into a tape recorder.

Whether these models are still available I do not know, but I am trying to find out.

Eric H. Christiansen
Jerome, Idaho

SOLICITATION OF MATERIAL

In order to broaden and diversify its coverage of the hobby, MODEL ROCKETRY is soliciting written material from the qualified modeling public. Articles of a technical nature, research reports, articles on constructing and flying sport and competition models, scale projects, and material relating to full-scale spaceflight will be considered for publication under the following terms:

1. Authors will be paid for material accepted for publication at the rate of two dollars ($2.00) per column inch, based on a column of eight-point type thirteen picas wide, for text, six dollars fifty cents ($6.50) for drawings, and two dollars ($2.00) for photographs accompanying text. Payment will be made at the time of publication.

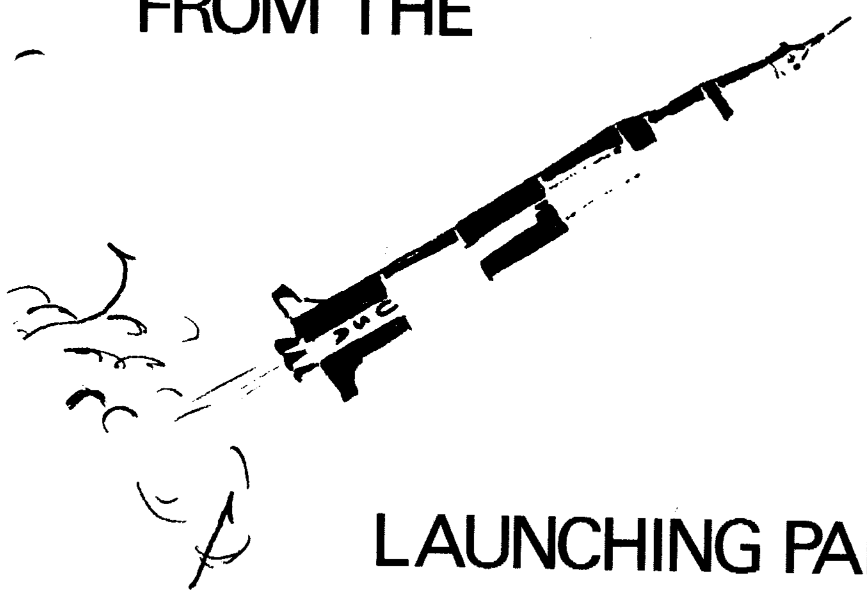
2. Material submitted must be typewritten, double-spaced, on 8½ by 11 inch paper with reasonable margins. Drawings must be done in India ink and must be neat and legible. We cannot assume responsibility for material lost or damaged in processing; however our staff will exercise care in the handling of all submitted material. An author may have his manuscript returned after use by including a stamped, self-addressed envelope with his material.

3. Our staff reserves the right to edit material in order to improve grammar and composition. Payment for material will be based on the edited copy as it appears in print. Authors will be given full credit for published material. MODEL ROCKETRY will hold copyright on all material accepted for publication.

Those wishing to submit material should send it to:

Editor, Model Rocketry Magazine, Box 214, Boston, Mass. 02123

FROM THE



LAUNCHING PAD

The November 1969 issue of *Model Constructor*, a monthly modeling magazine published in the USSR, reports the following additional results from the USSR national championships: Shakir Mekhtiev from Baku took first in Parachute Duration with 9 minutes 57 seconds. In 5.1-10.0 nt.-sec. Boost/Glide [comparable to NAR/FAI Swift class] Vasily Kolomichuk placed first with a flight of 2 minutes 27 seconds. The 10.1-40.0 nt.-sec. class [comparable to NAR/FAI Eagle class] was won by Alexander Geracimov with a flight of 3 minutes 11 seconds. In a single payload event, presumably similar to NAR/FAI Single Payload using a C engine, Igor Bychkov took first with an altitude of 330 meters. Constantine Jubitidye won dual payload with an altitude of 396 meters.

Modeling was consistently good at the USSR championships with six rocketeers turning in PD times of over four minutes. In both B/G events, however, the winners had almost a minute over their nearest competitors. One photo shows what appears to be a PD rocket employing small elliptical fins mounted flush with the rear of the rocket. Another shows an unusual variable-geometry B/G. The wings are swept back during boost phase and spread out after burnout. Two designs for B/G's which collapse to fit inside a standard cylindrical body tube (about 1.5" diameter) and spring open after being ejected from the tube were presented in the same issue of the magazine. This could indicate a new area of B/G development for the Soviet rocketeers.

The Washington State Model Rocket Association is pioneering the development of new contest events. At last year's state meet, a Payload Boost/Glide event was flown. The WSMRA rules permit any combination of engines to power the B/G,which must carry one standard, one-ounce NAR payload in this duration event. When flown, for the first time, at the state championships last spring, there were only four entries, but the top time turned in was 43 seconds, indicating the feasibility of this event. This year WSMRA has come up with another interesting event – Saturn V Superscale Altitude. Any scratchbuilt or kit Saturn V scale model bigger than 1/100th scale and powered by any number of engines is permitted. The event is judged completely on altitude, though a scale model is required.

Don't anyone tell Tom Milkie, but NASA changed the name of the Lunar Excursion Module (LEM) to the Lunar Module (LM) several years ago. In any case, see page 31 for Tom's conversion of the Revell plastic LM kit to flying scale. If you are not yet convinced that plastic conversion can be fun, be sure to try this one.

Model Products Corporation is planning a new line of model rocket kits. The kits are built to the standards of detail expected for plastic display models, but all the necessary parts will be included to build them for flight with standard model rocket engines. The first kit, a Russian *Vostok RD-107*, is expected to be available in March. Built in 1/100th scale, the rocket may be assembled in the configuration used to launch the first man into space, or you may leave off the strap-ons and change the nose cone, and you have the Sputnik I launch vehicle. Next off the line will be a *Titan III-C*, soon to be followed by a *Saturn I-B*. MPC claims the detailing on these kits is excellent, and the scale data is the best available on each of the vehicles; more on this when we have had a chance to inspect the models. . . . .

ARE YOU MOVING?

Send address changes to Change of Address, Model Rocketry, Box 214, Astor Street Station, Boston, MA 02123 Please include the address label from the last Model Rocketry you received.

Build the Super-Titan
. . . for high altitude ignition of upper stages.
by Lynn G. Miller

If you are getting tired of friends who criticize your model rocket hobby for being too *simple* and repititious,if your fellow rocketeers are losing interest because the hobby is for boys who play with toys which cannot really do very much, then you need to *complicate.* That's right, *COMPLICATE.* Start a project going which will spark imaginations and test abilities.

Build a booster rocket which is large and powerful enough to launch upper stages, yet simple and lightweight enough to still qualify as a model rocket. It must be easy to build and to repair, yet complicated enough to command respect. To make an impression on your friends, design the booster so that it ignites the upper stage high in the sky. Real rockets do not have ignition and separation of an upper stage until after the main booster has reached maximum acceleration at a high altitude, so why not do the same with your rockets.

The heart of the high altitude ignition system is a simple electrical circuit which is reliable and safe to use. Many experiments in ways to safely ignite an upper stage, other than using the direct hot gases from a zero delay engine, resulted in one triumphant discovery: if a small AG-1 flashbulb is set off, enough heat is produced to ignite a Centuri Sure-Shot Igniter fuse. Just place one end of the fuse into the engine of the upper stage and fasten the other end to a flashbulb with a strip of masking tape. The bulb will ignite the fuse every time.

Flashing the bulb is not hard if you can get current to it from a small AAA penlight battery or from two PX-825 Alkaline Energizers. The energizers are excellent for this application because they are shaped like a quarter and are easy to fit into the top of the booster, either in its nose cone or on each side of the parachute tube. The penlight battery has the reliability advantage, however, because it can be easily soldered into the circuit. Loose wiring is the most frequent cause of failure.

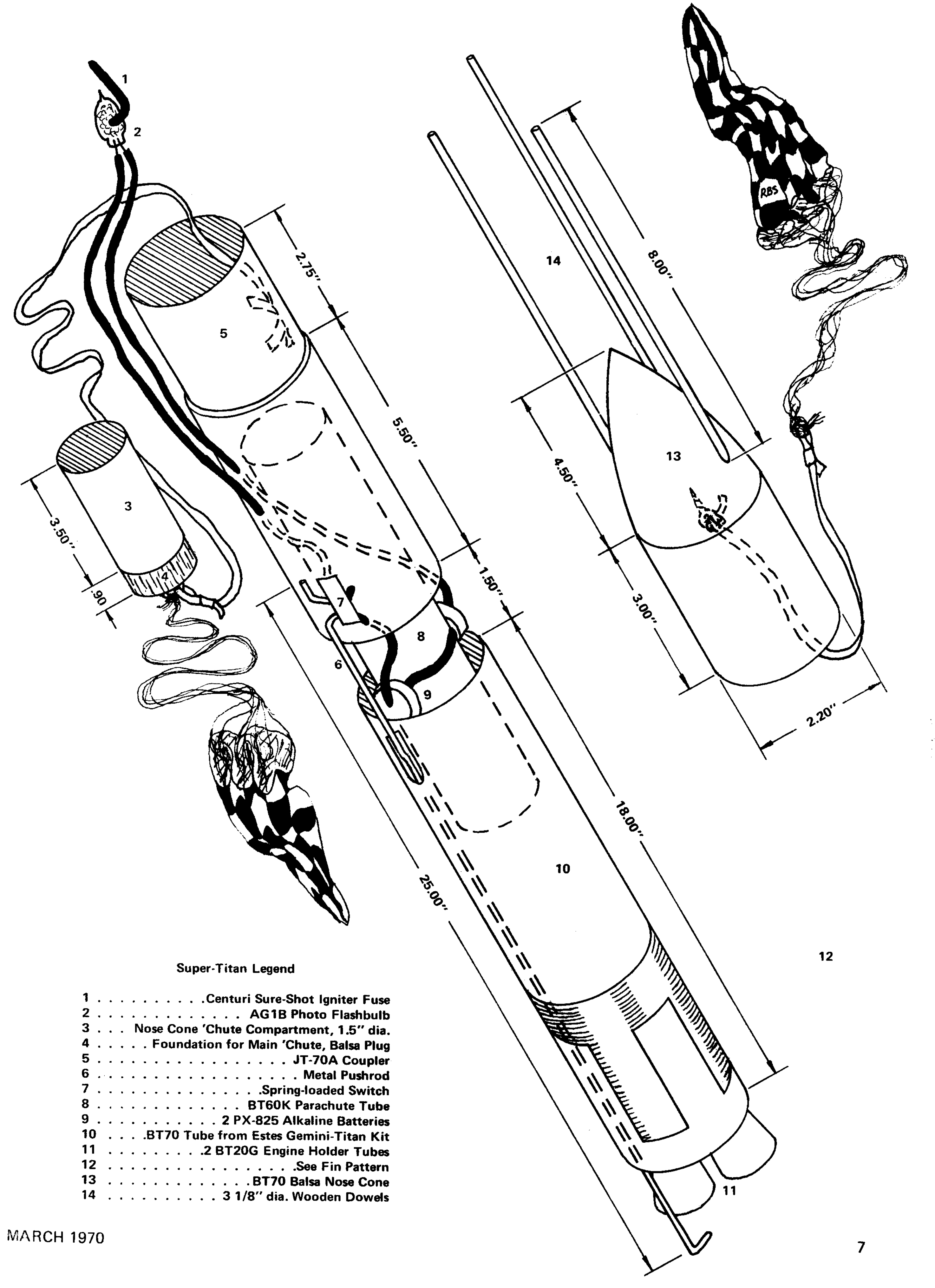
Finally, the only problem is choosing a switch that will close at the precise second that ignition of the upper stage is desired. Try experimenting with different methods; there is no end to the possibilities. Gas pressure from the ejection charge is available, but direct mechanical linkage of some kind is more reliable. A mercury inertia switch can be built so that ignition will occur immediately after burnout of booster engines when sudden deceleration of the rocket allows momentum of the heavy mercury to carry it forward in a tube to contact wires. The fact that one engine of a multi-engined booster can be made to eject itself out of a closed-off engine tube presents a possibility for linkage between that exiting engine and a spring loaded switch. Get your club working on these possibilities.

Construction

Here is a good example of a booster which has consistently sent upper stages virtually out of sight. To get started, purchase an Estes Gemini-Titan GT-3 kit. This is a semi-scale model No. 651-K-21 which uses two engines and a large 24 inch parachute. Length is 24.4 inches, body diameter is 2.22 inches, and weight is 3.8 ounces. Purchase a BT-70 or a BT-60 balsa wood nose cone with a length of body tubing to go with it. This nose cone will serve as a blast deflector, *if properly protected with heat resistant paint,* and as a means of keeping the booster streamlined after the upper stage has fired away. Without this feature, the Titan will head for the ground immediately after the upper stage has separated.

Two or three 1/8 x 8 inch hardwood dowels may be forced and glued into parallel holes in the nose cone to provide launch rods for the upper stage. For strength, merely provide lugs on the upper stage which will fit on these parallel rods during the initial launch. They also serve as guides during the high altitude ignition. The flashbulb can be located between these dowels on the apex of the Titan nose cone directly below the second stage engine. The bulb can be temporarily attached to the engine by masking tape which will burn away when the upper stage ignites. If the upper stage should fail to ignite for any reason, the masking tape will secure the upper stage to the booster nose cone which has its own parachute stowed in a small tube in the top of the main booster parachute compartment. The balsa wood base of this tube serves as the foundation for attaching the main booster parachute, as shown in the drawing.

To accommodate the second parachute and to provide the foundation for the switch, fit a BT-60K tube or a paper towel



Super-Titan Legend

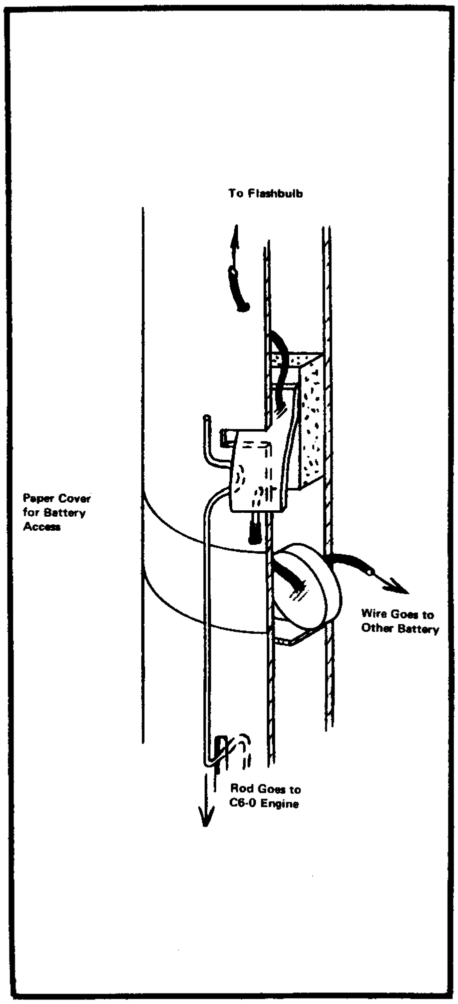
1 . . . . .Centuri Sure-Shot Igniter Fuse
2 . . . . AG1B Photo Flashbulb
3 . . . Nose Cone 'Chute Compartment, 1.5" dia.
4 . . . . . Foundation for Main 'Chute, Balsa Plug
5 . . . . JT-70A Coupler
6 . . . . Metal Pushrod
7 . . . . .Spring-loaded Switch
8 . . . . BT60K Parachute Tube
9 . . . . 2 PX-825 Alkaline Batteries
10 . . . .BT70 Tube from Estes Gemini-Titan Kit
11 . . . . .2 BT20G Engine Holder Tubes
12 . . . . .See Fin Pattern
13 . . . . .BT70 Balsa Nose Cone
14 . . . . 3 1/8" dia. Wooden Dowels

tube inside the main parachute tube so that the overall length of the compartment is extended by about six inches. The small batteries will now fit snugly between the parachute tube and the outer body tube. Connect the batteries with copper wires to the switch which is made from a 2 x ½ inch strip of a tin can or other suitable metals. Build the switch into the top of the Titan booster so that one end of the metal is forced through the outer tube and squeezed between the inner parachute tube and the outer body tube, as shown in the cutaway drawing. Use pieces of balsa wood to tighten the fit so that the switch will have a spring to it. As shown in the drawing, a 25 inch rod such as the push rods used for model airplanes must extend from the switch, down the length of the body between the outer tube and the inner parachute tube, and down to the end of one of the engine tubes. Putting a 90 degree turn in this end of the rod enables you to place the rod into a small 1/8 inch hole made in the top of a c6-0 engine. Putting several bends in the other end of the rod will keep the rod from being pulled completely out of the body tube.

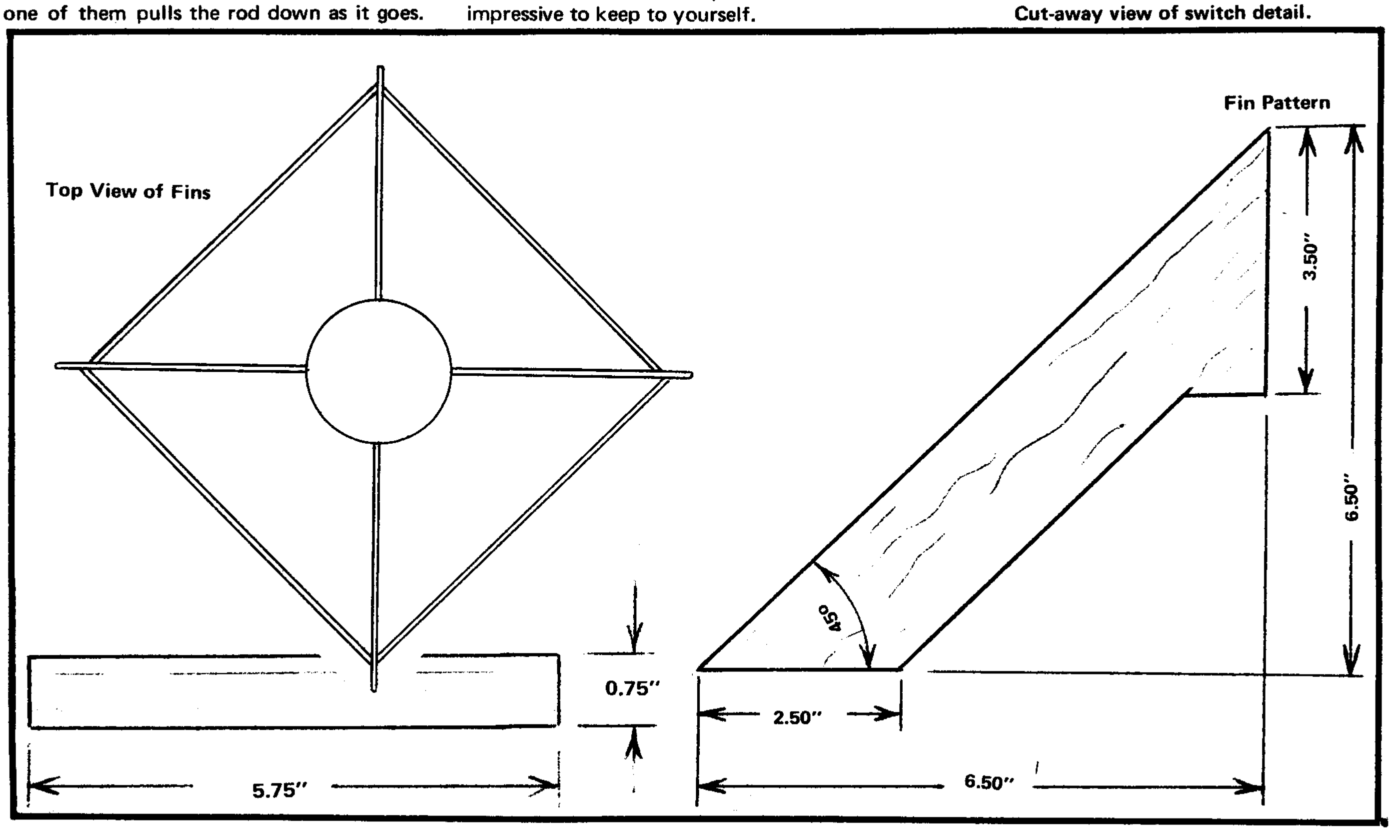
The Super Titan will give a fantastic show if you are willing to go through seven or eight engines in one launching. It will work on fewer, but the spectator applause results from the use of high impulses achieved by taping engines in series. Two sets of three engines each have been taped together and safely fired many times on the Titan shown in the pictures, using a B14-0 first, then a C6-0, and then a C6-5. The two B14-0's are not essential, but they get the heavy rocket quickly on its way. About two seconds after the set of C6-0's ignite, they fall away, and one of them pulls the rod down as it goes. This allows the spring-loaded switch to close, flashes the bulb, ignites the fuse, and sets off the upper stage engine. Not until about one second after the C6-0's are blasted away by the exhaust gases from the C6-5's does the upper stage engine actually ignite. By this time, the two main booster engines have reached maximum thrust, and the upper stage leaves with a tremendous initial velocity.

In the six foot long rocket shown in the pictures, even the upper stage had two engines in series. Tracking was a problem because a B14-0 and a C6-7 could accelerate the upper stage so rapidly and so far. In order for the observers to see the chute ejection, the upper stage featured a payload compartment for parachute powder and/or flour so that a white cloud was created when the chute ejected. The weight of the flour in the nose helped to move the center of gravity for the overall rocket above the center of pressure. Larger fins were needed also. Testing in a wind tunnel prior to launch is also recommended. Experiments in stability on a rocket of this size can keep any modeler too busy to become bored.

A word of caution before you begin. A rocket of this size and of this power must be fired by experienced modelers who know what they are doing. A disaster could result if a high velocity upper stage were ignited by a booster which was headed toward people. Windy days, for instance, are absolutely out, since weathercocking is inevitable. And remember, concentrate on keeping the total weight down. This Super Titan, when fully loaded, will be close to the 16 ounce weight limit imposed by the F.A.A. After perfecting all of this, don't hesitate to bring your skeptical friends along for a launch which will be spectacular and too impressive to keep to yourself.



Cut-away view of switch detail.



Ham Radio for the Rocketeer?

by Osler Johns, Jr.

More power, less interference, and more available frequencies are among the advantages which should make amateur radio attractive to the model rocketeer. . . . .

The rocketeer who confines his radio tracking, communications, control, and telemetry to the 100 milliwatts of power allowed on the citizen's band is missing out on a tremendous opportunity to improve the range and quality of such functions. Many model rocketeers are also amateur radio operators, better known as "hams". Both hobbies seem to attract the same type of technically-minded individual. The ham and model rocketeer who keeps both hobbies separate as well as the non-ham rocketeer should investigate the benefits of using amateur radio in conjunction with model rocketry.

Several model rocket enthusiasts in the Orlando area still use either the broadcast or the citizen's band for tracking and both the citizens band at 27 megaHertz and 72 megaHertz for radio control. The main reason for this is that if less than 100 milliwatts of power is used, no license if required for either the operator or his station. If a higher power level is to be used on the citizens band (CB) channels, a license is required but no test need be taken. If a frequency in one of the radio amateur bands is used a license is required and issued only if the applicant has passed a test.

The advantages of using the amateur radio bands are numerous: tens of thousands of extra frequency channels are available, power levels of up to 1000 watts may be used, far less interference may be expected than occurs in CB, the amateur may design and construct his own high-power radio control transmitter, frequencies may be picked that are far enough from each other to allow launchings to occur at the same time without mutual interference, various types of signals may be transmitted which are not allowed on CB.

Hams are divided into several classes of operators, each class carrying extra operating privileges and requiring a more difficult test. The lowest class license that would be of value to the model rocketeer is the "Technician"license. This class allows the operator the use of all amateur bands above 50.25 mHz.(see chart 1)

The test for the technician class license is comprised of two parts: first is the ability to send and receive International Morse Code at the rate of five words per minute; the second part is a written exam on basic electronic theory and fundamentals of transmitters.

Frequency Band (mHz)	
1.8-2.0 3.5-4.0 7.0-7.3 14.0-14.350 21.0-21.450 28.0-29.750	These frequencies are of little use to the rocket amateur except for communications. Technician operation not permitted.
50.0-54.0 144.0-148.0 220.0-225.0 420.0-450.0	Best frequencies for radio control, tracking, etc. Technician operation permitted on all bands above 50 mHz.
1215-1300 2300-2450 3300-3500 5650-5925 10,000-10,500 21,000-22,000 40,000-all higher	Little is known about the characteristics of these bands. Much original research can still take place.

Chart 1: Frequencies available to amateur radio operators

The code seems to be the stumbling block for most people, though it shouldn't be because five wpm is very slow. Most people can receive four wpm after simply memorizing the code letters. The applicant need only send and receive one perfect minute out of five. The written exam consists of 50 questions on basic electronic theory. It's not difficult, just challenging.

As previously stated, the technician class is the lowest of value to the model rocketeer; however, if the amateur wishes to put out

Class of License	Restrictions on Operation
Novice	Limited to 75 watts power and very small segments of only four bands. Communication is through telegraph only, no voice. Code speed required – 5 words per minute; simple written exam.
Technician	May operate with 1000 watts power using many types of signals on all frequencies above 50.25 mHz. Code speed – 5 words per minute. Written exam considerably harder than novice class.
General	May operate with 1000 watts in most portions of all frequency bands. Same written exam as the technician but code speed required is 13 words per minute.
Advanced	Slightly greater privileges in frequencies on the six lower frequency bands. Harder written exam and 13 words per minute code speed.
Extra	All amateur privileges. Very hard written exam and 20 words per minute code speed required plus two years of experience as a General class or higher.

Chart 2: Limitations on various categories of "ham" licenses

more effort, there is nothing to prevent him from seeking a higher class with more frequency privileges. The extra frequencies are primarily in the high-frequency portions of the radio spectrum and are used for long range communications. (see chart 2)

The 50.25 mHz band (also called the 6 meter band) has been used for years for the radio control of model airplanes by those enthusiasts not using CB. Many of the distance records for model airplanes have been possible because of the 6 meter band. Altitudes of 19,000 feet and higher have been acheived with no loss of control.

Amateur radio has several benefits for the rocketeer aside from helping to solve specific problems related to radio control and tracking of rockets. It enables him to learn first hand about the principles of electronic communications, a vital necessity in serious rocket research. Progressive hams have done research in radio astronomy, bouncing signals off the moon, off meteor trails, and a variety of other activities of a professional caliber.

Probably the most ambitious activities by radio hams to date have been the projects called Oscar and Australis. These projects are a series of Earth satellites constructed by radio amateurs and launched into orbit "piggyback" with other NASA and USAF satellites on a "space available" basis. (If you think you have problems trying to fly stand-by on the airlines, you "ain't seen nuttin yet".) Several Oscar satellites have been launched into orbit, each one being progressively more complex. Australis, as the name implies, is an Australian-built version of an amateur radio satellite. It was launched in mid-January, hitch-hiking with the NASA Tiros-M satellite.

As can be seen, amateur radio offers both direct and indirect advantages to the model rocket experimenter. The amateur may design better tracking, telemetry, communications, and radio control equipment. He has more leeway in the designs he produces because of the more liberal rules and regulations governing amateur equipment.

If you the rocketeer are interested in using the privileges of the amateur radio bands you must begin studying for the exam today. Forty-five minutes of code practice and forty-five minutes of studying theory each day for a month should prove more than enough preparation for passing the Technician class exam.

The best way to learn the code is to enlist the help of another local amateur or to attend a code class given by a local radio club. Most hams, like model rocketeers, are a friendly bunch and always willing to help each other; if you go to a meeting and explain your objectives and reasons for wanting a ham license you can be certain of much help.

Two books needed for studying the theory for the written exam are the **License Manual** and the **Radio Amateur's Handbook**, both publshed by the American Radio Relay League, Newington, Connecticut 06111.

The **License Manual** contains sample questions which are very similar to the questions on the exam itself; if the prospective applicant can answer all the questions in the samples he should have no difficulty with the actual exam. The rules and regulations of the Federal Communications Commission that govern amateurs are included in this important book.

The **Radio Amateur's Handbook** contains a wealth of information on basic electrical theory, transmitter and receiver design, construction projects, antennas, radio wave propagation, and much, much more. Even if the rocketeer doesn't become a ham he should obtain a copy of the "Bible", as the **Handbook** is often called.

If you, the model rocketeer, are interested in using ham radio to improve your capabilities in model rocketry, the best time to start studying is *NOW*!

Plastic Model Launch Tower Constructed

The model as pictured in the accompanying photograph is an engineering prototype of a standard space launch site. It consists of a mobile service tower, umbilical tower, launch pad, and an exposed underground section of the exhaust ducting.

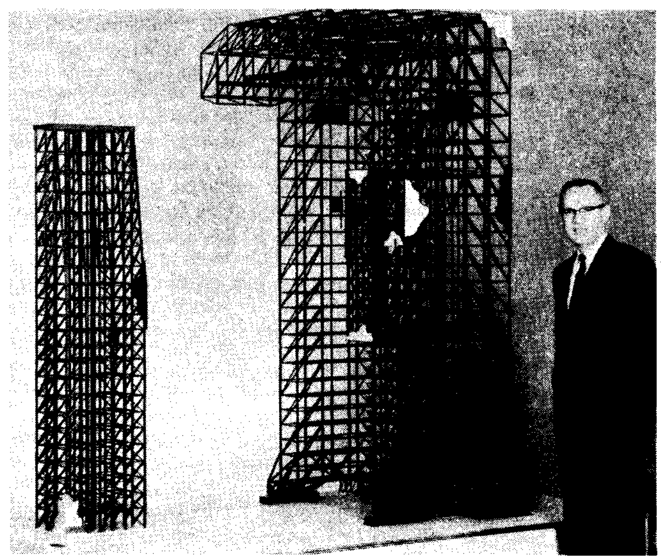
The entire model covers an area of 32 square feet, and has an overall height of approximately eight feet. With a scale of ¼":1', this height is equivalent to 385 feet. For comparison purposes, the mobile service tower alone is as tall as a 32-story building. This model is believed to be the largest and most complex structural prototype of its kind ever constructed.

The design specifications called for an accurate, scaled model of the actual structural members being employed. These were made up of H-columns, I-beams, channels, angles, and tees, of varying heights and measurements.

Construction of the model was accomplished through the use of a recently introduced plastic structural material, which is available in a wide choice of shapes and sizes from Plastruct, Inc. of Los Angeles. On this specific project, the new material proved to be one of the most significant innovations to modelbuilding that has been encountered in many years.

Major details of the model consist of the mobile service tower, which is essentially a large U-shaped structure, open at one end, which incorporates 26 platform levels, connected by freight and passenger elevators, also stairways and access ladders. The entire structure is mounted on special wheels and tracks which enable it to traverse over and around the umbilical tower and encompass the launch vehicle (not pictured). It also consists of an internally enclosed enviornmental chamber made up of eight levels, two very large access doors, and many intricate, folding platforms, which encircle the launch vehicle. The umbilical tower is a stationary structure with levels and platforms corresponding to the enviornmental chamber, and contains sliding platforms that facilitate the servicing of the launch vehicle.

Since its completion the model has traveled across country several times in various modes of transportation, with no appreciable damage of any kind. This is attributed in part to the extreme light weight of the plastic. The mobile service tower alone has a total weight of only 35 pounds, yet it exhibited tremendous



strength, impact resistance, and flexibility beyond all expectations. Prior to this new material, brass shapes had been used on similar projects. However, it would have been highly impractical to consider such an approach in this instance, due to factors of cost, weight, difficulty in painting, and the constant repair that is inherent in brass structures of this magnitude and complexity.

The success of the model has been substantiated by its extensive use in on-site discussions and briefings by engineering and construction personnel engaged in solving space, clearance, and assembly problems, and through the finding of errors with the model, rather than on the site.

The model was designed and fabricated by the Prototype Technical Laboratory of Space Age Engineering, Inc., of Hollywood, California.

RAM-AIR CONTROL

Part II

by Forrest M. Mims

A logical extension of the experimental investigation discussed last month was the design and construction of a functioning two axis guidance/control system utilizing ram air as the control force. This phase of the investigation consisted of launching five devices of this category. The work was initiated prior to completion of wind tunnel tests as time was available and it was expected that many of the problems certain to occur in a later investigation could be recognized and perhaps solved.

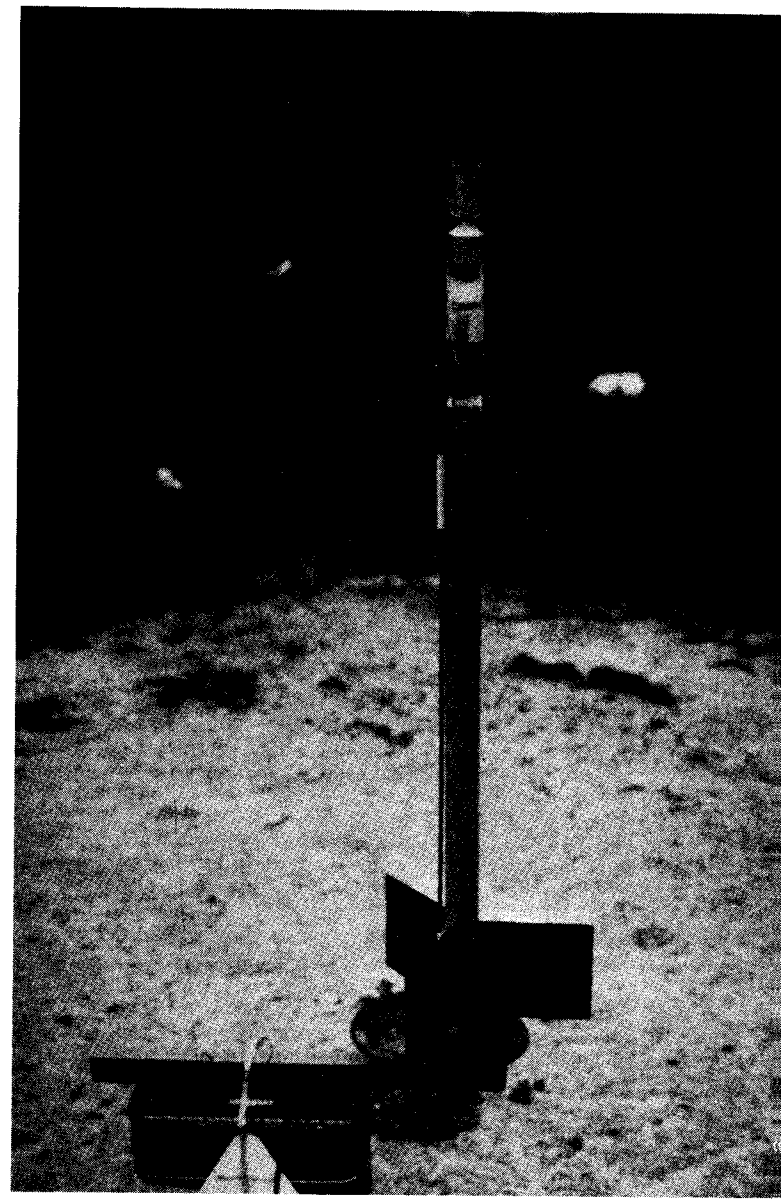
The mechanics of control were similar for each device. Brief pulses of air were consecutively expelled by a rotating deflector from ports encircling the forward section of a rocket. The air deflectors were powered by either an air driven turbine assembly or an electric motor. As the rotation of the air deflector provided a convenient approach for a scanner, a light/heat seeking guidance system designed to home on the sun was chosen. Loss of tracking stimulus by appropriate sensors on the rocket braked the rotating deflector causing a continuous jet of air to exit from the port opposite the intended new course angle. The resultant side force F_y caused a moment about the rocket's center of gravity until sensors on the rocket signaled target reacquisition. The air deflector then resumed its dual function of target scanning and sequential air deflection.

As indicated above, two basic approaches were utilized to achieve the dual function of scanning and air deflection. The first, shown in Figure 10, used a copper turbine and air deflector mounted on a freely revolving shaft coaxially centered in the forward section of the rocket. A copper disc from which a triangular section had been removed was mounted above the turbine and compelled to rotate with it, thus causing a silicon detector placed aft of the disc to be scanned by target radiation entering the forward facing port. Loss of light by the detector in any phase of the scan triggered a servo which immediately braked the turbine assembly. Ideally, the corrective jet of air applied opposite the point of signal loss would then sufficiently alter the rocket's course to permit target reacquisition and subsequent reactivation of the system.

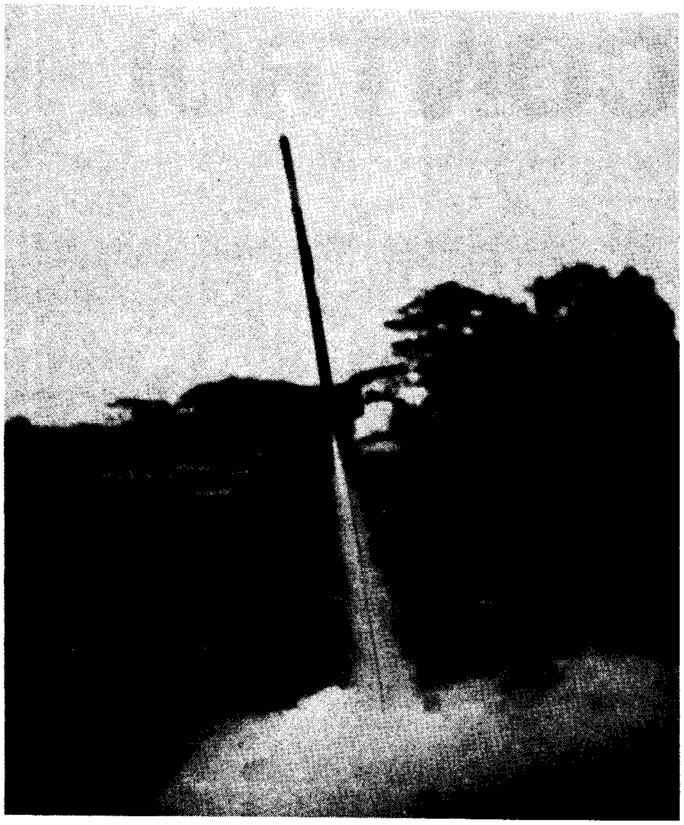
While the turbine approach permitted construction of an extremely compact, lightweight guidance/ contol system, its experimental application faced two serious problems: 1) Considerable difficulty was experienced in an effort to consruct a servo mechanism capable of braking the delicately balanced turbine assembly without causing damage, and 2) As an airspeed of approximately 80 ft/sec was necessary for the turbine to begin rotation, the rocket was over 30 feet from its launcher before the guidance mechanism was activated, thus inducing a significant error in the intended angle of attack during the initial phase of flight.

The magnitude of these problems shifted the experiment to an approach which eliminated most inherent problems of the ram air driven turbine. A miniature three pole direct current motor was utilized to rotate the air deflector and scanner. Loss of target stimulus caused the motor to be braked until the target was reacquired. A series of four ram air guidance and control packages of this type were constucted and flight tested. Their general configuration is shown in Figure 11.

Two significant problem areas were common to each of the



Mims' Ram-Air Guided rocket sits on the launching pad. The payload section of the homing rocket is visible through the clear plastic wall. A motor is used to select the exit port for the ram-airflow admitted through the nose.



Liftoff of the Ram-Air Guided rocket. Several flights of this instrumented payload are described in the text.

units: 1) The drive motors often failed to stop immediately upon target loss, and 2) The air deflectors permitted leakage of control air out several ports besides the intended. This leakage amounted to over 50% in one instance thereby greatly reducing the effect of the control jet.

Though flights of the first three motor driven units failed to produce evidence of course changes, the two flights of the fourth unit did. In all cases the rocket with guidance section was positioned at launch so that the detector was illuminated by direct sunlight. The rocket was then expected to home on the sun. The guidance apparatus, which in all cases operated perfectly on the ground before launch and in most cases after recovery (failures being due to improper parachute deployment and subsequent damage to the assembly on impact), showed several distinct course changes during two of the three flights with the fourth unit.

Though no actual guidance was achieved, the attempts at two axis guidance and control described above supplied abundant information and ideas pertinent for future considerations. Furthermore, the experiment demonstrated the possibility of guidance/control with but a single moving component. The fact that each of the guidance sections weighed under 45 grams and occupied a maximum volume of 2.3 cubic inches is also of significance.

The experimental investigation showed the effects of F_o to be more complex than anticipated in the Analytical Discussion. The relationship between V and F indicated that with sufficient increase in the jet output angle (a_1), F_o might equal or exceed $pQ(V_2 - V_1)$ cos a of Equation 4. Application of this effect might result in a method of rocket control by boundary layer manipulation. Furthermore, optimizing of channel design is important to the efficient operation of a Ram Air Control system. Optimization should consider Reynold's effects, boundary layer separation, velocity variations, and jet exit angle. In addition the experimental series showed that compression channels and chambers (i.e. input to output port ratio greater than 1:1) are inefficient at low airspeeds. It is possible, however, that at velocities greater than 450 ft/sec an input to output port ratio greater than 1:1 might realize an efficiency increase. This area requires more study.

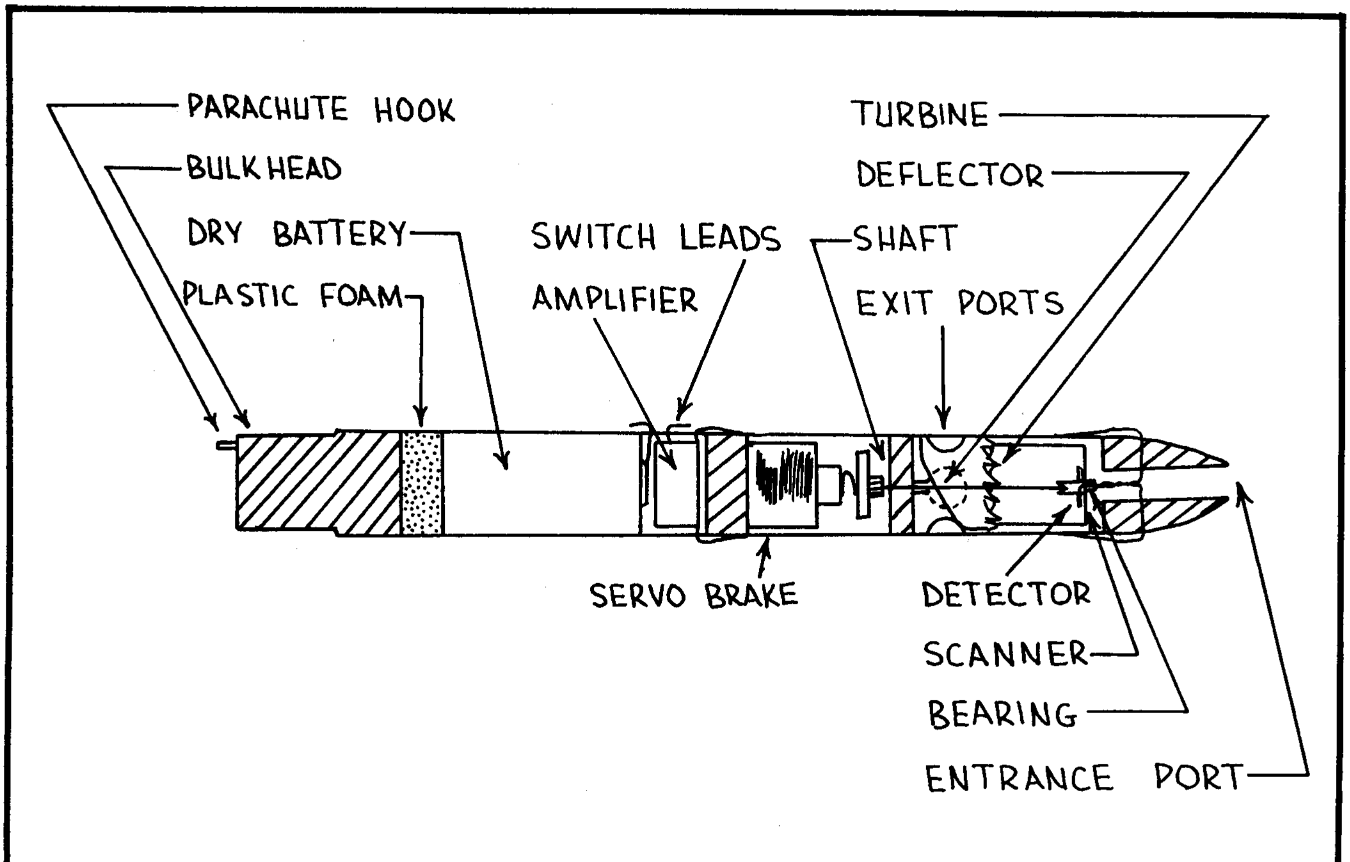


Figure 10: Payload Section

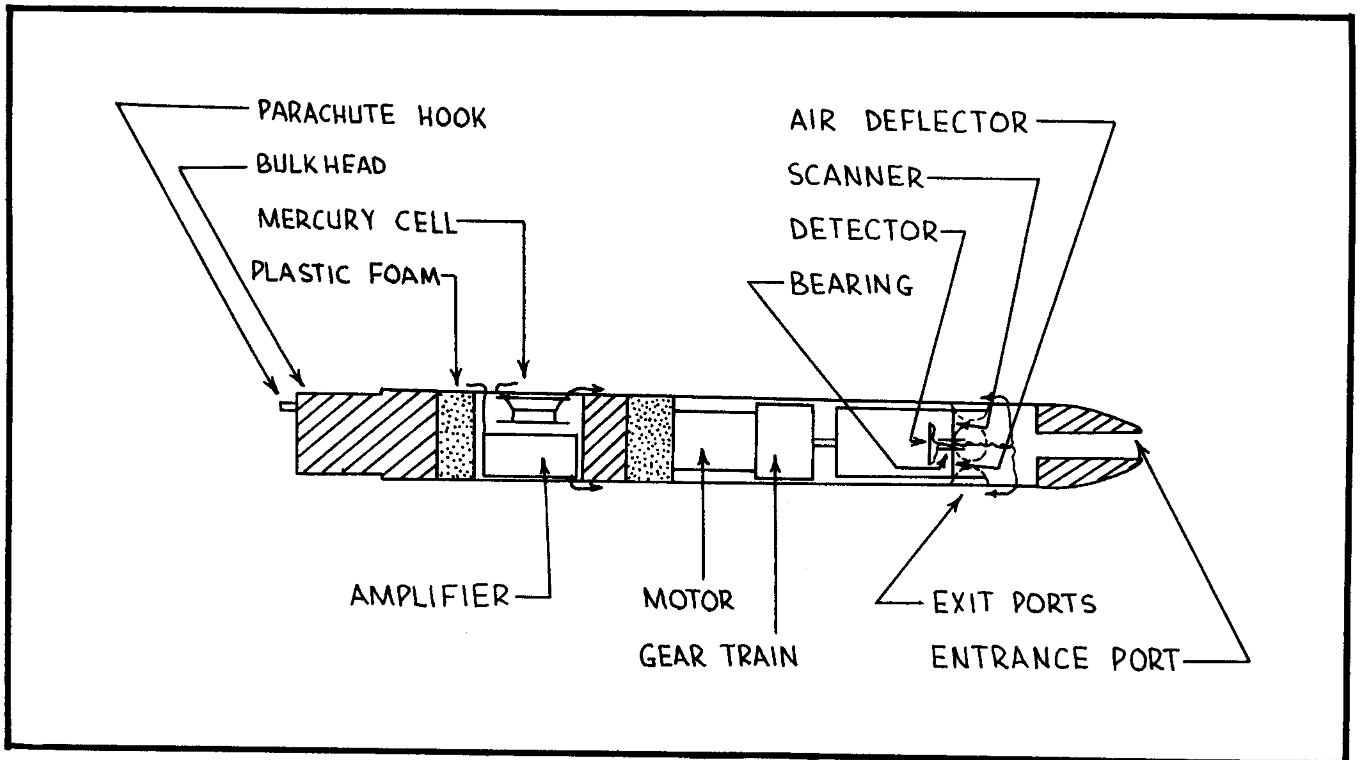


Figure 11: Modified Payload Section

Need for a detailed study of the effects of a jet interacting with a lateral deflecting flow was indicated by this investigation. Of particular interest is the effect on F_y by the exit angle of the jet. As the angle of the exiting jet is drastically altered by the lateral flow, it is not unreasonable to suspect a change in the *effective* exit angle. If valid, this "extended channel" concept would greatly alter the force vectors shown in Figure 2 and somewhat simplify explanation of F_o. Work in this area has been performed at the Army Missile Development Center at Redstone Arsenal, Alabama. However, the data acquired are not directly applicable to Ram Air Control as described in this paper as supersonic jets with velocities in excess of the lateral flow were utilized.

Though F_o was shown to be a complex component of F_y, the Investigation demonstrated that with even a poorly designed air inlet-outlet channel, deflections in the flight of a ram air influenced rocket are obtainable.

Concluding Remarks

The investigation described in this paper provides encouraging experimental evidence concerning the potential usefulness of ram air as a method of rocket control. The investigation will continue with wind tunnel tests and development of a sophisticated Ram Air Controlled rocket capable of homing on a light emitting target suspended from a lighter than air balloon. Work on the guidance system is currently underway, a transistorized circuit capable of varying the speed and torque of a direct current motor by sequential pulses frequency and amplitude having been designed and tested. The circuit will be coupled to a silicon quadrant detector. In this manner immediate stop-start capabilities of the motor as well as varying speeds and torques will be available. After testing in a wind tunnel, the rocket will be launched at night and two tracking lights on the rocket, one to provide a time base and the other to indicate when course changes are effected, will be recorded photographically.

The Ram Air Control methods described in this paper offer several advantages over existing control systems of small tactical military rockets: lighter weight, the possibility of systems with but a single moving component, and tube launch capability without the need for spring return control vanes. Perhaps, however, the most promising aspect of ram air as a method of rocket control is in the realm of total fluidic target acquisition, guidance and control. The author of this paper is currently exploring methods by which a fluidic system may be caused to detect a target emitting radiation in the near infrared. Two methods, a temperature sensitive fluidic oscillator and a fluidic amplifier with bimetallic control-jet gates, show promise. Either method would permit true proportional control with no moving components. This method of guidance and control would be advantaged by its compact size, light weight, ruggedness, and low cost.

The present investigation of ram air as a method of rocket control, which will continue with further wind tunnel tests and the launching of a sophisticated two axis guidance/control package, will be followed with a feasibility study of total fluidic guidance and control.

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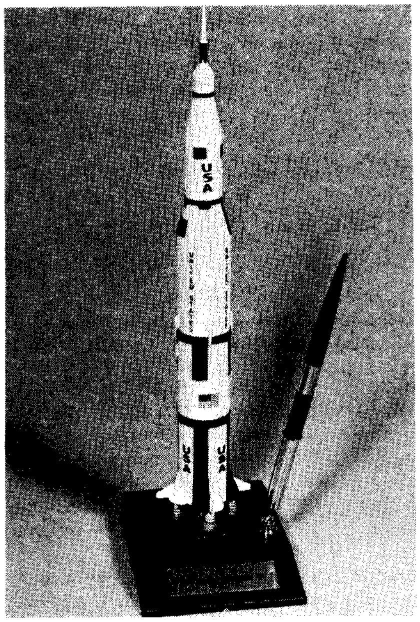
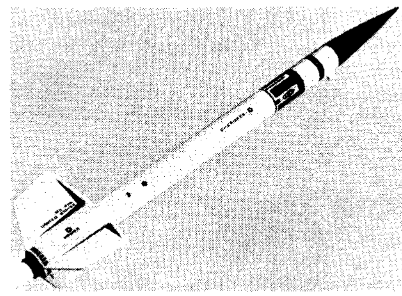
New Product Notes

Countdown, Inc. has introduced an Apollo/Saturn V model with executive desk pen. An excellent gift or addition to the desk of anyone interested in the space program, this scale model of the rocket that took astronauts to the moon stands 13½ inches tall. It is constructed of polystyrene plastic and comes completely assembled, with black and red scale markings. The pen is chrome trimmed. It includes a chrome nameplate on the black base which reads Apollo/Saturn V. The Apollo/Saturn V



Executive Desk Pen is available for $3.95 postpaid from Countdown, Inc., Dep t. MRI, PO Box 551, Jacksonville, Florida 32201.

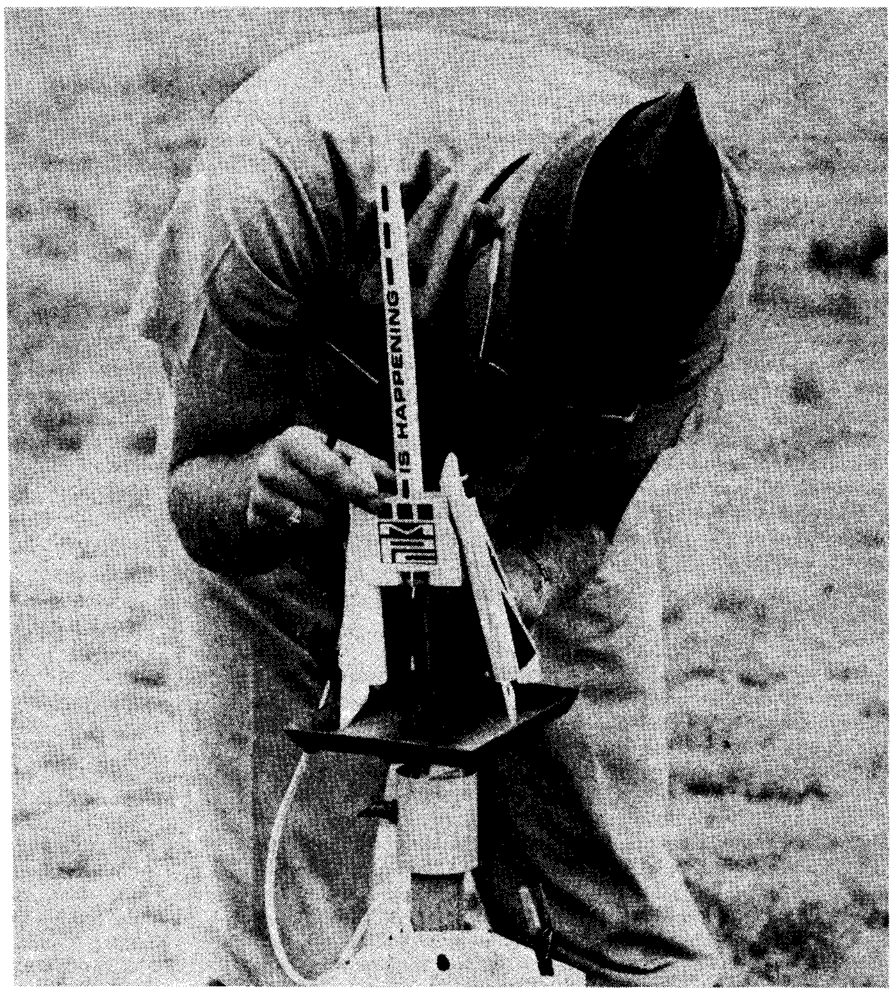
New from Estes is the *Cherokee-D*, a high-performance rocket designed especially for use with the new D engine. The 16.6 inch tall model is described as "the perfect model for getting started in the high-performance world of Estes D-engine power". The kit features die-cut fins, quick-change engine mount, and a colourful decal. The *Cherokee-D* is priced at $2.75.



Also introduced in conjunction with the D engines is the EM-5063 adapter, to convert the Estes Saturn V to single D power. Priced at $.50, the EM-5063 fits into the present Saturn V engine mount. The EM-2050 Engine Mount Adapter allows you to convert a D-engined model to any series I or II engine. Centering rings, AR-5055, to center the BT-50 D-engine mount in a BT-55 tube are available at 4 for $.25.

New from Competition Model Rockets are the *Rapier* parachute duration rocket and the *Marcus* strap-on booster. The *Rapier*, a four-finned design taking either 18 or 21 mm diameter engines, comes with a plastic nose cone, pre-formed plastic fins, a 12 inch diameter chute for sport flying, and a 28 inch chute for competition. The rocket weighs 28 grams and stands 15 inches high; it can also be used with the Competition egg-capsule and the *Marcus* strap-ons. The *Rapier* is priced at $1.95.

The *Marcus* strap-on booster kit is designed to supplement the main engine to provide additional weight-lifting capacity for lofting heavy payloads. The booster, 7.5



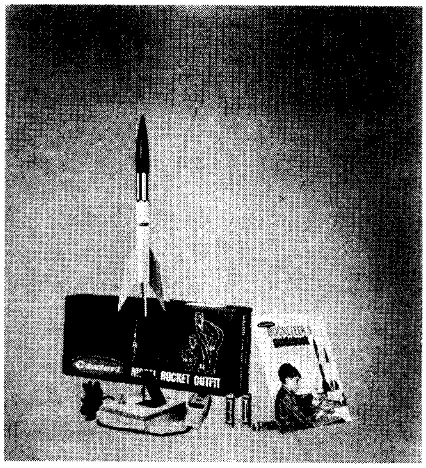
MPC Introduces the Lunar Patrol

The *Lunar Patrol*, a model rocket which carries two delta-wing boost/gliders aloft, is the newest addition to the MPC Mach 10 series. The *Lunar Patrol*, a 15" tall rocket, lifts off the pad carrying its two gliders. High in the sky, the two gliders disengage and begin to circle slowly while the rocket body returns to earth beneath the 14" parachute. The kit comes complete with 'chute, pre-shaped balsa nose cone, fiber body tubes, pre-printed balsa fins and wings, and decals. Shown above is the prototype *Lunar Patrol*, which was flown at NARAM-11. Priced at $3.00, the model should be available at your local hobby shop.

inches long and using standard 18x70 mm engines, can be used on most rockets. Two or four boosters should be used on four-finned rockets, while three should be used on three-finned models. *Marcus* kits are priced at $1.00 each.

Body tubes, plastic nose cones, pop launch lug kits, parachute material, and other model rocket supplies are described in the new Competition catalogue, available for $.15 from CMR, Box 7022 MR, Alexandria, Va. 22307.

Three of the most popular sellers in the comprehensive Centuri line of model rocket kits and supplies are the Beginner's Outfit, the Rocketeer's Outfit, and the deluxe Rocketry Outfit. These fast-selling and complete outfits, priced from $8.95 to $17.95, include everything needed to get started correctly in this exciting space-age sport. Each outfit contains from one to three model rocket kits, necessary solid-propellant model rocket engines, a launch pad with a professional-type electrical launch control panel, colorful recovery parachutes, and easy-to-read and easy-to-follow instructions. The carefully designed and engineered model rockets, furnished only in kit form, arch skyward to altitudes of more than a quarter mile and return safely to earth by colored parachute for many more thrilling flights.



Pictured above is the popular Beginner s Outfit, complete with a durable, colorful, and functional field box and extra bonus – The Rocketeer's Guidebook. This exciting, fact-filled, well-written guide-book will help the new rocketeer get started on the right foot. This 36 page Rocketeer'sGuidebook is provided as a bonus addition with each of the special Outfits. The Beginner's Outfit may be obtained at local hobby stores or may be ordered directly from Centuri Engineering Company, P.O. Box 1988MR, Phoenix, Arizona for $8.95 postpaid.

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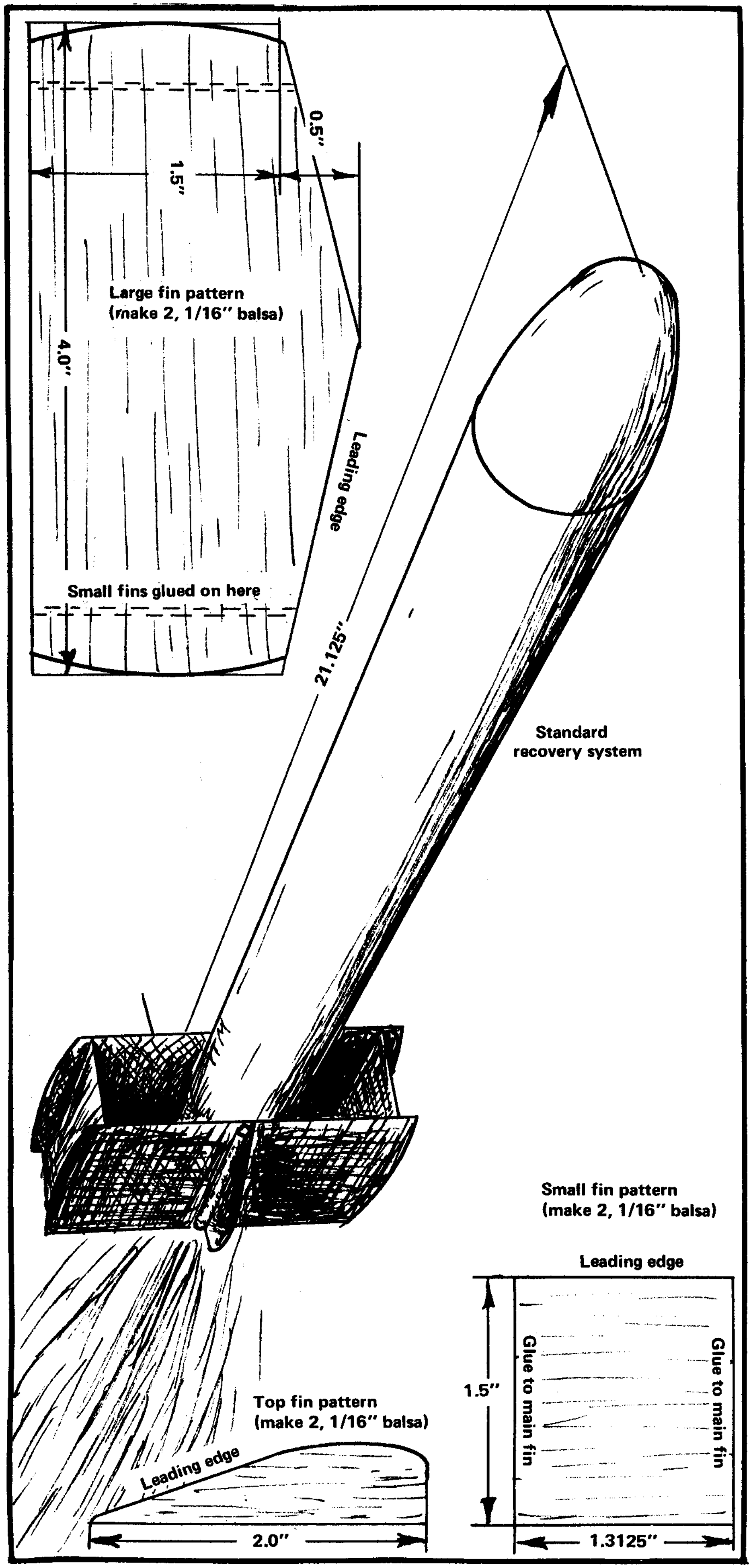
Martin Marietta Photos

During Christmas vacation, 14 year old rocketeer Mark Pescovitz spent two hours discussing the Pershing 1A missile with engineers at the Martin Marietta aerospace complex near Orlando, Florida. Mark, accompanied by his father Dr. Harold Pescovitz and 12 year old brother Robert, saw an actual Pershing 1A during the tour of Martin Marietta's Orlando facilities. (Photo left)Program Engineer Paul Willis discussed the operational missile with Mark whose scale design article on this missile appeared in the January 1970 issue of *Model Rocketry*. (Center)Mark displays one of his models of the Pershing 1A Army tactical missile while his brother Robert looks on. (Right)J. David Shipley, Martin Marietta's Senior Engineer, who has flown the 35 foot Pershing missile in test launches from White Sands Missile Range, explains the operation of Pershing systems to Mark and Robert Pescovitz. Mark is a founder and currently vice-president of the Cincinnati Model Rocketry Club. He is currently working on a gyro guided rocket, though he has experienced some difficulty in ground testing the gyro unit.

How to Build

Two Unusual New Fin Designs Are Presented. These Parallel-Fin Sport Rockets Equal the Standard Design In Their Performances.



The inspiration for this type of rocket came from seeing some pictures of old World War I biplanes. A few weeks later the finished product was ready for its first launch. It had passed a string stability test with flying colours, so I expected the rocket to fly well under power. It flew so well with an A5-2 that the next flight was made with a C6-5. It reached an altitude of about 900 feet and flew absolutely straight, without any wobble at all.

There are several types of parallel fin arrangements that will work, but these are the two I found most reliable. There is one important thing to remember when building one of these – the fins should be at least 1.5" apart to insure stability.

Construction

The first rocket is my original design, and also the larger of the two. Begin construction by gluing an Estes EH-2055 engine mount into an 18" BT-55 body tube. Next, turn the screw eye into the BNC-55AA nose cone. Remove it, squirt glue into the hole, and replace the screw eye. Cut two 0.5" slots in the opposite end of the body tube from the engine mount and insert the shock cord. Push the cut section out flush with the body again and coat with glue. Set aside to dry.

Cut out the fin patterns and trace two of

Parallel Fins

by Kevin O'Classen

NAR 13578, Jr.

each onto 1/8" balsa fin material. Sand the leading and trailing edges to obtain an airfoil shape. Glue the two main fins to opposite sides of the body tube, making sure that they are parallel. Allow them to dry, then glue the smaller fins between the main ones (see drawing). Allow these to dry and glue the small exterior fins onto the main ones.

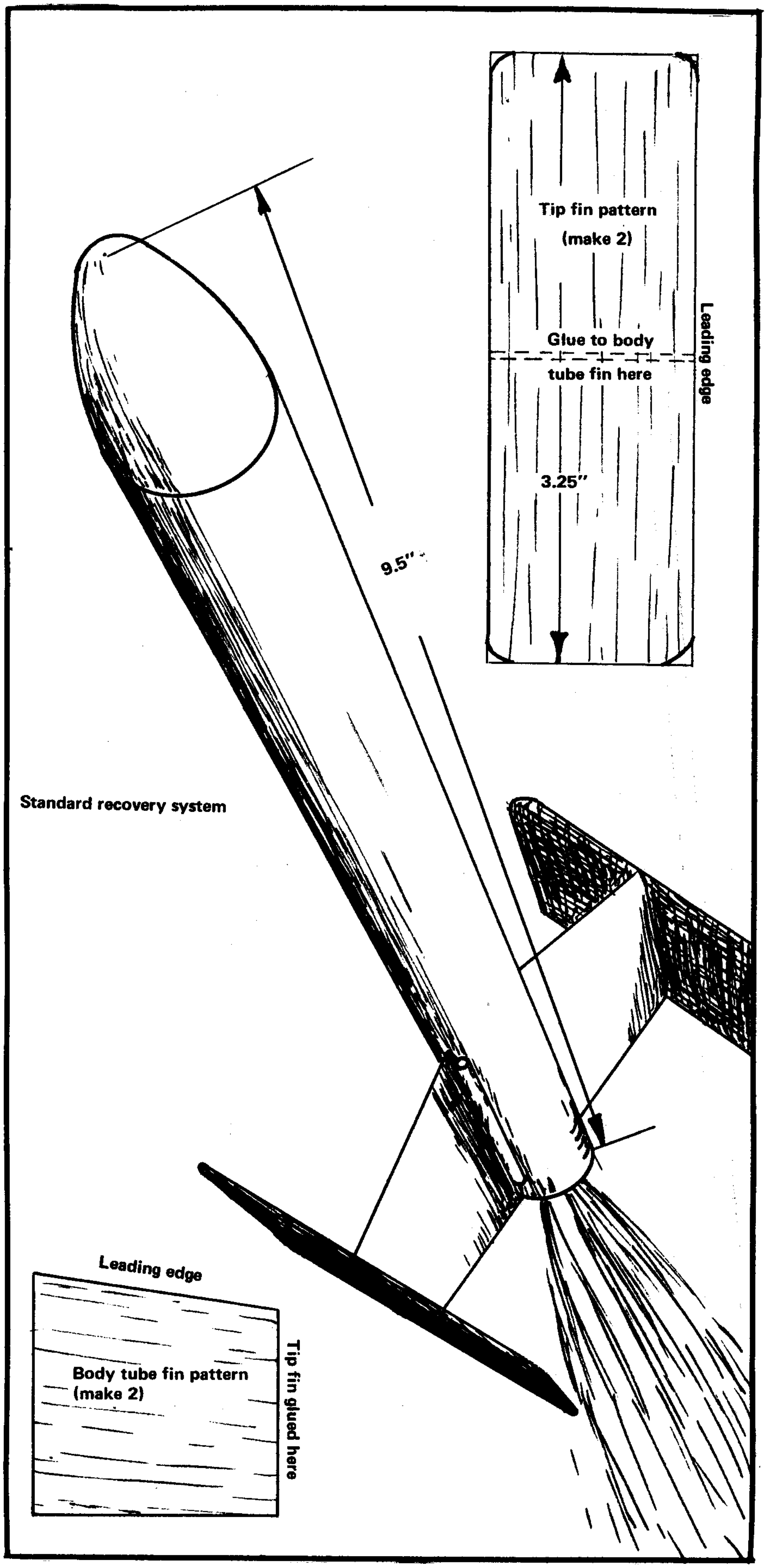
Attach the shock cord to the screw eye. Finish the model in the colour(s) of your choice. An 18" parachute is recommended.

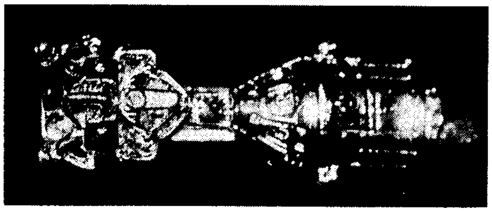
The second rocket is begun by gluing an engine block into an 8.65" length of BT-20B. Affix the screw eye in a BNC-20N nose cone as explained above. Attach the shock cord in the same manner. Cut out two of each style fin from 3/32" balsa. Glue the two support fins to the body tube, 180 degrees apart. Allow to dry, then attach the two outer fins. Attach the shock cord to the nose cone and finish the model in your choice of colours. An 8" parachute is recommended for this one.

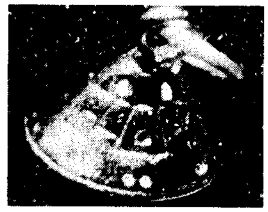
Flight characteristics

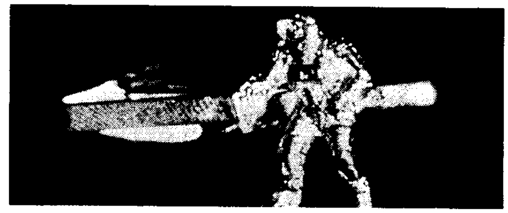
When flying these models for the first time, it is best to use small engines. If your rocket seems stable, try a C6-5 or B14-5. Both will provide good results.

Though this type of rocket is usually reliable, caution is indicated: if improperly built, it will wobble, do flip-flops, and in all likelihood crash. With a little care, however, these unusual rockets can be great fun.









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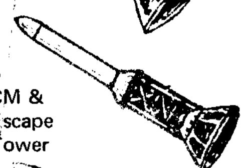
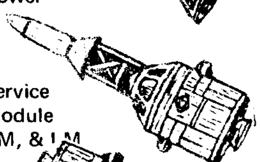
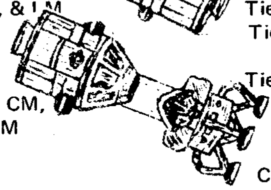
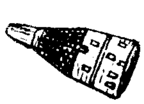
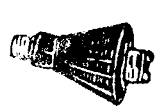
5 CM & Escape Tower		Charm Earring Pendant Tie Clip Tie Tac
6 Service Module CM, & LM		Charm Earring Pendant Tie Clip Tie Tac
8 SM, CM, & LM		Tie Clip
10 Gemini		Charm Cuff Links Earring Pendant Tie Clip Tie Tac
11 Mercury		Charm Cuff Links Earring Pendant Tie Clip Tie Tac

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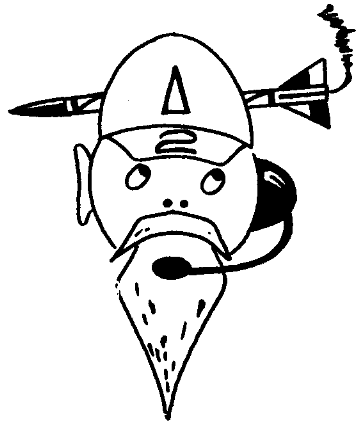


The Old Rocketeer

by G. Harry Stine NAR#2

MODELING WITH PLASTICS

For the past six months, I have been having a ball learning new things. Of course, I'm always learning new things in contrast to those people who put their brains in deep freeze when they think they've learned everything there is to know. I have been learning how to work with plastic materials in model rocketry.

Actually, I started doing this back in 1958 at the old Model Missiles, Inc. when we made a bunch of prototype test Aerobee-Hi models using PVC plastic nose cones, butyrate plastic motor mounts, and Royalite plastic fins; the only "classical" model rocket parts in the models were the paper body tubes. They flew fine and were very strong. But rocketry had to re-trench in 1959-1960 because all of you thousands of model rocketeers out there had not yet developed into the sort of a market that would justify spending thousands of dollars for a fin assembly mold, for example. The hobby had to grow to be able to support the sort of expense that goes into molds for plastic parts.

One thing about moldable plastics, however: Once you have the mold, you can turn out hundreds of thousands of parts that are all *exactly alike* in shape and dimension... and you can do it fast, fast, fast. And it's cheap, cheap, cheap.

So we are seeing a renaissance of plastics in model rocketry. And, although I am and will continue to be a balsa butcher all my life, I can only say "hooray" for plastics because we have a new material that now permits us to do a lot of things we could not do before.

We are also seeing a fully-anticipated phenomena among the model rocket "purists" who, having learned everything there is to know about how to cut, shape, sand, fill, paint, and polish balsawood, are suddenly discovering to their great dismay that they don't know *everything* any more.

Because some of this reaction from the purists is pure crud-on-the-clips, since they don't know what they are propagandizing about, I am going to try to pass along to those of you who will take the time and the trouble to read it, and who are not yet afflicted with the hardening of the neurones that comes from putting your brain in deep freeze, some of the things that I have learned about plastic materials from my own experience and from listening to the experts.

(If you think that fighting the Establishment is frustrating, try fighting an Establishment that you have established! I guarantee that you will never be bored with life and have to tune-out and turn-on.)

Types of Plastics:

Thermosetting plastics harden or cure by the application of heat. Further or subsequent heating will not soften them. They don't melt, but they will burn if they get hot enough. Some thermosetting plastics come in two parts, a liquid "resin" and a liquid or powder catalyst or "hardener." Commonly encountered thermoplastic materials include phenol formaldehyde, urea formaldehyde, melamine, polyesters, and epoxies. Mylar is one of the newer polyesters that you will encounter in model rocketry. **Thermoplastic plastics** soften under heat and reharden when heat is removed. They melt and then reharden when heat is removed. They melt and then reharden. Typical thermoplastic materials include polystyrene, polyvinylchloride (PVC), polyvinyl butyral, acrylics such as Plexiglas and Lucite, cellulose nitrate (otherwise known as celluloid), cellulose acetate, cellulose acetate butyrate, polyethylene, nylon, and Teflon.

Plastic materials are often combined with a "filler" such as rubber, wood flour, asbestos, mica, or sisal to obtain special

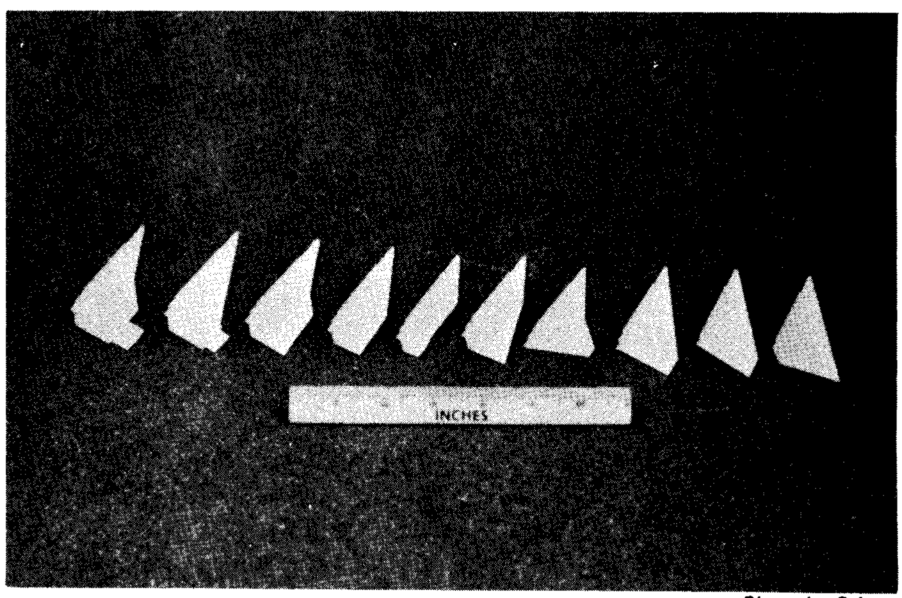


Photo by Stine

Here are nine different customized plastic fins modified from the MPC "Redstone" fins (Catalog Number R-108). The original fin shape is at the left.

characteristics. For example, clear, pure polystyrene is very brittle and will shatter; it is also heavy. By combining it with various organic elastomers, plastic chemists can render it more flexible, but this may in turn affect the transparency of the styrene. If you are casting polyester, you can mix sawdust with it as a filler to decrease its weight, but this will also decrease its strength to some extent. (You always have trouble getting something for nothing!)

Obtaining Materials:

Most of the plastics that you will be working with will be obtained from the model rocket kits you buy. These plastic parts will usually be injection-molded from high-impact polystyrene.

Clear acetate sheets in thickness of 0.020 inches and 0.040 inches can be obtained from Estes Industires as their catalog numbers CFS-20 and CFS-40 respectively.

A check of the Yellow Pages of your local telephone directory will probably reveal the name, address and telephone number of a shop which sells plastic materials. In the local plastic store, I have obtained sheet, rod, tubing and blocks of plexiglas, lucite, acetate, and other plastics. You can also obtain various solvents needed to cement, shape, or dissolve plastics. Various resins are also available for casting or molding your own parts. Furthermore, the owner of the store may be able to give you all sorts of information on how-to-do-it.

The recent up-surge of interest in the crafts area of the hobby industry has made available some new plastic materials that you may be able to find in your local hobby store. Some casting resins are now available. Although I have not tried them yet, some of the new "instant papier mache" materials may have interesting applications in model rocketry as materials to use in making your own parts. I know that the papier mache itself can be used to make model rocket parts; I've made some nose cones from this material.

The "customizing" area of plastic model cars and airplanes has made available in most hobby stores materials such as customizing body putties. AMT used to make a plastic body putty material in a tube; I have not used any recently because I have been using Testor's Wood Putty which also works well on plastics.

As a matter of fact, automobile body putty itself is a fine material to use as a model putty. I think it might be possible to cast the stuff into very strong parts. I used to use auto putty for making my own molds in which I would cast my own parts such as nose cones...until injection-molded nose cones became available. Try your local auto supply store for body putty. A big can will last for a long time...if you keep it tightly shut so that it won't harden, because it is a thermosetting material!

Tools For Working With Plastic:

Most of you already have nearly all the tools you would ever need to work with plastic.

Polystyrene and most other readily-available thermoplastics can be cut, sawed, sanded, drilled, carved, turned, and polished just like wood! Or is it the other ?

A sharp X-Acto knife will cut and carve plastic.

A razor saw will saw it. So will a coping saw.

A soldering iron is often helpful in shaping pieces by heating them. X-Acto makes a small soldering iron which can be used to solder or, if you put an X-Acto blade in it, can be used to cut plastic like soft butter.

I have a collection of files which are very helpful in shaping plastic. They also work pretty well with wood and metal. A small flat file will hack down a plastic fin to a super-airfoil faster than you can carve a balsa fin.

With sandpaper you can put a finish on plastic that you wouldn't believe. I use wet-or-dry (used dry) sandpaper in grits of No. 220, No. 300, No. 400, and No. 600. The No. 220 hacks away like mad and is good for shaping. No. 400 sandpaper will normally smooth the surface so that scratches will not show once paint is applied. No. 600 is even finer and results in a smoother finish.

If you wish to *polish* plastic so that you get an absolutely smooth, shiny, reflective surface, do the final polishing job with toothpaste. Or you can be real professional and obtain polishing rouge and use it with a cloth buffing wheel on your electric drill.

And that's about all you need to be a real plastics customizer.

Shaping Plastic Parts:

With a sharp knife, files, and sandpaper, you can shape most plastic materials to suit yourself.

Plastic is usually harder than balswood, but not harder than some woods used in woodworking. It is heavier, but it is also stronger.

The most important thing about plastic *viz-a-viz* wood is the simple fact that *plastic has no grain*!

That means that it is equally strong in all directions; wood is not because of the grain.

Thus, you can make fin shapes, antennas, and other parts from plastic with great ease,

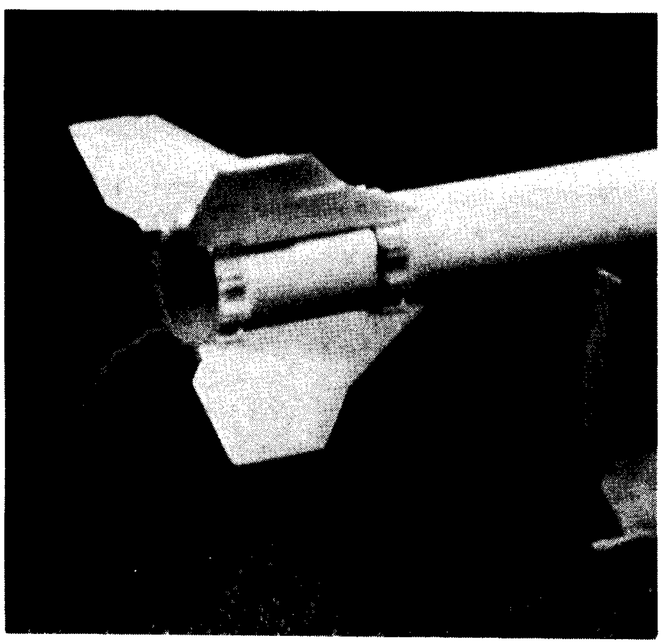


Photo by Stine

This is the simplest and most straightforward custom modification to the MPC "Redstone" plastic fins. Simply cut off the square tip tab, and you get this interesting shape.

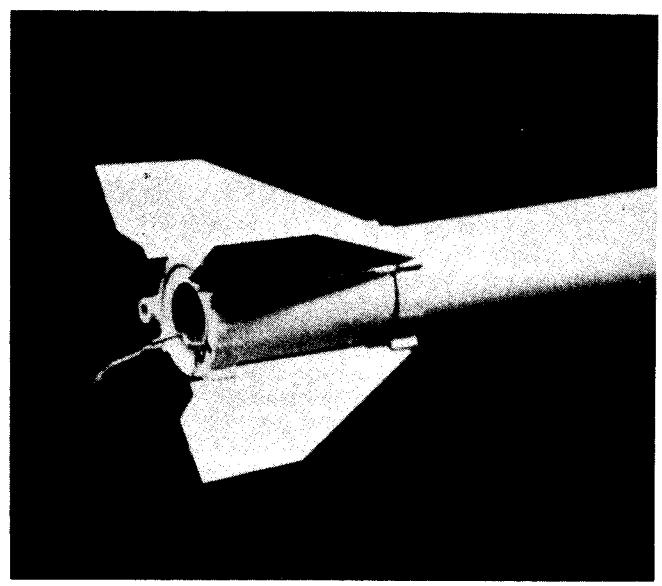


Photo by Stine

With a little more work, you can come up with this "V-2 fin" modification of the MPC "Redstone" fin. Note that some of the molded-on detail was removed and some of it was left on. Note also that the extra fin slots in the tail rings were removed and filed smooth.

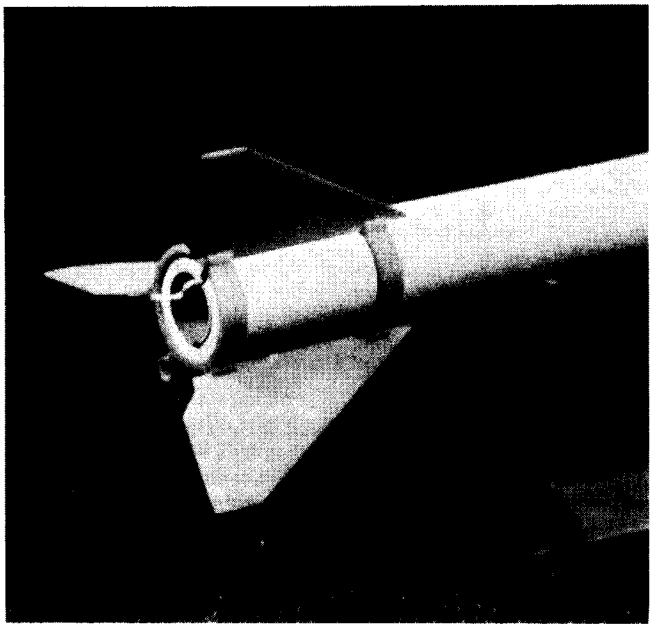


Photo by Stine

A set of straightforward high-performance plastic fins can be made from the MPC "Redstone" fins as shown. These were cut and shaped from the original factory-made fins, and the extra fin slots on the tail rings were removed. The tail rings were also beveled to improve appearance and drag coefficient. Assembly was then painted with Krylon flourescent spray enamel.

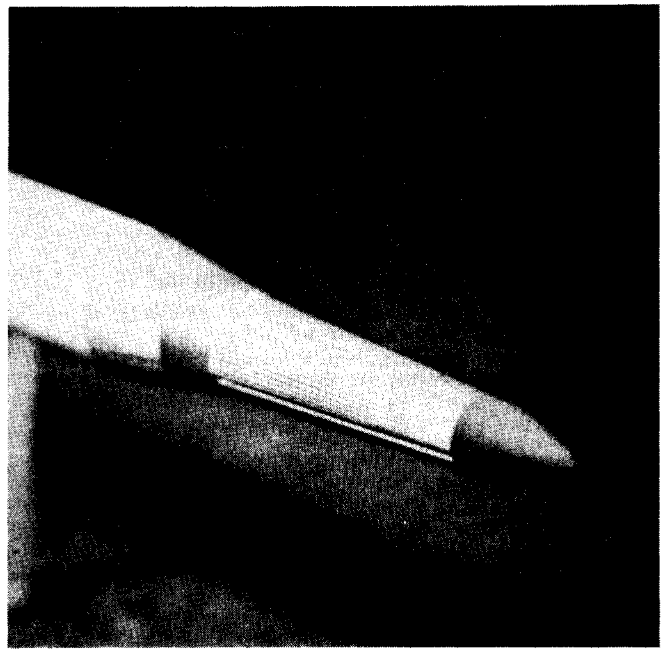


Photo by Stine

Here is a custom plastic nose cone for the T-30 MPC tube made from a No.63025P plastic coupler mated to the No. 625PA plastic "Viper" nose cone. It weighs a "ponderous" 10 grams!

things that are very difficult to make from wood.

It's easy to take off plastic. You just cut it away or file it off or sand it down...or all three.

Putting the plastic on is something else. You must use another piece of plastic that is cemented on, or you can build it up with plastic putty and then carve it down to shape.

As an example of what can be done in the take-it-off department, the MPC "Redstone" plastic fin assembly that fits their T-30 tube offered all sorts of interesting possibilities for changes. If you have not seen this tail assembly yet, it consists of two plastic rings that fit around the body tube, in this case the T-30 tube which is 30 millimeters (1.171 inches) in diameter. On the rings are 12 raised slots into which fins or launch lugs can be snapped. The launch lugs are little polystyrene parts that snap into the ring slots. The fins are flat molded polystyrene that also snap into the rings. You can mount 3, 4, 6 or 12 fins on the rings. For maximum strength, the fins and lugs should be glued into the slots, but a model will fly with the fins simply snapped in. This permits you change the entire fin if you break one. The whole works is molded out of fluorescent polystyrene; this is a boon to tracking crews because these fluorescent fins stand out against most sky conditions like a Basement Bomber at a NARAM. By just hacking a little bit with a No. 11 X-Acto knife, I came up with nine different customized shapes of the MPC fin...and there are lots more possibilities. The extra fin slots on the rings can be removed by simply carving them off with a knife (or a MOTO Tool) and smoothing the rings with a file. I even went so far as to bevel the front and back edges of the rings. This improved the appearance a great deal. I doubt whether it improved the drag coefficient. (Some wind tunnel work is going to have to be done to find out how such body rings affect the drag coefficient. At that point on a model's body tube, the flow is probably turbulent anyway.)

Going even further, I cut some new plastic fins from Estes CFS-40 clear plastic fin stock and slipped them right into the slots on the MPC rings. Since the MPC fins are 0.040 inches thick anyway, the Estes 0.040-inch thick plastic fits without trouble. The CFS-40 can be shaped to a perfect airfoil using a file and some No. 400 sandpaper. Hit them with some fluorescent Krylon paint, and they look like they just came from the factory. Such custom fins should be cemented into the rings because they do not have the little round bump on them that fastens them in the ring. The result is a set of customized fins that are thin, strong, the right shape, and the right size...for you.

Bonding Plastics:

I have used the term "bonding" to describe how to put plastic materials together. The actual process is one of welding, but this would confuse some people who think that metals are the only things that are welded. And since metals are generally *verboten* in solid-propellant model rockets, I don't want to scare anybody. Don't laugh! You'd be surprised, but most model rocketeers read only what they believe, and most of the time they totally misunderstand that!

Plastic materials are joined by one of two methods.

An intermediate adhesive can be used. This adhesive is usually a plastic with lots of solvent in it. It is usually compatible with the plastic material to be bonded. You put it on the surfaces you intend to join, and it bonds with both surfaces when they are put together. When the intermediate plastic adhesive evaporates its solvent, it becomes hard, and, *voila* you have a joint! Such an adhesive is used on plastics that do not soften easily with the application of a solvent. These plastic "glues" usually come in tubes. Testor's Cement For Plastic Models in the orange-and-white tube is such. The best plastic "glue" I have yet found ia DuPont No. 9011 Plastic Cement; it comes in a blue-and-white tube and can usually be purchased in a hardware store. The DuPont stuff is strong, will bond most plastics together fast, and is the best way to glue the Estes CFS clear plastic fin material together to make clear plastic fin assemblies.

Most plastic cements are solvents that will soften the plastic surfaces and allow them to weld together as the solvent evaporates. Professional plastic model builders buy their solvents in the large, economy-sized 5-gallon drum. The usual chemical solvents that can be used as plastic cements are acetone and methyl ethyl ketone (MEK). The liquid you buy in the hobby store labeled plastic cement is one or more of these solvents in combination, or such things as methyl isobutyl ketone or methyl cellusolve acetate. Such liquid cements are applied with a brush; I use as No. 0000 camel's hair paint brush for applying it to larger areas. Solvent cements melt the plastic itself. For the best bond, apply to both surfaces to be joined, then press together. The bond is then welded plastic and can be as strong as the plastic itself . . because that is what it is.

Liquid plastic cement can also be used carefully to treat surfaces for special effects. Since the solvent dissolves the plastic and makes it liquid or soft, the finish that you get where you have painted on the solvent will be different than the sanded or molded surfaces on the piece. Naturally, if you slop the solvent over while making a joint, the joint will show. By turning this glitch-making process into a deliberate thing, you can make interesting finishes.

Hiding a Joint

Usually when you bond two pieces of plastic together in a model assembly, you will still be able to see the joint. You can hide the joint in several ways. First, if the surface on both sides of the joint doesn't have rivets, scribe lines, or special texturing, you can "paint out" the joint using liquid solvent plastic cement. Just paint it on; the plastic softens; and as the plastic softens and you continue to paint with the brush, the plastic will flow together and even out. Or you can go after the joint with a knife, a file, and/or some No.400 sandpaper to smooth it out.

Usually, the very fine scratches left in plastic by No.400 sandpaper will be filled and smoothed out by the paint you later apply.

Painting Plastics

If you want to be absolutely sure that you get a good, smooth, even paint job on your plastic model,you should wash all the plastic parts in warm water and detergent before you start to assemble the parts. This will remove most oils, greases, or silicone mold release compounds that the manufacturer had to use. Wash them on their plastic runners or "trees" in a collander or seive so that the important little parts don't accidentally break off and go down the drain. Let the washed parts "air dry" rather than wiping them with a towel. Later, just before you get ready to paint the assembled model, wipe it down with a dry cloth, then with a wet sponge, to get the grease and oil from your fingers off.

Many modelers do not paint their plastic models at all. Most models today are molded in color. But if you want a realistic model, paint it. There is a reason for this. Colored plastic does not reflect light from its surface; the light penetrates and reflects back from the interior of the plastic. This is why plastic looks like plastic. The real prototype of your model reflected light from its surface, not from within it. When you paint your model, it will reflect light and color from its surface just like the real thing. And it will look more realistic.

Most modelers have learned to use flat, non-reflective, or non-shiny paints for their models unless the real prototype, in the case of a scale model, had a glossy, mirror-like finish. One of the ways that professional model makers for the movies or TV hide the small size of their models on-camera is to

(Continued on page 47)

PHOTO GALLERY

Readers are invited to submit photographs of their model rockets for publication on this page. Our staff will select those photographs having superior quality and composition for inclusion in the **Model Rocketry** *Photo Gallery. Send your photos to:*

Photo Gallery
Model Rocketry
Box 214
Boston, Massachusetts 02123

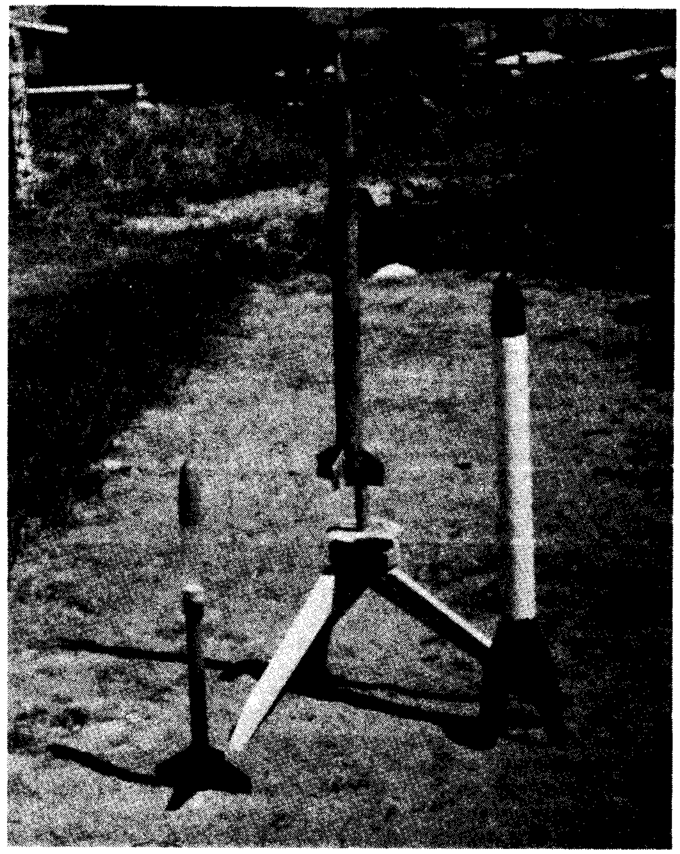


Photo by Scott Gladden

The Arcas, X-Ray, and Bertha stand ready for flight.

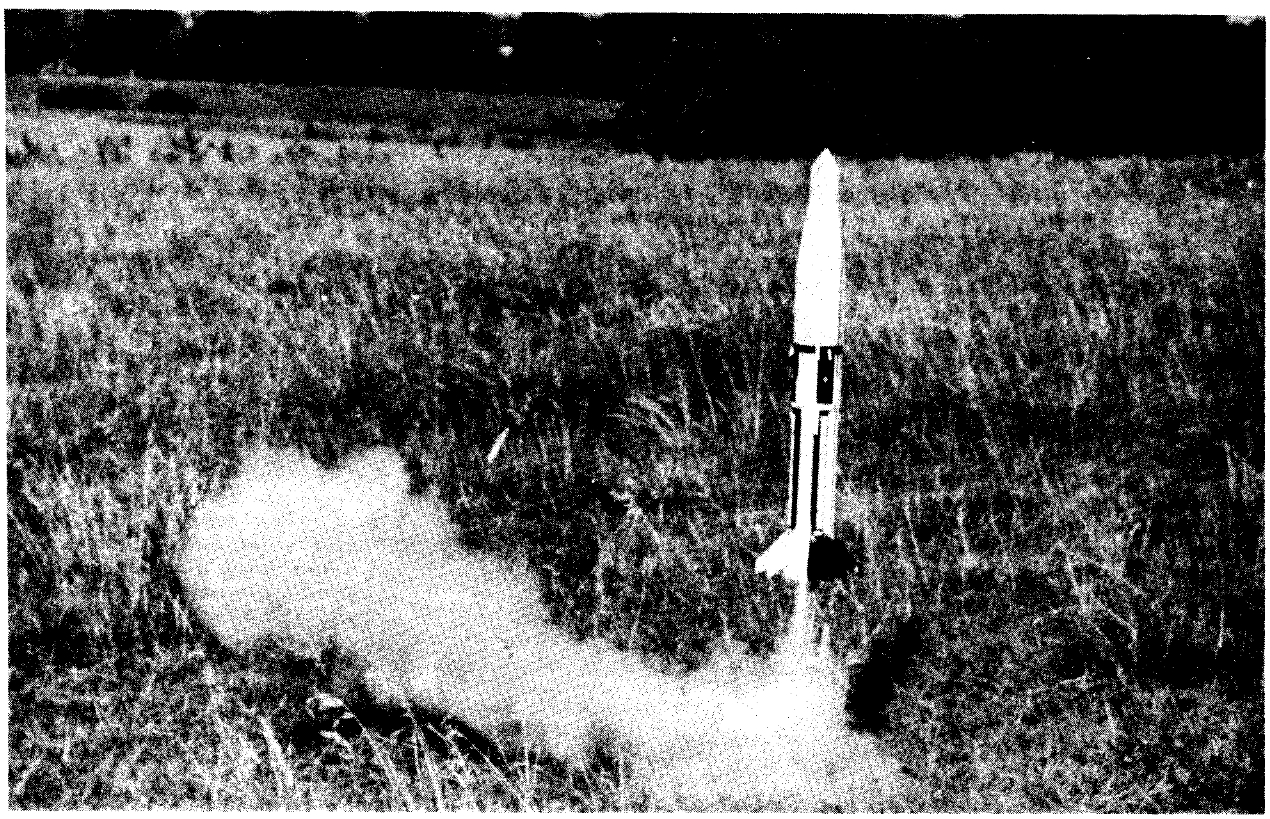


Photo by Duncan Dlugos

Liftoff! Another scale Saturn streaks skyward.

Houston Sports Association Photo

Saturn V lifts off from the 50-yard line before 55,000 fans in the Astrodome.

APOLLO-NASA LAUNCHES IN ASTRODOME

55,200 Spectators and National TV Audience Witness Blue Bonnet Bowl Spectacular

The model rocket highlight of 1969 was staged by Houston's Apollo-NASA Section before over 50,000 spectators and millions of TV viewers. During halftime of the Bluebonnet Bowl the Apollo-NASA demonstration team fired a salvo of small rockets, followed by a scale Saturn V launch, providing New Year's Eve entertainment for the football fans gathered in the Houston Astrodome.

This model rocket spectacular, the first launch ever broadcast on live national TV, came about as a result of a concentration of effort on the part of Apollo-NASA members to bring the club to the attention of local citizens. Earlier in the year, the club sent literature describing the model rocket hobby to the Houston area news media, public officials, and shoools. Among the people contacted was Paul Haney, formerly NASA's "Voice of Apollo" and now in charge of public relations for the Astrodome. Haney attended one of the club's launches and was presented with a Centuri Little Joe II, which Apollo-NASA Senior Advisor Forrest McDowell had constructed for the occasion. Haney was intrigued by the possibility of a launch in the Dome. Club members convinced him that model rockets could be flown safely indoors, and without smashing into the 194 foot high roof. Planning for the launch began.

On December 11 the Apollo-NASA demonstration team of Gary King, Barry Friedrichs, Ben Russell, Forrest McDowell Jr., Mark Evans, Daniel Vincent, Forrest McDowell III, and Chris McDowell, accompanied by Paul Haney, conducted the first model rocket launch in the dome. The historical first rocket off the pad inside the dome was an Estes V-2 powered by a ½A engine. Next up was an orbital transport powered by a B3-3. Then came another first — Forrest Mc Dowell III, eight-year-old son of the Apollo-NASA Senior Advisor, fired an A engine powered Alpha, which promptly became the first rocket to power prang on the way up — it hit the roof! Paul

Haney brought out his Little Joe II, modified for the new Estes D engine. It flew straight to the cieling, deployed its 'chute, and tangled in one of the beams. At last report, the Little Joe II was still hanging from the ceiling. Based on the success that after [illegible], plans moved forward for the Blue Bonnet Bowl launch.

As with any demonstration launch, a Saturn V was a must. But how? Cluster launching on live national TV? How about the new Estes D engine? Too powerful! A quick check of the Malewicki altitude curve (printed elsewhere in this issue) shows over 200 feet for a Saturn V powered by the new D. Pranging into the ceiling before 50,000 spectators would be a bit embarassing.

Estes Industries came to the rescue with the promise of a special engine for the Astrodome launch. Ed Brown of the engine manufacturing department prepared the special 15.5 nt.-sec. engines, designed to take the model to within 20 feet of the Astrodome roof. A number of the engines were test-flown in a Saturn V at the Estes plant. None flew as high as the 194 foot roof of the Astrodome, so a shipment of D's certified not to hit the roof if used in a standard Saturn V was sent to Apollo-NASA. Just to be sure, though, two additional practice launchings were held in the Astrodome before the big day.

It was decided, since college football rules specify the time available to each band during halftime, that the rocket demonstration would last only about four minutes. Just time for the launching of a salvo of small rockets from each end of the field followed by the Saturn V launch from the 50-y[illegible]ne. Mark Evans began construction of the Estes Saturn V to be used in the demonstration, while Bob DeLeon constructed the launch tower (note the detail shown in the cover photo). Just to be sure, a complete backup system was constructed. Maurice Stubblefield built another Saturn V, this one by Centuri, while F. McDowell built the back-up tower. The small rockets used in the demonstration were built on an assembly-line process at McDowell's house by Mark Evans, Barry Freidrichs, and Forrest McDowell while Forrest McDowell III prepared all the 'chutes. Ray Runnels completely rewired two of the club's six launch racks for the occasion.

Vern and Gleda Estes and Bill and Gail Simon from Estes Industries and Leroy and Betty Piester from Centuri Engineering came to town to witness the event.

During the half-time, six rockets were set up on launchers under each goal post. The firing was scheduled to occur after both bands had finished their performances. But, as the first band was leaving the field, the countdown began. The lights went off in the Dome, and the streaks of 12 Alphas, Javelins, and a Starfire were seen criscrossing the field. The lights were turned on, and the birds could be seen slowly drifting down on their parachutes. TV coverage provided by the Hughes Sports Network was excellent; the cameramen caught the liftoff and followed a rocket to the ground.

T[illegible]otlight shifted to the 50-yard line where Mark Evans and Darrel Vincent were

Photo by Mark Evans

Gary King and Barry Freidrichs pose with a Saturn V and V-2 after the December 11 launch, the first inside the Astrodome (in background).

Apollo-NASA Photo

Paul Haney, who assisted with the arrangements for the Dome launch, prepares to fire his Little Joe II at another Apollo-NASA launch.

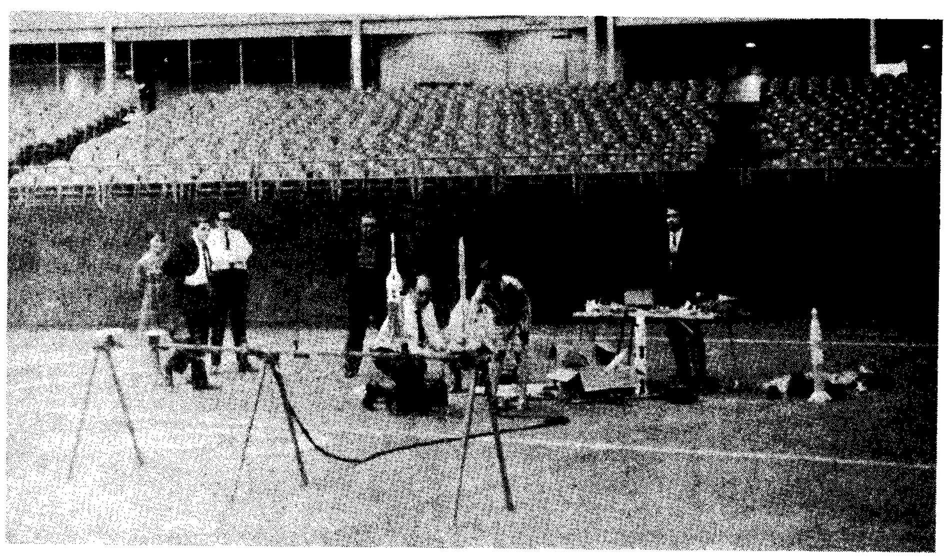
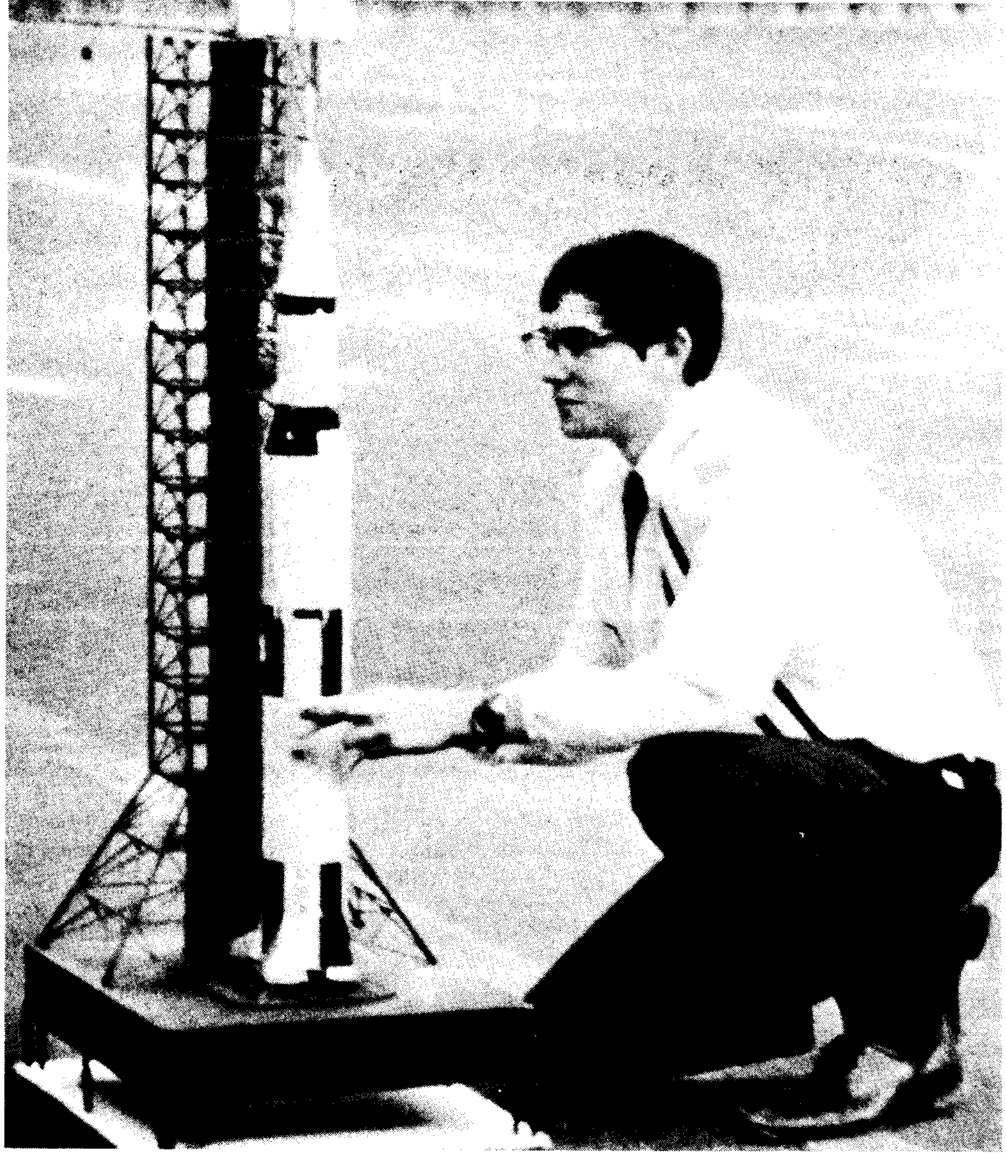


Photo by Ben Russell

Apollo-NASA prepares a demonstration launch for the Houston Sports Association. One of a series of practice shots before the Bowl event.



Estes Industries Photo

Mark Evans (above) prepares the Estes Saturn V for launch from the 50-yard line. The rocket, which was built by Mark, was flown twice in practice and then on national TV during the Blue Bonnet Bowl. At the same time Forrest McDowell (below) and other Apollo-NASA members prepared twelve smaller rockets for firing from the end-zones. These rockets had flourescent-coloured fins, black nose cones, and bodies covered with metallic wrapping paper.

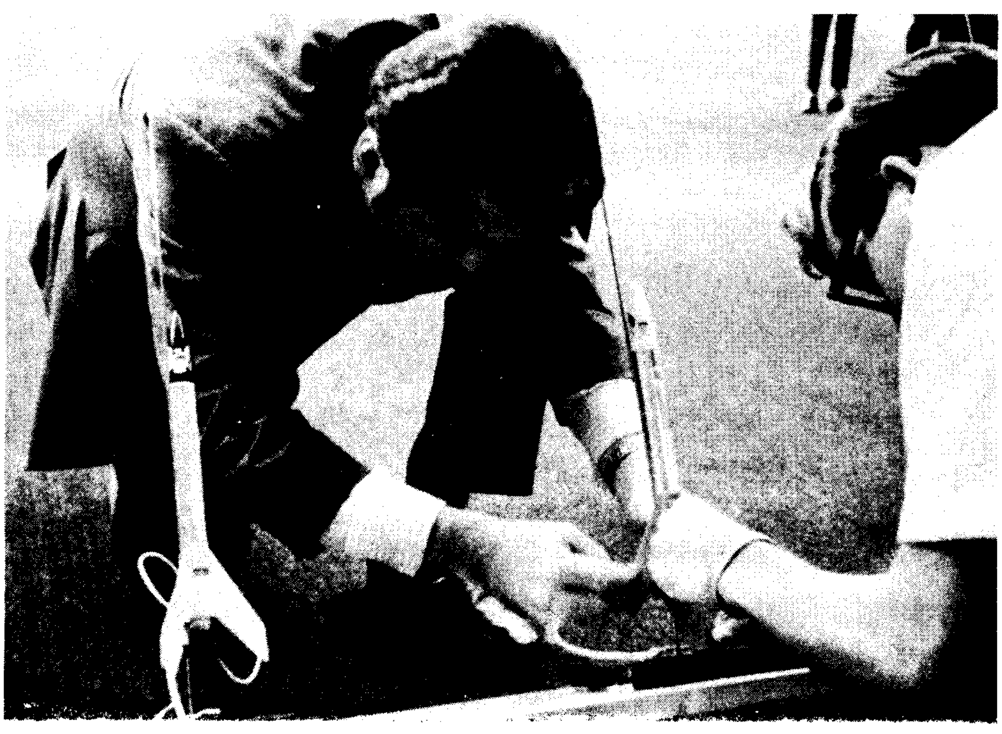


Photo by Ben Russell

Forrest McDowell presents one of the salvo rockets to the Bowl Queen.

preparing the Saturn V for launch. A cheer went up from the 50,000 fans as the countdown reached zero and the Saturn lifted from the pad. It climbed towards the ceiling, the parachute deployed, and it was recovered successfully. Again the TV cameramen did a remarkable job, allowing the Saturn to climb majestically out of the fields of their cameras and then picking it up again as it drifted slowly down under the 'chute.

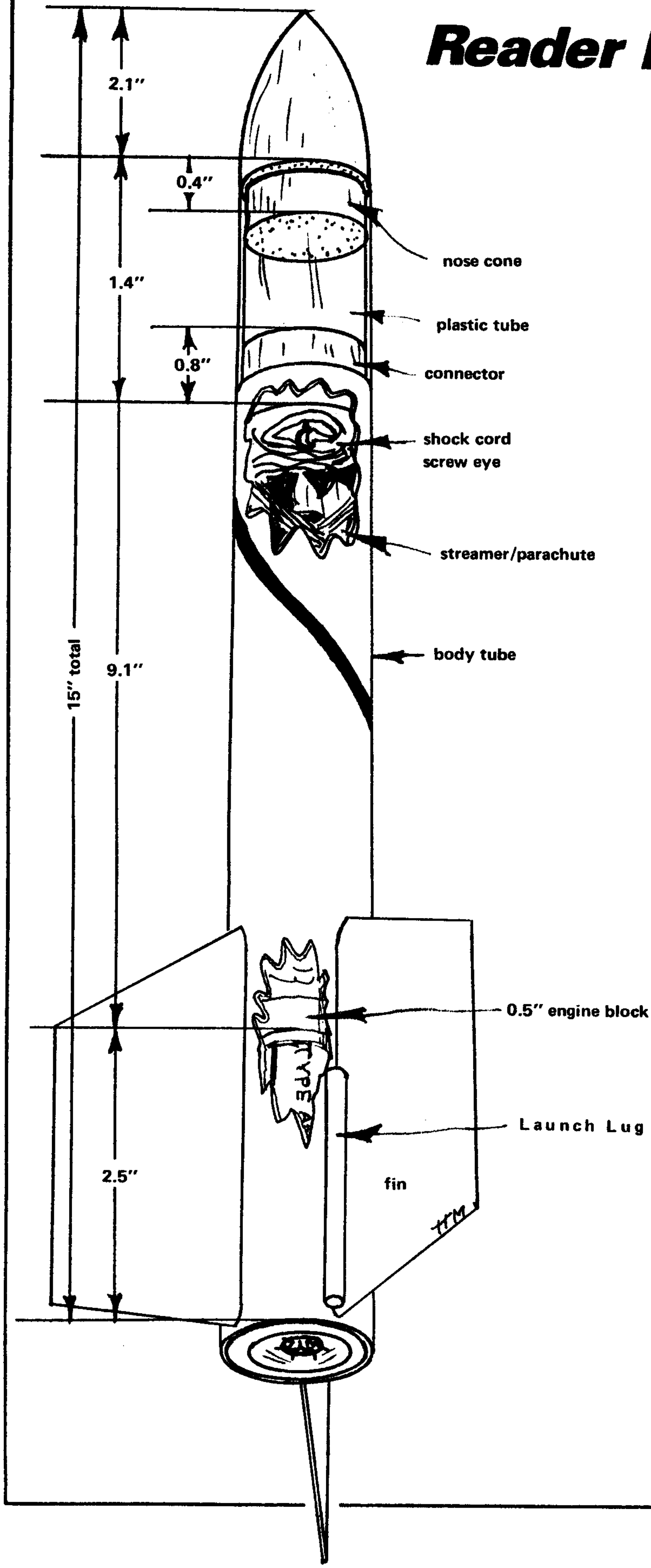
Following the launch, rockets from the salvo were presented to the Bowl queen and her alternates as well as to Betty Piester, Gleda Estes, and Gail Simon.

The demonstration launch generated a great amount of publicity for model rocketry, Apollo-NASA, and the NAR. Apollo-NASA, however, doesn't consider this a one-time event. They have demonstrated that launchings in conjunction with major sports presentations are practical, and have several more in the planning stage. With the increasing number of scale models on the market, Apollo-NASA plans to present a history of space exploration illustrated with scale-model rocket launchings. No date has yet been set, but keep watching your TV, for you will probably hear again this year, "Now, live from the Houston Astrodome, Apollo-NASA presents . . ."

Estes Industries Photo

Mark Evans and Vern Estes hold two rockets flown in the Astrodome launch.

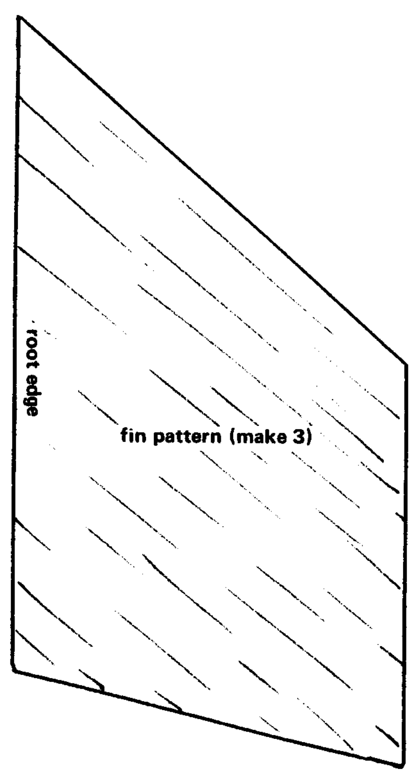
Reader Design Page



This month's Reader Design, the *Avion 2*, was submitted by Eric Christiansen of Jerome, Idaho. This altitude model is designed especially for use with FSI A to D class engines. Parts required are a Centuri BC-80 nose cone, a CPT-80 payload tube, two BTC-8 connectors, one ST-818 body tube, one LL-1 launch lug, fin balsa, and a recovery system.

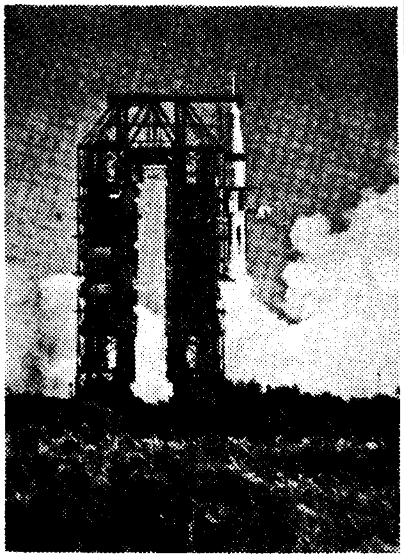
Each month **Model Rocketry** will award a $5.00 prize for the best original rocket design submitted by a reader during the preceding month. To be eligible for this prize, entries should be carefully drawn in black ink on a single sheet of 8½ by 11 paper. Sufficient information should be contained in the drawing so that the rocket can be constructed without any additional information.

Submit entries to:
Rocket Design
Model Rocketry
Box 214
Boston, Mass., 02123



SPECIAL OFFER!

Beautiful, full-color photograph of the Apollo 7, Saturn 1B liftoff of October, 1968



This magnificent photograph of a most historic moment in the history of spaceflight was obtained by **Model Rocketry** editor George Flynn from an advance position not accessible to most Kennedy Space Center visitors. Showing the moment of liftoff, this 7 by 8 inch full-color print will make an inspiring addition to the album of any space enthusiast.

Full-color copies of the photograph, which is reproduced in black and white above, may be obtained by sending 50¢, or $1.00 for 3, to:

Saturn Photo
Model Rocketry
Box 214
Boston, Mass. 02123

For Twin-E Egglofting Power

Build the *Challenger*

by James C. Worthen

The Challenger was developed in an effort to find a dependable, competitive egglofting bird and eliminate the problems of three-engine cluster ignition.

My first experiments with a single FSI E engine in a 1.6" diameter body tube proved to be unacceptable. I discovered that the high-impulse lift-offs that are available from the smaller engines are not available from E engines presently on the market. The slow take-offs, particularly with an egg on board, allowed the model to weathercock severly in the slightest breeze.

So, proceeding to the next logical step, why not two E engines? Although this meant returning to cluster ignition, experience has shown a much higher percentage of success with two-engine clusters than with three; besides, two E's would be almost twice as good as one. However, two E engines in holder tubes measure 1.82"; the inside of the standard 1.6" diameter tube measures 1.595". At first only two choices were apparant: move up to the new BT-70 [2.175" diameter] with vastly increased weight and frontal area, or cut the 1.6" tube and mount the engine holder tubes partly exposed, accepting a tremendous increase in drag from the broken surface.

Then a fellow model rocketeer suggested flattening the 1.6" tube slightly so that the tubes might be inserted. In this manner the frontal area is only slightly increased and a smooth transition is provided from the circular rocket body to the ellipsoidal portion containing the engines.

By mounting the engines in this manner and using four fins to maintain symmetry, I have a dependable eggloft rocket that will consistently fly to altitudes in excess of 600 meters. The Challenger was, unfortunately, among the senior entries at this year's Nationals which were disqualified due to lack of closed tracks.

Construction

Assemble engine holders first, securely gluing motor mounts to forward ends of .9" dia. x 3.75" tubes. If the FSI shock cord is to be employed, it must be included in the setting of one of the motor mounts. If standard shock cord attachhment, is to be used, it can be completed later, but don't forget it.

*Caution: FSI MM202 *must* be used because pressure from flattened 1.6" dia. tube will crush balsa or paper engine blocks.

Next, lay the two engine holder tubes on a flat surface and glue them together. While these are drying, hollow out nose cone and nose block. This may be done with a drill and rotary file or by carefully cutting them in half, hollowing them with the appropriate tools, and gluing them back together again. This operation is strictly a weight-reduction process; it can add as much as ten to twenty-five meters to the final altitude.

Glue the nose block into the 4" section of 1.6" dia. tube. Sand the nose cone carefully to match the tube in order to hold drag at the joint to a minimum. The payload section and engine holders are now complete.

To install the engine holders in the rocket body, first moisten the tube slightly by holding it over steam and slowly but firmly squeeze the sides of the tube until the engine holder assembly will slide in. Slide engine holder assembly in so that after end is flush with that of the body tube and remove from steam. Allow to dry throughly [one to two hours], then remove engine holder assembly and apply glue to the inside of the body tube where engine holder will make contact. Reinstall the engine holder, setting the rocket aside to dry.

Cut fins from 1/8" balsa stock and sand a symmetrical airfoil, rounding leading edge and tapering trailing edge. Before installing fins insure that sufficient glue has been use to secure the engine holder assembly in the rocket body. This can be done with a brush or dowel, spreading the glue along the entire area of contact. Then fill open areas around engine holders to prevent ejection gases from escaping through the after end. This may be accomplished in a number of ways, but I prefer a glue and tissue putty method.

When this has set, glue fins to body at locations as indicated in the drawing. While extra coats of balsa filler and paint may add a small amount of weight, it will be more than compensated for by the streamlining and reduced drag. Each coat should be rubbed down with 600 grit sandpaper or steel wool for the best finish.

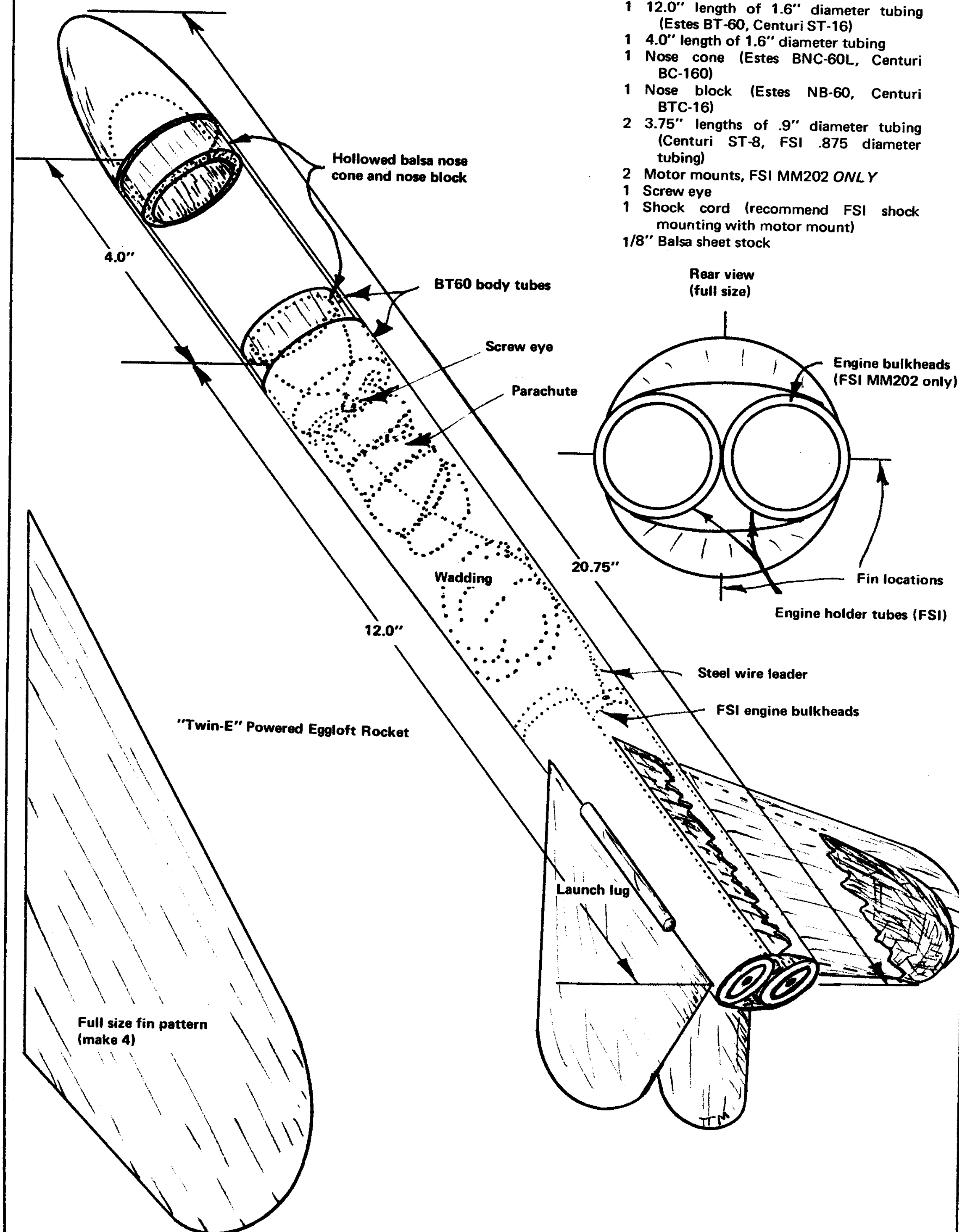
To gain maximum altitude, the Challenger should be flown from a tower, thus eliminating the launch lug. If you install a launch lug, mount it six inches forward of the tail, and be sure it is on a side between engines, since otherwise it will ride the body tube where it is expanded to accomodate the engines.

The Challenger can be recovered using a single 18" diameter parachute or two smaller ones allowing the model to come down in two serarate parts, which is a much safer way of insuring the safe return of the egg.

***Caution**: Since the Challenger was specifically designed for carrying an egg, special precautions should be exercized to be sure that the model is stable if you desi to fly it without the egg payload.

Parts List

1 12.0" length of 1.6" diameter tubing (Estes BT-60, Centuri ST-16)
1 4.0" length of 1.6" diameter tubing
1 Nose cone (Estes BNC-60L, Centuri BC-160)
1 Nose block (Estes NB-60, Centuri BTC-16)
2 3.75" lengths of .9" diameter tubing (Centuri ST-8, FSI .875 diameter tubing)
2 Motor mounts, FSI MM202 *ONLY*
1 Screw eye
1 Shock cord (recommend FSI shock mounting with motor mount)
1/8" Balsa sheet stock



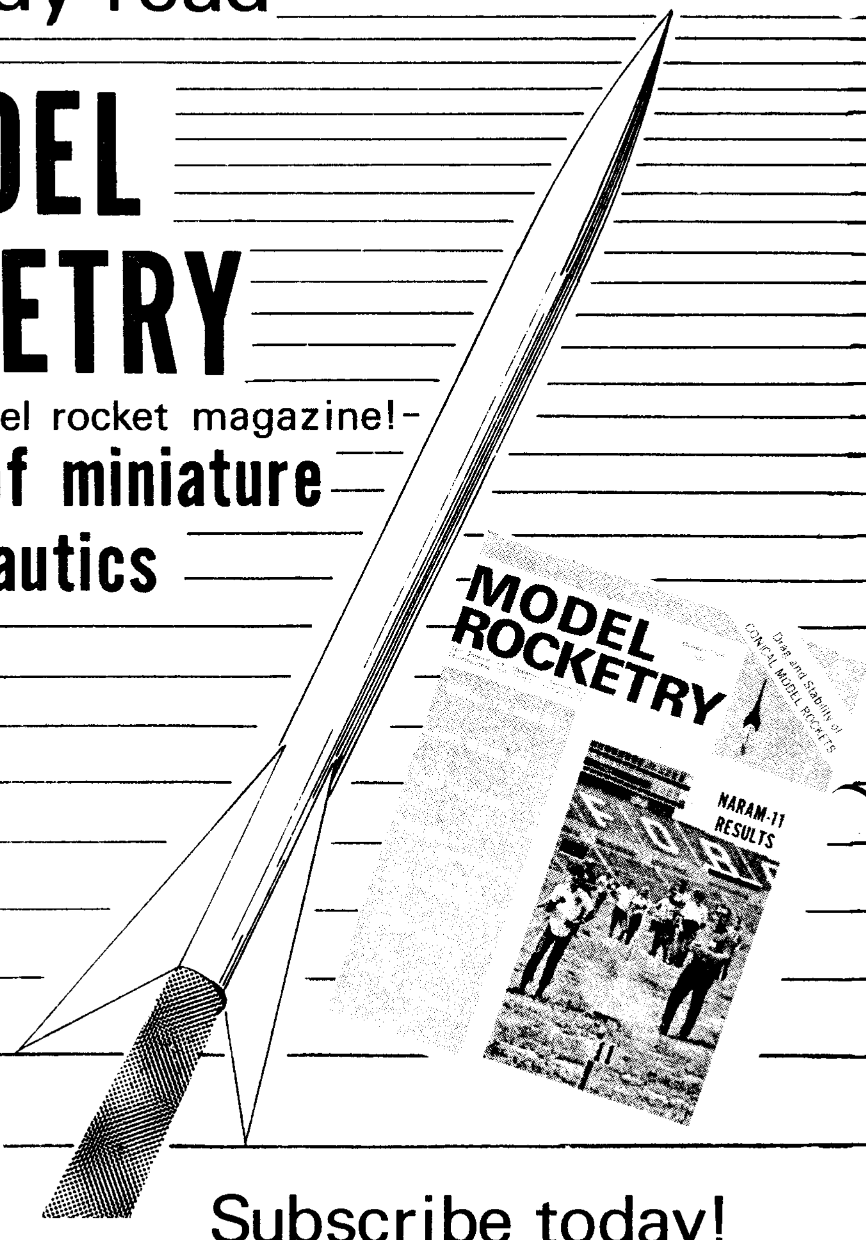
"Twin-E" Powered Eggloft Rocket

If you're a *serious* model rocketeer you already read

MODEL ROCKETRY

The only monthly model rocket magazine!

the journal of miniature astronautics



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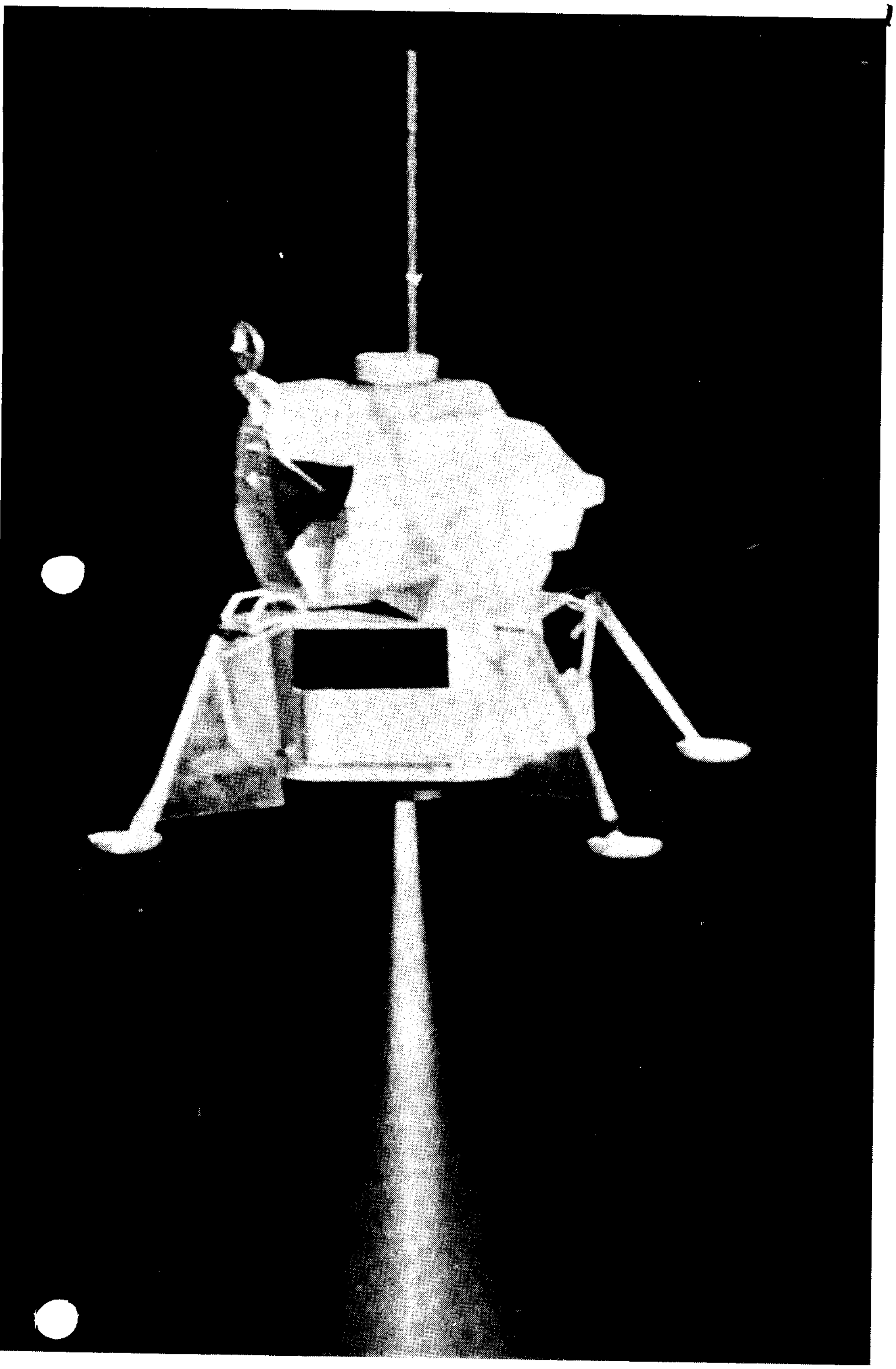
the Escape Tower

by Tom Milkie



A FLYING LEM?

Several months ago, I made the casual remark that maybe there was a way to build a flying scale model Lunar Excursion Module. Everyone knows that the LEM, due to its awkward shape, is impossible to make stable. Paul Tuinenga of Homewood, Illinois, says no!. He sent some nice plans for converting the Revell 1/48 scale LEM for model rocket power. It appears as though he built the model and it flies stably. I couldn't resist the temptation when I saw his plans, so now I also have a semi-scale flying LEM. I made a few changes in his suggestions to make the design sturdier, as are outlined below.

Construction can begin with the completed and painted Revell model, but some inside work is necessary if you wish to use wire legs.

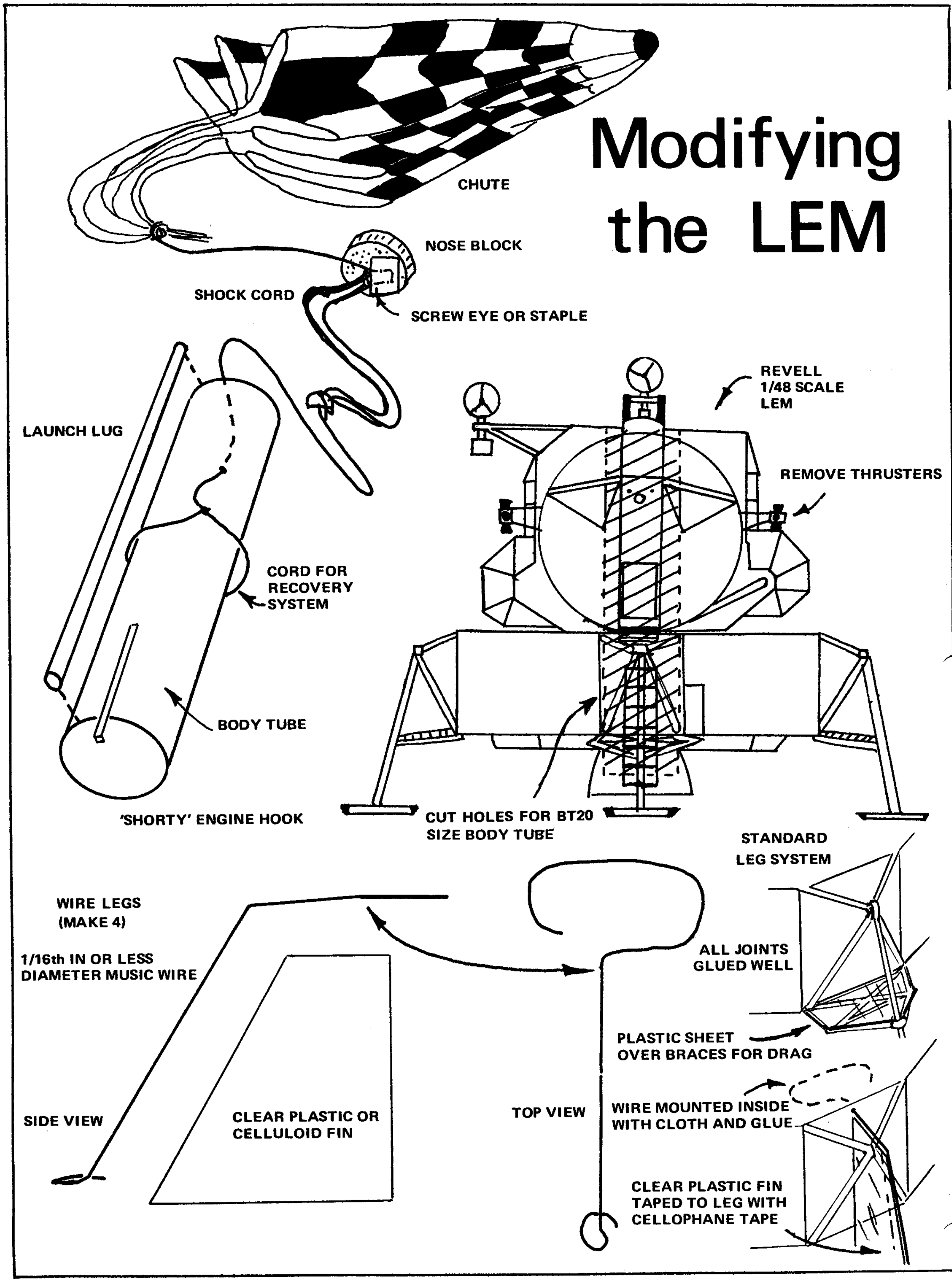
First hack a hole straight through the different pieces to pass a BT-20 size tube. You can drill or hack away with an X-Acto knife and a soldering gun. The descent engine will have to have the top cut off to fit over the tube. Also cut a slot beside the large hole for a launch lug.

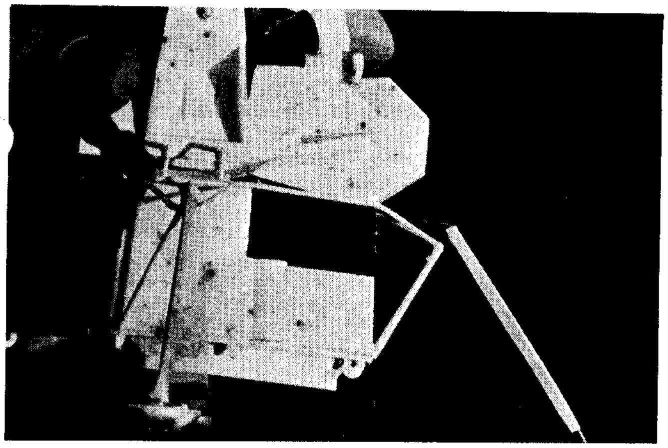
The tube that is the heart of the rocket should be cut so that it is exactly flush with the top of the LEM. Attach a line to the tube on the outside and run it in to the tube. This will be attached to a shock cord and a (standard) recovery system. There is only enough room to use short engines in the tube. Since removal of engines is a problem, I would suggest using a wire engine hook to retain the engine. Glue a straw on the side of the tube, equal in length to it, as a launch lug.

The nose cone is merely a disk cut from an adapter or nose cone or a nose block, sealed and painted to look like a hatch. The tiny black thrusters on the sides of the LEM may be broken off if left on, so cut them off. Other weight reduction, such as removing the astronaut, would help the poor weight situation.

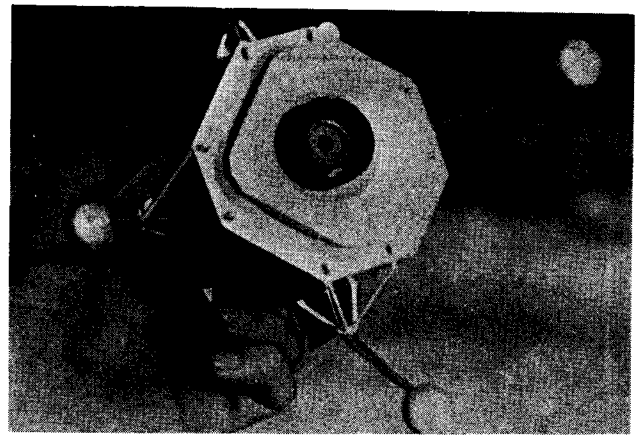
Paul suggests using the landing gear fin system shown in the diagram. This is just the kit gear, glued in place, with a sheet of clear plastic material glued horizontally over the struts to move the CP rearward and thus make the vehicle stable. What I did involves a little more work. With the bottom plate of the descent engine removed, drill holes in the center, at the top, of the four leg

Modifying the LEM





Clear plastic fins are attached to the LEM kit between the landing legs and the body.



A short A-engine is mounted in the descent stage, at the center the nozzle.

positions and insert the 1/16 inch (or smaller) music wire legs, bent in the shape shown. Then, using cloth and lots of plastic cement, carefully mount the legs on the inside of the descent engine top piece. Glue together the upper two leg support sections after cutting the pieces shorter and bending them to keep them out of the way of the flexing wire leg. Discard the bottom two sections. Now slit the leg sections vertically so that a vertical plastic fin can be slipped in and attached to the leg. Attach this to the music wire with a strip of ¼ inch wide cellophane tape.

The feet can be attached by heating the end loop of the music wire legs and pressing them into the plastic. Lots of epoxy cement will also work. Cover the top of the foot with cotton filled with white glue or a filler such as model putty or balsa filler.

Power is provided bv the new Estes short A's (A5-2S). This plastic rocket is quite heavy, so altitude even with A engines is not too good.

Not challenging enough? How about separate descent and ascent engines with a delay between the two?

Book Review

German Secret Weapons: A Prelude to Mars

by G. Harry Stine

German Secret Weapons: Blueprint for Mars, by Brian Ford; Ballantine Books, Inc., 101 Fifth Avenue, New York, New York 10003, first printing October 1969; paperbound; 160 pages; $1.00.

This book has some lovely historical photographs in it, but it is riddled with errors to the extent that its value as a historical reference is highly questionable. I intend to catalouge herein some of those that I found in my own particular field of aerospace history.

On page 42 is a photo of Johannes Winkler, but to claim that he flew the first camera rocket is incorrect. The German Maul camera rocket was flying and taking photos before World War I.

The drawing of the A4 (V-2) combustion chamber on page 50 states in the caption that the graphs are recorded firing data . . . which is nonsense because the graphs show the pressures, velocities, and temperatures inside the chamber and nozzle at various points along the length of the chamber. On the following page, a cutaway drawing of the A4 shows the smaller, simpler single-plate injector type of combustion chamber which was tested at Peenemunde but which was never put into production at Nordnausen. None of these simple single-plate injectors found their way to the US for the V-2 program at White Sands.

On page 62 is a fine photo of the tail section of an experimental Peenemunde A4. The caption claims that the insignia on the tail cone is that of an operational unit whereas it is actually the emblem of that particular round. Most early Peenemunde A4's up to the number 50 carried some sort of special emblem which was most assuredly not that of an operational unit.

Another error appears on page 68 in the text, which reports that the Schmidt pulse-jet of the Feisler Fi-103 (V-1) would not work unless the vehicle had air speed. The author has confused the pulse jet with a ram jet. The Schmidt duct will certainly operate and produce thrust while at rest.

On page 69, the photograph of the A4 on its Meilerwagen is a wooden mock-up, a dummy. I have an original print of this photo. The Meilerwagen is one of the very first prototypes. In the photo, they are checking things out at Test Stand VII at Peenemunde.

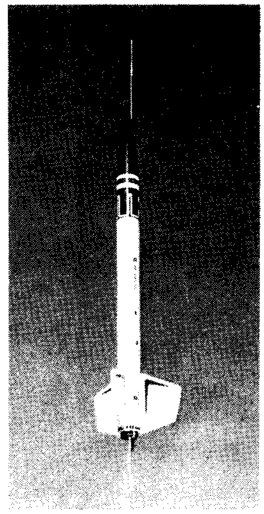
These were the major mistakes of interest to rocket modelers that I found in the book. There were many others relating to German aircraft and other weapons developed by the Germans during World War II.

Model Rocketeers will be interested in the drawings of the **Rheintochter, Rheinbote, Wasserfall,** and **Enzian** published herin. I cannot at this time vouch for the authenticity of the drawings and sketches of these vehicles, as I have not yet had the opportunity to check them against those in my own files and those of the Smithsonian.

This book is part of a Ballentine series relating to World War II. I have found a few mistakes in some of the other books, too. This is an unforgivable historical sin, since thousands of people will read this misinformation and it will be reproduced and quoted through the years until it becomes as fact. Thus are history books often written - history was once defined as an incorrect record of things that never happened by people who were not there.

However, the late Willy Ley left a legacy which says, "Tell it like it was. Tell it like it is." Willy Ley would not have been guilty of the errors in Ford's book. Ley was too thorough, too much a Teutonic perfectionist, and only too well aware of the fact that tiny errors in historical documentation seem to be the ones which are perpetuated until it is too late to separate them from what really did happen.

I therefore cannot vouch for much of the historical accuracy of Ford's book; there are too many errors in it which were apparant to me in my own field. It's an interesting book full of many photos which have not been widely reproduced elsewhere. Buy it for these, but don't use it for scale data or as a historical "Bible" of German rocket development.



Cherokee-D, powered by the new Estes Industries class D engine.

Estes Introduces D-Engines

D Engine Specifications

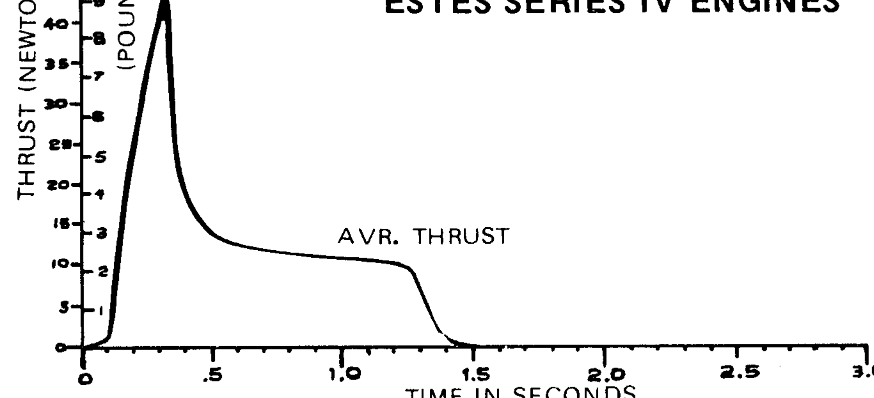
Delay times	**0,3,5,7 sec.**
Total Impulse	**4.48 lb-sec**
	20.00 nt-sec
Ave. Thrust	**2.99 lb**
	13.00 nt
Prop. Weight	**.055 lb**
	24.93 gm
Thrust Dur.	**1.50 sec.**
Max. Thrust	**9.0 lb**
Weight	**1.5 oz**
Length	**2.75 in**
Diameter	**0.945 in**

Series IV engines, in the D-engine classification, have been introduced by Estes Industries. The new engines, producing 13 newtons average thrust for about 1.5 seconds will have a total impulse of approximately 20 newton-seconds. With a propellant weight of 24.9 grams, the new engines will be 2.75 inches ling and 0.945 inches in diameter. Available with 0, 3, 5, and 7 second delay trains, the new D's are suitable for booster, single-stage, or upper-stage use. These new engines are available at $.75 each or 3 for $2.

The D engine weighs about twice as much as a Series I or II engine. This results in a rearward concentration of weight which must be allowed for in the design of D engined models. Estes has introduced the **Cherokee D**, an altitude rocket especially designed for the new engine. An adapter to convert your present Saturn V to a single D for flights to over 200 feet is also available.

Estes' tests indicate that it is not necessary to tape D engines together when multi-staging. However, the rocket must be built so that the stages slide apart in a straight line when they separate.

AVERAGE TIME/THRUST CURVE
ESTES SERIES IV ENGINES



D-13 Engine Altitude Charts

The following four graphs will allow you to establish the total flight performance picture of rockets powered by the new Estes "D13" engine. If you have TIR-100 (reference 1), you will know how to use these graphs. Similarly, if you have Estes TR-10 (reference 2), you will also be aware of the theoretical basis for the graphs, the actual equations involved, and the limiting assumptions of the mathematical simulation.

In the next issue of **Model Rocketry** we will present several "D13" sample problems. Note that we *will not* review any of the *basic* material and example applications covered in the earlier works on altitude prediction. Instead, we will explore problems on a more advanced level for those who already have the pre-requisite basic understanding. *Those of you who are not familiar with the references should have enough time to obtain them and learn how to utilize the graphs prior to the April issue.*

It is hoped that this more thorough approach will provide the readers of this magazine with further insight into general performance analysis, while simultaneously pointing out the various capabilities of the "D13" engine. At this same time we also intend to clarify some of the more common misinterpretations that have come to my attention. Meanwhile, I would like to suggest that you spend some time seeing just what the "D13" has to offer.

For my own experiments, I initially modified an Estes Constellation kit for the new "D13" engine. She really went and was lost on the first flight—even though I only used a 12 inch diameter chute in order to minimize wind drift.

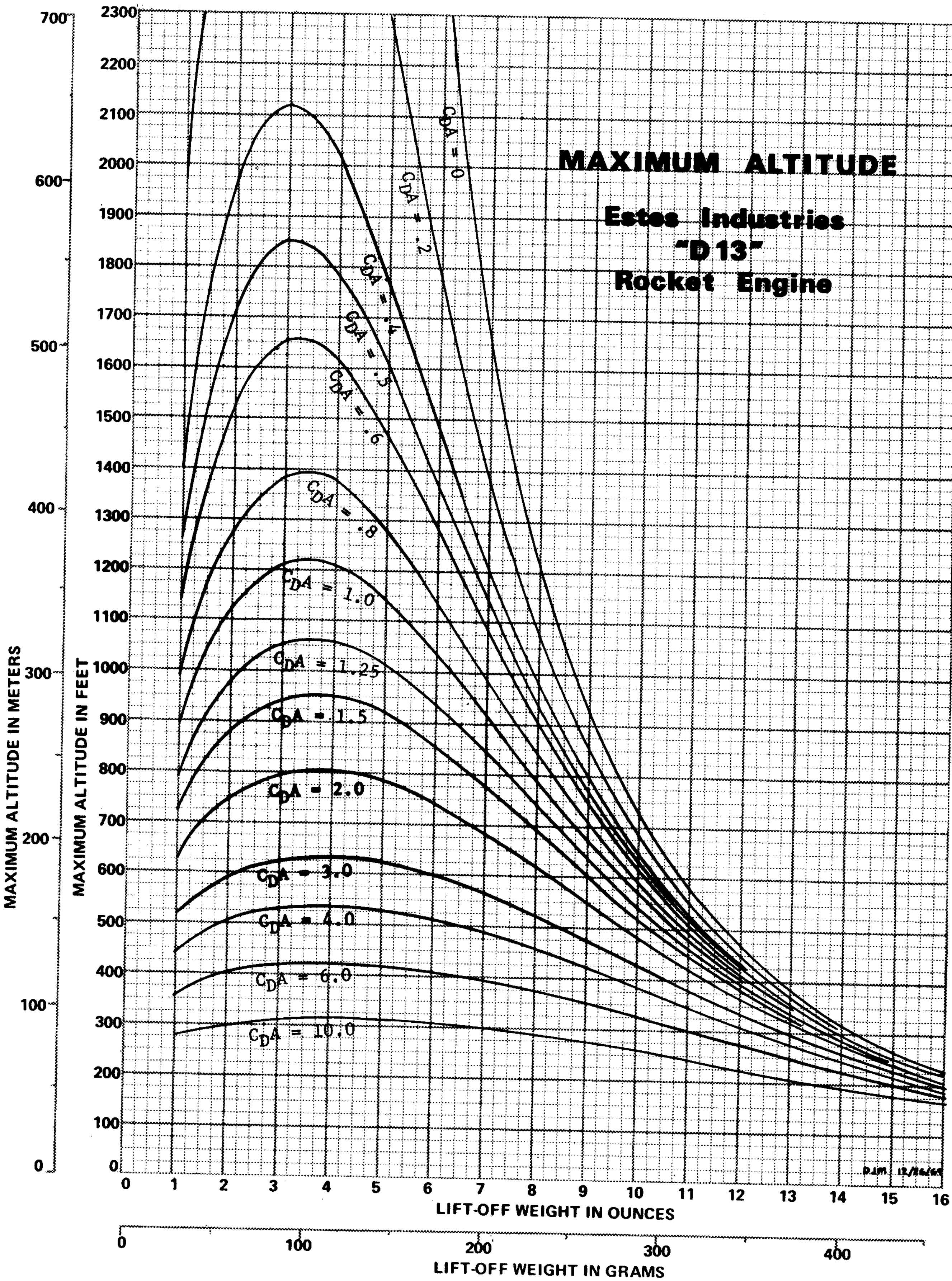
Did you ever see a multi-staged Estes Starlight? That was my second "D13" powered project. I especially chose the starlight for its "desirable" aerodynamic drag characteristics. It was demonstrated as a single stage and then as a multi-stage rocket at the Glen Ellyn Rocket Society's Annual Labor Day Meet. Both flights, needless to say, were quite impressive.

My experimental flights and the analytical graphs both confirm the tremendous load lifting capability of these new engines. This fact, along with the inexpensive price and reliability which we all take for granted with Estes products, have convinced me that the "D13" will become model rocketry's workhorse of the 70's.

Doug Malewicki

1. Douglas Malewicki, Model Rocket Altitude Performance, Technical Information Report TIR-100, published by Centuri Engineering in 1968 ($1.00 postpaid).

2. Douglas Malewicki, Model Rocket Altitude Prediction Charts Including Aerodynamic Drag, Estes Technical Report no. 10 ($.50 postpaid).


MAXIMUM ALTITUDE
Estes Industries
"D 13"
Rocket Engine
MAXIMUM ALTITUDE IN METERS
MAXIMUM ALTITUDE IN FEET
LIFT-OFF WEIGHT IN OUNCES
LIFT-OFF WEIGHT IN GRAMS
$C_DA = 0$
$C_DA = .2$
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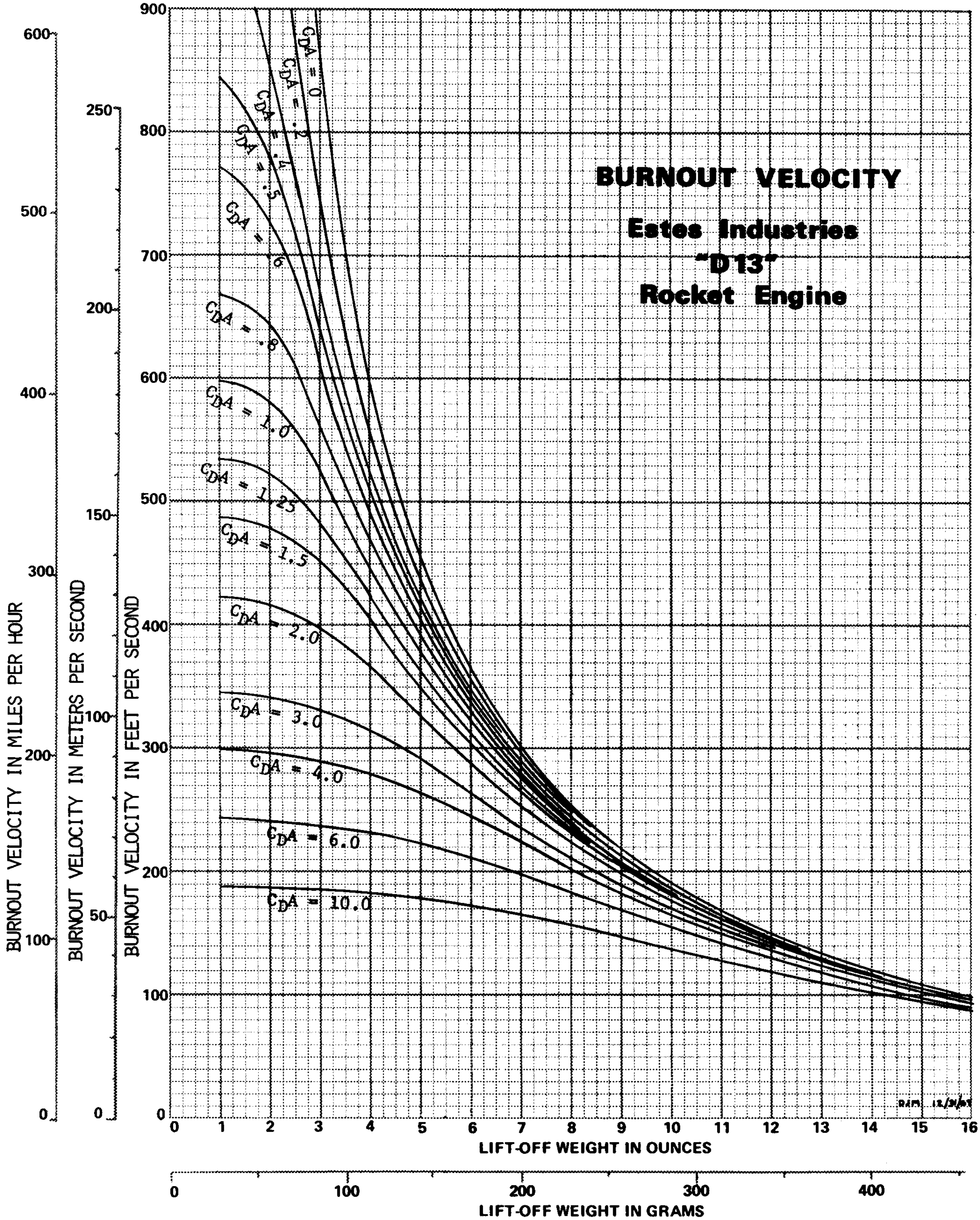

BURNOUT VELOCITY
Estes Industries
"D13"
Rocket Engine
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$C_DA = .2$
$C_DA = .4$
$C_DA = .5$
$C_DA = .6$
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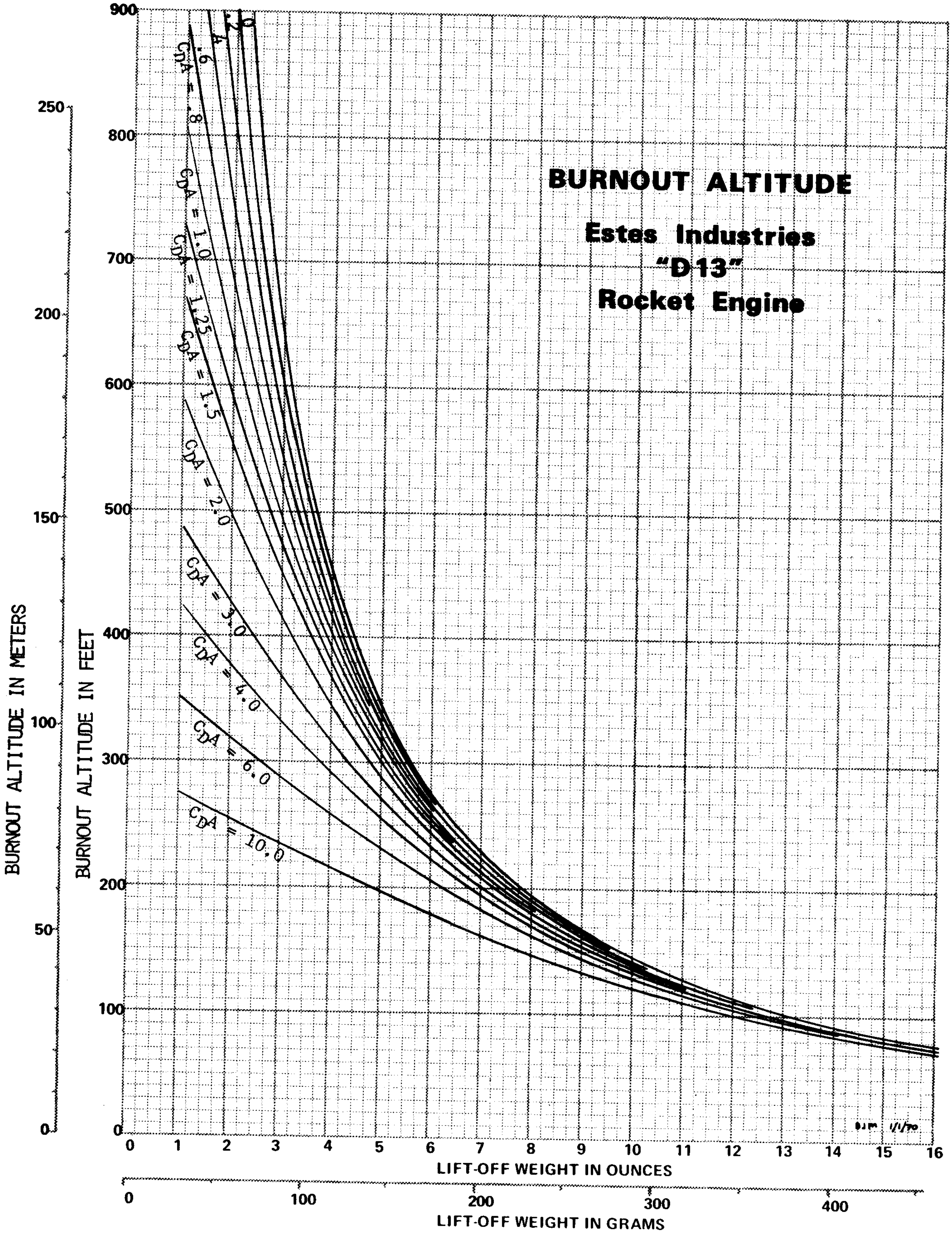
$C_DA = 1.25$
$C_DA = 1.5$
$C_DA = 2.0$
$C_DA = 3.0$
$C_DA = 4.0$
$C_DA = 6.0$
$C_DA = 10.0$
BURNOUT VELOCITY IN MILES PER HOUR
BURNOUT VELOCITY IN METERS PER SECOND
BURNOUT VELOCITY IN FEET PER SECOND
LIFT-OFF WEIGHT IN OUNCES
LIFT-OFF WEIGHT IN GRAMS



BURNOUT ALTITUDE
Estes Industries
"D13"
Rocket Engine
BURNOUT ALTITUDE IN METERS
BURNOUT ALTITUDE IN FEET
LIFT-OFF WEIGHT IN OUNCES
LIFT-OFF WEIGHT IN GRAMS
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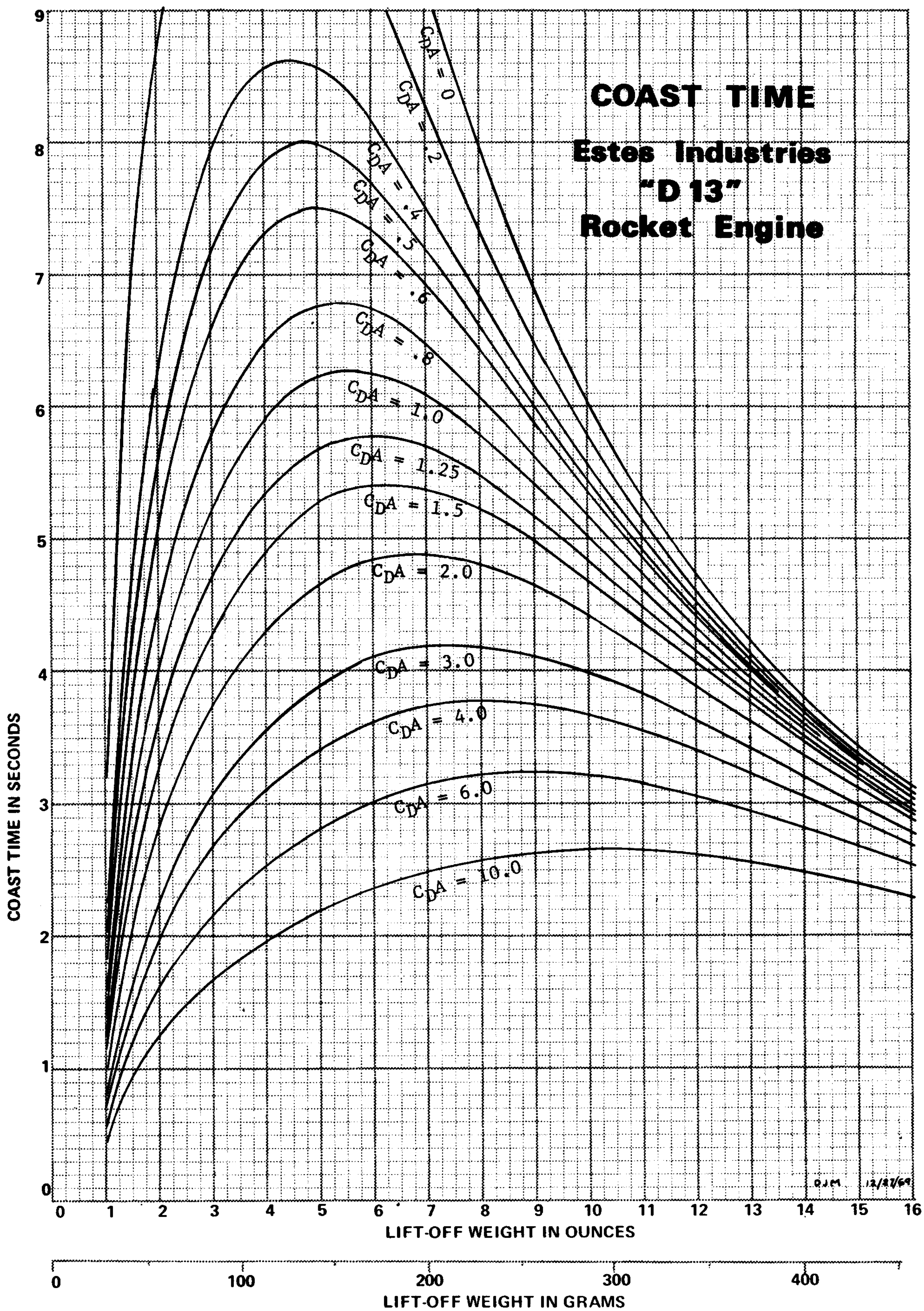
0 100 200 300 400


COAST TIME
Estes Industries
"D 13"
Rocket Engine
COAST TIME IN SECONDS
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LIFT-OFF WEIGHT IN GRAMS
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All photos by Eric Max.

Photographing Model Rockets

by Eric Max

Have you ever tried photographing your model rocket as it lifts off the launching pad, fire and smoke trailing behind? You might want to take pictures just for the fun of doing it or to show your friends when they see your rockets on the shelf and ask "What do they do?" Photos are also a good addition to your flight data sheets.

You can't just walk out to the field with your Instamatic in your hand and expect good results. If you do, you will end up with either a picture of the launch rod and a column of smoke, the column of smoke alone, or a big blur which vaguely resembles your rocket.

Here is the way to go about taking good, clear photos of your rockets:

First, you need a good launching system so that your rocket will ignite the second you push the button. For this you need a good strong battery (car batteries are your best bet), solid electrical connections, and properly installed ignitors.

Second, you need a correct camera. I use a good, high speed 35mm camera. A shutter speed of 1/300 second is too slow and won't work; 1/500 might do if you are lucky; 1/1000 second is best.

Third, you need high-speed film. For black and white photos use Kodak Tri-X. Tri-X has an ASA rating of 400 and will give good results. Kodak High-Speed Ektachrome or GAF Anscochrome 500 will produce good color transparencies.

It's best not to attempt to photograph your rocket if you are also launching it unless you use a tripod and cable release. Besides, you will get a better-looking picture if you have someone in the background rather than just getting the rocket and pad.

Stand fairly close and focus on the rocket, but be sure to include at least the whole rod so the rocket isn't out of the picture when you snap it. Hold the camera steady, signal for the countdown, and at the launch squeeze the shutter.

If after the first few times you find that you keep missing the rocket, don't be discouraged — it takes a while until you are able to time it just right. It depends on how fast your individual reflexes are; I personally wait until I can hear the first noises of the engine igniting and then I snap the picture.

THE MODEL ROCKETEER

NATIONAL ASSOCIATION OF ROCKETRY, Box 178, McLean, Virginia 22101

NARAM-11 Point Changes

On November 14, 1969, a special NARAM-11 review committee met at the request of the NAR Contest Board to review recent facts that could indicate a possible change in the results of the meet. After thorough examination and hand checking the results the committee has arrived at the following conclusions:

Due to reasons unknown to the committee, the computer used to calculate the results of the meet was off from 30 to 400 points on most of the contestants' scores for Wednesday and Thursday of the meet. This could have been the result of mis-punched data cards or other computer error. Because of this error all the results of the meet [in respect to points] were off. This also caused trophies to be given to the wrong persons. The final results of the meet should read as follows:

Championship Section

1st Place . . . . Apollo-NASA Section with 8533 points
2nd Place . . . . MARS Section with 8394 points
3rd Place . . . . . YMCA Space Pioneers Section with 5096 points

Team Championship

1st Place . . . . Sipes Team with 763 points
2nd Place . . . . Ball-Hagedorn Team with 582 points

Senior Division

1st Place . . . . Howard Kuhn with 1373 points
2nd Place . . . . G. Harry Stine with 1052 points

Leader Division

1st Place . . . . Mark Evans with 1643 points
2nd Place . . . . Jim Stevenson with 1358 points

Junior Division

1st Place . . . . Scott Layne with 104 points
2nd Place . . . . Alan Stolzenberg with 932 points

This will result in the transfer of the Section Championship trophy from the MARS Section to the Apollo-NASA Section, the Team Championship trophy from the Ball-Hagedorn Team to the Sipes Team, and the Junior Reserve Championship trophy from Ellie Stine to Alan Stolzenberg.

FAI and US Records Announced

31 December 1969

Federation Aeronautique Internationale records filed by USA:

SINGLE PAYLOAD: Sven R. Englund, NAR 8053, New Canaan, Conn., 296 meters, 11 August 1969. (Tentative)

OPEN PAYLOAD: R. E. Hagedorn, NAR 9338, and D. Ball, NAR 11691, Mansfield, Ohio, 603 meters, 14 August 1969. (Tentative)

PARACHUTE DURATION: J. S. Medina, NAR 14147, Seattle, Washington, 209 seconds, 15 August 1969.

SPARROW BOOST/GLIDE DURATION: E. A. Stine, NAR 1955, New Canaan, Conn., 120 seconds, 14 August 1969.

SWIFT BOOST/GLIDE DURATION: R. B. Dunbar, NAR 10930, New Canaan, Conn., 230 seconds, 22 June 1969.

To our knowledge, at this time these are the only FAI records filed by any nation and must therefore stand at this time as the only FAI categories in which records have been established.

NAR United States Records:

CLASS I PARACHUTE DURATION, SENIOR DIVISION: J. S. Medina, NAR 14147, Seattle, Washington, 209 seconds, 15 August 1969.

SWIFT BOOST/GLIDE DURATION, JUNIOR DIVISION: R. B. Dunbar, NAR 10930, New Canaan, Conn., 230 seconds, 22 June 1969.

SWIFT BOOST/GLIDE DURATION, LEADER DIVISION: R. B. Singer, NAR 6102, Chevy Chase, Md., 275 seconds, 22 August 1968.

SPARROW BOOST/GLIDE DURATION, JUNIOR DIVISION: E. A. Stine, NAR 1955, New Canaan, Conn., 120 seconds, 14 August 1969.

OPEN PAYLOAD, SENIOR DIVISION: R. E. Hagedorn, NAR 9338, and D. Ball, NAR 11691, Mansfield, Ohio, 603 meters, 14 August 1969.

At this time, these are the only USA model rocket performance records that have been homologated by the NAR or are the best of several performances or records that have been filed in each category and age division.

The following records are pending:

FAI:

George Pantalos, NAR 10620, Sparrow B/G

NAR:

Senior:

Harry Stine, NAR 2, Class I Scale Altitude
A. D. Joseph, NAR 12861, Design Efficiency
Sven W. Englund, NAR 8052, Class O Altitude
Dane Boles, NAR 10395, Class O Altitude, Class I Altitude, Pee Wee Payload

Leader:

Norman K. Wood, Jr., NAR 10523, Class I Parachute Duration, Class O Altitude, Class I Altitude, Pee Wee Payload

Junior:

Sven R. Englund, NAR 8053, Class I Scale Altitude
Dane Munro, NAR 12857, Design Efficiency
Gary Jacobsen, NAR 12862, Class O Altitude
Gregory Cutter, NAR 12364, Class I Altitude
Ken Lehmann, NAR 10232, Class O Altitude
Steven Lenhard, NAR 10452, Pee Wee Payload
Bruce A. Reynolds, NAR 12491, Class I Parachute Duration

To the knowledge of the contest board as of 15 January 19, these are the only US or FAI records currently pending.

The Model Rocketeer is published monthly in Model Rocketry magazine by the National Association of Rocketry, Box 178, McLean, Virginia 22101. The National Association of Rocketry, a non-profit educational and charitable organization, is the nationally-recognized association for model rocketry in the United States. Model Rocketry is sent to all NAR members as a part of their membership benefits. NAR officers and trustees may be written to in care of NAR Headquarters. All material for *The Model Rocketeer* should be sent directly to the editor.

The new column flags were designed and drawn by Steve Fentress of the West Covina Section. Steve's artwork will appear regularly in these pages along with that of other artists being recruited. A replacement for the vacant position of Technical Editor has not yet been appointed. The job of Technical Editor is to solicit technical articles and R&D reports from the membership and prepare them for publication in the magazine. I would like to hear from anyone who is interested in accepting this challenging responsibility.

At long last the first official NAR/FAI model rocket performance records have been announced by the NAR Contest Board. G. Harry Stine, Records Committee Chairman, explains the cause of delay in publishing these records: "One of the big problems we have encountered is the fact that record aspirants delay in submitting data, do not submit the data called for, submit sloppy data, and/or send photos that are blurred and indistinct. Record aspirants should carefully read and follow the provisions of Paragraph 32, US Model Rocket Sporting Code, 1967 edition. If they would do this, it would make our job a lot easier and records would get homologated faster." A model rocket record is not considered official until all flight data and documentation has been properly submitted and accepted by the NAR and/or FAI.

Beginning next month we will include point standings of the top five modellers in each age category and the top five NAR sections in the US. In order to expedite computation of point standings, the Contest Board has been fully computerized. The Contest Board and other interested NAR members met in Washington on January 24 and 25 to discuss revisions of the 1967 "Pink Book" edition. Full details of this meeting will appear next month. CB Chairman Richard Sipes requests that all sections apply for area and regional meet sanctions *at least* two months in advance in order to allow publication of the dates in The Model Rocketeer. Also note Richard's recent change of address which appears in the list of officers and committees.

Incidentally, the complete list of NAR officers, committee heads, and division managers will be printed in each issue. Any mail sent to NAR Headquarters, designated for one of these people, will be promptly reposted to him.

Upcoming features in The Model Rocketeer include a description of the NAR Standards and Testing facilities, proposed "Pink Book" changes, an article on NAR districting, and more NARAM-12 details.

Carl Kratzer

FROM THE CONTEST BOARD

Regarding FAI records, the Contest Board must be notified within eight days after the date on which the record flight takes place.

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Checks or money orders (NOT CASH) should be sent when requesting contest sanctions. Make all checks payable to "NAR Contest Board".

******

Contest Directors wishing their Regional Meets listed in The Model Rocketeer must apply for sanction at least 90 days in advance of the meet.

******

Please fill out application forms completely. Juniors are reminded that their forms must be signed by their parents.

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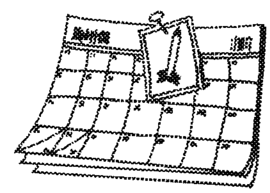
Model rocket records may be set at any NAR sanctioned model rocket meet (Section, Area, Regional, or National Meet) or at a sanctioned Record Trial.



Pittsburgh Convention: March 20, 21, 22 at the Red Raven Holiday Inn in Pittsburgh. Sponsored by Steel City Section.

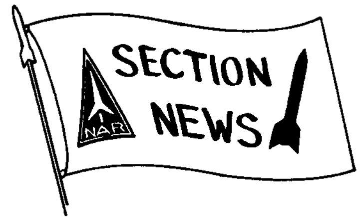
West Covina Regional Meet: March 20, 21. Sponsored by WCMRS Titan Section, Dane Boles, 144 West Garvey Avenue, West Covina, Calif. 91790.

MIT Convention: April 3, 4, 5 at Massachusetts Institute of Technology, Cambridge, Mass. Sponsored by MIT Section.

ECRM-4: Regional meet on April 10, 11, 12 at Camp A. P. Hill, Bowling Green, Va. Sponsored by NARHAMS, 6809 97th Avenue, lanham, Md. 20801.

TEXAREA-II: Texas State Championship Meet on June 27 or 28 near Houston. Sponsored by Apollo-NASA Section, Gary King, 13903 Barryknowl Lane, Houston, Texas 77024.

MMRR-II: Ohio area Regional Meet on June 27 and 28 near Columbus. Sponsored by CSAR Section; contact MMRR-II, c/o Dr. Gerald Gregorek, 4451 Danforth Road, Columbus, Ohio.



By Charles M. Gordon

The National Association of Rocketry welcomes the following new sections to the organization. These sections were chartered since the last section roster was published.

Santa Clara Rocket Association
c/o David Cohan, 1425 Edgewood Drive
Palo Alto, California 94301

Southern California Rocket Society
c/o Mrs. John Yanos, 2709 W. Adrian Way
Santa Anna, California 92704

The Good, the Bad, and the Ugly Club
c/o Wiley Styles, Palatka Middle School
1100 Husson Ave.
Palatka, Florida 32077

South Seattle Rocket Society
c/o Jess Medina, 15824 43rd Ave. South
Seattle, Washington

The Moon Snoopers
c/o Leonard Palka
St. Thomasmore School, 8130 S. Calif.
Chicago, Illinois 60652

Hawk Eye Section of NAR
c/o Dwight Luckington
2018 Marquette Street
Davenport, Iowa 52804

The Apollo-NASA Section (Houston, Texas) has formed a 20-member demonstration team under the title of Project Eyeball. The team gives rocketry demonstrations at area schools. Team members have appeared on TV five times (one time included a live firing of a model rocket on a test stand). A display was set up and manned by the team at the Houston Museum of Natural Sciences. On New Years Day a live salute was flown to the Bluebonnet Bowl Queen. This demonstration team has contributed greatly to increasing interest and respect for model rocketry throughout the Houston area. Keep it up, Project Eyeball.

The second annual Texas State Championship meet, TEXAREA II, has been scheduled for June 27 and 28, sponsored by the Apollo-NASA Section of Houston, Texas. TEXAREA II will include contestants from the entire state. All entrants of TEXAREA I, held last year, will be invited, as will all new NAR members in Texas.

As of the end of December the events had not been chosen though mention is made by the section that a much larger launch site will be available this time. Invitations were to have been mailed by January 5. If you have not received yours, contact the Apollo-NASA Section immediately.

On December 11, 1969, five members of the Apollo-NASA Section demonstration team launched the first model rockets ever flown inside the Astrodome in Houston, Texas. Junior member Forrest McDowell holds the distinction of launching the first model rocket [an Estes Alpha powered by a class A engine] to have a power-prang on the way up – it hit the roof!

******

The Liverpool Organization of NAR is active again. In August they put on a display at the 1969 New York State Fair, which included display models, photos, news clippings, and modelers providing information. The documentary film taken of the most interesting displays of the 1969 Fair will include shots of the LONAR booth. Over 100 persons requested information on joining the section and many have since done so (over 35 new members already). Modelers in the area interested in contacting the group should write to Mr. John Fensterer, 4854 Juneway Drive North, Liverpool, New York 13088.

******

The Metro-Atlanta Society for Educational Rocketry plans to host the North Georgia Regional Meet sometime in early June. The purpose of this two-day meet will be to bring all the modelers in the area together in one competition. For information, contact Mr. R. Wallace, 4676 Kingston Road, Dunwoody, Georgia 30338.

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Two sections have decided to change the names of their newsletters. As of Vol. 1 No. 7 the Southern Maryland Area Rocket Team has changed theirs from *SMARTmouth* to *SMARTtimes*. The Tri-City Cosmotarians of Gladstone, Oregon, have changed the name of their newsletter from *The Probe* to *Tracking West*. And the search for bigger and/or better names goes on.

******

The *Nozzle News*, newsletter of the Saturn Model Rocket Section of El Paso, Texas, reports that in November a section meet dubbed SMRS II was held. A total of 102 points were awarded.

SMRS also reports that NASA films will be shown, if available, at each regular meeting, including many aspects of the Mercury manned space program.

******

The Southern Maryland Area Rocket Team also reports that the application filed for use of the field at Eugene Burroughs Jr. High School for club launches and contests has been approved by both the principal of the school and the Prince Georges County (Md.) Board of Education. Model rocketeers interested in using the field should contact Mr. Ralph Swick, RR 1 Box 580, Accokeek, Maryland 20607 for information.

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The Metro-Denver Section plans to hold its first contests of the new year in May. A sanctioned meet with Scale only is planned for May 3; May 17 is planned as a sanctioned meet with Class I Parachute Duration only. Other meets are planned for early June. Interested persons should contact the contest director, Mr. Vic Cross, 2630 S. Federal Boulevard, Denver, Colorado 80219. Only NAR members will be allowed to compete.

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The Laurel Area Rocket Society (Laurel, Md.), formerly known as the Hobby House Model Rocketeers, is planning a spring program which will include Apollo movies, model building, workshops, and open launches at the club field.

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The Good, the Bad, and the Ugly Rocket Club is a newly chartered section in Palatka, Florida, and would like to have some home and away meets with other clubs in Florida, Georgia, and Alabama. Interested clubs are asked to contact the GB&UR.

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The Tri-City Cosmotarians of Gladstone, Oregon, report that "certain(?) members are involved in construction of a wind tunnel. Hopefully, it will be ready for spring training."

******

To help promote intersection communications through newsletter swapping, the Southern Maryland Area Rocket Team has sent out a letter of introduction about the club and copies of the newsletter, *SMARTtimes*, to other NAR sections.

******

The Metro-Denver Rocket Association (Denver, Colorado) has had club shirts painted for the members. All members who have the shirts are required to wear them at launches to be eligible to fly any models.

******

NAR SECTION NEWS appears each month as a regular part of The Model Rocketeer. Sections wishing to have news and/or information of their activities printed in this column should prepare all material and send it to:

NAR SECTION NEWS, c/o Charles M. Gordon, 192 Charolette Drive, Laurel, Maryland 20810.

Remember: IF I DON'T HAVE IT, I CAN'T PRINT IT!

NAR Contest Certified Engines
(As of 1February, 1970)

The following model rocket engines currently carry the NAR Contest Certificate. Please note that Centuri Engineering Co. "Minimax" and Rocket Development Corp. "Energet" do not, as yet, carry either the NAR Safety Certificate or the NAR Contest Certificate. The Flight Systems, Inc. A4-4 engines have just been granted the NAR Safety Certificate but *not* the Contest Certificate. A complete list of Safety Certified engines will appear in a future issue, and all changes will be published when they become available.

Centuri Engineering Company

¼A3-1	A5-2	B4-2	C6-0
¼A3-2	A5-4	B4-4	C6-5
¼A3-4	A8-0	B4-6	C6-7
½A6-0	A8-3	B6-0	
½A6-2	A8-5	B6-4	
½A6-4		B6-6	
		B14-0	
		B14-5	
		B14-6	
		B14-7	

Estes Industries, Incorporated

¼A3-1	A5-2	B4-2	C6-0	D13-0
¼A3-2	A5-4	B4-4	C6-5	D13-3
¼A3-4	A8-0	B4-6	C6-7	D13-5
½A6-0	A8-3	B6-0		D13-7
½A6-2	A8-5	B6-4		
½A6-4		B6-6		
		B14-0		
		B14-5		
		B14-6		
		B14-7		

Flight Systems Incorporated

B8-0	C8-0	D4-0	E4-6	F6-7
B8-4	C8-6	D4-6		F80-0
B8-6	C8-8	D4-8		F80-8

Model Products Corporation

A5-3	B3-3	C6-4
A3-3		C6-0

Rocket Development Corporation

½A5-2	A5-0	B3-0
½A5-4	A5-3	B3-4
	A5-5	B3-7

G. M. Gregorek, Chairman
NAR Standards and Testing Committee

Drive-In Launch

The Randallstown Rocket Society of Randallstown, Md., held a "Drive-in Launch" in January. Elaborate tracking, communications, and recovery networks were not used due to the cold weather. Instead, hot chocolate, coffee, and hot dogs were sold to raise money and keep modelers warm during the launch. Cold weather doesn't stop this section from holding its monthly launches.

New Jersey Clubs

Bob Mullane of the Pascack Valley Section requests that the senior advisors of all rocket clubs in New Jersey inform him of their existance and provide any information they can about the club. Write to:

Bob Mullane
NAR PVS
34 Sixth Street
Harrison, N.J. 07029

Bob is interested in expanding communication between clubs in the state.

Change of Address

NAR members should promptly inform NAR Headquarters, Box 178, McLean, Virginia 22101, of all changes in mailing address. Please include your new and old addresses and mailing label to speed processing. Since mailing tapes are prepared in advance and the Post Office will not forward magazines, you should notify HQ as early as possible to insure uninterrupted service.

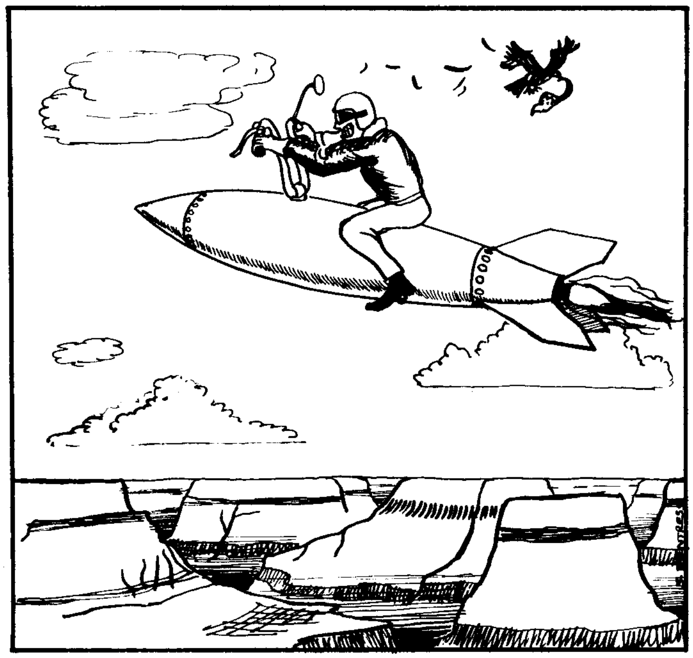
Material for Publication

NAR members holding US and FAI records are requested to submit drawings and photos of their record-holding models for publication in The Model Rocketeer. All such material should be sent to Carl Kratzer, The Model Rocketeer, 320 Thurston Road, C-31, Ithaca, New York 14850.

NASA Photo

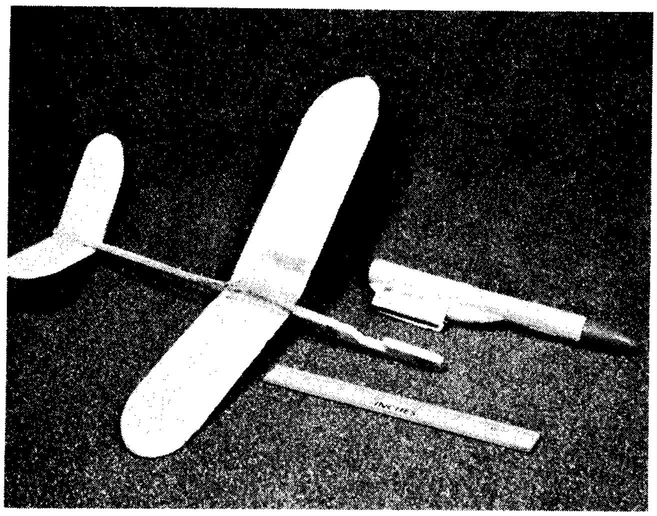
Teaching nun joins the space-age hobby at a recent NASA educational workshop.

Easy Rider

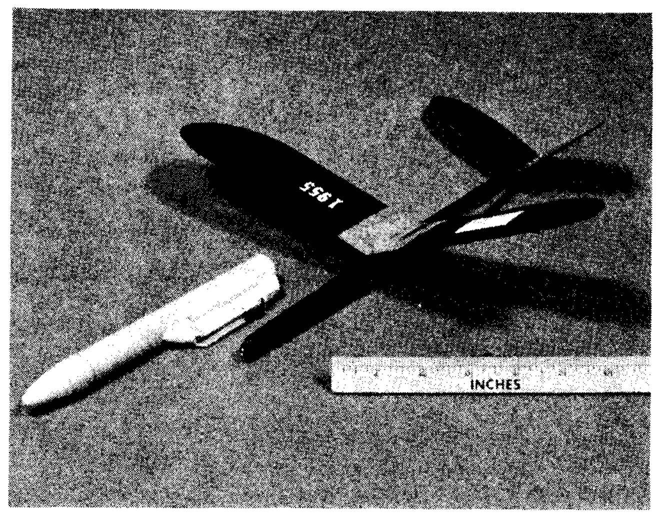


An article in the January issue of *Esquire* describes a rocket-assisted motorcycle to be used by stunt driver Evel Knievel to jump across the Grand Canyon. The vehicle, which resembles "a snow-white rocket or bomb with three tail fins", was designed by none other than Doug Malewicki (NAR 4639), an Aerospace Engineer for Cessna Aircraft Company.

UNICORN-25 Record Setting B/G's

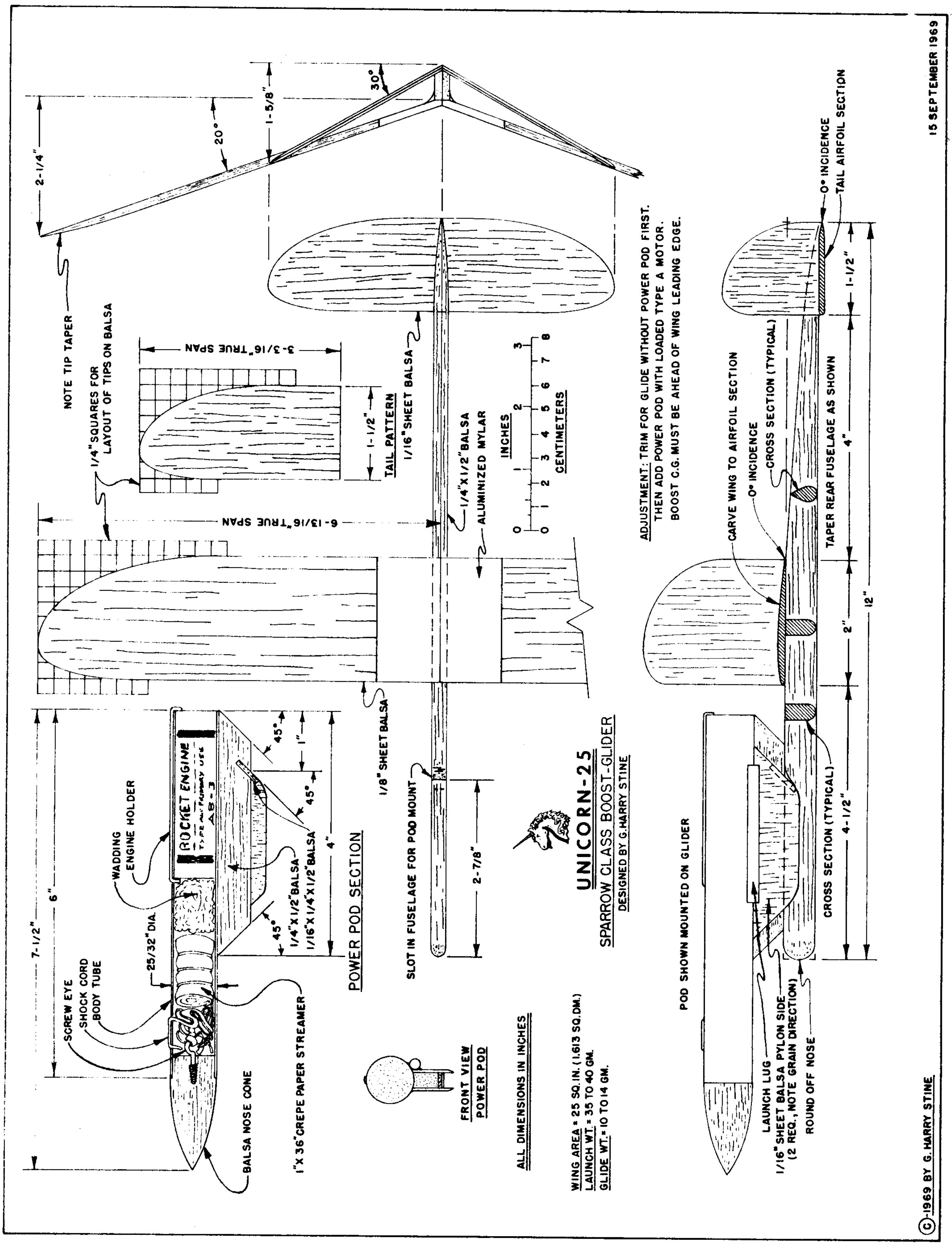


Robert Dunbar's record-holding Swift B/G



Ellie Stine's record-holding Sparrow B/G

The Unicorn-25 boost/glider, designed by G. Harry Stine, has been awarded two model rocket performance records by the Federation Aeronautique Internationale. Ellie Stine filed a Sparrow B/G record for her 120 second flight, and Robert Dunbar's 230 second flight acheived the Swift B/G record. Dunbar's model differed from the original design in that it used a slightly different pod system. The plan and photographs are reproduced here with permission of Mr. Stine.



UNICORN-25
SPARROW CLASS BOOST-GLIDER
DESIGNED BY G. HARRY STINE
15 SEPTEMBER 1969
NOTE TIP TAPER
2-1/4"
20°
1-5/8"
30°
1/4" SQUARES FOR LAYOUT OF TIPS ON BALSA
3-3/16" TRUE SPAN
1-1/2"
TAIL PATTERN
1/16" SHEET BALSA
6-13/16" TRUE SPAN
1/4"X1/2" BALSA
ALUMINIZED MYLAR
INCHES
CENTIMETERS
ADJUSTMENT: TRIM FOR GLIDE WITHOUT POWER POD FIRST. THEN ADD POWER POD WITH LOADED TYPE A MOTOR. BOOST C.G. MUST BE AHEAD OF WING LEADING EDGE.
0° INCIDENCE
TAIL AIRFOIL SECTION
CARVE WING TO AIRFOIL SECTION
0° INCIDENCE
CROSS SECTION (TYPICAL)
TAPER REAR FUSELAGE AS SHOWN
1-1/2"
4"
2"
12"
4-1/2"
CROSS SECTION (TYPICAL)
1/8" SHEET BALSA
SLOT IN FUSELAGE FOR POD MOUNT
2-7/8"
7-1/2"
6"
4"
1"
45°
45°
45°
WADDING
ENGINE HOLDER
ROCKET ENGINE
AB-3
25/32" DIA.
1/4"X1/2" BALSA
1/16"X1/4"X1/2" BALSA
SCREW EYE
SHOCK CORD
BODY TUBE
POWER POD SECTION
BALSA NOSE CONE
1"X36" CREPE PAPER STREAMER
FRONT VIEW POWER POD
ALL DIMENSIONS IN INCHES
WING AREA = 25 SQ.IN. (1.613 SQ.DM.)
LAUNCH WT. = 35 TO 40 GM.
GLIDE WT. = 10 TO 14 GM.
POD SHOWN MOUNTED ON GLIDER
LAUNCH LUG
1/16" SHEET BALSA PYLON SIDE (2 REQ., NOTE GRAIN DIRECTION)
ROUND OFF NOSE
© 1969 BY G. HARRY STINE

DEALER DIRECTORY

Hobby shops desiring a listing in the **Model Rocketry** Dealer Directory should address their inquiries to Dealer Directory, **Model Rocketry** magazine, Box 214, Boston, Mass. 02123. Space is available only on a six-month contract for $18.00 or a twelve-month contract for $35.00, payable in advance.

CALIFORNIA – Mt. View
Model Rocket Supplies
SAN ANTONIO HOBBY
417 San Antonio Road
Sears Shopping Center

CALIFORNIA – Whittier
Complete Selection of Model Rockets
Estes–Cox–Centuri–MPC
JACK'S HOBBYCRAFTS
14710 E. Whittier Blvd. 90605
Mon-Thurs 10-6, Fri 10-9, Sat 9:30-5:30

CONNECTICUT – Bridgeport
Model Rocketry & Radio Control
is are only business
FRED'S VARIETY
184 Success Avenue

ILLINOIS – Chicago
M&G HOBBY SHOP
3443 North Pulaski Road
Chicago, Illinois 60641
Phone 539-5310

MASSACHUSETTS – Melrose
MIDDLESEX COIN, STAMP,
AND HOBBY SHOP
473 Main Street
02176 662-8319

OHIO – Upper Sandusky
Estes and Centuri Rockets
THE ROCKET SHOP
640 Skyline Drive
6-9 pm 294-1322

NEW JERSEY – Highland Park
Complete Rocket Supplies
Estes, Centuri, MPC, BoMar, etc.
MINIWHEELS HOBBY CENTER
714 Raritan Avenue

NEW JERSEY – Princeton
Complete Rocket Supplies
Centuri – Estes – MRI – SA !
NASSAU HOBBY
142 Nassau Street Princeton

NEW JERSEY – Wayne
TOTOWA HOBBY SHOP
131 Boontown Road
Rocketry isn't our only hobby!
is only one hobby section
Open Sundays 696-5170

NEW YORK – Elmira
SCIENCENTER
147 West Water Street
Estes – Centuri – Flight Systems
Elmira 14901

(Club Notes continued)

The latest issue of the *Intercept*, newsletter of the Bethlehem, Pennsylvania, ABM Section, reports results of their recent Parachute Duration Contest. Richard LaBarre took first place with 55 seconds, Richard Klingston placed second with 37 seconds, and The Klan (team) tied with A. MacWilliam for third with 27 seconds.

The Saturn Model Rocketry Section in El Paso, Texas, staged its first contest of the 69-70 contest year on November 1, 1969. The competition, flown from the club's new Eastwood Heights Elementary School launching field, was reported in *Nozzle News*. In Drag Race, Larry Griswold placed first with David Shindo second. Kenneth Longnecker took first in Parachute Duration with 127 seconds; Scott Norris took second with 120 seconds. In Sparrow B/G, Scott Norris placed first with 46 seconds; Kenneth Longnecker placed second. In Open Spot Landing, Scott Norris took first place with Kenneth Longnecker second.

William Endicott of Rocket Research Corporation in Redmond, Washington, addressed the December 5 meeting of the South Seattle Rocket Society. The discussion, reported in the latest issue of *The Modroc Flyer*, centered on the development of the US space program. Endicott discussed his company's participation in the space program in the development of exotic propellants for the EVA propulsion units employed by American astronauts. He also narrated a slide tour of Cape Kennedy and discussed future space travel prospects.

Ken's Hobbies Model Rocket Society of Midwest City, Oklahoma, offered free model rocketry classes each Saturday morning during November. Captain Melville G. Boyd USAF conducted the seminar sessions. He stressed safety, construction tips, and basic principles of model rocketry. The course was concluded with a flying contest. Capt. Boyd demonstrated several unusual designs, including one employing helicopter recovery. Due to the high winds on the day selected for the contest, Spot Landing was deemed to be the only practical event. Mike Robinson took first place with 15 feet flying an Aerobee 300; Neal Sellars took second with 35 feet flying a Sky Hook.

The Model Rocket Club of New Brunswick, New Jersey conducted a rocket and space exhibition in January at the gymnasium of a local church. John Rusyn, club president, said the purpose of the event was to show that model rocketry is "just as safe as swimming, baseball, or football."

A rocket club has been formed at Marlboro Jr. High School near Hudson, Massachusetts. Under the direction of Francis Joubert III, a science teacher at the school, 32 8th grade students have been studying rocketry as part of their classwork. The students also receive extra credit for the demonstration launchings they conduct for others at the school. A story about the club's activities recently appeared in the Hudson *Sun*.

Several active members of the Skymasters Model Rocket Club in Robesonia, Penn. are looking forward to a tour of Cape Kennedy in June. Their trip, which will cover ten days and include a six-day drive down and back, with the nights spent camping along the way. The club's two adult supervisors, Edward Schofer and Irvin Jones, will provide transportation in their cars. Money to finance the trip is being earned by such activities as the club's Christmas Gift Sale. The six club members participating in the sale added $135 to the club's treasury.

Australia beware! A model rocketry club has been organized in Melbourne, Australia. The club, called MARS, standing for the Melbourne Association of Rocketry Sciences, has been spreading the modroc gospel for about one year. Any Aussie rocketeers reading this are invited to contact Garry Ramler (President, MARS) at 2[illegible] Harcourt Ave., Caulfield. Melbourne, Victoria, Australia 3162. (Phone 53-1075).

Doug Plummer is attempting to form an NAR section in the Chambersburg, Pennsylvania area. Interested rocketeers, especially someone over 21 years of age who is interested in serving as an adult advisor, are invited to contact him at 930 Leidig Drive, Chambersburg, Pa. 17201, or phone 264-5739.

Members of Junior High School 73 in Maspeth, New York have formed a rocketry club under the direction of Mr. Haratonik The club is especially interested in de-

Photo by Eric Max

A Thor-Agena B, built by Gregg Max, lifts off during a regular launch of the Fairmont Estates Model Rocket Association in Fairfax, Virginia.

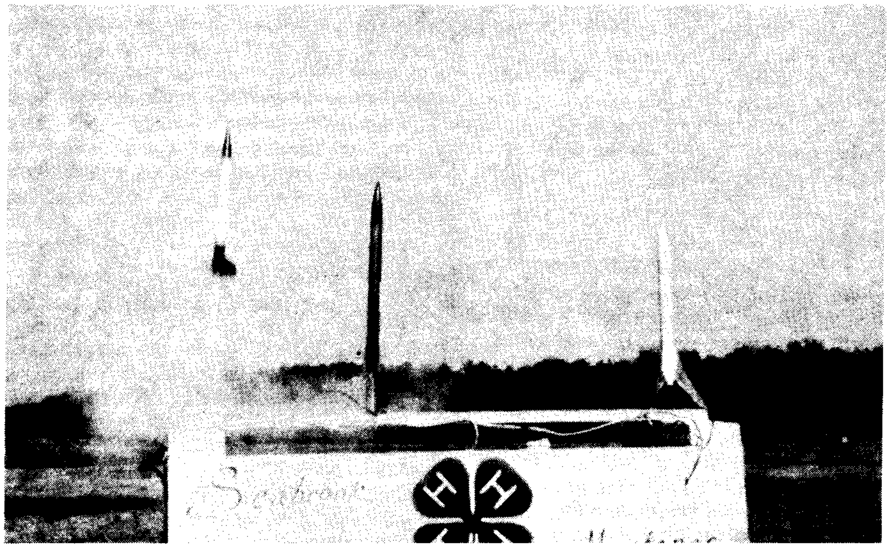


Photo by Mark Sickle

The Seabrook Mustangs 4H Club held its annual model rocket competition on December 13, 1969. Among the rockets entered were (left to right above) a Wac-Corporal built by Richard Chambers, a Patriot built by David Sickle, and a Drifter built by David Spurlin. In the contest, Scott Lyon took first place in A engine altitude with 2180 feet; while Michael Johnson took first in B engine altitude with 1800 feet; and Mark Sickle captured the Eggloft event championship with 950 feet.

veloping the skills of beginners and channeling the interest of advanced rocketeers into research projects. In the spring the club plans to organize several competitions open to rocketeers in the Queens, New York area. Interested rocketeers should contact Michael Roeder, 40-30 73 Street, Woodside, New York 11377.

The Central Astronautical Society was recently formed in the area of Milltown, Marengo, and Evansville, Indiana. The club already has 42 members, 23 rockets, a library, two laboratories, and several launch sites. The club has conducted several successful rocket flights under the supervision of Garland White, club advisor who is also a private pilot. The Central Astronautical Society is particularly interested in hearing from other clubs in the area with interests in exchanging ideas and holding competitions. Interested rocketeers and clubs can contact Jeffrey Cox, CAS President, 333 Harrison Avenue, Milltown, Indiana 47145.

ATTENTION

CLUB

SECRETARIES

Send your club or section newsletters, contest announcements and results, and other news for this column to:

Club News Editor
Model Rocketry Magazine
P. O. Box 214
Astor Street Station
Boston, Mass. 02123

(**The Old Rocketeer** continued)

use flat paint. The bigger an object is, the flatter its surface finish appears to be.

When modelers paint their plastic models, they usually do it wrong. The most common mistake is to use thick enamel paint. This gobs-up and runs and makes lumps and looks terrible. A little thinner in the enamel to make it more "runny" works wonders, particularly if you don't try to do the whole paint job in one application.

Good modelers generally use spray painting.

Enamel paint in aerosol spray cans is great if you have a small model to do, are in a roaring rush to finish, or don't do enough modeling to justify getting an air brush. The big problem with aerosol paint cans is the fact that you can't control their spray. It's usually too much. The result is a paint job with too much paint, so it obeys the law of gravity and you get a "runny . . ." which spoils the model by making it look like a model built by a chimpanzee.

Although plastic modelers have used enamel paint for a number of years, it has only been recently that the modeling clan was introduced to the acrylic polymer paints. I discovered them in the local hobby store as"Poly-S" acrylic paint put out by Floquil. When the hobby store owner decided not to stock Poly-S any longer because it wasn't selling as well as the nicely-racked enamel paints, I walked across the street to the local art supply store and bought the same, identical stuff in a wider variety of colors for about a third of the price. Acrylic polymer paints have been on the market for use by artists for over 10 years.

Acrylic polymer paints use *water* as a thinner. But when they set up and harden ("polymerize," in a chemist's terminology), they can be attacked only by that "universal solvent," Pactra Aero-Glass Dope Thinner. As such, the acrylic polymer paints are great for use in spray guns and hobby air brushes; they don't stink like enamel and you can clean out the air brush with water. Same goes for ordinary paint brushes. When brushed on, acrylic paints leave no brush marks. When sprayed on with an air brush, you have to just "dust" the first coat on or it beads up like water. (I wonder why?) But applied with an air brush, the acrylic paints give the finest, most professional paint job I have ever seen.

And the white acrylic paint does not yellow with age the way white enamels do.

And acrylic paint goes on over anything, unless the surface is soluble in water!

Final Finishing Tips

If you put decals over a flat finish, the decals will shine. Even the so-called "flat finish" decals will shine. To eliminate this and give an over-all flat finish, spray the model with Testor's "Dullcote" from an aerosol can.

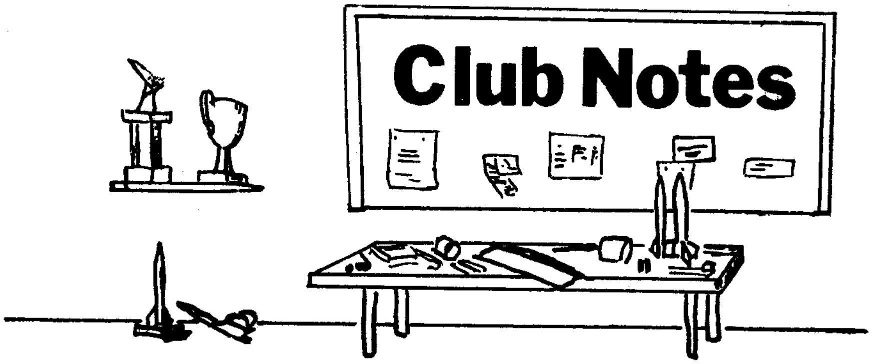
If you want an overall gloss finish, spray with Testor's "Glosscote."

If you want a super-slick finish, wax it with paste wax.

Conclusion

The myth that plastic models cannot be changed, modified, or customized to suit the whim of the rocket builder has been totally shattered. Those model rocketeers who were among the silent minority that enjoyed the Plastic Model Event in competition knew this all along. And the techniques were worked out a long time ago by the model car customizers and the I.P.M.S. plastic airplane builders. Why is it that model rocketeers seem to be the last ones to learn anything about modeling? Could it be that most model rocketeers are not modelers? Eat your hearts out, balsa butchers! Plastics are here to stay!

Club Notes



Students at Princeton High School have formed a new rocket club in New Jersey. Membership is currently 17 and growing rapidly. Interested rocketeers in the area should contact Joshua Rafner, 108 Clover Lane, Princeton, New Jersey 08540.

The Albuquerque Model Rocketry Club in Albuquerque, New Mexico, has been organized for about one year. The club, with nearly 30 active members, meets every other Monday night at a local high school. Captain Forrest Mims serves as the club's advisor, and through him the club is sponsored by the Kirtland Air Force Base Junior Officers' Council. Several parents of club members also serve as advisors. A launch is held every month, and other clubs from the area are welcome to join in the competition.

Last summer, the ARC-Polaris Rocket Club of Portales, New Mexico, participated in the AMRC's second launch, and both clubs put on an exhibition. Another joint launch is scheduled for this spring.

There is no age limit on membership in the Albuquerque Model Rocketry Club, and parents are encouraged to attend launches and meetings. Model rocketeers interested in joining the club should contact Ford Davis at 256-7614 after 5 pm.

The Merril Rocket Club of Denver, Colorado, is planning a competition open to all rocketeers in the Denver area. Rocketeers wishing to attend should contact Gary Hayes, 3345 Harrison Street, Denver, Colorado 80205 for complete information.

The Peak City Section has been reactivated in Colorado Springs, Colorado. The club, active throughout the winter months, has scheduled training sessions and launches on a biweekly basis.

(From the MDRA *Misfire*.)

A new rocket club is being formed in the Perth Amboy, New Jersey area. Rocketeers interested in joining the National Aeronautics of Sayre Avenue are invited to make contact with Daniel Tucci, 542 Sayre Avenue, Perth Amboy, New Jersey 08861.

On Sunday January 11th the White Council Rocketry Society in Wallington, New Jersey held its first contest — a boost/glide duration event with all contestants employing C6-5 engines. All entries were required to be recovered within 15 minutes after touchdown. Robert Sudol, President of the club, took first place flying his Estes Nighthawk to a 23 second duration. Second place was taken by a modeler flying a Centuri X-21. An Estes Falcon was clocked at 55 seconds before streaking out of sight, however it was not recovered.

Later in the day, the club also held a sport-flying meet. Several two staged rockets were flown, and a double size Infinite Loop had three spectacular flights. The club is now planning an E5-6 powered Parachute Duration competition, an Open Altitude performance meet, and is working on an accelerometer.

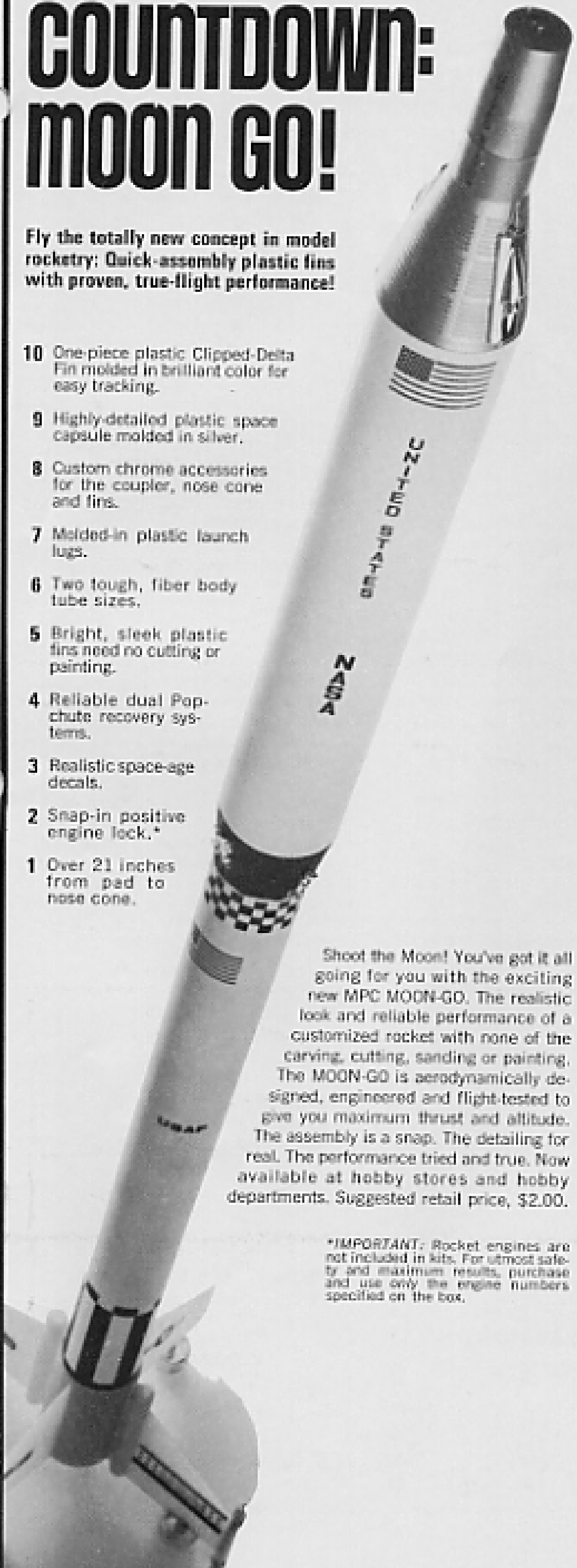
A new model rocket club has been formed at Parkside Junior High School in Roselle, Illinois. Under the supervision of Gene Kujawa, a seventh and eighth grade science teacher at the school , the club was formed in November and spent a month preparing for its first launch. Interviewed by the Roselle *Register*, Kujawa said: "I think that rocketry really shows how science can appeal to students when they take an active part in its work. Rockets are almost replacing model trains. They are safer than riding a bicycle and the only danger of the hobby is the boys falling out of the trees getting the rockets."

The model rocketry division of the Gattis Junior High Science Club in Clovis, New Mexico recently held a demonstration launch for other students at the school. Twelve rockets were launched, and only one was lost even though there were brisk winds on the morning of the launch. The club is under the supervision of Mr. Joe Griego. One of the rockets launched was a two-stage "Mini-Max" powered rocket which was reported to have reached 3,000 feet.

The Miami Valley Rocket-Flight Association is looking for a Senior NAR member in the Centerville, Ohio area to act as advisor to a planned NAR Section. Junior and Leader members are also welcome. Interested rocketeers should contact Orville Weyrich, Jr., 6619 Chilton Lane, Dayton, Ohio 45459, or phone 433-1337.

(Continued on page 46)

COUNTDOWN: MOON GO!



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