MODEL ROCKETRY

April 1970
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The Journal of Miniature Astronautics
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THE NARWHAL FOR DESIGN EFFICIENCY

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Volume II, No. 7
April 1970

Model Rocketry

Cover Photo

This month's cover photo shows the flying Apollo capsule built in early 1967 by Doug Malewicki. Tom Milkie details Doug's construction methods in this month's *Escape Tower*. In the background is Doug's wife Ruth. (Photo by Doug Malewicki.)

From the Editor

Is there any advantage to joining a club? Or organizing one? Can the individual rocketeer benefit as much from the hobby alone as he can within the club structure? Let's look at the advantages membership in an active club has to offer:

Launch Equipment — The most significant expense a new rocketeer must face is the cost of a launcher. Even a simple commercial system will cost almost $10, including batteries, etc. Most clubs have launching equipment available for their members. This makes it less expensive for the beginner to get started in the hobby, and provides a major incentive to early club membership. (If your club's system is in a state of disrepair, restoring it to operational condition is an excellent project. A good launch system will allow even an inactive club to attract new members.)

Launch Site — In many areas, the individual has little chance of finding a suitable launch site. A club, however, has many members, each with a circle of friends and relatives one of whom is almost sure to own or know someone who owns a suitable firing area. In addition, many landowners are less reluctant to give permission to use their land to a club under competent supervision than they are to give permission to a single person.

Tracking — Soon the beginner wants to know, "How high did it go?" Tracking equipment, and rocketeers to man the trackers, are a vital necessity. A club can easily provide tracking at its launches, though it is quite difficult for a lone rocketeer to do so.

Civic Sponsorship — Many civic clubs, such as the Optimists, Kiwanis, Lions, Rotary, and other clubs as well as schools, parks and recreations departments, and other agencies are interested in sponsoring

(Continued on page 46)

Regular Features

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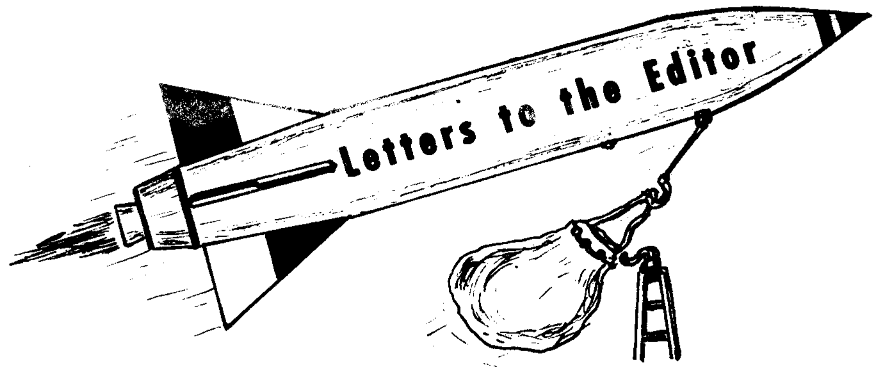


Trimming the FlatCat

In the past few weeks I have built and flown the FlatCat boost/glider which appeared in your August 1969 issue. Due to alignment errors in the rudder assembly, the glider spiraled to the right. Regardless of how much (within reason) weight I put on the wings, it still made a *hard* right turn.

After experimenting, I found that a wedge placed on the rudder corrected the situation. The wedge can be made from 1/16" or 3/32" sheet balsa cut to the dimensions shown in figure A. The wedge should be sanded to the proper shape and glued to the right side of the right rudder if the glider spirals to the left or to the left side of the left rudder if the glider spirals to the right. If the glider turns in the *opposite* direction after addition of the wedge, sand it thinner until the flight path is as desired. (If more correction is needed, put a similar wedge on the same side of the other rudder.)

The success of this method on the FlatCat suggests that similar additions of wedges (or adding an asymmetrical airfoil) to the rudder provides sufficient corrective moment to cause a B/G to circle and increase the chances for recovery.

John P. Nowakowski
Dayton, Ohio

Plastic Conversion

I would like to congratulate you for your article, "Converting the Hawk Jupiter-C for Flight" that appeared in the November issue of your magazine.

I read the article through several times and then purchased the model and began construction. I had completed it in about two evenings and found it to be quite easy. Today came the moment of truth. I took the rocket to a near-by field, set up the launcher, and made final preparations. As I began the countdown I wondered if I would ever see this "beautiful" rocket in one piece again. Well it worked great. The parachute came out right on time and lowered it gently to the ground.

This has gotten me very interested in plastic model rocketry and I would like to know where I could get more information on the subject.

Mike Curtis
Decatur Ga. 30032

Plastic scale conversion has always been a popular area with model rocketeers. However, until our November 1969 conversion article on the Hawk Jupiter C no detailed conversion plans had ever been published. The March 1970 issue of **Model Rocketry** *contains plans for modifying the Revell*

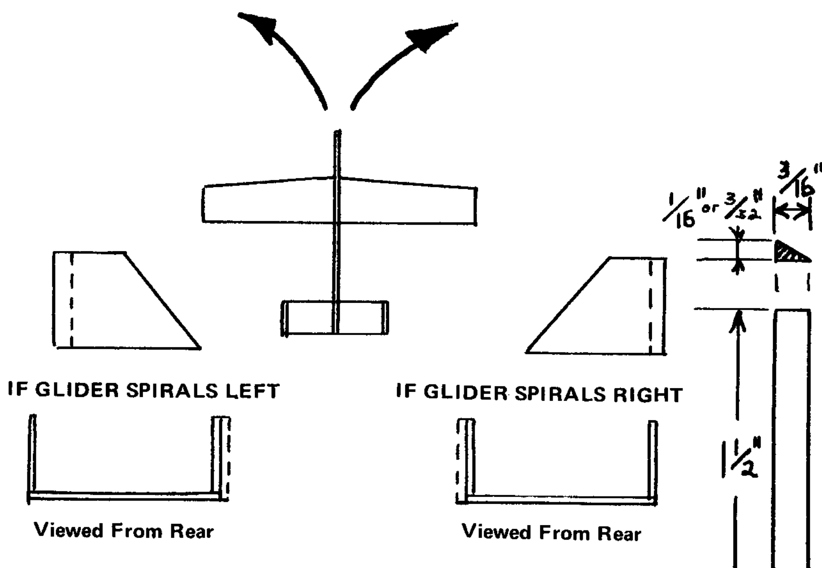
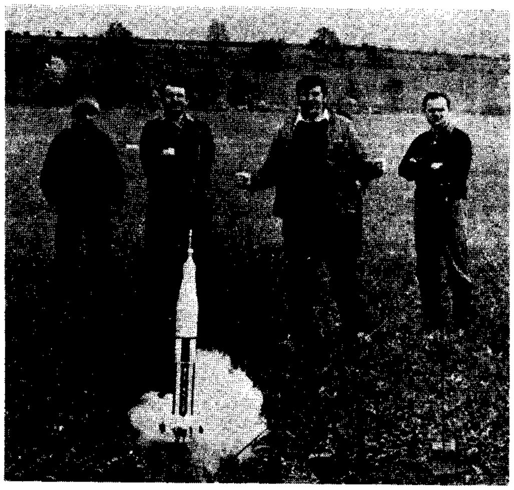


Figure A



Photos by Jaroslav Divis, President of the Prague Rocketry Club, show his 1/90 scale Saturn 1-B model, one of the first Saturn models in Czechoslovakia.

Lunar Module for flight. Additional plastic kit conversion articles are planned for future issues of **Model Rocketry.** *Many plastic models presently on the market are suitable for conversion to flying plastic scale. Saturn V models from Revell, Monogram, and AMT; a Saturn 1B from AMT; a Mercury Atlas from Revell; X-15's from Revell and Aurora; an Apollo Capsule from Revell, a Lunar Module from Monogram, and several other kits are presently being converted by our staff. As soon as the articles are prepared you will see them in* **Model Rocketry.** *In addition, several discontinued kits (which may still be found in unassembled condition in some modeler's basement) such as the Revell X-17 and Atlas-D, Adams Thor, Renwall Hawk, etc. are suitable for plastic conversion.*

Canadian Rocketry

It has occurred to me that there are many rocketeers in North America, including some Canadians, who are unaware of the situation of model rocketry in Canada. Those who have tried will know that it is extremely difficult to start rocketry in full up here. You must have a Licensed Firing Supervisor present at all launches; he must be over 21 and pass an exam for the license. The Supervisor idea is fine, but people over 21 who are willing to do it and have the time are rare. So why not lower the age requirement?

You are required to send a map of your launch area, telling how far it is from the nearest buildings, tree, and road to the Canadian Association of Rocketry for approval.

Other rules may be found in "Approved Regulations for Rocketry by Amateurs in Canada". Some of the rules are reasonable, but others do not pertain to model rockets at all (for example, requiring a sandbag wall to protect anyone within 25 feet of a rocket to be launched).

I don't know about other Canadian rocketeers, but I don't like following rules such as these when they are irrelevant and when they take all the fun and sport out of the safe hobby of model rocketry.

The only thing for the CAR to do is to reorganize itself and the rules. I would appreciate hearing the views of other Canadian rocketeers.

Barry Nicolle
Ottawa, Ontario, Canada

Czechoslovakian Developments

I have had the opportunity to see your magazine several times, and I like it very much. I am a rocketry fan, and have been practicing the hobby for a number of years. Here in Czechoslovakia it is very difficult to get any plans, information, and pictures of space vehicles. Your magazine has been one of the only sources of information for me.

I am the leader of the Prague Rocketry Club, and I should like to show you some pictures of my models. I am enclosing pictures of the space vehicle Saturn 1-B in 1/90 scale. This model was built in 1967.

Jaroslav Divis
Prague, Czechoslovakia

Green Mountain

Harry Stine's article *Return to Green Mountain* in the January 1970 issue of **Model Rocketry** was very enjoyable. He presented the facts of the world's oldest model rocket range in such a way that it made me feel as if I were there. Seeing the pioneers of model rocketry at work made me wish I were around there way back then.

Dan J. Voss
Palo, Iowa

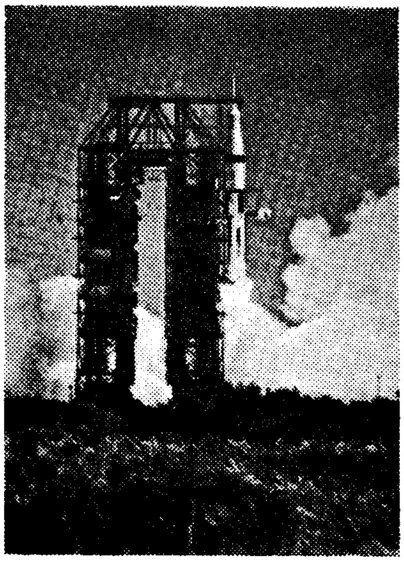
Bumble-Bee

I built the excellent Bumble-Bee boost/glider from the plans in your December issue. On its first flight, with a ½A6-2 engine, it turned in a flight time of 2 minutes 13 seconds. Even with a ½A, it outperformed any other B/G I have ever built.

Les Share, NAR 12769
Miami, Florida

SPECIAL OFFER!

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

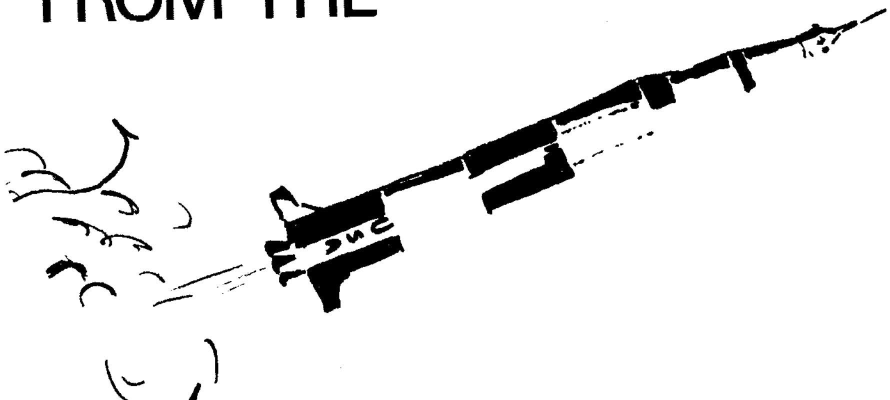


This magnificent photograph of a most historic moment in the history of spaceflight was obtained by **Model Rocketry** editor George Flynn from an advance position not accessible to most Kennedy Space Center visitors. Showing the moment of liftoff, this 7 by 8 inch full-color print will make an inspiring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

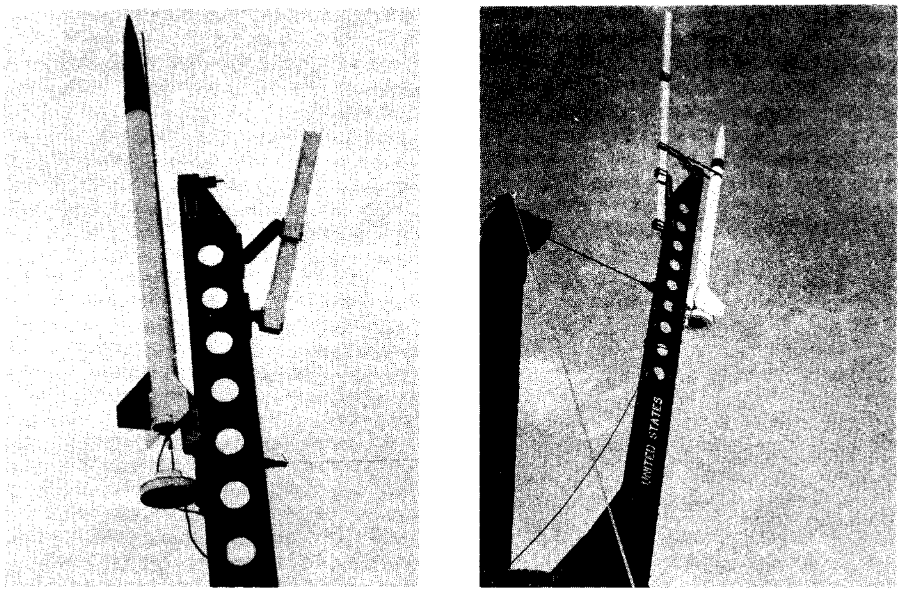
Full-color copies of the photograph, which is reproduced in black and white above, may be obtained by sending 50¢, or $1.00 for 3, to:

Saturn Photo
Model Rocketry
Box 214
Boston, Mass. 02123

FROM THE



LAUNCHING PAD



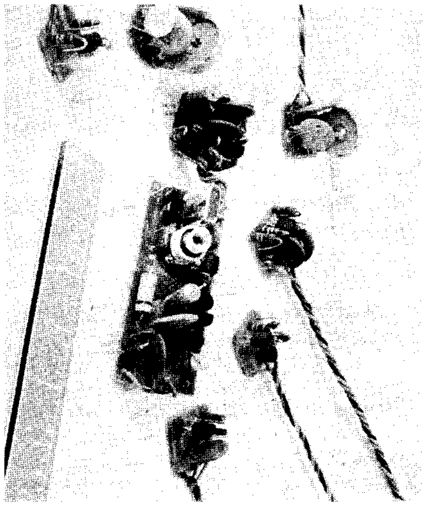
Which one is the real IQSY Tomahawk?

The one without the micro-clips leading to the tail is the scale IQSY Tomahawk, of course. But a comparison of the two photographs should convince you that, if you're willing to put in enough time, you can build a believable scale model.

The model above [left] was built by Doug Ball and Robert Hagedorn of Mansfield, Ohio. Take a few tips from their scale methods, and any rocketeer can get impressive results. First, model a simple rocket, such as the IQSY Tomahawk shown at right (NASA photo) on the launcher at NASA's Wallops Station. If the prototype is large, a Saturn V or Mercury-Atlas for example, you could never model it in a large enough scale for rivet and bolt detail to show on your model. By choosing a simple prototype, you can spend your time adding such details as bolt heads and scratches on the prototype which are usually only seen on models built by perfectionists. Second, build it large. The Ball-Hagedorn model stands over three feet tall. Adding details to a model that size is easy . . . or at least easier than adding the same details to a model one-fourth that size. Third, be patient when building the model. Don't try to rush it together just to see how well it is going to look. It will look a lot better if you take your time. *(That means you don't start on your scale entry the night before the contest.)* Good luck!

Dick Fox has been active modifying the "Foxmitter" during the winter months. At a recent meeting of Pittsburgh's Steel City Section, Dick demonstrated the newly designed transmitter. The modifications reduce the unit's sensitivity to antenna loading, making the antenna length less critical to achieving optimum performance. The range of the new transmitter is about 2/3rds of a mile. Several new sensors, including a humidity sensor, have also been developed. Dick promises to have an article on these modifications ready for a future issue of **Model Rocketry.**

The first telemetry modules from Micro Instrumentation Telemetry Systems are in production. The transmitter was reduced in length from the expected 2½ inches to 2 inches just before production was begun. The photo below, which should give you an idea of the number of parts MITS has packed onto their boards, shows the roll-rate sensor, amplifier, voltage regulator, tone generator, and the transmitter connected to a voltage-controlled oscillator.



The production units will be surrounded with epoxy to increase their durablility and crash resistance. All MITS modules will fit in a BT-50 body tube. Before the modules were accepted for production, they were tested not only by MITS staff members but by members of the Albequerque Model Rocket Club to assure that the average rocketeer could operate the units with only the information supplied in the instructions. These new telemetry units should open the world of model rocket experimentation to those rocketeers who have been hindered by lack of sufficient electrical engineering knowledge to design and build their own circuits.

There is a new rocket in NASA's family of sounding rockets. The reliable Aerobee 150 sustainer has been mated to the M-5 Nike booster. The Aerobee 150, employing a standard Aerobee X-103C booster, will carry a 200 pound payload to 120 miles. In the new configuration, with the M-5 replacing the X-103C, it can carry a similar payload to 155 miles. The new Aerobee 170 vehicle was test-launched from Wallops Station on February 5 and 13, 1970. An additional launching was scheduled for March 7, in conjunction with the solar eclipse.

Pat Stakem, who has been investigating model rocket trajectory and altitude calculations, has prepared a bibliography of about 30 books and papers on trajectory and altitude calculations. Copies of this bibliography are available to all rocketeers sending a stamped self-addressed envelope to Pat Stakem, Box 655, Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213.

Pat has been working on modroc trajectory analysis for about 4 years. His trajectory program, now in its seventh revision, is written in Fortran, has been run on IBM 7040 and 360 and Univac 1108 computers, and has Calcomp plotter routines to provide neat graphical output. The present program is based on Pat's R&D report presented NARAM-11, on *Advanced Methods in Model Rocket Trajectory Analysis.* Copies of this 70 page report are available at the above address for $1.00 each (to cover printing costs). Pat would like to hear from other rocketeers working on similar problems.

Preliminary results from our January 1970 "Reader's Survey" have been tabulated. There doesn't seem to be any clear trend in the returns, with historical articles, contest coverage, scale, history, designs, etc. all proving popular with some segment of the readers. There were, however, some articles which proved exceptionally popular. *Model Rocketry in Vietnam* proved to be the most popular article in the issue, with The Old Rocketeer's *Return to Green Mountain* running a close second. Tom Milkie's *Retro Rockets Forever* ran a good third, with the two contest articles, *MARS IV Regional Meet* and the *USSR Championships* sharing fourth. Mark Pescovitz's scale article on the *Pershing 1* came next, closely followed by *Parawing Recovery* and the *Tilt-A-Tower.*

Your responses to **Model Rocketry** "Reader's Surveys" are *important.* The contents of future issues of this magazine will be determined by your preferences. Keep the responses coming.

The Yugoslavs have developed a new, small-diameter model rocket engine. This engine powered Sovjetskom Savezu's parachute duration entry (the "JUG-1") at the Vrsac Championships. These new engines are 12 mm (approximately ½ inch) in diameter and 40 mm (approx. 1 3/5 inches) long. (Old-time rocketeers may remember the ½ inch diameter UniJet engine that was manufactured for a short time in this country.)

The engines put out 0.125 nt-sec total impulse, putting them in the ½A category. The specific impulse of the propellant, which is assumed to be black powder, is 45.5 kg-sec/kg. Taking advantage of these new engines, Yugoslav modelers have been able to reduce the diameter and thus the frontal area of their competition rockets. The "JUG-1" has a body diameter of 13 mm, whereas the standard American model (using an 18 mm engine) has a minimum diameter of 19 mm. A quick look at the Malewicki charts will indicate that at optimum weight a 13 mm diameter rocket can reach 520 feet while a 19 mm diameter rocket will fly to only 350 feet (assuming a C_d = 0.50) when powered by a ½A enigne. Quite a difference in performance!

George

THROW THE ESCAPE TOWER OUT THE WINDOW!

Those of you who read my column in the February issue ("Throw Your Rockets Out the Window") may have thrown the issue out too, because of a few errors in the figures. Well, here's some helpful corrections:

In the box on page 17, the fifth paragraph should have read, ". . . then $W/\rho = 3.68 \times 10^5$ in^4/sec^2".

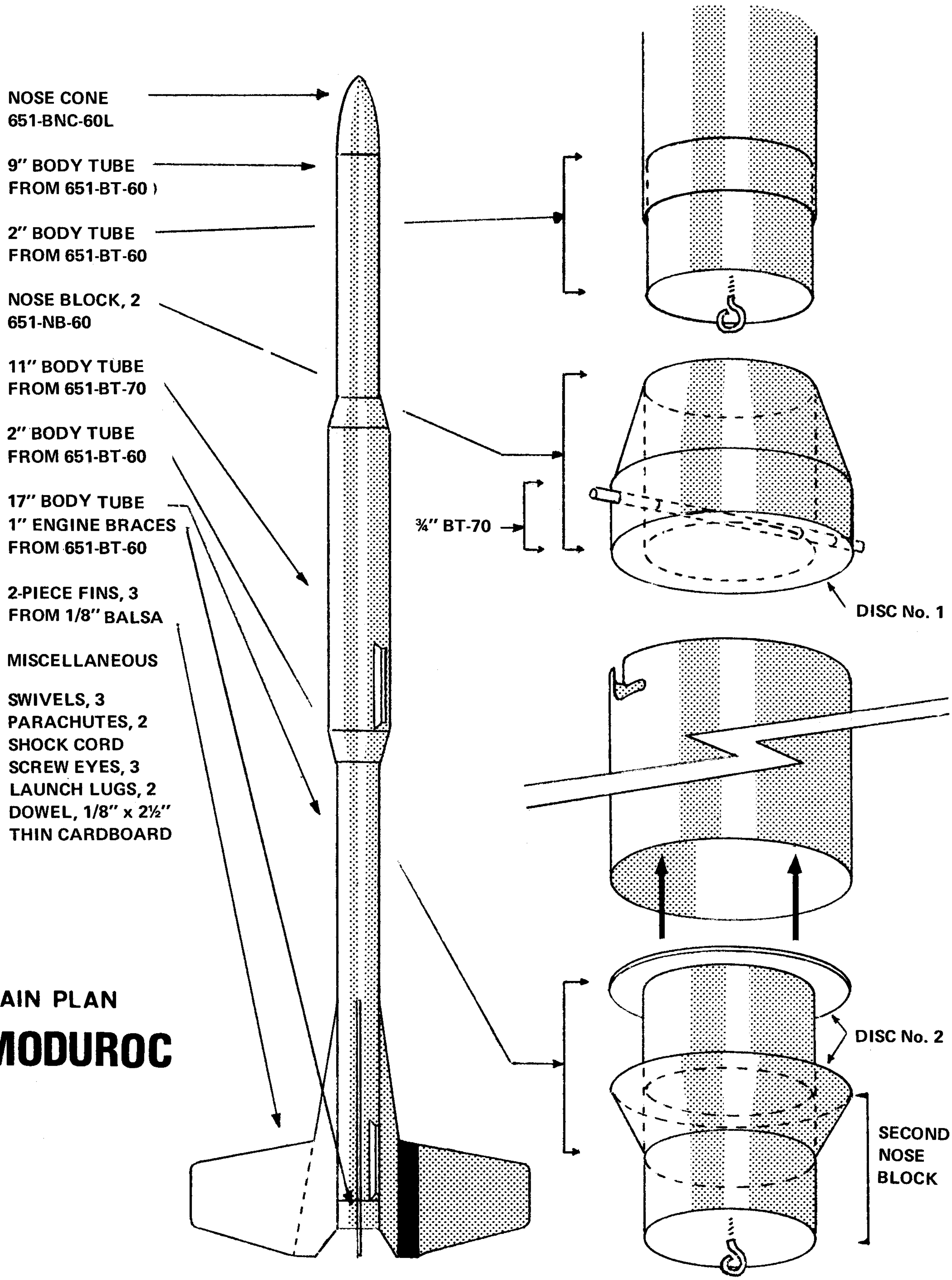
The little two's in the equation are multipliers, not square root symbols.

The large graph is correct if you refer to the **"ounce"** labels on the lines. The numbers (and units) of W/ρ on the lines are not correct. The numbers shown are for mass/air density. To find the correct value for weight/air density, multiply each number by 386.4 (the acceleration of gravity in inches/sec^2). For example, the first line on the left side of the graph should be labeled:

"$W/\rho = 5.468 \times 10^4$ in^4/sec^2
(.1 oz. at sea level and 60°F)"

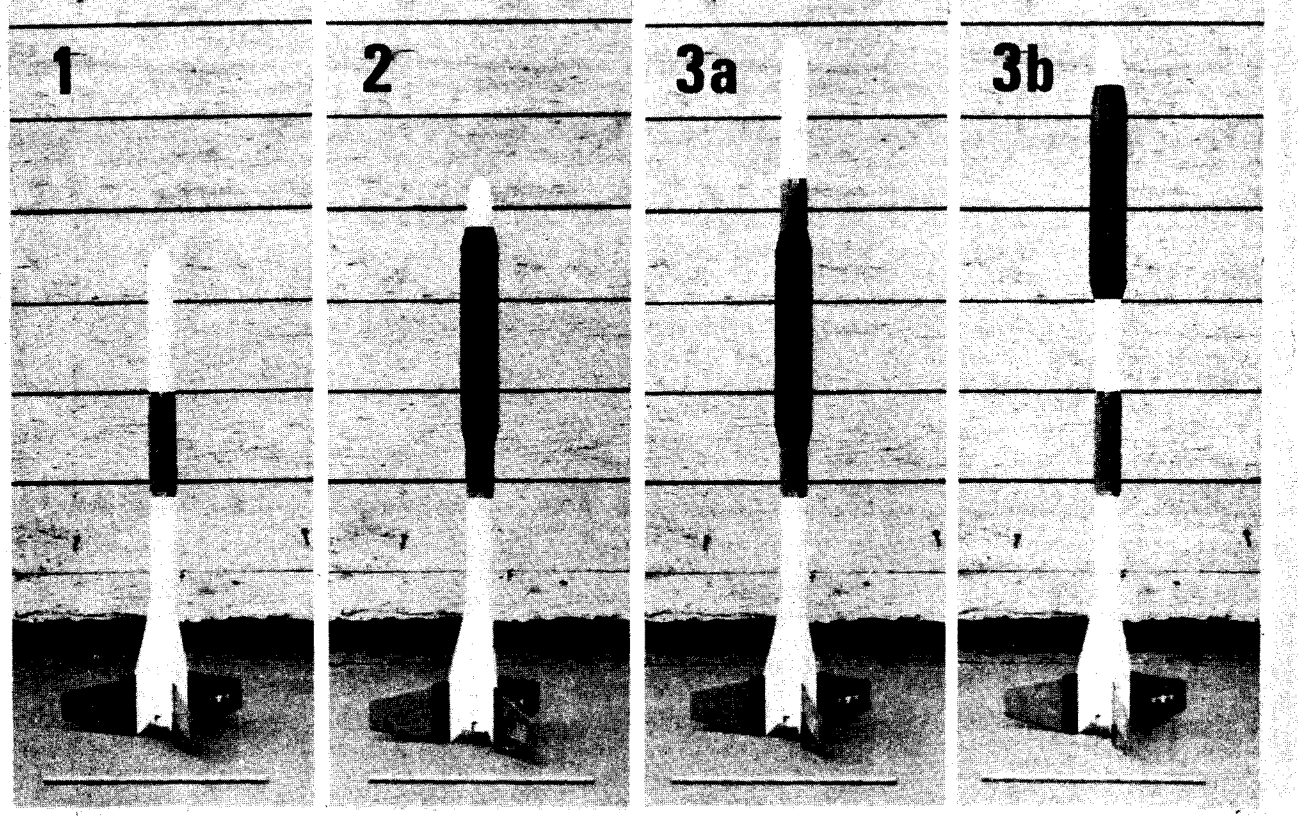
The photographs on page 15 shown a separation of 27 inches. This may not seem too accurate, working with the chart. There is a subtle reason for the large drag coefficient which I will report on next month.

–TTM



MAIN PLAN

MODUROC



Build the MODUROC

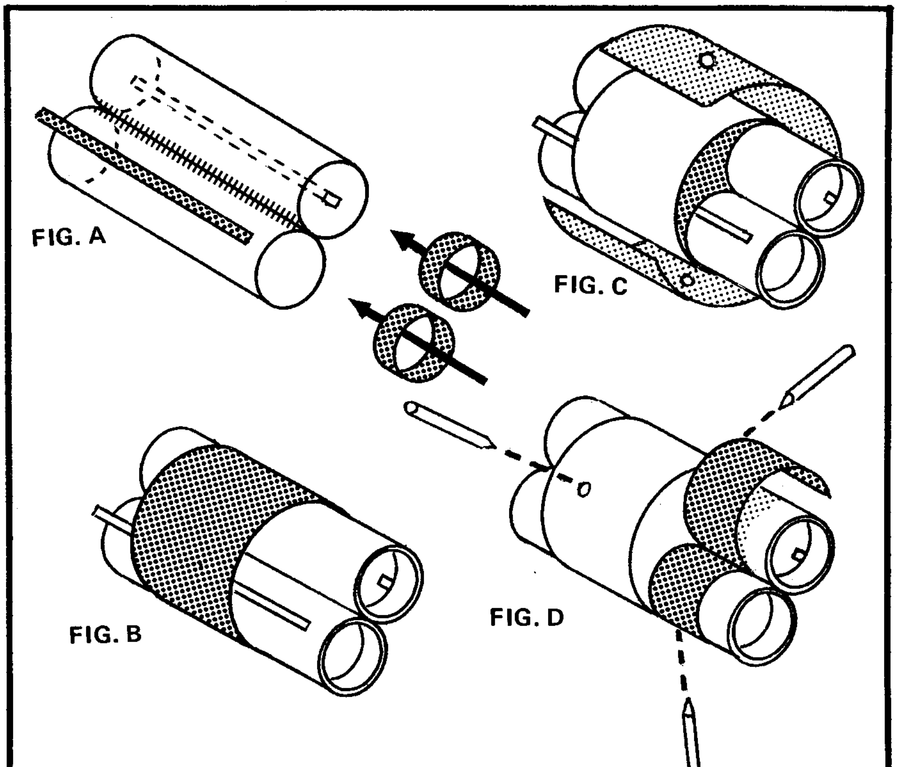
by Melville Boyd

The *MODUROC* opens up a new concept in model rocketry . . . the ability to quickly change the number of engines to be used in a bird. When using the *MODUROC* technique a rocketeer no longer must rely solely on choice of engine ratings for varying the altitude. With *MODUROC* you simply choose the appropriate engine holder, insert, twist and you are ready to go.

The engine holder instructions are presented separately from the original *MODUROC* vehicle, as the builder may prefer to design his own vehicle. All parts are Estes or common items. White glue is used throughout.

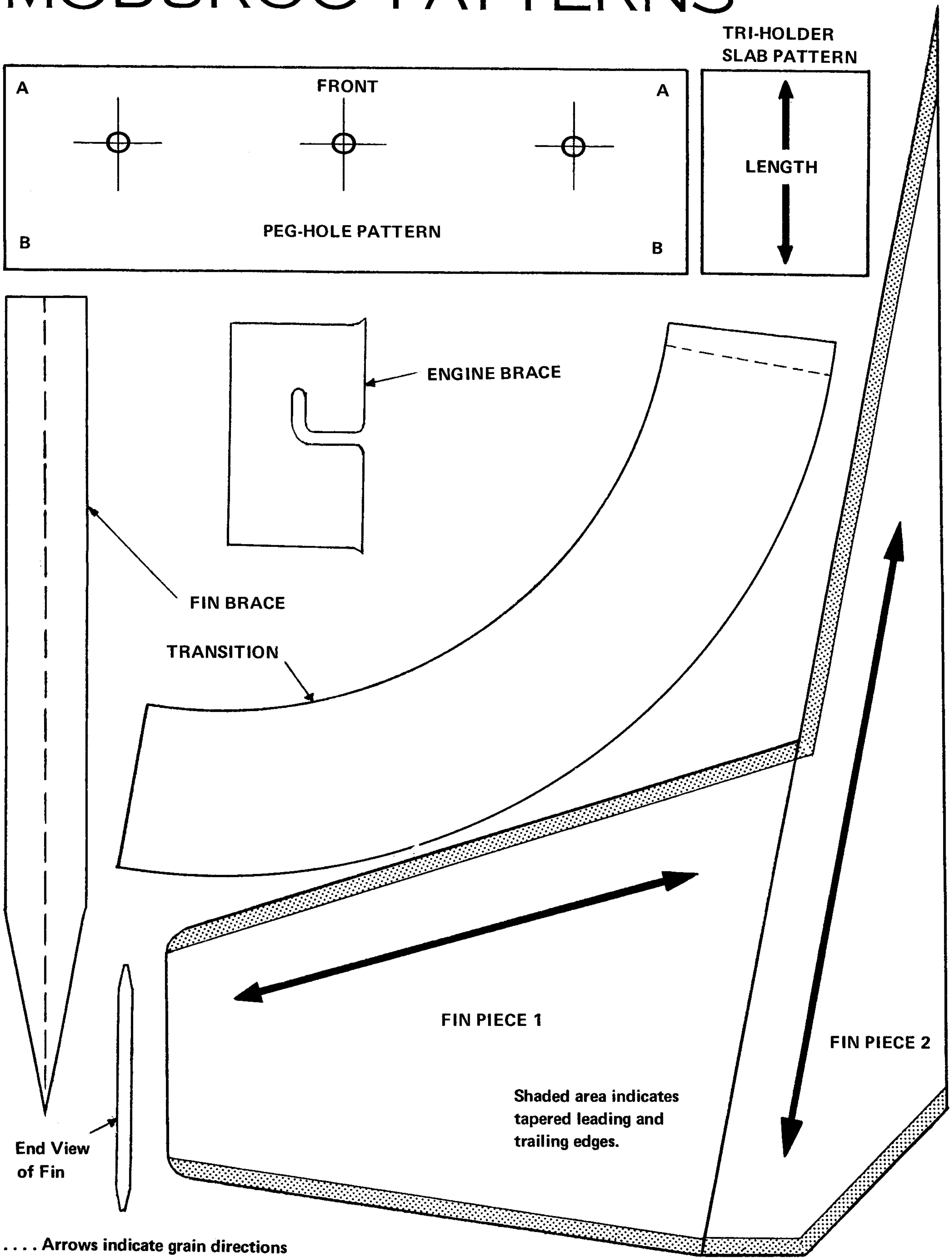
Figures A thru D show the construction steps common to each of the three engine holders. Figures 1R (rear) thru 3R and 1S (side) thru 3S show the relative positioning of parts. In all cases, engine-body tubes should be glued together while lying on a flat surface. Engine blocks are glued in the forward ends of the tubes. Engine holder devices are inserted into small slits cut flush with the rearward ends of the engine blocks. Next, for the clustered holders, glue the stage couplers in place, followed by the carefully cut cardboard end pieces. For the single engine holder, reverse the process by glueing the end pieces to the coupler, then glueing the engine-body tube into the assembly.

Cut or trace the "peg-hole pattern" while the engine holder assemblies are



ENGINE HOLDER VIEWS

MODUROC PATTERNS (FULL SIZE)



. . . . Arrows indicate grain directions drying. When dry, wrap the pattern around each coupler to mark the holes for the positioning dowels. Refer to the engine holder views for correct positioning in each case.

After cutting holes for the dowels, cut them to length, again referring to the drawings, and glue in place. Now, to do something about those metal engine holder devices that keep flopping around. Cut strips of bond paper 5/8" by several inches and glue in place, wrapping tightly around each engine-body tube as shown in figure D.

Now that you have completed the holders you can either design your own vehicle or build your own version of the *MODUROC*.

It must be stressed that the *MODUROC* is purely a demonstration rocket, designed for spectacular liftoffs, not maximum aerodynamic efficiency. One of its impressive features is the modular arrangement of its body sections. The various body sections may be easily rearranged to provide five different configurations.

Referring to the main plan the reader will see that the only unusual features are the transitions (adapters) and the use of engine braces. The paper transition pieces are used rather than balsa in an effort to cut down on weight and expense. The terms DISC #1 and DISC #2 refer to circles that must be cut from cardboard. DISC #2 will be cut so that the inside circumference will match the outside circumference of the BT-60, and the outside circumference will match the inside circumference of the BT-70. That's pretty confusing, but it's necessary for a good fit.

Glue the nose blocks into the 9" body tube and the lower transition piece.

By now these instructions must be seeming pretty dictatorial to the reader. Well, this text is intended only as construction hints which the reader may use as a base for coming up with his own design. Pressing onward . . .

The main plan refers to a "modified BT-70." This piece, 3/4" in length, must have its circumference shortened just enough for it to fit neatly inside the BT-70 body tube. You can do this easily by snipping out a 3/16" section as shown in the figure entitled "SNIP".

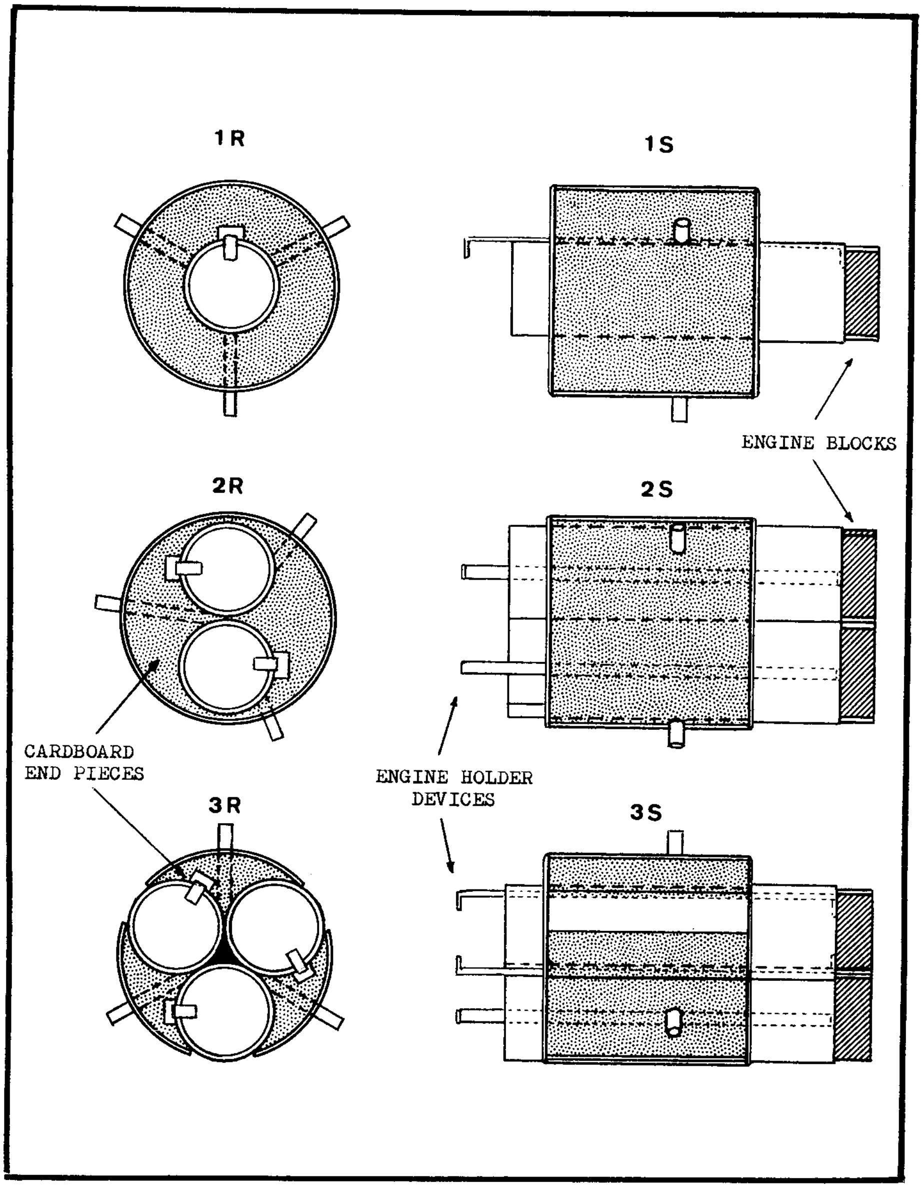
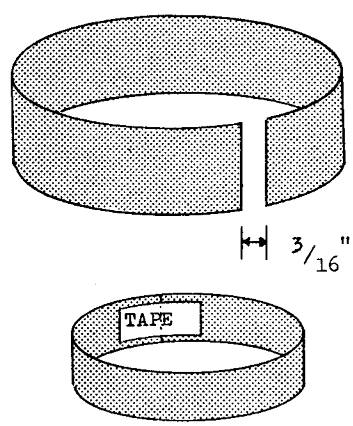


FIG. SNIP



The upper transition piece is held in place by the dowel and slot method, much the same as the engine holders. The lower transition is glued in place, while the upper is not. This allows for payload capability.

The original *MODUROC* has these additional features: fins covered with paper for extra rigidity, hollowed nose cone, launch lugs supported away from the body with balsa strips, and screw eyes in the base of each module. The final parts of the structure are the engine braces. These are absolutely necessary as the thrust of the engines can easily rip an unbraced body tube that has its circular strength weakened by slots.

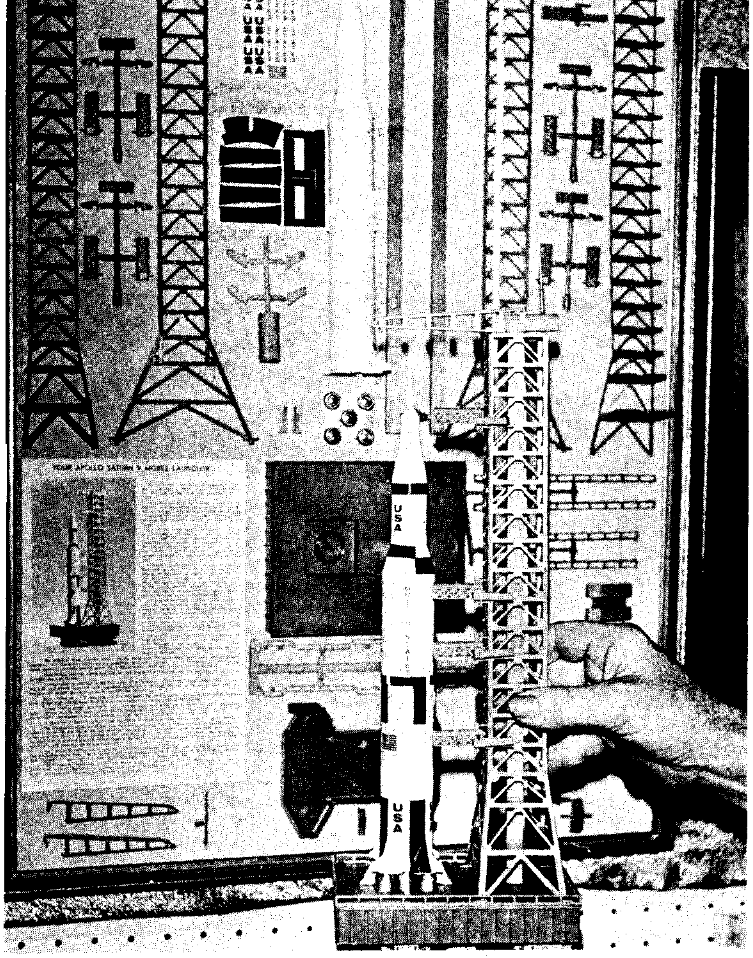
Final touches . . . Use a strong shock cord mounted securely into the lower module, with a snap swivel on the free end. Tie a swivel to each parachute. These swivels will greatly simplify changing the configuration. Finish balsa with sanding sealer or fillercoat and paint entire model with dope for minimal weight.

Test flying the *MODUROC* has shown configurations 1, 2 and 3 to be the most satisfactory. In each case the configuration number indicates how many engines were used. B and C engines are recommended due to the relatively high weight. Configurations 2 and 3 employ the thick BT-70 module, thus increasing frontal area sufficiently to warrant adding two ounces of weight to the upper end.

Constructed carefully, the *MODUROC* will rise slowly and majestically off the launch pad, ascend to a modest height, deploy the chutes and settle gracefully to earth, providing spectators a thrilling performance.

One last point . . . always use engines with short delay charges. Don't take a chance on the *MODUROC* pranging before deployment . . . as model rockets go, it is heavy.

Configuration	Weight	Length
1	4.1 oz.	30.5"
2	5.3 oz.	34.8"
3	6.1 oz.	43.8"



New Product Report

FROM THE 1970

HIAA Trade Show

New rocket kits, engines, paints, tools, construction materials, etc. will be introduced this year........

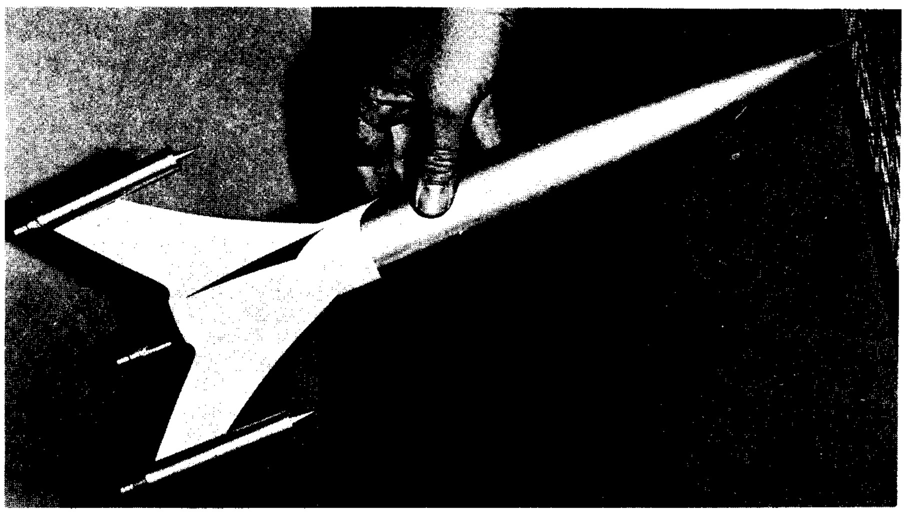
Countdown, Inc.'s, new, easy-to-assemble Saturn-V with mobile service structure is available in kit form. Great as a display item, and the ambitious rocketeer should have little trouble with flight conversion.

As readers of last April's **Model Rocketry** will recall, the Hobby Industry Association of America (HIAA) holds it annual trade show in Chicago each February. All the major hobby manufacturers display their new products for the upcoming year for the hobby wholesalers and dealers to see. At last year's show only MRI and Vashon, from among the model rocket manufacturers, displayed their products at the show. This year, however, the rocket manufacturers were out in force, with Centuri, Cox, MPC, SAI, and Vashon representing the kit manufacturers. In addition, several other manufacturers had rocket oriented products in their displays. From the crowds of buyers gathered around the rocket booths, it seems that many more hobby shops will be handling rockets this year than last.

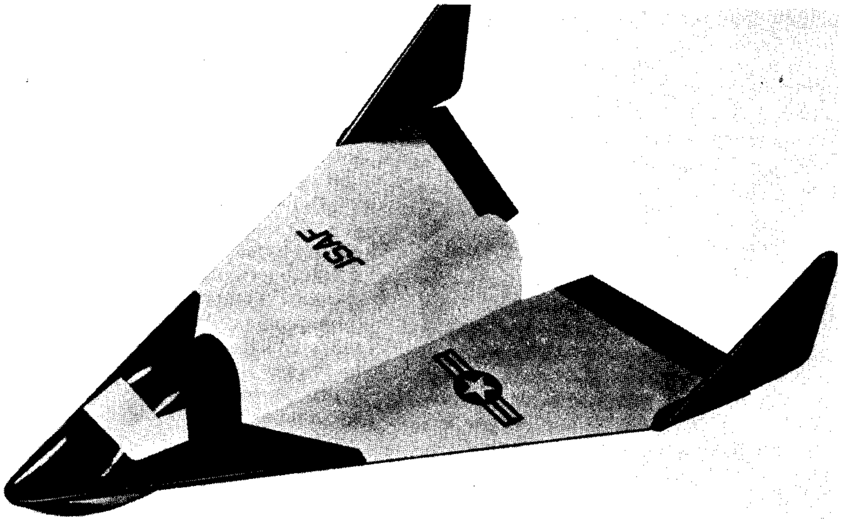
With Vern Estes, Leroy Piester, Lee Jones of MPC, Tag Powell of SAI, Bruce Paton of Cox, and Alan Forsythe of Vashon all gathered in Chicago's Sherman House at the same time, it was a great time to find out what's new, and in some cases what's going to be new, in the rocket field. The manufacturers displayed some models which will be on sale by the time you read this report, prototypes of others some of which will not be on sale until eight months from now, and mock-ups of others that may never go on sale unless a favorable response is received from the dealers.

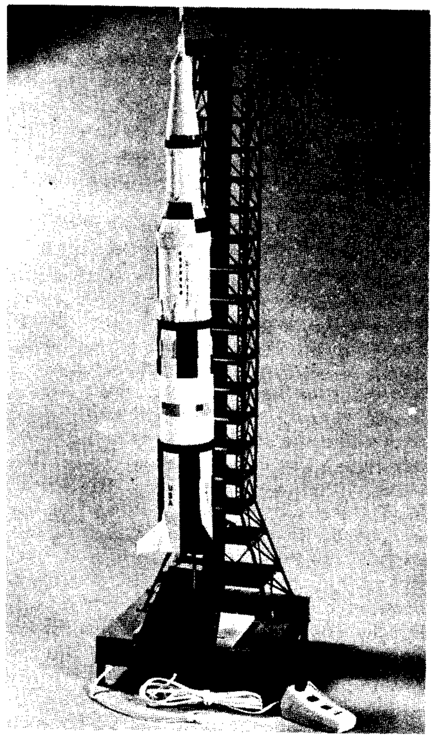
So, what's new from the rocket manufactures? Quite a bit! Let's take them in alphabetical order, so no one will be offended.

First up from Centuri with an impressive display of their scale models for all the new dealers to see. With the detailing on these models, and the colorful new packaging, Centuri's scale birds should even sell as static display models to non-rocketeers. Two new scale models, a Thrust-Augmented Delta and a Mercury-Atlas, are scheduled for release in June. Only photos of these birds were available at the show, but if they are up to Centuri's usual scale quality, they should be very impressive. Three new sport models, including a futuristically designed,



Centuri's futuristic demonstration/sport model should be on sale later this month. Also announced by Centuri is the release of two scale birds in early summer.





Two additions to the Cox rocket line are the Dyna-Soar boost/glider shown above, and the 33" tall Saturn V with semi-scale tower and launcher assembly. Both rockets are expected to be on the market in late spring.

2-foot demonstration model, will also be introduced in the spring. New molded plastic nose cones, to be available in white, chrome plated, and fluorescent colors, will soon be available in eight sizes. Watch for an announcement on these.

With the acquisition of Enerjet by Centuri, the introduction of high-impulse (D, E, and F) rocket engines of high quality is expected. Lee Piester had a sample D, in an 18 x 70 mm casing at the show.

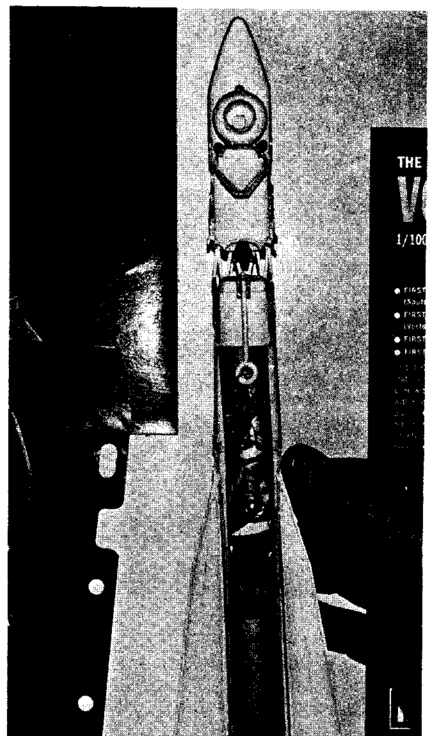
A series of four multicolored wall posters, ideal for decorating any rocketeers workroom or clubroom, is now available from Centuri. These 14 x 20 inch posters are designed to explain the proper operation of model rockets. Titled "How Model Rocket Engines Work," "Major Parts of a Model Rocket," "How Does a Model Rocket Work," and "Model Rocketeer's Safety Code," these posters printed on glossy card-stock, are available at $3,00 for the set of four. Two new decal sets, "Missile Markings", and "Military Insignia", each priced at 50 cents, were also recently introduced.

By May, Centuri will have a Parts Merchandising Display Rack available to its dealers. This display rack was designed to meet some dealers' resistance to stocking model rocket parts and supplies. All commonly used parts are contained in a neat, space-saving rack, which should encourage many dealers who now only carry kits engines to sell the parts and supplies necessary for scratchbuilding.

The L. M. Cox Company presented their new line of six ready-to-fly modrocs at the show. These all plastic rockets are ideal for beginners and as demonstration rockets. After the initial orders for the Little Joe II, Honest John, and Nike-Zeus (see description in November, 1969 MR) are filled, the Saturn V, Saturn 1B, and a semi-scale Dyna-Soar boost/glider will be introduced. Easy to assemble plastic kits of the same kits will follow soon after the ready-to-flys. For those rocketeers who aren't yet convinced that plastics can be made *light*, Cox's Product Design Manager, Bruce Paton, disclosed the weights of these new plastic models. The Little Joe II, lightest of them all, tips the scales at only 0.85 ounces; the Honest Joe weighs in at 1.2 ounces; and the two-stage Nike Zeus weighs only 2.4 ounces (all without engines). The Saturns are quite light for their size, with the 33-inch-tall Saturn V weighing only 7.25 ounces; the 21-inch-tall Saturn 1B weighs 5.5 ounces. The Dyna-Soar was only in prototype form at the show, but it is expected to weigh about 3.5 ounces when marketed.

Estes Industries introduced its new products for 1970 to the rocketeers before presenting them to the dealers, so there were no suprises at the Estes booth. The emphasis was on the new D-engines, being shown to the dealers for the first time, and the CINEROC movie camera. Vern assured everyone that the CINEROC is still on schedule, with the first production models to come off the lines in the spring and delivery to begin shortly thereafter. Though it was previously announced that only black & white film would be available for the CINEROC, arrangements have now been made to offer an Ektachrome color movie with the camera. New packaging for the Mars Lander and the Saturn V, which should make these models more popular with hobby dealers, were also introduced by Estes.

MPC's motto seems to be "think different," and this company introduced several spectacular innovations to their product line. A prototype of the MPC plastic, 1/100 scale, RD-107 "Vostok" kit was displayed. Molded in white plastic, this rocket can be assembled as a static display model or for



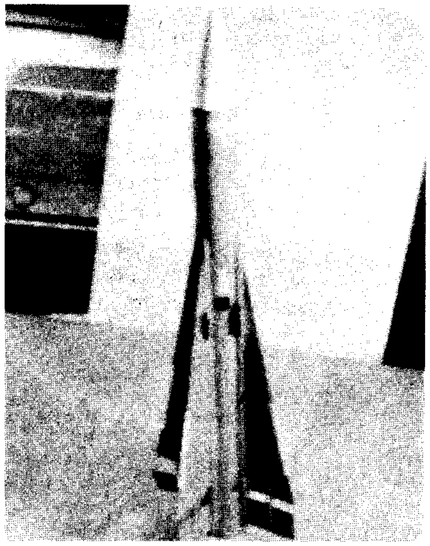
An interior view shows the engine mount and parachute system of MPC's new "Vostok" plastic flying model rocket kit. The kit should be on hobby shop shelves in April.

flying scale. The two 1/100 plastic models to follow the Vostok have also been announced by MPC; first is a Titan-III, to be followed by a Saturn 1B. Both ate intended for release later in the year. Each of these rockets is light enough for single engine power, though the ambitious rocketeer should have no trouble converting the Titan III to three engine power.

For the UFO minded rocketeer, MPC has the Martian Patrol—a variation on the previously released Lunar Patrol. Two strap-on boost/gliders are carred aloft on the Lunar Patrol and released into gliding flight at ejection (see "New Product Notes," **MR**, March, 1970). On the Martian Patrol, two 5 inch diameter expanded-foam disks are deployed at apogee and float individually to earth while the rocket returns to earth by parachute. The MPC Pegasus is the first model rocket customizing kit. The kit includes three fiber body tubes, two plastic nose cones, balsa fin material, a one-piece plastic fin assembly, two recovery streamers, and enough additional material to build a towering 22-3/4 inch tall two-stage model, *or* a high flying 22-3/4 inch tall single-stage rocket, *or* two individual rockets, one 14 and the other 9 inches tall.

The newest addition to the MPC Astroline series is the Aquarius. This 23-1/2 inch tall rocket employs snap-on fins, a plastic motor mount, and a plastic nose cone, making the Aquarius an easy-to-build demonstration and sport model. In the Mach 10 series, MPC introduced the Microsonde III, a three-stage rocket employing swept balsa fins and a balsa nose cone. A model rocket starter set including the MPC Rocket Launch Pad, Launch Controller, Pioneer I rocket kit, two A3-2 engines, carrying case, and instructions rounds out the MPC line.

Space Age Industries introduced three new rocket kits at the show. Their first two-stager, the Gamma II, weighed in at 2.25 ounces and stood 20-1/4 inches tall. The Gamma II will come with die-cut fins for ease of assembly. The Pegasus, a 2 foot tall sport and demonstration model, uses the

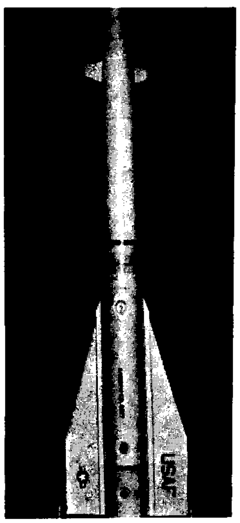


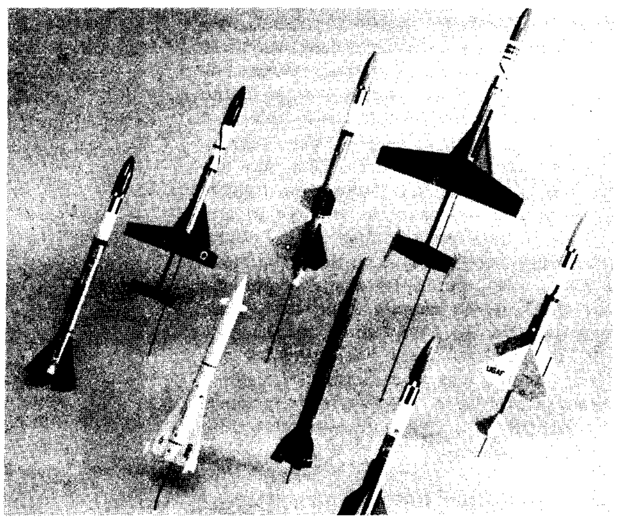
SAI's impressive "Falcon" scale model comes complete with a set of blueprints drawn from factory information and checked for accuracy with an actual Falcon on loan from the Air Force.

SAI 45 mm diameter tube. Both the Gamma II and the Pegasus are scheduled for April release.

Unfortunately, the SAI Falcon scale model was not on display at the show (since the prototype was in **MRm**'s offices having its picture taken during the week of the show), but literature on this impressive kit was available for the dealers. Scaled around the SAI 30mm tube, this model of the Air Force AIM-4E Falcon stands 15-3/4 inches tall and weighs 2-3/4 ounces. This kit may be worth the $4.50 price just for the scale data it contains, since the complete plans were drawn up from a real Falcon on loan to SAI from the Air Force.

Also new from SAI is the "Blinky", a miniature, transistorized tracking light. "Blinky" will be available in kit form, including the printed circuit board, in early April. No price has yet been announced, but it is expected to retail below $5.00.





Vashon's scale Sandpiper (left) is powered by their standard V-1 engine. The entire Vashon line is shown to the right, (back row, left to right) Valkyrie-2, Astro-Gnat B/G, Viking 2-stager, Baron B/G; (front row, left to right) Sandpiper, Sergeant, Valkyrie-1, and the X-13 B/G.

Vashon Industries, whose cold-propellant model rockets attracted much attention at last year's show, was back this year with a greatly expanded line of modrocs. Their first two-stager, the Viking-II, a series of boost/gliders, and two scale models, as well as a jet plane, complement the two single-stage models introduced last year. The boost/gliders, which strap to the side of a standard Vashon rocket (or, perhaps, any other modroc) employ a novel release mechanism which uses tension in a stretched cord to release the glider at parachute deployment. Three different boost/glide designs, all employing the catapult deployment system, are presently available. The X-13 Rocket Plane is a delta-wing design, while the Baron and the Astro-Gnat are standard glider shapes. No word yet on the durations, but they should be fun to try. These new boost/gliders will also be available without the booster rocket, for those rocketeers who want to mount them on other modrocs.

Vashon's two new scale birds will both retail for under $10.00. The Sandpiper, a 13-1/2 inch long model of the Air Force's new missile, features delta-shaped tail fins, and a small canard fin. The scale Sergeant stands 15-1/2 inches tall, and employs a standard Valkyrie-1 rocket motor. Both new scale rockets will feature pre-shaped styrofoam nose cones.

Simpliway Products Corporation (Dep't. R, 6 East Randolph Street, Chicago, Ill. 60601) displayed their new electronic ignition system. This system, using electronic switching of a battery located at the pad, allows remote switching of a launch from hundreds of feet away. A single rocketeer can use this system to launch his rocket from the tracking station, and then track the rocket as it leaves the pad. Priced at $8.50, the Simpliway ignition system is supplied with a 60-foot cable.

Lectronix (PO Box 42R, Madison Heights, Mich. 48071) has been experimenting with rocket applications of several of their electronic kits. The "Blinky" dual flasher (PC 3) kit, the amplifier-oscillator (PC 2) kit, and the amplifier (PC 1) have applications as model rocket instrumentation.

The new structural shapes from Plastruct (1621 North Indiana Street, Dep't. MR, Los Angeles, Calif. 90063) should remind you of the scene looking around a Cape Kennedy launch pad. "I" beams, "T" beams, columns, pipes, ladders, stairs, ladders with cages, wheels, sylinders, hemispheres, etc. are all part of the expanded Plastruct line. These shapes are designed for building archetectural and engineering models of structures, *just the material for building your scale models' gantrys, towers, and launch pads from.* Send for their new catalog, and sit down and plan that scale launcher today.

While we're on the subject of scale launchers, Countdown, Inc. (PO Box 551MR, Jacksonville, Fla. 32201) has come out with a very nice scale Saturn V with its mobile service tower. The rocket stands about a foot tall, and the gantry a few inches taller. This easy-to-assemble kit, which is molded in several colours of plastic so that no painting is necessary, can be put together in about two hours. Though not designed as a flying model, this Countdown kit (which is sold at the Kennedy Space Center) makes an excellent display model. If you're a serious rocketeer, take a look at the kit again, as it looks like very little effort would be required to convert it to flight.

From the other plastic kit manufacturers, there was nothing very spectacular. Revell has improved their LM kit, and renamed it "Tranquility Base". The updated kit contains reflecting foil for the descent stage, an instrumentation package, and a mock lunar surface. (The conversion plans published in MR, March 1970, apply to this kit as well.) Monogram has also introduced a 1/48 scale Apollo 11 lunar module, including the scientific experiment package and the lunar surface. As with the Revell kit, this one should be flight convertable. Airfix, the British model manufacturer, has also introduced an LM kit, as well as a 1/144 scale Saturn V. AMT has packaged the 1/200 scale Saturn from their "Man in Space" kit separately, and this kit also has conversion possibilities.

Rocketeesrs now have their own paints, Rocket Glare acrylic flourescent permanent water colours by Palmer Paints. These flourescent colours – Flaming Red, Blast-Off Blue, Universal Yellow, Galaxy Green, Orbital Orange, and Power Pak Pink – were designed with ease of tracking in mind. Neatly packaged in a kit of six ¾ oz. bottles, these Rocket Glare paints are the only flourescent water-base acrylic on the market.

Magic Masker, a painting aid for use in masking applications where tape was formerly required, was displayed by the Cary Locomotive Works. This liquid is easily applied with a brush to those areas which you want to have remain unpainted. After use it peels off without marring the finish underneath.

Rocketeers now have their own paint: Palmer "Rocket Glare", a flourescent, water-base acrylic designed for ease of tracking.

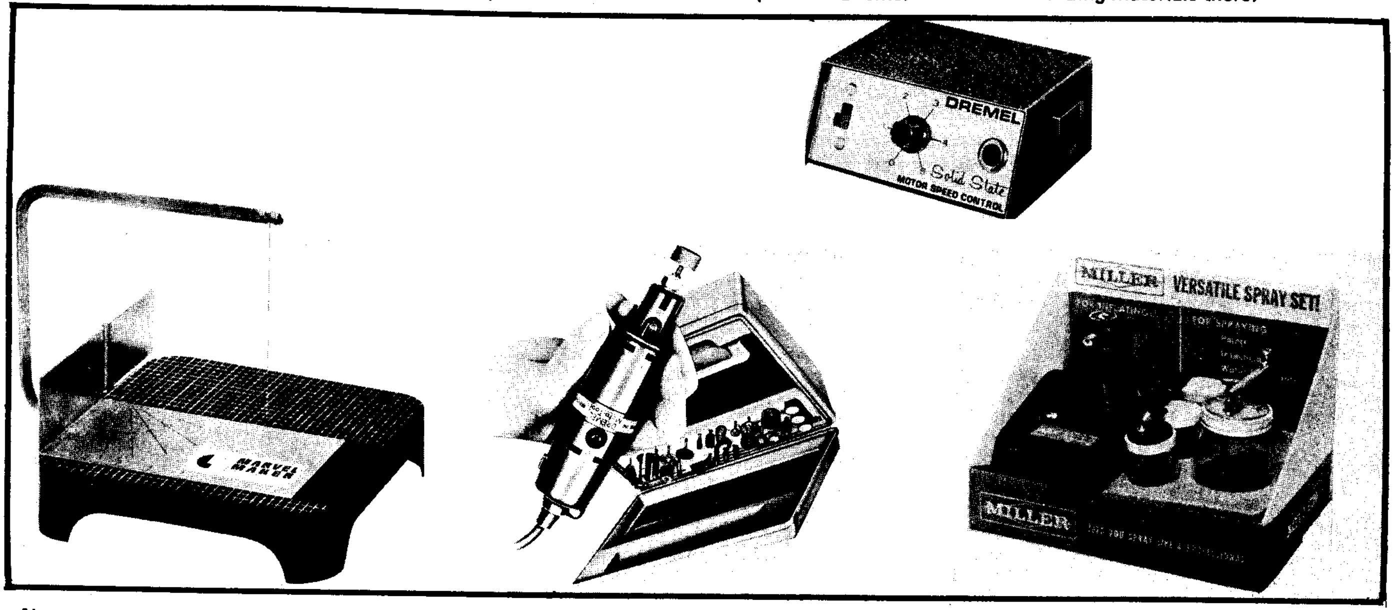
Another unusual finishing material has been introduced by ISLE Laboratories (PO Box 173R, Sylvania, Ohio 43560). Their model customizing material is a gold, silver, red flourescent, or green flourescent foil with a pressure-sensitive backing. It adheres to any surface, waterproofs, and strengthens, and allows an authentic silver finish to be applied to scale models.

New tools with modroc applications have been introduced by several firms. Just across from the Estes booth was Lancer Industries (1402M Norman Firestone Road, Goleta, Calif. 93107), manufacturers of an easy-to-use thermal styrofoam cutter. With the new high-density, low-weight styrofoams available, this new construction material should be ideal for boost/gliders. The Lancer hot-wire cutter, priced at only $12.95, was designed to cut such things as model airplane wings. Lancer also has styrofoam blocks available by mail order, if your local distributor cannot supply the material.

Dremel has just released a variable-speed control which makes their Moto-tool ideal for plastic conversions. The speed control, priced at $16.95, allows you to slow down the Moto-tool grinder, polisher, or deburrer to the correct speed fpr working with plastics. The new workshop from Dremel should give your plastic conversions the professional look. This tool can also be used to hollow out balsa or hardwood nose cones to accomodate instrumentation or reduce the weight to the optimum.

Model rocket workmanship seems to be on the upswing, and there has been a considerable interest in airbrushes. Three manufacturers showed airbrushes in the show. The least expensive was the $1.49 paint sprayer from Preval. Employing compressed gas, the Preval sprayer is ideal for the beginner. Badger and Miller exhibited more sophisticated airbrush kits for the more serious modeler. The new Badger "Press and Paint Kit" comes complete with an airbrush, 15 oz Propel can, 4 jars of paint, thinner, and instructions; it is priced at only $9.98. From Miller, the "Spray Set" includes a compressor and three spray guns and is priced at $45.90; it is the ultimate in spraying equipment. Each spray gun is designed to cover a different-sized area.

Over the next few months these and other hobby supplies introduced at the HIAA Show should be reaching the shelves of your local hobby shop. From the interest the dealers showed in rockets and rocket-related products, you should have no trouble finding materials there.



New tools of interest to rocketeers include the Lancer "Marvel Maker" styrofoam cutter, great for cutting out B/G wings. From Dremel the Motor Speed Control" allows their "Moto-Tool" to be used for plastic modeling as well as hollowing out nose cones and forming boat-tails. The Miller spray-painting set enables one to easily apply a professional-looking finish to scale models.

"D-13" Engine Flight Performance

Part II – Example Problems

by Douglas Malewicki

INTRODUCTION

Last month we presented four graphs which enabled you to establish the burnout altitude, burnout velocity, peak altitude, and coast time for "D13" powered model rockets. This month, as you can see, we also have included a Drag Form Factor Graph and an Atmospheric Density Ratio Graph.

The sample problems we have prepared are not especially difficult, but do assume some previous knowledge in working with such graphs. Instead of the present more commonly accepted drag coefficient value of C_D = .75, we will be using C_D = .5 throughout for any problems involving *THEORETICAL* predictions. The preliminary wind tunnel drag coefficient measurements discussed elsewhere in this issue explain the reasons for this reduction.

PROBLEM 1
A "D-13" POWERED BIG BERTHA

To give you a better feel for just how much power the Estes D13 engine has, let's first run a flight analysis on that well-known minimum drag, minimum weight wonder on the model rocket world—the Estes Big Bertha! If the D13 engine can do anything good for that energy dissipating beast, the point will be more than proved.

Assuming that the necessary internal modifications for "D13" power do not affect Big Bertha's overall weight, we can use the Estes catalog weight value:

BIG BERTHA EMPTY WEIGHT = 2.25 OUNCE

A D13-5 engine will increase the weight by 1.5 ounces, or:

$$\text{TOTAL LIFTOFF WEIGHT} = \text{EMPTY WEIGHT} + \text{ENGINE WEIGHT}$$
$$= 2.25 + 1.5$$
$$= 3.75 \text{ ounces}$$

The Big Bertha body tube is a 1.6" diameter BT-60. Using a drag coefficient of C_D = .5 in the Drag Form Factor graph results in:

$$C_DA = 1.05 \text{ in}^2$$

Using the above data and the D13 graphs presented last month we obtain the complete flight performance picture for a D13 powered Big Bertha.

BURNOUT VELOCITY	$= 460 \frac{FT}{SEC}$ = 310 MPH
BURNOUT ALTITUDE	= 410 FEET
MAXIMUM ALTITUDE	= 1200 FEET
COAST TIME	= 5.8 SECONDS

See what I meant about power to spare! If you think that the analytical basis for the graphs exaggerated the altitude, why not just modify a Bertha for a D13 engine and see for yourself.

The theoretical coast time to the peak altitude is 5.8 seconds. Thus, it looks like using the 5.0 second delay will be the best choice possible. Best choice for what? *Are you sure* you want the parachute to eject as close to the peak as possible? If it's a windy day, you could be in for a lot of chasing from that altitude. One might well consider choosing the 7 second delay instead in order to let it fall awhile before popping the chute to slow its descent. If you minimize the time the rocket is on its chute, you will have helped minimize the distance it will drift in a wind.

PROBLEM II
PREDICTED ALTITUDE CONTESTS

You plan to enter the above rocket in an NAR Predicted Altitude contest. You know that prior to your first official flight you have to tell the judges just how high you expect it to go. What altitude do you specify?

Until you obtain some additional information, the previously calculated 1200 feet more than likely is *not* your best guess. The extra information you'll want is: 1) the altitude above sea level where the rocket will be launched, and 2) the probable temperature at the time of launch. Why? Because the 1200 foot value was based on the rocket flying in a STANDARD atmosphere based on a sea-level launch when the temperature is 59°F.

This past year the National Association of Rocketry Annual Meet was held at the Air Force Academy where the elevation above Sea Level is 6500 feet and the temperature was 83°F at times. Needless to say, the air at this altitude and temperature is thinner than air at Sea Level. This change in atmospheric density must be taken into consideration when analyzing your rockets.

The aerodynamic drag force used in generating the "D13" flight performance graphs was based on:

$$D = C_DA \, \tfrac{1}{2} \rho_{S.L.} V^2$$

where $\rho_{S.L.}$ means the STANDARD SEA LEVEL day atmospheric density.

$$\rho_{S.L.} = .002378 \frac{\text{lb-sec}^2}{\text{ft}^4} \quad (\text{or } \frac{\text{slug}}{\text{ft}^3} \text{ if you prefer})$$

In the February, 1970 issue of **Model Rocketry** we introduced the use of the density ratio as defined by the greek letter (σ) sigma.

$$\text{DENSITY RATIO} = \sigma = \frac{\rho}{\rho_{S.L.}}$$

where

ρ is the actual density at the launch altitude and temperature of interest

and

$\rho_{S.L.}$ is the fixed STANDARD 59°F SEA LEVEL density used in generating the flight performance graphs.

With the aid of the density ratio (σ), we can compute the drag on the rocket at any density of interest (ρ) from the basic drag force formula as follows:

$$D = C_DA \, \tfrac{1}{2} \rho V^2$$

is the same as:

$$D = C_DA \, \tfrac{1}{2} (\sigma \rho_{S.L.}) V^2$$

because:

$$\rho = \sigma \rho_{S.L.} = \left(\frac{\rho}{\rho_{S.L.}}\right) \rho_{S.L.} = \rho$$

Since the only variables we work with when using the performance graphs are: 1) Liftoff weight, and 2) Drag Form Factor, we re-arrange the above equation so that the Drag Form Factor is multiplied by the density ratio (σ).

$$D = \left[\sigma C_DA\right] \tfrac{1}{2} \rho_{S.L.} V^2$$

This last equation tells us that flying a rocket of a known drag form factor (C_DA) in thinner, less dense air (σ less than 1.0) is *exactly* equivalent to flying a more streamlined rocket (σC_DA is less than C_DA) in the denser standard sea level air ($\sigma = 1.0$).

In either situation, the *total* drag force—which is all that we're really concerned with—is identical at any particular flight velocity. Lumping the density ratio in with the drag form factor as we just have means that the graphs which were originally calculated only for standard sea level density ($\rho_{S.L.}$) can still be used.

With this background information we can now proceed to properly modify our maximum height estimate for a Predicted Altitude contest held at the Air Force Academy in 83°F weather.

Using the DENSITY RATIO GRAPH with a launch altitude of 6500 feet above sea level and a temperature of 83°F, we find that:

$$\sigma = .80$$

The liftoff weight and drag form factor have not changed.

$C_DA = 1.05$ in^2

LIFTOFF WEIGHT = 3.75 ounces

This time we do not look up flight performance at $C_DA = 1.05$ in^2. Instead, we look up:

$$\sigma C_DA = (.8)\ (1.05\ \text{in}^2) = .84\ \text{in}^2$$

Note that the σ symbol does not appear with each printed C_DA =——— on the four graphs. Printing σC_DA =——— would be extra confusion to beginners just learning how to use such graphs—especially since most introductory example problems deal with the analysis of rockets launched under standard 59°F sea level conditions ($\sigma = 1.0$). You can either imagine that you are looking at σC_DA = symbols and not just C_DA = , or you can interpret the printed C_DA's to mean the "equivalent drag form factor" needed to obtain identical flight performance in a standard sea level atmosphere.

Summary of "D13" powered Big Bertha Flight Performance for a 83°F, 6500 feet above sea level launch.

BURNOUT VELOCITY	= 485 $\frac{FT}{SEC}$ = 330 MPH
BURNOUT ALTITUDE	= 415 FEET
MAXIMUM ALTITUDE	= 1350 FEET
COAST TIME	= 6.2 SECONDS

PROBLEM III
A MOUNTAIN TOP LAUNCH

What altitude would you expect the Big Bertha to reach if it was taken along on a hike to the top of a 14,000 foot mountain and launched when the temperature was 50°F.

The density ratio for these atmospheric conditions is:

$$\sigma = .60$$

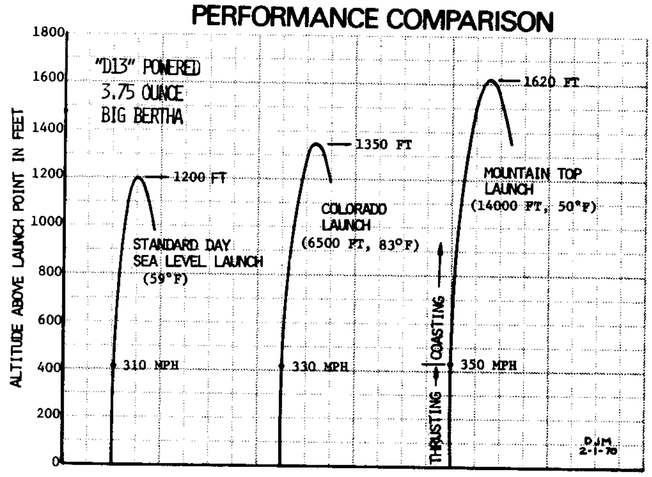
and now:

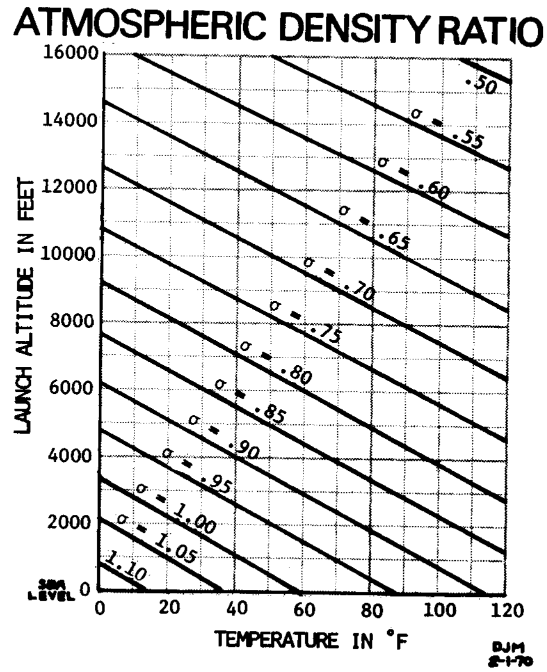
$$\sigma C_DA = .6\ (1.05\ \text{in}^2) = .63\ \text{in}^2$$

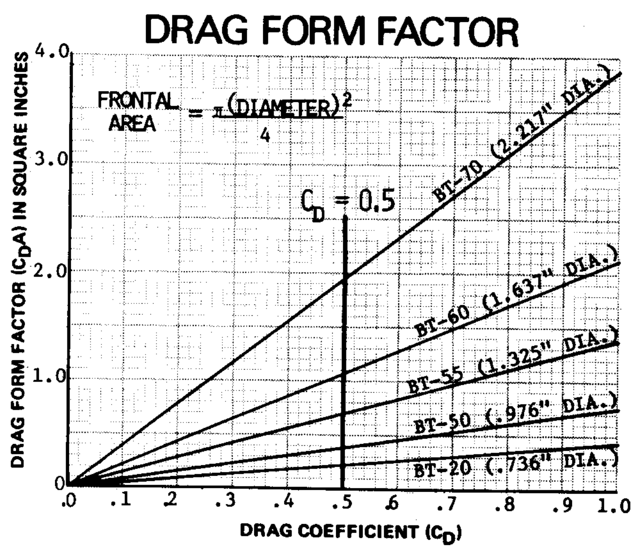
for this σC_DA and a weight of 3.75 ounces we obtain:

BURNOUT VELOCITY	= 515 $\frac{FT}{SEC}$ = 350 MPH
BURNOUT ALTITUDE	= 435 FEET
MAXIMUM ALTITUDE	= 1620 FEET
COAST TIME	= 7.1 SECONDS
ABSOLUTE ALTITUDE ABOVE SEA LEVEL	= 15,620 FEET

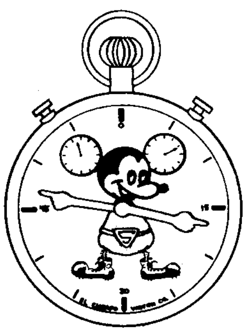
The following pictorial comparison of the Big Bertha's flight performance for the three separate atmospheric conditions summarizes what has been learned from these problems.

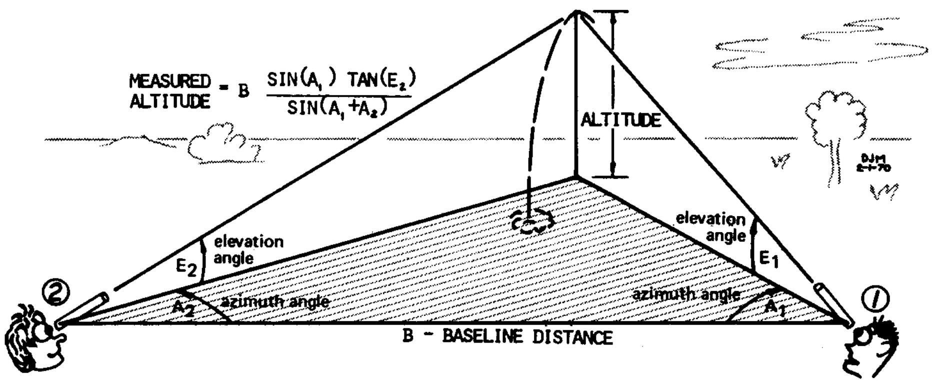




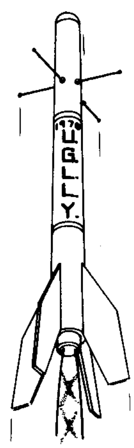


PROBLEM IV
FINDING DRAG COEFFICIENTS
TIMING VERSUS TRACKING





In order to actively participate in scientific research during the 1970 *United Geophysical Lunar Year*, two rocketeers, Jim and Fred, modify their Estes *Big Bertha* to carry both a telemetry package and a picture-taking *Camroc* nose. Realizing that it will be fairly heavy they also convert it for "D 13" power. The combination of the very blunt *Camroc* nose and the four special whip antennas shown in the drawing will increase the rocket's drag coefficient (C_D) by some unknown amount. This, in turn, will introduce an unknown error in any altitude predictions.



Jim confidently tells Fred that he will obtain their research rocket's drag coefficient and also will measure how high it goes using a stop watch! He adds, "All I have to do is measure the total time between rocket lift-off and peak altitude." After rounding up some help and three club stop watches (so that they can average recorded times for improved accuracy), they proceed to the launch field. Prior to launch they noted that:

Lift-Off Weight = 6.0 ounces
BT-60 Reference Frontal Area $A = 2.105 \text{ in}^2$
Launch Elevation = 1000 feet above sea level
Temperature = 70°F
Density Ratio (from the Graph) σ = .95

After the flight, the three stop watch times are recorded:

TOTAL TIMES TO PEAK ALTITUDE = 7.2, 6.7, and 6.8 seconds

$$\text{AVERAGE TOTAL TIME TO PEAK} = \frac{7.2 + 6.7 + 6.8}{3} = \frac{20.7}{3}$$
$$= 6.9 \text{ seconds}$$

Jim proceeds with his analysis as follows: Since the "D13" engine thrusts for 1.5 seconds, subtracting 1.5 seconds from the total time will give the time the rocket spent *coasting* to its peak altitude.

$$\text{COAST TIME} = \text{TOTAL TIME FROM LIFT-OFF TO PEAK} - \text{THRUST DURATION}$$
$$= 6.9 - 1.5$$
$$= 5.4 \text{ seconds}$$

Using this value, he then refers to the "D13" Coast Time Graph and finds that for a lift-off weight of 6.0 ounces that it would take a C_DA of 1.50 to obtain the above measured coast time.

Noting that this is really $\sigma\, C_DA$ for flights in non-standard, non-sea level air as discussed earlier, Jim proceeds to calculate the drag coefficient from the experimentally determined $\sigma\, C_DA$ value.

$$C_D = \frac{(\sigma\, C_DA)}{(\sigma)(A)} = \frac{1.50 \text{ in}^2}{(.95)(2.105 \text{ in}^2)}$$
$$= .75$$

This tells him immediately that adding the telemetry antennas and the blunt Camroc nose have increased the drag of the basic $C_D = .5$ Big Bertha shape by 50%.

Since a value has been established for C_D, Jim now uses the "D13" Maximum Altitude Graph to find out how high their research rocket must have gone. He *could* use this C_D in the Drag Form Factor Graph for the BT-60 body tube and then multiply the result by the density ratio—but in this case he doesn't have to bother since he already knows that $\sigma\, C_DA = 1.50 \text{ in}^2$.

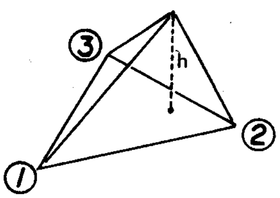
Thus, for a lift-off weight of 6 ounces and a $\sigma\, C_DA$ of 1.50 in^2, he finds that:

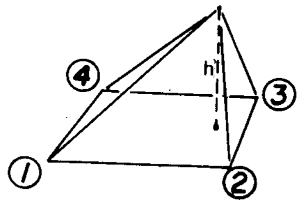
MAXIMUM ALTITUDE = 850 feet

At this instant, Fred the skeptic says, "I don't believe your altitude can be found that easily and will look forward to laughing at your method as soon as we get some good numbers from 3-D tracking." Jim remarks, "Even with 3-D tracking you get two separate altitude answers and will be lucky if their average is within ± 10% of the *true* altitude. Besides, the theodolites and walkie talkies cost too much and those 3-D calculations are a lot of work."

Fred returns with, "Listen Jim, we can improve our accuracy considerably by using more than two theodolites. Here, look at this:

Number of Equally Spaced Theodolites	Number of Calculated Altitude Answers Per Flight	Number of Answers If One Station Reports "Track Lost"
2	2	0
3	6	2
4	12	6
•	•	•
•	•	•
•	•	•
•	•	•
N	N(N-1)	(N-1)(N-2)





"As far as those involved calculations you are upset about, I take it you haven't seen the new Malewicki Model Rocket 3-D Circular Slide Rule. All you have to do is line up the A_1 angle with the A_1 + A_2 angle, move the cursor to the E_2 angle and read off the calculated altitude—Super Swift."

(Editor's Note: The slide rule won't be available for about two more months—meanwhile assume it already exists for this problem).

Jim answers, "OK, OK, OK—I'm sold—let's just try three theodolites for a starter, though. I'll have to agree with you that the six altitude answers should give a decent average. Having two answers even when one station loses track will sure help. Hey, let's plan to use the same setup at all of our future NAR contests too!"

Some time and expense later Fred and Jim launch the 6 ounce bird again and obtain their first three station 3-D tracking measurements. Their slide rule calculations give:

SIX MAXIMUM ALTITUDE ANSWERS — 875, 835, 840, 825, 880, and 845 feet

$$\text{AVERAGE MAXIMUM ALTITUDE} = \frac{875+835+840+825+880+845}{6} = \frac{5100}{6}$$

$$= 850 \text{ feet}$$

Referring to the "D13" Maximum Altitude Graph, Fred finds that C_DA must equal 1.50 in² in order for a 6 ounce rocket to reach 850 feet. Fred gives Jim an apologetic look and says, "Well, how do you like that—exactly the same C_DA you got with the stop watch". Jim comes back with, "Fred my friend, you are a real clod—you forgot to take out the density ratio and today it was 41° out there, not 70°. Don't forget, σC_DA = 1.50, not C_DA! It's obvious that the two altitude methods will give somewhat different drag coefficient values."

At an elevation above sea level of 1000 feet and a temperature of 41°, the Density Ratio Graph gives:

$$\sigma = 1.0$$

(In this situation the *decrease* in density due to the higher elevation was exactly offset by the *increase* in density due to cooling from a standard 59°F down to 41°F). Thus:

$$C_DA = \frac{(\sigma C_DA)}{(\sigma)} = \frac{1.50 \text{ in}^2}{1.0} = 1.50 \text{ in}^2$$

$$C_D = \frac{(C_DA)}{(A)} = \frac{1.50 \text{ in}^2}{2.105 \text{ in}^2} = .712$$

This is 42.5% more than the plain Big Bertha shape and just 5% different from the C_D found using a stop watch.

At this time we have to add that any real conclusions as to how accurate the stop watch method is compared to the tracking method are presently impossible because the problem is completely fictitious! Needless to say, I would greatly appreciate receiving any such experimental results acquired by a competent group. Just send your data to me in care of **Model Rocketry.**

The following table presents some additional and hopefully interesting "D13" flight performance results. For review purposes, it is suggested that you use the four graphs to check these answers yourself.

"D13" ENGINE FLIGHT PERFORMANCE
(Standard 59° F Sea Level Atmosphere, C_D = 0.5)

Model	Number and Type of Engines	Liftoff Weight	Body Diameter	Frontal Area	Drag Form Factor	Burnout Altitude	Burnout Velocity	Max. Altitude	Coast Time
ESTES SATURN V	one D13	11.5 oz	3.93 in	12.13 in²	6.05 in²	110 ft	135 fps	280 ft	3.1 sec
	cluster of two D13's	13.0 oz	3.93 in	12.13 in²	6.05 in²	215 ft	250 fps	580 ft	4.1 sec
	cluster of three D13's	13.0 oz	3.93 in	12.13 in²	6.05 in²	292 ft	332 fps	785 ft	4.6 sec
	cluster of four D13's	13.0 oz	3.93 in	12.13 in²	6.05 in²	362 ft	400 fps	950 ft	4.9 sec
ESTES CONSTELLATION	one D13-7	2.5 oz	.976 in	.748 in²	.374 in²	680 ft	780 fps	2150 ft	7.5 sec
	two stage* both D13's	5.0 oz	.976 in	.748 in²	.374 in²	1305 ft	795 fps	2850 ft	7.6 sec
MARS LANDER (Use C_D = .88)	one D13	4.5 oz	3.8 in	11.34 in²	10.0 in²	210 ft	180 fps	310 ft	2.1 sec

***Analysis requires use of the multi-stage equations found in Estes TR-10**

Sven Englund Receives MPC Award for R&D

A new development in launch pads that will benefit all model rocketeers recently won a $75 savings bond for Sven R. Englund, 16, of New Canaan, Conn. Sven conceived the ceramic jet deflector which is a feature of the new MPC Lunar Lectric Launch Pad. Since the deflector is ceramic, it will not short-out the electrical ignition wires, a common problem with old metal jet deflectors.

Sven began work on the ceramic jet deflector in 1969 and was helped by his mother, Alice R. Englund—who is also a model rocket builder—whose own hobby of ceramics allowed her to fire her son's experimental clay shapes. After exhaustive tests of various sizes and shapes, Sven found out that a parabolic shape did the best job of directing the jet of a model rocket engine away from both the model rocket and the launch pad. He entered his work in the Research and Development competition of the 11th National Model Rocket Championships at the Air Force Academy last August. It was there that Sven's work came to the attention of MPC engineers.

Sven's award is the first presented by MPC under its policy of rewarding young model rocketeers for outstanding technical work in model rocketry. In the future, MPC will present more $75 savings bonds to worthy young model rocketeers whose work comes to the attention of the MPC model rocket engineers.

Sven's ceramic jet deflector will be a boon to all model rocketeers. It is an integral part of MPC's new Lunar Lectric Launch Pad and will also be available as an accessory item for up-dating existing launch pads with the latest innovation from MPC.

Sven Englund examines the parabolic ceramic jet deflector on the new MPC Launch Pad.

Second Southwest Conference Scheduled

In July the ARC-Polaris Rocket Club of Portales, New Mexico will again sponsor the Southwestern Model Rocketry Conference. The conference will be held on the campus of Eastern New Mexico University, and will feature many events which should be of interest to model rocketeers.

The club plans to bring in four new displays recently released by the Manned Spacecraft Center. There is a possibility that an MSC spacemobile display will be available for the Conference.

Representatives from Estes Industries and Micro Instrumentation and Telemetry Systems will describe their new products to Conference participants. MITS expects to display the complete line of model rocket telemetry systems it has recently developed.

Conference plans have not yet been finalized, but several speakers from universities in New Mexico connected with NASA and White Sands Missile Range rocket projects have been invited to participate.

NEWS NOTES

Centuri Expands to Industrial Markets

High-Impulse D, E, and F Engines planned

CENTURI Engineering has acquired an 80% interest in a new subsidiary company, called ENERJET, Inc., whose purpose will be to introduce the Model Rocket concept to the industrial and institutional sounding rocket and research field. The model rocket concept of rocket engine making and vehicle construction applied to these commercial uses is unique and will result in "mission accomplishment" at greater reduced costs.

Of primary interest to ENERJET now are such applications as:

- Weather Sounding Rockets
- Air Pollution Sampling Rockets
- Lightning Research Rockets
- Radiation Sampling Rockets
- Pyrotechnic Signaling and Warning Devices
- Hi-Altitude Emergency Flares for Sportsmen
- Military Infiltration Detector Devices
- Research Rocket Motors
- Educational Demonstration Rockets & Test Equipment

The key to ENERJET's success in this field will be a new, low cost method of rocket motor production, together with a newly developed high energy synthetic propellant. For example, this new propellant releases such a high amount of impulse per pound of fuel, that a 'D' type rocket engine (2.24 to 4.48 lb-sec total impulse) can be built into the same size rocket motor casing (2.75" long X .70" dia.) as is presently used to house a 'C' type engine (a 'D' type motor has twice the packaged power as a 'C' type).

Today most model rocket propellants have a specific impulse (impulse per pound) of 80 to 95. The new ENERJET propellant has a specific impulse of 175 to 215. This means that a rocket powered with this new propellant will climb nearly twice as high as a rocket powered by the same amount (weight) of common m.r. propellant.

ENERJET will manufacture rocket motors with Total Impulses (average thrust X total thrusting time) of from 4 lb-sec. all the way up to 400 lb-sec. ENERJET will maintain an "on-the-shelf" inventory of these motors. Centuri Engineering will market motors of this type, for ENERJET, in the 4 to 18 lb-sec. range (types 'D', 'E', & 'F'). This group of engines will easily adapt to the existing line of Centuri rockets. Production on these engines is expected to begin before June 1970.

Centuri's president, Leroy Piester will also serve as president of ENERJET, Inc. Irv Wait formerly president of Rocket Development Corporation in Indiana, will be vice-president.

Modrocs Featured at Oklahoma Hobby Fair

Model rocketry was one of the outstanding attractions at the first annual Model Hobby Fair in Oklahoma. This event is unique because it is the first time the Academy of Model Aeronautics has sanctioned a full scale combination manufacturers tradeshow/modeler competition. The Fair, expected to be an annual event, was sponsored by the Oklahoma Science and Arts Foundation as an attempt at nurturing the growth of Aerospace Education in Oklahoma.

The Fair opened at 9:00 AM on a cool, windy Saturday. Crowds built up rapidly for registering of competition models before the various demonstrations were to start. After registering some of my own model rockets for the display contest I hurried off to man the Centuri Engineering Company display booth. The gentlemen from Centuri who would normally run such a booth were in Oregon at an Aerospace Educators Conference along with the Estes Representatives. I had a great time "moonlighting" for Centuri, but little did I realize how much work it can be! The crowds were enormous! People of all ages (and both sexes) were fascinated by the prospect of model rocketry and nearly cleaned out my stock of free literature, before I started rationing it.

By Sunday the winds had died down to 30 mph (mild for Oklahoma), and rocket demonstrations were then possible though not very sensible. The crowds desire to see flights overcame my reluctance, however. By using B and C engines, aiming the launch rail 25° into the wind and cutting large holes in the chutes all seven flights were able to be recovered within 1000 feet. Needless to say, with the large crowds, assembling enthusiastic recovery teams was not difficult. Model rocketry drew larger crowds than any other demonstration, including radio control airplanes, cars, railroads and combat stunt flying. It even had more spectators than the "dogfight" held with a R/C Fokker and an experimental model plane shaped like Snoopy's Doghouse!

Over 2000 people attended the fair, and most were exposed to model rocketry. A pattern emerged in our conversations: those people who had little or no modeling experience, but with a scientific interest, saw great potential for scientific investigation with model rocketry. On the other hand, veteran modelers of gas powered planes, boats, etc., refused to even consider the potential of model rockets. It may have been due to jealousy, lack of information or the simple fear that their more traditional hobbies are somehow threatened by model rocketry. At any rate, most of these older modelers were unwilling to admit the benefits of model rocketry, and chose instead to react defensively. This seems unfortunate to me, because model rocketry could well use some of the expertise and craftsmanship of this type of modeler, while they in turn could benefit from rocketry experience, such as R/C boost gliders.

Despite this professional in-fighting, the Hobby Fair was a great success, with modelers and "civilians" finding many areas of common interest. The model rocketry success was due in no small part to the staff of this magazine, who donated hundreds of back issues of **Model Rocketry** magazine to be given away to interested participants. Interest in forming clubs and joining the NAR is now at a high pitch. With any kind of luck, next years Model Hobby Fair will be an even bigger success for rocketeers and all other modelers.

—Melville G. Boyd

Appollo 8 Astronaut Visits Centuri Plant

Colonel Frank Borman, Commander of the Apollo 8, Moon-orbiting Mission recently visited Centuri Engineering Company in Phoenix, Arizona and inspected a scale model of the Apollo 8 Saturn V booster and capsule. Leroy Piester, President of Centuri Engineering Company presented Colonel Borman with a meticulously detailed 1/100th scale model of the Apollo/Saturn V. This model was constructed from a standard Saturn V kit marketed by Centuri Engineering for $15.95. Colonel Borman was impressed with the model presented him after a recent appearance in Phoenix and returned to the plant for another kit.

MODROC CALENDAR

MIT Convention – April 3-5, 1970. Technical conference open to all rocketeers. Discussion groups, technical presentations, and banquet at MIT. Launch April 4 at L. G. Hanscom Field, Bedford, Mass. Contact Convention Chairman, MIT Model Rocket Society, Box 121, MIT Branch PO, Cambridge, Mass. 02139.

SMARR-8 – April 4, 1970. Section meet sponsored by the Annapolis, Md. AAR section of the NAR.

ECRM-4 – April 10-12, 1970. East Coast Regional Meet open to NAR members from NARHAMS, SSB, AAR, NARCAS, SCS, and NAR members from the East Coast not associated with clubs. Events: Scale, Class I PD, Eggloft, Class O Altitude, Hawk B/G, and Swift B/G. Site: Camp A. P. Hill, Md. Contact A. Elliott, 10203 Leslie Court, Silver Spring, Md. 20902.

SP-18 – April 12, 1970. Section meet sponsored by the New Canaan, Conn. YMCA Space Pioneers.

Buckeye-1 – May 2-3, 1970. Area meet between CSAR and MASA NAR Sections. Events: Scale Altitude, Eggloft (10 nt-sec limit), Hornet B/G, Sparrow B/G, PeeWee Payload, Parachute Duration. Site unannounced. Contact Miss Vikki Lundberg, 1970 Beal Road, Mansfield, Ohio 44903.

NARCAS Annual Record Trials – 1 – May 15-17, 1970. A record trials event open to NAR members from NARHAMS, SSB, SCS, and New Castle Sections interested in attempting to exceed current NAR and FAI model rocket records. Events: Eggloft, PeeWee Payload, Design Efficiency, Parachute Duration, Condor B/G, and Hornet B/G. Site: unannounced. Contact Carl Guernsey, NARCAS, 2915 Maple Road, Camp Hill, Pa.

SPQR-5 – June 21, 1970. Space Pioneers Quality Regional open to NAR members in the Northeast. Events: Scale, Super Scale, Swift B/G, Sparrow B/G, Class 1 PD, and Open Spot Landing. Site: Lapham Field, New Canaan, Conn. Contact YMCA Space Pioneers, 564 South Avenue, New Canaan, Conn. 06840.

MMRR-2 – June 27-28, 1970. Regional meet sponsored by CSAR, open to NAR members in the Midwest. Events: Eggloft, Super Scale, Sparrow B/G, Swift B/G, Design Efficiency, Parachute Duration, Open Spot Landing, R&D. Site: unannounced. Contact Miss Vikki Lundberg, 1970 Beal Road, Mansfield, Ohio 44903.

(Continued on page 47)

The Wayward Wind

by Gordon K. Mandell

Modroc UFOlogy

Oddball designs seem to be a favorite topic among my correspondents, and outstanding among these are models of the "flying saucer" and "rocket helicopter" type. A particularly detailed survey of this design category was sent in recently by Tom Rust of Morton, Illinois, and I've decided to devote this first-anniversary installment of the *Wayward Wind* to an in-depth treatment of the principles he espouses.

By a "flying saucer" model I do not mean a disc-shaped boost/glider like the Estes *Astron Invader* or the strap-on gliders of the MPC *Martian Patrol*; I mean a circular model rocket which is made to rotate about its center by the action of canted engines, as in Figure 1. The moment causing the saucer to rotate is given by the formula

$$M = T \times R \times N \times \sin\theta$$

where M = moment about centerline
R = radius from center of saucer to centerline of engines
N = number of engines
T = thrust of each engine
and θ = angle of canting from the vertical

while the net useful thrust causing the "saucer" to rise is

$$F = T \times N \times \cos\theta$$

Such a device, of course, wouldn't go very

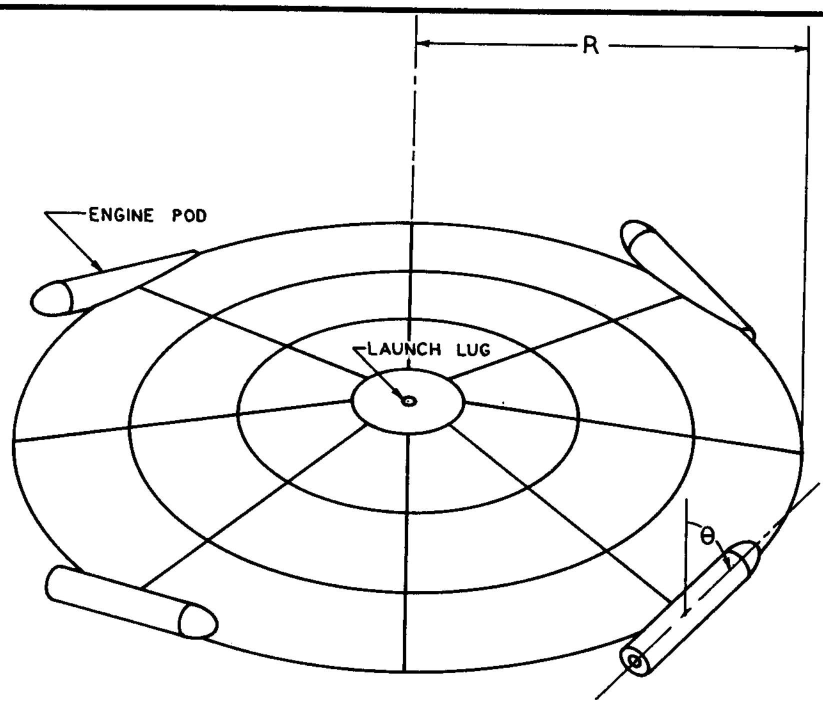


FIGURE 1

FLYING SAUCER WITH FOUR ENGINES

high. Not only does it have a very large frontal area (a one-foot diameter saucer has a frontal area 144 times that of a one-inch diameter model rocket!), but its drag coefficient based on that area is about 1.25 – twice that of an average model rocket. You'll never find a C_DA of 180 on a Malewicki chart, but if you guess 10 feet for the maximum altitude of a one-foot saucer using two B engines canted 60 degrees I have a feeling you won't be far wrong!

The flying saucer is basically a limiting case of a spin-stabilized model rocket using canted engines. I built one of the latter type back in 1963, using two Estes BT-20's canted about 10 degrees for motor mounts inside a BT-60 which served as the main body tube and chute container. This design got called a lot of things before I got it working right, but XS-1 was finally inked on the body tube. Figure 2 shows XS-1 with its spin-mounts seen from edge on. I found that the model wouldn't tolerate much of a negative stability margin, but that when weighed to about neutral stability would turn in reasonably good flights, leaving an interesting "braided" smoke trail on the way up. The small spin-fins at the base didn't produce positive static stability, but they did help increase the spin rate. A word to the wise: if you build yourself an XS-1, make *sure* the fins are canted the same way as the engines!

The use of only two engines is not all that desirable, either for standard model rockets (canted-engine or otherwise) or for flying saucers. The center of gravity stays on the centerline of the model, to be sure, but the model has two different moments of inertia about the principal axes which are perpendicular to the centerline. What this means is that the rocket, if set spinning, will behave more like a two-bladed airplane propeller than a gyroscope; it will shiver and shake a lot in addition to the ordinary "coning" motion associated with spin stabilization. Three or more engines should really be used to insure the straightest, steadiest flights. From the standpoint of dynamics, a three-engined design should fly just as smoothly as if it were a uniform disc or cylinder with no concentrated masses in it anywhere.

I put standard launch lugs on the side of my XS-1 canted-motor bird, which meant that the rocket couldn't start spinning until it cleared the top of the launch rod. As Tom Rust points out, though, you're much better off in the case of a flying saucer design if you run the launch lug right through the center of the disc—straight up and down through the saucer's "hub". The launch rod should be cut down to about one foot to reduce "binding" and friction drag during the launch, while still allowing a good margin of spin-up time before the saucer is in free flight. Flying saucers launched without benefit of *any* guidance tend to lose big, especially if you don't get perfectly simultaneous ignition of the engines!

I must confess, though, that the category of disc-shaped rockets that really turns me on is the rocket helicopter. It *is* more of a model airplane than a model rocket, since it relies primarily on the lift from its rotor blades to ascend, but since I'm a now-and-then airplane type myself I won't let that stop me! Tom envisages this type of model as developing from efforts to reduce the weight and frontal area of a flying saucer by cutting away sections of the interior of the disc, leaving a sort of "wagon wheel" configuration. When the spokes of the wheel are replaced by inclined slats or by more efficient, turbine-like airfoiled blades, the wheel will develop lift when it's spun up by the rocket engines at the periphery—and the whole thing will whiz off the launcher like one of those toy helicopter-projectiles that you shoot from a wind-up spring "gun". Figure 3 shows a model rocket helicopter of the type Tom suggests. This one is of the turbine, or wagon-wheel, style and still has the solid "hoop" at the periphery which is convenient for mounting the engines and also provides strength. There is no reason why a rocket 'copter couldn't be built without this "full-span shroud", as it is called by professional engineers, but the hub would have to be made larger and the blades fewer and stronger. A part-span shroud (hoop partway out on the blades) is also a possibility; such a design is often used for the titanium compressor blades of large jet engines to provide maximum resistance to vibration.

The rocket helicopter should be launched like a flying saucer—with a launch lug up the middle of the hub and a short rod—but the engines need not be canted so as to produce any upward thrust. They can, and probably should, be tipped all the way over so that they fire tangent to the "rim" of the wheel ($\theta = 90^\circ$), because thrust used to spin the 'copter up is much more effective than thrust used to lift it directly. To see why, we can use an energy approach to estimate the altitude of a hypothetical model. Suppose I have a "turbo-copter" (neat brand name, huh?) with a radius of 15 centimeters and a radial moment of inertia I_R of 25,000 gram-cm^2. Suppose my model has to spin at 100 radians/sec to hover motionless in the air, and suppose it uses four B engines to spin it up. How high will it go? Well, I know that four B4-4 engines have a total linear impulse of 20 nt-sec (MKS units) or 2,000,000 dyne-sec (CGS units). This gives a total rotative impulse of $15 \times 2{,}000{,}000 = 30{,}000{,}000$ dyne-cm-sec to the 'copter. This rotative impulse is equal

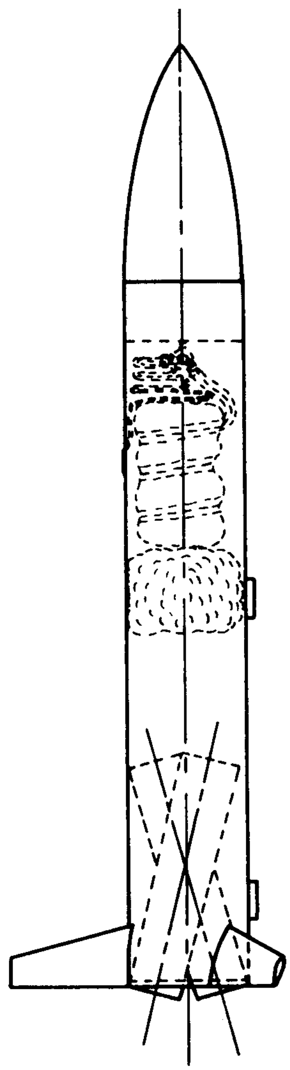


FIGURE 2

XS-I

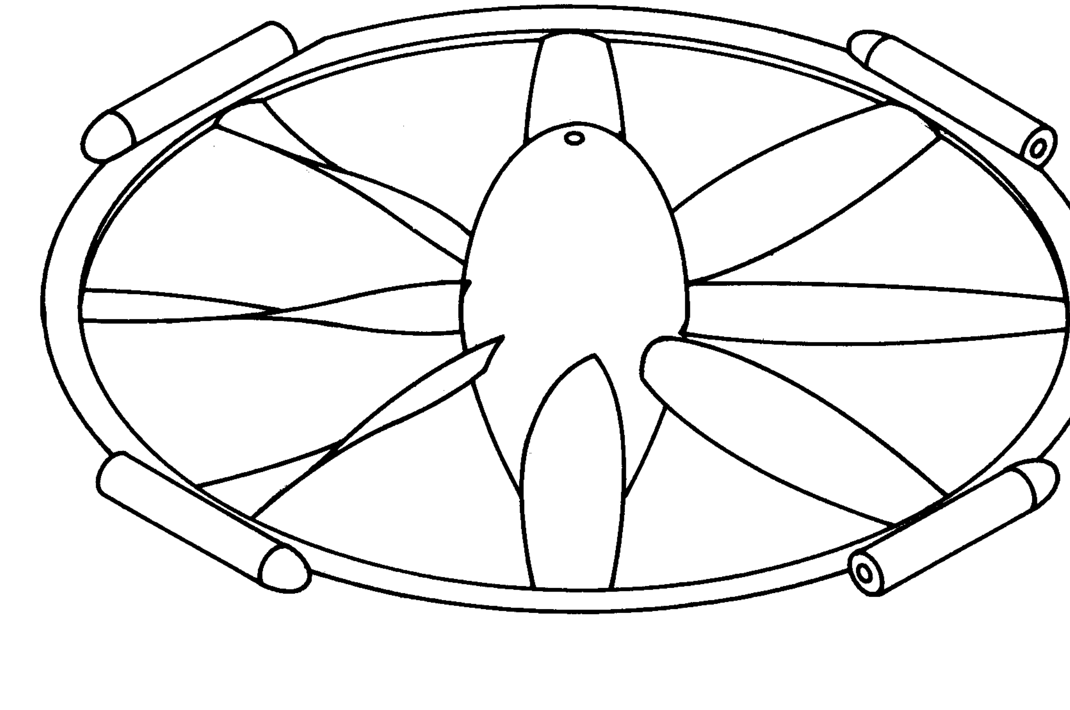


FIGURE 3
MODEL ROCKET HELICOPTER WITH FOUR ENGINES

to the angular momentum, $I_R\omega$, of the 'copter just after the engines stop firing. Remembering that 1 dyne = 1 gram X 1 cm/sec^2, we can give the rotative impulse in angular momentum units of gram-cm^2/sec instead of the impulse units of dyne-cm-sec. Dividing by I_R, we can find how fast the 'copter is spinning at the moment the engines quit:

$$(30{,}000{,}000 \text{ gram-cm}^2/\text{sec})/(25{,}000 \text{ gram-cm}^2) = 1200/\text{sec}$$

This means 1200 *radians*/sec, since radians are dimensionless and don't show up in the units. Now the ship is spinning 12 times as fast as it has to in order to hover, so it will go up. How far? Well, far enough so that it slows down until it's just hovering, and that's where the energy business comes in. The spinning 'copter has a *kinetic* energy of $\frac{1}{2}I_R\omega^2 = \frac{1}{2} \times 25{,}000 \times (1200)^2$ gram-cm^2/sec^2 just after the engines stop firing. Going over to scientific notation,

$$\begin{aligned} \text{K.E.} &= 0.5 \times 2.5 \times 10^4 \times (1.2 \times 10^3)^2 \\ &= 0.5 \times 2.5 \times 10^4 \times 1.44 \times 10^6 \\ &= 1.8 \times 10^{10} \text{ gram-cm}^2/\text{sec}^2 \end{aligned}$$

As the 'copter ascends it slows down, both because of drag and *because it's doing work* to pick itself up. When it has slowed to 100 radians/sec its kinetic energy of rotation has decreased to

$$\begin{aligned} \text{K.E.} &= 0.5 \times 2.5 \times 10^4 \times (1 \times 10^2)^2 \\ &= 0.5 \times 2.5 \times 10^4 \times 1 \times 10^4 \\ &= 1.25 \times 10^8 \\ &= .0125 \times 10^{10} \text{ gram-cm}^2/\text{sec}^2 \end{aligned}$$

Almost none left! Where did it go? Well, of course, a lot of it must have been dissipated by drag, but we'll ignore that for now. *Some* of it, at least, must have gone into lifting the 'copter to its peak altitude—into increasing its *potential* energy. Now suppose my 'copter has a mass of 125 grams. I know the formula for potential energy is

$$\text{P.E.} = mgh$$

where m = mass in grams
g = 980 cm/sec^2
h = altitude in centimeters

Then mg for my ship is $1.25 \times 10^2 \times .98 \times 10^3 = 1.23 \times 10^5$ gram-cm/sec^2. The *kinetic* energy of the 'copter *decreased* from 1.8×10^{10} to 0.0125×10^{10} gram-cm^2/sec^2 on the way up. The *potential* energy must (*neglecting drag*) have *increased* by the same amount so that, at flight apex, it is 1.7875×10^{10} gram-cm^2/sec^2. Now

$$\begin{aligned} h &= \text{P.E.}/(mg) \\ &= 1.7875 \times 10^{10}/1.23 \times 10^5 \\ &= 1.525 \times 10^5 \text{ centimeters} \\ &= 1525 \text{ meters} \\ h &= 5000 \text{ feet (wow!)} \end{aligned}$$

Now you and I both know my "turbo-copter" will never get anywhere near that high, because most of its kinetic energy is really lost to drag dissipation. I would guess that only 10% at the *most*, is useful for gaining altitude—but that still makes 500 feet look like a possibility, so performance just might be on a par with ordinary model mockets, if you really could keep the thing light enough while having adequate strength to withstand spinning at 1200 radians/sec, which is about 11,400 RPM!

And if you can solve that one, recovery should be no problem at all. The 'copter will just fall slowly to earth as its rotative speed decreases. As for flying saucers, they're so big and draggy they'll float down without the need for any recovery system at all, too. *And* there's plenty more you can do with these basic ideas. Tom Rust suggests elongating the saucer into a "teardrop" shape to lower its drag and let it get up out of reach, at least, or perforating a saucer with holes to make it whistle or "sing" as it spins.

How much of this has been done? For once I can say, not much! The saucer idea has shown up from time to time, but most of the ones I've seen were not too carefully built or balanced and didn't perform well. There was a saucer at NARAM-5 back in 1963, but it suffered an ignition failure in one of its two engines and delighted the crowd by hopping crazily across the field. It fared better on its second flight—cleared the rod by at least three feetl Of the whistling saucer, "teardrop" spinning rocket, or rocket 'copter, I've never seen a trace. The only things that come close are the Jetex helicopters of model aviation, and they would disintegrate under the thrust of our engines. One thing I can say, though: if we ever *do* develop model rocket helicopters with performance anywhere near what seems possible, we'll sure be giving the airplane boys a run for their money. We'll have to fly against AMA types, anyway, since NAR regs define the things as model planes!

The HAD

Australian Sounding Rocket

by George Flynn

The HAD is a two-stage, solid-propellant, research rocket developed by the Australian Weapons Research Establishment. The HAD is capable of carrying a 20 pound (9 kg) payload to a height of 80 miles (129 km). The rocket was developed primarily for upper-atmosphere research studies. It was used mainly for a series of experiments utilizing the falling-sphere technique to examine seasonal and diurnal variations of atmospheric density, temperature, pressure, and wind velocities. It has also been employed to carry atmospheric composition experiments to about 400,000 feet.

First Stage

The first stage consists of a standard 10.10" diameter Gosling motor which burns for approximately 3 seconds. The first stage boosts the rocket to a velocity of 4,200 feet/second at a burnout altitude of 6,000 feet. Overall liftoff weight is 640 pounds.

Second Stage

The second stage coasts to an altitude of 50,000 feet, and its velocity drops to 2,000 feet/second, after first stage burnout. At this point, about 18 seconds into the flight, the upper-stage Lupus motor is ignited. The second-stage, which is 5.0" diameter and 8'4" long, burns for 3 seconds. Burnout velocity is 4,900 feet/second at about 60,000 feet. The Lupus motor remains attached to the 2 foot long instrument compartment, and the entire upper-stage coasts to 400,000 feet, where the payload is deployed.

Performance

1st Stage	
Length (including adapter)	142.4 inches
Diameter	10.10 inches
Weight (loaded)	525 pounds
Burning Time	3 seconds
Burnout Velocity	4,200 ft/sec
Burnout Altitude	6,000 feet
2nd Stage	
Length	100 inches
Diameter	5.0 inches
Weight (loaded)	115 pounds
Payload Weight	30 pounds
Burnout Velocity	4,900 ft/sec
Burnout Altitude	60,000 feet
Peak Altitude	400,000 feet

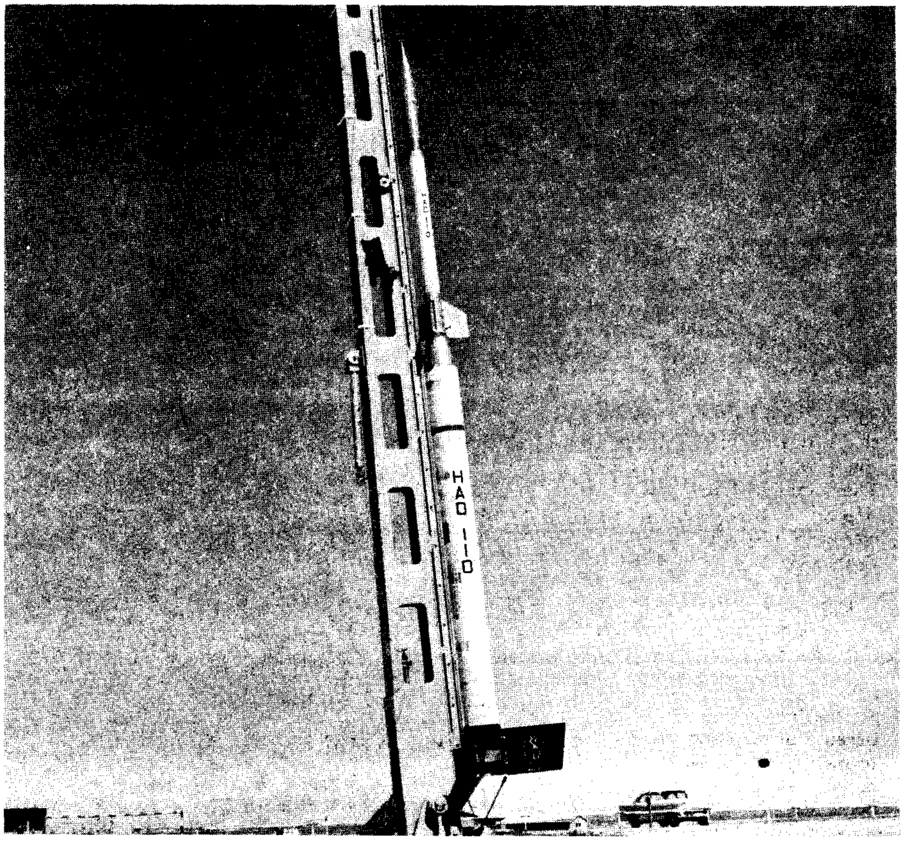
Modelling Information

The scale of a model should be selected to conform with the amount of data available about the prototype. If the prototype data is exact down to the last rivet, the model should be constructed in a large enough scale to allow rivet detail to show on the model; however, if no rivet detail is available on the prototype the model should be constructed in a small enough scale so that rivet detail would be unnoticeable on the model.

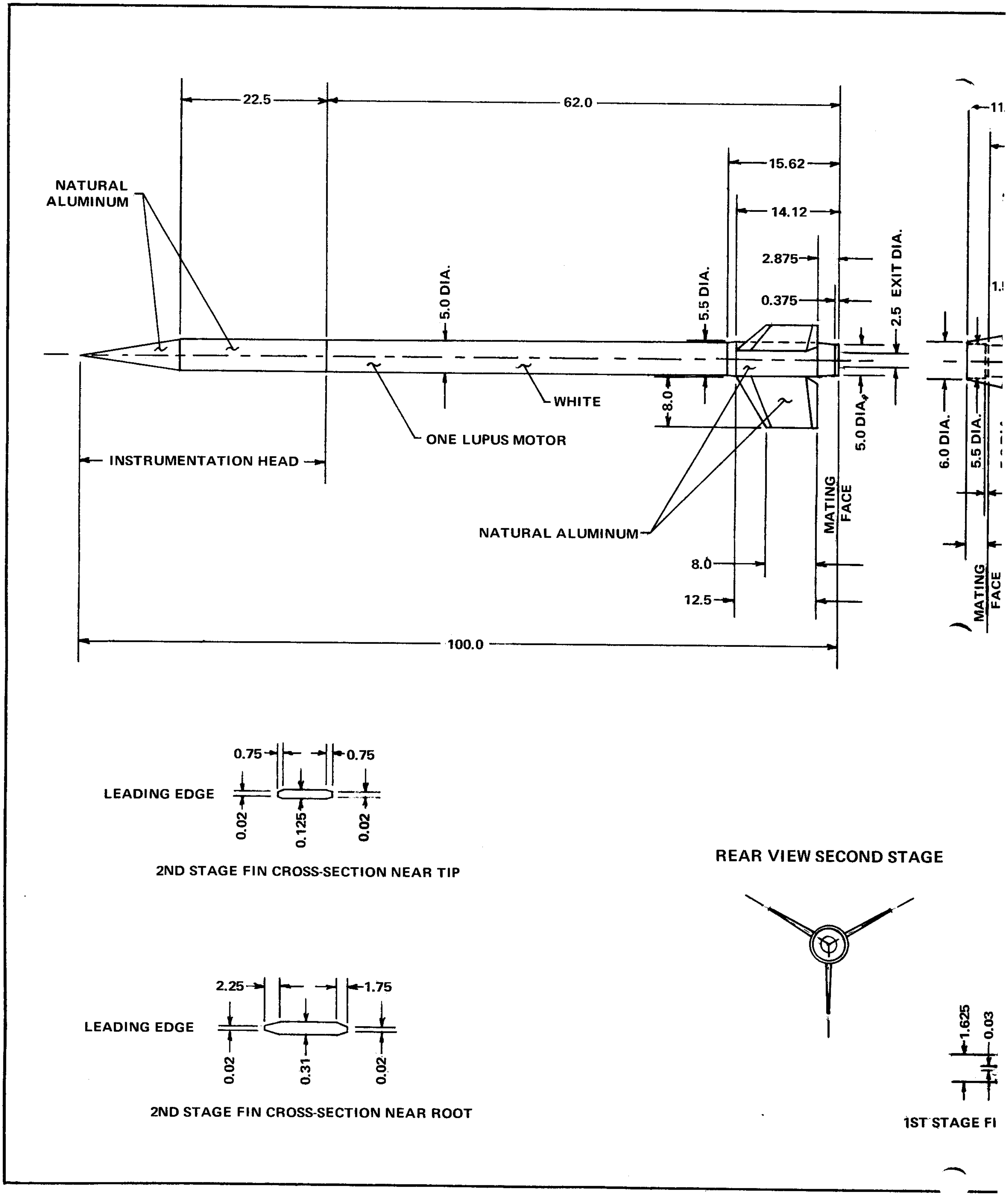
The fin airfoil, motor fairing, adapter detail, and other major airframe detail on the HAD was available (see blueprint), however rivet detail and other fine detail on the prototype was not available on the best set of blueprints we could obtain. With this in mind, a scale of approximately 5:1 was selected so that only available details would be significant in that scale.

After a rough scale (of 5:1) was selected, a survey of available parts was made. The prototype HAD had a pure conical nose cone with a length to diameter ratio of 15.5"/5.0" = 3.1. Only one commercially manufactured cone, the Estes BNC 20R, comes close to matching with a length to diameter ratio of 2.375"/0.736" = 3.2. The precise modeller will, of course, turn his own cone, but the Estes cone only misses by 4.5%, a tolerable margin of error if perfection is not desired. (If you use the Estes cone, be sure to compensate for the slightly increased length of the cone by cutting the 2nd stage body tube slightly shorter than scale to preserve the correct overall length.)

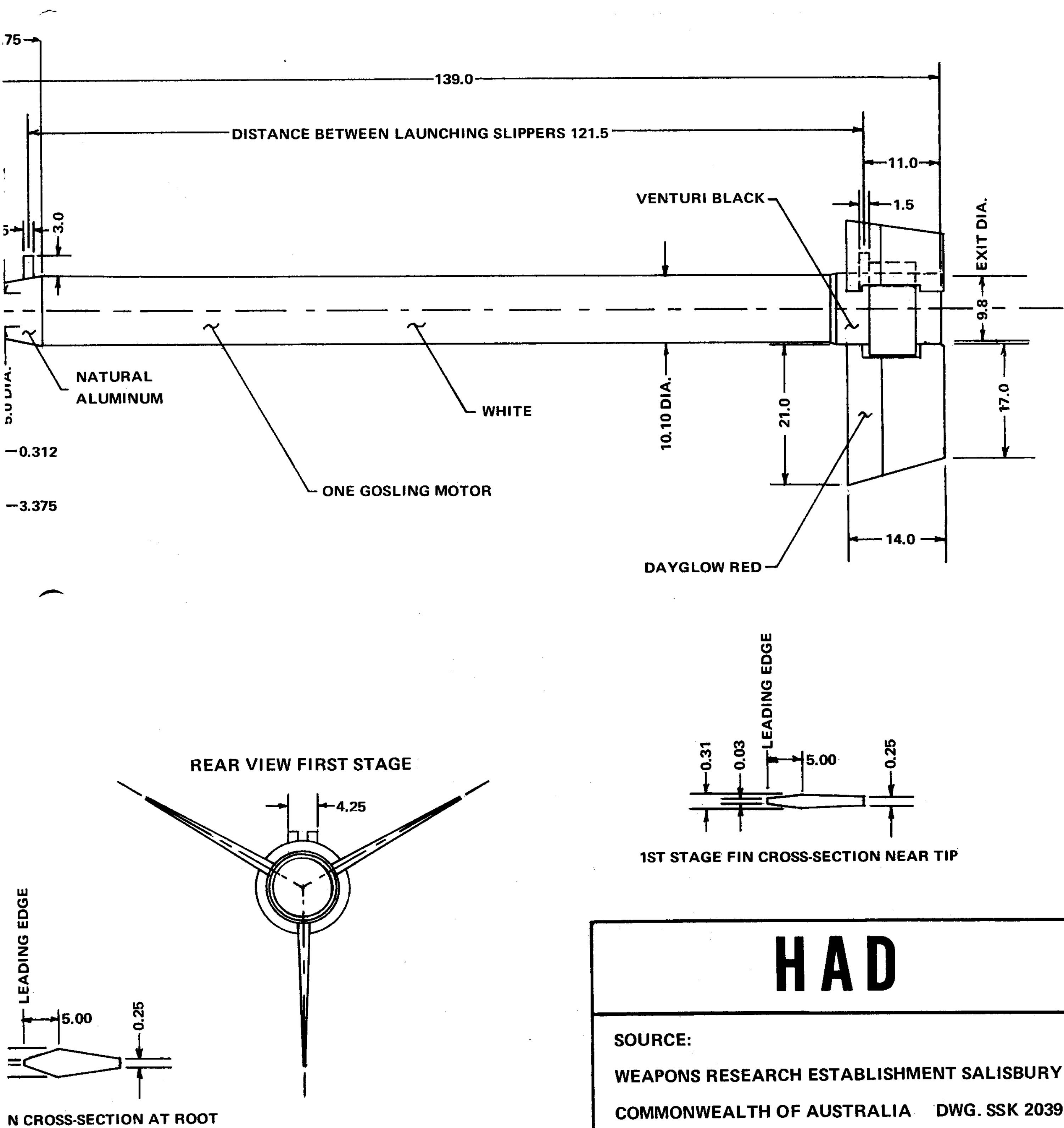
Using a BT-20 tube for the upper stage gives a scale (based on upper stage prototype to model body diameters) of 6.79":1.00". Thus the booster body tube scales to a 1.49" diameter. No luck on finding this tube among those commercially manufactured, so you will have to roll your



HAD SOUNDING ROCKET



22.5
62.0
15.62
14.12
2.875
0.375
2.5 EXIT DIA.
5.0 DIA.
5.5 DIA.
NATURAL ALUMINUM
WHITE
8.0
ONE LUPUS MOTOR
INSTRUMENTATION HEAD
5.0 DIA.
6.0 DIA.
5.5 DIA.
MATING FACE
NATURAL ALUMINUM
8.0
12.5
100.0
MATING FACE
0.75
0.75
LEADING EDGE
0.02
0.125
0.02
2ND STAGE FIN CROSS-SECTION NEAR TIP
REAR VIEW SECOND STAGE
2.25
1.75
LEADING EDGE
0.02
0.31
0.02
2ND STAGE FIN CROSS-SECTION NEAR ROOT
1.625
0.03
1ST STAGE FI



ALL DIMENSIONS IN INCHES

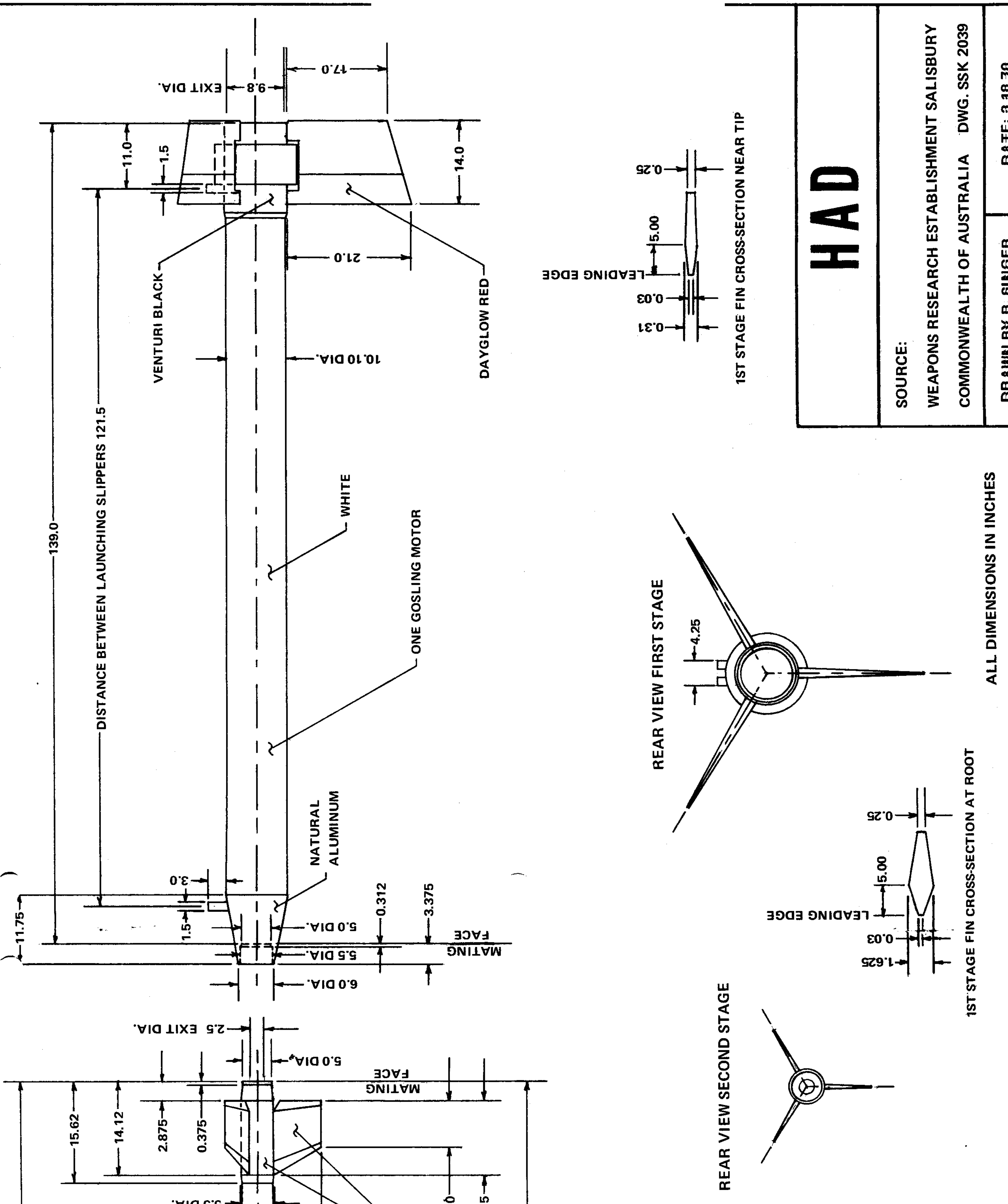
HAD

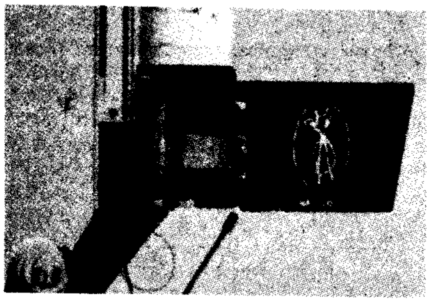
SOURCE:

WEAPONS RESEARCH ESTABLISHMENT SALISBURY

COMMONWEALTH OF AUSTRALIA DWG. SSK 2039

DRAWN BY R. SINGER	DATE: 2-18-70


HAD
SOURCE:
WEAPONS RESEARCH ESTABLISHMENT SALISBURY
COMMONWEALTH OF AUSTRALIA
DWG. SSK 2039
ALL DIMENSIONS IN INCHES
EXIT DIA.
9.8
17.0
11.0
1.5
14.0
21.0
VENTURI BLACK
DAYGLOW RED
10.10 DIA.
139.0
DISTANCE BETWEEN LAUNCHING SLIPPERS 121.5
WHITE
ONE GOSLING MOTOR
NATURAL ALUMINUM
3.0
1.5
11.75
5.0 DIA.
5.5 DIA.
6.0 DIA.
0.312
3.375
FACE
MATING
2.5 EXIT DIA.
5.0 DIA.
15.62
14.12
2.875
0.375
1ST STAGE FIN CROSS-SECTION NEAR TIP
0.25
5.00
LEADING EDGE
0.03
0.31
REAR VIEW FIRST STAGE
4.25
1ST STAGE FIN CROSS-SECTION AT ROOT
1.625
REAR VIEW SECOND STAGE



Enlargement of the fin section shows the unusual marking on the HAD lower-stage fin.

own body tube from paper. (See the Nike-Deacon scale article **MRm** November 1969 for spiral winding instructions, or "How to Make Your Own Body Tubes" in **MRm** February 1970 for parallel winding instructions.) You can use a standard paper towel tube (approximately 1.50" OD) though covering up the spiral lines on this uncoated tube will require a layer of model airplane Jap tissue to be applied before finishing.

The fins on this bird are fairly thick. The lower stage fins are 1.625" thick on the prototype, scaling to 0.24" thick on the model. Start out with 1/4" thick sheet balsa, trace the fin outline, cut out, sand to the proper thickness, and airfoil as shown in the plans. The upper stage fins are 0.31" thick at the root, scaling to 0.046" thick on the model. 1/20" thick sheet balsa, if you can find some locally, is great for these fins. If 1/20" balsa is unavailable in your area, start with 1/16" sheet, and sand to the proper thickness.

The mating section will have to be turned on a lathe, or a paper adapter can be formed. Note the fattening of the Lupus body near the fin section. This 0.25" thick (on the prototype) bulge scales to only a 0.037" thickness on the model. This can be simulated by wrapping 1/32" sheet balsa around the body tube before attaching the fins.

If the rail launch mounts are copied from the prototype, the HAD model can be launched from a thin metal rail. Two short launch lugs can be added in the center of these launch mounts to allow launching from a standard rod launcher.

Painting the HAD

The overall color of HAD-110 (the prototype shown in the photo) is gloss white. Notice the scrapes and streaks on the lower stage body exposing bare metal. These can be simulated on the model by applying a base coat of aluminum paint, then painting the entire model white, and scraping the surface with a razor blade or modeling knife to expose the metal surface. Both the nose cone and the upper-stage/lower-stage-adapter-section are bare aluminum metal on the prototype. According to the blueprint (SSK 2039), the first stage nozzle area is painted "Venturi Black" while the fins themselves are painted "Dayglow Red." An enlargement of the white insignia on the first stage is shown in the photo. The lettering "HAD 110" is painted down the side of both the booster and the upper-stage.

A photo of another HAD (bearing HAD-105 markings) showing another paint scheme as well as a different launcher can be found on page 545 of **Janes' All The World's Aircraft 1968-1969.**

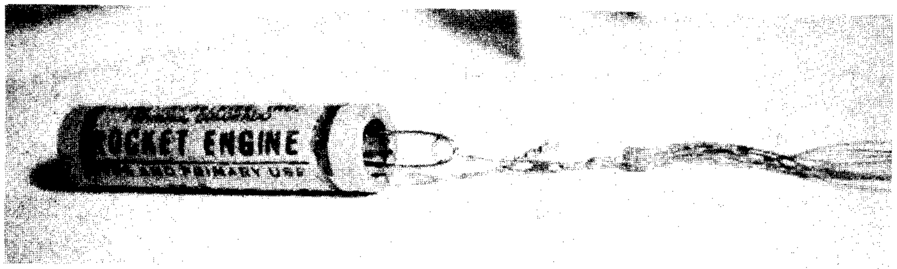
References

Blueprint SSK 2039, Weapons Research Establishment, Salisbury, Australia, 1968.

Photo E1734E, Weapons Research Establishment, Salisbury, Australia, October 30, 1962.

HAD Fact Sheet, Weapons Research Establishment, Salisbury, Australia, undated.

"Australia", **Janes' All The World's Aircraft 1968-1969,** London, 1969, page 545.



The Rear-Ejection Clip

by Gary Stephens

The use of Rear-Chute Ejection is becoming increasingly popular in Model Rocketry. When using this system with the engine-size body tubes, such as the Estes BT20 and Centuri Series 7 tubes, various means of attaching the recovery system to the engine have been devised. Cutting a hole or notch in the engine body or just taping or gluing the shock cord to the engine will provide the necessary attachment. These and similar methods leave something to be desired however, *especially when changing engines in the field.* The methods described above, require cutting and/or taping and gluing each time the engine is changed.

The development of the REC clip eliminates these undesirable features and provides an easy and reliable method for rear-ejection of the recovery system.

The REC clip is made from a large safety pin available at most five and dime stores. The pin is modified as shown in figure A. After cutting and bending the pin (see figure B) file points on the "Teeth". Attach the shock cord and recovery system to the REC clip as shown. Squeeze the clip and install it in the *EJECTION* end of the engine as far as possible (see figure C).

Give the clip a couple of "wiggles" back and forth to "set" the teeth in the engine casing. A test pull on the clip will assure proper installation. Finally, install the chute, shock cord, wadding and engine in the rocket in the normal manner. You should now be ready for the count-down and a reliable rear-chute ejection.

The REC clip will provide you with an easy, cheap, and best of all reliable means of attaching the recovery system to the engine casing for Rear Chute Ejection. Upon recovery, the clip is easily removed from the spent engine, and ready for installation in the next one.

This device has been flight-tested many times, and has yet to fail to do it's job properly.

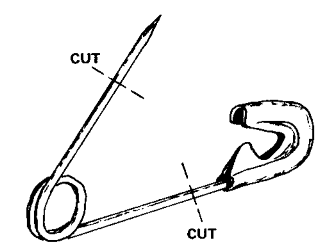


Figure A

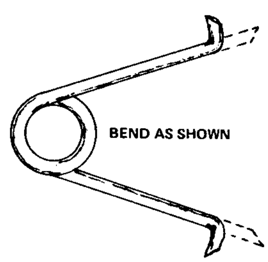
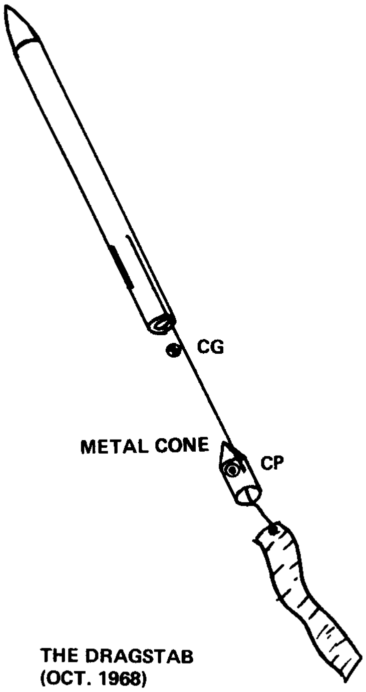


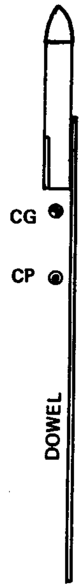
Figure B

The Rear Ejection Clip can be installed in a standard engine in the field with none of the difficulties experienced with other installation systems.

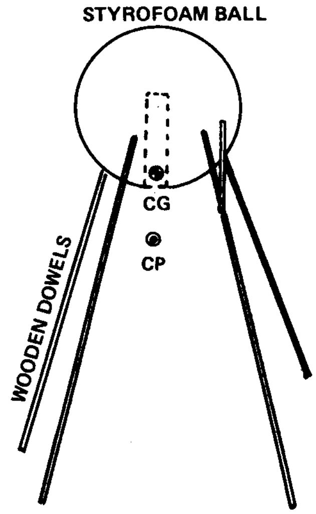
SOME FINLESS ROCKETS



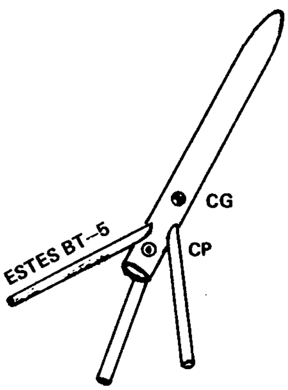
THE DRAGSTAB
(OCT. 1968)



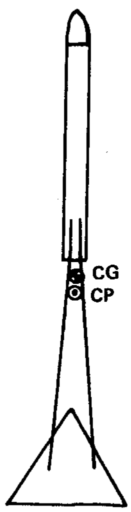
FROM KERRY JONES



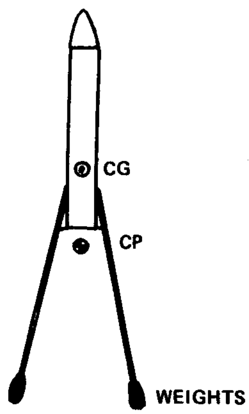
THE ESTES SPUTNIK



FROM GLEN DAVIS

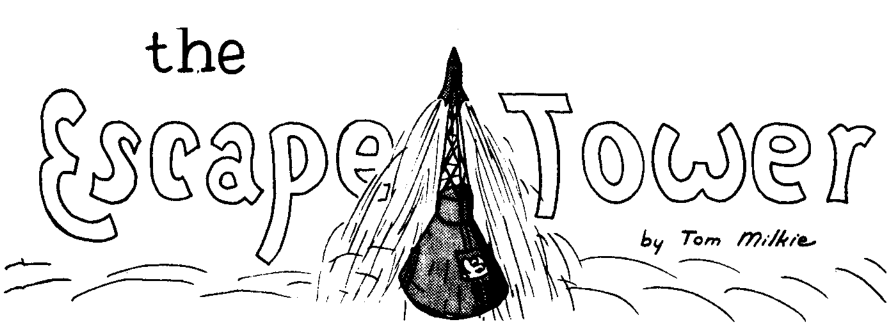


FROM DOUG MALEWICKI



THE SHAM–ROC
(OCT. 1969)

TTM



COMMENTS FROM THE READERS

Now that this column has been running for 5 months, I have begun to receive a few comments about some of the wilder designs that have appeared here. The design in the October, 1969 *Escape Tower,* for the "Sham-roc", has instilled many rocketeers with maddening creativity. The design of the "Dragstab" (October, 1968 MRm) is similar to many of these designs, so I have included a sketch of that finless bird. The "Dragstab" used a streamer attached to the rear to cause drag and bring the Center of Pressure way back. The long tail may bring the CG back, but the CP is even farther back, making this rocket stable.

Kerry Jones of Kokomo, Ind. responded to that design with the "skyrocket" design shown. Kerry says that launched off a 5 foot rod, this bird is stable. The principle here is the same. Although the long dowel may appear to bring the CG way back, this rocket is still stable by the traditional method. All that dowel *does* have side area, and acts like a fin that makes the rocket fly stably. Another possible effect of the long tail may be to increase the moment of inertia, making the rocket act slowly to a disturbance.

I believe that an old Estes design, the "Sputnik", worked the same way. The "Sputnik" was made from a styrofoam ball and dowel legs.

Doug Malewicki has also given me a few pointers on some of these finless rockets. He says that although many people are used to discounting the effect of body tubes, they can provide correction forces to make a rocket stable. When the angle of attack of a body tube (angle between body and air flow) approaches 10 degrees, there is a slight force exerted by the flow on the tube. Doug suggests that the tube rocket shown would be stable by virtue of the body tube fins.

Glen Davis of Lumberton, North Carolina, sent in his suggested version of the "Sham-roc" called the "Flying Escape Tower". He didn't say if this has flown, but I suspect that there would be problems in stability. The large cone of metal in the rear would tend to bring the CG to the rear, while it would not contribute enough to bringing the CP to the rear. Any design like this also has the inherent problem of increased drag, due to sticking something into the engine exhaust. However, a long model may be stable.

Unlike most of these designs, though, I have concluded that the "Sham-roc" is unstable, with its CG behind its CP. Once more I would like to say, in the hope that those last few disbelievers will be converted: *A rocket is not necessarily stable if the engine is in front of the center of gravity!* Denis Lufkin of Alberta, Canada has brought to my attention, though, a possible reason for the misconceptions. In an old Estes Technical Report (TR-7 on Front Engine Boost/Gliders), Gordon Mandell made a statement that is contrary to that above. Gordon has since admitted that the statement, just inserted as a remark in the report on boost/gliders, is a generality not true for some designs.

The 1/16th scale Apollo Capsule design that I presented in the November, 1969 issue of **MRm**, was meant as just a suggestion, but I later received information on just such a model built a few years ago. Doug Malewicki again was the creator of the bird shown.

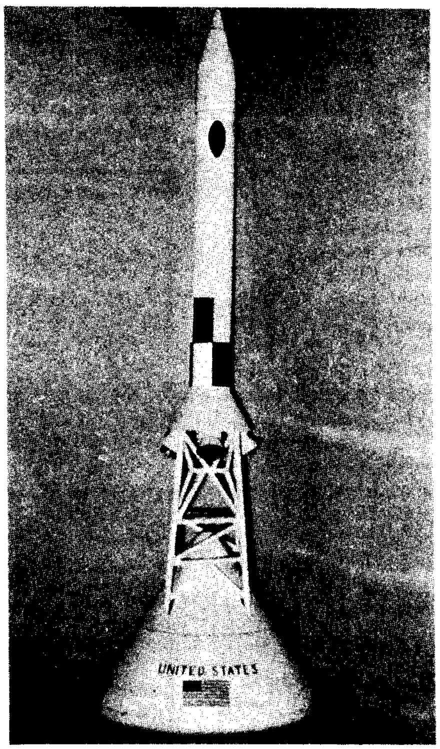
The capsule was built from wind tunnel model plans, to a scale that neatly allows the escape engine to be made from Estes BT-60 body tube. (about 1:19 scale) Doug says he constructed the cone from a light cardboard covered balsa frame. The heat shield was carved from styrofoam. The tower was constructed from 1/4" and 3/16" hardwood dowels.

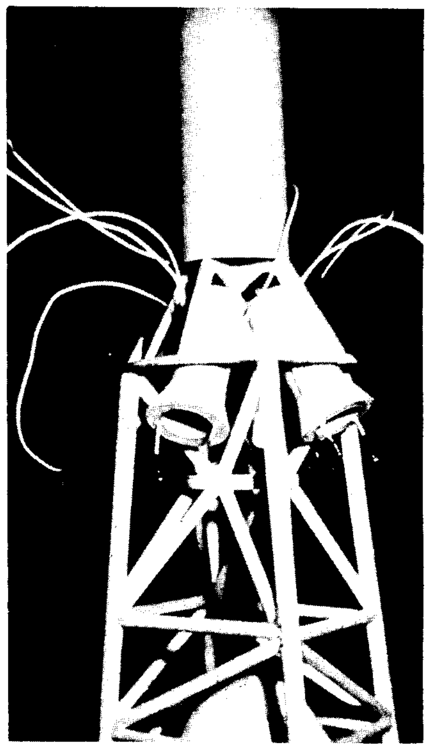
Doug's model (which he no longer has) was powered by *four* old *B* engines. (Estes' new shorty A5-2's could possibly power a bird like this.) The scale nozzles were made larger to accommodate the engines. The rocket weighed in around 12 oz. CP-wise, the model is quite stable, but Doug complained that the four motors would not burn identically, and the rocket would fly erratically.

Recovery was by three chutes in the BT-60 escape "engine" and the rocket appeared to reach sufficient altitude for a smooth deployment.

A novel feature is the ignition wiring. Doug ran parallel ignition leads through the inside of the escape engine and down to the rocket engines in each nozzle. The wires went down the tower structure, through the capsule and ended on the bottom of the capsule. Ignition clips were then fastened to the wires. The launch rod ran down the center of the capsule. Doug later was stricken with the problem of having the launcher leads pulled up into the air with the capsule. To remedy this problem, Doug drove a steel hook over the leads and into the ground. When the rocket took off, the clips would be separated from the rocket leads.

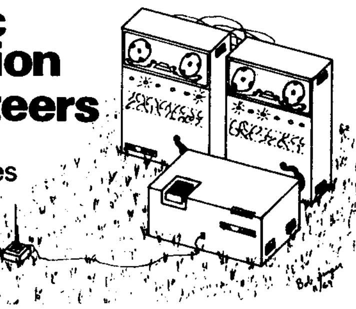
What do you do after a flying Saturn V, Apollo escape tower, and Lunar Module? How about a simulated orbital rendezvous?





Shown above is Doug Malewicki's "Flying Apollo Capsule". Note that Doug runs his ignition wires through the supports of the launch escape system. The tower is constructed from ¼" and 3/16" hardwood dowels. The heat shield was carved from styrofoam.

Automatic Computation for Rocketeers



by Charles Andres

Those who have followed this column since last October and who have tried to run some of the programs already published may have run into problems even when they used an IBM/360 and 2740 with FORTRAN IV. This is due to the fact that each computer center and each computer is programmed differently, although they are all basically the same when the hardware is the same. Any piece of computing equipment can be programmed to accept programs in an individual way although there is still some consistency in sticking to a particular format. However, even when computer centers are similar to the point where they are using the same equipment with the same language and the same formats for programming, IBM changes and continually updates its equipment and methods of computation. For example, there is not only just one computer type labelled /360. There are many variations. The one which I have had access to is an IBM/360 40. There are also models: /360 20, /360 30, /360 50, and /360 65 that I know of which are similar in function but quite different in what they can do. In addition, the /360 can be programmed in two different ways—either by remote terminal with the RAX system or by cards under the O/S system. (These cards resemble turnpike tickets or record club cards.) This great diversity among computer centers which are usually tailored to fit an individual institution's needs can cause great confusion, and can make the programs illustrated here meaningless to some rocketeers who have access to only one particular type of computer which varies greatly from the IBM/360. Fortunately, FORTRAN IV is one of the more widely used languages in the United States, although there are others. In addition to the FORTRAN series, there are also ALGOL, BASIC, MAD, and BAL. The newest language is PL/1, which is gaining popularity quite rapidly. One of the centers I have had access to plans to switch next year from its IBM/360 40 with FORTRAN IV to an IBM/360 50 with PL/1.

Needless to say, there are other computer companies besides IBM. There are the UNIVAC and Honeywell Corporations which also build computers which operate on the same principles as IBM's although the languages are often different. But good old FORTRAN will be around for a while, and is as good a language as any to write your programs in for future use. IBM will be around for a while too, at least according to Stanley Kubrick's 2001. (For those of you who don't know it, HAL is an anagram of IBM. Subtract one letter from each character in IBM.)

Some might ask if there is a reason for all of this diversity, change, and updating which is beginning to approach a point of absurdity. Well, the 21st Century is only 30 years off, and if we are going to reach the sophistication of the HAL 9000, we had better keep on updating our present versions. (Incidentally, if HAL gave you the impression that ultra-intelligent machines are undesirable, read Isaac Asimov's **I Robot.** It is a little more encouraging about the future relationships between man and machines which have surpassed the intellect of their creators.)

Getting back to /360, it might be interesting to point out that even at its archaic level in comparison to HAL, it is beginning to think for itself so to speak. Technicians have reported that they have found electric current flowing in parts of the 360 where it wouldn't normally have been. Since electric current can be considered to be synonomous with brain waves, one can say that the machine is reaching a primitive level of thought. Therefore, even the /360 can "feel" to a very limited extent. Technicians have reported that if you suddenly pull the plug on a /360, it can "feel" pain. Thus, please excuse the diversities and updates in computers as just another example of our unbelievable rate of technological progress. We are progressing toward the 21st Century.

CHANGES IN RAX

The RAX system which I have used to program the equations thus far also has gone through a period of technological growth. In other words, there have been changes in program procedure which have caused a change in the writing of programs. (As readers from October will remember, RAX stands for Remote Access Control System. This is the time-sharing system where any number of terminals set at any distance from the center may use the computer simultaneously.) The main computer needs only a micro-second or two to respond to each terminal, and a wait of ten seconds or more for the computer to respond is unusual. The only disadvantage to this is that the programmer realizes that it took him six hours to write a program, and another hour to type the thing in. Then the computer gives him an answer or painstakingly itemizes all of his mistakes in less than a second—quite a blow to one's morale. To add insult to injury, it would probably take the programmer several hours to carry out the same equations by hand, but the computer runs through each equation thirty times in less time than it takes to read this. But the programmer can be consoled by the fact that the computer is still incredibly stupid since it has to be meticulously told in explicit detail what it is to do, and will still take everything literally!

A computer center makes changes approximately once every six months to a year, which usually includes changes in programming techniques and an erasure of all programs which aren't asked to be saved. The latter is usually done because any given center has a limited amount of storage space in its disks, and thus old programs are cleaned out from time to time to keep storage space available. Thus, any computer user should check with his local center every so often to find out when they are going to clean house so that he can make sure that all of his programs can be saved.

The computer center which I have been using, namely that at the University of New Hampshire, has made some changes in the programming scheme which I shall now mention. All programs written henceforth will employ these changes since this was the way in which the programs were successfully run. These changes are relatively minor, but if you are still using the old program type with success and your computer center is not planning to change over, ignore these changes. However, there is a better than average chance that the changes were made on advice from IBM, which would also encompass all /360's from coast to coast.

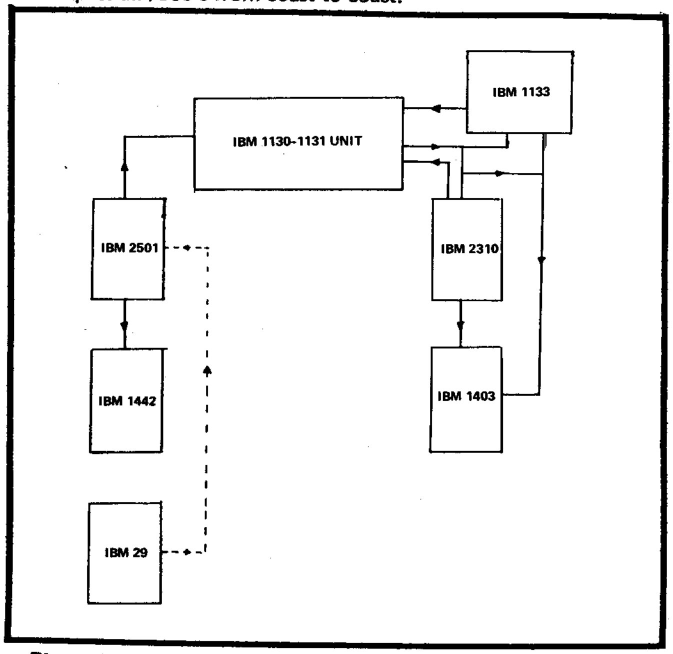


Figure 1: Schematic diagram of typical IBM computer center.

These are the changes made within the past six months at U.N.H.:

(1) The phone numbers used for calling from either a 1050 or 2740 terminal have now been separated. Thus each type of terminal has a separate set of phone numbers that it can use to call the computer.

(2) More characters are now legal which can be used with the computer. Besides those mentioned in the preliminary article of last October, these characters are now also acceptable:

- > Greater Than
- < Less Than
- ¬ Logical Not
- | Logical Or
- " Double Quote
- ; Semi-Colon
- : Colon
- % Percent Sign
- @ At Sign
- ! Exclamation
- # Number Sign

(3) The tab position has been moved from column 7 to column 10 for reasons unknown to me presently. This means that if this has happened to your computer, then all of the lines which go out farther than 69 spaces will have to be retyped or truncated. 72 spaces is still the limit for program lines, but beginning at column 10 makes some lines too long now.

(4) Although program lines begin in the 10th column now, the continuation code which allows lines normally over the 72 space limit to be continued on the next line is still in column 6. Thus, instead of backspacing one space on from tab, one will now have to backspace to column 6.

(5) The identification number used in typing in the program on a terminal is now the only lock code allowed. (This is the /id number needed to activate the system at the start of programming, and the one they send the bill to.) Thus if your id number was (xyz1-23) and you wanted to save a program called rocket, you would type: **/save rocket(xyz1-23)**. This isn't as safe as the old system since anyone can find a program's lock code by knowing the id number of the programmer. On the other hand, one can also find out who programmed it in the first place if they can get the lock number displayed.

All other changes made in the RAX system do not pertain to the discussion here and have been ignored.

THE O/S SYSTEM

There is a very good chance that many readers will be programming these programs with cards rather than with a remote terminal. Cards are a much older and more widely used method of programming computers, and thus it is likely that it is being used by a large number of persons. The language which is typed on cards does not vary much from that typed out on a terminal, as long as it is the same type of language. The June issue of **Model Rocketry** will contain one program as it was written for use with the /360 2740 remote terminal operation, and the same one as written for use with an IBM 1130 using cards typed out previously. Most, if not all the differences in the programs are due to the differences between the /360 and the 1130 computers. The only difference likely in typing cards is that some preliminary and execute cards may be needed in order for the computer to accept the program. But these can be found at the individual center. The technician who places the cards in the machine will inform you of any and all cards which you may need to supplement the program.

Three common IBM computers using cards are the 1130, the 1620, and the 360. The process of programming a computer with cards is as follows:

1. Punch cards in FORTRAN IV with card punching machine
2. Add execute and compiling cards
3. Feed cards into machine and start computation process
4. Pull out data from printer and reclaim cards.

The cards are punched out on a cardpunching machine which feeds cards one at a time into a slot where the card is punched and the corresponding character is printed on the top of the card. It then is released and moved out of the way so that another card may be punched. Each card holds one line of the program. If there is any need to duplicate any part or all of the card just punched, it can be duplicated in the position it is in between the keypunch and the finished stack of cards. A card is punched by typing on a keyboard similar to a typewriter which types the letter on top of the card while punching the corresponding holes underneath which are read by the computer later. Each array of holes stands for a different character. On a standard card, there are twelve rows on which holes can be made, and 80 spaces across. The main disadvantage to cards is the fact that if you make a mistake of any kind, the card must be discarded since holes cannot be plugged after they have been typed.

The keypunches used for a given computer must be checked before using to make sure that it can be used compatibly. The IBM 26 keypunch can be used successfully with the 1620 but not with the 1130 or /360. The IBM 29 keypunch can be used with the latter two systems but not with the first. This is due to the fact that although they all employ FORTRAN IV, they do not read the characters the same since they do not all punch the same holes for every character. In the twelve rows, the number one is always represented by a single punch in the first row. The number 2 is represented by a single punch in the second row, and so on. But odd characters such as parentheses are represented as a punch in the fourth, eighth, and twelfth rows under one system, and with punches in the second, sixth and seventh rows in another system. Thus, the computer would be unable to read the card correctly if it were typed on an incompatible keypunch.

To cite an example of a complete O/S system, I shall describe one familiar to me. The Nahama Data Processing Corporation in Portsmouth, New Hampshire uses cards for programming their 1130 computer system. As in all card systems, there are the following advantages:

(a) Less actual computer time is used since the programmer can spend all the time he wants to on the keypunch, and then put the cards through the computer in a matter of seconds. This keeps the computer free and prevents the clogging of people wanting to use the computer itself. (It helps to have several keypunches available.)

(b) The program cards can be shuffled, rearranged, added to or subtracted from, in order to fit the program. Thus, updates are a simple matter since the only process necessary is to type out new cards and insert them properly into the card deck.

(c) The print-out is very fast. Most RAX terminals operate with the IBM typewriter which has a small typing ball that types one character at a time, but still is faster than the fastest typist. The O/S computer system using cards generally employs the line-at-a-time printer which prints one entire line in the time it takes a typewriter to type a single character. This can amount to 2000 characters a second.

Every card system also has the following disadvantages:

(a) The time saved on computer usage is economical, but line-at-a-time printer time can run to $3.00 per minute.

(b) The cards are bulky and can be damaged.

(c) The keypunch keyboards approximate those of a typewriter, but there is so much difference that even a fast typist is reduced to hunting and pecking until he gains practice at finding odd characters.

(d) If you make a mistake, the whole card is ruined. This can be extremely exasperating since you can spend years typing and retyping even the simplest of cards. But cards are only $.002 apiece.

The equipment which one can always find at a computer center closely approximates that found at Nahama. The more sophisticated centers have more, but this is about the least one can successfully have to operate a computing center. In fig. 1, I have made a schematic diagram of a typical computer center. The number on each piece of equipment refers to its IBM number and is defined below:

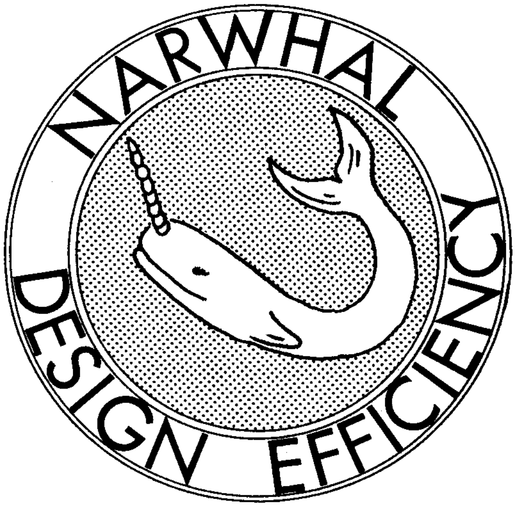
29	IBM cardpunch
2501	Automatic Card Reader (cards are inserted, read, and re-stacked here)
1442	Card Duplicator (will duplicate entire deck if desired)
1130	Computer
1131	Processor
1133	Multiplex Control Enclosure
2310	Disk Storage Memory Unit
1403	Printer (line-at-a-time)

The process undertaken by the computer during compilation is as follows: The cards are placed in the card reader and a button is pushed to start the machine. Other buttons on the main computer console, the IBM 1130, are pushed in order to start the machine's analysis of the cards. The cards are then read in, one at a time, with the information going into the computer processing unit. If the compilation process involves information stored in the 2310 unit, it can be referred to before print-out. The 1133 is part of the processing machinery which does the actual computing. After the program has been compiled, the process taking one or two microseconds measured from the time the last card was read in and the time the printer starts working, the program is printed. All of the cards are displayed in order followed by a list of mistakes or the desired computations as compiled from the program. As soon as printing is complete, which takes five seconds or less, the program can be taken off, the cards reclaimed, and the entire process repeated.

The O/S system also has the distinct advantage of the fact that if you are planning on using another computer center, you can pick up your cards and put them through almost any other similar computer with only minor changes in the first and last cards. Cards are a permanent record of your program. For this reason, it would benefit RAX users to get their typewritten programs transferred to cards so that they will never be lost if erased. This can be done without typing them all over again at some centers. It also would help to get all cards for one program in one color so that you can separate them in the event of a catastrophe.

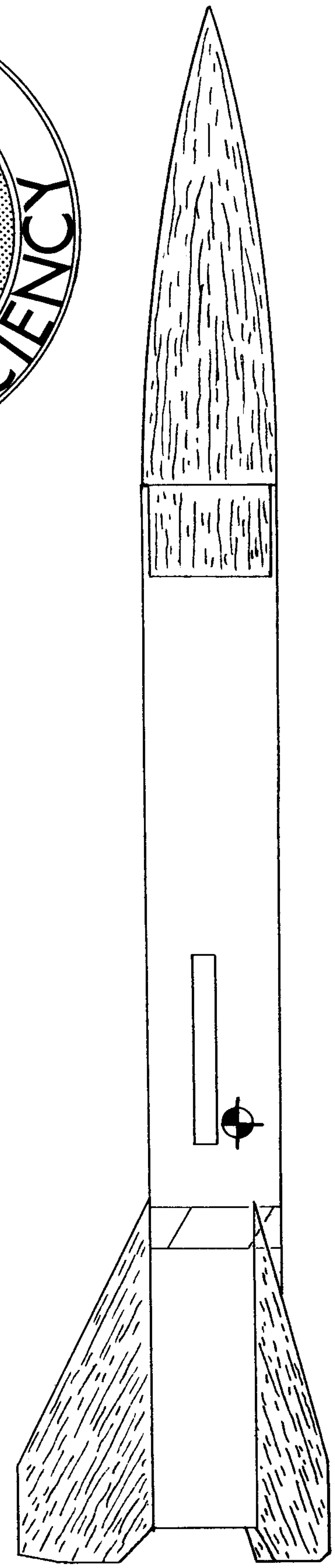
The next article in this series will present the program for Multi-Stage Altitude Calculations. See June 1970 **Model Rocketry**.

For high-flying performance in Design Efficiency competition, build



THE NARWHAL

by Richard Sternbach



This August promises to see the twelfth national meet, NARAM-12, in Houston, Texas. Among the events there is to be the one called Design Efficiency. This calls for any model rocket within NAR limits to be flown, its altitude in meters being divided by the total impulse of the engine or engines used. The highest number of resulting points is declared the winner. Right away some contestant-to-be will figure, sure, put a big engine in a small rocket and it'll reach the highest altitude. What this modeller might not take into account is the fact that his altitude will be divided by a mighty total impulse. Some thoughtful calculations on my part resulted in a few surprises.

What brought about the Narwhal was some basic division and some careful chart-work. One look at Centuri's Altitude Prediction charts told me that the model would have to be fairly light (I am limiting myself to engines up to and including C6's). It would also have to be small in cross sectional area, that is, a BT-20 as opposed to a BT-60. The lightest vehicle I could come up with was the size of the model shown. The basic weight (empty) is close to .3 ounces. With a variety of engines and their weights, I added the vehicle weight and checked the charts. Starting with the biggest engine, a C6-7, I found that when the altitude was divided by the total impulse, 500/10, the total points was 50. On down the scale of weights, altitudes, and total impulses, I came up with the following points:

ENGINE	*POINTS*
C6-7	50
B14-7	60
B6-6	63
B4-6	64
A8-5	75
A5-4	75
1/2A6-4	82
1/2A6-4S	*84!*

Needless to say, I went ahead to build the Narwhal, outfitted for "Shortie" engine and a conventional streamer recovery. I should mention that once you get below the 1/2A into the 1/4A the points drop off from lack of sufficient altitude.

Construction is simple and should pose no great problem to any modeller, even a beginner. Parts needed are:

- Estes BNC-20N balsa nose cone (1)
- Estes EB-20 paper engine block (1)
- Estes BT-20 one 6-inch length (cut 1/2" from BT-20D)
- 1/16" thick balsa for fins (3 used, trace left-hand fin pattern)
- 1 1/8" section of launch lug (1)

Because the Narwhal is small and will reach a very high altitude, be sure to paint it with a high-visibility color such as black or fluorescent orange, etc. *Happy flying!*

WICHITA STATE UNIVERSITY
LOW SPEED WIND TUNNEL

DRAG COEFFICIENT MEASUREMENTS

by Douglas Malewicki

INTRODUCTION

Last summer I started working on a design for an ultra-sensitive electronic strain gage wind tunnel balance to accurately measure very small Lift Forces, Drag Forces, and Pitching Moments on boost gliders. Six months and two graduate research courses later, I finally have some real data to look at and think about—and am elated as any good fellow engineering nut would be under similar circumstances.

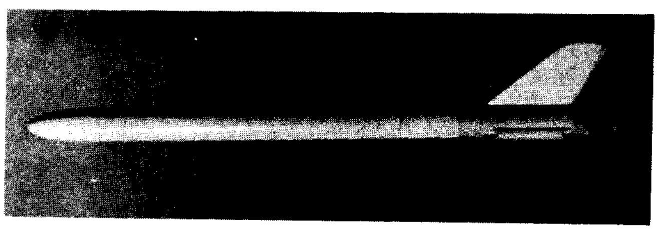
The first group of models tested consisted of Estes Industries Falcon B/G, Space Plane B/G, Nighthawk B/G, and Orbital Transport Parasite B/G. Also included was a pop-pod B/G of my own design, and *as an afterthought* the Skychute XI rocket.

I haven't taken the time to write up the glider data yet because the rocket drag data proved more intriguing. At the earliest possible date, however, I intend to present the Estes Nighthawk data, its meaning, and some of its basic implications.

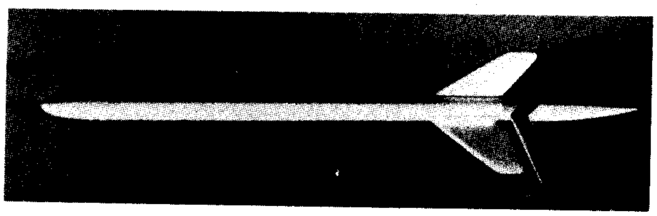
TEST CONFIGURATIONS

The Skychute XI was run in the wind tunnel in two distinct configurations—WITHOUT a base fairing and again WITH a base fairing as shown in the photos.

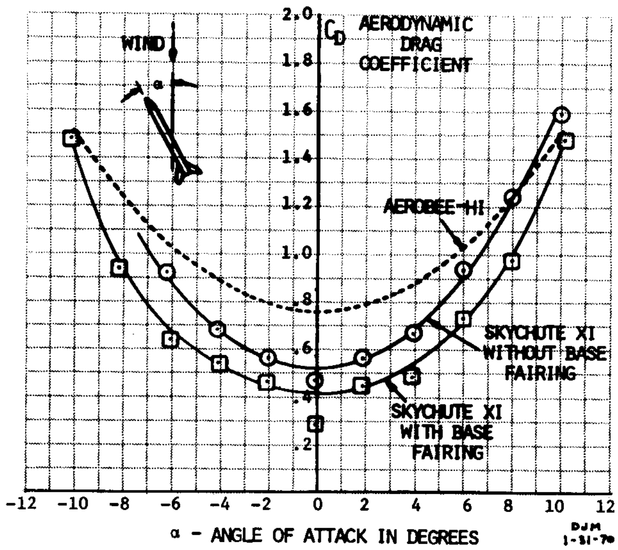
Without the base fairing, the rocket gives a true aerodynamic representation of a free fall flight condition. However, one must ask himself, do model rockets really every fly in this manner? It seems more logical to assume that the rocket engine—whether it is thrusting at full power or merely generating large volumes of smoke for visual tracking—*is* producing a positive pressure region which must help streamline the flow as it goes past the *base* of the rocket. Without smoke or exhaust flow, air particles going past the rocket's tail have to turn sharply at right angles to try to fill the void left by the squared off base. In actual flight it appears that the engine exhaust would allow the air to keep right on going, meaning corresponding less energy losses and less total aerodynamic drag. Inserting a long smooth nose cone backwards into the base of the rocket is my version of an "idealized" engine exhaust.



SKYCHUTE XI without fairing, simulates free-fall condition.



SKYCHUTE XI with fairing, simulates effect of the engine exhaust plume.

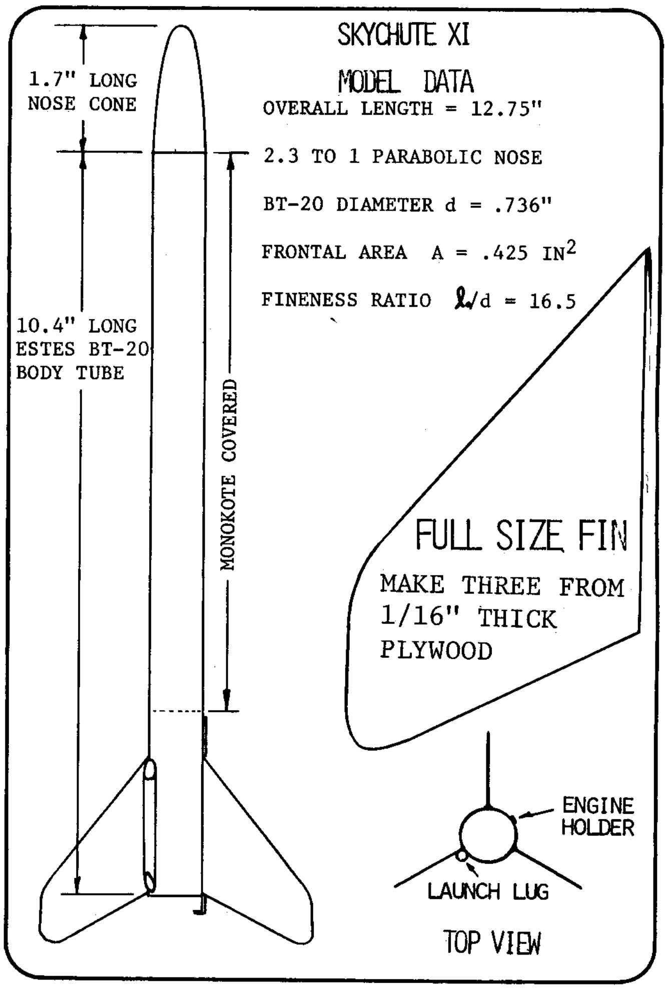


TEST CONDITIONS

AIRSPEED V = 40.4 FT/SEC = 27.6 MPH

REYNOLDS NUMBER RN = 261000.

MACH NUMBER M = .036 (mini-sonic?)



PRELIMINARY CONCLUSIONS

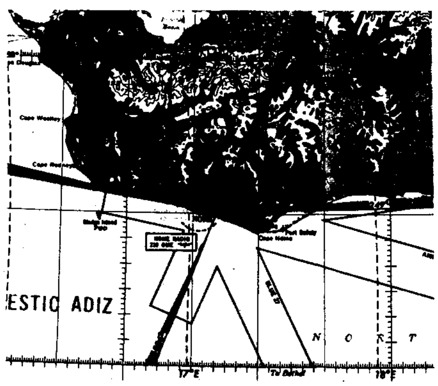
For comparison purposes, the pre-1965 Aerobee-Hi aerodynamic drag data presented in G. Harry Stine's **Handbook of Model Rocketry** has been superimposed on the Skychute XI wind tunnel results. The Aerobee-Hi was a 13 inch long model having a fineness ratio of 16. The data was collected at 50 MPH in one of the U.S. Air Force Academy's small wind tunnels.

The Aerobee-Hi's minimum drag coefficient of $C_D = .75$ at zero angle-of-attack has been the accepted value to use when predicting theoretical altitudes for quite some time now.

My first conclusion based on this comparison is that *using a drag coefficient of .75 is at least 50% too high.* Using a C_D of .5 for aerodynamically clean rockets should be quite reasonable and may actually still be somewhat on the high side in view of Professor Gerald Gregorek's work on analytically estimating Drag Coefficients (see *Technical Notes* by George Caporaso, **Model Rocketry**, January 1970). Especially note that the Skychute XI had its launch lug on during the tests.

The second conclusion is that the total drag is less with a simulated exhaust plume (the base fairing) than without—as expected. However, just where do real model rockets lie. Also consider that the base fairing will have some surface friction drag associated with it, whereas the real high speed exhaust flow won't.

Lastly, what about those weird extra-low drag coefficient values at zero angle-of-attack? Maybe Malewicki's ultra-cosmic super balance ain't! *OR* maybe some model rocket nose shapes really exhibit the small bucket shaped drag minimums typical of laminar-type airfoil sections as shown below:



AERONAUTICAL CHART OF APPROACHES TO NOME, ALASKA

Reference

Pages 2-10 and 2-12 of **Fluid Dynamic Drag** by Dr. Sighard F. Horner, 1965 edition.

Such an airfoil was used on the famous World War II Mustang fighter aircraft. Before you start analyzing your rockets' altitudes based on minimum C_D's of .3, look at how restrictive angle-of-attack oscillations would have to be. Also, the single test points at zero angle-of-attack are inadequate to define the complete drag shape variation *near* zero. Unfortunately, the initial tunnel testing concentrated on getting good glider data. As a result, I only collected data on the rocket in crude two degree increments, instead of at many finer in between positions. I wasn't anticipating anything other than the usual smooth parabolic drag curve and can only comment that discovering the unexpected is, after all, what makes research fun.

I should be into a second series of tests in a couple of weeks and, as you can probably guess, will be very carefully checking to see if such a laminar "bucket" does indeed exist and, if so, to what extent.

THE SKYCHUTE XI

Next we need to discuss the model itself to explore possible reasons why the Aerodynamic Drag Coefficient is so small compared to previous experimental data.

The Skychute XI tests were run *with* the launch lug in place (as you can probably see in the photos) *and* the C_D's at zero angle-of-attack are still below .5. Perhaps gluing the launch lug right in the fin-body joint instead of just to the body at some place *forward* of the fins has some influence?

One item that I'm sure helps in reducing drag is the use of minimum area fins. For your own rockets, use the smallest size you can get away with and still insure adequate stability. The minimum safe size can be determined by trial-and-error calculations using the well-known Barrowman method.

I would also like to note that the fins are made from *thin* 1/16 thick plywood instead of balsa. Prior to gluing the fins to the body tube with Titebond, they were carefully shaped to an airfoil cross-section having a very sharp trailing edge and then progressively sanded until the finest 600 grade sandpaper produced a perfect surface—without any sealer or filler coats of paint. The surface of the plywood is much harder than balsa and it feels like you are rubbing your fingers over smooth plastic once you have completed the sanding operations.

Especially note that, with the exception of the nose cone, *no* paint or fillers of any kind were used on the rocket. The body tube was covered with yellow Super Monokote from the base of the nose cone down to the top of the engine holder. Monokote, as you may already know, is .0025 inch thick mylar plastic and you can't beat it for a super-smooth, lightweight finish.

By the way, you might be interested to know that the Skychute XI rocket used in these wind tunnel tests was the same one I flew in parachute duration this past NARAM. It had a *30 inch* diameter circular chute with 24 shroud lines *all* in a BT-20 body tube. Packing that size of a chute in such a small tube is not impossible—just difficult and time consuming in order to insure reliable deployment and opening. Scott Layne, NAR's Junior Champion of 1969, was kind enough to take time from his busy point gathering schedule to help with the chute packing process. It took a full 10 minutes working as a coordinated (?) team to get the folding and packaging just right.

The official flight progressed as follows: Nice clean lift-off, good altitude, and the chute popped fully open within a split second of ejection—all worked fantastically according to plan. It may be hard to believe, *but* it didn't even place! Why? Simply because the thermals didn't arrive until later!

All the background theory; *all* the optimizing; *all* the analysis—useless, useless, useless! Why does one even bother? I don't know, perhaps scientific thinking is just another form of self-entertainment.

Anyway, my fellow theorists, *all* hope is not lost! Several years ago, I remember reading about an electronic *thermal detector* in one of the model airplane magazines. I can't find the article and I don't even know which magazine it appeared in. Nor, do I know how well it worked in actual practice or even what physical parameters it measured.

I would dearly love to own one and in order to stimulate research on the topic will gladly give a free six pack to the first electronically oriented rocketeer who cares to re-invent it. Glider and chute duration records here we come! (By the way, that's two tubes of Estes engines—not six cans of the bubbly stuff. Model Rocketry is after all a wholesome, educational hobby – right G. Harry?)

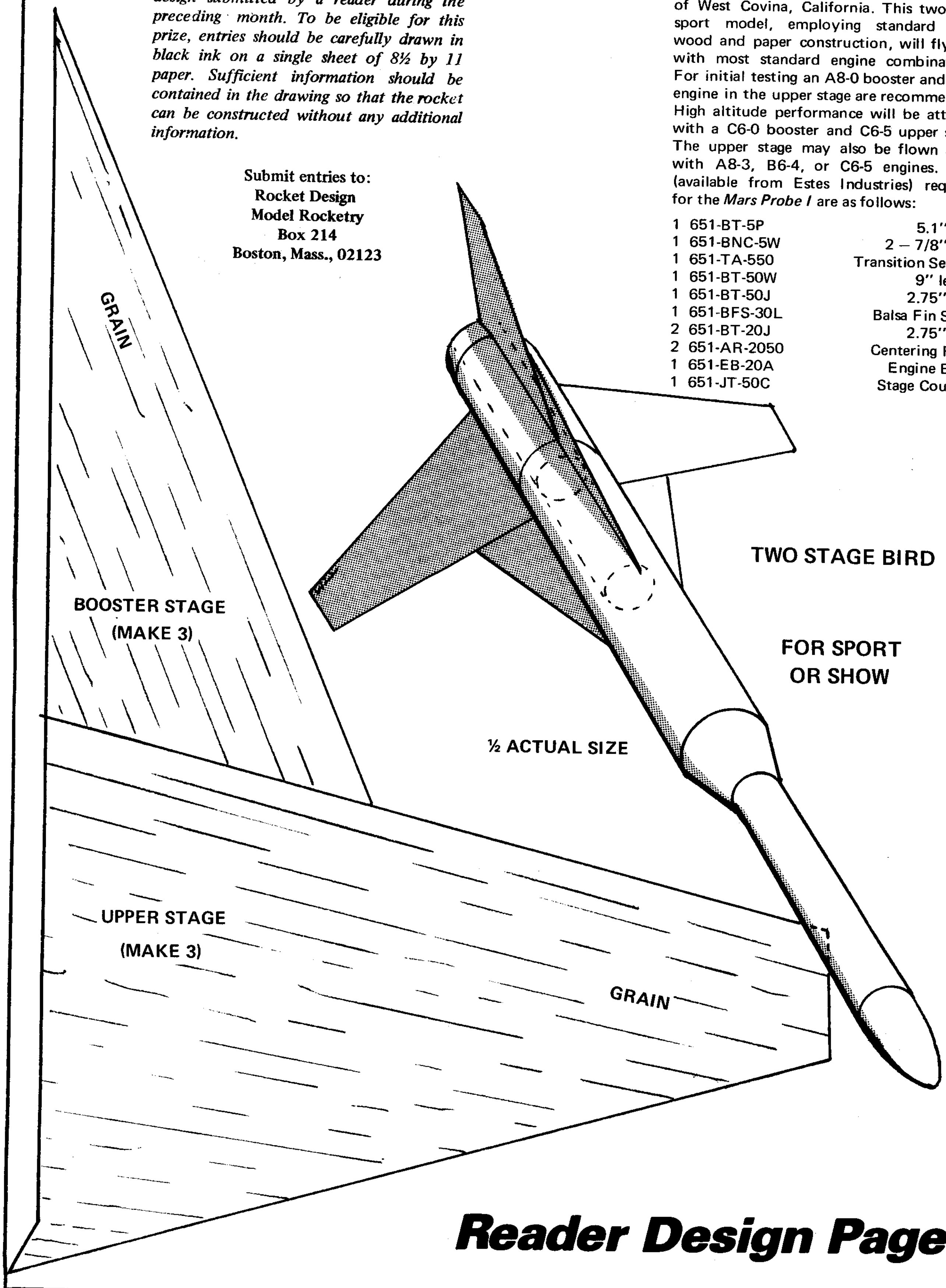
Details on exotic chute packing and additional pointers on chute duration contest birds will appear just as soon as Carl Kratzer's extensive series of indoor parachute drop tests are completed and mentally digested. Comparing these experimental results to those obtained with the duration prediction theory presented in the February, 1970 issue of **Model Rocketry** should be especially interesting.

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.*

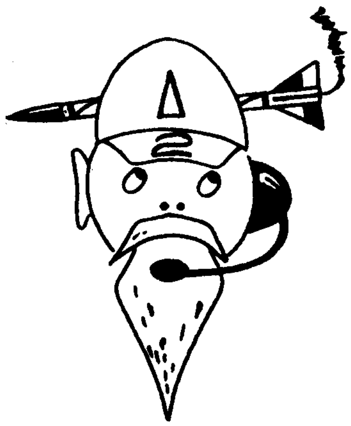
Submit entries to:
Rocket Design
Model Rocketry
Box 214
Boston, Mass., 02123

This month's Reader Design, the *Mars Probe I*, was submitted by Bruce Reynolds of West Covina, California. This two-stage sport model, employing standard balsa wood and paper construction, will fly well with most standard engine combinations. For initial testing an A8-0 booster and A8-3 engine in the upper stage are recommended. High altitude performance will be attained with a C6-0 booster and C6-5 upper stage. The upper stage may also be flown alone with A8-3, B6-4, or C6-5 engines. Parts (available from Estes Industries) required for the *Mars Probe I* are as follows:

1	651-BT-5P	5.1" long
1	651-BNC-5W	2 – 7/8" long
1	651-TA-550	Transition Section
1	651-BT-50W	9" length
1	651-BT-50J	2.75" long
1	651-BFS-30L	Balsa Fin Stock
2	651-BT-20J	2.75" long
2	651-AR-2050	Centering Rings
1	651-EB-20A	Engine Block
1	651-JT-50C	Stage Couplers



Reader Design Page



The Old Rocketeer

by G. Harry Stine NAR#2

Psionic Control of Modrocs

Every model rocketeer knows that sometimes a model rocket goes where he doesn't want it to go. For example, if there is a single tree in the flying field, a model rocket will invariably go toward that tree either during boost or after recovery deployment. In a like manner, it is a well-proven fact that during a flight demonstration for local officials the very worst possible thing always goes wrong . . . and has a 1.00 reliability of being disasterous if pre-tested models built from kits and using selected engines are used. If there happens to be a recovery failure, a model rocket will always land on top of the automobile belonging to the most politically influential and the most anti-rocket spectator present. Most model rocketeers have also run up against the so-called "Zero-wind weathercocking" phenomenon wherein a multi-staged rocket will weathercock into the breath of the closest spectator even when there is a dead calm.

Is there a model rocketeer who has *NOT* run up against the perverse characteristic of aerodynamics, sometimes known as the "perversity factor", that permits a model to go neutrally stable in flight even with a two-caliber static stability margin?

All of these universal and ubiquitous common model rocket occurrences gave rise several years ago to a theoretical concept involved with the telepathic guidance and control of fin-stabilized, free-ballistic rockets. The work was prompted by earlier investigations conducted in the 1955-1957 time period at White Sands by Nathan Wagner, George L. Meredith, and the author who was at that time Flight Safety Engineer for the U.S. Navy contingent at White Sands. Flight performance calculations and impact area predictions for the Aerobee RTV-N-10a and RTV-N-10c rocketsondes involved complex wind weighting factors and data taken from high altitude balloons. Impact predictions were also made on a real-time basis by an analogue computer which read-out on a plotting board predictions of the landing point of the Aerobee at any instant during its flight if the thrust were terminated at that instant. Thus, several million dollars worth of equipment was involved in trying to determine in advance where a rocket would land. Wagner, Meredith, and the author came up with a much more economical impact predicting device built in the shops of the Slight Safety Branch and costing a total of 23 cents. This impact predictor was an ordinary wheel of chance mounted with the axis of rotation in the horizontal direction. Numbers from 1 to 99 were placed around the periphery of the wheel, and a small nail was driven into the base to serve as a pointer. Prior to the launch, the Flight Safety Officer spun the dial. The first number was recorded as the number of miles north of the launch pad the Aerobee would land. The second spin of the wheel would indicate whether the Aerobee would land to the east or the west of the north-south line—an odd number would indicate east, and an even number would indicate west. The third spin of the wheel would give the number of miles to the east or west that the Aerobee would land.

This Simplified, Handy-Dandy Impact Predictor was tested on no less than 17 Aerobee and Aerobee-Hi flights during the 1955-1957 time period. Its error in predicting the impact point of an Aerobee flight was *LESS* than that of the computer and *MORE ACCURATE* than the complicated wind-weighting calculations performed by Aerobee scientists in the blockhouse. In fact, the simplified predictor accurately predicted *before launch* the total failure of three Aerobee-Hi rockets whose sustainers failed to ignite.

This impact predictor was one of a number of devices known generically as "psionic machines." In some fashion, psionic machines are capable of being controlled by the human mind or, by using the human mind as an amplifier, of bridging the sequential nature of the time dimension to foretell the future. (Some model rocketeers may already have had experiences with a common psionic device known as a Ouija Board. In fact, at White Sands there was a Ouija Board mounted in the Flight Safety plotting room with instructions to use it in emergency if the computer failed.)

All psionic devices have in common their small size and low mass.

Model rockets have small size and low mass.

Model rockets appear to behave as if they were miniature guided missiles with little minds of their own.

But model rockets do not have guidance systems in the commonly-accepted sense of the word.

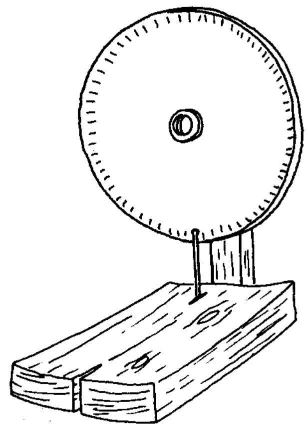
Ergo, model rockets must occasionally be controlled or somehow affected by unknown mental radiations, and therefore can be considered as small psionic devices.

Earlier, we pointed out the well-known facts that model rockets usually don't do what their builders want them to do. It was therefore possible to develop the generalized equation for telepathic guidance or psionic control of model rockets in flight. In simplified form, this is:

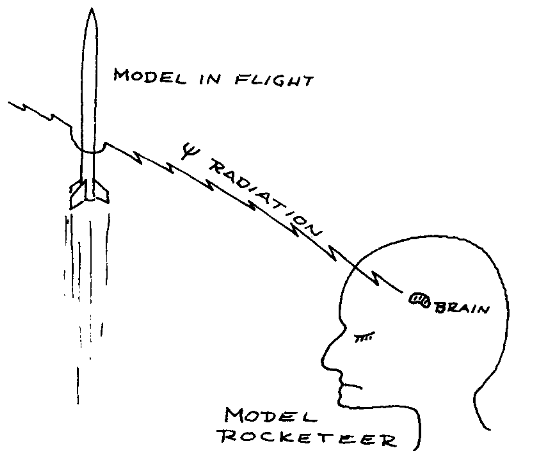
$$\vec{V} = \frac{1}{D}$$

where $\vec{V}$ = the vector velocity or direction and D = the desire of the builder.

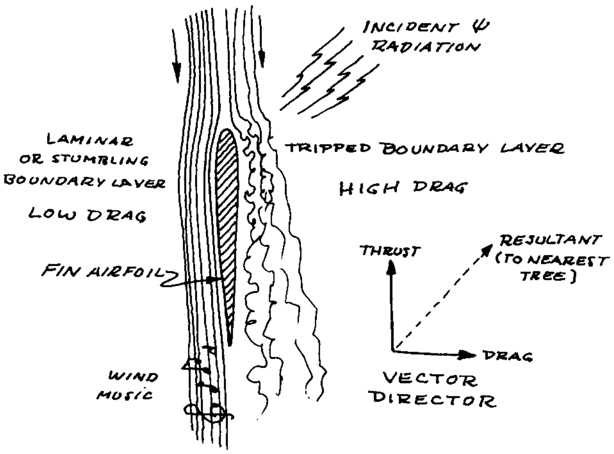
In other words, if you want the model to fly north in such a direction that it will land again on the field, it will fly south and be



PSIONIC IMPACT PREDICTOR
MARK I
(AFTER WAGNER, MEREDETH, ET AL)



BASIC CONTROL LOOP (OPEN)



PSIONIC CONTROL PRINCIPLES (DO NOT SCALE!)

lost. The harder you want it to go north, the more strongly it will go south. This is, admittedly, a simplistic explanation of some very complex experimentation and theorization that has taken place during the past few years and which is currently being withheld until the developers have the chance to clobber everybody else in the NARAM-12 Spot Landing Event.

However, some of the theoretical if not the pragmatic aspects of telepathic guidance and psionic control of model rockets in flight can be discussed because Science Knows No Country (or NAR Section) and the history of science shows that once a basic principle has been discovered by one person, it is quite likely that at least one other person has also discovered it. Witness the development of Fluxions by both Newton and Liebnitz simultaneously. Perhaps by initiating a general discussion on psionic control, we can generate some work in the field, shed some light on many problems, develop a dialogue, and get into correspondence with other investigators from whom we can steal some good ideas.

The basic theory of psionic devices includes the concept that the machine is just a symbol or focus of attention for mental radiations. Many researchers are of the strong opinion that since psionic devices are symbolic and appear to negate the basic postulates of general semantics, it helps if a psionic investigator is symbol-minded.

Mental or psi radiations—psi is a Greek letter which has been arbitrarily assigned to the phenomenon so that it can be easily confused with the use of psi as the amplitude of matter waves in the Schrödinger wave equation—are apparently quite weak. In fact, some mental radiations from some people are so weak that one must postulate that the power output of the transmitter must be zero . . . which means that the transmitter is either working into a dummy load or is turned off. This seems to verify the observation that many persons appear to be walking around with their brains turned off. The postulate that the mind may be working into a dummy load is, however, also suggested by the common use of the phrase, "Boy, is that a load off my mind!"

If psi radiations are weak and of low power, a psionic device must therefore act as an amplifier. Such an amplifier cannot possibly have much gain because most psionic devices such as Ouija Boards, wheels of chance, etc. have little or no energy input . . . and it is difficult to have a state where one gets something for nothing, except a welfare state.

However, it is possible to list a number of physical processes that can be initiated or controlled by very weak or low-energy factors. One little bitty neutron, wandering around and minding its own business, is capable of copulating with a nucleus of Uranium-235 which results in one tremendous bang worth millions of dollars and releasing gigawatts of power. It has been estimated that the power involved in pushing a button is about 5.48×10^{-9} watts, yet it is common practice to expend such energy to turn on a 10^{2}-watt light bulb. As a matter of fact, we live in a world where a single human being can exercise considerable control over the lives of billions of people by using a trigger consisting of a red telephone. So low-energy initiators and triggers are common in technology, and there is no reason to believe that psi radiation cannot act as a trigger or control signal even though it may be weak or down in the noise level.

What mechanism might be evoked to explain the observed effects of mental energy or psi radiation on a model rocket in flight? Consider the following:

Model rockets because of their size and flight velocities are known to operate in that Reynolds Number regime commonly referred to by aerodynamicists as the "transition" or "confusion" regime, to use the printable nomenclature (aerodynamicists have been known to apply some quite unprintable appellations to the transition regime of Reynolds Numbers).

Reynolds Number is an obscure and little understood pure number like drag coefficient. Some aerodynamicists believe that Reynolds Number is Area Code 212, 538-0584 . . . but don't believe them because it is disconnected. Actually, it was invented by a physics professor named Reynolds at Miskatonic University for the purpose of making the simple subject of aerodynamics quite complicated and thereby justifying his faculty standing, tenure, and budget request of 17 cents for a new pith ball on his electroscope. But that is a different story and will be related here later in full . . . with the Editor's permission.

At model rocket flight velocities, it is very easy to trip the aerodynamic boundary layer flowing over the nose cone, body tube, and (you hope) the fins. It has been calculated that an object 0.10 times the diameter of a human hair will trip a boundary layer and cause it to transition from laminary flow to turbulent flow. It is also equally easy to detach it completely from the surface. This is because the boundary layer very close to the surface of a model rocket has very little energy.

Aha! Therefore, it can be controlled with even less energy!

If you wanted to create more drag on one side of a model rocket than on another, the easiest way to do it would be to trip the boundary layer on one side and not on the other. This would create a difference in drag which would produce a rotational couple (Ed.: Watch it, Stine! There are postal regulations . . .) which in turn would turn the rocket in flight.

Thus, an experienced model rocketeer or one who is in tune with the environment can and probably does cause the boundary layer to transition asymmetrically over the external surface of a model rocket in flight and by thus changing the instantaneous local drag force, steers the model rocket through the air. In a like manner, the flow around a deployed parachute can be controlled by psi radiation, although there may be yet another phenomenon connected with parachute directional control: Since no parachute is exactly symmetrical, it has a tendency to side-slip, and the direction of side-slip can be psi-controlled by controlling the rotation of the chute, an act requiring very little energy.

Thus, it can be readily seen that many contests are won NOT by luck and fortuitous circumstance as has been believed in the past by un-initiated on-lookers and losers. The winner of that duration contest was, consciously or unconsciously, psionically controlling his model so that it went where *he* wanted it rather than at the whim of fate OR in the direction *somebody else* experienced in psionic control wanted it to go!

This brings up the question: Why the inverse or perverse relationship in the basic equation discussed above? The reason for the equation is probably as abstruse as the reason for any equation. It just happens to fit the Universe. The reason why some model rocketeers are able to make their models do what they want them to is that they understand, consciously, empirically, unconsciously, or otherwise that it is an inverse perverse relationship with which they are dealing. The reason why the majority of model rocketeers have trouble is because they don't know about it.

Well, now they do, and the Big Secret is out of the bag. It may be stated categorically that the prime transfer function for telepathic guidance systems is: A Model Rocket Always Does Exactly What You Want It To Do, Provided You Make It Think It Is Doing What You Don't Want It To Do.

Do I make myself clear?

(AUTHOR'S NOTE: This started out to be the Old Rocketeer's April Fool leg-pulling for 1970. But the joke is on me, because I've now convinced myself that there is indeed *something* to this telepathic guidance bit. R&D competitors, look out! However, if this keeps up, I'm afraid the R&D judges may turn out to be men in white coats . . . .)

Modroc Demonstration Held in Thailand

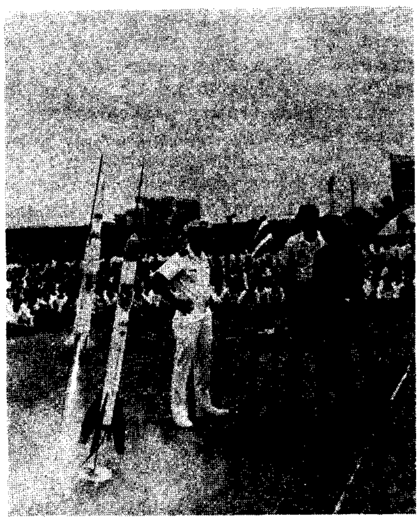


Photo courtesy NAR

Lt. Cmdr. Cook acts as safety officer for the launching of a Saturn V by a Thai Navy officer (right) and USAF SSgt. Al Sowles (center) serves as launch control officer. Launch panel and equipment for the demonstration were designed and constructed by SSgt. Sowles. SSgt. Sowles and SSgt. Wells are still assigned to a USAF base in Thailand. TSgt. Larry Loos, NAR public relations staff member, returned to the US in January, and is currently assigned to Westover AFB, Massachusetts.

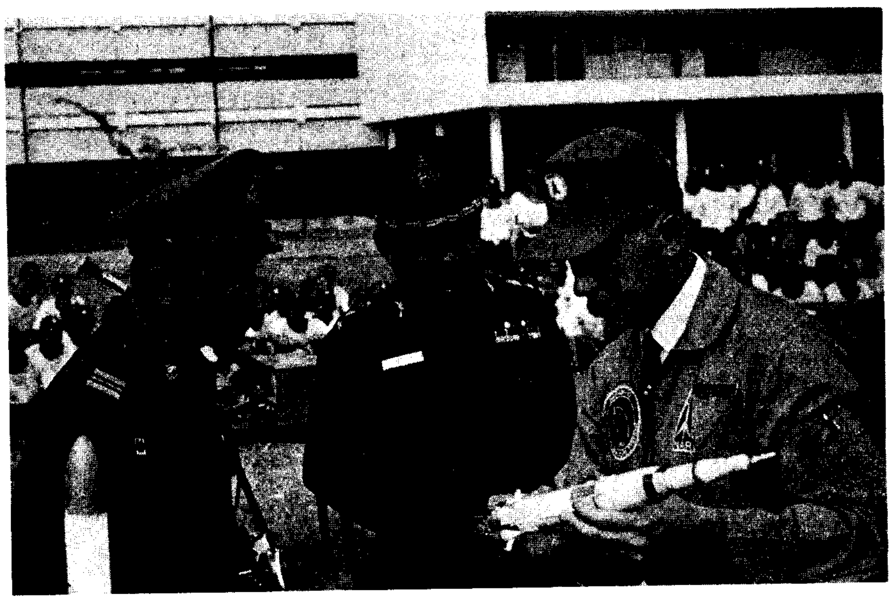
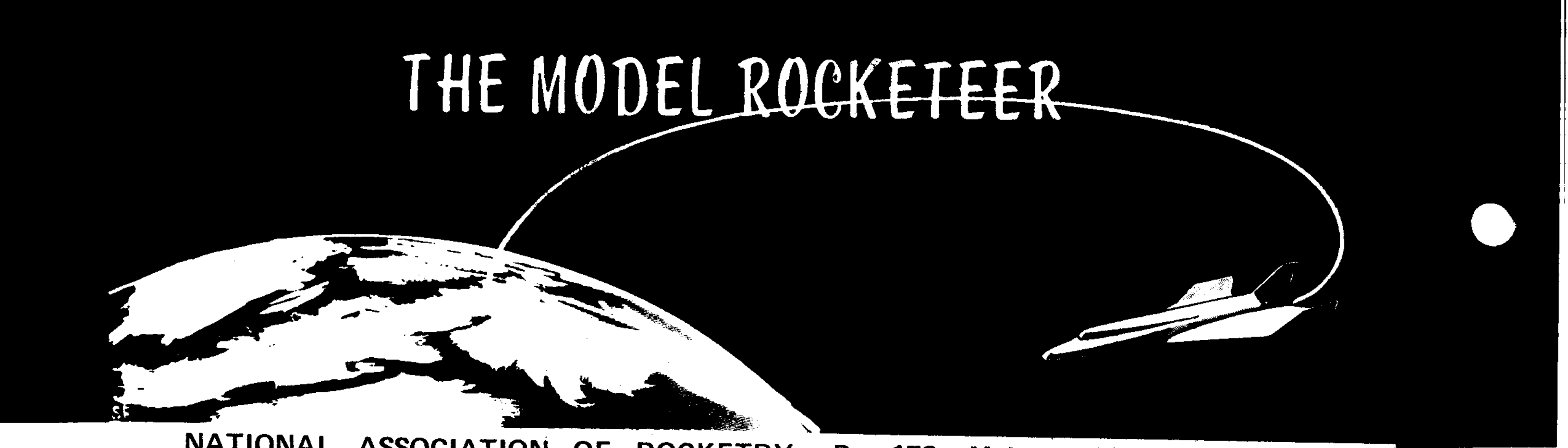


Photo by Lt. Cdr. G. Cook, USN

NAR's Larry Loos, #7127, explains details of the Estes Saturn V model to Colonel Paiboon Sirayakorn, commanding officer of the Armed Forces Academies Preparatory School, Bangkok, Thailand. The model was constructed by SSgt. Jim Wells, USAF, who assisted Larry and SSgt. Al Sowles in the demonstration requested by the Royal Thai Government. Held over Christmas, the three man team gave an impressive show, launching eight model rockets. All models were recovered by a recovery team selected from the thousands of students, instructors, and guests who attended. At left is Major Tawon Chamapai, AFAPS public relations officer who arranged the event through the school's U.S. advisor, Lt. Cmdr. Gary Cook, USN, from Bangkok.



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

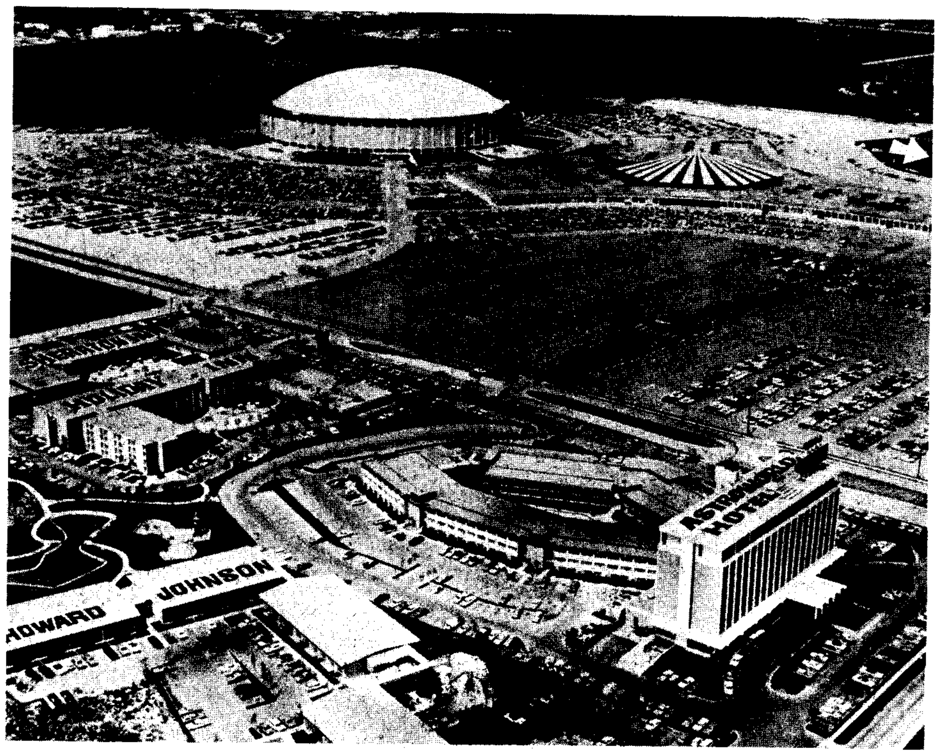
The Model Rocketeer is published monthly in Model Rocketry magazine by the National Association of Rocketry, Box 178, McLean, Virginia 22101. The National Association of Rocketry, a non-profit educational and charitable organization, is the nationally-recognized association for model rocketry in the 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.

NARAM-12 Application Information

Anyone interested in attending NARAM-12 should send a postcard requesting an application to the Contest Board, c/o Richard Sipes, 5012 60th Ave., Bladensburg, Md. 20710 by June 1, 1970. Please include your name, address (with Zip code), and NAR number.

A NARAM-12 application package will be sent to you as soon as your card is received. The application must be returned with all fees by July 6th, 1970 at the latest.

You will be notified shortly thereafter if you are accepted. If, for any reason, you have not been accepted all fees will be returned to you with the notification.



An aerial view of the Area surrounding the Astrodome in Houston. The NARAM-12 launch area is indicated in the upper-right corner by an arrow. Contestants will be housed at the Sheraton Inn, located in the left of the photograph.

NARAM-13 Site Disclosed

Dates: August 14-19, 1971

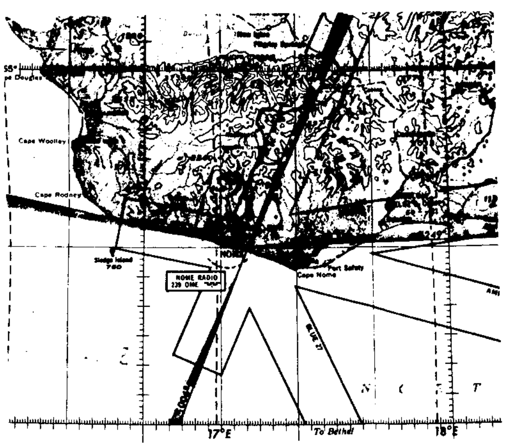
Location· NARAM-13 will be held at U.S. Army Fort Davis, Nome, Alaska. Nome is situated on the Seward Peninsula at the mouth of Norton Sound, only 150 miles from the Siberian coastline. This is the first year that the NAR Championships have ever been held on the west coast.

Events: Class 1 Altitude
- Scale
- Space Systems
- Open Payload
- Parachute Spot Landing
- Class 3 Parachute Duration
- Drag Race
- Plastic Model
- Predicted Altitude
- Research and Development

Transportation: Contestants will have to provide their own transportation to NARAM-13. The most practical method of transportation is by private airplane or helicopter. An air approach chart has been provided below for your convenience. For those NAR members with limited financial resources the overland route is recommended. First travel by any commercial means to Seattle, Washington. From Seattle fly by Yukon Airlines to Anchorage. Take the Trans-Alaskan Railway to Fairbanks. From Fairbanks take a land-rover to Minto (on the Tanana River). Embark on charter raft down the Tanana which joins the Yukon River at the city of Tanana. At Tanana buy passage on a paddlewheel steamer to Koyukuk. From there take the Nanuk Dogsled Line to Dime Landing on the Koyuk River. Paddle a kayak down the Koyuk to Norton Bay and follow the coastline to the city of Kwik. Then board the Kwik Iceboat Line to Nome.

Local Transportation: Transportation from the Nome landing dock to Fort Davis will be provided by military snowshoe.

Housing: Accommodations for contestants and range crew will be provided by the U.S. Army in surplus quonset huts. Female contestants will be housed in the regular barracks. A nominal fee of $1.00 per night will be charged for linen.



U. S. Coast & Geodetic Survey Map

Aeronautical Chart of Approaches to Nome, Alaska.

Launch Field: The launch field measures approximately 100 meters square and is bordered on the East and West by virgin forests, on the North by the Kigluaik Mountain range, and on the South by impenetrable ice flows. Outlying areas of the field are abundant with permafrost bogs. These areas are strictly off limits to all contestants. Rockets will be fired from the divine "misfire alley" system. Any rocket requiring a special launching device must be supplied by the contestant. Rocket safety check-in lines will be long.

Food: Contestants are advised to eat their meals at the Fort Davis Officers Club. The food is cheap and prices are not unreasonable. In Alaska you must be at least 21 years of age to drink. Coupons for the awards banquet may be purchased at $2.00 each or three for $4.95 at the door. The main course is Walrus ribs and muktuk followed by Eskimo Pies for dessert.

Range Store: All major model rocket manufacturers may be purchased at the range store located near the firing area. Engines may also be purchased in downtown Anchorage.

Tours and Displays: All NARAM-13 contestants will be treated to a guided tour of the Tin City underground ABM launch complex. All contestants must present their NAR licenses for identification purposes. There will also be an expedition to see Mary's Igloo. All major model rocket manufacturers will be on display at the launch site.

Groundrules for Contestants:
1. All contestants will be flown in age divisions.
2. All eggs must be USDA Grade A Large hen's eggs measuring not less than 4.29 cm diameter and weighing not more than 37.63 grams.
3. Prevailing winds blow from the south-west off the coast of Namchitka Island.
4. Model rockets will be tracked with theodolites provided by the host section. If the range tracking equipment is not ready within a contestant's launch window he may elect to launch without range instrumentation. In this case, his altitude will be scored as a lost track. Tracking may be occasionally hindered by white-outs blowing in from the north.
5. Don't figure on "ejection-poppers" for your models. All motors used in the contest must be purchased at the range store. No ¼A3-1 (.24 second burn) motors will be for sale. They are not designed for lifting anyway.

Air Rules for Contestants:
1. A broken shock cord will not disqualify an entry unless part of the model falls.
2. Ejection charge failure will be considered as a malfunction of rule 11.3.
3. To qualify as having returned his entry, a contestant must present to the Contest Jury enough remains of his entry to permit the parts to be reassembled for another flight.
4. No smoking in bed.
5. All rockets must have been stability tested before the meet. A copy of the Barrowman CP calculation or superior method must be presented to the Safety Officer.
6. Beware of prevalent wildlife in the area. These include bald eagles, kodiak bears, wallop mosquitos, walri, and young boys in green sweaters with casts on their left arms. Bring *lots* of insect repellent; on the basis of past experience the NAR recommends using gasoline, Chemical Mace, or morningstar mace.

NARAM-13 Sponsors:

Fort Davis YMCA Space Pioneers
Nome Chamber of Commerce
SCINAR
Western Alaska Rocket Modellers
National Geographic Society
Novosti Press Agency
Chukotskiy Society for the Advancement of Rocketry
Madame Zinski's funeral, palm-reading, and good-eats parlor.

Requests for applications to NARAM-13 must be received no later than April 1, 1971.

EDITOR'S NOOK

Many thanks to those who contributed material for this issue. Steve Fentress has again provided us with another masthead. Credit for the "Washington Scene" article in January was inadvertantly omitted; the article was prepared by Jim Kukowski, NAR trustee and public affairs chairman. Jim had been working on some material for this issue when he suffered from serious injuries. We are wishing him a speedy recovery.

The NAR Board of Trustees held an official business meeting at the HIAA trade show in Chicago last month. A new NAR-HIAA safety code was adopted and will be released next month. The trustees were also notified by **Model Rocketry** magazine of an impending price increase in the magazine to the NAR. It is hoped that the NAR will be able to afford the additional cost without raising membership dues.

NAR membership has been growing at record speed with over 3000 members renewed at the beginning of the year. Optimistic NAR officials are predicting a total membership of nearly 10,000 at the end of the year. The increasing membership has been largely attributed to the adoption of **Model Rocketry** magazine as the vehicle for our newsletter.

My apologies for the untidy abbreviations of the club names in the section roster. They were used to conserve space, leaving more room for other features.

Contest Board Chairman, Richard Sipes, has appointed a committee of NAR members to rewrite the NAR Sporting Code. The team includes Dick Sipes, Jim Barrowman, Ed Pearson, Howard Kuhn, Bob Atwood, Raymond Werre, and three others still unannounced. For the first time, NAR members will be able to view the proposed rule changes and express their approval or disapproval of them before they are officially accepted. A list of the proposed pink book changes will appear in the May or June issue. The Contest Board is also revising the contest records system to eliminate unnecessary paperwork and inaccurate results.

The "ANNOUNCEMENTS" column of *The Model Rocketeer* has been transferred to another part of the magazine in order to include announcements of non-NAR sanctioned events.

Springtime is here. Time to thaw out your models and get back in the competition swing. Why not see if you can set a new NAR or FAI record? Existing records were reported in March issue; many categories are as yet untouched. Be advised that if you are applying for a FAI record you must notify FAI HQ in Paris within one week after the flight; the substantiating data may be submitted later however. Complete information on FAI record applications will appear in an upcoming issue. Let's see if we can set some hard records for the Europeans to beat.

–Carl Kratzer

LAC ELECTION ANNOUNCEMENT

This year, elections for the Leader Administrative Council will be open to all Leader and Senior NAR members. Any Leader member is eligible to run for one of the seven seats on the Council.

Any Leader member who wishes to have his name included on the ballot must submit a resume of his model rocket activities to:

Joseph V. Persio
P.O. Box 123
Cheshire, Conn. 06410

The resume must be typed on standard size paper and be less than 100 words. Those over 100 words will be disqualified. Please include your NAR number. Please be brief and to the point. The resume must be postmarked no later than midnight May 1, 1970.

After all nominations have been received, a ballot and the resumes will be published in *The Model Rocketeer.* The results of the election will be announced at NARAM-12 and in this magazine.

SECTION NEWS

By Charles M. Gordon

Congratulations to the NAR Capitol Area Section (Camp Hill, Pennsylvania) for publication of their first issue of the NARCAS NEWSLETTER. Keep it coming. Included in this issue was the following report:

A new Giant Food Store in Camp Hill was the site of a NARCAS display, December 11 to 13, 1969. Included in the exhibit were camroc photos, several unusual demonstration models (including a seven foot "skinny-minnie", and a Rogallo wing glider), and other eye-catching models. The display was manned by NARCAS members who explained the safety and fascination of our space age hobby.

******

The Anchorage Association of Model Rocketry (Anchorage, Alaska) sent in a report of the International Dog Sled Races held February 20-22, 1970 as a part of FUR RENDEZVOUS activities. During the race the dogs run a 25 mile trail each day for the three days.

On February 21 a new event was added to the festivities. The 1st Annual Fur Rendezvous Demonstration Launch was conducted by the Anchorage section. Since this demonstration fell right in the middle of the holiday, it is hoped that many new members will be brought in from the spectators.

******

The following "VIEWPOINT" has been reprinted from the January 1970 issue of the *APOLLO-NASA Section News.*

"Congratulations and sympathy to all sections who have started section newsletter, papers, etc. this year. We know how hard it is to keep them up and we are much in sympathy with your problems. Keep it up though, for it will add much to the moral of your group and is surely a fine advertisement for the section."

******

On November 22, 1969 a group from the Xaverian High School Rocketeers (Brooklyn, New Yrok) went on a field trip to the Hayden Planetarium. During the tour, displays of the Apollo and Gemini projects and other manned and un-manned projects were viewed. After a show on light and it's properties was seen a small piece of moon rock was also displayed.

******

The Metro-Denver section reports that soon each member will be required to read and study the basic concepts of model rocketry in the CENTURI Students Guide to Model Rocketry. Then he will be quizzed on the material. Each member will have to pass a certain percentage of the questions. This will insure that each member knows the basics of what he or she is doing in model rocketry.

******

In the *AMANON,* newsletter of the YMCA Space Pioneers Section (New Canaan, Connecticut) the plan of a new electronic gadget was presented. Section member, Peter Joseph, has designed the "Siren Bird", the newest thing in model rocket in-flight hardware–designed to produce a high pitched sound to help in locating models caught in nearby trees. The only drawback in the design is the reaction of the range officials and spectators to this screaming rocket sitting on the launch pad, since the unit must be activated before the launch. It is hoped that any modelers that decide to build this have good ears.

******

This suggestion was seen in the December 20, 1969 issue of the Xaverian Section Newsletter. "If I wrote the pink book I'd make it blue."

******

The Annapolis Association of Rocketry (Annapolis, Md.) reports that work has been completed on the section's Wind Tunnel. The project was financed with a $100 development grant from the section. AAR plans to use the wind tunnel for testing regular competition models and new and unique designs before actual flight.

******

The Three Rivers Section (Pittsburgh, Pennsylvania) has now come out with it's own cartoon strip, titled "The Last Man" by member Rich Baier.

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The Southern Maryland Area Rocket Team (Accokeek) reports that their model rocketry display covered three bookcases at the Oxen Hill library, and was on display for the entire month of January. The display included over 35 models and much assorted literature, and was very successful. Many requests for information have been received as a result of this.

******

"NEITHER SNOW NOR COLD SHALL STAY . . ." could be called the motto of both the Wheaton Rocket Association (Wheaton, Md.) and the Annapolis Association of Rocketry, who both report of range launches in January despite the 2 inch layer of snow on the ground in Wheaton and the actual falling snow in Annapolis. WRA and AAR (which are both members of the *WA*shington-*MAR*yland-*V*irgini*A* group) report that regular launches are held and that interested modelers should contact them for more information.

******

The NAR would like to welcome the following new Sections to the Association:

Outa-Sight Section
Patrick Hickert
Route 7, Box 60
Wayzata, Minn. 55391

Metro-Cleveland
Robert H. Allen
1437 Seneca Blvd.
Broadview Hts, Ohio 44141

Northglen Rocketeers
Daniel Eastman
10909 East 39th Pl.
Northglen, Colo. 80233

Liverpool Organization
John Fensterer
4854 Juneway Dr. North
Liverpool, NY 13088

Northside Rocket Club
Joe Guthridge
2765 Northside Dr.
Atlanta, Ga. 30305

Cosmos Orbits Section
David Valkema
13737 Summerset Rd.
Poway, Calif. 92064

******

Many thanks to Jim Poindexter of Houston for handling Southwest Division activities during the past year. With the new year Forrest McDowell of Houston has taken over that position. His address appears in the officer directory elsewhere in this issue.

The Annapolis Association of Rocketry held their annual Potluck Dinner on February 1. The event featured static displays of rockets and range equipment and a NASA motion picture. Over 100 people were expected to attend.

******

On January 24 the Randallstown Rocket Society (Randallstown, Md.) took a trip to the Franklin Institute in Philadelphia. Some of the interesting items seen on the tour were: the planetarium, featuring a projection of certain stars and what objects or constellations were formed; the insides of a heart (a walk in model); and displays of certain rockets and airplane engine parts. A display of a Saturn V being taken out of and put into the Verticle Assembly Building and a model of the launching from Cape Kennedy was an interesting exhibit for the section. Models of such famous ships as THE NORMANDY and THE S.S. UNITED STATES were also on display.

******

The APOLLO-NASA Section (Houston, Texas) reports that it is working hard on the many details in preparation for NARAM-12, which will be held in Houston this year with A-N as host section.

APOLLO-NASA is sorry to report that it was unable to hold it's planned activities at the AFL All Star Game as planned earlier.

******

The Randallstown Rocket Society (Randallstown, Md.) set up a display at the Randallstown Library on January 3 showing the various aspects of model rocket club activities and the section's Junior Optimist Banner.

******

The Pascack Valley Section (of New Jersey) has grown again. Originally a combination of four sections to form the Fanwood, Kenilworth, Piscataway, and Madison "districts", two more have been added in the form of the Harrison and Bloomfield districts.

******

The area meet SCRAM-23 was held November 9, 1969 between the Steel City Section and The Three Rivers Section, both of Pittsburgh. Reported point scores are: S.C.–364/T.R.–340

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Correspondence has also been received from the following sections, although actual news of the club may not appear this month.

Natural Science Museum Model Rocket Research Society
Tri-City Cosmotarians
The Good, The Bad, and The Ugly Rocket Club
The Moon Snoopers Section

******

NAR SECTION NEWS appears each month as a regular feature in the MODEL ROCKETEER. Those sections wishing to have news and/or information of their activities printed in this column should submit such material to:

NAR SECTION NEWS EDITOR
Charles M. Gordon
192 Charolette Drive
Laurel, Maryland 20810

Pink Book Revision Meeting

BY JUDITH BARROWMAN

On January 25, 1970 the first informal meeting to discuss pink book revisions was held at Dick Sipes' house. Those present included Dick Sipes, Carl Kratzer, Bill Werre, Bruce Blackistone, Bob Atwood, Mark Schaal, Sam Atwood, Jim Barrowman, Judy Barrowman, Ed Pearson, and Tammy Benson.

Some suggestions were read off given by others who were not present at the meeting is as follows: that a color photo not be required scale data, also since we have weighing factors from 1-10 why not make use of the full scale.

Suggestions for new events were payload duration, semi-scale, streamer duration. Not too much was said on these at this time. On the M P C proposal it was generally agreed that some type of expert class was needed. The ideas on this were to have the individuals who wished to fly in an expert class declare themselves in the beginning of the season. They would fly in their respective divisions unless there were two or more present at any given meet. It was also brought out that the individual would have to build the models he was flying. Also that they would have to fly as individuals and not as teams.

Points were also discussed. We could go to a system of only the first five places taking points. This could eliminate a section getting all their members out just to get lots of flight points. Another method was suggested of inflating the first, second and third places to the point that anything given for just flying would be just token. For example, 1st-50, 2nd-30, and 3rd-20 with 1 for just flying.

There was much discussion of the Scale event. It was suggested to eliminate Space Systems and in its place put Semi-Scale. Thereby having Super Scale for those who are perfectionists and want to be exactly perfect, regular scale as it is now and semi-scale for the beginner modeler who hasn't as yet the experience to build a true to scale model. Also it was brought up that there are discrepancies in the scale rules. Should a rocket be disqualified from the whole of scale if he has an unstable flight? Or should he just not get any points in the actual flight of his rocket and still be eligible for flight points for entering? We took a vote and 8 decided to disqualify and 2 would not.

The next topic to be elaborated on was R & D. Should flight points be dispensed with for this event? Most thought that points for first, second and third should be given. Also the possibility of breaking down R & D to scientific and hardware so all may be judged in their own category. Is it necessary to put a limit on junior spending in their R & D projects?

Staging was also brought up and it was agreed that there should be a limit of 3 stages only permitted within the rules of the safety code. Several reasons were given stability, gravity turn, and tip off. Is it necessary to limit the number of engines under the safety code and also clusters and strap on boosters. Some present did not want a limit on stages.

Another point brought up under scale was should the NAR make up scale packets to be sold to their members or should the Contest Board have the authority to OK certain packets as 100% for data? Is it feasible to have a contest that scale data be given to all contestants and that be the only rocket allowed thereby having only one prototype to judge?

Another point brought up was having only rockets that were flown before safety checked for contests.

Last but not least was the valkyrie rocket. Should there be stipulations in the pink book to cover that rocket and any like it? Although this would have to wait till Standards & Testing Chairman and the trustees make a ruling to allow or disallow.

Change name from "pink book" to something less laughable.

On January 26, 1970 the second informal meeting to discuss pink book revisions was held at Dick Sipes house. Those present were: Dick Sipes, Tammy Benson, Bill Werre, Jim Barrowman, Judy Barrowman, Ed Pearson, Paul Conner, Guppy Lindgren, Sam Atwood, Howard Kuhn, Mark Schaal, Peggy Sipes, and Bob Atwood.

Events were discussed mainly today. A suggestion to eliminate plastic model, also dual and open payload events.

Plastic model was discussed as good without data and judged only as workmanship as the factor. Quite a few do like to build plastic models but it was also brought up that it could be the same as a metal object.

Dual and Open payload is not needed because it does not test anyones skill as a modeler because the more weight in the nose the less critical the rest of the rocket is. Someone else pointed out that you have to lighten your rocket itself to get the optimum altitude and keep stability. Most were agreed that open payload should be eliminated, just by the fact that 4 ounces of any material falling from 200 meters is dangerous. Should the payload be made of another substance?

We progressed to new events the first duscussed was semi-scale. In this event a modeler has little substantiation data maybe only a color photo and you judge on the workmanship rather than on data.

Design for frontal area event. Say a 2½" diameter for front end and a certain engine.

Payload duration or egg loft duration which could be flown without trackers.

Streamer duration which can be done in two ways: one limit the size of fin and body, or leave it open and define the streamer.

Odd Ball event covers anything from junk to plastic battleships only judged on workmanship and safety checked very carefully.

With the use of a camera rocket designate a certain spot to photograph and try to get the best picture.

Altitude efficiency essentially fix the weight of the rocket at a certain figure and all rockets must be that weight. This would give you an event on workmanship and design. Would this be nullified by tracking and engine performance variations?

Payload boost glide was another suggestion but was kind of shied away from at this time.

It was also suggested that there be a trial period for new events of one year and if the sections liked it it would stay and if not then pitch.

There was also much discussion that with altitude events only those that were not tracked or had a no close would receive second flights. Also the wording of many events had to be looked at closely to take out most of the loopholes.

A better definition of the contest officials is needed in the pink book. Range safety officer is fairly good definition. Contest Director's duties are not clearly defined, as to who has authority where. And is the contest jury working? Most would like to see a new official known as a flight judge to stand behind the firing officer and disqualify flights or OK them.

Also since most sections do not have 2 leader members then we should allow one senior, and 2 juniors to judge especially in section meets. If juniors can track why can't they push a stop watch?

Should the regional, areas, and section meets have any other limitations but the ones outlined in the pink book put on them? Should an area meet be allowed on 2 days? There was also a suggestion that meets be graded in Classes. Class 1 being a section to class 8 a division and Class 12 a National meet. These could be graded by the number of people attending, and by the number of sections present. The point system should be revised to provide equitable opportunity for all individuals and sections to become champs.

All meets above a certain level should be open to anybody who wants to compete.

This is the extent of the discussions that were held on Saturday January 25, 1970 and Sunday January 26, 1970.

All NAR members are invited to send in their comments on the ideas discussed above to the Contest Board for consideration in the new pink book. Send them to Richard Sipes, 5012 60th Avenue, Bladensburg, Md. 20710.

The **National Association of Rocketry**, an affiliate of the National Aeronautic Association, is THE nationally and internationally recognized organization for the conduct of model rocketry activities in the United States. As such, NAR:

ESTABLISHES RULES AND REGULATIONS for the safe operation of model rockets;

CERTIFIES MODEL ROCKET ENGINES and assists manufacturers in establishing standards of construction and performance;

PROMOTES MODEL ROCKETRY as an educational tool and recreational activity;

SANCTIONS CONTESTS throughout the United States, including the annual National Model Rocket Championship;

CERTIFIES RECORDS of model rocket flights for national and international performances;

CHARTERS model rocket sections (clubs).

NAR MEMBERSHIP Gives You:

A subscription to Model Rocketry Magazine which includes THE MODEL ROCKETEER.

$300,000 liability insurance coverage while flying model rockets

A NAR "Pink Book" that details model rocket contest rules and regulations

Privilege to purchase NAR supplies from NARTS

Assistance in forming a NAR chartered club.

NAR competition license for NAR sanctioned meets and record attempts

SAFETY CODE

I am a model rocketeer and do not engage in any other form of non-professional rocketry. As a member of the **NATIONAL ASSOCIATION OF ROCKETRY**, it is my responsibility to keep model rocketry safe. Because safety is my watchword, I will obey this **NAR** Model Rocket Safety Code.

1. I will use only pre-loaded, factory-made commercial model rocket engines that do not require my mixing of chemicals.
2. I will make model rockets of paper, wood, plastic and other non-metallic materials.
3. I will always use a recovery device in my model rockets that will return them safely to the ground so that they may be flown again.
4. My model rockets will weigh less than 16 ounces and will contain less than four ounces of propellant in their engines.
5. My model rockets will contain no explosive warheads.
6. I will fly model rockets in open areas away from buildings and power lines.
7. I will check the stability of my model rockets before flying them so that their flight paths will be predictable.
8. I will use a remotely-operated electrical firing system to ignite and launcn my model rockets
9. I will use a launching device that is pointed within 30 degrees of the vertical.
10. My model rockets will not be flown as weapons against targets.
11. I know that model rockets share the air with other objects and must present no hazard to such objects.

NATIONAL ASSOCIATION OF ROCKETRY

POST OFFICE BOX 178, MC LEAN, VIRGINIA 22101

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IF I AM ACCEPTED IN THE NATIONAL ASSOCIATION OF ROCKETRY, I PLEDGE TO OBSERVE AND FOLLOW THE NAR SAFETY CODE. I AM AWARE THAT A REPORTED VIOLATION OF THE NAR SAFETY CODE MAY LEAD TO THE REVOCATION OF MY MEMBERSHIP RIGHT. I ALSO AGREE TO ABIDE BY THE BY-LAWS AND THE STANDARDS AND REGULATIONS OF THE NAR.

__________ DATE ____________________ SIGNATURE OF APPLICANT

YOUR MEMBERSHIP INCLUDES A SUBSCRIPTION TO MODEL ROCKETRY MAGAZINE, EFFECTIVE WITH THE EARLIEST ISSUE AVAILABLE AFTER MEMBERSHIP PROCESSING THROUGH THE LAST ISSUE PUBLISHED DURING THE CURRENT CALENDAR YEAR.

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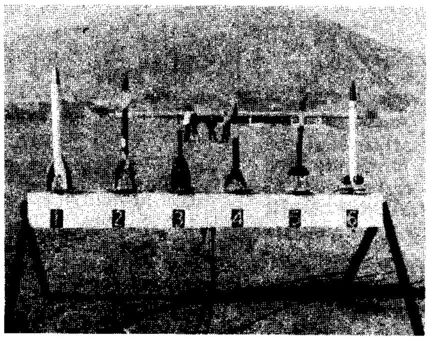
Hobby shops desiring a listing in the **Model Rocketry** Dealer Directory should direct their inquiries to Dealer Directory, Model Rocketry magazine, Box 214, Boston, MA 02123. Space is available only on a six month contract for $18.00, or a twelve month contract for $35.00, payable in advance.



The Brisbane Aerospace Rocket Team was organized in Brisbane, California last September. Since that time club members, under the direction of Senior Advisor Fred Wolfe, has built a multi-position launcher (see photo at left), and a launch panel. The club's eight members (six of whom are shown above) have constructed many rockets and held three launches. The club plans to hold a competition with another club in the Bay area, and is seeking sponsorship of an area organization.

(Club Notes, continued)

system. The equipment should be constructed and thoroughly tested in time for the Fifth Annual Pittsburgh Spring Convention in late March.

Bruce Thomas and Steve Citko are attempting to organize an NAR Section in Chicago, Illinois. Interested rocketeers in the Chicago area should contact Bruce Thomas, 5339 W. Winnemac, Chicago (PE 6-2212), or Steve Citko, 5936 W. Berenice, Chicago (MU 5-3845).

The latest issue of the *Intercept,* newsletter of the Bethlehem, Pennsylvania ABM Section of the NAR, reports that nine club members attended the club's December 21st launch. David LaBarre had a 40 second Hornet Boost/Glide flight, but all other B/G entries were disqualified.

A new model rocket club has been organized on Long Island, New York. The Elwood Association of Rocketeers and Astronomers held an election on February 3, 1970 to select officers to run the club for a three month organizational period. Tom Whymark was elected president, Donald O'Grady vice-president, and David Tideman secretary-treasurer. The club's immediate plans are to observe the Solar Eclipse on March 7th, and the transit of Mercury on May 9th. A contest will soon be scheduled with another club in the area. Rocketeers interested in contacting the club can write to Tom Whymark, 17 Eltona Place, East Northport, New York, 11731.

The Voyager, newsletter of Maryland's Annapolis Association of Rocketry, reports that a wind tunnel under construction by two club members, Guppy and Mr. G. Meese has been completed. The tunnel passed its final tests and was formally turned over to the club on February 6th. The project was financed by a $100 development grant from the club.

A meeting between the MASA and CSAR sections was held January 10, 1970, to decide upon the coming contests and events for the coming year. The meeting was held in Mansfield, at the home of Vikki Lundberg, the MASA secretary. Dr. Gerald Gregorek, the senior advisor for the CSAR, presided over the meeting. The refreshments were provided by Mr. Robert Hagedorn (the MASA senior Advisor), Vikki Lundberg, and Doug Ball.

After much cake-eating debate the results of the meeting were as follows:

Section Meet	March 15
Section Meet	April 12
Section Meet	June 14
Buckeye #1 (Area)	May 2-3
Scale Altitude	
Egg Loft 10 nt-sec.	
Hornet B/G	
Sparrow B/G	
Pee Wee Payload	
Parachute Duration	
MMRR #2 (Regional)	June 27-28
Super Scale	
Egg Loft (limit not yet decided)	
Sparrow B/G	
Swift B/G	
Design Efficiency	
Parachute Duration	
Open Spot Landing	
R and D	
Mansfield Invitational	July 11-12
Scale	
Hornet B/G	
Hawk B/G	
Plastic Model	
Parachute Duration	
Open Spot Landing	

Anyone interested in participating in any of the contests should contact:

Miss Vikki Lundberg
1972 Beal Road
Mansfield, Ohio 44903

Also discussed at the meeting was the topic of limited eggloft for NARAM-12, MASA and CSAR have had much success with limited eggloft. Here are some of the altitudes achieved (in contests) for various nt-sec limitations:

20 nt-sec	302 meters
15 nt-sec	214 meters
10 nt-sec	97 meters

Dr. Gregorek, the originator of this event suggested at the Trustee Meeting in Chicago that the eggloft event for NARAM-12 should be limited to perhaps 25 nt-sec.

Rocketeers in the area of Jackson, Mississippi are invited to contact Billy Wallace, 3776 Canton Road, Jackson, Miss. who is interested in forming a club.

The Midland Model Rocket Society of Midland, Michigan is planning for its third year of activity. The Society had 40 members at the end of 1969, but there is need for more leader and senior members. The club would like to hear from any interested rocketeers in the Saginaw Valley area or any other rocket groups near enough to be interested in possible joint meets.

The Midland group is not yet able to affiliate with the NAR but is organized using the NAR as a guide and Section status as a goal. Last year's program scheduled three competition meets and eleven open launch dates. All were successful as measured by the enthusiasm of those attending, though numerical attendance was not always the best. Persons interested in this year's program can contact Gary Ungefug, Vice President, Route 3, Midland, Michigan 48640; phone (517) 835-2997.

The Mount Hermon Rocket Society, located in Mount Hermon, Massachusetts, was organized in September 1969. The club presently has 15 active members and an adult advisor. Three launches with an average of 25 rockets launched at each have been held since the club's formation. They have a five position launcher, and work is progressing on a tracking system. Club officers are Rick Lindgren, President; Bill Bloch, Vice-President; Matt Soja, Treasurer; and Dick Girard, Secretary. Recently the Mount Hermon Rocket Society held an "Astron Drifter" contest, and a design contest is on the schedule for Spring.

Under the supervision of Science Club sponsor Mr. Lawrence Foster, members Bruce Toski, Les Share, and Alan Sukert launched several rockets at a demonstration at Palmetto Jr. High School in Miami, Florida. A Starlight, a Nike-Smoke, and a Defender were among the rockets launched. The group is planning a trip to the John F. Kennedy Space Center for later in the year.

Les Share would like to start an NAR Section in the Kendall-Perrine, Florida area. Interested rocketeers should contact him at: 12900 S.W. 74 Ct., Miami, Fla. 33156.

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

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

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(From the Editor, continued)

youth activities. By obtaining the support of one of these local groups, a club can assure itself of publicity from the local newspaper(s), cooperation from the local citizens and businessmen, and perhaps even a source of capital. Such benefits are not available to the individual rocketeer.

Modeling Skill – Generally the more experienced members of the club will take time to explain basic modeling techniques to the newer rocketeers. Finishing techniques, scale construction methods, and R&D techniques are more easily learned from the experience of others than through months of one's own failures.

Scale and Technical Data – Many clubs maintain files of technical reports and scale data for the use of their members. In many cases, scale data for old rockets and/or older technical papers which are not already in an individual rocketeer's files are not available from any other source.

Competition – If you're interested in competing, you could just attend competitions sponsored by other clubs; however, if you are interested in participating in the organization, event selection, etc., you will have to join a club.

If you are new to the rocketry hobby, joining a club can provide the easiest way to learning model rocketry skills. The other advantages are also tremendous. The more advanced modeler, working through a club, can promote the growth of the hobby, and benefit from the more advanced opportunities for R&D, competition, etc. offered by the club. If your club is *not* providing all of the benefits mentioned above, perhaps you ought to mention it at the next club meeting and *volunteer* to work on a particular project. Only with the active support of all its members can a club offer all of the services it is capable of providing.

To help those "lone rocketeers" interested in locating a club in their area, **Model Rocketry** would like to maintain a directory of clubs active in model rocketry. If you are already a club member, please sit down today and fill in the "Club Registration Form" at right, give us the name and address of your club, and we will forward any requests from your area to your group. You may be surprised to learn how many rocketeers there really are in your area!

(Modroc Calendar, cont.)

Canadian Convention – July 4-5, 1970. Conference open to all rocketeers. Discussion groups and launch sponsored by Montreal's Atmospheric Rocket Research Society. Contact Steven Kushneryk, 7800 Des-Erables Ave., Montreal 329, Quebec, Canada.

ATTENTION
CONTEST DIRECTORS
Mail notices of your contests at least 90 days in advance for listing in Model Rocketry's Modroc Calendar to:

Modroc Calendar
Box 214
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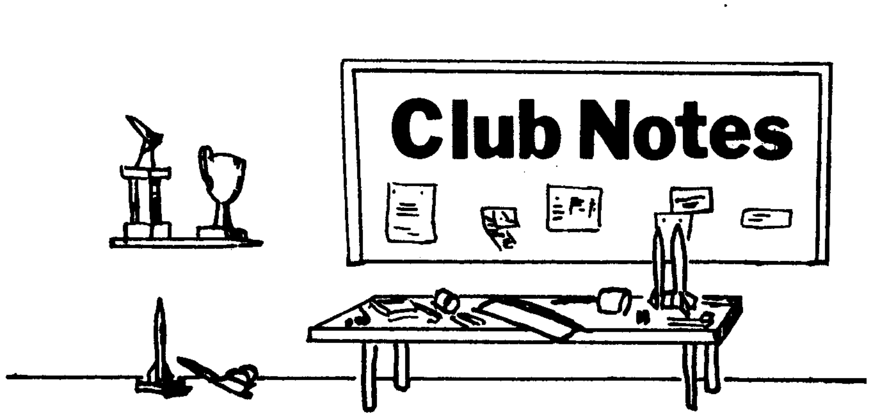
MODEL ROCKETRY CLUB REGISTRATION FORM

Club Name: . . . .
Contact: . . . .
City: . . . . **State:** . . . . **Zip:** . . .

Number of Members: . . . . **Date of Organization:** . . . .
Recent Club Activities and Projects: . . . .
. . . .
. . . .
Area (part of city, state, etc.) from which members are desired: . . . .
Signature of Club Officer: . . . .

SEND FORMS TO: Club Registration, Model Rocketry, Box 214, Astor Station, Boston, Massachusetts 02123.



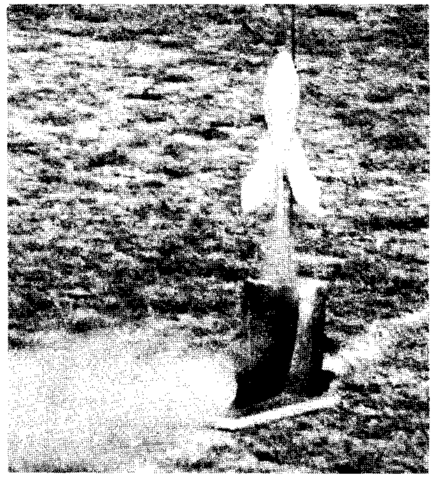


Photo by Dale Mantell

The NOVA Model Rocket Club of Virginia is interested in sponsoring a model rocket competition for all rocketeers from Virginia. The competition is still in the planning stages, and the NOVA Club would like to hear from other Virginia area rocketeers who have suggestions for the competition. Individuals and clubs can contact Bill Ritchie, NOVA President, 1303 Beverly Drive, Richmond, VA. 23229 or phone AT 2-3926.

The Bay Ridge Model Rocket Club in Brooklyn, New York was recently organized. Regular launches are held by the club's eight members. At a recent launch a Raven Boost/Glider, constructed by club vice-president Norman Engelsen from Estes Industries plans, left the rod and flew over 1/2 mile from the pad before circling and landing only 100 feet from the takeoff site.

The latest issue of *The Boeing Rocket News* reports election results for the Boeing Employee's Rocket Research Society. Elected were: Lewis Walton, President; James Worthen, Vice-President; Robert Cramer, Secretary; Doug Wooding, Treasurer; and Trevor Norsworthy, Member-at-Large.

Sixty-eight students at the Fieldstone Middle School in Montvale, New Jersey have formed a rocket club under the direction of Richard Russo, a science teacher at the school. Russo organized the club when school opened last September so his students could apply the knowledge gained in math and science classes. Though he expected only about 15 participants, almost 70 applied. The activities of the club have recently been publicized in the Hackensack *Record.*

The Greenville Rocket Research Club is looking for new members in the southern Illinois area. We presently have about 10 members, a six-rod launcher and a large launching area. We will be having our first contest in April. Anyone interested should contact Gordon Leidner, 710 Shannon Dr., Greenville, Illinois, 62246. Phone: 618-664-0998.

The Pascack Valley Section of the NAR has gained a new District. The addition of a District in Bloomfield, New Jersey, with Kevin Flanagan as president, brings PVS membership to about 65 for its 6 districts in five New Jersey counties.

The J.E.T.S. Club at the Lindenhurst Senior High School in New York has recently been conducting a series of R&D projects. The rocket shown above, constructed by Dale Mantell and Louis Walcer, is the product of a shape experimentation project. It was constructed using standard model airplane techniques. A frame of balsa rings was placed around a BT-20 tube. Bamboo strips were heated until they became flexible, and were allowed to cool in a form of the desired shape. The bamboo strips were placed over the balsa rings, and the entire frame was covered with tissue paper. The completed rocket (minus engine) weighs only 12 grams. The J.E.T.S. Club regularly launches from a stretch of beach on Fire Island, and uses a 200-ft. high abandoned anti-submarine tower for tracking.

Pittsburgh's Steel City Section is constructing new launch equipment. Arnold Pittler, a SCS veteran, has completed the firing panel, and club president Marvin Lieberman is constructing the new PA
(Continued on page 46)

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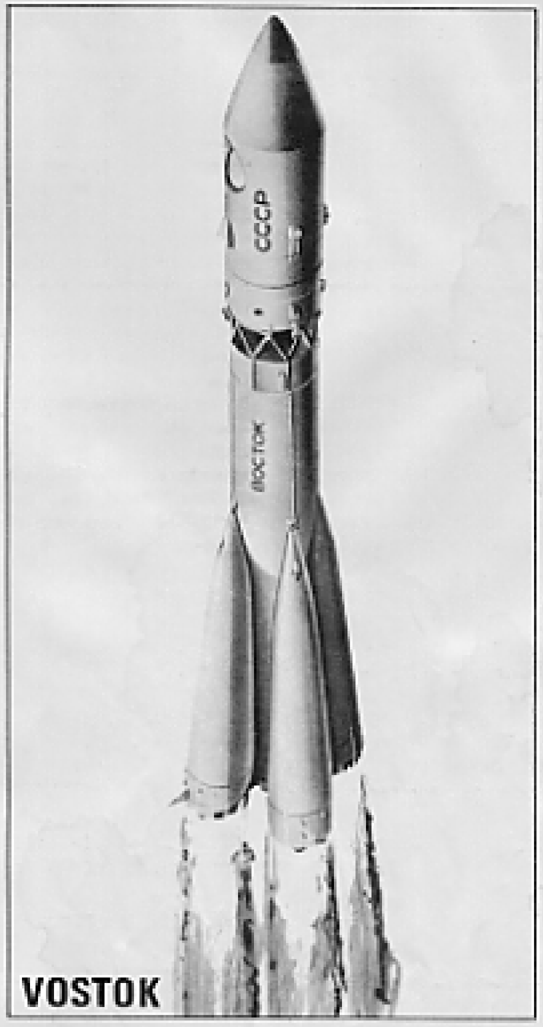

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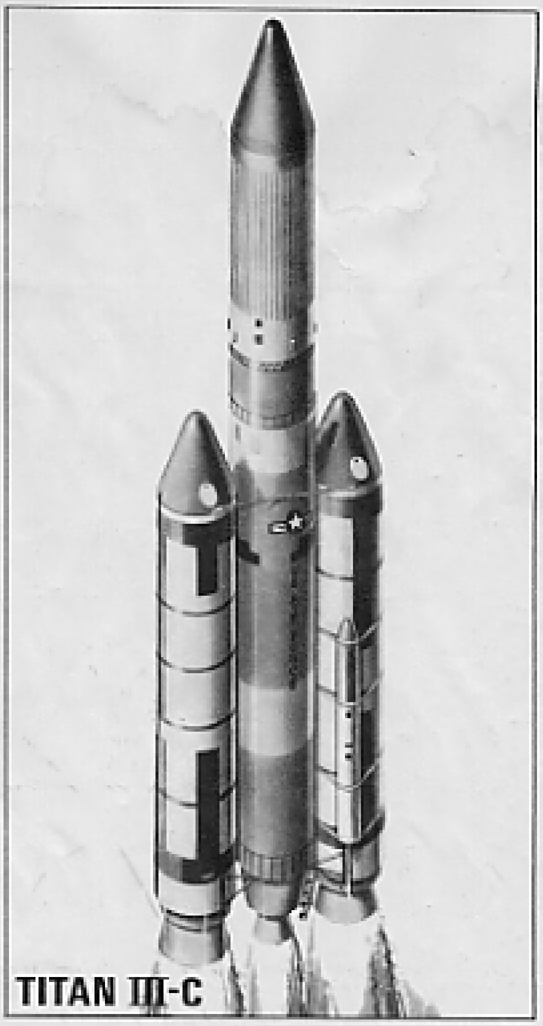

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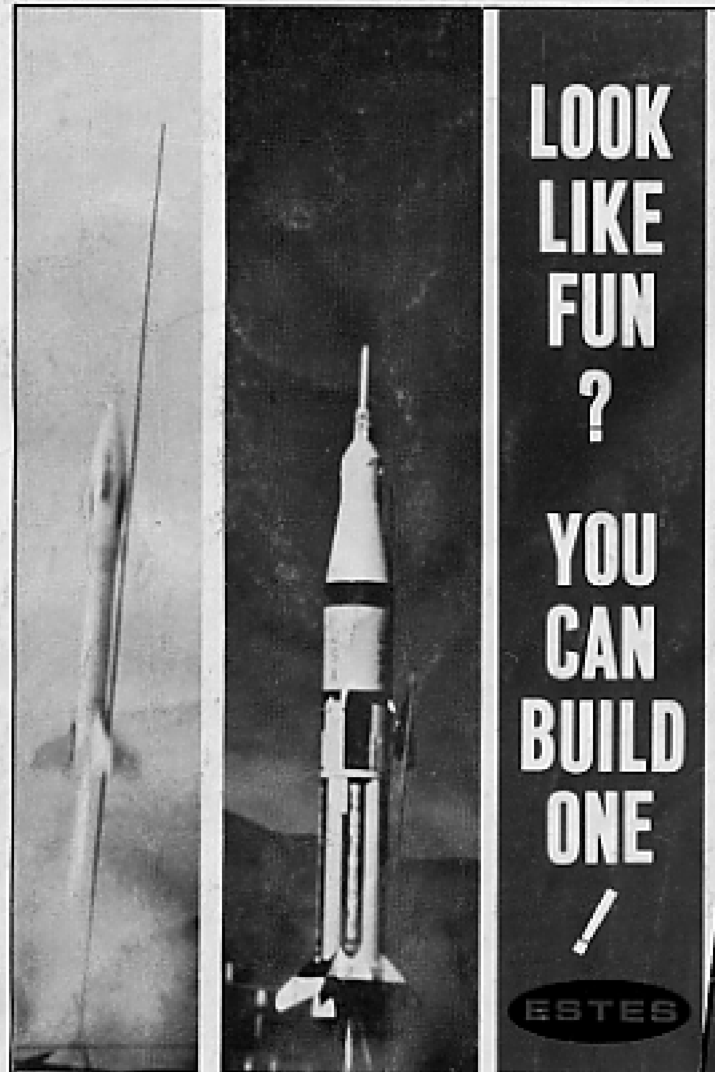

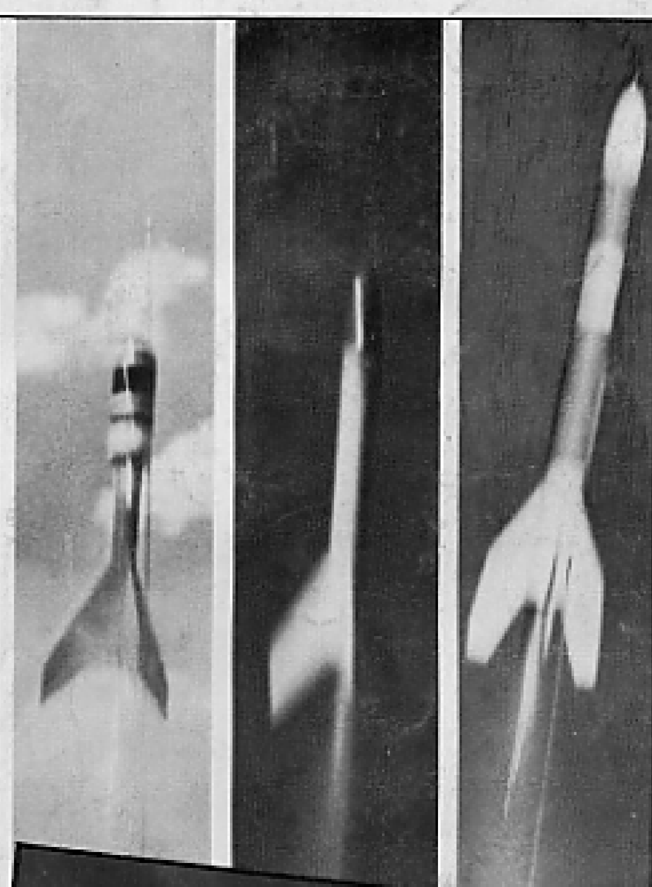

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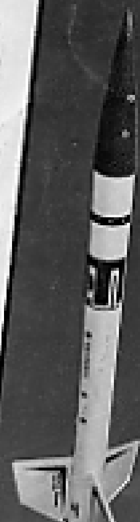

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