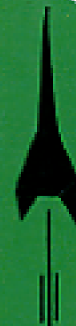
MODEL ROCKETRY

November 1969
50¢

The Journal of Miniature Astronautics
Incorporating THE MODEL ROCKETEER

Scale Design
NIKE-APACHE



JUPITER C
PLASTIC CONVERSION

MIDWEST MODEL
ROCKET REGIONAL

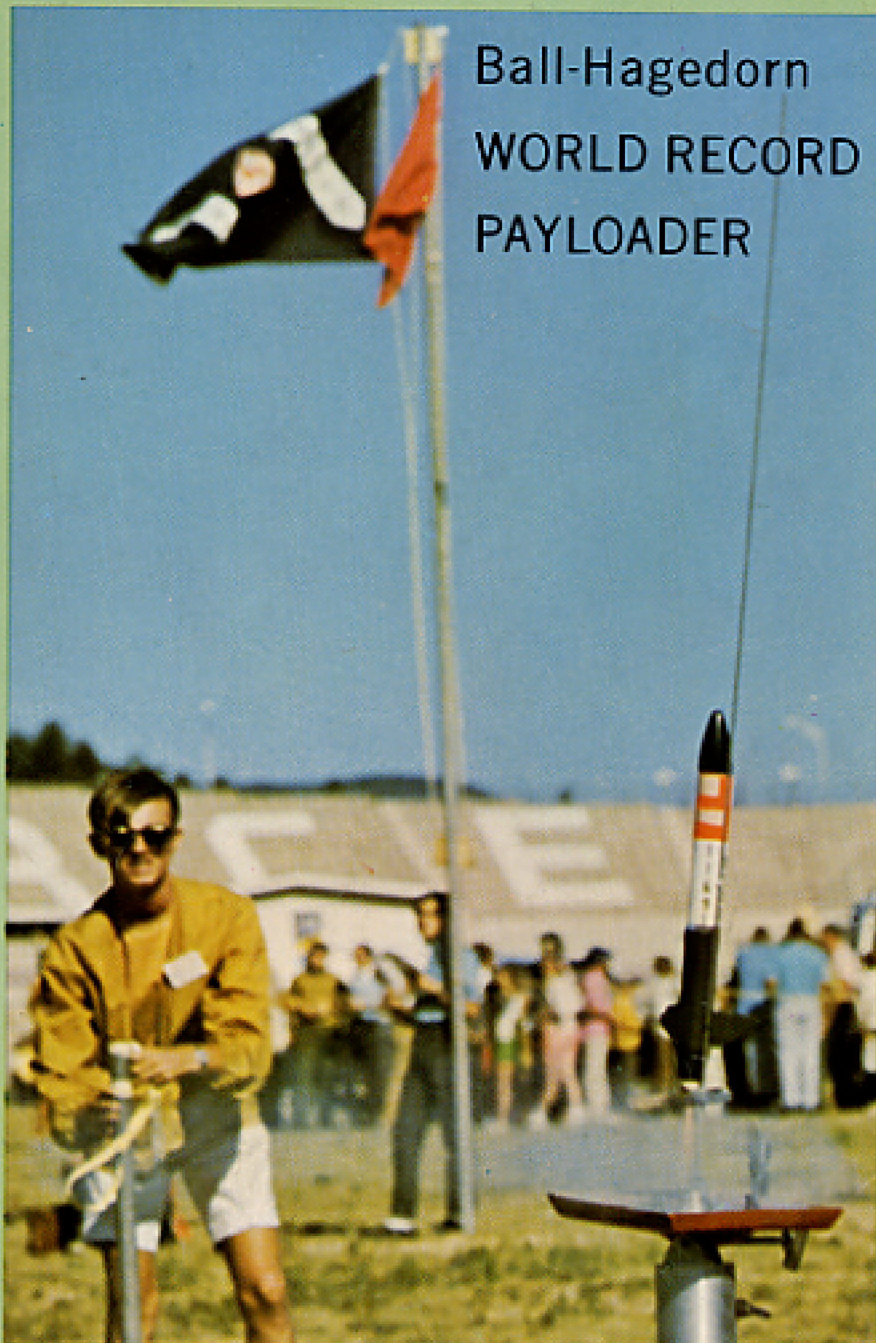
FOXMITTER
MODIFICATIONS

KRUSHNIC EFFECT

FLY AN APOLLO CAPSULE

WASHINGTON STATE
CHAMPIONSHIPS

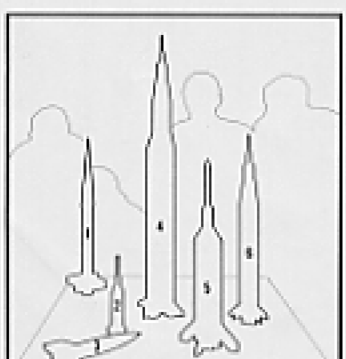
REGULAR FEATURES



EXPERIENCE

builds a line of SCALE MODEL ROCKETS

Build and fly these SUPER-SCALE models!



1	Nike–Smoke KS-15	(1/10)	$3.00
2	Little Joe II KS9	(1/100)	$3.00
3	V–2 KS-19	(1/40)	$3.00
4	Saturn V KS-12	(1/100)	$15.95
5	Little Joe II KS-8	(1/45)	$12.95
6	Saturn 1-B KS-10	(1/100)	$8.95

engines not included in kits.

Take a close look at the model rockets pictured above. They're fine examples of the new, top-quality kits now available from Centuri Engineering Company. These accurately scaled historical models incorporate ultra-lightweight materials and new simplified construction techniques. Specially molded and formed parts duplicate the exact details needed to win those scale contests and science fairs. They look terrific . . . and fly great too!! All of these and many, many more are included in the world's largest model rocket supply catalog that's just been published. One hundred exciting colorful pages for just a quarter – and we'll refund the quarter on your first order too! Send for your copy today – right now – hurry!!

Centuri

Centuri Engineering Co. Dept. MR-1 Box 1988, Phoenix, Arizona 85001

Model Rocketry

Vol. II, No. 2

November 1969

Cover Photo

This month's cover shows the liftoff of the Ball-Hagedorn Open Payload rocket fired at NARAM-II. The rocket set an altitude record of 1,960 feet. Construction details are given in an article beginning on page 24. (Photo by Tom Pastrick.)

From the Editor

With the number of rocketeers in the country increasing so rapidly, many local and county officials are receiving their first exposure to the hobby. Some officials, having been approached by interested rocketeers and their parents who try to explain the safety features inherent in the hobby, have received it enthusiastically. Others, whose first exposure to the hobby is a phone call or letter from an irate citizen, have "cracked down" on the hobby in their area.

There is no excuse for the hobbyist to introduce model rocketry into a new area without consulting his local officials. The manufacturers (Estes Industries and Centuri Engineering) have produced booklets designed to explain the hobby to these officials. Estes' booklet *Why Model Rocketry* (available for 20 cents) is must reading for both the rocketeer constructing a case for presentation to his Police Chief or Fire Marshall and for the interested Police Chief or Fire Marshall. A copy of the *Code for Model Rocketry* (41-L) adopted by the National Fire Protection Association will further reassure your town officials that their endorsement of model rockets in your community is warranted.

When a phone call or letter comes in from some irate citizen, and there *will* be at least one in every town, a well-informed public official will be able to reply to the complaint. His opinion towards the hobby

(Continued on page 47.)

Scale NIKE-APACHE Flight 14.04UE *by Jay Pollock*	5
The Midwestern Model Rocket Regional *by George Pantalos*	10
Build The ARCTURUS: Finless Rocket *by William James*	14
Final Notes on the Foxmitter *by Richard Q. Fox*	17
World Heigth Record Established *by Douglas Malewicki*	22
Ball–Hagedorn Open Payload Design *by Robert Hagedorn*	24
Washington State Model Rocket Championships *by John Worthen*	26
The Old Rocketeer: Jupiter C Conversion *by G. Harry Stine*	31

Regular Features

From the Editor	**1**	**Photo Gallery**	**30**
Letters to the Editor	**2**	**The Escape Tower**	**34**
Q & A	**16**	**Reader Design**	**36**
News Notes	**20**	**The Wayward Wind**	**37**
New Product Notes	**29**	**Club Notes**	**48**

The Model Rocketeer *(National Association of Rocketry)* **41**

Worldwide newsstand distribution by Eastern News Distributors, Inc., 155 West 15th Street, New York, New York 10011. Hobby shop distribution by Kalmbach Publishing Co., 1027 North Seventh St., Milwaukee, Wisconsin 53233.

Second class postage paid at Boston, MA and at additional mailing offices.

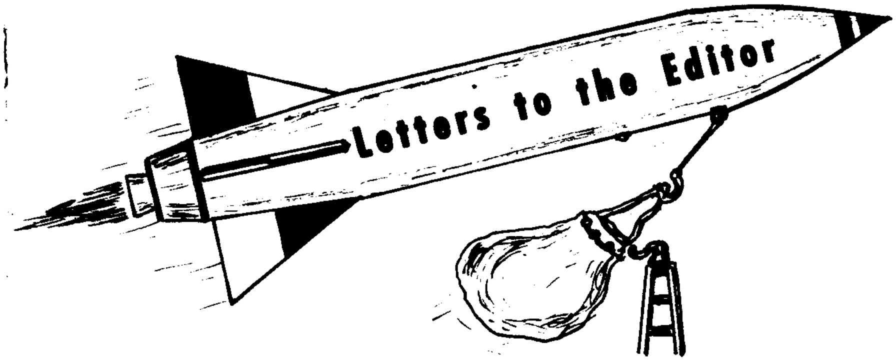
Model Rocketry magazine is published monthly by Model Rocketry, Inc., 595 Massachusetts Avenue, Cambridge, MA 02139.

Subscription Rates: US and Canada $5.00 per year, $3.00 for 6 months, 50 cents for single copy; Foreign $9.00 per year, $5.00 for 6 months, $1.00 for single copy. For change of address please notify Subscription Department, Model Rocketry, Box 214, Astor Street Station, Boston, MA 02123 at least 6 weeks in advance. Include former address or mailing label with the new address.

Material submitted for publication should be accompanied by a self-addressed, stamped envelope if return is desired. Model Rocketry can assume no responsibility for material lost or damaged, however care will be exercised in handling. Articles accepted for publication will be paid at the rates current at the time of publication. Letters, contest information, news, announcements, etc. are assumed to be submitted gratis.

Undeliverable copies, notices of change of address, subscriptions, and material submitted for publication should be submitted to Model Rocketry, Box 214, Astor Street Station, Boston, MA 02123.

Printed in USA



CANADIAN NEWS?

I have in my possession a copy of **Model Rocketry**! Big deal, eh! Well it is if you live in Canada.

It's this condition that I'm beefing about. I think a few words should be said about what's going on up here, like names of clubs, interested parties and organizations. I realize that **MRm** is an American magazine but we just don't have anything up here and you wouldn't believe how hard it is to find a copy of **MRm** here.

Unfortunately, I can't supply any names of clubs or anything else because I can't find any and this is where I thought you could help.

It would be a great help if some of the manufacturers had suppliers in Canada in each major city (thats only 3) and they could print names and locations in their ads in small print at the bottom.

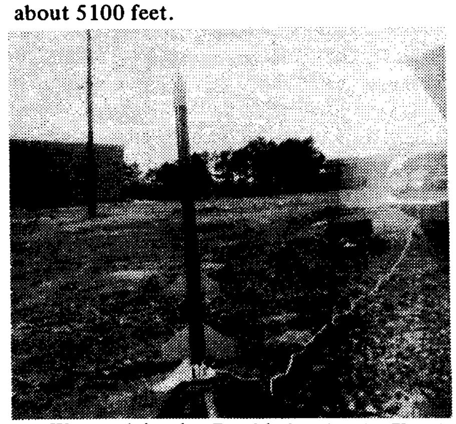
I think your magazine is first class and I was very pleased with the copy I was able to get. Thanks in advance for any help you might be able to give me.

T.D. Sewell
Chomedey, Laval
Quebec, Canada

Canadian rocketeers are just as welcome to make use of our Club Notes section as are U.S. modelers. Send your announcements of club formation, activities, contests, etc. to Club News, **Model Rocketry**, Box 214, Astor Street Station, Boston, Mass., 02123. *Keep us up to date on your activities and we'll be glad to print it.*

Micrometeorology

In line with the recent references to the applications of model rocketry to micrometeorology in your magazine, you may be interested in a project in climate control which a friend (Trip Ross of Charlotte, N.C.) and I carried out in late February in North Carolina. We designed and built a high-performance two-stage rocket to use an FSI F100-0 engine in the lower stage and an F7-6 in the upper one. (See accompanying photos.) The body tube and nose cone were FSI parts, and the plywood fins, which were of a special low-drag shape, were attached with epoxy. The whole rocket was given a high-gloss, low-drag finish. With a 4 oz. payload, the vehicle's peak altitude was about 5100 feet.



We read in the Doubleday book *Cloud Seeding and Cloud Physics* by Louis J. Battan that finely powdered sodium chloride particles, when dispersed in a supersaturated rain cloud at temperatures around the freezing point, can serve as nuclei for the condensation of the cloud's water vapor and its eventual precipitation as rain or snow. Accordingly, we placed 4 oz. of this powder above a balsa piston inside the upper stage of the rocket and waited for a cloudy day of the appropriate temperature to launch it. When the day came of Feb. 22, 1969, we fired the vehicle and it flew straight up through the low-hanging stratocumulus clouds. Presumably, the powder was discharged and did its job when the ejection charge kicked out the piston at peakout. At any rate, it began to rain less than half an hour later, and we're taking credit for it.

Trip Barber
NAR 4322
Cambridge, Ma.

R/C Airplanes

I wish to compliment you on the R/C boost/glider article in your August issue. Malewicki was completely right in saying that R/C modelers spend a lot more than the rocketeer. It costs about $560 for a Kraft proportional radio control set.

My dad has three planes–one biplane, his own design, a low-wing, also his own design, and a high-wing, with the same feature as the rest. He is currently building a full-scale Citabria.

For the average modeler, flying the plane is quite easy. Many have electric engine starters, electric fuel pumps, and steerable nose gear and brakes on their airplanes. Enclosed are some pictures I took at the local flying field. Number 64 is a full-scale pylon racer. When worse comes to worst the modeler's time and effort gets buried in the ground. But usually he'll have a plane in the air again by the next week.

Paul Osterman, III
Walnut Creek, Calif.

Thanks for the information, Paul. We, in the model astronautics field are becoming increasingly aware of this different and growing facet of the hobby. Who knows, if it gets large enough, Model Rocketry *might even publish a plan or two for a model airplane.*

Public Officials

In your August issue, I came across an article in *News Notes* which got me just a little bit angry. This was the one "Defiance Ohio Bans Model Rockets." I realized that this kind of thing must happen quite often. Therefore, I would like to say a few words to Officials who feel the way that Chief Hall Does.

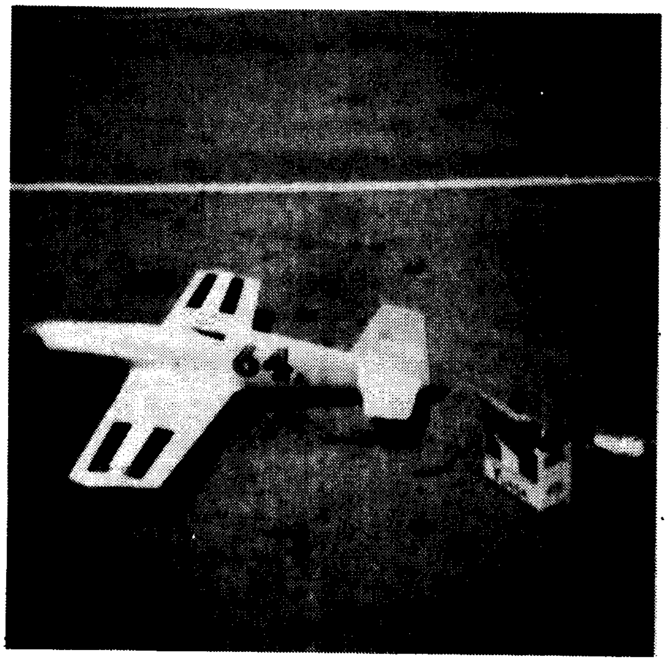
First, I want to say that I can see their point of view. They're right: model rockets *can* be dangerous in unskilled hands. Of course, so can just about anything else. But more importantly, the way to cure this problem is not to ban Model Rocketry; what they should be doing is promoting it, getting more people to use model rockets and teach them to use them. Take swimming. Swimming is a dangerous sport. It is easy to drown, easier, I think, than blowing yourself up with a model rocket. However, this problem was overcome not by making swimming illegal but by promoting swim classes, teaching swimming to anyone who liked the water. This probably has saved more lives than any other legal action that could be taken. If this were done to rocketry, if launch fields could be set up where ever they were wanted, if official instruction were offered, I believe this would be just as effective, if not more, in preventing accidents than banning rocketry.

Next, I would like to point out that, to my knowledge, *all* model rocket engines and all rockets are packed with specific instructions on the use of these items and if a person follows these instructions and uses a little common sense, the possibility of an accident to either himself or is rockets is practically nil. If he does not follow these instructions, well, I almost feel that he deserves the injuries he would receive, if any.

David Moore
Columbia, Missouri

Movie Camera

In your January issue, George Caporaso says in his *Technical Notes* column that he plans to launch a Bolsey 8 movie camera as



The photo on the left is of the pylon racer which Paul referred to in his letter. The starting equipment can be seen on the right side. Let's not get our hopes up too high, however. The picture on the right depicts the perils of this still dangerous and experimental hobby.

soon as the weather clears.

I am happy to say that I launched a Bolsey 8 movie camera this morning.

The rocket used was built for the job from parts supplied by Centuri. The bird was powered by an F15-4 and left its launch pad at 10:25 MST. It carried the camera to about 500 feet; after the nose over the parachute opened, the camera landed about 100 feet from the launcher. The camera was undamaged, although the booster did loose a fin. The film is on its way to the lab. I should have it back in about a week, I hope.

Terry A. Hollinger
Tucson, Arizona

Technical Discussion

In recent issues of Model Rocketry, the problem of finding experimentalists to finish the work of the theorist has been brough out very accurately. But in most cases one person working in a problem by himself has proved inadequate. Either the money problem holds him back or he has too few others nearby who are interested or trained enough to help him. As you have stated before, rocketeers must get together. Many have formed clubs for building and launching rockets, but few have done serious research work together as a group. Looking back through back issues of Model Rocketry, all the main research contributions have been done basically by only one person.

Groups have tremendous advantages, most of which are quite obvious. There are more people working on it, more money to work with, and the old saying, "Two heads are better than one," certainly can help. But the biggest problem of forming organizations has been that most interested people don't know of other experimentors existence or can't get a hold of them. My suggestion is to print *full* name and address of those who have made contributions to Model Rocketry and to form a section of the magazine where people of various interests in the field of model rocketry can at least make their names known. Then communication can at least be accomplished by mail, if not by directly traveling to some central area for a certain group.

I myself have many problems that I would like to work on (and I'm sure many others have too) but I can't possibly accomplish them alone. If there are others out there who are interested and have problems of there own that they would like to solve, let's get together!

Tom Rust
240 N. Kansas
Morton, Ill. 61550

P.S. Please print my name and full address also if possible. I'd appreciate it.

We'll be glad to print the name and address of any author who specifies with his article that he is willing to answer the resulting deluge of mail.

SOLICITATION OF MATERIAL

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

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

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

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

Those wishing to submit material should send it to:

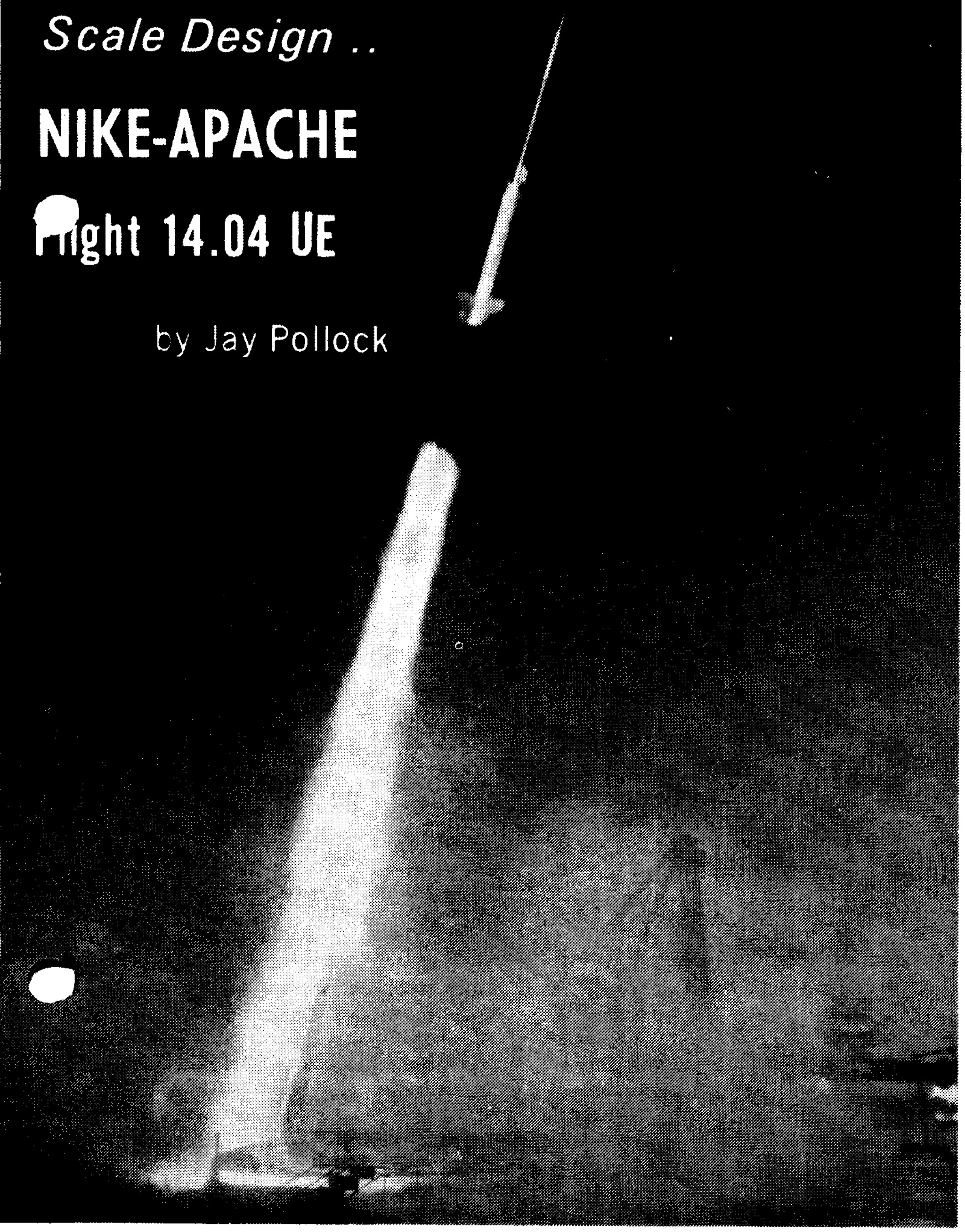
Editor, Model Rocketry Magazine, Box 214, Boston, Mass. 02123

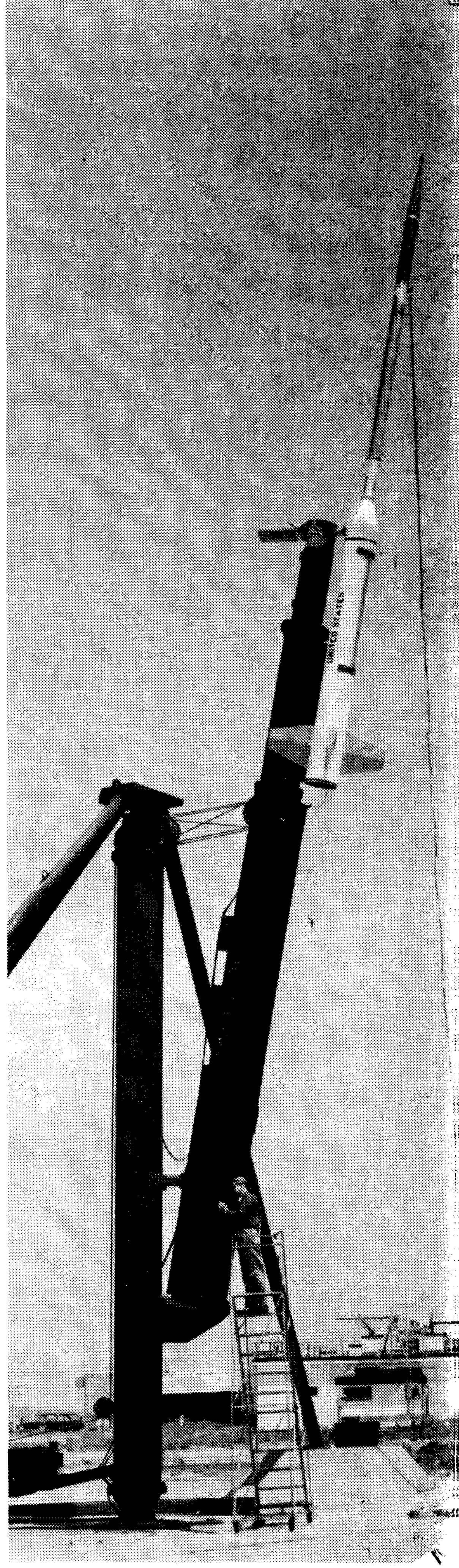
Scale Design ..

NIKE-APACHE

Flight 14.04 UE

by Jay Pollock





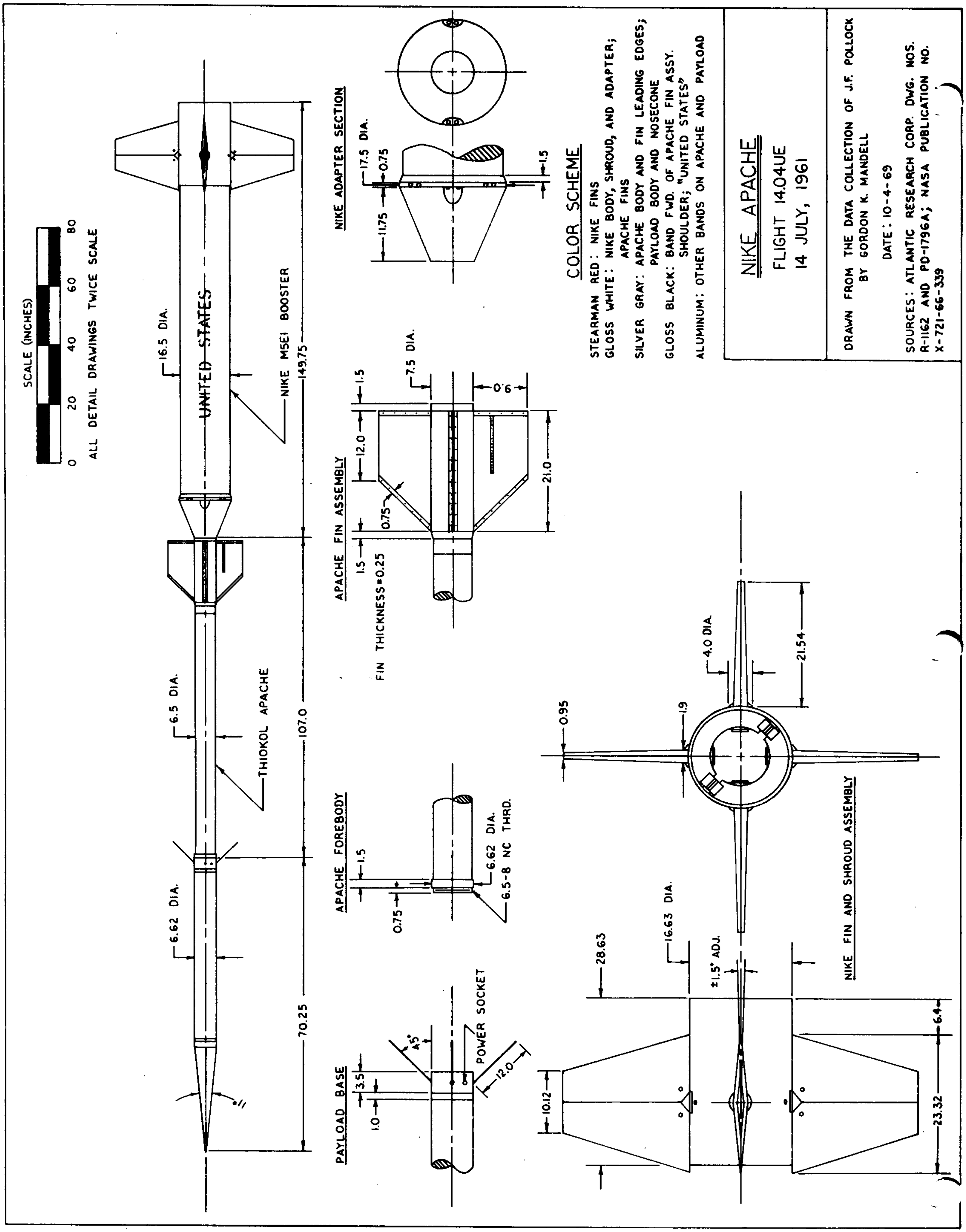
Since 1963, the Nike Apache has been one of the most widely used rockets in NASA's sounding-rocket program. This vehicle, consisting of a Nike M5-E1 first stage and a Thiokol TE-307 Mod II (Apache) second stage, is capable of lifting payloads in the 50 to 100 pound range to altitudes of 100 to 130 statute miles, when launched at an elevation of 80 degrees from a sea-level test facility.

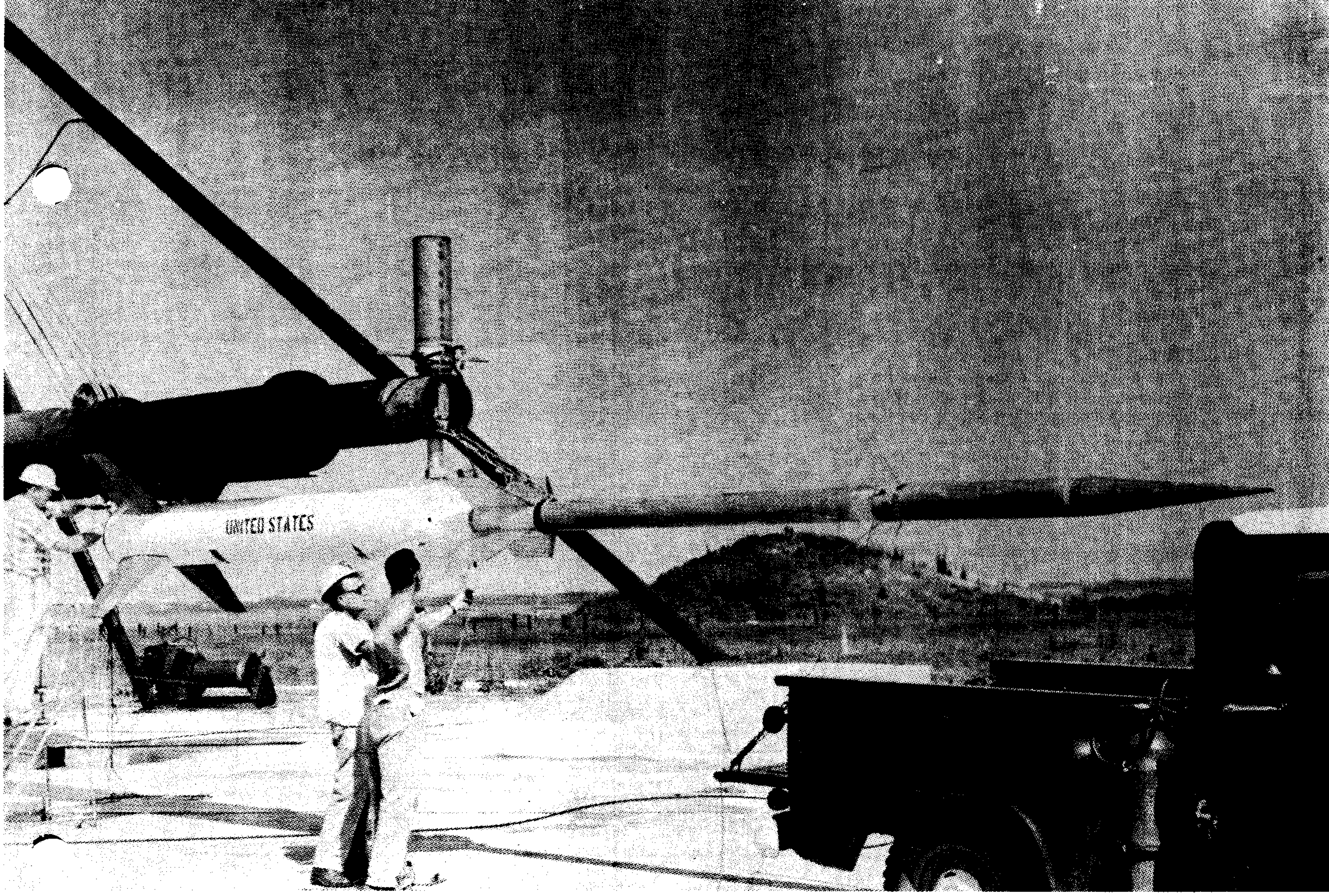
The Nike Apache is a two-stage, solid propellant, unguided sounding rocket stabilized by four fins (on each of the two stages) in a cruciform configuration. The stages are connected by a conical transition section that is bolted to the first stage and slip fits into the nozzle of the second stage. Separation is achieved after burnout of the first stage by differential drag forces. There is *no* mechanical restraint between the second stage and the transition section or adapter.

The primary internal difference between the Cajun and Apache is the propellant. The Apache is loaded with an aluminized polyurethane propellant that has a higher specific impulse and a longer burning time then that of the Cajun. Besides having a considerable performance improvement over the Cajun the Apache should prove to be more reliable over the Cajun in terms of lower probability of motor failure. The operating pressure of the Apache is about 300psi below that of the Cajun, although the case thickness is the same.

Construction Details

Now that you know a little about the Nike Apache you can attempt to build one yourself. You can't build this type of scale


SCALE (INCHES)
0 20 40 60 80
ALL DETAIL DRAWINGS TWICE SCALE
16.5 DIA.
UNITED STATES
NIKE M5E1 BOOSTER
149.75
6.5 DIA.
THIOKOL APACHE
107.0
6.62 DIA.
70.25
NIKE ADAPTER SECTION
17.5 DIA.
0.75
11.75
1.5
APACHE FIN ASSEMBLY
7.5 DIA.
9.0
1.5
12.0
0.75
21.0
1.5
FIN THICKNESS=0.25
APACHE FOREBODY
1.5
0.75
6.62 DIA.
6.5-8 NC THRD.
PAYLOAD BASE
POWER SOCKET
45°
12.0
3.5
1.0
COLOR SCHEME
STEARMAN RED: NIKE FINS
GLOSS WHITE: NIKE BODY, SHROUD, AND ADAPTER; APACHE FINS
SILVER GRAY: APACHE BODY AND FIN LEADING EDGES; PAYLOAD BODY AND NOSECONE
GLOSS BLACK: BAND FWD. OF APACHE FIN ASSY. SHOULDER; "UNITED STATES"
ALUMINUM: OTHER BANDS ON APACHE AND PAYLOAD
NIKE APACHE
FLIGHT 14.04UE
14 JULY, 1961
DRAWN FROM THE DATA COLLECTION OF J.F. POLLOCK BY GORDON K. MANDELL
DATE: 10-4-69
SOURCES: ATLANTIC RESEARCH CORP. DWG. NOS. R-1162 AND PD-1796A; NASA PUBLICATION NO. X-721-66-339
4.0 DIA.
21.54
0.95
1.9
NIKE FIN AND SHROUD ASSEMBLY
16.63 DIA.
28.63
±1.5° ADJ.
10.12
23.32
6.4



NASA Photo

Nike-Apache 14.04UE being prepared for launching from the Wallops Station tubular launcher.

SPECIFICATIONS

WEIGHTS (lb)

Apache Motor (empty with head cap and ignighter)	58.75
Propellant	131.00
Loaded weight (no payload)	189.75
Fin Assembly	27.25
Flight Weight (less payload)	217.0
Nike Motor (empty)	460.0
Propellant (mass consumed)	755.0
Loaded weight	1215 0
Nike Apache Adapter	27.0
Fins	75.0
Flight Weight	1317.0
Launch Weight (less payload)	1534.0

CENTER OF GRAVITY FROM BASE OF MOTOR (in)

Apache Motor (no fins)	
Full	54.8
Empty	58.1
Apache motor (with fins)	
Full	49.2
Empty	38.1
Nike Motor	67.5
Propellant	83.5
Fins	18.4
Adapter	162.0

model from pre-manufactured parts and maintain true scale. Thus I will describe how to build the rocket from scratch. The materials needed are;

One Utility knife	Estes 651-kns-3 Cent. XK-8
Masking Tape	Estes 651-MT-I
Shellac	
Balsa Fillercoat	Estes 651 SS-I Cent. MF-70
Brushes	Estes 651 PB-3 Cent PB-20
One Utility knife	Estes 651-kns-3 Cent. XK-8
Masking Tape	Estes 651-MT-I
shellac	
Balsa Fillercoat	Estes 651 SS-I Cent. MF-70
Brushes Estes 651 PB-3	Cent. PB-20
Glue	Estes 651-WG-I Cent. GL-100
Dope	Estes 651-BRD-I
1 inch dowell	
Half inch dowell	
7 sixteenths dowell	
6 sixteenths dowell	
Model putty	Estes 651-FM-I Cent. MF-10

Cardboard
1- 1/2 inch gummed tape
1- 1/2 inch square by 4-7 inch block Cent. BS–3
Eighth inch fin stock Estes 651-BFS-40 Cent. BFM-12
1/2" square by 3' balsa block
Eighth inch fin stock . . . Estes 651-BFS-40
1 engine mount . . . . .Cent. EM10A
Parachutes . . . . Any type
Baby powder

STEP I

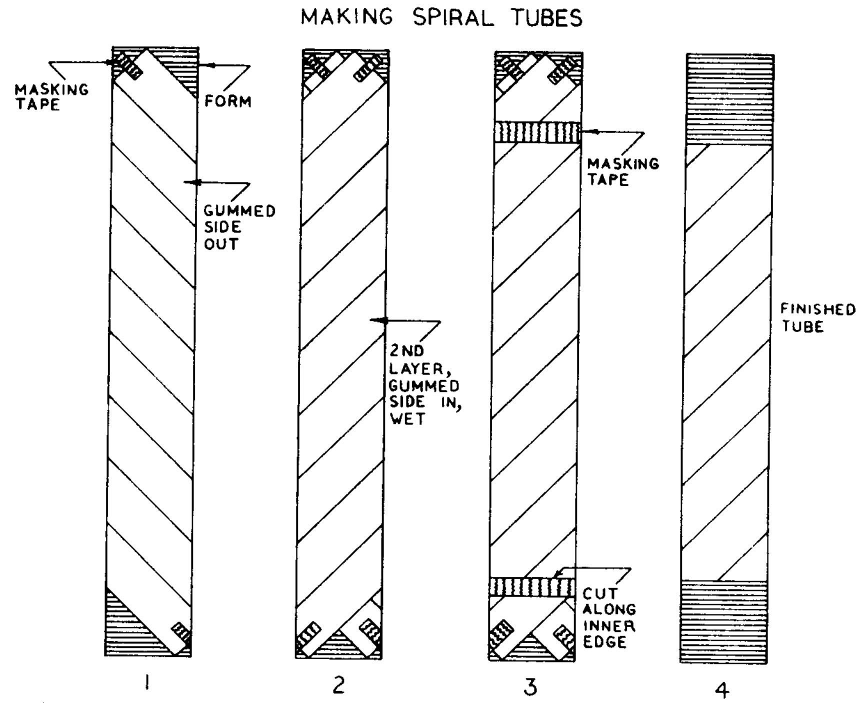
The first step is to make the body tubes, which is the most difficult task of the whole model. First take the 1 inch dowel and place it in front of you. Next, take about two feet of the gummed paper and tape one end to the dowel so as the gummed side is up and, grasping the dowel, wrap the gummed paper around the dowel making sure that it does not overlap but so it mates with the previous turn. Only the 1" body tube is spiral wound. Next, take another two feet of gummed paper, this time tape it so the gummed side is down and so that it is turned in the opposite dirrection. After this has been done, wet the gummed side of the paper and wind this around the dowell so that this also mates with the previous turn. Let it dry for 5 min. Now you are ready to cut the tube to size. The Nike Motor including the transition section (adapter) will measure 9 and 12/16; therefore it would be wise to cut the tube to a 9 inch length and make the adapter 12/16" long (consult drawings). Set this tube aside until later.

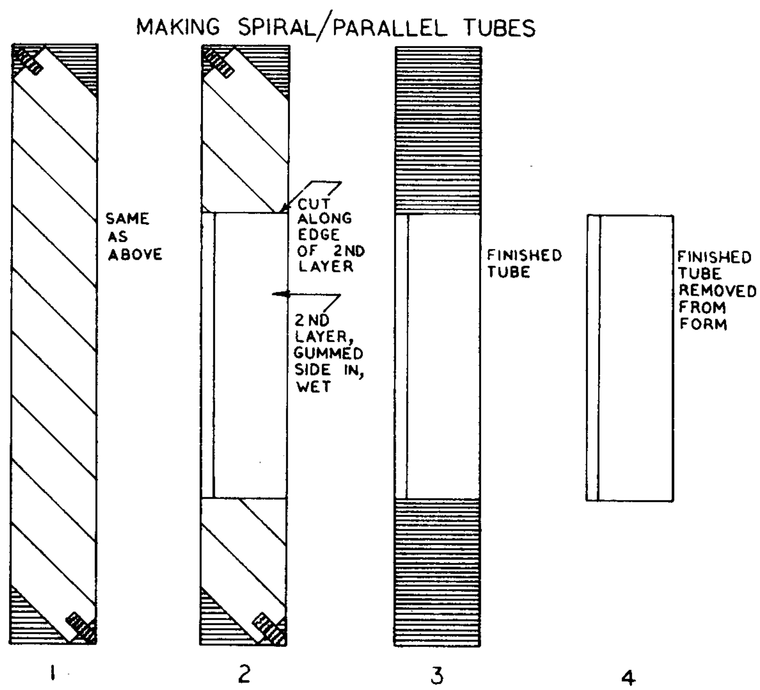
The smaller body tube for the Apache is parallel wound. Since the gummed paper is too large to fit around the smaller tubes without overlapping, simply wrap it around as well as possible. As with the big tube make sure that the gummed side is up, on the first layer. Use sufficient gummed paper so that it is long enough for the length of the tube. Take a length of gummed paper and cut it to the length of the tube you are making. Then take this paper and wrap it around in a parallel fashion. Apply the paper around the circumference of the tube, then cut off the remaining paper where it overlaps the edge where you started. Wet this gummed paper and wrap it around the tube. Let dry for 5 min. and then cut the first layer to the profile of the second. Set this tube aside and build up the remaining tubes in the same manner.

STEP 2

This step will be concerned with putting a smooth finish on the tubes you have made. If you are careless here you may have to make some new tubes!

First, take the tubes and put each one about one fourth of the way onto its own form. Then open the can of shellac and graciously spread the shellac onto the tubes





with a soft cloth. Make sure it does not drip, since drips or streaks will dry giving a bumpy surface. When these tubes are dry, sand lightly with no. 220 sand paper until fairly smooth. Then brush on Balsa Fillercoat, spreading it generously into the cracks. This will dry quickly. When dry, sand again with no. 220 sand paper. In this stage almost all of the fillercoat should be sanded off because *you are trying to fill the cracks not cover the tube.* Repeat again with Filler coat if necessary and then shellac again. When you have obtained a smooth finish on the tubes, paint them as indicated on the paint.

STEP 3

The fins on the Nike Motor are constructed from 1/8 inch balsa stock. Cut the fins to the pattern indicated. Remember that one of the factors in Scale Competition is "Trueness to Scale," and that the fins are the area which have the greatest possibility to be incorrect. Get them right the first time!

After you have cut out the fins, sand them to the correct shape. Next, sprinkle a little talcum powder onto fins and rub it into grain. This step is not necessary but allows you to get a better finish more quickly! It is very important to get a mirror finish in Scale Competition. The next step is to put Balsa Fillercoat on all surfaces of the fin except the root edge. When dry sand lightly, *BUT* remember to sand off all of the fillercoat (as with the tubes the purpose is to fill the grain, not cover the surface). Repeat this process until no grain can be seen. At this point the fins can be shellaced and then attached to the Nike body tube about 10/16 inch from one end. Paint the fins insignia red or stearman red after attachment to the body. Mask off the body tube with tape to avoid painting over the white finish.

The next step will be to make the fins for the Apache. These fins are to be made of cardboard (consult diagram for detail to fin assembly).

STEP 4

This step is concerned with the Conical Transition Section or the adapter which connects the first and second stages.

Take the balsa block and find its exact center by making an X from corner. When this is done make a circle with a diameter of I 2/16." Take a knife and cut off the edges so as you have a rough cylinder. Then sand it down to a cylinder using medium grade sandpaper.

After this has been done to the block measure down 1 12/16 from the top of the cylinder and cut off the remaining balsa. Then, make a mark 1 inch from the bottom of the cylinder. Use the center point of the larger circle and from this measure a circle with a one inch diameter. Round the bottom 1 inch of the adapter to a one inch diameter cylinder. Study the diagrams of this section. The one inch section which has already been made is the base which mounts into the body tube. From this base, cut the cylinder at 60 degree angle out to the full diameter. At this point on the top of the balsa cylinder, draw an 8/16" diameter circle using the previous center point. Then from the point where the one inch diameter extends out to the full 1 2/16" diameter, cut the conical transition section down to Sand to a conical shape and apply Balsa Fillercoat.

STEP 5

The Apache motor section is prepared from the 8/16 inch diameter tube. Then take the dowel used as form and cut off two ½" sections. Insert these dowels ¼ inch into each end of the body tube and glue in place. Then with paper build up the dowels so that one end will mate with a 6/16" tube and the other end a 8/16"tube. Glue these tubes in place so that the ends mate but do not overlap. Take the body putty and build up the joint to give the appearance of an adapter. Let dry and sand untill smooth.

STEP 6

The nose cone of the Apache Motor is made of the ½" square balsa stock. Find the exact center of the square and draw a circle with a diameter of 7/16." Cut off about 5" of this stock and sand it down to this diameter. After it has been sanded down to a cylindrical shape, measure down 1 ½ inches from the end and form this into a pointed nose section. Measure to the correct length, cut off and glue to tube.

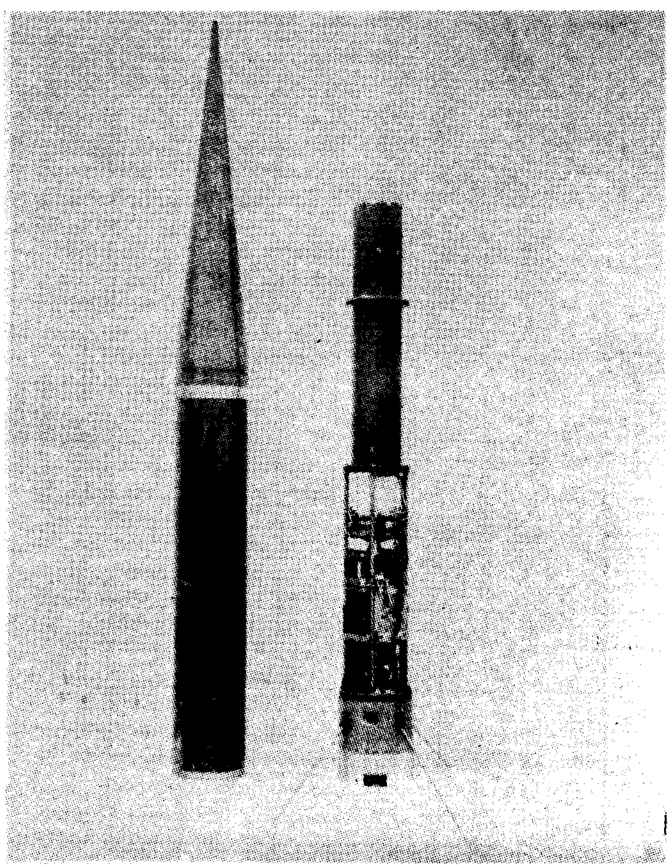
STEP 7

This step tells you how to connect the transition section to the second stage.

First drill a ¼" hole in the top center of the transition section. Insert a ¼" by 1" dowel. Build up the dowel with paper and glue it into the Apache body tube.

Your rocket is nearly complete. Add a couple of parachutes and an engine mount. The engine mount can be a Centuri EM-10 or EM-10A. The parachutes can either be two 12's, two 18's, or one big 24".

The model can be flown with an A8-3, B6-4, or C6-5 engine.



NASA Photo

Payload section of the 14.03 vehicle (identical to the 14.04 payload) shows attachment of the telemetry antennas.

References

The Nike Apache performance data and facts on the rocket are according to:
The Nike Apache Performance Handbook
By Howard L. Galloway, Jr.
Goddard Space Flight Center
and Ruth Ann Crough
Fairchild Hiller Corporation
as of. . .December, 1966

On the scene report from the .....

Midwest Model Rocket Regional Meet

June 28-29,1969

Columbus, Ohio

by George Pantalos

The first annual Midwest Model Rocket Regional, held on June 28 and 29, was deemed a success by its thirty participants from Indiana, Pennsylvania, and Ohio. Hosted by the Columbus Society for the Advancement of Rocketry, it was the first regional held in the Midwest.

Tracking west is Go! As Mark Maselli handles communication with data reduction, Jon Bonine (R) mans the Ball-Hagedorn rear-pivot theodlite.

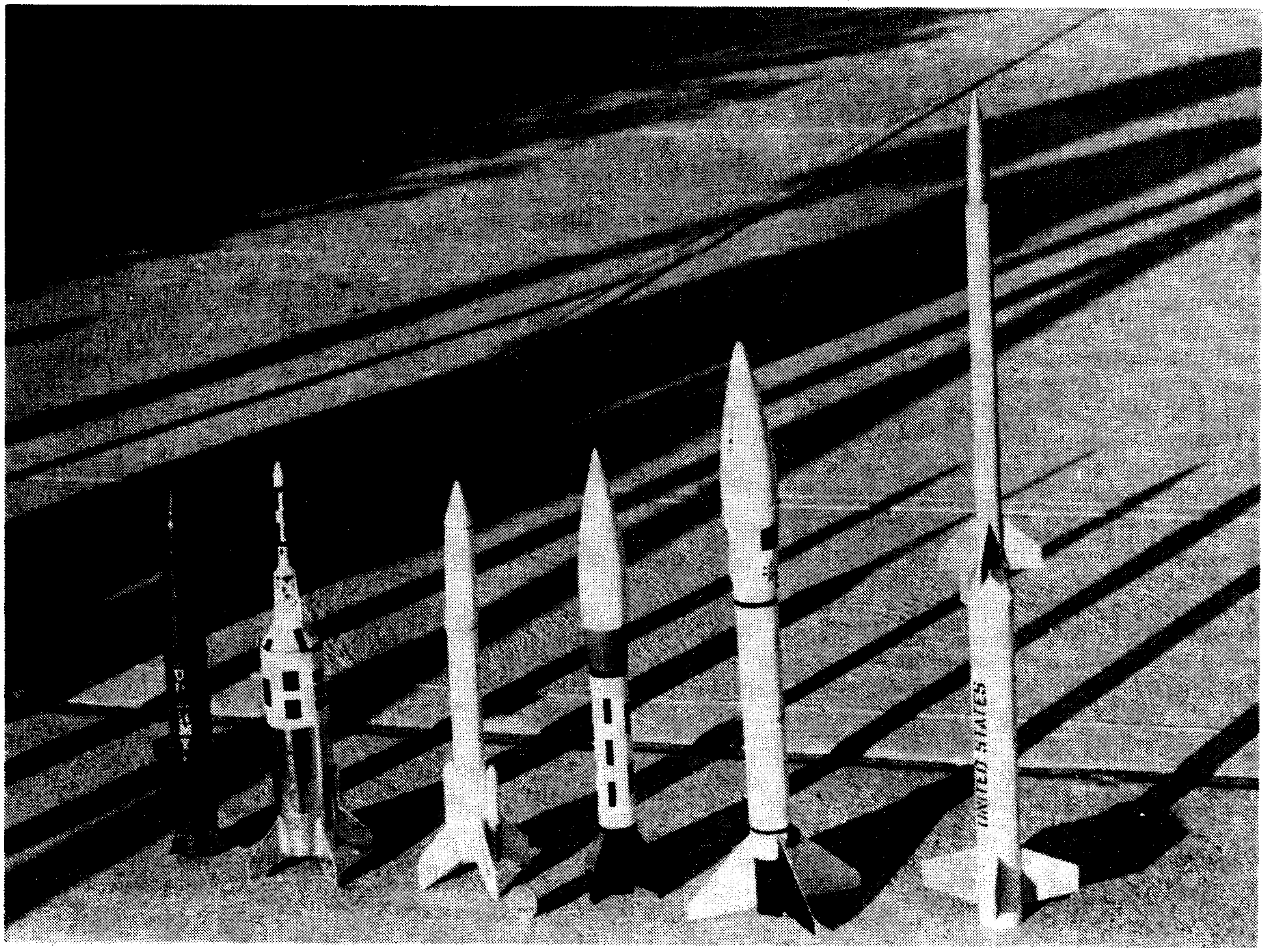
After a contestants' meeting and opening ceremonies, the competition started with Class 1 Parachute Duration. Although the wind was relatively calm, several excellent times were recorded. Unfortunately, a few times were too good. Dr. Jerry Gregorek's "Roamin' Candle" and two or three other nice birds were seen for the last time as they headed down range for over two miles into a clump of "bird-hungry" trees.

After untangling her bird that had found its "hang up" in a local obstruction, Ohio's answer to the Stine girls, Vikki Lundberg, posted a 3:06.2 time to best the Juniors, and the Doug Ball–Bob Hagedorn team returned with a 1:52.3 time for the parachute duration crown in the Leader/Senior division.

The Red Baron paid an unexpected visit to the MMRR Saturday afternoon as Sparrow Boost/Glide was flown. If you were lucky enough not to get "shot down", the various changing wind currents provided a challenge that was tough to overcome. To avoid the issue further, the boost/glide times were poor. Junior Jeff Gordon turned in the best time in his division of 0:49.7. In the senior division, Tom Stumph posted a 1:13.1 mark.

Capping the first day's competition was Egg Scrambling... er... a... Egg Lofting. Due to the limited size of the launch site, a 20 nt.-sec. limit was established to keep the birds from going out of sight or being lost down range. Due to the low total impulse restriction, the event was quite challenging and several different methods of clustering or staging were attempted. As could be expected, some of the birds "laid their eggs" but generally, the flight performances were good. Two C's, which were clustered in Craig Street's "Eggotistic", lofted his egg to 320 meters to take the Junior honors. Tom Stumph bested the Leader/Senior division with a flight of 265 meters.

Following the day's competition, most of the participants made the short trek to the Ohio State University's Aeronautical and Astronautical Research Laboratory. Following a lecture on the operation of wind tunnels by Dr. Jerry Gregorek, an Associate Professor at OSU, Aero students conducted a tour of the lab. Among the facilities shown were hypersonic shock tubes, rocket



Sizing things up-Standing on display after judging are some of the better Class 1 Scale Altitude entries.

blast pits, a transsonic wind tunnel, a tube train transportation test facility, and a Mach 2.5 wind tunnel. Since a majority of the students are not on campus during the summer, most of the facility was not operating; however, a demonstration was given with the Mach 2.5 tunnel. This demonstration included the use of a Schlieren observation system to view the shockwave formation on the test probe and the automatic read-out and graphing of the probe's aerodynamic drag by an analog computer.

An early morning haze posed a problem for the tracking of the Pewee Payload birds. However, by the time the second flights were started, the haze lifted and the tracking showed a high percentage of closures. Vikki Lundberg again topped her male competitors with a flight of 198 meters while leader Charles Russell came out on top of the Leader/Senior with a shot of 192 meters.

All types and sizes of birds were entered in the Class 1 Scale Altitude. A 1:9.91 scale Tomahawk built by Brian Dolezal reigned over the Junior scale birds and the Astrobee 1500 of the Ball-Hagedorn team took the Leader/Senior competition.

To wrap up the competition Open Spot

Ignition- Little Joe II becomes airborne in the scale altitude competition as the firing crew and communications crew look on.

MMRR 1969 RESULTS

Class 1 Parachute Duration

Leader/Senior	1st	Ball–Hagedorn Team MASA	1:52.3
	2nd	Joe Baxter CSAR	1:10.5
	3rd	Tom Stumph Astro-Modelers	1:08.5
Junior	1st	Vikki Lundberg MASA	3:06.2
	2nd	Jon Bonine CSAR	2:24.8
	3rd	George Pantalos CSAR	2:10.5

Sparrow Boost/Glide

Leader/Senior	1st	Tom Stumph Astro-Modelers	1:13 1
	2nd	Gregorek Team CSAR	0:32.2
	3rd	Chas Russell CSAR	0:21.0
Junior	1st	Jeff Gordon MASA	0:49 7
	2nd	Bob Flisik QCMRS	0:29.9
	3rd	Paul Kreiger	0:29.8

Egg Lofting

Leader/Senior	1st	Tom Stumph Astro-Modelers	265
	2nd	Chas Russell CSAR	74
	3rd	Gregorek Team CSAR	71
Junior	1st	Craig Streett CSAR	320
	2nd	Don Berky	252
	3rd	George Pantalos CSAR	214

Peewee Payload

Leader/Senior	1st	Chas Russell CSAR	192
	2nd	Tom Stumph Astro-Modelers	182
	3rd	L. P. Streett CSAR	159
Junior	1st	Vikki Lundberg MASA	198
	2nd	Paul Kreiger	186
	3rd	Brian Dolezal	185

Class 1 Scale Altitude

Leader/Senior	1st	Ball–Hagedorn Team MASA	865
	2nd	Gregorek Team CSAR	847
	3rd	Chas Russell CSAR	834
Junior	1st	Brian Dolezal NSMMRRS	938
	2nd	George Pantalos CSAR	847
	3rd	Tom McKim NCMRS	802

Open Spot Landing

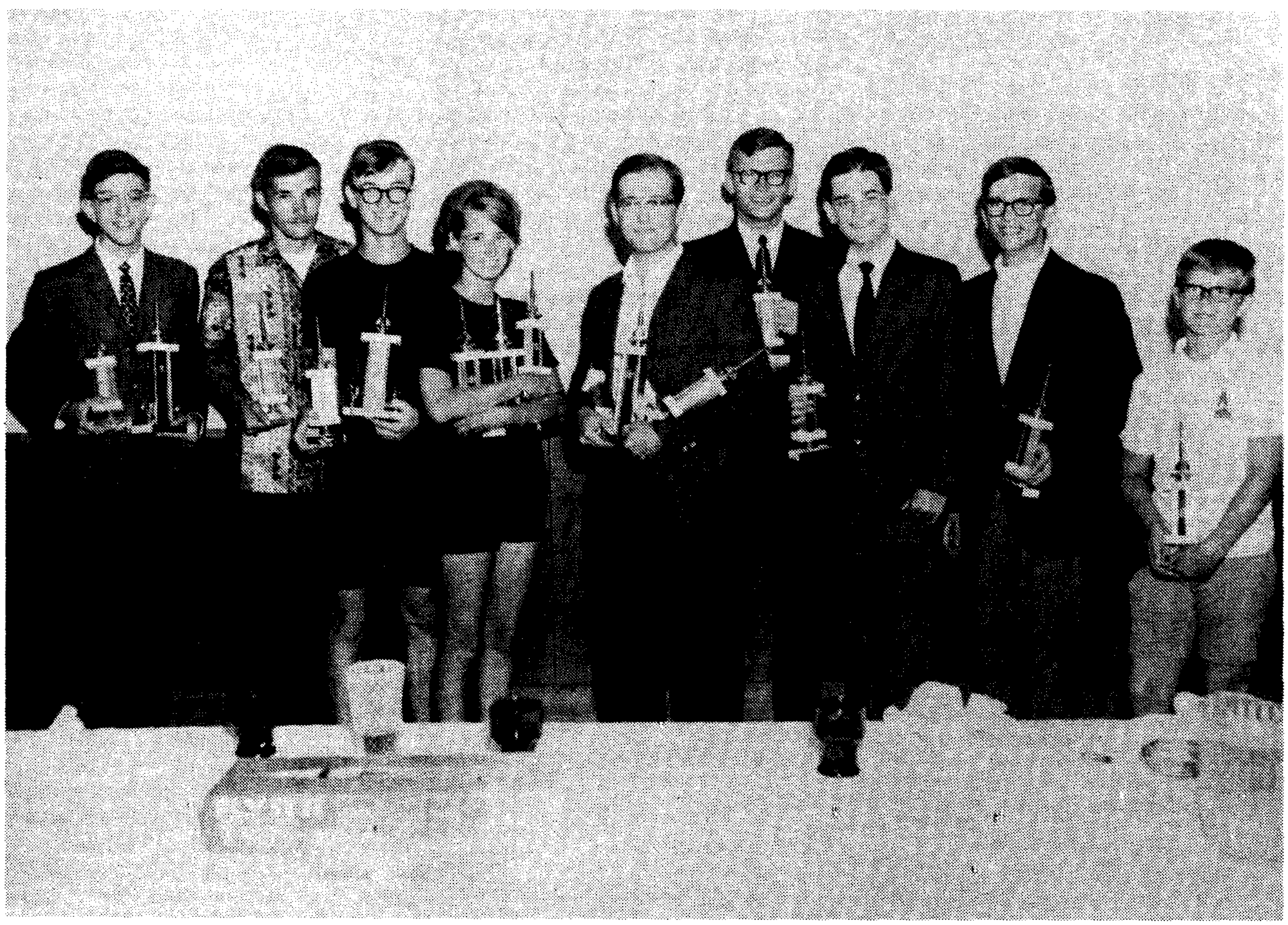
Leader/Senior	1st	Joe Baxter CSAR	3'2"
	2nd	Tom Stumph Astro-Modelers	23'1"
	3rd	Chas Russell CSAR	30'3"
Junior	1st	Julius Brand QCMRS	16'9"
	2nd	Jon Bonine CSAR	27'0"
	3rd	Brian Dolezal NSMMRRS	31'0"

OVERALL			
Leader/Senior	1st	Tom Stumph	150
	2nd	Ball–Hagedorn Team	120
	3rd	Chas Russell	118
Junior	1st	Brian Dolezal	108
	2nd	Vikki Lundberg	96
	3rd	George Pantalos	87
		Section Standings	
	1st	Columbus Society for the Advancement of Rocketry	594
	2nd	Mansfield Aero. and Space Assoc.	291
	3rd	Nat. Sci. Museum Mod. Rocket Research Soc.	201

Landing was flown. The attempts of almost everyone seemed to be of no avail until Joe Baxter's "Point" really got to the point, as it landed two feet, three inches away from the marker. The Juniors, however, were not quite so lucky, as Julius Brand landed his bird sixteen feet, nine inches from the spot.

A rear pivot theodlite, developed by the Ball-Hagedorn team, was used successfully throughout the MMRR. Because the pivot point is behind the tracker rather than in front of him, body movement is reduced, thus making the job of the tracker easier and more accurate. Although the closure for Eggloft was only 47%, the closure on Peewee Payload and Scale altitude birds were a respectable 72% and 82%.

After a final tally of points, the awards banquet was held at the Green Meadows Inn. Following dinner and the "Debrief: Apollo VIII" film, the awards were presented. Tom Stumph of the Astro-Modelers was overall winner in the Leader/Senior division with 150 points while Brian Dolezal of the Natural Science Museum Model Rocket Research Society had 108 to edge his other Junior competitors. The Columbus Society for the Advancement of Rocketry was the winning section with a tally of 594 points to their credit.



In The Winner's Circle–MMRR winners (L to R) Brian Dolezal, Bob Hagedorn, Doug Ball, Vikki Lundberg, Tom Stumph, Chas Russell, Craig Streett, Joe Baxter, and Jeff Gordon proudly display their recent winnings.

Build the *ARCTURUS*

A Finless Rocket

by *Warren James*

We all know that the only requirement for a rocket to have static stability is that its Center of Pressure be behind its Center of Gravity. However, there are many different ways of achieving that condition, the following examples should prove my point. The most common solution is to attach a set of fins to the base of the bird and allow them to pull the C.P. behind the C.G. Then if the fins are not large enough to do the job completly the C.G is shifted toward the nose by adding lead weights or a payload. Please note that weight is sometimes added to the nose in order to optimize the rockets' design to achieve the maximum possible altitude. If you will look on page eight of Barrowmans' report you will see that the C.P. of a cone is 2/3 L from the tip of the cone[1](see fig. 2).

Parts List for the *ARCTURUS*
(All parts available from Estes Industries)

651-BT-60J	Body Tube
651-BT-20B	Body Tube
651-BT-20J	Engine Tube
651-BNC-20N	Nose Cone
651-TA-2060	Adapter
651-RA-2060	Centering Rings
651-EB-20B	Engine Block
651-SE-1	Screw Eye
651-SV-12	Snap Swivel
651-SC-2	Shock Cord
651-PK-12	Parachute
651-NCW-1	Nose Cone Weight

It should be apparent that you can use a cone without fins for the body of a rocket, just so long as its C.G. is less than 2/3 L back from the tip of the cone. This was done by Centuri Engineering in their kit, the POINT, which was nothing more than a hollow paper cone with an engine mounted in its nose. Its C.G. was ahead of its C.P. so it flew in a stable manner. A third method of producing a stable rocket is to do like Tom Milkie and hang a streamer behind the rocket, the drag produced by the streamer will be sufficient to pull back the C.P. and produce a stable rocket. Or you can do like I did on the *ARCTURUS.* By studying Barrowowmans' report you can see that an adapter will pull back the C.P. of a rocket.[2] In order to pull back the C.P. as much as possible it is desirable to have the ratio D/d be as large as possible (see fig. 3) and to have the adapter as near the tail as possible. This leads to a configuration with a short, wide tail section topped by a long, narrow upper section. This in turn leads to a rocket that is tail heavy unless weights are added to the nose to move the C.G. forward. It is the above considerations that lead to the design of the *ARCTURUS* seen in figure 1a.

CONSTRUCTION

The construction of the *ARCTURUS* is rather simple since you do not have to worry about cutting, gluing or finishing a set of fins. The *ARCTURUS* consists of four sections; the engine housing, the adapter, the recovery section and the nosecone (see fig. 1b). Each section is to be built individually, weighed and then mated to the other sections. The engine housing is a 1.75 inch section of BT-60 that has a light weight engine housing in it. The adapter is a section of TA-2060 that acts to bring back the C.P. and that has been hollowed out to save weight. The recovery section is a BT-20B that is used to hold parachute recovery system. The nosecone is a BNC-2ON that is weighted as needed to bring the C.G. ahead of the C.P. Construction is as follows:

1). Mount the shock cord in the BT-20B by any method that you prefer.

2). Hollow out the adapter, being sure to

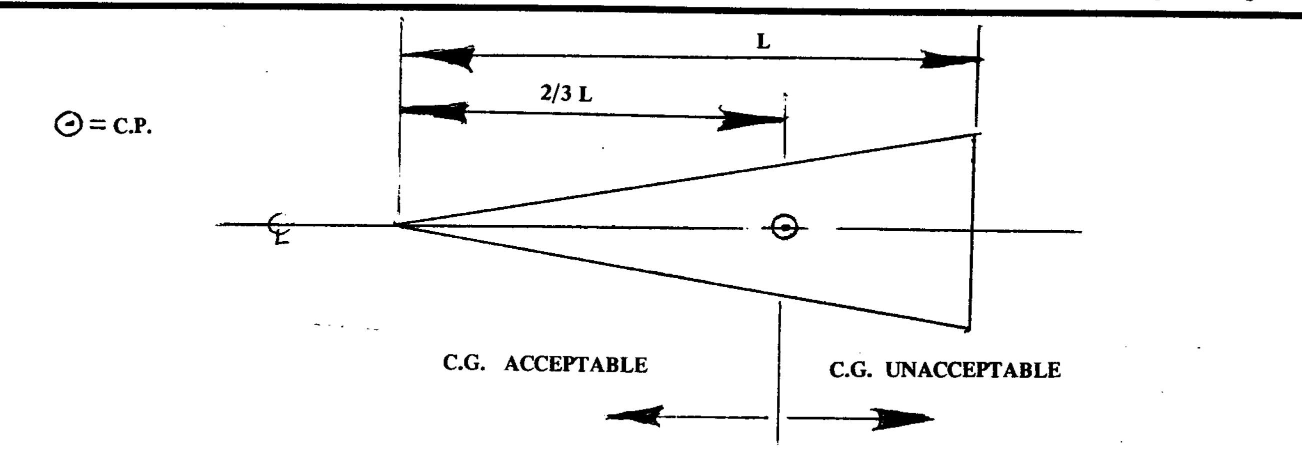


Fig. 2 The C.P.–C.G. Relation for a Conical Finless Rocket

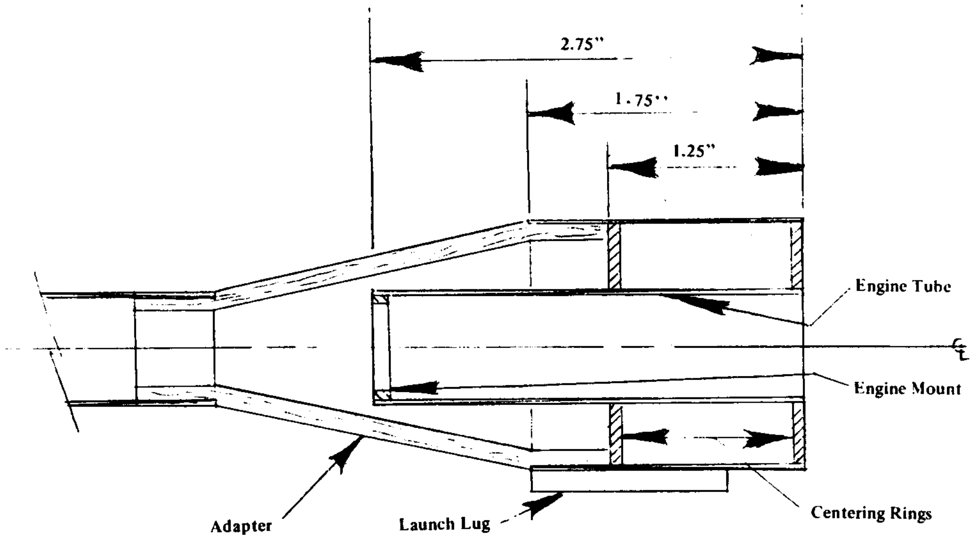


Fig. 1c. Detailed Section View of Adapter and Engine Housing

1 CM.=1 IN.

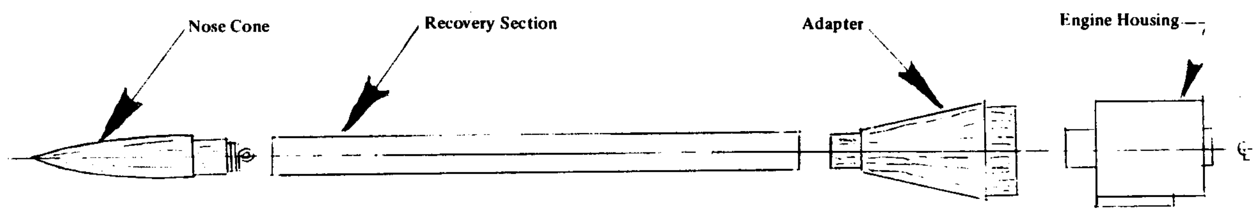


Fig. 1b. Exploded Side View

1 CM.=1 IN.

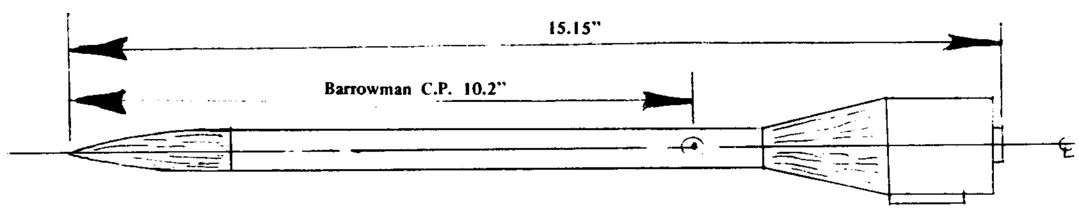


Fig. 1a. Assembled Side View

drawn by Warren James

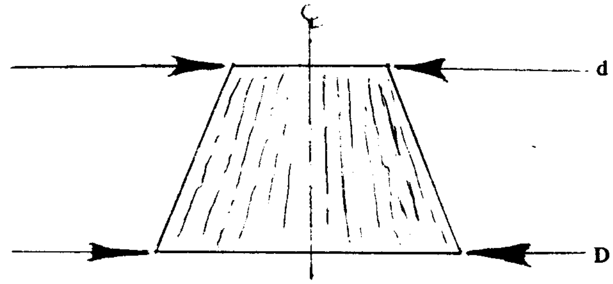


Fig. 3 Definition of the terms D and d

leave 1/8 inch thick walls.

3). Glue the EB-20B to the end of the BT-20J. Next glue one of the centering rings flush with the bottom of the BT-20J. The other centering ring is set, not glued, 1.25 inches from the bottom of the BT-20J. Then fit, do not glue, the engine holder into the BT-60 and insert the adapter in its proper position. By doing this you can check to see that the upper ring is in the proper position, if it is then remove the engine housing and glue the upper ring in position. After the centering rings have dried glue the engine holder into the BT-60.

4). Now you must weigh the individual assemblies to see that they have the following weights. A plus sign means that a greater weight is unacceptable and a minus sign means that a lesser weight is unacceptable.

Nosecone (includes weights)	25 gms.	–
Recovery Sections (includes weights)	09 gms.	–
Adapter	.05 gms.	+
Engine housing (less engine)	.08 gms.	+

If any of the assemblies followed by a plus sign are heavier than indicated you must do one of two things. You can shave some weight from the heavy assembly or you can add weight to the nosecone. No matter what happens, though, be sure to check that the C.G. of your bird is ahead of its C.P. before you fly it.

5). Glue the recovery section to the adapter and then glue the adapter to the engine housing. Sand and seal all balsa surfaces and you are ready to paint the bird. My *ARCTURUS* was painted silver on the recovery section and the engine housing and black everywhere else.

COMMENTS

You go about preparing the *ARCTURUS* for flight the way you would any normal parachute recovered rocket.

Because the *ARCTURUS* needs a fairly heavy weight in its nosecone to be stable, it would seem to recommend itself for use as a payload modroc. In which case a BT-20 payload section would be used in place of the nosecone and a payload equal to or heavier than the nose weights would replace the nose weights. However, the adapter will give the bird a large frontal area and a great deal of base drag, both acting to reduce the maximum altitude that the rocket can reach.

You must remember that when you use larger motors in the *ARCTURUS* the C.G. will move toward the tail and that will have to be compensated for by adding weight to the nose. Which in turn will tend to lower the maximum altitude the *ARCTURUS* can reach. This suggests that there is an optimum engine size that can be used with the *ARCTURUS*. Anything smaller than optimum size and the rocket will lack the impulse to reach its peak altitude. Anything larger than optimum size and the extra weights in the nose will prevent the rocket from achieving the velocity needed to reach its maximum altitude. Unfortunately I have no idea what the optimum engine size will be for this rocket. I leave the determination of that as a problem for someone with access to a computer.

---

1). *Calculating the Center of Pressure of a Model Rocket,* James Barrowman, Centuri Engineering Company
2). Ibid

q & a

My question to your column concerns stability. In the new Estes Catalog, the section on stability states that ... "finally, the rocket should balance at least 1/8 its length ahead of the front of the fins. This gives the fins the leverage they need to counteract the force on the nose." I have been in model rocketry for about two years, and in that time I have built rockets which were not stable when tested by the same test method, even though the CG was about the center of the rocket and the rocket was over 18" in length. I have had no difficulty in stabilizing them but I am curious as to the discrepancy between the information in the catalog and my own experience. The Astron "Avenger," one of the newer two stage Estes rockets, has rather small fins and is about 29" in length in the top stage. Is it possible that a rocket will fly even though it tests unstable by the string test method?

Paul F. Freiburg
Pittsburgh, PA 15209

The statement on stability you quote from the Estes catalog is meant to be a rough rule of thumb for the design of average rockets. It has no basis in the mathematical physics of fluid flow and cannot be expected to make accurate predictions of the stability of rockets whose design departs, even slightly, from the average.

The actual criterion of rocket stability is that the center of pressure shall lie aft of the center of gravity by sufficient amount when the rocket is flying at small angles of attack to the relative airstream. This "sufficient stability margin" is usually taken as at least one "caliber," that is, one body diameter. If you have any difficulty understanding what I mean by the terms "center of pressure" and "stability margin," you should obtain the Estes and Centuri technical reports on model rocket stability. Centuri also publishes a technical report, TIR-33, that will enable you to compute the location of the center of pressure of a model rocket. These reports are all well worth their price and contain a great deal of valuable information that it would take me many hours to write down in a letter like this.

If, in making a string test, you start the rocket broadside to the wind rather than nose on to it, your rocket may test out unstable even though it will in fact be stable when flown with a rocket engine. This is because the center of pressure moves forward when the rocket assumes a large angle of attack. If the rocket is stable at small angles it will never assume large angles, so the loss of stability at large angles of attack is not a problem. You can make the string test a true indicator of stability if you make sure the rocket is facing directly into the relative wind when you start the test. If you do this any rocket which the string test shows to be stable will fly and any rocket which it shows to be unstable will not.

Any questions submitted to this column and accompanied by a self-addressed, stamped envelope will be personally answered. Questions of general interest will also be answered through this column. All questions should be submitted to:

Q and A
Model Rocketry *Magazine*
Box 214
Boston, Mass. 02123

Final Notes On

The Foxmitter

by Richard Q. Fox

The May through October issues of this magazine contain six articles on the construction and use of a transmitter designed to operate in a model rocket. The articles contained information on how to use the transmitter to send information on the rocket's acceleration, spin rate, physical position, on the temperature of the air surrounding the rocket and on the noises generated inside the rocket during flight. A large number of people have built the transmitter and its associated sensors and some of these people have written **Model Rocketry** magazine with questions and with suggestions. This final installment in the first series of articles answers some of the questions raised by the readers and passes on some information that has come to light during the six months that the series was published.

The process of developing an electronic device and publishing its design is a complex one and inevitably some errors are committed between the construction of the final prototypes and the publication of their design. A few such errors crept into this series. The May issue parts list for the basic transmitter assigns values to R2, R3 R4, and R5 which are not readily available. These resistors should have the following values:

R2	4,700,000 ohms
R3	4,700 ohms
R4	470 ohms
R5	47 ohms

In the same parts list, C4 is listed as 2 picofarads. The value of this part is not critical and any value between 2 and 4 picofarads may be substituted. The antenna is listed as 6' 0" of thin hook-up wire. This is incorrect. The length should be 26" of thin hook-up wire but the exact length depends on the neatness of the wiring job done on the transmitter. This subject is covered in more detail in another part of this article. The extra capacitor represented by dotted lines on the schematic is not necessary if the antenna is installed properly. Inductor L2 has been a source of problems and a replacement for it is suggested in another section of this article.

In the July issue, the section which describes the use of the direction sensitive antenna contains an error. The direction sensitive antenna is a length of stiff wire formed into a circle, with two eight inch lengths of hook-up wire attached to the ends of the stiff wire. One of these pieces of hook-up wire is supposed to be attached to the metal case of the walkie-talkie receiver. The other piece is supposed to be clipped to the antenna, with the antenna fully contracted into the walkie-talkie, not fully extended out of the walkie-talkie.

The August issue of Model Rocketry describes an Accelerometer Module for use with the transmitter. Unfortunately, the parts list was left out of the article. The correct parts list is as follows:

Lo .570mh - 2.80mh "Adj. r. f. coil"; Miller no. 9003
Ca 100 pfds
Cb 3.0 mfds, 25 v.d.c.
B1 22.5 volt battery, Burgess no. Y15
Battery Holder Lafayette no. 34H5005
Plug Lafayette no. 99H9091 (Ultra-miniature r.c. connector)

All parts except the battery holder and plug are available from Burstein-Applebee, Kansas City, Missouri. The battery holder and plug are available from Lafayette Radio, Syosset, L.I., N.Y.

The left hand illustration in figure 5 is supposed to indicate the use of a battery holder to support the battery. The battery holder is mounted to the perforated board by means of the semi-circle of wire indicated at the top of the drawing. Figure 4 shows a washer at the bottom of the inductor assembly. The washer can be made from either metal or fibre.

Improving Inductor L2

Correspondence indicated that one problem plagued builders of the transmitter more than any other and that was extreme sensitivity to the position of the antenna. The prototype transmitters did not demonstrate this effect and the problem remained a mystery until Michael Mallinger and David Kindler of Pittsburgh sent their transmitters to the author. Mike and David had elected not to follow the wiring diagram and as a result the inductances and capacitances of the internal circuitry varied from those of the prototypes. Mike and Dave's problem was solved by replacing inductor L2 of the basic transmitter with a Nytronics no. SWD–10 10 uh. r.f. choke available from Allied Radio, Chicago Illinois. The Nytronics choke has a much higher Q than the Miller choke listed in the May article. Further testing has indicated that the Nytronics choke makes a noticeable improvement on any transmitter's signal and it is suggested that all owners of the transmitter make this substitution.

Adjusting the Antenna for Maximum Power Output

The circuit used in the Model Rocket Transmitter has a low number of components, small size and light weight. However, these features were obtained at the expense of having the RF oscillator coupled directly to the antenna. As a result, the transmitter is sensitive to the position and length of the antenna.

In electrical terminology, the antenna is referred to as the load of the radio frequency transmitter. How much the antenna loads down the transmitter is a function of the antenna length, thickness, direction, position with respect to the transmitter circuit board and especially how close it is to any conducting objects such as the ground or metal. The antenna and transmitter were designed for use in model rockets flying through the air, hundreds of feet away from the ground and any metallic objects. As a result, when the antenna is brought near a conducting object, it can change its loading properties so drastically that the r.f. oscillator output drops to practically nothing. Those modelers that have already built the transmitter have experienced this effect.

The instructions in the May issue warn that the antenna may have to be lengthened or shortened in order for the transmitter to develop full output. If the antenna length is far from what it should be, the r.f. oscillator will put out no signal at all. There are some simple tests for determining if the antenna length is preventing the transmitter from working. First, turn the transmitter on and plug in a sensor module. Place a crystal earphone between the collector and emitter of transistor Q4. If an audio tone is heard, the audio section of the circuit is operating properly. Next, take a walkie-talkie and collapse its antenna all the way into the case. Turn the transmitter on and touch the walkie-talkie antenna tip to the negative side of the terminal on the battery holder. If the tone is given off by the walkie-talkie, the r.f. oscillator is in working condition and the only problem is the antenna length, provided the nytronics inductor is used for L2. If the walkie-talkie does not give off the tone, check the wiring, the battery voltage under load and the crystal. The best check for the crystal is to plug it into a walkie-talkie that works and try to transmit with it. One other source of trouble could be the use of parts which are slightly different from those called for by the article. In some cases the substitutions may not make much difference but substitutions of inductors and transistors probably will lead to trouble. Even though some all purpose transistors claim to be replacements for the RCA 40080, they do not work properly in the circuit.

If the walkie-talkie test does generate a tone, the only step necessary to make the transmitter operational is the adjustment of First, the antenna and transmitter must be hung in the air, away from other objects, the antenna length. This is done by preparing five ten inch lengths of insulated hook-up wire. Strip one-half inch of insulation off of each end of the wires and bend the exposed ends into small hooks. Take one piece of the wire and tie a one foot length of string to one end. Secure the other end of the string to an overhead lamp. Now connect the free bare end of the wire to the antenna side of inductor L2. (No other antenna should be connected to L2 at this time.) Allow the whole arrangement to hang from the lamp. This arrangement simulates the transmitter in free air with a ten inch antenna. Turn the transmitter on and turn on a sensitive receiver. Listen for the transmitter's audio tone to be picked up by the receiver. Probably none will be heard. Now stand away from the operating transmitter and slowly extend your hand toward the battery and battery holder to the point where you finally are touching the battery Placing your hand near the battery changes the loading of the antenna and has the effect of increasing the effective length of the antenna. If the receiver picks up the transmitter's tone as you bring your hand near the battery, the antenna needs to be slightly longer. If this test did not cause the receiver to pick up the tone, extend the antenna to twenty inches by using two lengths of wire, one hanging from the other. Again listen for the signal from the receiver and try moving your hand near the battery With a twenty inch antenna and your hand about one-half inch from the battery, the transmitter's tone should come through loud and clear. If not try thirty, forty and fifty inch antennas.

Once you have established that the antenna should be between, say, twenty and thirty inches, try different length antennas between those two extremes until you find the length which allows the transmitter to put out full output with no objects near it. If you followed the wiring diagram in the May issue, your antenna length should be very close to 26 inches, however, home transmitters have needed antennas as short as 10 inches and others have needed antennas as long as 4 feet.

Your transmitter should now have a range of between a third and a half a mile on the ground. One additional improvement which can be made is to stabilize the signal by using the payload carrier described in the September issue. The payload carrier is designed to minimize changes in the loading of the antenna caused by its whipping around in the wind during the flight. However, if the payload carrier is used, the antenna length must be corrected by the above procedure while the payload carrier holds the transmitter circuit board.

The problem of transmitter antenna loading has one additional side-effect. When an operating rocket transmitter vehicle is placed on a metal launch rod, the presence of the metal rod is frequently enough to change the load of the antenna so that the transmitter stops. This is inconvenient at times but as soon as the transmitter is lifted off the pad and away from the launch rod, the transmitter will start right up.

Sources of Parts for the Transmitter

The parts for the Model Rocket Transmitter and its associated sensor modules are available from three large mail-order firms. The catalogues of all three firms are necessary to build the project, but they can be obtained by simply writing. The addresses are:

Allid Radio
100 N. Western Ave.
Chicago, Ill. 60680

Burstein-Applebee
3199 Mercier St.
Kansas City, Missouri 64111

Lafayette Radio
111 Jerico Turnpike
Syosset, L.I.
N.Y. 11791

****

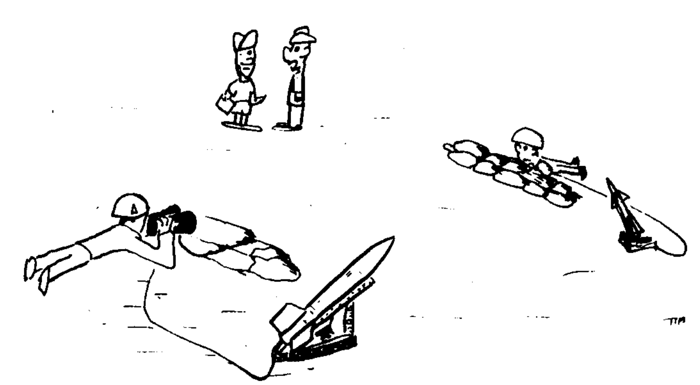
Model Rocketry Magazine has received a number of letters from people who indicate that they have no experience with electronics but that they would like to build the transmitter. They request that Model Rocketry print a pictorial diagram of the transmitter construction. Unfortunately, the response we have received indicates that people who are experienced with electronics are not always completing the transmitter without some trouble, and it would seem that publishing such a pictorial article would only create a large number of non-operational wastes of money. Those model rocketeers who are sincerely interested in building the transmitter should contact someone in their area who is familiar with electronics for assistance.

Modifications

Some readers have proposed modifications to the transmitter circuit. The most common proposal is the replacement of the three transistor Darlington audio amplifier with a single transistor or with an integrated circuit, as described in the October *Technical Notes.* The three transistor circuit was used because of its extremely high gain and because of its superior performance over single transistor modulation circuits. There are some integrated circuits on the market which can do the same job as the three transistor circuit and do it in a much smaller space, however one of the objectives of this project was to use only inexpensive, readily available components and the integrated circuits needed do not fall in this classification yet.

Model Rocketeers are encouraged to experiment with the design and to send any suggestions to me in care of Model Rocketry.

This article is the last in the series on the construction of the transmitter and its associated sensors. It is hoped that this series encourages some origional work in the area of instrumenting model rockets and hopefully produces some more articles for Model Rocketry Magazine. How about write-ups on the results of science fair projects based on the transmitter and how about proposals for additional sensors? One possibility that needs development is a pressure sensor that can be used either as an altimeter for model rockets or as a device for measuring the barometric pressure changes in the first 1000 feet. The trick is to develop a small light weight pressure sensor which does not have to be recalibrated after every flight. How about it?



"They're both top contenders for the space-systems event."


Are you interested in

Estes Featured on NBC TV

A humorous treatment of the model rocket industry was featured on the NBC *First Tuesday* television broadcast on September 2. The segment, filmed at the Estes Industries plant in Penrose, Colorado, showed scenes of a scale model Saturn liftoff, the new Estes Mars Lander, and the company's new engine test stand. Using special effects produced by wide-angle lenses as well as unusual background music, the broadcast brought the hobby of model rocketry to the attention of the NBC network's large prime-time audience.

Setting the tone of the broadcast, NBC correspondent Sander Vancour likened the model rocket industry to the "military-industrial complex" as the screen showed scenes of the "Restricted Area" and "Secret" signs on fences surrounding the Estes plant. Continuing in this humorous vein, Vancour remarked "toy making is an example of the spreading claok and dagger mentality. Security is tightened on the excuse that industrial espionage and personal safety demand it."

Films from the new Estes CINEROC movie camera, illustrating the spectacular results obtainable from model rocket instrumentation, were screened for the TV audience.

"One of the most interesting things about our business here," Vern Estes pointed out during an interview, "is the number of rocket engines we've produced. Just recently we tabulated this, and we find that we have made over 24 million engine units. We believe this to be the largest number produced by any manufacturer anywhere in the world."

This ten minute feature introduced the hobby to a large number of people previously unfamiliar with model rockets.

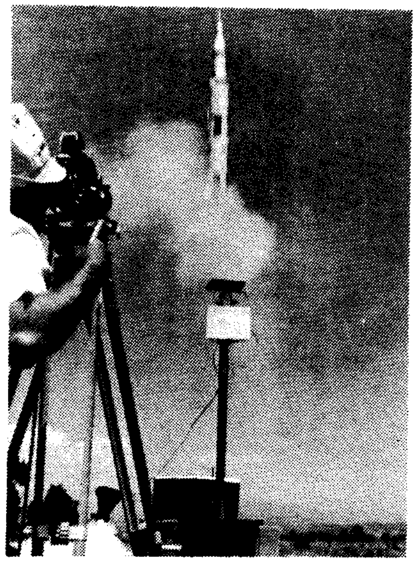


Photo for Estes
by Mike Dorffler

Estes Industries scale model Saturn-V lifts off for an NBC cameraman during filming of a segment of the NBC First Tuesday program.

SAI Acquires USAF Falcon

Tag Powell, President of Space Age Industries, examines a Falcon air-to-air missile on loan from the US Air Force. The missile, seen on display in the Mini-Wheels Hobby Shop in Highland Park, New Jersey, was obtained as a source of scale dimensioning data for the new SAI Falcon kit. The Falcon kit, not to be confused with the demonstration model semi-scale Falcon presently available from Space Age Industries, is expected to be available from hobby shops later this year.

NEWS

ESTES MERGES WITH

Vernon Estes, President of Estes Industries, Inc., Penrose, Colorado, has announced that the Estes Firm has joined the Educational Division of Damon Engineering, Inc., Needham Heights, Massachusetts. The transaction was completed on Saturday September 27th by the exchange of the Estes interests for an equivelant value in Damon Engineering stock.

Estes Industries, pioneer in a safe form of non-professional rocketry, is the world's largest manufacturer of model rockets and associated educational products. Damon Engineering's Educational Divis designs and manufactures apparatus and material compatable with the new science courses being developed by leading educators.

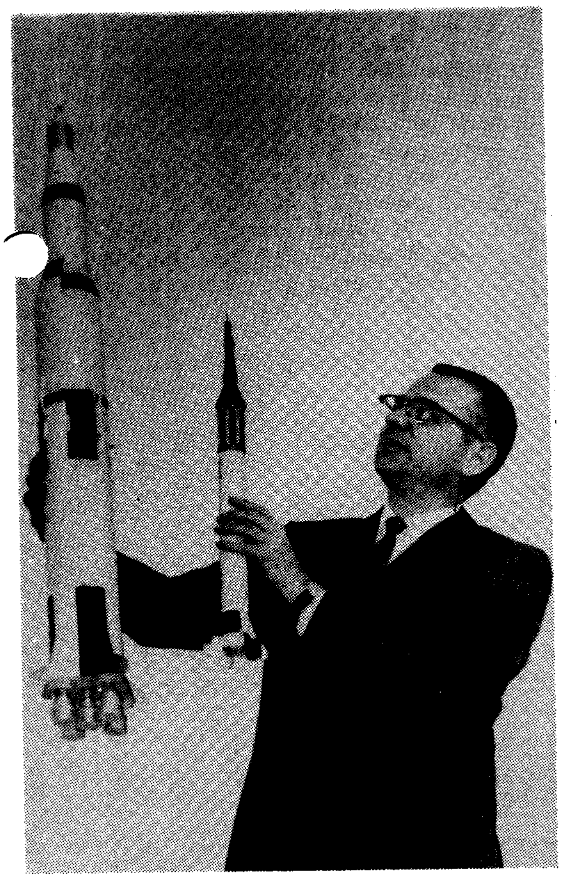
Vernon Estes will remain as President and General Manager of the Estes Division, and no changes in the operations staff are planned "The Estes-Damon merger," Vern Estes reassures rocketeers, "is not expected to change any of the basic policies, programs, or model rocket products in our line."

The merger assures Estes Industries of the ability to meet financing needs for the rapid expansion necessary to maintain its dominant position in the model rocket market. Present plans call for construction of a new woodworking shop which will triple the present capacity. A new propellant plant will soon be under construction, and work on additional engine manufacturing facilities will be started. New facilities for the rocket engine packaging operation are also planned. A new shipping facility will be designed and constructed to handle orders more efficiently.

While the Estes model rocket product line will not be affected, the merger will add a new line of scientific- educational products to the Estes line. "Many of the products now marketed by Damon to the school market for science experiments in the classroom," Estes believes, "would also be ideal for the home experimenter who is learning on his own, or for use in Science Fair projects." Such items as equal arm balances and wind velocity gages will be of special interest to rocketeers. It will also make model rock materials more available to educational progra through Damon's marketing connections.

NOTES

DAMON ENGINEERING



The already extensive new products development program at Estes Industries, which has produced the Camroc single exposure rocket camera and will introduce the Cineroc aerial movie camera in 1970, will be accelerated. Emphasis will continue on imaginative and innovative products which teach rocketry principles to rocketeers who build and fly Estes models.

GUEST EDITORIAL

(The following is an Editorial on Range Safety which appeared in the Jan. 25, 1969 edition of LIFTOFF, *the official publication of the Waynesburg Assn. of Rocketry.)*

Range safety has affected all of us, either favorably or adversely. When we were individual rocketeers, safety didn't mean as much because only *we* were in jeopardy. But with 30 or more people buzzing around the launch site, range safety must be our ultimate consideration. Just because our NAR insurance covers each of us for $300 000 doesn't mean a thing, because one, just one, infraction of the safety regulations will invalidate all of our insurance.

If you break a rule and there is an accident, you put not only yourself in jeopardy but others also, along with model rocketry itself. If a serious accident should occur, the authorities would probably move to abolish model rocketry, at least as we know it today.

So the editors of LIFTOFF (Chris Wunder & John Dulane) propose to levy fines for safety code violators. This, we hope, will make everyone more conscious of range safety.

Model Rocketry has an excellent safety record with over 4,000,000 launches since 1957 without a mishap.

So please don't break the rules and ruin model rocketry for everyone else. I have no ambition about going back to *airplanes!* YUK!

(Editorial written by Charles C. Wunder)

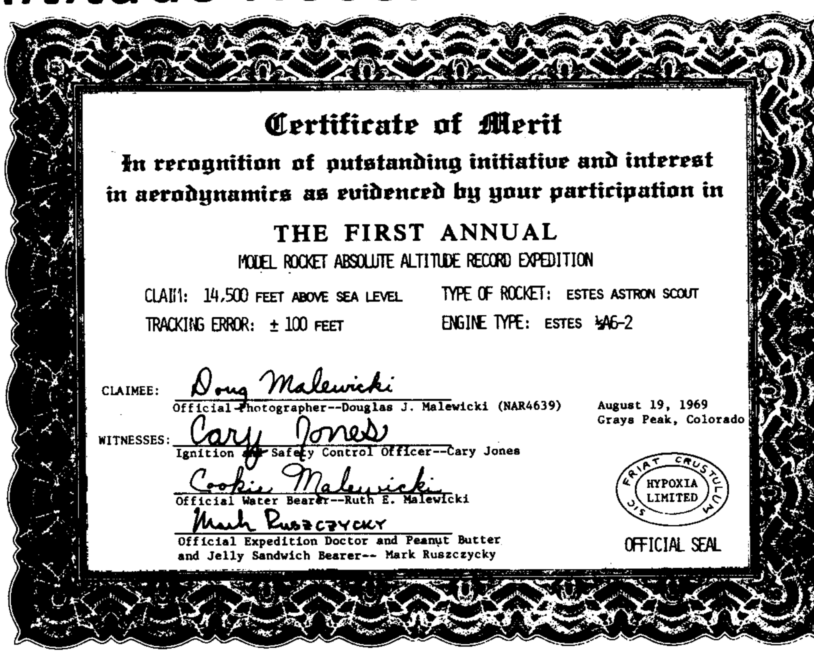
Cheltenham PA Bans Model Rockets

The Cheltenham Township Pennsylvania fire marshal, Owen P. Adams, has urged a crackdown on model rocketry in his area. Recently he has been collecting model rocket supplies for sale at local stores and by mail order. He appeared at a meeting of the Cheltenham Public Safety Committee to point out the safety hazards these rockets pose for local residents. Adams told the committee that, while it is illegal under Pennsylvania state law to sell model rocket engines, these supplies can be purchased at almost any hobby shop in the state.

Commissioner Robert H. Fritz substantiated the seriousness of Adams' report. He told the committee of one family which has been repeatedly frightened by explosions. "Each time they call the police and our men are there right away but even the short lapse of time is enough for the culprit to escape. These people are terrified that their house will be set on fire."

On the basis of Adams' recommendation, the Township Manager was authorized to contact state representatives to urge their consideration of ways to increase the effectiveness of these laws.(From the Jenkintown Times–Chronicle)

Altitude Record Established



Certificate of Merit

In recognition of outstanding initiative and interest in aerodynamics as evidenced by your participation in

THE FIRST ANNUAL

MODEL ROCKET ABSOLUTE ALTITUDE RECORD EXPEDITION

CLAIM: 14,500 FEET ABOVE SEA LEVEL — TYPE OF ROCKET: ESTES ASTRON SCOUT

TRACKING ERROR: ± 100 FEET — ENGINE TYPE: ESTES ½A6-2

CLAIMEE: Doug Malewicki
Official Photographer--Douglas J. Malewicki (NAR4639)

August 19, 1969
Grays Peak, Colorado

WITNESSES: Cary Jones
Ignition and Safety Control Officer--Cary Jones

Cookie Malewicki
Official Water Bearer--Ruth E. Malewicki

Mark Ruszczycky
Official Expedition Doctor and Peanut Butter and Jelly Sandwich Bearer-- Mark Ruszczycky

FRIAT CRUSTULUM SIC — HYPOXIA LIMITED

OFFICIAL SEAL

See full story on next page.

World Heigth Record

by Douglas Malewicki

Contrary to most everyone's intuitive feelings *it is not impossible* for a single stage ½A6-2 powered rocket to reach 14,500 feet above sea level. This indeed would be impossible (as suspected) if the rocket *was launched* initially from sea level but this one lifted off from the top of Grays Peak in Colorado which is already 14,270 feet above sea level itself.

At first glance 14,500 feet with only + 100 feet on a net altitude of 230 feet which means my calibrated eyeballs say the rocket reached somewhere between 130 feet and 330 feet above the mountain top – fair enough?

Ever since Estes TR–10 on Altitude prediction was published in 1967, I have been waiting to hear of someone launching off of a mountain top to claim an "absolute" record. In that report I mentioned the performance improvements that could be obtained by launching from Pikes Peak (Elevation of 14,110 feet above sea level) due to reduction in atmosphere density and resulting aerodynamic drag.

No one ever bothered, so with NARAM–11 being held at Colorado Springs, Colorado the idea became an irresistable way to spend the remainder of the weekend after the meet was over. As soon as the NARAM–11 Awards Banquet ended my wife and myself joined my friend Mark Ruszczycky for a quick drive to and then 60 miles west of Denver in hopes of establishing a base camp before dark. Mark has a master degree in Aeronautical Engineering, is presently enrolled at Colorado Universities Medical School and has his eyes on a career in aerospace medicine and bio-engineering. We, of course, promptly drafted him to be the official expedition doctor.

Needless to say we didn't arrive till after dark. We just parked the car at the first reasonable spot, then hauled out and crawled into our sleeping bags. The stars and Milky Way at our base camp altitude of 10,000 feet were really intense and beautiful. Before dozing off I saw three shooting stars and one tumbling satellite.

We all got up on Saturday at the crack of dawn and immediately deduced that the campsite we selected was amidst an old garbage dump. Since the gold miners of the area abandoned the nearby mine shafts some 20 years ago it wasn't really that bad. By the time we moved our campsite, finished breakfast and started hiking up the mountain it was 8:30 A.M. We reached the top of Grays Peak about 1 PM and after some rest began preparing the Astron Scout, which was kindly donated for the purpose by Bob Cannon, the Education Director of Estes Industries, for the momentous launch.

Several Boy Scouts were already at the top and one of them, Cary Jones of Denver, immediately recognized the rocket. Cary volunteered to count down and electrically launch the Scout for us so I could get a nice liftoff picture. I clicked the shutter too soon and before I could recock the camera–off went the Scout–a white streak of smoke against a deep blue sky. It then tumbled back down, hit the rock strewn side of the mountain and bounced several times before finally stopping.

It took a good five minutes to find the record setting bird and it was now missing two fins which further searching did not discover. Meanwhile several stragglers of Cary's Boy Scout troop appeared from a bend in the trail going full bore (or whatever you call its thin air gasping equivalent) with their first aid kits in hand yelling "We saw your flare– who needs to be saved?" Much to their disappointment we stated we already had religious affiliations and that they really needn't bother.

After a delicious peanut butter and jelly sandwich lunch and a bit more rest we started down Grays for an attempt at Torreys which is 14,267 feet above sea level. We reached that summit at 3 PM for another spectacular view of the world below. Due to the previously sustained rocket damage we could not get off another launch as originally planned.

After much too short of a rest we started down again because it began snowing on us – in August no less! We were lucky though, as the snow bearing cloud passed beyond us in about five minutes. We were

Doug Malewicki and Cary Jones–ready for launch.

Post recovery, less two fins. (Clockwise: Cookie Malewicki, Cary Jones, Doug Malewicki, and Mark Ruszczycky.

Magnificant Desolation—after 2½ hours of thorough scientific exploration it was concluded that this planet is uninhabitable.

also rained upon later but it was fairly light so no one got soaked.

We were back at our base camp by 6 PM (Its a lot faster going down than up) and after checking our topological maps estimated that the entire trip covered approximately nine miles. We roughed it that evening with a dinner consisting of Beef Straganoff, Wine, etc. The real rains came shortly thereafter and we sat in the car till 10 PM hoping it would quit. We finally gave up on the idea of exploring some of the abandoned mines the next morning after a second night under the stars and disgustedly drove back to Denver--to spend the night in our sleeping bags on Marks living room floor. That sure was nice and warm compared to sleeping outdoors at 10,000 feet.

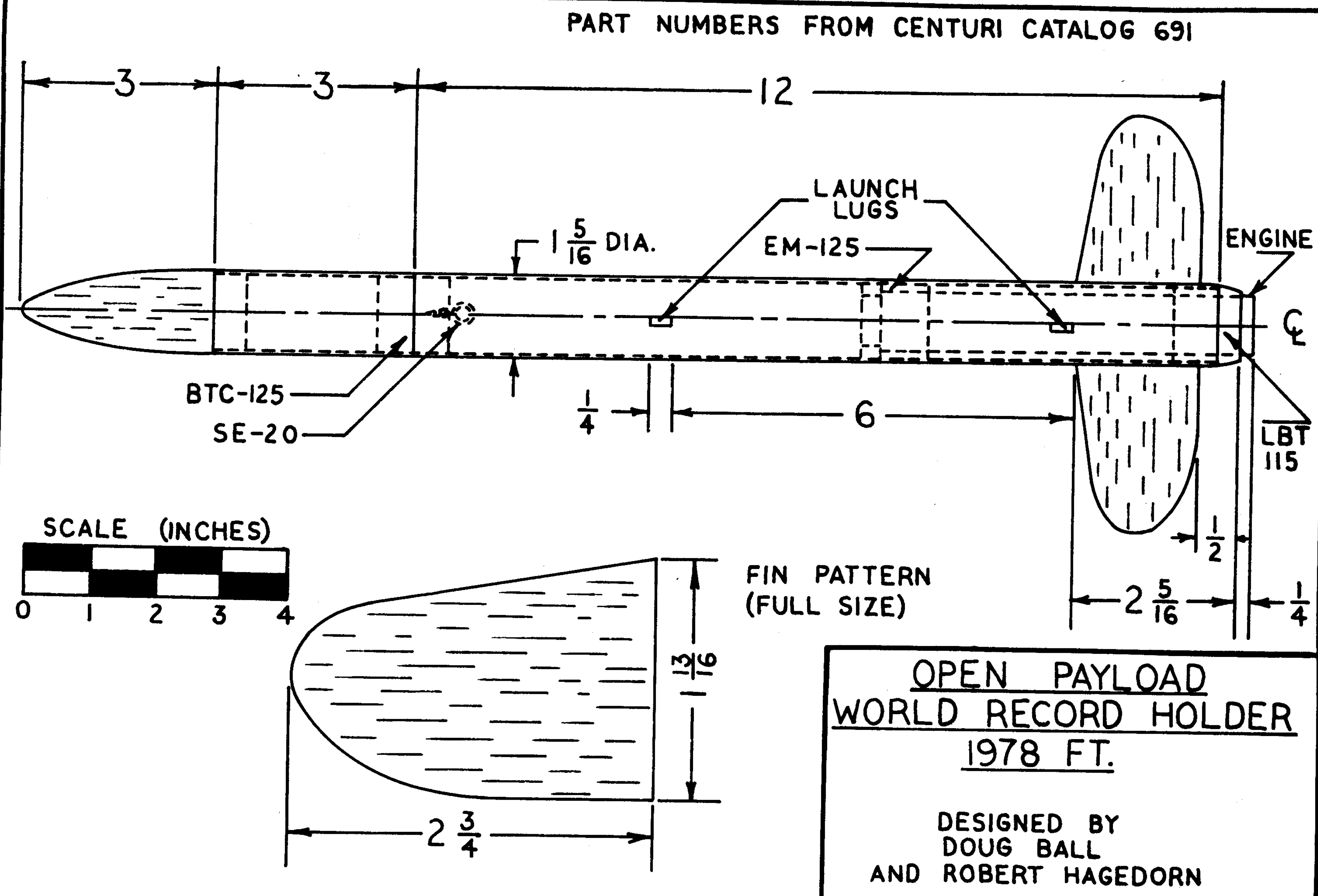
Future Altitude Records

In order to encourage the achievement of future model rocket absolute altitude records, I am more than willing to give similar Certificates of Merit bearing the "official" Hypoxia Limited Organization Seal for those who send me the relevant details of their own expeditions in care of **Model Rocketry** magazine. Rules for qualification will be: 1) Electrical Ignition as per usual model rocket practice is required. 2) The rocket *must be* recovered. 3) The rockets altitude must be tracked. However, until light weight theodolites are developed or theodolite bearers are cajoled—calibrated eyeballs will be acceptable *when backed up* with a reasonable theoretical performance prediction analysis. 4) Some photos (black and white or color) *must* be included in the claim. 5) Two or more witnesses must also sign the record claim. A record will exist in each standard NAR Total Impulse class. At present, I feel the ½A record we established should hold at least until next summer mostly because by the time this article appears all the good mountains will be covered solid with snow at the upper elevations. If you Colorado rocketeers are thinking of simply driving to the top of Pikes Peak, my 14,500 feet ½A record will probably still remain intact. Pikes Peak is only 14,110 feet above sea level so you will have to squeeze an extra 160 feet from your ½A bird to reach a true 14,500 as compared to launching from 14,270 feet. Of course, the ¼A and other class records can be quite easily set from Pikes Peak even though just driving up is really not in the spirit of the idea.

A few hints are in order at this time First, the winds are pretty nasty on the top of most mountains. If you use a large engine in hopes of achieving more altitude, you'll probably lose the rocket—especially if you use any kind of chute recovery system. Second, its cold up there—the Standard Atmospheric Variation tables show that a 50 degree difference in temperature exists between sea-level and 14,000 feet. Third, the air is thinner and you'll find you need to take a thirty second breathing rest after every 25 steps uphill. This, of course, depends on your own personal physical condition— some well trained and acclimated characters jog all the way up mountains non-stop. At 14,000 feet you have left 40 per cent of the earth's atmosphere (and 99.9% of the pollution) below you. Fourth, the Sun's rays have that much less atmospheric filtering and sunburns are that much more probable. Sunglasses and plenty of suntan lotion is helpful.

If you have any specific questions, write me in care of the magazine. If you ever happen to be taking a tour thru Estes Industries you can ask to see the present 14,500 foot Astron Scout Record Holders remains in their Mini—Museum where it now rests in peace.

In case you're wondering—yes, everyone but Mark (who had climbed two other 14,000 foot peaks in the last month) had a blister or two by the time we finished.



<u>OPEN PAYLOAD</u>
<u>WORLD RECORD HOLDER</u>
<u>1978 FT.</u>

DESIGNED BY
DOUG BALL
AND ROBERT HAGEDORN

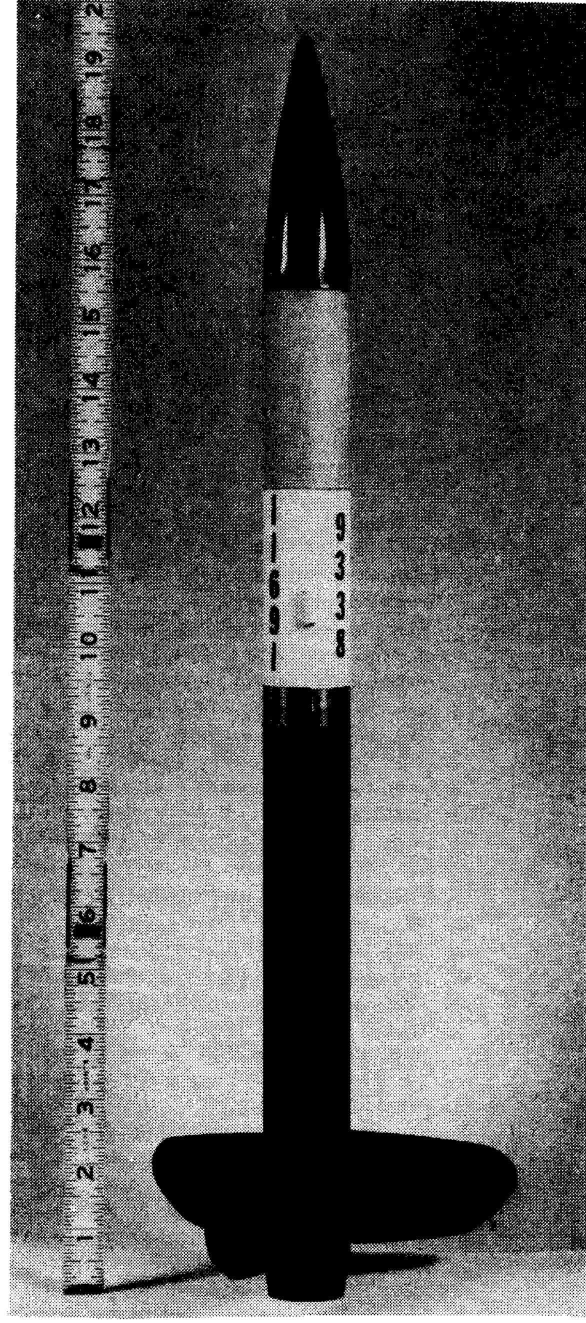
Ball-Hagedorn Payloader

Build Your Own

World Record

Payloader

by Robert Hagedorn



General Information

Before taking on this project you should have built and flown payload models and models powered by the more powerful "F" series engines. I might mention at this time the added weight of many coats of sanding sealer, filler and paint is outweighed by performance and in the end you will achieve a much greater altitude.

Tools Needed

1. sharp modeling knife
2. file or grinder
3. ruler
4. pencil
5. a very good wood glue
6. sandpaper (fine and extra fine)
7. balsa filler
8. paint

Materials Required

LBT–115A body tube
LT–125A payload section
EM–125 engine mount
BTC–125 balsa coupler
BC–125A nose cone
SE-20 screw eye
1/8" sheet balsa
TC–36 shock cord
CP–16A parachute
SR–12 reinforcing material

Note: all above items available from Centuri Eng. Co. piece of styrofoam 1¼" O.D. by ¾" T.D. by 2" long

Step by Step Construction

1. cut LT–125A body tube to a length of 12" long 2. cut slot in engine mount, tie shock cord on mount with knot in front of mount, glue in engine mount so that rear of thrust ring measures 5¼" to rear of body tube 3. cut LBT–115 to length of 1" and glue in same end of body tube as engine mount with 5/16" protruding beyond body tube and set aside to dry 4. cut LT–125 body tube to length of 3" for payload section 5. sand nose cone to take all flatness out of tip of nose (do not sand to sharp point) 6. trace fin design on paper and cut out, trace again on 1/8" sheet balsa (make 3) cut out the 3 fins and slightly round leading and trailing edges (do not round root edge) 7. now is the time to seal balsa and body tubes, seal nose cone and fins at least 4 times and body tube and payload section at least 2 times (sand after each sealing) 8. file, sand or grind boat tail on rear of body tube starting ¼" from end of LT–125 body tube to 0 on end of LT–115 body tube, seal and sand at least 2 times 9. mark on body tube the location for the three fins and 2 launch lugs, take a sharp knife and cut off the first layer of paper on body tube where the fins and launch lugs are glued on, this is to assure you a good glue joint, glue on the three fins and 2 launch lugs taking your time as this step is important 10. after glue has dried cut 6 pieces of reinforcing material ½ by 1" and attach to fins and body tube by putting on white glue with paint brush 11. after glue has dried you are ready to paint the color of your choice, I recommend flat black from bottom of rocket to bottom of payload section, fluorescent read on payload section and gloss black on nose cone, paint on white strip 2" wide under payload section and attach sliver strip of mylar ½" wide below white strip.

Preparation for Launch

This model was built for use with F-100-8 engines and 4 oz. of weight in payload section, use only these items as the rocket will not be stable without them, make the 16" chute and attach to screw eye, cut shock cord to length of 18" beyond top of body tube and attach to screw eye, glue screw eye into blasa adaptor you are now ready to load and fire, put at least 4" of wadding in body tube and pack parachute and shock cord push adaptor down 1" into body tube, put 4–1 oz weights in styrofoam tube and insert into payload section put nose cone on payload section and attach to other end of balsa adaptor (you may have to put wadding in payload section to take up some room) insert engine (make sure it is tight by wraping it with masking tape, insert ignitor and you are ready to fire.

Boost/Glide Payload Event Flown

Washington Championships

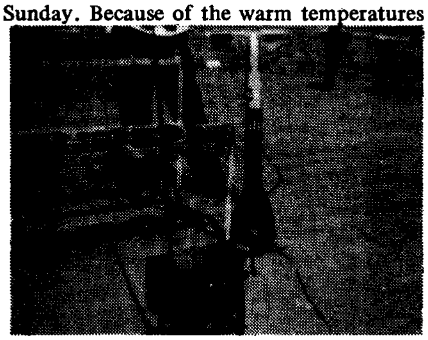
August 2-3, 1969
Spokane, Washington

by James C. Worthen

On August 2 and 3 over seventy-five rocketeers from around the state of Washington gathered in Spokane for the First Annual State Model Rocket Championships. This is the second year that a statewide meet has been held in Washington, but the first year under the direction of the Washington State Model Rocket Association. WSMRA was formed on February 15, 1969, for the purpose of furthering model rocketry in Washington State. Membership in this, the first statewide organization in the country, now numbers in excess of two hundred members. It is the desire of the Association to coordinate the model rocket activities throughout the state and enable the membership to engage in meaningful and challenging competition with each other.

The launch site for this year's state championships was a large open grassland area in the northern part of Spokane. The area, quite flat with evergreens around the perimeter, is the launching site of the Nova III club of Spokane, this year's host club. It is equipped with permanent launch facilities including a launch rack set in concrete, guard rail and posts also set in cement, and buried communication line to the tracking stations. The site is also equipped with a heavy timber barricade left over from the days of "basement bombers." With these launch facilities plus some other arrangements necessary to handle the crowds, the launch site was quite adequate for our State Championship Meet.

Weather conditions were ideal, with a clear blue sky and warm temperatures. The only weather problem encountered was a ten to fifteen knot wind that came up Saturday afternoon and prevailed most of Sunday. Because of the warm temperatures



Mark Dierks' RC rocket

(90 to 95) the fire danger was extreme, as we found out later Saturday afternoon.

This year's contest director, Mike Aronson of Spokane, along with WSMRA Vice President Eric Vannice of Seattle, and WSMRA Secretary Treasurer Al Hassell of Centralia did a masterful job on the organizing and running of the competition.

The competition began about 9:30 A.M. Saturday with Class I (total impulse to 5.0 nt/sec) and Class II (total impulse to 10.0 nt/sec) Altitude events. Both events showed just how keen and tight the competition for the whole meet was going to be.

The winner of Class I was Orin Pierce with an altitude of 1580 feet. Second place went to Joe English, and the third spot was won by Steve Watson with altitudes of 1430 feet and 1260 feet respectively. All three of these boys are Junior members from Vancouver.

The winner of Class II Altitude with an impressive 2640 feet was Lew Walton of Seattle. This win turned out to be the first of two wins for Lew and the first of six wins for Seattle Area rocketeers. Second place in the Class II Altitude event was Gil Haines with an altitude of 2160 feet and third place went to Bob Michener for his altitude of 1870 feet.

Set Altitude was the next event to be run. The judges selected out of a hat the altitude of 500 feet. Each contestant then chose the model and engine of his choice that he felt would come closest to the Set Altitude. First place trophy for this event went to Tom Medina of the South Seattle Rocket Society with an altitude of 510 feet. Second place went to Joe English with an altitude of 470 feet and Mike Dunning won third place by sending his rocket to an altitude of 448 feet.

The fourth event of the day and final flying event was Payload Altitude. According to the rules for this event each contestant was restricted to one B14-5 engine. The event was dominated by the members of the Nova III club of Spokane, who captured four of the top five altitudes. The event was won by Rick Meikle with an excellent 860 feet. If you don't think that is a good altitude, load up your Pee Wee Payload bird with a B14 and see if you can hit 800 feet!

The Payload Altitude event was just finished when the word we had been dreading to hear and praying that we would not hear came over the public address system—"FIRE!"

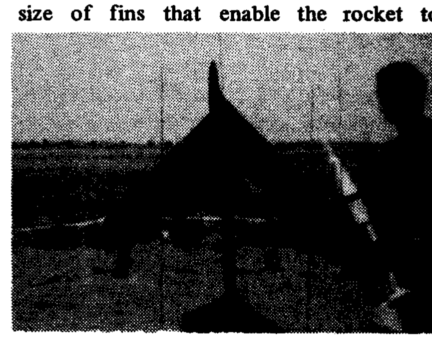
About one hundred yards down the recovery area a fire of undetermined origin had broken out. As I mentioned before, we were in a grassy area that was exceedingly dry. The heat combined with the wind made the fire impossible to stop.

Although we had three CO_2 fire extinguishers, wet gunny sacks, and shovels, the hundred or so of the contestants and spectators were unable to even slow it down. The only thing that prevented it from turning into a disaster for us was a road which cut right across the main path of the blaze. A word to the wise to anyone launching under similar fire hazard conditions, CO_2 fire extinguishers are of no help whatever in a wind driven grass fire.

By the time everyone returned to the launch area, rested, and got something to drink, we had pretty much lost our enthusiasm not to mention the fact that we were all near sheer exhaustion.

We wound up Saturday's competition with the Research and Development entries. This event was won by Mark Dierks from Richland, Washington. His entry was a radio controlled launch stand combined with a transmitter carrying rocket. The transmitter in the rocket was hooked to a G force gauge and transmitted the data back to a receiver and a graph read out. Mark has spent much time on this project and it shows great promise.

Second place in Research and Development went to Lew Walton of Seattle for his work with a collapsible parawing glider. While building the rocket to carry the glider, Lew hit on just the right length of tube and size of fins that enable the rocket to



Mike Underwood's Payload B/G

actually glide after ejection.

Third place went to Jess Medina of Seattle for his work on a "variable geometry" boost glider. While the glider still has a few bugs to be worked out, it shows that it might be possible to adapt a "swing-wing" configuration to our boost glide event. Although swing-wing designs have had their problems other places such as the Boeing SST and the F-lll.

Another Research and Development project showing some thought was a "no rod" launcher by Richard Dierks. His idea stemmed from a challenge from his adult coordinator Gene Wooley. Richard's idea was that on a calm day, a "no rod" launched rocket would consistently beat a rod launched rocket and Gene said it would

2nd WSMRAC Results
August 2 & 3, 1969

ALTITUDE – CLASS 1
[0.01–5.00 nt.–sec. total impulse]

1st	Orin Pierce	CMRC	1580 ft.
2nd	Joe English	CMRC	1430 ft.
3rd	Steve Watson	CMRC	1260 ft.

ALTITUDE – CLASS 2
[5.01–10.00 nt.–sec.]

1st	Lewis Walton	BERRS	2640 ft.
2nd	Gil Haines	CMRC	2160 ft.
3rd	Bob Mitchener	NOVA	1870 ft.

ALTITUDE – CLASS OPEN
[10.01–80.00 nt.–sec.]

1st	Mike Underwood	RMRS	3800 ft.
2nd	Gil Haines	CMRC	2660 ft.
3rd	Jess Medina	SSRS	2480 ft.

SET ALTITUDE
[500 feet]

1st	Tom Medina	SSRS	510 ft.
2nd	Joe English	CMRC	470 ft.
3rd	Mike Dunning	NOVA	450 ft.

PAYLOAD
[Single–stage, B–14 engine, NAR payload]

1st	Rick Meikle	CMRC	860 ft.
2nd	Joe English	CMRC	750 ft.
3rd	Bobby Rile	NOVA	720 ft.

SPOT LANDING
[Single–stage, one engine, unlimited recovery]

1st	Tom Medina	SSRS	24.5 ft.
2nd	Bobby Rile	NOVA	27.0 ft.
3rd	Gene Wooley	RMRS	31.6 ft.

PARACHUTE DURATION
[Open]

1st	Jim Worthen	BERRS	27:00 min.
2nd	Bobby Rile	NOVA	8:00 min.
3rd	Gil Haines	CMRC	6:22 min.

BOOST/GLIDE DURATION
[Open]

1st	Lewis Walton	BERRS	91 sec.
2nd	Gil Haines	CMRC	66 sec.
3rd	Tom Medina	SSRS	62 sec.

BOOST/GLIDE PAYLOAD
[NAR payload]

1st	Mike Underwood	RMRS	43 sec.
2nd	Lewis Walton	BERRS	22 sec.

RESEARCH & DEVELOPMENT

1st	Mark Dierks	RMRS
2nd	Lewis Walton	BERRS
3rd	Jess Medina	SSRS

CRAFTSMANSHIP

1st	Jim Worthen	BERRS
2nd	Roger Case	CMRS
3rd	Al Hassell	NOVA

CHAMPION ROCKETEER

Lewis Walton BERRS

CHAMPION CLUB

Columbia Model Rocket Club

KEY

BERRS – Boeing Employees Rocket Research Society – Seattle, Washington

CMRC – Columbia Model Rocket Club – Vancouver, Washington

CMRC – Campus Model Rocket Society – Seattle, Washington

NOVA – NOVA III – Spokane, Washington

RMRS – Richland Model Rocket Society – Richland, Washington

SSRS – South Seattle Rocket Society – Seattle, Washington not. While a "no rod" launcher has advantages in considerably reduced drag with no launch lug and no drag on launch rod, the disadvantages of not being able to launch in any kind of a breeze or launch marginally stable rockets defeat the purpose of launching without rods or towers.

With the conclusion of the judging on Research and Development the day's activities came to a close. Members of the Nova III club spent both Friday and Saturday nights camped at the launch site in an effort to discourage vandals and prowlers from disturbing any of the many things that had been set up for the two days of competition. Some of these things included chemical restroom facilities and two booths, one for the range store and one for the manufacturers' displays.

The range store had everything from kits and engines to ice cold pop and ice cream bars. They also had a few back issues of Model Rocketry for sale. The other booth housed the displays of Centuri Engineering Company and Estes Industries. Both Col. Bruno Larson of Centuri and Norm Avery of Estes Industries. Both Col. Bruno Larson of Centuri and Norm Avery of Estes were there and graciously concented to being two of our judges.

Sunday proved to be much more interesting and exciting in terms of the unexpected actually happening. The first event was Parachute Duration which was open as far as total weight and impulse limitation. The event started out with three, four, and five minute flights which appeared to be the trend. Then yours truly fired his rocket to about 400 feet where a 48" diameter aluminized mylar parachute blossomed out. It landed some 27 minutes after take-off and some five miles down wind. I almost did not find it. Second place was won by Bob Rile of Spokane with a flight of eight minutes, and third place went to Gil Haines for a time of 6.22.

The next event that was flown is one that I do not believe has ever been tried before–Payload Boost Glide. The name is quite self explanitory. The object being to build a boost glider capable of carrying one NAR-FAI Standard payload. There were only four entries and two of those were disqualified do to malfunctions. One lifted ten feet in the air and pitched over coming in under power. The other flew well under power but was not balanced for glide.

The other two entries were specifically designed for the event and did fairly well. First place went to Mike Underwood with a forty-three second flight. Lew Walton took second place with a twenty-two second flight.

Boost Glide Duration, which followed Payload Boost Glide, turned out to be somewhat of a demolition derby. A number of rockets did not even make it into the air before disintegrating, while others made it into the air but failed to function properly and either crashed prior to ejection or did not glide very well. Yours truly fell into the last category by staying in the air a full eight seconds. When it was all over and the dust had cleared, Lew Walton garnered his second First place finish of the meet with a time of 1:31. This win also gave Lew an insurmountable point total of 350 towards the Champion Rocketeer Title. Second place went to Gil Haines with a time of 1:06. Third place in Boost Glide went to Toni Medina with 1:02, just beating his father, Jess who placed fourth with a time of 1:01.

Our next event brought out just about as many varieties of models as you could imagine. Open Altitude had only two requirements–1) The rocket could not weigh more than 454 grams (16.0 oz) which is a Washington State Law, and 2) That it be returned to the judges after the launch. The type of models varied from single stage "F" power birds to sophisticated three stage models powered by a B-14 booster with two C6's stacked one on top of the other.

The winner in Open Altitude was Mike Underwood with a flight to 3870 feet. Mike used B14, C6, C6 combination. Second place went to Gil Haines by sending his rocket to an altitude of 2660 feet. Jess Medina captured third place with a 2480 feet flight.

Spot landing was the final flying event of the meet and had twenty-three entries, the most of any event. The entry landing closest to the spot belonged to Toni Medina. This win was the second First place finish for the Medina family who had traveled all the way across the state in force. Toni's model landed only 24 feet 6 inches from the target.

Jess Medina and his four sons and one daughter have been very active in model rocketry over the last two or three years. The Medinas are involved with the South Seattle Rocket Society, the largest club in Seattle. A constant support to the Medina rocketeers is wife and mother Mrs. Delores Medina. The Medinas entered at least one person in every event at the State Meet and in most events there were several family members competing. This family's participation in both the WSMRA Northwest Regional Competition as well as the State Meet earned them a special "Certificate of Recognition" from the Contest Director.

The final event of the meet was Craftsmanship. The original plans for this event had included that any rocket entered in Craftsmanship must make a stable flight, but since the wind was high and the time was slipping away from us, it was decided to make Craftsmanship strictly a static display event.

Eric Vannice, WSMRA Vice President acted as third judge along with Col. Larson and Mr. Avery in judging the Craftsmanship entries. As was my good fortune in locating my parachute duration model, my entry was judged to be First in Craftsmanship. There were some beautiful entries and I certainly feel lucky to have won that event.

There were two manufacturer demonstration flights on Sunday. One was a flight of the Estes Saturn V powered by their new "D" class engine. The engine provided adequate power for a good flight and appears to be one good solution to flying the large scale models without the risk involved in launching them with clusters.

The other demonstration flight was the new five pulse engine currently being tested by F.S.I. The engine has five separate thrust stages built into one "E" engine casing with slight delays between each stage. The engine funtioned properly and made a good flight to about 1200 feet. While at this time the engine does not appear to be competitive, the flight was impressive and as with all FSI engines, very realistic.

While the Northwest Region (Seattle) took first place on a regional basis, Columbia Model Rocket Club of Vancouver, Washington (just north of Portland) placed first in club competition. They had one First place finish and an incredible seven second place finishes out of eleven events. The host club, Nova III, finished second and the Boeing Employees Rocket Research Society of Seattle placed third.

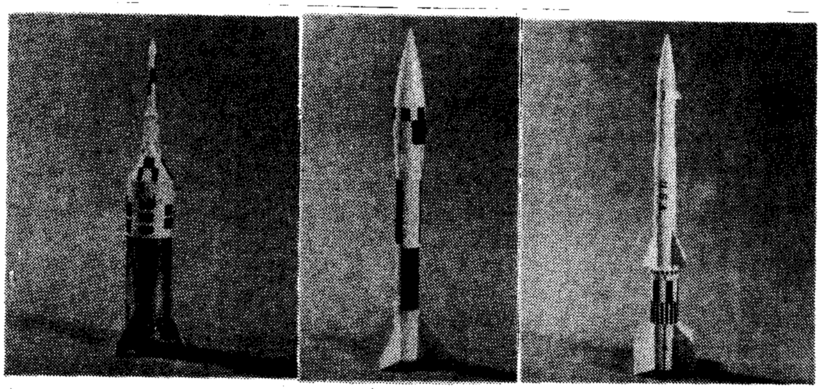
Lew Walton, an aeronautical and astronautical engineer for The Boeing Company captured the Champion Rocketeer trophy by winning two events and placing second in two more.

By doing some calculating we found there were over two hundred rocket flights made during the two days, and over one hundred were tracked for altitude. The tracking was done with some modified altiscopes developed by Geroge Palmer, President of Boeing Employees Rocket Research Society. They used the closed circular tube around a protractor with a screw type lock device rather than a lever. This is mounted on a rifle type stock rather than a small hand held piece of material. A bazooka sight is used rather than a nail and screw eye for sighting. While not having an azmuth reading, using three trackers and taking an average we were able to get some reliable data.

This year's State Championships was a real experience for everyone from around the state. Hats off to the Nova III club and Contest Director Mike Aronson for a job well done.

Next year we hope to be able to get some support from the hobby stores from around the state and break the competition into two age group divisions, Senior-Leader and Junior. This will enable a few more Senior members to get trophies and the Junior members will not feel that they are competing against the "Pros." Of course we should point out that Junior members won seven of eleven first place trophies, and twelve of twenty-two second and third plac prizes.

New Product Notes



The first members of the new Cox rocket line are (left to right) The Little Joe II, Honest John and Nike-Zeus. All rockets are molded in plastic and will be available in ready-to-launch as well as kit form.

The L.M. Cox Manufacturing Company, long known for their model airplanes and engines, will introduce a line of model rocket products later this month. The rockets, all replicas of NASA and military launch vehicles, are molded in plastic and will be offered both ready-to-launch and in kit form. The first three Cox models will be the Little Joe II, Honest John and Nike-Zeus.

The Little Joe II, a 1/125 scale model of the Apollo test vehicle, stands 8½ inches tall. Fine details are molded into the body and the engine section is metalized for scale appearance. Complete with a 12 inch parachute, the Little Joe II will retail for $3.98.

The Honest John, a 1/24 scale model of the Army surface-to-surface ballistic missile, has a payload section in the nose cone. This 14 inch model is capable of flights to 2,000 feet when powered by a C engine. The ready-to-launch Honest John will retail for $4.50.

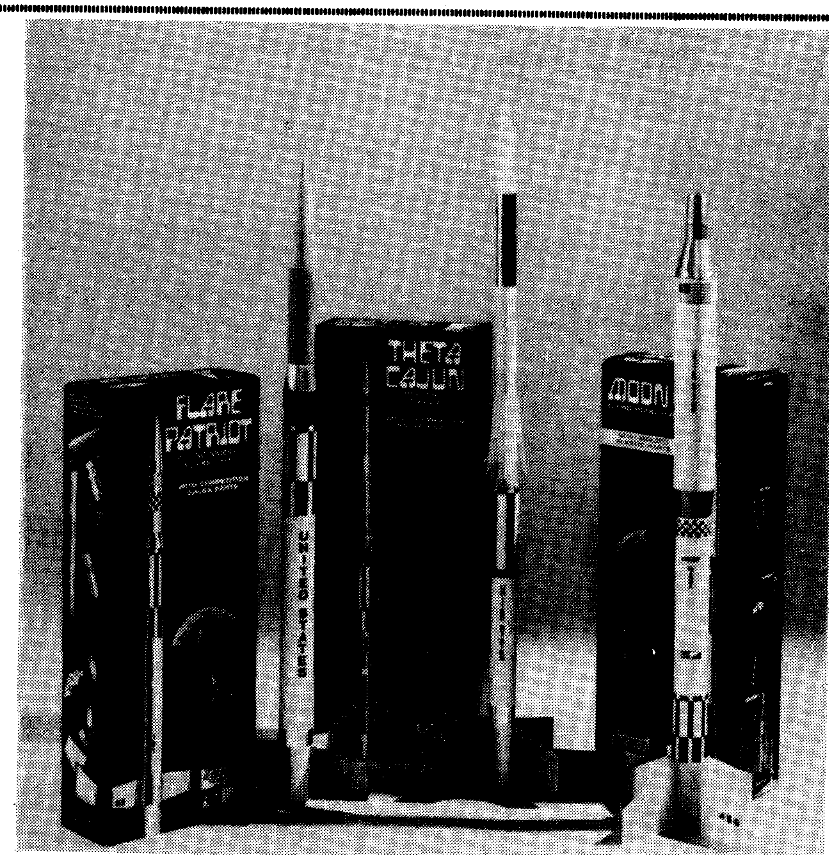
The Nike Zeus, a 2 stage, 1/24 scale model with a payload section in the nose, is also molded in white plastic. The model, standing 18 inches tall, will retail for $4.98 complete with a 12 inch parachute.

The Cox Astra Launch System is a ready-to-use launching unit which comes completely assembled except for the launching rod, which is easily erected and held in place by split-pin connectors. It consists of a high-impact plastic launch platform, angled exhaust deflector base, safety interlock wiring, control switch with safety key and continuity check light and recessed push-to-fire button. The plastic base is designed to hold eight Photo flash D-cell batteries (not included), but the system can also be used with a 12 bolt car battery. Retailing for $4 98, the Cox Astra Launch System will be available at all stores and hobby shops selling Cox rockets.

The Cox Astra Engines, containing a colored smoke charge for easy tracking, will be available in 12 sizes. A6-0, B4-0 and C6-0 booster engines; A6 5, B4 6, and C6-7 upper stage engines; and A6-2, A6-4, B4-3, B4-5, C6-4, and C6-6 single stage engines will be available. A Cox safety igniter will be included with each engine. The igniter, a chemically treated nichrome wire secured in a plastic arming plug, is preshaped to make positive contact with the fuel charge every-time. Engines will be sold in cards of 3 complete with igniters for $1.00.

Other model rocket products scheduled to be marketed by Cox in the early spring include all plastic Saturn 5 and Saturn 1B rockets, a boost/glider and a tracking theodolite.

A new cadmium plated steel launch rod pivot has been introduced by Darryl Henderson, 26 Knight Ave., Marblehead, MA 01945. With a 45 degree ball and socket movement, the pivot is capable of orientations anywhere in a cone 22½ degrees from the vertical. It can be used to correct the launch angle for local wind conditions or to orient the rocket for spot landing competitions. The pivot comes complete with an adapter to allow standard 1/8 inch diameter launch rods to be used. It will also accept 3/16 inch diameter rods. Priced at 70 cents each or six for $3.70, the pivots are available from Darryl Henderson at the above address.



The MPC *Mach 10* series was introduced into stores across the country last month. The *Flare Patriot*, *Theta Cajun*, and *Moon Glo* employ standard balsa wood and fibre–tube construction. The fins are pre-printed to aid in construction.

Other model rocket products available from MPC include *Astroline* kits employing plastic fins, adapters and nose cones; a launch pad; a hand launch controller; a line of six different model rocket engines; a new, complete, flying model rocket starter kit.

MPC's entry into model rocketry is another move in the company's diversification program. Since it's start four years ago, MPC has quickly become a leader in the plastic model car field. More recently they have introduced a line of 1/72 Scale model airplane kits. This September the company introduced it's first toy product, the Dyno-Racers, the first 1/25 Scale free-wheeling model cars.

PHOTO

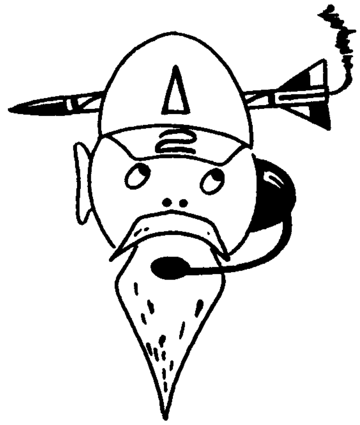
GALLERY

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

Photo Gallery
Model Rocketry
Box 214
Boston, Mass. 02123

(Photo by Ross Plactzer)

"But the instructions said to get the motor in real tight. They didn't say how to get it out again!" (Photo by Stine at NARAM-8)



The Old Rocketeer

by G. Harry Stine NAR#2

Converting the Hawk Jupiter - C for Flight

At this particular point in time, gettting a plastic model rocket to fly is somewhat of a challenge to a model builder's expertise and courage. This is because nearly all plastic model kits of rockets and space vehicles have been designed and produced as "static" or non-flying models intended to look good on a mantlepiece. As a result, these models are heavier than necessary. Some of them also require considerable modification in order to make them flyable with model rocket motors.

But plastic model rocketry being the challenge that it is, lots of advanced model rocketeers give it a whirl . . . some with great success and some with, well, not such great success.

Between 1964 and 1968, plastic model rocketry nearly died in the USA because there were no static plastic rocket kits available unless you spent days searching through rural hobby shops and out-of-the--way toy-and-hobby stores in the back-woods of America, hoping that you might stumble upon an unsold and ancient Revell V-2 or Adams Thor kit.

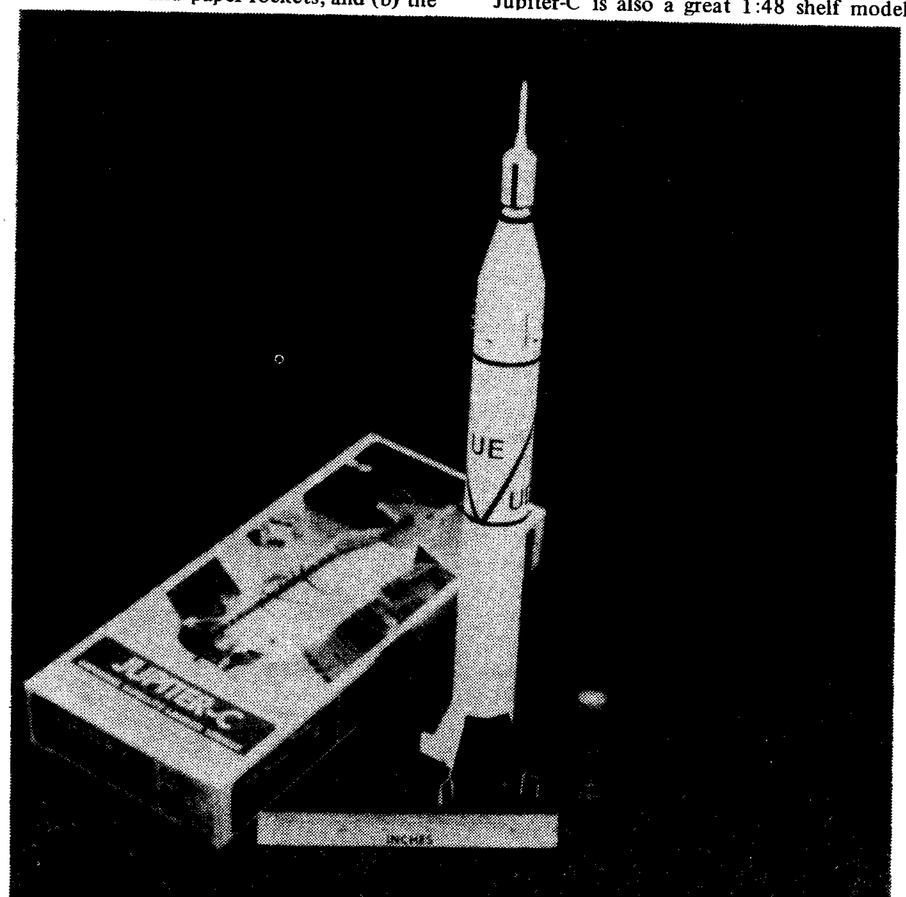
But plastic model rocketry is again on the up-swing because a number of firms are dusting off old molds for kits put out a decade ago. One of these is the Hawk Model Company Model No. 552, the Jupiter-C Explorer Satellite Launcher. This kit was originally released in 1958 but made a re-appearance a decade later in 1967. It is accurately scaled in 1:48 scale and, except for the markings, is very close to being right on the button scale-wise. It lacks some pullaway plugs up on the nose, some vents down around the tail section, and some small fine detail. Other than that, the Hawk kit is commendable for its scale qualities . . . something I cannot say for many other plastic rocket kits.

Furthermore, the Hawk Jupiter-C is one of the easiest plastic rocket kits to convert for flight with model rocket motors.

Note that I said that it was one of the easiest, but *not* that it was *easy*. Because it isn't. And it should be attempted only by a reasonable experienced modeler who wants to get his feet wet in plastic model rocketry.

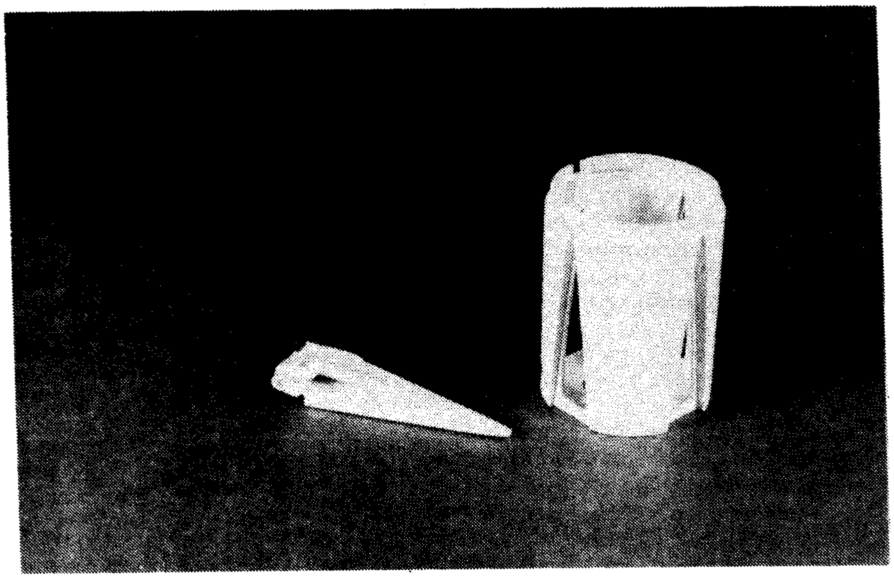
It is not easy because (a) it involves techniques of plastic modelling that are well-known to model car and IPMS model airplane builders but that are totally unknown to most model rocketeers who are used to balsa and paper rockets; and (b) the model is *heavy*, being designed as a static model, and because its small fins require a hefty load of plasticene clay in the nose to bring the CG far enough forward for proper stability.

The first thing to do with the Hawk kit is to build up and paint the launch table, setting it aside for later use in displaying the model . . . because your completed Hawk Jupiter-C is also a great 1:48 shelf model.



Stine photo

The completed Hawk Jupiter-C plastic flying model not only flies pretty well (for a plastic job) but is also a good scale model of our first satellite launcher of 1958.



Here are the various parts from the Hawk Jupiter-C plastic kit, plus the model rocket tubes and other parts, necessary to convert this non-flying plastic model for flight.

The only parts you need throw away are Part No. 20, the plastic exhaust nozzle, and four Parts No. 22, the jet vanes.

But you will also need some other parts common to model rocketry in order to make the conversion:

1. An Estes BT-55 body tube 5 inches long.
2. An Estes BT-20 body tube 8.75 inches long.
3. An Estes EH-2 engine holder wire.
4. An Estes PK-18 parachute.
5. Launch lugs.
6. An Estes EH-2055 engine mount.
7. Miscellaneous shock cord, etc.
8. Plasticene modelling clay.
9. ½-inch diameter plastic tube ½-inch long.

You'll also need plastic cement. I prefer to use the liquid plastic cement and a No. 1 brush for applying it. You should also have some white glue or Franklin Tite-Bond glue, some No. 200 and No. 400 wet-or-dry sandpaper, a *sharp* No. 11 X-Acto blade in a No. 1 X-Acto handle, and some plastic paint in white, black, silver, and gold.

The Hawk Jupiter-C can be adapted to use standard 18x70 mm. model rocket motors with very little alteration. But you have to assemble things in the proper order.

The BT-55 and BT-20 act as stuffer tubes as well as providing pressure-tight tubes to contain the ejection charge. It is possible to build and fly the Jupiter-C without the paper stuffer tubes . . . IF you can make a good, pressure-tight plastic joint where the halves of the model's body join together. Otherwise, POW, the first ejection charge splits the model apart like a hard white banana.

The stuffer tubes also prevent the heat of the ejection charges from melting the plastic model . . . which will happen after about 10 to 12 flights if you don't use stuffer tubes.

The first step in construction is to assemple the tail section. You may wish to undertake a "weight improvement" program by carving away some of the unneeded plastic of the tail section and the fins, thus eliminating some of the weight in the tail of this already-heavy model. The plastic webs at the fin roots and on the boat-tail where the fins attach may be whittled away as shown in the photograph.

With a small Swiss pattern file or an X-Acto knife, carve a slot radially in the base of the boat-tail to clear the engine mount wire. There is no need to fiddle with the hole in the center of the boat-tail as this is precisely the correct diameter to clear either a BT-20 or a Centuri No. 7 tube.

The fins should be fitted carefully with strong plastic glue joints. The fin tabs on the fin tips should not be installed until the whole tail assembly is attached to the rest of the model; otherwise, it is very difficult to line-up these tabs so that the model does not spin in flight.

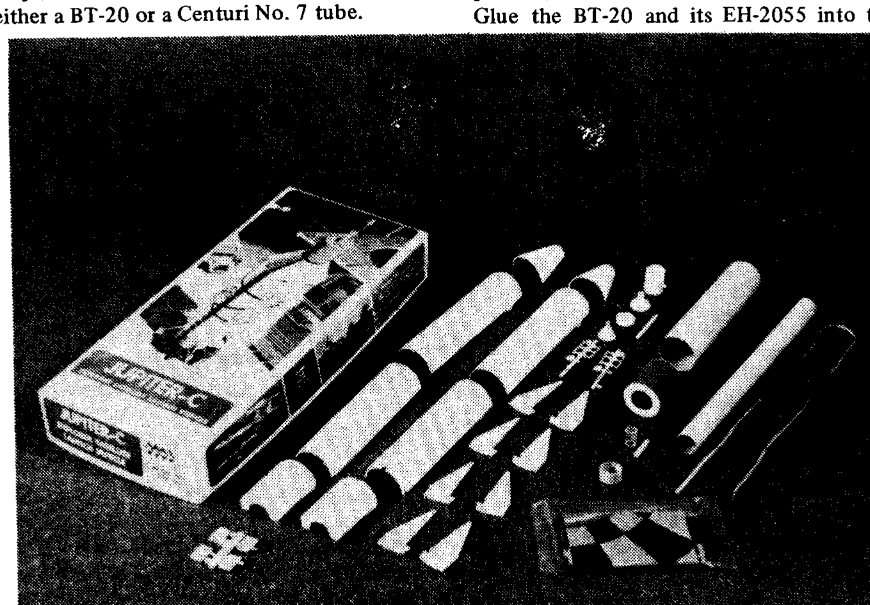
Assemble the nose section next, filling the "bucket" that houses the 2nd and 3rd stages of the prototype with plasticene modelling clay to add weight. Glue the nose section together and glue the bucket and the Explorer satellite to the nose section.

In order to attach the shock cord and parachute assemblies to the nose cone, it will be necessary for you to glue a small plastic ring to the inside of the nose section. This little ring, which can be fabricated from a piece of plastic tubing, serves the same function as the screw eye on normal balsa-and-paper model rockets.

Now the fun begins. The BT-55 must be installed inside the front plastic body section before these sections are glued together! The little ridge around the front of the plastic body section, plus the plastic tabs on the rear of this section, hold the BT-55 in place inside this section. So, install the BT-55 before you glue the halves together, or you won't be able to install the BT-55 easily!

Now prepare the BT-20 by installing the engine mount wire in the aft end and the rings-and-collar of the EH-2055 engine mount on the front end thereof. Use white glue of Tite-Bond for strength. While this drying, assemble the rear two shells of the plastic body and glue the tail section to these.

Some careful measurement is required to insure that the BT-20 and its engine mount precisely come to the hole in the boat-tail. Glue the BT-20 and its EH-2055 into the



Stine photo

A significant amount of non-essential weight can be taken out of the plastic tail and fins of the Hawk Jupiter-C as shown by carving away unnecessary plastic at the fin root and in the boat-tail.

BT-55 so that, when everything is finally assembled, the aft end of the BT-20 just inserts into the hole in the plastic boat-tail.

Final assembly involves glueing the plastic parts of the shell and boat-tail together with the front plastic shells. Everything should be lined-up straight and the glue joints should be well-made.

By using liquid plastic glue, you can "paint" the solvent into any cracks that remain when joints are set up. This will melt and flow plastic down into the joint. Naturally, this should be done neatly. However, if you slop some glue over, you can clean it up after 24 hours by sanding with No. 400 wet-or-dry sandpaper used dry. As a matter of fact, for highest workmanship points in competition flying, you should clean up all plastic joints anyway in the following manner:

First, get a good, solid, plastic-to-plastic joint by painting the liquid solvent glue into the joint. Once everything has thoroughly dried – and this is an overnight or 24-hour affair – you can sand the joint smooth with No. 400 sandpaper or with a small Swiss pattern file. Surprisingly enough, styrene plastic can be sanded, filed and carved just like wood! Once you paint the model, you should not be able to tell that there is a joint anywhere on it.

Assemble all the little plastic details to the outside of the model, and add the launch lugs. I used two launch lugs – one up front next to one of the telemetry antennas and the other back on the tail section – made from plastic tubing with a ¼" o.d. and a 5/32" i.d. so I could launch from a standard 1/8" rod. The bird is heavy enough to really require a longer, 5-foot rod 3/16" in diameter if you have such a launcher available, so just add those lugs if you do.

An 18-inch plastic parachute, shock cord, and other model rocket items were then added.

The model should be painted flat white overall. Fin color pattern is *not* as indicated in the kit, but goes as follows:

Locate the square hatch between the fins. The fin to the left of this hatch is No.1; the fin to the right is No. 2 . . . and so forth around the body to Fin No. 4 (unless you've goofed somehow and put 8 fins on, impossible as this may seem to be . . . but you know model rocketeers . . .)

The facing sides of Fin No. 1 and Fin No. 2 and the quadrant between them are flat black; the other sides of Fins No. 1 and No. 2 are flat white.

Fin No. 3 is black on both sides, and the quadrant between Fin No. 3 and Fin No. 4 is black, but Fin No. 4 is white on both sides.

The boat-tail aft end is silver.

The telemetry antennas are gold.

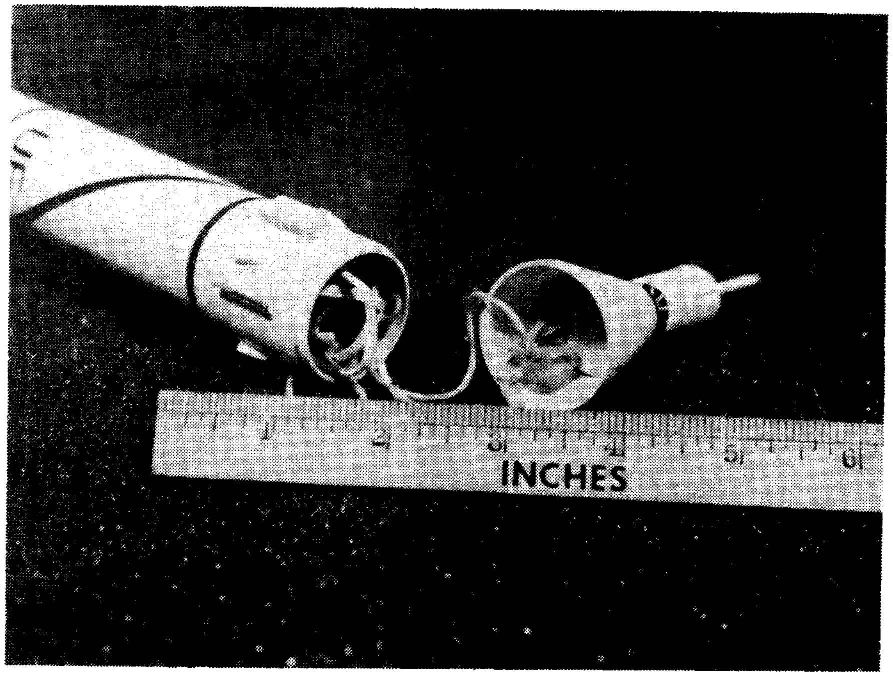
The upper black stripes of the roll pattern go around the body just behind the first score mark behind the telemetry antennas. The aft circular band goes around the aft end of the forward body shells at the body joint. The diagonal roll strips join the top band in line with Fin No. 3 and the bottom band in line with Fin No. 1.

The code letters UE are not red as in the kit decal, but black. ½-inch black decal letters or dry transfer letters can be used instead. The "U.S. Army" decal in the kit was never used on any flight round of the Jupiter-C when launching Explorer satellites.

There is a black band around the top of the nose cone section and down the side of the bucket.

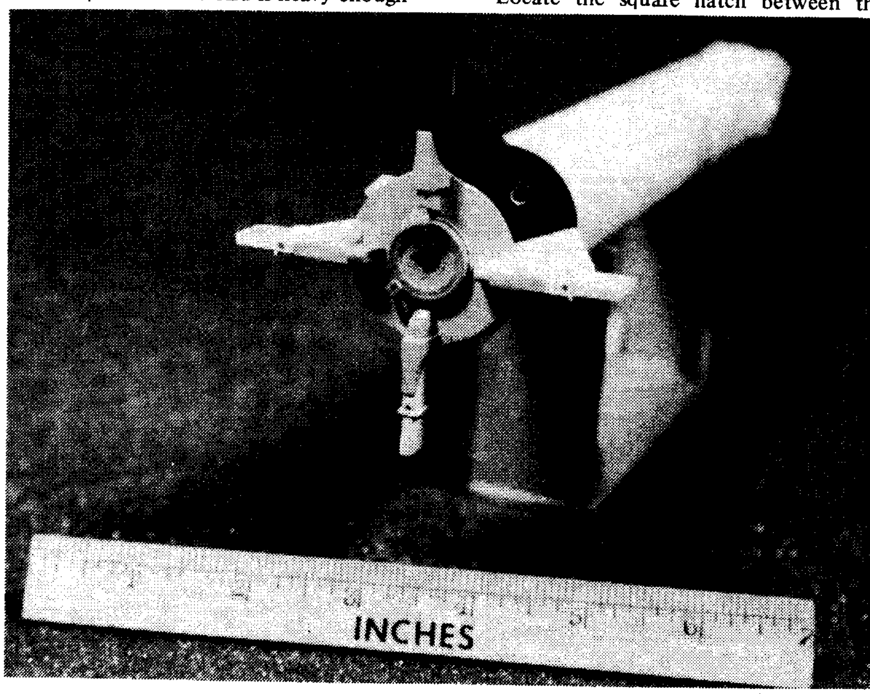
When you get all done, you *must* balance this bird before you fly it. According to a very conservatively-done Barrowman CP calculation on the Jupiter-C, the CG must lie 10.25 inches aft of the very forward tip of

(Continued on page 47.)



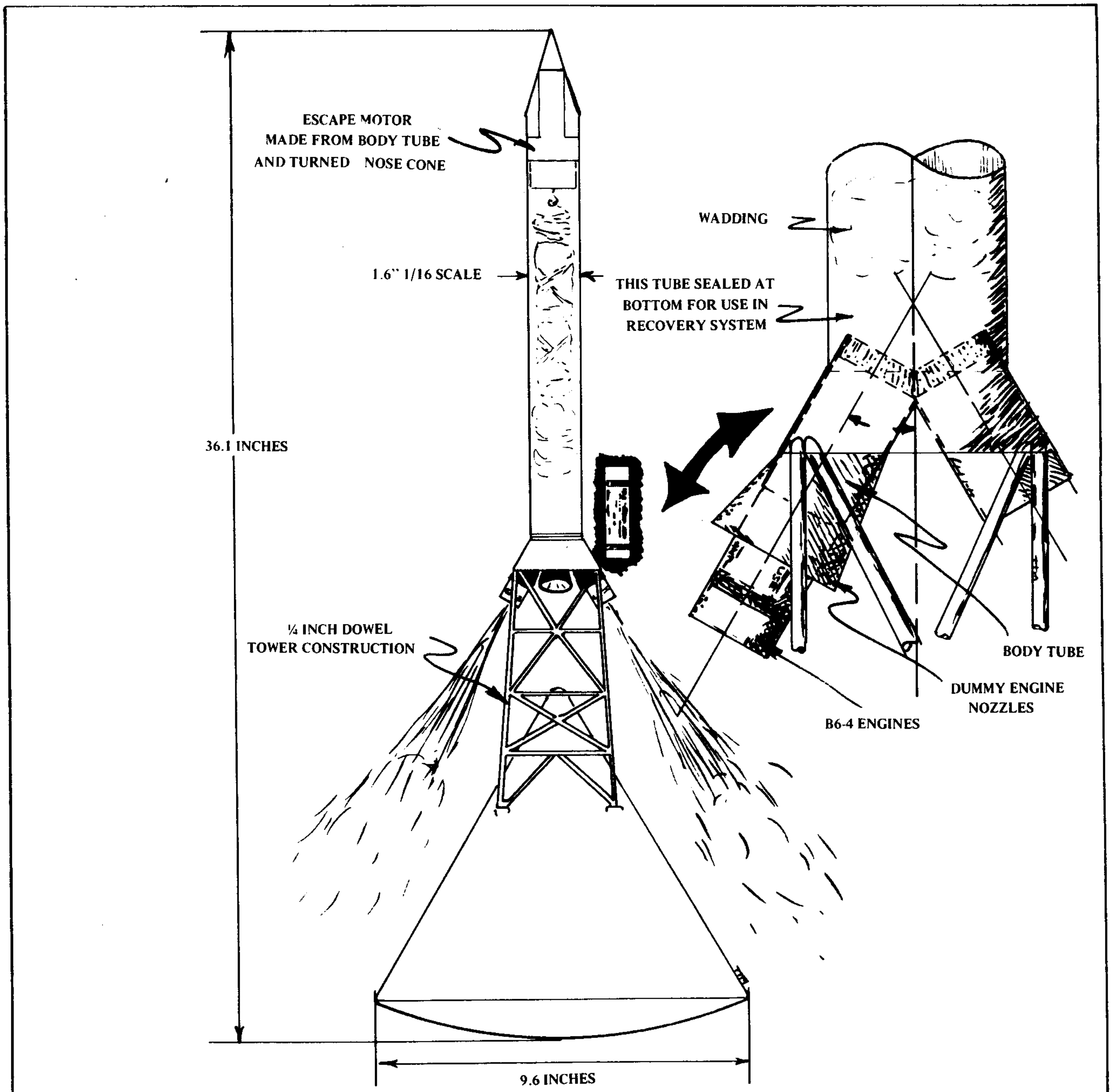
Stine photo

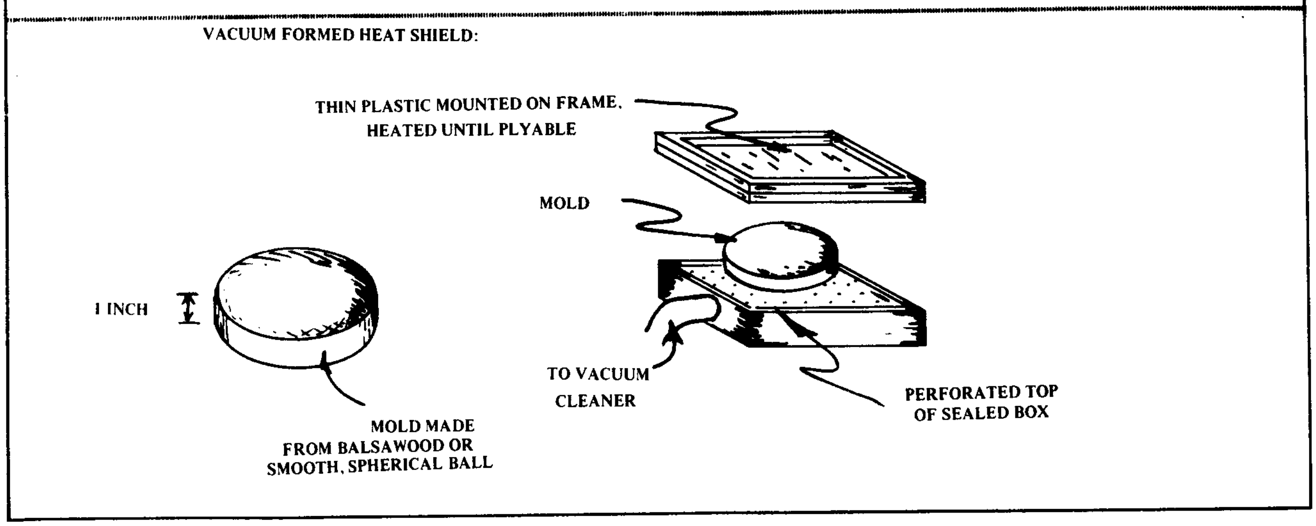
The nose of the Jupiter-C plastic kit separates at a good point for a flying model. Shock cords, etc. are attached to plastic ring glued to side of nose section. Plasticene clay is pressed into nose to give proper CG location.

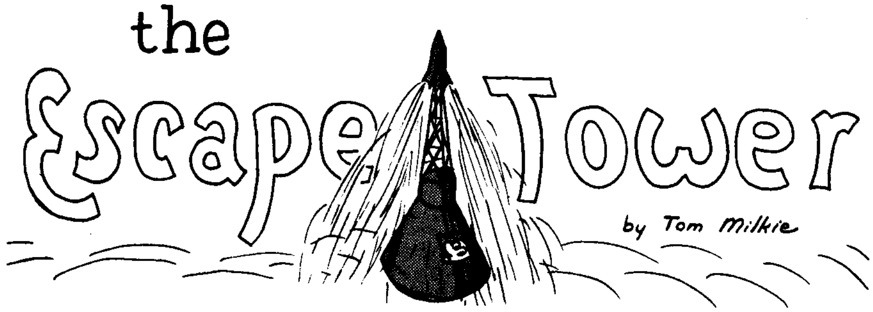


Stine photo

The completed tail section of the Hawk Jupiter-C showing a Type B4-2 motor installed with an engine holding wire. The plastic jet vanes of the non-flying kit are not used. Calculations show they would melt away after 3.5 milliseconds in the jet exhaust!


ESCAPE MOTOR
MADE FROM BODY TUBE
AND TURNED NOSE CONE
WADDING
1.6" 1/16 SCALE
THIS TUBE SEALED AT
BOTTOM FOR USE IN
RECOVERY SYSTEM
36.1 INCHES
¼ INCH DOWEL
TOWER CONSTRUCTION
BODY TUBE
DUMMY ENGINE
NOZZLES
B6-4 ENGINES
9.6 INCHES


VACUUM FORMED HEAT SHIELD:
THIN PLASTIC MOUNTED ON FRAME,
HEATED UNTIL PLYABLE
MOLD
1 INCH
TO VACUUM
CLEANER
PERFORATED TOP
OF SEALED BOX
MOLD MADE
FROM BALSAWOOD OR
SMOOTH, SPHERICAL BALL



FLYING SCALE APOLLO CAPSULE

No, newcomers, this column is not on how to build escape towers! It is, rather a forum for a few somewhat successful (or hopeful) wild ideas in model rocketry.

This month, though, I'd like to share some thoughts on a yet untried method of getting some far-out scale rockets– namely an Apollo or Mercury capsule powered by its escape tower! So, this month at least, this column IS on how to build escape towers!

Scale builders who are sick of seeing the run-of-the-mill scale rocket event won by a run-of-the-mill scale rocket (The IQSY Tomahawk?, or is it the D-Region Tomahawk?), take heart! How about a 1 to 16 scale Apollo capsule. (That works out to about 3 feet high including launch escape tower and motor.)

The power for such a system would come out of model rocket engines mounted in the scale escape motors. In the case of the Apollo capsule, there are 4 real motors, with nozzles pointing out from the escape tower.

The scale of the Apollo capsule was set at 1 to 16 mainly due to the engine placement problem of a smaller scale. Since engines will not be delivering full thrust in an upward direction, and since the large scale rocket will be fairly heavy, it will be necessary to use as much power as possible. If it is desireable to keep the diameter of the escape motor in scale, this may mean using a *fat* engine ; *fat* in the sense that it must be short enough to fit in a small scale nozzle, yet wide enough to pack power. Therefore, probably a smaller than 1/16 (1/32 even?) scale capsule may be built using Estes' series III motors (½A6-2S). A weight analysis may rule out that small an engine, though. D engines might have possibilities, and really wild experiences may result from trying the Enerjet 8 from Rocket Development Corporation (another fat engine about equal to an E).

The most important consideration when choosing a powerplant is power. To be precise, a high average thrust is needed to lift off the pad smoothly, and a decent duration (a fairly high impulse then) is needed to get the capsule up to a safe parachute ejection altitude.

B6-4 engines provide probably the best weight-lifting characteristics (Let's leave out B14's – this is scale, not balsa duration.) of engines that can fit into the escape motor. (*That* leaves out F's!) Now the MSMLOWG (Manufacturer's Suggested Maximum Lift-Off Weight, Gulp!) for B6-4's is 4.5 oz. Two B's make 9.0 oz. If these engines are both canted at about 25 degrees to the vertical, there is a thrust loss that brings the lift-off weight to about 8.0 oz. (Multiply by the cosine of 25 degrees.) Two loaded B's weigh 1.6 oz., bringing the maximum rocket weight to 6.4 oz. – That could be difficult! More on weight later. Four B's may be hard to fit into the escape motor (in 1/16 scale the motor is only 1.6 inches in diameter.) but if that can be done, a top rocket weight hovers near 13.5 oz. Difficult to work with, but possible.

But its not possible to make a 1/16 scale monster weighing in under 10 tons!, says the sceptical scaler. That's not exactly true. Both the Mercury and Apollo capsules are basically perfect cones. Thus it may be possible to run a cardboard or paper cone over a light frame. Details like hatches, windows, etc. can be added to this with a little modification.

The spherical heat shield is another problem. But as the Ole Rocketeer has suggested, *Why not try plastics?* A spherical heat shield can easily be vacuum formed by someone with a little ingenuity. The entire capsule may be cast out of foam plastic and coated with silkspan, Monokote or layers of protective, non-attacking paint. A completely balsawood model is not entirely out of the question either, for better balsa butchers.

Now about that old bug–a–boo: stability! The capsule has no fins, but is it really unstable? The center of pressure of a cone (thanks to Gary Schwede) is 2/3 of the height of the cone back from its nose. With the engines far forward, stability shouldn't be too hard to achieve. She certainly seems sufficiently stable.

The last big point: What goes up must come down....how? A simple solution would be to use the engine ejection charges to push a conventional chute system out the end of the scale escape motor. However, what about letting the nosecone coming off release a string that runs through a tubing leg in the escape tower, and releases a catch, which holds the capsule to its tower, letting it fall, until its own chute deploys!

This is just a rough analysis to show what is possible. I'm sure some readers are already thinking of other additions to this design, or how to fly that previously unflyable design. Good luck!

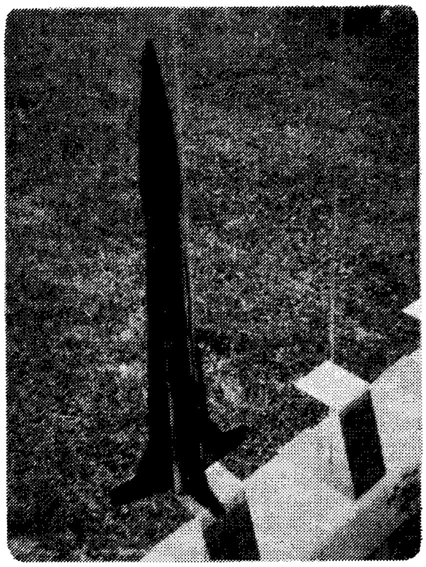
Now, let's see, if you built a Saturn V to go with it, it would be about 23 feet high and...

YUGOSLAV NATIONALS

G. Harry Stine, Model Rocketry's correspondent at the Yugoslav national meet reports that the top parachute duration time was 1400 seconds (over 23 minutes) and the best B/G time was 800 seconds (over 13 minutes)! Czech and Polish rocketeers also attended the meet. Full coverage of the event will be featured next month in MRm.

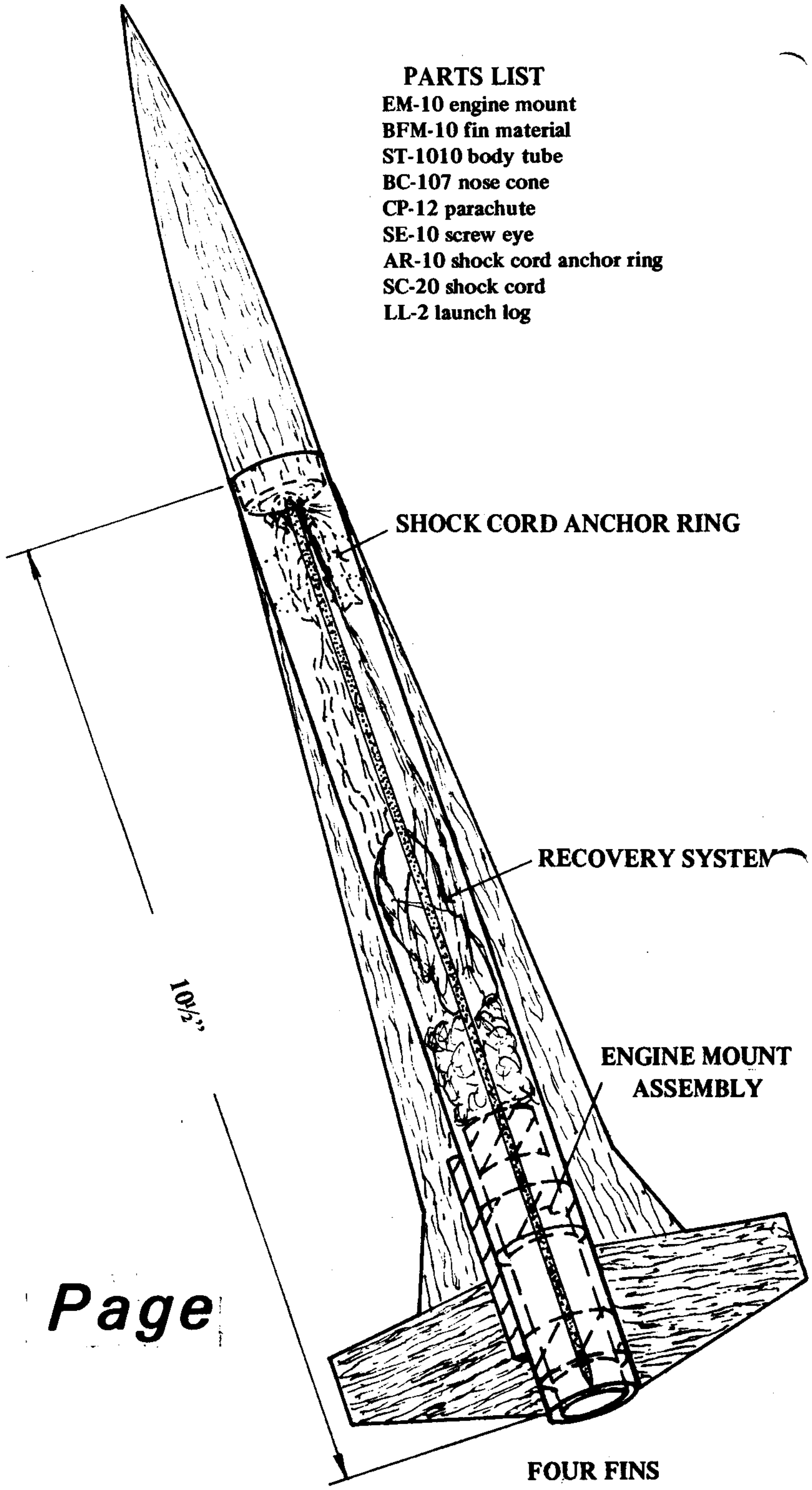
Reader Design Page

This nameless rocket design was submitted by Terrence R. Gibes, of Lockport, Illinois. Construction is straight- forward, making use of Centuri parts. The designer recommends using A8–3 or B6–4 engines for power, but with a C6-5 this good looking rocket would make a spectacular demonstration bird.

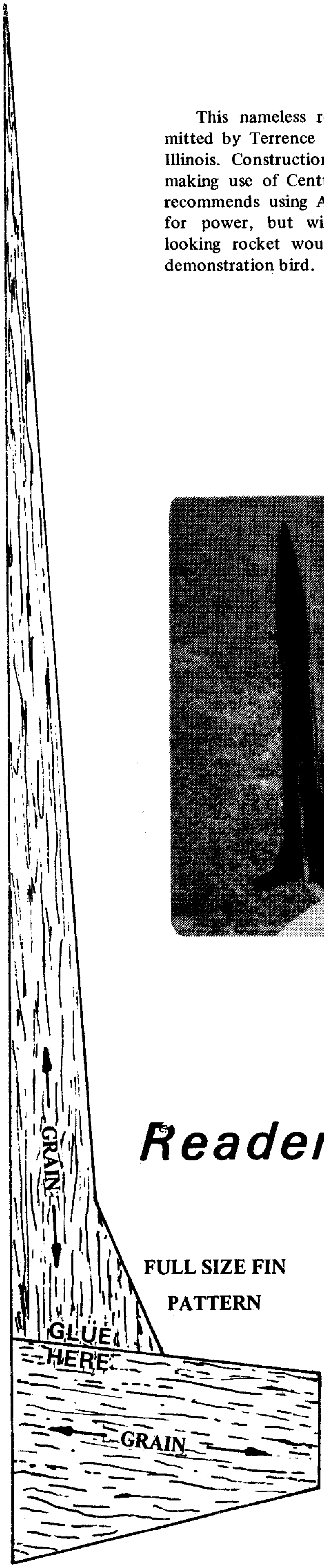


PARTS LIST

EM-10 engine mount
BFM-10 fin material
ST-1010 body tube
BC-107 nose cone
CP-12 parachute
SE-10 screw eye
AR-10 shock cord anchor ring
SC-20 shock cord
LL-2 launch log



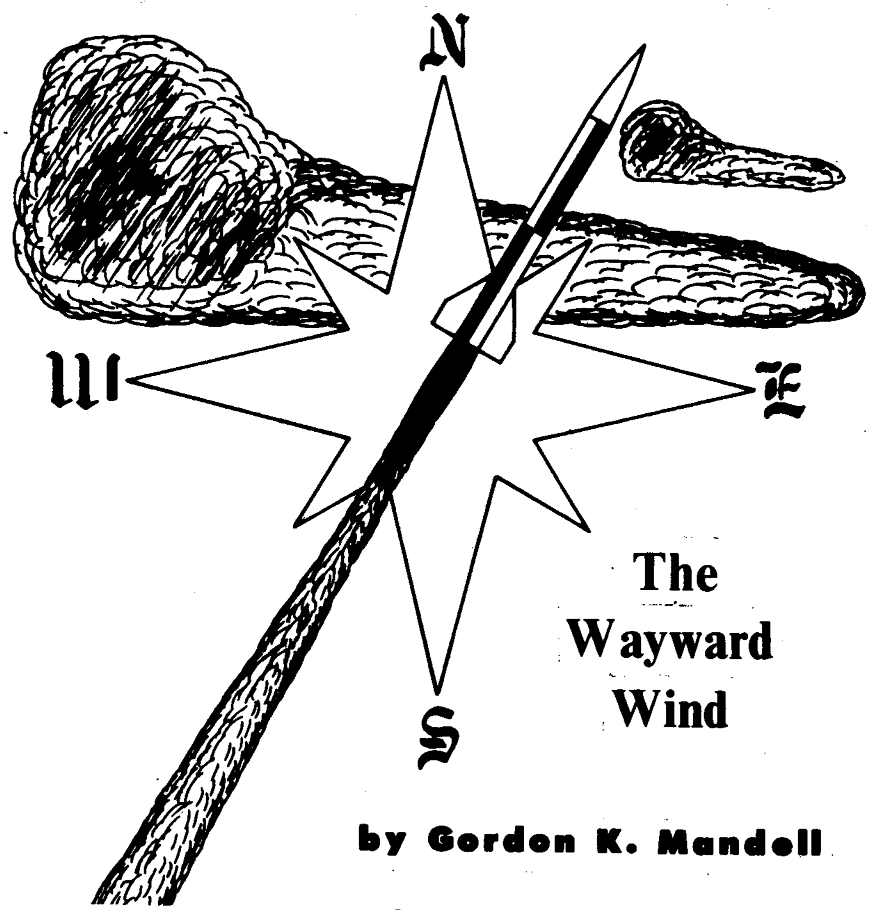
FOUR FINS



FULL SIZE FIN PATTERN

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



The Wayward Wind

by Gordon K. Mandell

THE KRUSHNIK EFFECT

"Oh, no! That subject's been beaten to death a hundred times!"

If that's what you think, dear reader, be prepared for a rude shock.

You are a member of a tiny minority.

Yes, believe it or not, despite the extensive research of more than half a dozen highly qualified investigators throughout the twelve-year history of the National Association of Rocketry it remains a fact that only a pitiful fraction of the million or so rocketeers in the United States today have any idea what those words mean. We, too, once thought the whole, wide world knew all about the Krushnic phenomenon—until we casually mentioned it in our June issue. Sadder but wiser after digging out from under the ensuing avalanche of mail, I decided I had better devote some space to explaining what we mean by the term "Krushnic Effect" in the pages of this column.

For our story to be complete we must go back to 1879, for it was in that year that a brilliant Swedish engineer named Karl Gustaf Patrik de Laval developed a device which still bears his name and is basic to the operation of reaction-propulsion systems that range from model rockets right on up to the huge F-1 engines that power Saturn moonships. De Laval was designing a high-speed centrifugal cream separator which was to be driven by jets of steam impinging on a vaned wheel attached to the drive shaft of its cylindrical milk tank. Because the device depended on rapid rotation for its operation, the velocity of the steam jets used to turn the wheel had to be very high. Over the next four years the system which De Laval had devised to run the cream separator evolved into what we know today as the *impulse steam turbine*, while the specially-shaped orifice he developed to direct steam onto the turbine's blades became known as the *De Laval nozzle*.

De Laval knew that, in order to achieve the greatest steam velocity, his nozzle would have to be designed in such a manner as to take maximum advantage of the fact that gases (of which steam is but one example) are compressible substances. He therefore made use of the convergent-divergent shape illustrated in Figure 1, which indicates the notation used in describing the De Laval nozzle as adapted to rocket propulsion. The nozzle operates in the following manner:

The combustion chamber contains the hot gases resulting from the burning of the rocket's propellant at a pressure that is very much higher than that of the air (if any) outside of the motor. The hot, high pressure combustion products can only escape from the chamber by passing out through the nozzle, and this they do. Entering the *convergent* portion of the nozzle at a very low velocity, they soon begin to pick up speed due to the decreasing cross-sectional area of the passage through which they are flowing. As the velocity of the exhaust gas increases, its temperature and pressure both decrease—the nozzle is converting the internal energy of the gas from one form (high temperature and pressure) to another (high speed). If the pressure in the combustion chamber is great enough (greater than about 3½ times the pressure of the

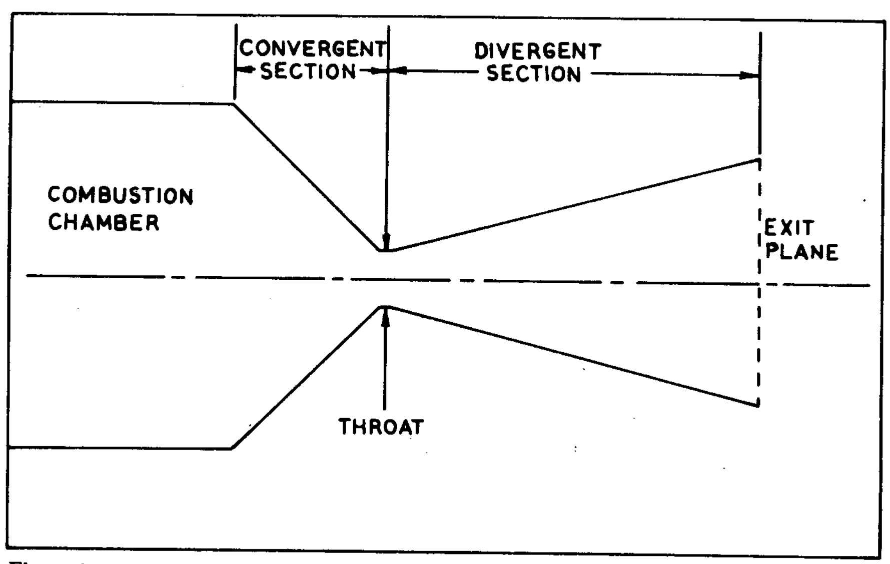


Figure 1. A De Laval nozzle as adapted to rocket propulsion, illustrating the various sections. Note that nozzle exit plane is a geometrical abstraction nothing solid is really placed over the nozzle exit!

outside air) the exhaust will be travelling at Mach one—the speed of sound at the temperature it then has—when it reaches the nozzle *throat.* As it enters the *divergent* section of the nozzle the gas's velocity becomes supersonic—faster than sound. The behavior of gases travelling at supersonic speeds is much different from that of subsonic gas flows. Whereas the speed of a subsonic gas *increases* as the cross-sectional area of a passage through which it is flowing *decreases*, precisely the opposite it true of a supersonic gas. The rocket's exhaust thus *continues to accelerate* as it flows through the divergent section, so that it has a speed of many thousands of feet per second by the time it leaves the nozzle altogether and mixes with the outside air astern of the exit. To De Laval this meant that a strong force was exerted on the blades of his turbine wheel, even when it was spinning very rapidly. To the modern-day astronautical engineer it means that a great deal of *thrust* is generated to propel the vehicle in which the rocket engine has been installed. According to the law of conservation of linear momentum, this thrust is equal to the product of the exhaust velocity and the rate (in mass units per second) at which the rocket propellant is being consumed.

For a De Laval nozzle to work properly it must have the correct size and shape. Suppose we call the pressure in the combustion chamber P_o, the pressure of the exhaust gas at the nozzle exit plane P_e, and the pressure of the outside air P_a. Also, let's call the cross-sectional area of the nozzle throat A_t and the cross-sectional area of the exit plane A_e. Then we can be more specific and state that, for the proper operation of the De Laval nozzle, it is necessary that, for a given value of P_o, the *expansion ratio* (A_e/A_t) be such that P_e is nearly equal to P_a. In fact, the greatest thrust for a given mass flow rate will be generated when P_e is *exactly* equal to P_a; the condition $P_e = P_a$ is therfore referred to as *optimum expansion,* and nozzles which produce it are called *optimally-expanded* nozzles. The exhaust gas exits from such a nozzle as shown in Figure 2, mixing with the outside air with a minimum of disturbance far astern of the nozzle exit.

If the expansion ratio is *too small* for the given value of P_o the nozzle will operate in an *underexpanded* condition in which Pe is *greater* than P_a, as shown in Figure 3. The exhaust plume fans out as it leaves the nozzle and an array of *expansion waves* is formed at the lip of the nozzle exit. These are reflected from the exhaust boundaries and become a series of alternating expansion

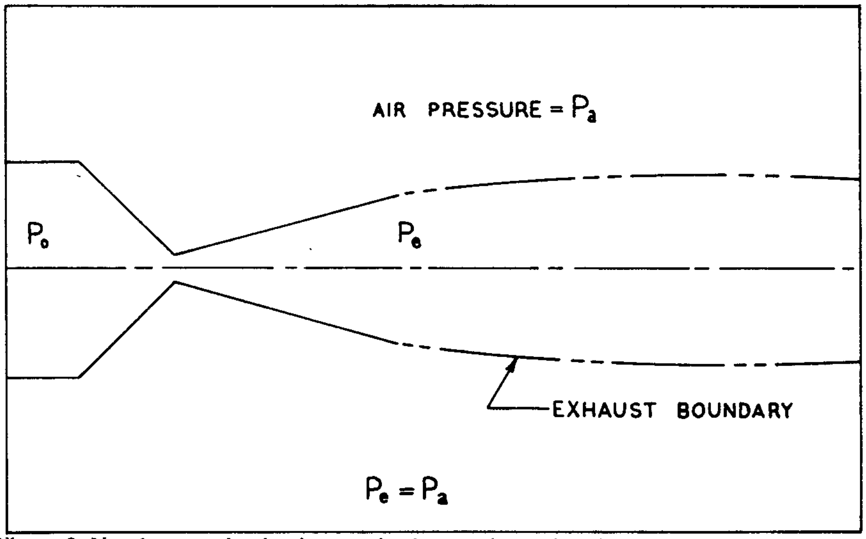


Figure 2. Nozzle operating in air at optimal expansion ratio. The pressure at the nozzle exit plane is equal to the outside air pressure, and the exhaust mixes with the air downstream a minimum of disturbance.

and compression waves through which the exhaust pressure adjusts itself to the pressure of the outside air. The exhaust is not travelling as fast when it leaves an underexpanded nozzle as it is when leaving an optimally-expanding nozzle, and so there is a thrust reduction associated with underexpansion. Some additional loss of thrust also occurs due to excessive radial outflow of the exhaust.

If the expansion ratio is *too great* for the given P_o, the nozzle will be running in an *overexpanded* condition in which P_e is *less* than P_a. As long as the value of P_e is not less than about 0.36 P_a the behavior of the exhaust will be as shown in Figure 4. A pattern of *oblique shock waves* forms at the nozzle exit lip and is again reflected from the exhaust boundary in a series of alternating expansion and compression waves. In passing through these disturbances the exhaust is accelerated and compressed until its pressure equals that of the outside air, and again a thrust loss results. Those of you who have seen films of the Viking rocket rocket launches will remember the bright patterns of "shock diamonds" in their exhausts. The Viking's nozzle was designed to operate most efficiently at high altitudes and was therefore slightly overexpanded at sea level; hence the brilliant display of shocks and expansions at takeoff.

But suppose the nozzle in so badly overexpanded that P_e would be *less* than 0.36 P_a if the exhaust followed the nozzle's contour all the way to the exit—what happens then? Well, generally what happens is that the exhaust gas *refuses* to follow the

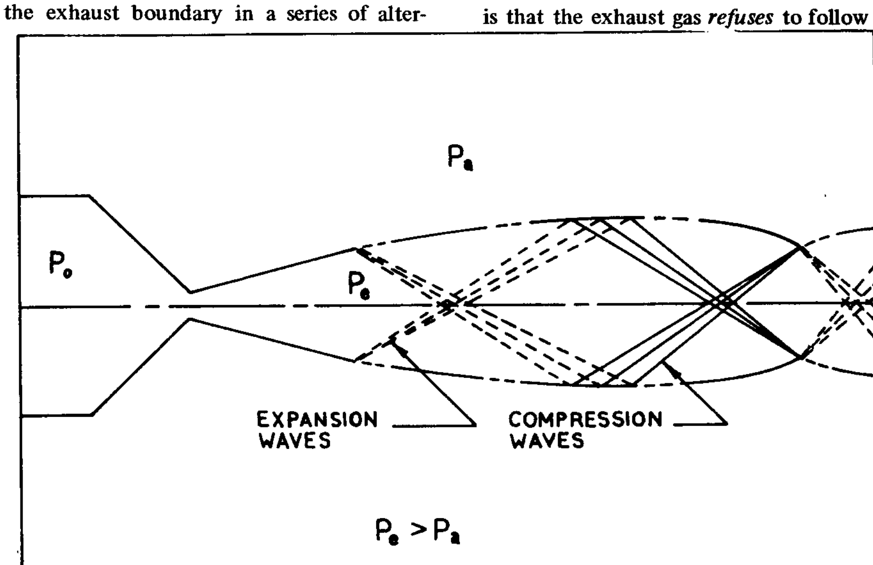


Figure 3. Nozzle operating in air in an underexpanded condition. Nozzle exit area is too small; pressure of exhaust at exit plane is greater than atmospheric pressure. Exhaust leaves nozzle lip in an array of expansion waves, which reflect from exhaust boundary and set up a pattern of alternate compressions and expansions. Thrust is reduced.

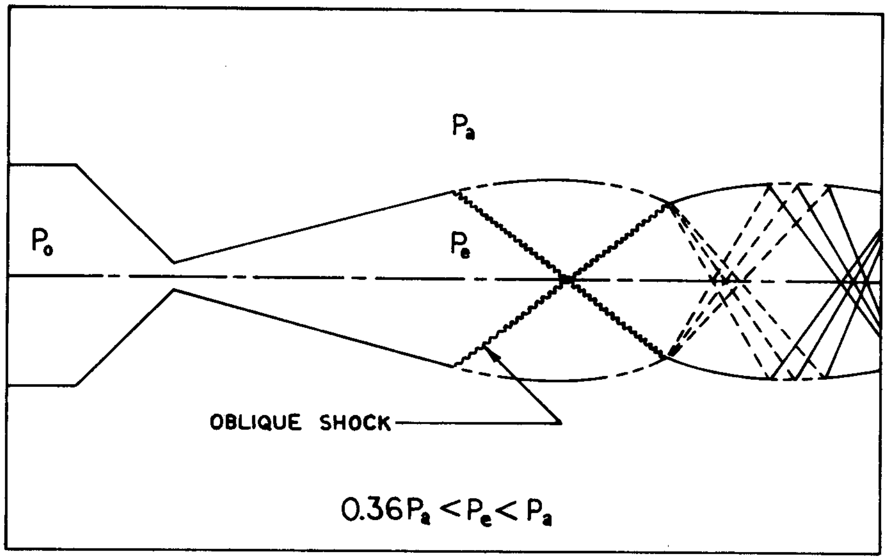


Figure 4. Nozzle operating in air in a slightly over expanded condition. Nozzle exit area is too large; pressure of exhaust at exit plane is less than atmospheric pressure. Oblique shocks occur at nozzle lip, then reflect from exhaust boundary causing alternating expansions and compressions. Thrust is reduced.

nozzle wall all the way to the exit—it separates from the wall at some point in the divergent portion and the oblique shock pattern moves up into the nozzle until it reaches the point of detachment, also becoming *steeper* (i.e., more nearly perpendicular to the nozzle axis) in the process. In the extreme case, the oblique shock pattern steepens into a *strong normal shock*—a disc-shaped zone of violent deceleration and discontinuity in pressure, temperature, and density, standing at right angles to the nozzle axis. The air near the nozzle walls astern of the shock is actually drawn up into the nozzle and shot downstream again by contact with the exhaust boundary (Figure 5). The vorticity and turbulence thus produced, in addition to the effect of the normal shock, greatly reduce the thrust generated by the nozzle.

Now for a look at the Krushnic phenomenon. Suppose that some modeler has decided to give his rocket some extra stability by moving the weight of its engine forward. In order to do this he places his engine block so that, when the engine is fully in place, it is *recessed* up into the body tube. Now what happens when he ignites the engine? The exhaust gases reach the exit plane of the nozzle at atmospheric pressure, as the engine manufacturer has designed the nozzle to be optimally expanded at sea level. But when the exhaust leaves the nozzle *it is still surrounded by a duct—the length of body tube between the rear of the engine and the stern of the rocket.* The exhaust cannot tell the difference between one duct and another; *it "thinks" the body tube is part of the nozzle.* Even for a body tube that is a glove fit to the engine casing, the cross-sectional area of the tube will be many times greater than that of the nozzle exit plane. Consequently, the pressure of the exhaust as it tries to expand to fill the tube will be far below 0.36 P_a and a strong normal shock will form immediately behind the nozzle exit. As some of the exhaust gases will be travelling radially outward in a desperate attempt to fill the tube, the shock will be curved somewhat as shown in Figure 6. There is a great deal of turbulence and vorticity, a hollow, roaring sound and a brilliant exhaust plume associated with this condition. The thrust of the engine is greatly reduced and the rocket's tail is often burned to a cinder. This is the Krushnic Effect, named for Richard Krushnic of Denver, Colorado, who in 1958 became the first model rocketeer to experience it.

Krushnic subsequently showed himself that the effect could be be reduced to negligible proportions be insuring that the rocket engine was recessed no further than half the diameter of a glove-fit body tube. It is tempting to extrapolate this result and conclude that the engine recession must be no more than half the diameter of the body tube, regardless of the tube diameter, for the Krushnic loss to be negligible; this, however, is probably conservative. After all, common sense tells us that when the tube diameter approaches infinity the effect of its shrouding the engine exhaust must diminish to zero, regardless of the recession. Some work has been done on measuring the thrust reduction for various tube diameters and recession distances, but it has not been published and is not generally available. As I write this, though, that problem may well be in the process of being corrected by one or more of our contributors . . .

There is a lot of work yet to be done in the field of exhaust-shrouding effects, as numerous uses can be made of the partial vacuum generated by the rocket exhaust within the shrouding tube. A number of truly fascinating projects are possible within this area, but to avoid duplicating the experiments of others you should get yourself a copy of the *National Association of Rocketry Technical Review* before starting one. This journal, available for 35 cents to NAR members only through NAR Technical Services, 511 South Century, Rantoul, Illinois 61866, contains an excellent short summary of investigations to date of the

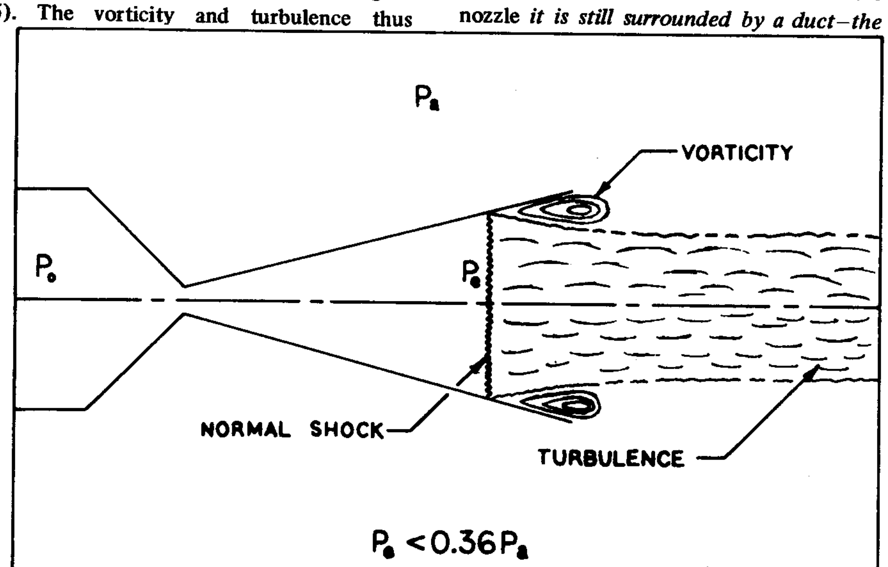


Figure 5. Nozzle operating in air in a strongly overexpanded condition. Pressure of exhaust at exit plane is less than 0.36 of atmospheric pressure. Normal shock forms inside nozzle where flow breaks asway from nozzle wall. There is much turbulence and viscous loss; thrust is greatly reduced.

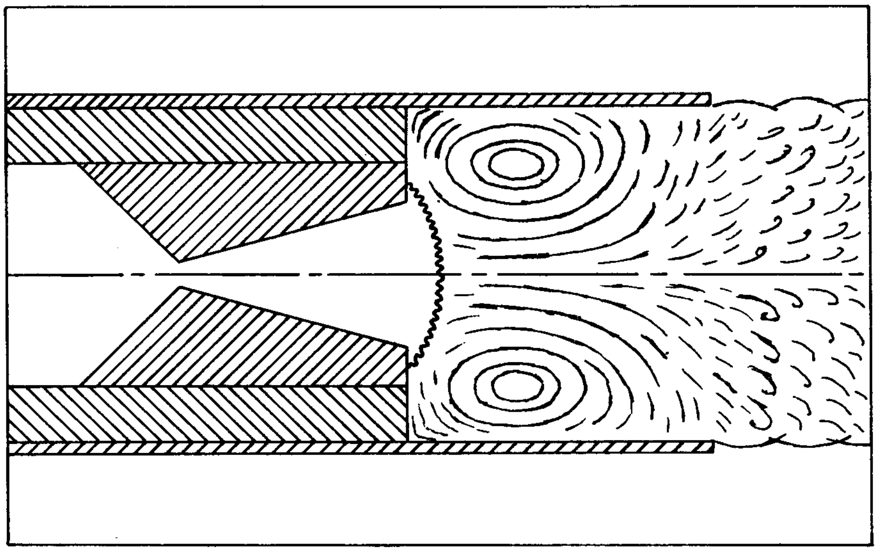


Figure 6. The Krushnic Effect: an extreme case of overexpansion. Pressure suddenly drops far below atmospheric as exhaust leaves rocket nozzle; strong, slightly-convex shock forms just downstream of nozzle exit plane. There is a great deal of turbulence and eddying, large viscous loss. Thrust is reduced.

various manifestations of the Krushnic phenomenon. Read up, turn on, and dive in!

. . . But even if you don't, I will rest secure in the knowledge that there are now several tens of thousands of model rocketeers who will never again say, "The Krushnic Effect? What's *that?*

You, too, can be a part of the forefront of development of model rocketry. You, too, can contribute to the advancement of this space-age hobby of ours. All you've got to do is let us hear from you! Send that pet theory, idea, design, gadget, or whatever, to me in care of The Wayward Wind, **Model Rocketry**, *Box 214, Boston, Mass 02123.*

THE MODEL ROCKETEER

NATIONAL ASSOCIATION OF ROCKETRY, 1239 Vermont Avenue, N.W., Washington D.C. 20005

WAMARVA SECTIONS MAKE A SPLASH AT SMITHSONIAN

June seventh opened the first day of the Smithsonian Museum's (Washington, D.C.) First Annual Aerospace Modeling Exhibit.

So to kick it off right, the officials at the Smithsonian asked The National Association of Rocketry to set up a rocket launch–right on the mall, with the Washington Monument towering in the left and the Capitol across in the background to the right.

The Washington, Maryland and Virginia sections of the NAR (WAMARVA as they call themselves--a loose association of some of the strongest sections in the nation, originally meeting together in 1968 to promote intra-section unity and cooperation) prepared for the event in various ways.

MARS Section of Lanham, Maryland readied its fine relay switching launch pad and panel.

Annapolis Section lent its $120 public address system for public relation purposes (bought from the revenue of the section's well-stocked range store).

Star Spangled Banner, NARHAMS, and MARS Sections of suburban Maryland built rocket kits donated by Centuri, Estes, and MRI to be flown on the mall, caught and kept by youthful spectators.

"Casey" Kukowski of UFO Section in Rockville, Maryland (former Executive Director of the NAR, radio announcer and presently NASA public information officer at Goddard Space Flight Center) volunteered his services as P.A. announcer for the fete.

Other WAMARVA Sections promised their help over the three-month period the modeling exhibit would last.

The big day came and the mall (on a sunny Saturday in June) was packed.

Among the notables, George Flynn, from this magazine, came down from Massachusetts with his ever present camera to witness the event. G. H. Stine and his rocket-sharp daughter–Ellie–also showed for the demonstration. Estes Industries even sent its special assistant to the president–James Stewart–to observe and take photographs. Tim Skinner, sales representative of MRI, also made the scene.

The first rockets were sent off by Howard Kuhn of Competition Models. Fred Durant III–Currator for Aeronautics and Astronomy of the Smithsonian and Assistant Currator Lou Purnell visited and later assisted with the flying. Afterwards the launches were in the hands of "Casey," "the Old Rocketeer"–Mr. Stine, Dick Sipes of MARS, and Mr. Kuhn. Jim Barrowman of NARHAMS served as safety officer.

In the five hour period 58 models were launched. The original plans called for three models to be flown in an hour (taking all of five minutes) followed by forty-five minutes of "range patter" until the next launch could be scheduled. But the tourists and the children in the crowd were so enthusiatic that instead of keeping flown rockets, they returned them so that the rockets could be launched again. Range recovery was superb.

In all, the launch–the kickoff for the Smithsonian First Annual Aeromodeling Exhibit–was a howling success; the NAR giving a real show of safety and sport flying to the tourists of Washington.

The actual exhibits for the Smithsonian aeromodeling demonstration were provided by three organizations over a three month period. Housed in the Air and Space Industries Building a demonstration building booth (right under the Wright Brothers' original airplane) and several glass cases and counters were provided by Smithsonian workmen for the modelers.

Along with the Displays of the National Association of Rocketry were ones from the Academy of Model Aeronautics and the International Plastic Modelers Society. These three groups divided up the time to be shared in the building booth, with each group occupying it for three to four weeks during the summer.

For the four weeks the N A R had use of the booth, WAMARVA sections scheduled their activities so as to be sure that each section was down at the Smithsonian at least one day of each week–talking to the public and demonstrating their rocket wares.

Three fine display areas were provided for the NAR in addition to the demonstration booth.

The first contained scale models. Included here were models built by Bob Royal and Keith Niskern of Centuri (their two versions of the Little Joe, the V-2, a Nike Smoke, the Saturn IB and V), models of Estes Industries (their V-2, and uprated Saturn I), and a donation from Mr. Stine (who also serves as a special consultant on astronautics for the Smithsonian) consisting of a Czechoslovak model of the V-2 by Dipl. ing. Horacek (no kidding).

The second display area contained rocket models of futuristic design by local WAMARVA members.

The third display was provided by Competition Models Inc. and consisted of four identically painted "Effys" depicting a typical model rocket's flight–from ignition to parachute recovery.

On the wall to the left of the displays a huge picture poster revealed John Belkwitch, Sr. (NAR range safety officer for the last five NARAMS and senior advisor of the Pascack Valley Section in New Jersey) supervising a youngster putting an Estes Gemini Titan kit on a launch pad.

In the foreground before the displays lay a sales counter, surrounded by plastic airplanes, where among Indian combs and Dutch shoes, one could buy the Estes Gemini kit pictured on the wall or any of several kits provided by Estes and Competition Models.

The models were impressive and the NAR did a fine demonstration job. Next year the NAR may look forward for bigger displays and more time to meet the public at the Smithsonian's Second Annual Aerospace Modeling Exhibit.

Ed Pearson

EDITOR'S NOOK

I had written a lecture on how every rocketeer should do his share to pull the load but it was such a bore that I fell asleep proofreading it. Thus, this will be a short dissertation for the October issue. I will let the contributions for this issue do the talking: Ole' Ed Pearson comes through with a fully detailed report on the success of the Smithsonian, done while he prepared to enter the armed service - keep your head down, Ed, and thanks for a good job; Andy Elliot provides us with some insight as to what others did during the historic flight of Apollo ll; Chuck Gordon sent in another very decent Section News column with stories of similar work by other sections; Bob Mullane of LAC gives us a very useful list of addresses for obtaining NASA materials. Thanks to all the above and others contributing their time and/or newsletters to this issue. It appears that the new Rocketeer will be an easy success from now on. The only problem encountered so far is a slight dearth of good tech material. Plans for reviewing all R&D reports submitted at NARAM–ll are underway but there is much from the past that should not be allowed to gather dust. Thus, I again ask those who have received requests for material to please dig into their archives and help out. There has been some overlapping of efforts but a reply to one requester will take care of all. All reports will be copied and returned intact and full credit given. We would like to vary the consistency of the Rocketeer but need some reports from the average rocketeers to do so. Several are in the works now but we'd like to expand the NAR space soon and this requires participation by anybody with news to tell. A good example of how anybody can have news valuable to all is the article detailing Scott Brown's work with the Infinite Loop design. Don't keep your work a secret; let's hear about it.

Another way you can help make a better Rocketeer is to tell us what you think of our efforts so far. Too much news, not enough scale data, maybe? Do you read the whole thing? What parts do you like best? What new features should be added? Should some fairly technical articles be included? I personally have been itching to finish work on design theory and mathematical parameters on pressure tube launchers as they make an interesting problem for most modelers who have toyed with R&D. Calculus rears its head, however and the resulting banjo music tends to frighten off most young people. Anybody interested in such dissertations, as in the original Malewicki derivations? Let's have some opinions so we can make a mag that everybody'll read! Finally, we are seeking article topics for features, both technical and non-technical. If you tell us what you'd like to read about, we'll find someone in the know capable of writing an article on it. For example, Jim Barrowman is prepping a blurb on NAR and its anatomy and the hows and whys of convention planning are being handled by several participants. Similarly, technical questions may be developed into interesting essays if a query Krushnic effect - so an article on it is in the works. The primary problem with such efforts is that they are written from the slant of just a few authors. Thus, we are also looking for semi-competent writers who'd like to try their hands at tech writing. We'll help you avoid some of the pitfalls and you might just learn something. Same goes for those junior drafters in the audience. We have several lengthy notes floating around that detail the secrets of drawing rockets and are looking for guys to train for future work. Anybody interested? A short version of those notes is being prepped for an article on how to draw rockets and should show up before February.

Well, that's enough for now. Enjoy this issue and drop us a line at NAR HQ or through Chuck Gordon's address under Section News.
Lindsay Audin

SECTION NEWS
by Chuck Gordon

TEACHER AEROSPACE WORKSHOP

The annual NASA Aerospace Workshop for elementary teachers was held at Mankato State College, Minnesota, June 23-27, 1969. There were 26 teachers in attendance. The Zenith Section participated by conducting the model rocket portion of the workshop. Members of the section were on hand to aid the teachers in constructing model rockets and one evening was devoted to flying the rockets built by the teachers participating. Zenith Section set up the range equipment and conducted the launchings.

The NASA Aerospace Workshop has been a part of the summer program at Mankato State College for seven years. The Zenith section has participated in this event for five of the seven.

ODDS & ENDS

The Xaverian Rocketeers report in their XAVERIAN NEWSLETTER of plans to set up an "Education Committee." "It will be the purpose of the Education Committee to work with rocketeers outside of the NAR through an NAR clinic and introduce them to the workings of NAR."

****

Carl Guernsey and Mike Coxen of the NARCAS section in Camp Hill, Pa. are reported to have built closed-breech launchers. The first one was tried out and the hoped for effect of increased performance is said to have been achieved on the first attempt. Good going, Carl and Mike.

****

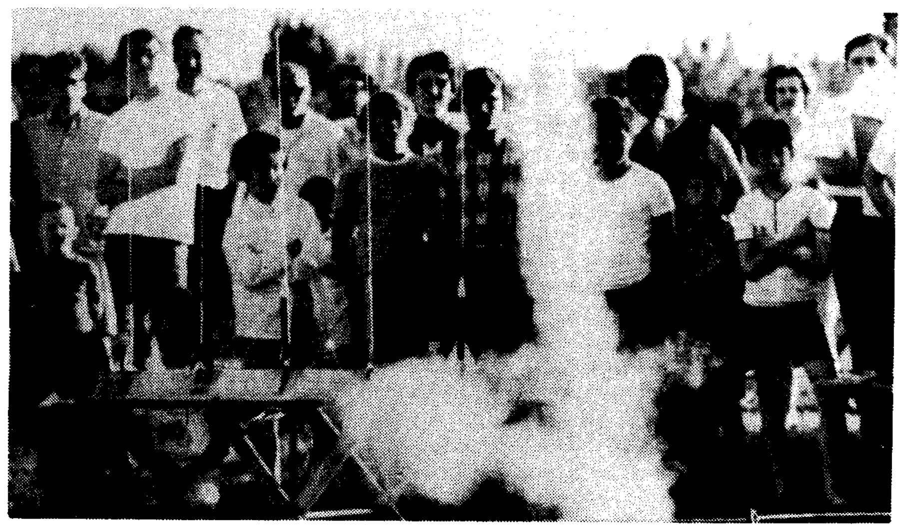
The IGNITER CURRENT, newsletter of the Fairchester Section says that efficient range operation, well selected events and high caliber as well as quantity of contestants made the SPQR-3 regional meet, held June 23, in New Canaan, Conn., one of the best of the season. Sections participating in the meet were Space Pioneers, Fairchester, Pascack Valley, and Cheshire.

****

The Cosmotarians Section of Oregon is planning to take a trip to the Boeing Space Center in Washington state in either September or October. This trip promises to be very interesting for all involved.

****

Daniel Winter, of the Aerospace Unlimited Section, of Eden, New York, presented an exhibit using model rockets to illustrate aerodynamics at western New York's 27th annual Science Congress, held at the Buffalo Museum of Science.



(ZENITH SECTION PHOTO)

Photo taken at the launchings for the NASA Aerospace Workshop, Mankato, Minnesota. Models flown all built by participating teachers.

SECTION NEWS

The Cosmoratians Section and the Northwest Rocket Club put on a rocket launch demonstration as part of the Oregon Museum of Science and Industry Air Show in mid-August at the Capitol City Airport in Salem, Oregon.

****

The Star Spangled Banner Section of Baltimore, Maryland plans to hold a regional meet in October. Persons interested in more information should contact H. Galloway, Jr., 428 Ben Oaks Drive, W., Severna Park, Maryland 21146

NAR SECTION NEWS will appear each month as a regular part of the Model Rocketeer. Those sections wishing to have news and/or information of their section printed in this column should prepare all material and send it to:

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

MIDWEST MODEL ROCKET REGIONAL - 1

The first Midwest Model Rocket Regional (MMRR-1) was held on June 28th and 29th at a small airfield north of Columbus, Ohio, sponsored by the Columbus Society for the Advancement of Rocketry. About 30 contestants took part in this competition. Although open to NAR members in six states, contestants were mostly from Ohio, with a few from Pennsylvania and Indiana.

During the meet a tour of the Ohio State University Aeronautics and Astronautics Laboratory was conducted for all participants at the meet. At the meet banquet the movie "Apollo 8: Debrief" was shown.

C.S.A.R. TRACKS APOLLO 11

The Columbus Society for the Advancement of Rocketry ran a tracking station at the Columbus Center of Science and Industry (COSI) during the recent Apollo ll mission. Members monitored TV and radio stations for news coverage of the flight, while short wave radios were used to listen to the world's reactions to the lunar landing flight.

Members also ran simulations in a full-sized mock-up of the Apollo ll command module, provided to COSI by North American Rockwell. One member, George Pantalos, made a four hour "flight" on which he ate space food provided by the Whirlpool Corporation, while other members of the section gave slide shows depicting the whole mission.

Members of the Columbus Society for the Advancement of Rocketry are now looking forward to next summer and the flight of the APOLLO 14.

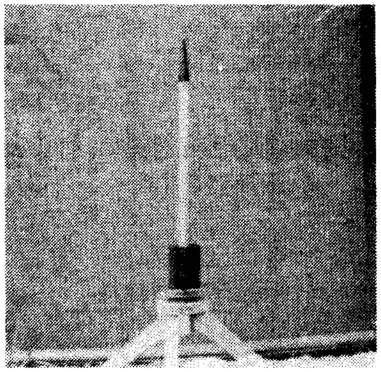
NASA MATERIALS
To obtain NASA films, info, etc.

If you live in:	Write to:
Alaska* Idaho Montana California (North of LA) Oregon Washington Wyoming	NASA Ames Research Center Public Affairs Office Moffett Field, California 94035
Conn. Maine Mass. New Hampshire N.Y. Rhode Island Vermont	NASA Electronics Research Center Educational Programs Office Cambridge, Mass. 02139
Alabama Arkansas Louisiana Mississippi Missouri Tennessee	NASA George C. Marshall SFC Public Affairs Office Marshall Space Flight Center, Alabama 35812
Delaware Dist. of Columbia Maryland N.J. Pa. West Virginia	NASA Goddard SFC Photographic Branch Code 253 Greenbelt, Md. 20771
Florida Georgia Puerto Rico Virgin Islands	NASA JFK Space Center Code SOP 323 Kennedy Space Center, Florida 32899
Kentucky North Carolina South Carolina Virginia	NASA Langley Research Center Langley Station Public Affairs Office Mail Stop 154 Hampton, Virginia 23365
Illinois Indiana Iowa Michigan Minnesota Ohio Wisconsin	NASA Lewis Research Center Office of Educational Services 21000 Brookpark Road Cleveland, Ohio 44135
Colorado Kansas Nebraska New Mexico North Dakota Oklahoma South Dakota Texas	NASA Manned Spacecraft Center Public Affairs Office Houston, Texas 77058
Arizona Hawaii* Nevada Southern Calif. Utah	NASA Pasadena Office 4800 Oak Grove Drive Pasadena, Calif. 91103

* Alaska requesters may also obtain NASA films from Dept. of Audio-Visual Education, University of Alaska, College, Alaska 99701

* Requestors in Hawaii may obtain prints from State Dept. of Education, Audio-Visual Center, 4211 Waialae Ave., Honolulu, Hawaii 96816.

NEW GLIDER DEVELOPMENT



Scott Brown's version of the Loop using MRI parts. It's silver (monokote) with flat black nose and base.

Scott Brown, NAR no. 11759, President of the new Gemini Section of New Castle, Delaware, reports some interesting results when he modifies the "Infinite Loop" model featured in the May issue of **Model Rocketry.** As the story goes, Scott didn't attach the shock cord to the body tube and, at ejection, the nose cone and streamer separated from the rest of the rocket. The nose cone fell (naturally) but the main section glided! As you may recall, the Infinite Loop has no fins but instead has 6 three inch body tubes at its base. Apparently, a burned out engine casing provides enough weight at the tail end to move the CG into an ideal position to obtain a glide. Scott notes the CG is three inches from the aft end, placing it at the top of the stabilizing tubes. The only trimming needed was placement of a paper clip at the front end to avoid stalling. The front is not the front, however, as this "thing" glides aft end forward. Glide is in a straight line with no noticeable rolling. Conditions in 5 preliminary tests were ideal, with temperature about 80 degrees, wind speed 3 – 8 mph and 4 miles of visibility. Delaware is a lowland so height was 19 feet above sea level. When trimmed with .07 oz. at the "front," a time over 25 seconds was obtained with a B engine. Flights using C6–5 engines have yielded times over three minutes, however.

Some refinement appears necessary and Scott plans to put out a report when he completes more research. Presently he has four "loop gliders" under construction, including one utilizing an FSI E5-6. Anyone interested in trying similar experiments is urged to contact and trade data with Scott. He may be contacted at:

700 Delaware Street
New Castle, Delaware

Any further developments will be reported via the Rocketeer so keep us informed,Scott.

A Rocketry Gathering – the U.S. & Japan

On the Sunday of Apollo ll's landing, the NARHAMS section, in the form of its senior advisor, Jim Barrowman, and seven other section members, was host to two Japanese reporters. Mr. Jin Uyeda, from Asahi magazine, the Japanese equivalent of TIME, was here to do a human interest background for a special issue on Apollo ll. Peter Kamura, an exchange student at Georgetown University, was interpreting, as Mr. Uyeda knew little English. The reporters wanted to record feelings about Apollo before and after the lunar landing and walk, so everyone involved spent that night and morning at the Barrowman's home.

Since Peter and Mr. Uyeda would be here all day that Sunday, the club decided to hold a short demonstration launch before the landing, to interest the reporters in model rocketry. The range was set up at the Goddard Space Flight Center Antenna Range from 12:30 till 1:30. Only fifteen or so rockets were flown, however these represented all phases of the hobby. Included were scale, sport, odd-ball, even a boost/glider. This very small B/G, designed by Bob Singer, was lost into the surrounding woods on a ½A!

The reporters were very interested and they asked quite a few questions. Although regulations prohibit transporting any engines back to Japan, a lot of pictures were taken. Model rocketry may get to Japan yet.

Later, seven rocketeers, two reporters, and four Barrowmans crowded into the Barrowman livingroom and quietly watched "The Epic Journey of Apollo ll." After Aldrin brought the craft down safely, Mr. Uyeda and Pete asked around for feelings now that man was on the moon. All that came through was, "unbelieveable," and it was.

After the shock wore off, everyone, except Mrs. Barrowman, relaxed, had dinner or played ping–pong, the official NARHAMS sport. In the spirit of the occasion we had an Internationals, American–Japanese mixed doubles. Finally we settled down to Walter Cronkite and Wally Schirra and the Eagle. When Armstrong finally hit dirt (?), he got a full round of applause.

After the two and one half hours of lunar walk were over, the questions were asked again but by now most feelings were inexpressible. Pete and Mr. Uyeda left to write the story then, as it had to be in that morning. Those remaining played ping–pong till about 3:00 a.m, then hit the sack.

It was a unique experience. Special thanks go to Jim and Judy Barrowman for their hospitality and to the crew of Apollo ll for a great show.

–Andy Elliott, NARHAMS

FROM THE CONTEST BOARD

A new contest director has been appointed. He is Richard Sipes, senior advisor to the M.A.R.S. section of New Carrollton, Md. His first order of business being Pink Book revisions, Mr. Sipes has set Jan. 15 as the deadline for membership suggestions for changes. Present plans set the completion of the first rough draft for March to be unveiled at the Pittsburgh convention. Final drafts are to be out in May and the new book is planned to take effect after NARAM–12.

The first immediate rule changes will be: Scale Altitude weighting factor rises from 4 to 5, all altitude events have weighting factors raised from 1 to 2 and Quadrathon may be flown simultaneously with its 4 base events. That is, a contestant can fly the 4 base events singly and call them Quadrathon but if he stops competing after 3 events (say, due to loss) he may count those 3 events for points. The rule will still remain, however, that one flight cannot be counted for 2 events. These changes go into effect 30 days after membership notification.

Rumor has that the Pink Book will see numerous changes, including creation and destruction of several events and revamping R&D.

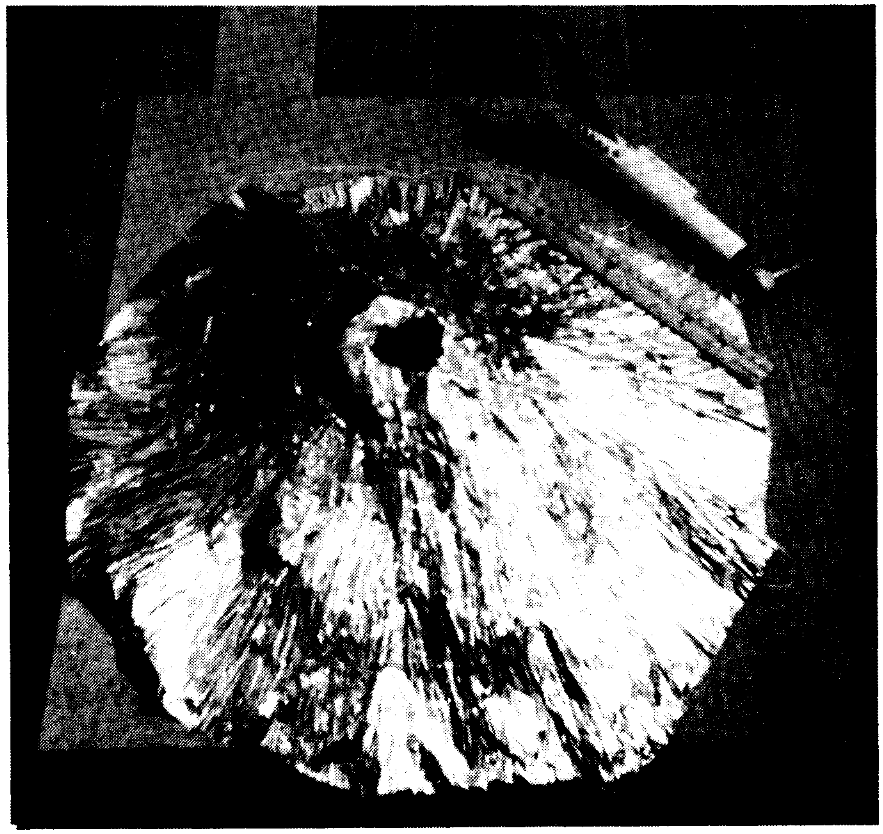
Our new contest director may be unknown to the membership outside the Eastern area but his qualifications certainly deserve mention here. Dick Sipes, NAR 11544, has been in rocketry more than 3 years and has been an invaluable aid at regionals and nationals. Those attending NARAMs 10 or 11 know he is responsible for the computerized Altitude Data Calculation Tables used in place of laborious individual calculations. Dick is Southern Division Manager for NAR Section Activities and is a prime coordinator for the WAMARVA sections' activities. At 27, he is programmer for the NIMBUS weather satellite at Goddard Space Flight Center. Mrs. Sipes is no stranger to model rocketry - she and Dick made up the team that took the Senior Reserve Championship trophy at NARAM-11.

Mr. Sipes would like suggestions for Pink Book changes sent to his home address:
Richard Sipes Apt. 101 5427 85th Avenue
Lanham, Md. 20801
Suggestions sent to NAR HQ will also be forwarded to the new CD.

Here is the opportunity to be heard on NAR's contest procedures. Dick wants constructive ideas but gripes are welcome, too. At contests, it's always heard how the rules should be written - now's the time to put those ideas on paper.

* * * *

New World Parachute Duration Record Established



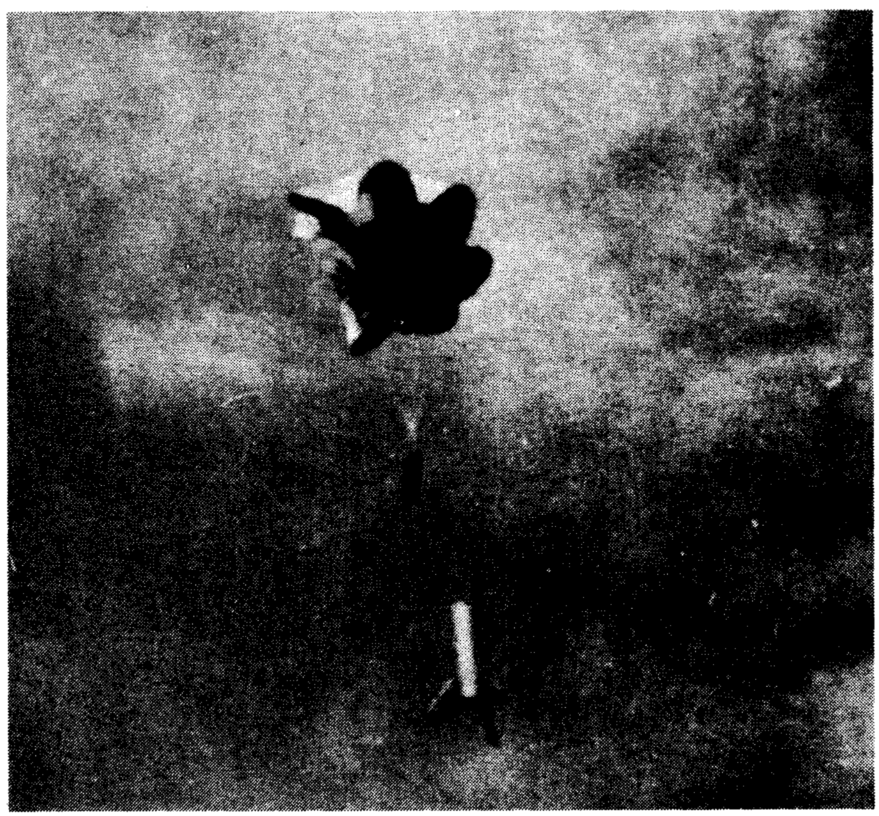
RECORD WINNING FLIGHT

An official record has been established for Senior Division Parachute Duration: time - 209 seconds. The holder is a 52 year old NAR member, Jess Medina NAR 14147, of Seattle, Washington.

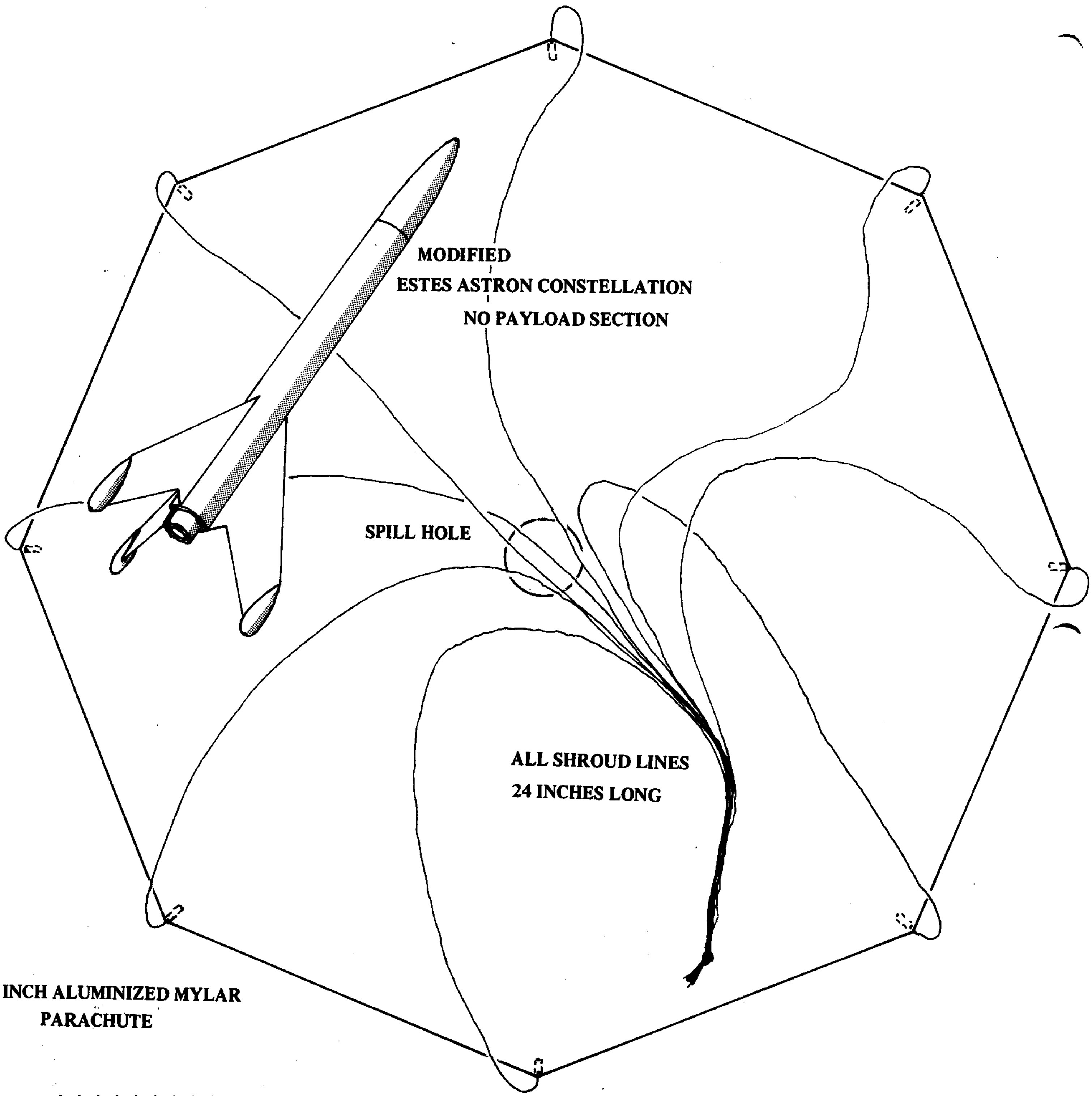
Utilizing a modified Estes Constellation (see drawing) without a payload section, Jess added a 24 inch parachute of .0005 (five ten thousandths) in. aluminized mylar. The material was obtained from Vashon Island Industries, Vashon Island, Washington, and is available in 12 inch square sheets. Jess glued four sheets together using Elmer's glue with a 1/8 inch overlap Take-off weight with an A8-3 engine was 1.32 ounces.

This record flight was recorded at NARAM–11 on Aug. 15, the return of which is pictured at the right. Note also the size of chute compared to available space in the body tube: that's a 24 inch 'chute packed in less than a 4½ inch space.

To obtain a national record, see details in the Pink Book. Also, forthcoming is an article on "how to file for a record." Now that an official record has been set, we all have something to aim for. Why not make a stab at record trials and become world famous? Somebody's going to set records now - why not let it be you? Send all applications for records to the CD or NAR HQ for proper handling.



NOTE MYLAR PARACHUTE



24 INCH ALUMINIZED MYLAR PARACHUTE

(Club Notes continued)

seconds. C. Martin placed first in Pee Wee Payload with 308 feet, T. Bray was second with 160 feet and R. Baier took third with 124 feet. An Estes *Orbital Transport* flown by M. Thomas took first in Boost/Glide Duration with 49 seconds, R. Labash took second with 24 seconds and R. Baier took third with 10 seconds.

In Spot Landing R. Brandon and F. Toperine managed distances of 60 feet and K. Dougherty took third with 61 feet. The Construction and Design event was won by T. Wuellette with 3 450 points. R. Brandon placed second and R. Baier took third. In The Egg Loft event D. Brandl placed first with 2,608 feet, while R. Baier and M. Martin tied for second with 1,556 feet and D. Martin took third with 1,174 feet. In Predicted Altitude J. Croyle placed first with an error of +65 feet, T. Wuellette took second with -66 feet and C. Martin placed third with +85 feet. In the overall standings R. Baier took first with 17 meet points. R. Brandon placed second and C. Martin and M. Thomas tied for third. The trophies and prizes for this contest were contributed by Burland's Hobby Shop in the North Hills Shopping Center in Pittsburgh. Brothers Csarny and Smith of North Catholic High School provided the PA system used and assisted in printing the issue of *Con-trails*.

(Old Rocketeer continued.)

the Explorer satellite in the nose . . . or, in other words, the tip of the nose of the model. This should put the CG exactly on the rear black band of the roll pattern. To get this CG with a Type B4-2 motor installed, you will have to add a half-ounce or more of plasticene modelling clay up in the tip of the hollow plastic nose cone.

My own Hawk Jupiter-C modified for flight with a Type B4-2 motor installed weighs in at a thundering 4.75 ounces! It literally lumbers off the pad! The 2-second time delay pops the chute nearly at peak. According to calculations in the Malewicki report (Centuri TIR-100), a Type C6-5 motor would open the chute well after the 3-second peak time of this larger motor. So, I have been flying my Jupiter-C solely with the Type B4-2 motor to date. However, with a little more nose weight, the Jupiter-C could be flown with the new C6-3 motor.

Using the same techniques as outlined in this article, I also converted another Jupiter-C to use the FSI motors. This requires more modification because a Centuri No. 8 tube must be used to house the larger FSI notor. An FSI Type D motor heaves the Jupiter-C plastic model well up there.

A final hint: Buy two or three Hawk Jupiter-C kits. They are cheap at a buck apiece. You may discover that you need the extra parts from time to time. I pranged my Jupiter-C rather hard at NARAM-9 and had to use one of the spare kits as a source for a new bucket and Explorer; the original ones are underground at Mankato Airport.

(From the Editor continued.)

will have been established by your earlier discussions with him. Keep in contact. If their are complaints, make sure there is nothing in the way you are flying to justify the complaints.

Remember, other rocketeers have lost their flying field because some other less responsible rocketeer used it in a manner which gave the hobby a bad name in their area. So form a club, get *all* the rocketeers involved. Follow a well thought out safety code, such as the NAR code or the Estes Astron Rocket Society Safety Code. If you and all the other rocketeers in your community fly safely, communicate with your public officials, and work to explain the merits of model rocketry to the rest of your community it will be far easier for you to obtain cooperation from them.

Maryland now has another Model Rocket club. The club held its first meeting on June 8, 1969 with 7 members, and on June 21 the club adopted the name Southern Maryland Area Rocket Team. In three weeks the membership had grown to sixteen!

SMART has had five meetings, one workshop and one range-launch; the SMART Newsletter (name subject to change after August 2) is in its third issue.

Officers are: President, Mark Crummett; Vice President, Ralph Swick; Treasurer, Bill Grimes; Section Advisor, Mr. Clovis Crummett.

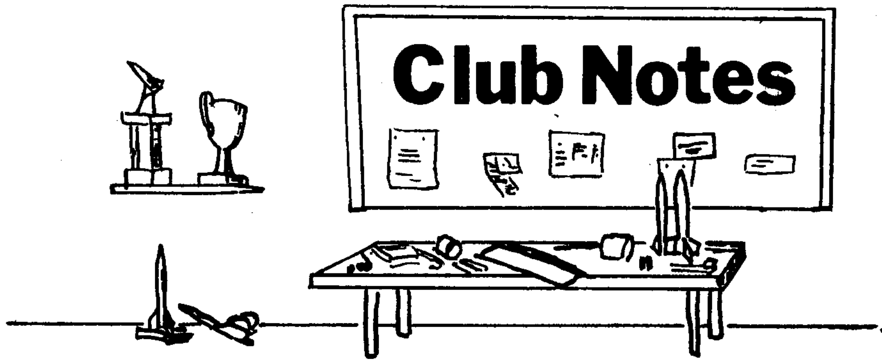
Membership is open to all who wish to join; interested persons should contact Mark Crummett, 1113 Broadview Rd., Oxon Hill, Md., 20022, 248-2994, or Ralph Swick, RR 1 Box 580, Accokeek, Md., 20607, 283-2246.

The Nicolet High School Rocket Club would like to get together with other Southeastern Wisconsin clubs and hold a contest. Anyone interested call Jeff Nickels (352-9044)

The Chicopee Comprehensive High School academic enrichment summer program included a rocket program. Over 140 model rockets were constructed by program participants. The Massachusetts school program was capped by a model rocket launching at the graduation exercises.

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

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



The Scottsbluff Model Rocketry Club of Scottsbluff, Nebraska, has been meeting weekly on Saturdays since August 10, 1969. Activities so far have included the steps of formal organization. A Constitution has been adopted, and the Club Charter was signed by the members at a regular meeting on September 13, 1969. Elections were held on September 6, and the President, Vice President, Secretary, and Treasurer were elected at that time. The total membership as of September 13, 1969 is 28.

Other activities include the process of finding a suitable launching range. Also, the Club's unofficial advisor, Dr. F. Kenneth Bloom of the Hiram Scott College is perfecting a new, more accurate system of visual altitude tracking.

Persons interested in the Scottsbluff Model Rocketry Club and its activities should contact the President, John Wilmerding, at 305 W. 26 St., Apt. no. 1, Scottsbluff, Nebraska 69361. Phone (308) 632-7791.

A new model rocket club is being formed in the Jefferson Davis High School area of West Palm Beach, Florida. The club has had four meetings so far and have launched over 50 rockets, including a Camroc. Interested modelers should contact Mark Dohner, 1975 Richard Ln., W. Palm Beach, FL. PH 967-0473.

A new rocket club is being formed in Oil City Pennysylvania. All local rocketeers interested should contact, Bill Frank, 12 Stevens St., Oil City, PA. 16301 Ph. 646-7975.

Ronald Smith of Worth, Illinois wants to start an official N.A.R. section in the S.W. suburban Chicago Area. Interested N.A.R. members (espescially seniors and leaders) should contact Ron. Call 448-7799 after 4 p.m. or write him at 6835 W. 109 St., Worth, Ill. 60482.

Between 60 and 70 spectators viewed a model rocket launching at the Crawford County Fairgrounds near Meadville, Pennsylvania. The event, sponsored by the Meadville Aerospace Research Association, included eleven Meadville rocketeers as well as groups from Saegertown and Clarion County. Poor weather conditions restricted the number of launchings and forced cancellation of an attempt to track and record the rockets altitude. Interested rocketeers in the Meadville area should contact Kenneth Neely at 335-8835.

A group of rocketeers at Mundelien High School, Mundelien, Illinois are interested in organizing an NAR section. Local rocketeers interested in participating should contact David Carpender, Acting Chairman, Mundelien Rocketry Club, in care of the high school.

Rocketeers in the Fayettsville, North Carolina area are invited to contact Billy Arnold of the Exploring Rocketeers Association for information on membership. His address is 803 Juniper Street, Fayettsville, NC 28304.

Following the example of many other towns where model rocketry is becoming a popular hobby, the city of Fort Wayne, Indiana has designated a model rocket launching site in the town. The Park Department has selected Shoaff Park, as the town's model rocket launching site.

Volume I, Number 3 of the North Pittsburgh Rocket Club *Con–trail* contains the results of their latest competition. In the Scale event R. Baier took first with his Little Joe II, R. Brandon took second with a Nike-Smoke, and R. Labash took third with a Nike-Deacon. In the Pee Wee Parachute Duration M. Thomas placed first with 70 seconds, M. Martin took second with 45 seconds and C. Martin was third with 37 (Continued on page 47.)

ANNOUNCING THE MPC SPACE SYSTEM.

A complete new concept in flying model rockets.

The MPC Space System. Everything you need to fly. All under one name. New flying model rockets...new kits...new NAR-certified model rocket motors...new parts and accessories. It's a totally new concept of what model rocketry is all about.

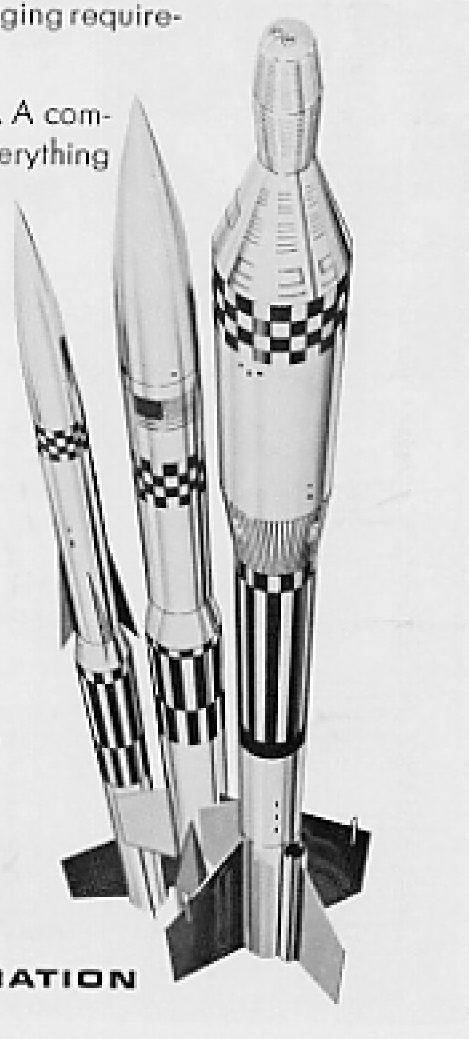
MPC Astroline Series. A complete innovation. Molded plastic parts and accessories with fiber-tube bodies. The MPC integral cruciform tail fin assembly, molded in brilliant orange plastic with low-drag fin planform and airfoils. Acclaimed by the nation's top model rocketeers at the 11th National Model Rocket Championships. Two new kits: Moon Go and Redstone Maverik...with plastic fins, nose cones, couplers and accessories for instant assembly, super detailing and proven true-flight performance.

MPC Mach 10 Series. Four contest-rated and contest-proven balsa and fiber-tube rockets. Icarus-C...perfect for contest flying in the FAI/NAR Pee Wee Payload events. Flare Patriot ...the only rocket specifically designed for the NAR Quadrathon Competition and a proven design of NARAM-11. Theta-Cajun...a sporty altitude and duration model patterned after NASA rocketsondes. Lambda Payloader...for sport flying and small payloads in a clear payload section.

Motors. A range of 18 x 70 millimeter rocket motors to meet contest and sport flying needs. Safety certified and Contest certified by the National Association of Rocketry. A3-2, B3-3 and C6-4 plus dash-zero motors in types A, B, and C for staging requirements.

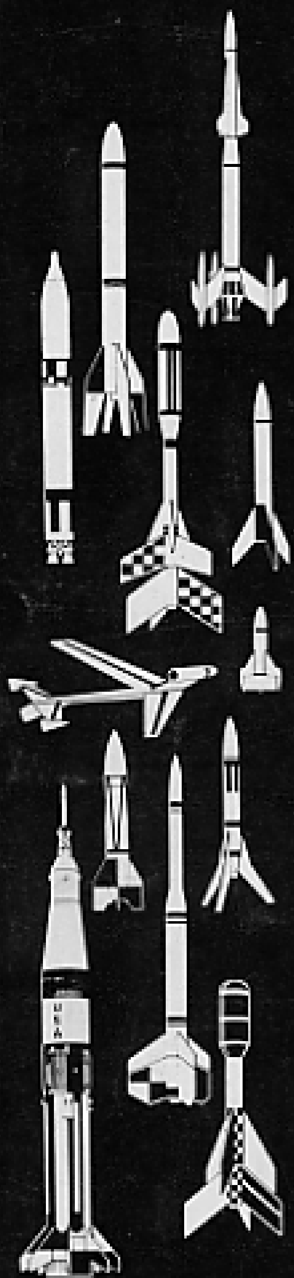
Accessories. A complete line. Everything you'll need.

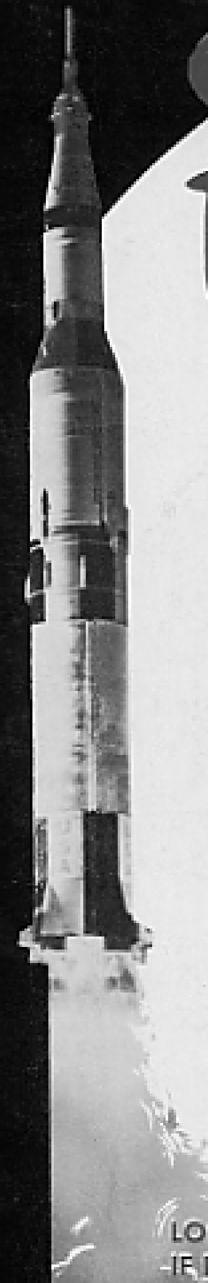
The MPC Space System. It's all there at your local retail stores. No more waiting, no more writing, no more wondering when. Fly it soon.



MODEL PRODUCTS CORPORATION
MOUNT CLEMENS, MICHIGAN 48043

. . . the space-age "fleet"





ESTES ROCKETS

. . . a whole "fleet" of real flying models to challenge every rocketeer!

5 — 4 — 3 — 2 — 1 . . . . BLASTOFF in a space program of your own . . . build your own rockets! Know the challenge of building a "bird" for perfect flight — the thrill of seeing it soar high into the sky — the reward of a billowing parachute returning it safely to earth. Send aloft an experimental payload or an aerial camera. Measure your rocket's peak altitude on your altiscope. All this and more is available through the Estes model rocketry program . . . true scale models, space-age designs, experimental equipment, tools, kits and supplies. Join the space-age action — be an Estes model rocketeer!

ESTES ROCKETS ARE DESIGNED WITH MANY EXCITING FEATURES:

- SINGLE OR MULTI-ENGINE POWER
- SINGLE AND DOUBLE PARACHUTE RECOVERY
- PAYLOAD CAPSULES
- FLIGHTS TO 2500 FT
- MULTI-STAGE SEPARATION

A COMPLETE LINE OF SUPPLIES FOR DESIGNING AND BUILDING YOUR OWN ROCKETS IS ALSO AVAILABLE.

THE MOST COMPLETE ROCKETRY CATALOG WITH 32 YELLOW PAGES OF TECHNICAL INFORMATION.

LOOK FOR ESTES ROCKETS AT YOUR HOBBY STORE. IF NOT AVAILABLE, SEND THIS COUPON.

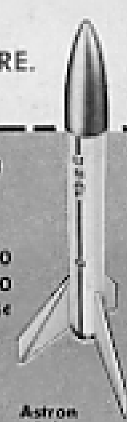
Estes Industries, Dept. 31, Box 227, Penrose, Colo. 81240

Payment enclosed. Please send me the following:

- ☐ Starter Special #DSK-20. Includes high-flying Astron Alpha kit, 2 powerful engines, complete instructions and design manual $2.00
- ☐ #DSK-70 — Same as above plus electric launching system with batteries . . $7.00
- ☐ Huge illustrated color catalog and design manual (free with order) . . . . . . 25¢

NAME . . . . ADDRESS . . . .

CITY . . . . STATE . . . . ZIP . . . .



Astron Alpha