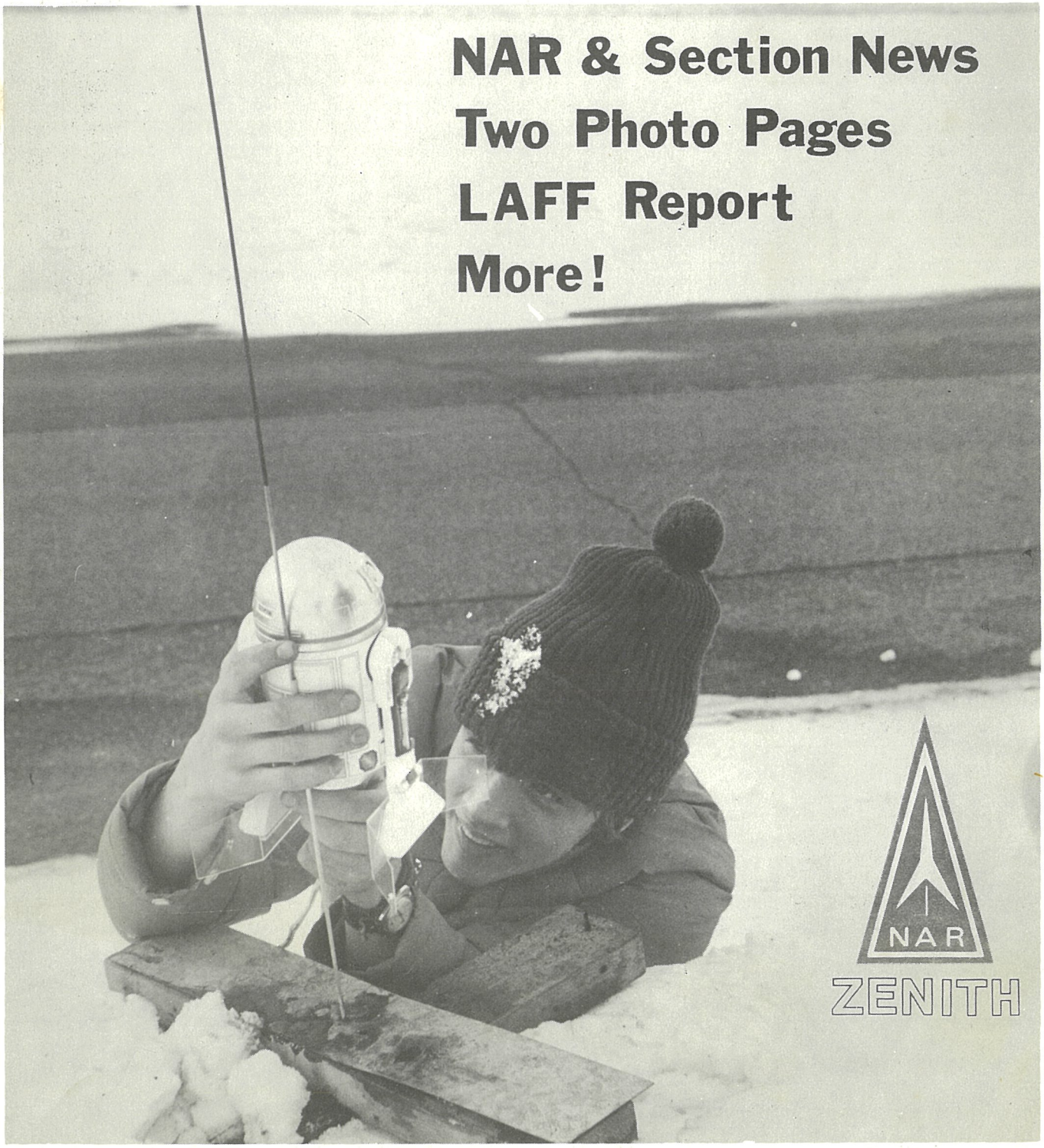
VIEW FROM ZENITH

Estes Merchandise Certificates Come Through!

March 1979

Official Newsletter Of The Zenith Section Of The National Association Of Rocketry



NAR & Section News

Two Photo Pages

LAFF Report

More!

EDITOR'S SPACE

Disturbing news: the NAR has succumb to the Estes Syndrome.

First, an explaination of terminology. The "Estes Syndrome" is a term we use to describe the policy of the major model rocket manufacturers (most visibly Estes) to down grade their products and services to gear toward the mass market of temporary rocketeers. These rocketeers are kids in the 10 to 14 year old age group that buy a starter kit and perhaps a few rockets which they fly for about a year, get bored with, and quit rocketry. This type of rocketeer makes up the vast bulk of the rocketry market for the major companies, and the manufacturers make no pretense on this point. This explains the trend towards plastic parts, pre-colored models, simplified assembly and lack of technical information. All this is supposed to make it easier for more kids to get into rocketry (and supposed to increase the prophits of the rocket manufacturers).

Now the NAR has adopted this policy. The board of trustees decided to "accept the fact that junior NAR members have a high turn over rate and gear the NAR's offerings not to junior renewals but to a high turn over market". But is the Estes Syndrome a bad thing? After all, it just gets a lot of kids involved in rocketry that would not have flown rockets anyway, right?

Well, perhaps, but I have always wondered how many young rocketeers with potential to be great modelers are we losing by putting them through the hey-kids-fly-these-toys-for-a-while-get-bored-and-quit ringer that the manufacturers have set up. After all, how seriously can they be expected to take a hobby with all-plastic-no-brain-required rockets and technical information that reads like "look, look, see it fly!"?

I realize that this is a chauvanistic attitude but it has been a concern of mine for quite a while.

Tom

View From ZENITH Vol. 2 No. 3 March 1979

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COVER PHOTO: Todd Schwiem hooks up the clips to his R2-D2 during the February 19 winter LAFF launch. For more photos of the launch see page 4.
Photo by Tom Beach

NAR NEWS...

The Board of Trustees of the NAR met recently in Chicago and a report sent to Mr. Butterworth by President Miller contained all sorts of news, both good and bad.

First, the bad news. Last year the National Association of Rocketry had a total income of $25,080.38 and had total expenses of $26,076.84. Now, a deficit of $996.46 is not a whole lot (the federal government can do it six times a second) but you will notice the effects in a short while. The Model Rocketeer, which was responsible for about half the deficit, will be cut back to twelve pages starting in April. The Rocketeer will stay at twelve page length until the publications committee can work itself back up out of the hole.

The other bad news is that Rockwell has denied the NAR's request for $7500 to fund the 1980 World Championships of Model Rocketry. Trustee Jay Apt is now asking several other companies for smaller donations of $1000 or $2000.

Now for the good news. The price for individual insurance will be reduced by $0.75 per purchasing member as of March 1, 1979. The requirement that sections must have insurance in order to have a sanctioned competition has also been dropped.

The NAR is planning several new programs to stimulate membership, both on the junior and senior levels. New programs for the juniors include preperation of a brochure and preperation of a flyer that Estes will allow in mail order kit stuffing. The NAR Technical Services will attempt to come up with several new items designed to appeal to the junior market. On the senior level, there are plans for new NARTS items and a brochure aimed at senior level rocketeers. The Model Rocketeer also plans to run more articles on the activities of senior members to make them more visible with the Association.

The new Pink Book will definately be ready for the next contest year, but there was talk of having the book mailed only to the members that request it and pay for its shipping (due to the deficit).

All the committees and trustees are hard at work and if all thier plans go as well as President Miller seems to think they will, the NAR should have a fine year in 1979. Let's do it!

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NARTREK

NARTREK Headquarters has moved and is now being headed up by Claud Greenlee. If you want to get into the NARTREK program to prove and improve your rocketry skills just write to Claud at the address below:

CLAUD T. GREENLEE
30 LAKE TERRACE DRIVE
CRAWFORDSVILLE INDIANA 47933

WEAR THE NARTREK GOLD!

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SECTION NEWS

For the past half year or so Zenith Section has had no money and we have been barely getting by on the donations of a loyal few (thanks!) but those days are at an end. The merchandise certificates Estes promised to give us for building their X-Wing Fighters (you remember...last August) are finally going to arrive. Mike Hodapp has discussed the delay with Estes and Estes says they are sorry and will send the $100 certificate shortly. To get the ball rolling right away, Mike has given us two $50 certificates he had previously earned from Estes and will take the $100 certificate when it arrives.

Now, the good news! In order to turn these certificates into cash, we are now taking orders for Estes merchandise for 10% off! Get your supplies at a discount and help out your section by giving us your orders. First come, first serve, so let us know as soon as possible. Contact Tom or John Beach. Thanks for getting things straight with Estes, Mike.

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N.R.A.

Do you know all of the model rocketry companies there are? Well, here is one you haven't heard of before: NOVA RESEARCH ASSOCIATES

A new company, they specialize in designing launch systems for model rockets. Products include their Gemini, Sirius, and Orion class launchers as wel as transistorized launch systems that give an audio continuity check and are flash bulb safe. We will let you know when the products become available and other news (or you can see for yourself at WISCon!

NOVA RESEARCH ASSOCIATES
David Babulski
P.O. BOX 305
Lakeland Minnesota 55043

The finest in personal launch systems.

LAFF

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On the following page are several rare and interesting photographs of a very rare species of animal, the Winterus Rocketeeris (northern variety). This reporter was extremely lucky to get within camera range of a group of five of these hearty individuals as they congregated for some sort of tribal ceremony in the snow on February 19. The ceremony involved many strange activities including launching of model missiles (predominantly UFO's and R2-D2's) followed by running swiftly through the knee deep snow and often involving falling flat into the snow. Often the brave beings recited sacred chants like "5,4,3,2,1" and "damn chute didn't open!".

The activities lasted for over two hours, with the Winterus Rocketeeri making frequent retreats into their cars to seek warmth. After they had sacreficed enough of their models to the great wind god, who was out in full force that day, they packed up all the gear and headed for warmer climates.

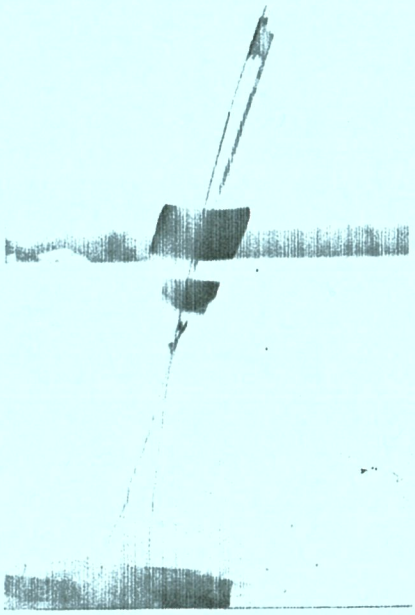
It appeared they had an emmense amount of fun (despite the nasty hole one of them found by vanishing into a large snow bank) and you missed a great launch if you weren't there!

Todd Schwiem loads his "Holy Hand Grenade of Antioch" onto the pad.

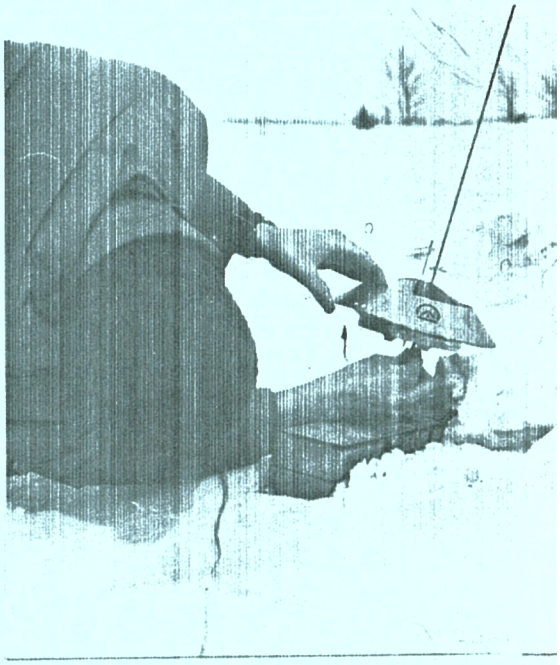
John Beach prepares for the launch of the "Hand Grenade" by digging into the snow.

Ted Krause, Jim Whitehead, Todd Schwiem and John Beach watch one of the several flights John's R2-D2 made during the launch.

John says good-bye to his "Pro-Slam 2" shortly before it vanished into the clouds on an E5-4.



Tom Beach's "Big Bird", a built-up-sliding-flop-wing rocket glider. Of course it didn't work (almost!).



Todd hooks up the section's demo UFO for a test. The UFO kit is a perfect winter rocket (no sticking chute!).

SO MUCH STATIC

(Editors note: All of you who have been in Doctor Standeford's astromomy lab and have been lucky enough to escape without getting lost in the vast piles of stuff are well aware of Doc's experience in the building of plastic models. He didn't put all those models together without learning somthing about static model building, so we asked him to do an article on the subject. This article is only the first in a series so read on and learn...)

I have been building models, mostly aircraft, since World War II. The kits of that era consisted of printed balsa wood, stringers, tissue, wire, wheels (usually wooden), plans and sometimes even paint and/or glue. With the coming of prefabricated models and plastic kits, much of the romance of model building faded for me. The plastic kits especially seemed an insult to my skill as a modeler (I was conceited even then) but also a curiosity. It was nice to have a cockpit interior (sometimes) and a pilot figure, even if the glue joint ran through the center of the pilots face. This latter condition lead either to extensive plastic surgery (pun intended) or cutting off the head (a mercy killing).

In other words, I didn't see much in plastic models in those early days. Fortunately, others saw model kits for what they really are - - boxes full of slightly processed raw materials which could be converted into replicas of aircraft or spacecraft. (I'm finally getting to the point of this series of articles.)

Over the years, kit quality and variety has shown major improvements. Additionally more and better supplies have become available both to produce the structures of the model and to add those little details which make the difference an assortment of parts glued together, and a page of history frozen into a replica you can hold in your hand.

Scale model rocketry is, of course, not new, but the addition of static model competition opens the door to a whole variety of model types which are available but which are hazardous for flight operations.

In the next article, we will start looking at kits and kit conversions. There are several kits available of the Apollo CSM and LM although one popular kit shows flight configurations of the spacecraft that were never actually used on the moon or during manned flights. A total loss? See next month's column...

Leo Standeford
NAR 29371

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CHEER UP, PRANGERS!

By its own definition, not even Murphy's law can work ALL of the time! -TB

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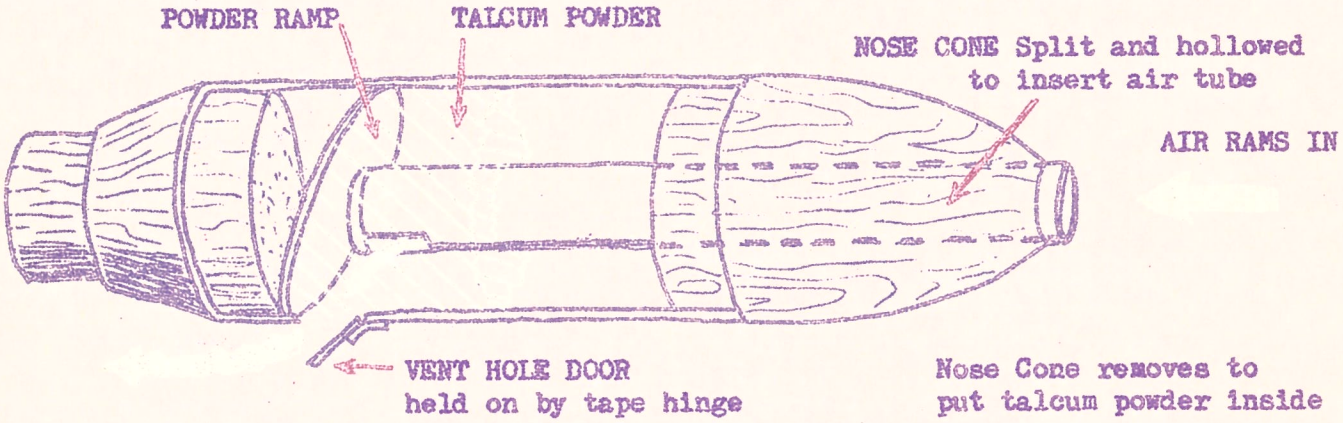
MINI PLAN

Here's a couple of ideas that you may want to try out. The first is an old idea that might be fun for a demo bird or wind experiments. The second idea is a new one that has yet to be tried but may prove very useful.

If you remember Enerjets (the composite fuel engines, not the present sacrilege of putting the word Enerjet on ½A6-2's), then you may remember the Enerjet Nike Smoke kit that left a "smoke trail" in its wake as it flew skyward. Here is how the system worked. If you try this method, make sure to use a high power engine and not too much talcum powder for best results, otherwise the rockets speed will be too slow.



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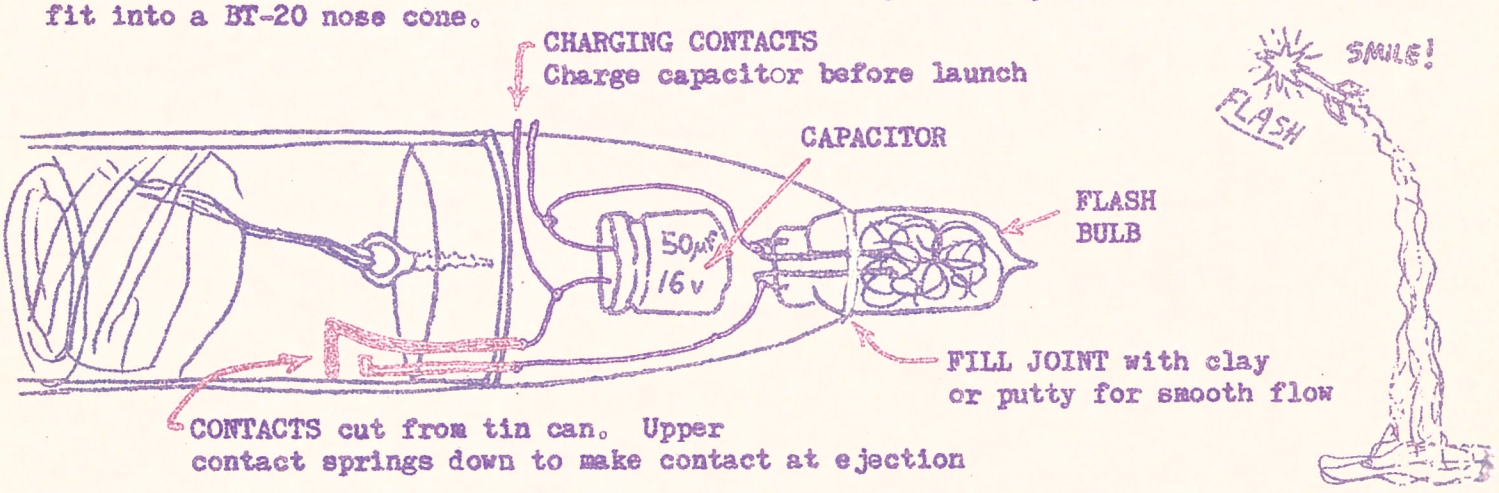
The second idea is for all you class 5 altitude freaks. Are you tired of having to suffer the penalties of weight and drag that go with the large model you have to fly in order to be tracked? Does it bother you when the trackers can't see your puff of tracking powder at 1100 meters because of a broken cloud layer background? Well, then try the ejection flasher shown below. The flash bulb system weighs only a few grams, but it should produce a flash that will show the trackers where to find your little puff of tracking smoke.

This system is still untried and I am not sure how far away you can see the flash of a flash buld during the day, but it is worth a try. The system should be able to fit into a BT-20 nose cone.



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PISTON LAUNCHER ?

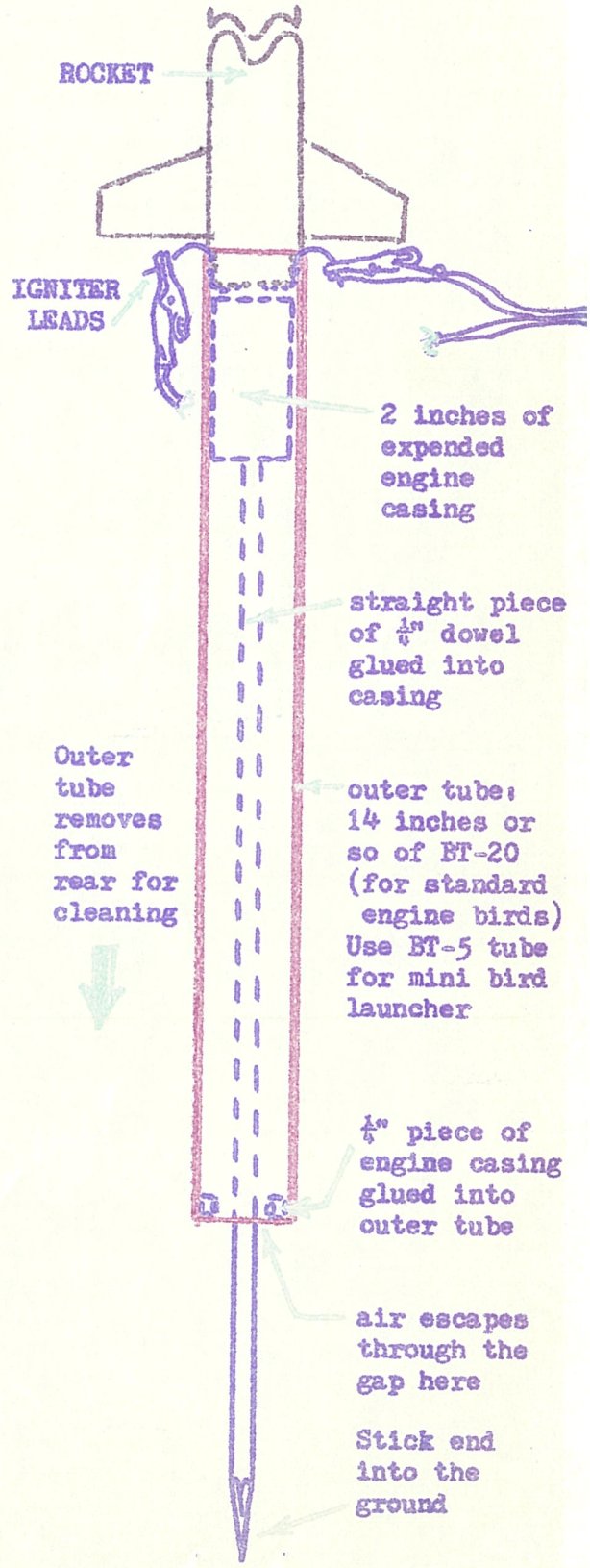
The family of pressurization effect launchers includes such devices as closed breech launchers, Khun augmenters, and piston launchers. The most efficent member of the family is the Zero Volume Piston Launcher.

The zero volume piston launcher makes use of the pressure exerted by the expanding exaust gas of the model rocket's engine to give the rocket an initial kick and literally throws the model into the air. Use of a piston launcher can increase the performance of a model significantly and they are quite common devices at any major model rocket meet. The question that you may be asking is: is the piston launcher worth the effort? To help you answer this question for yourself, we will explain the operation of a piston launcher and show how to build a "cheap and dirty" piston launcher that you can make with little trouble to test for yourself.

A zero volume piston launcher consists of a stationary central core that is attached to a base or stuck in the ground. This core forms the piston. The outer tube slides freely on this core and is the same diameter tube as the tube that holds the engine you are using. This tube can slide forward on the piston core until it hits a stop at the front. The tube must be designed so that it can be removed from the launcher for cleaning.

The model sits on the top of the outer tube with its engine fitted snugly into the tube. The igniter is hooked up either by wires that run up through the central core (for most designs) or by running the igniter wires back around the engine and out the top of the tube (in the design here). When the engine ignites, the exaust gasses expand into the outer tube and force the tube and model to move upward. When the tube comes to a stop, the pressure and the inertia of the model act to separate the rocket from the launcher. This initial kick increases the performance of the rocket very much, especially for heavier models that would normally lift off slowly. In order to insure that the launcher operates properly, the outer tube MUST be cleaned out after every flight.

The piston launcher diagramed at right is a simple to construct design that you can try out to see if piston launchers are worth the effort you put into building and cleaning them. For a rocket to use the launcher, its engine must extend at least a fourth inch out of the model. The engine must be fitted snugly, but not too tightly, into the top of the tube. Attach the micro clips to the igniter wires that are brought out of the top of the tube.



WANTED

NIGHT HAWK

Are you looking for some rocketry item or bit of rocketry information that someone reading our newsletter might have? Let us know and we will list it in a future issue to try to help you out. For this issue we have:

Donald Miller Hoosac Street Waterville MN 56096	Donald is looking for the wing patterns of the ESTES NIGHTHAWK kit or for anyone who has a Nighthawk that he can trace the patterns from.
Jim Whitehead Box 67 Amboy MN 56010	Jim needs the following issues of the Model Rocketeer: 1972 Nov 1973 Feb, Nov, Dec 1974 Jan, Dec 1975 Jan, Feb, March, April, May, June, July 1977 March
Tom Beach 315 Common St Waterville MN 56096	Tom is searching for back issues of Model Rocketry Magazine, and being the fool he is, he is willing to pay good money for them.
John Beach	John is looking for ZE-KNIGHTS who want to save 10% on stuff he will order for you from Estes! (In case you missed this)

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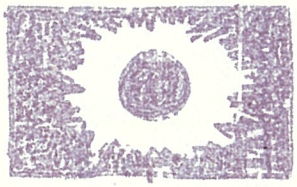
ECLIPSE



by Tom Beach

I stood in the center of a snow covered gravel road in the wide open spaces of northern Canada and adjusted the settings on my camera. As far as you could see, there was nothing for miles around except snow covered prairie. The sky was clear and the sun shone brightly but the air was freezing cold. Down the road to my left there were many other camera tripods waiting and several groups of people trying to keep warm. The group was made up mostly of students from Mankato State University who had come all the way up here to frozen Canada to witness a rare event: a total solar eclipse.

The partial phases were unexciting. I had seen many partial eclipses before. As the moon covered more and more of the sun, weird things began to happen. The day grew visibly darker and the light turned sort of steely grey, like the look the sky gets when a tornado is approaching. Colors began to look unatural and there was a definate tension in the air and in the people. During the final minute, you could actually see the moons shadow racing across the prairie towards us. Then it happened: TOTALITY. Darkness fell over the area and the suns outer atmosphere and prominences glowed in a halo around the moon. The view was fantastic, and is like nothing you will ever see anywhere else. I found it difficult to concentrate on shooting photos and just stopped and stared at times. It was the shortest three minutes of my life.

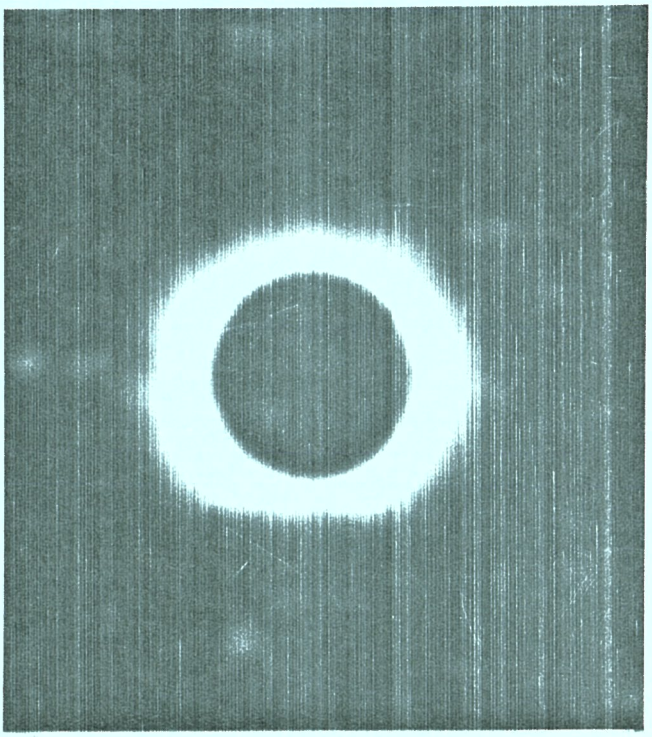
I had brought along my Camroc-Delta and I tried to get a picture of the eclipse using a C5-3 engine and a 60 degree angle toward the sun (after all, NASA does it). Both shock cords snapped in the cold but the rocket was recovered from its small crater in the snow. Alas, the photo did not turn out (but I got several nice ones from the ground, one of which is on the next page).

WORKSHOP FUN: Todd Schwiem tests the feasibility of levitation in model rocketry. John Beach seems to be suitably impressed.
Photo by Tom Beach

A model of a sailing ship? No, Donald Miller is working on an experimental flex-wing B/G.
Photo by Tom Beach

ECLIPSE BLITZ '79 TO CANADA

Tom Beach's Camroc heads into the sun to try for a picture of the eclipse.
Photo by Dan Zimmerman



A shot of the eclipse taken during totality (from the ground).
Photo by Tom Beach

Get Ready For...

CONTESTS '79

Here is the list of contests that Zenith section will be involved in during 1979. Check this list over NOW and see if there are any conflicts in the dates. There have been several changes since the last version of this schedule was published so check it out. It is never too early to start building models!

SKY HIGH 4 JUNE 9-10 Regional meet held in Tomah Wisconsin.
EVENTS:
Open Spotlanding
¼A Parachute
B Streamer
½A Streamer
Plastic Model Conv.
A Helicopter
Gnat Boost Glide ¼A
Swift Boost Glide B
Hornet Boost Glide ½A
Eagle Rocket Glide E
Hawk Rocket Glide C

ZENITH 1 JUNE 24 Zenith Section meet.
EVENTS:
Quadrathon
Design Efficency
Superroc A
Eggloft C

ZENITH 2 JULY 22 Zenith Section meet.
EVENTS:
¼A Streamer
½A Parachute
½A Helicopter
Gnat Boost Glide ¼A
Hawk Boost Glide C

Z.A.M. 2 AUGUST 19 Zenith Annual Meet 2. Section meet.
EVENTS:
Scale
Superroc B
Eggloft C
Pee Wee Payload
Altitude ½A
Altitude E

M.A.Z.E. 1 SEPT 8 Minnesota Area Zenith Encounter. Open meet.
EVENTS:
½A Streamer
¼A Parachute
Predicted Alt.
Superroc B
Eggloft C
Helicopter A
Hornet Boost Glide ½A
Sparrow Rocket Glide A

M.O.R.T 1 SEPT 30 Minnesota Open Record Trials.
RECORD TRIALS.

* * *

And for those who are thinking of making it down to Texas this summer, remember...

N.A.R.A.M. 21 AUGUST 5-10 Johnson Space Center

NARAM!

Scale
Eggloft D
Helicopter A
Dual Eggloft E
B Streamer
A Parachute
Superroc D
R&D
Hornet Boost Glide ½A
Sparrow Rocket Glide A
Predicted Altitude

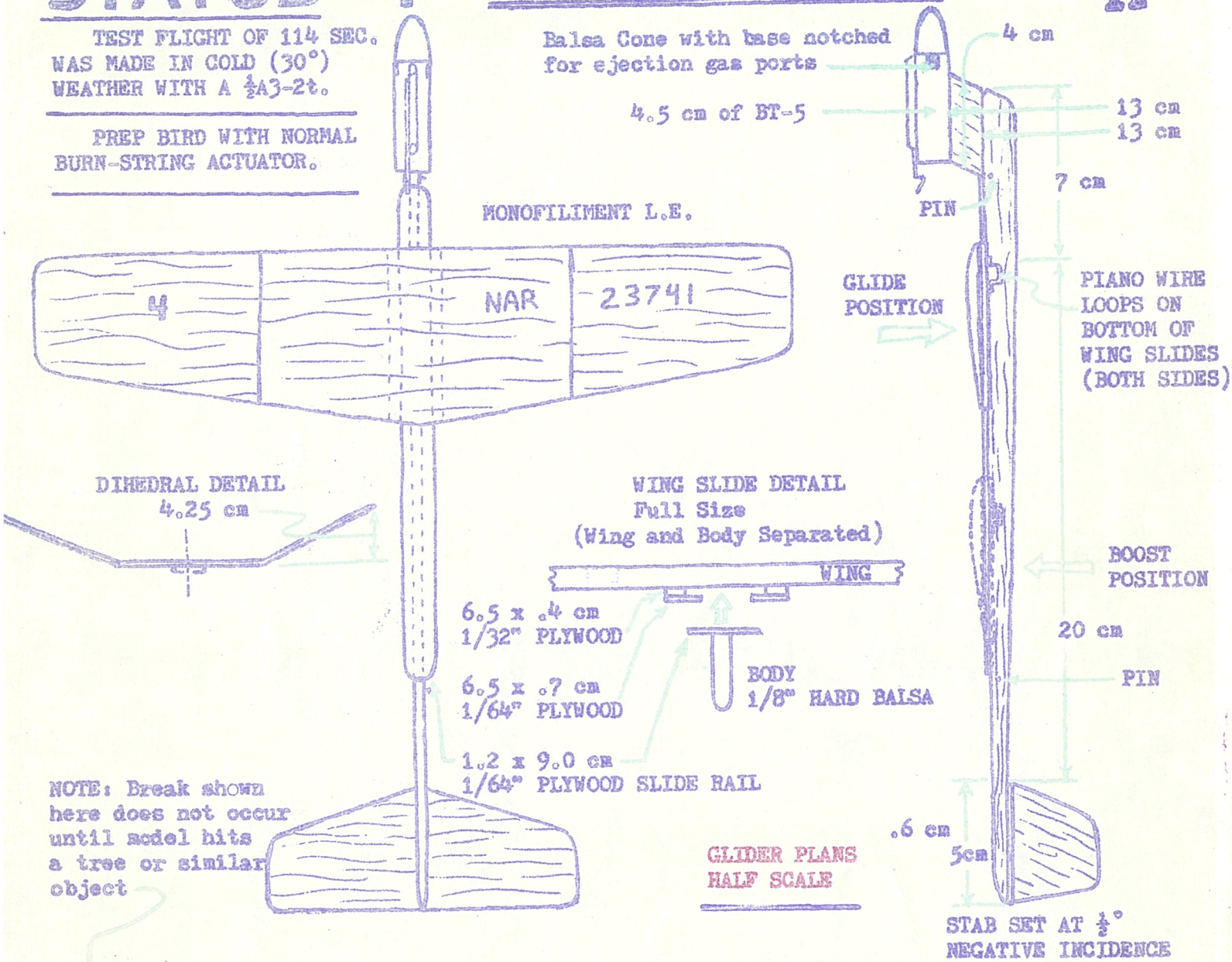
* * *

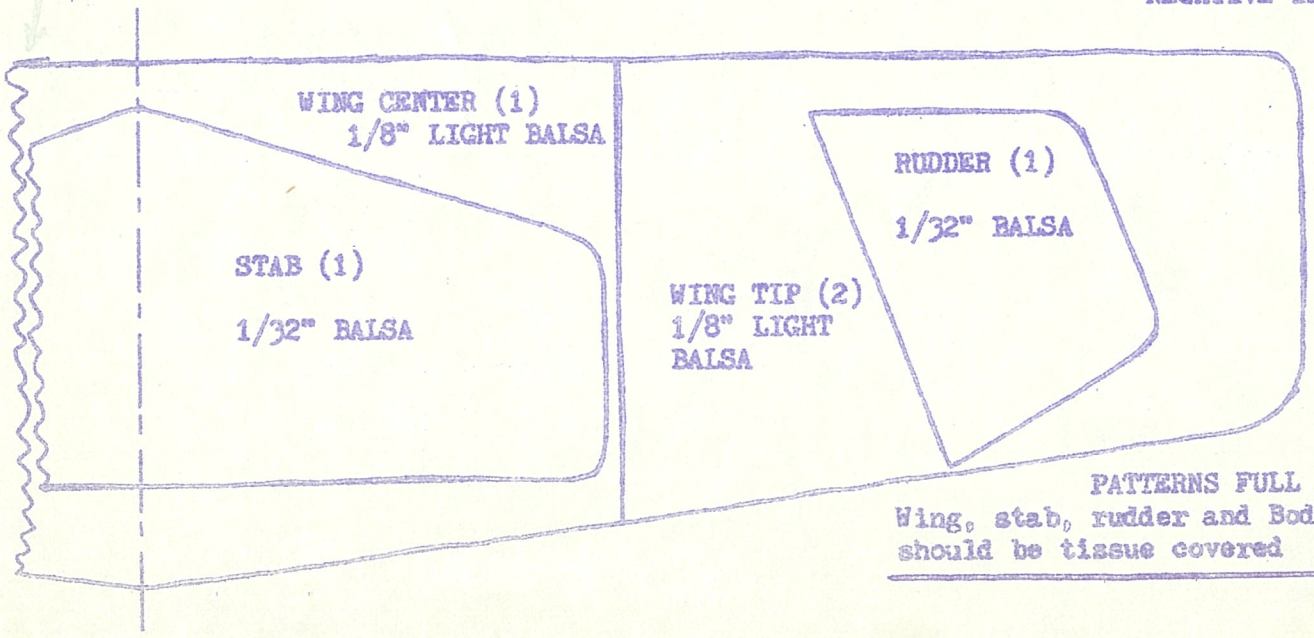
STATUS - 4

HORNET / SPARROW R/G by TOM BEACH

TEST FLIGHT OF 114 SEC. WAS MADE IN COLD (30°) WEATHER WITH A ½A3-2t.

PREP BIRD WITH NORMAL BURN-STRING ACTUATOR.





PATTERNS FULL SIZE
Wing, stab, rudder and Body all should be tissue covered

ALTITUDE

EQUATIONS

On the next page is a set of equations that describes the flight of a model rocket. These equations are derived by taking the basic motion equations for a rocket and mixing them together using the methods of calculus, a process that is quite interesting to me but would be of little use to an average rocketeer. The equations on the next page are only the results of this derivation and they are presented here because they are useful to the average model rocketeer. Using these equations you can produce altitude prediction charts, optimize the mass of a rocket, evaluate the flight performance of a model, etc. All this can be done by any rocketeer that has access to a simple electronic scientific calculator (which is EVERYBODY now).

The equations presented here are known as the Capraso-Bengen solution to the general equations of motion. An alternate solution that is more commonly presented is known as the Malewicki solution, but that set of equations involves hyperbolic functions, which would make them more difficult for rocketeers. Also, several of our members who have access to a computer will find that these equations can be programmed easily in BASIC language, where as the Malewicki solution is better suited to FORTRAN.

How to use the equations: Say you have a model rocket that you wish to find the maximum altitude for, but you don't have any altitude prediction charts for the type of engine it will use. Your first step is to measure or look up the values for the variables listed at the bottom of the next page (that is, you measure the mass of the model, calculate its frontal area, look up the total impulse and burn time for the engine, etc.). Then you simply put the values into equation 1 and calculate the burnout velocity of the bird. Equation 2 will give you the burnout altitude for the model and equation 3 (which uses the results of equation 1) will give you the coasting altitude. Add those two values and you get the total altitude. If you want to get an idea of how long a delay to use in the engine, simply solve equation 4. Not hard at all! Just make sure you put in your values with the correct units (use metric system) and the answers you get will be a close approximation of what your rocket will do.

To produce an altitude prediction chart, you have to program a computer to do the same steps we went through above. The program then loops around and does the same thing over and over for different values of mass and drag factor. The results are printed out in a table that tells the altitude obtained for a given mass and drag factor and you can draw up the chart from this (or just use the table).

You can optimize the mass of your model by making use of just equation 1. You can do this for any type of motor, even if the manufacturer does not make optimization charts for his engines. Recall from an earlier article that we found out that to maximize the altitude your model will reach, we have to adjust its mass so as to maximize its kinetic energy at burnout (great help, right? Don't worry, I'll explain). The Kinetic Energy that your model has at burnout is given by the equation $K.E.=\frac{1}{2}mV_b^2$ where m is the mass of the model and V_b^2 is the square of the burnout velocity (which we get from equation 1). Build your rocket light and strong and calculate its burnout velocity and its kinetic energy at burnout. Then run through the procedure again using a slightly heavier mass value. If the K.E. answer increases, do this again. When the K.E. answer goes down, you have passed optimum mass. You can do more calculations to get as accurate a value as you wish, but a few times through should be sufficient to get an answer that is close enough.

1. BURNOUT VELOCITY (meters per sec)

$$V_b = \frac{I_t - m g t_b}{\sqrt{m^2 + k t_b^2 (F - m g)}}$$

2. BURNOUT ALTITUDE (meters)

$$Y_b = \frac{-m + \sqrt{m^2 + k t_b^2 (F - m g)}}{k}$$

3. COAST ALTITUDE (meters)

$$Y_c = \frac{m_b}{2k} \ln \left[\frac{k V_b}{m_b g} + 1 \right]$$

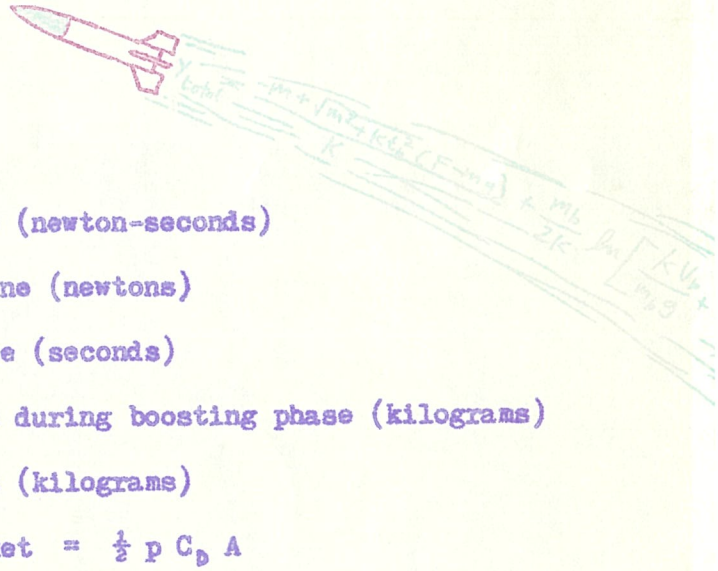
4. COAST TIME (seconds)

$$t_c = \sqrt{\frac{m_b}{g k}} \tan^{-1} \left[V_b \sqrt{\frac{k}{m_b g}} \right]$$

Wow! And I thought it just went up!

TOTAL ALTITUDE = $Y_b + Y_c$

TOTAL TIME TO APOGEE = $t_b + t_c$



Where the symbols in the above equations mean:

ENGINE DATA- I_t = Total impulse of engine (newton-seconds)

F = Average thrust of engine (newtons)

t_b = Burn time of the engine (seconds)

ROCKET DATA- m = Average mass of rocket during boosting phase (kilograms)

m_b = Burnout mass of rocket (kilograms)

k = Drag parameter of rocket = $\frac{1}{2} p C_D A$

p = Density of air (1.1895 kg/m^3) (in Mankato)

A = Frontal area of rocket (square meters $A = \pi r^2$)

C_D = Drag coefficient (varies from as low as .3 to as high as over 1.0 for a draggy rocket. Average is about .75)

g = Acceleration due to gravity (9.8 meters/second^2)

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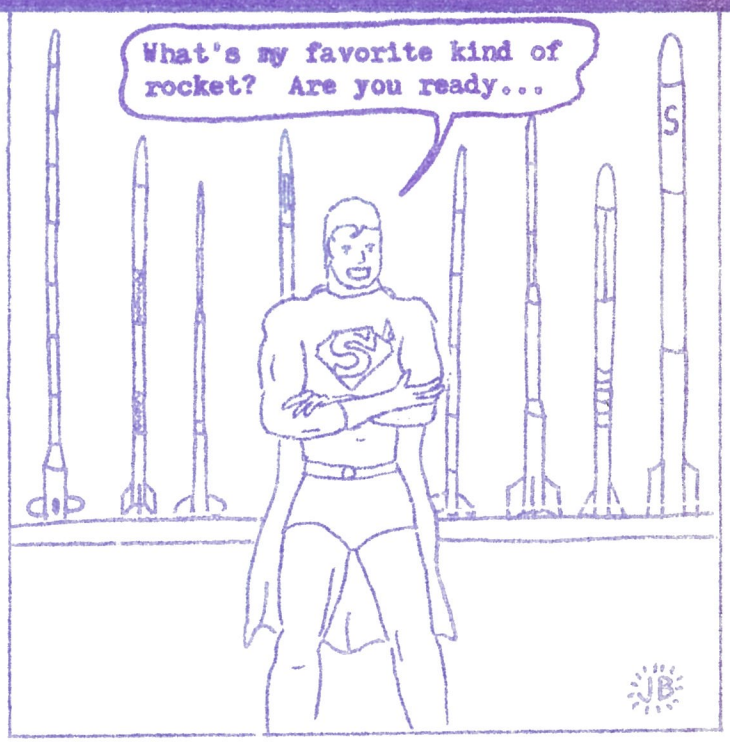
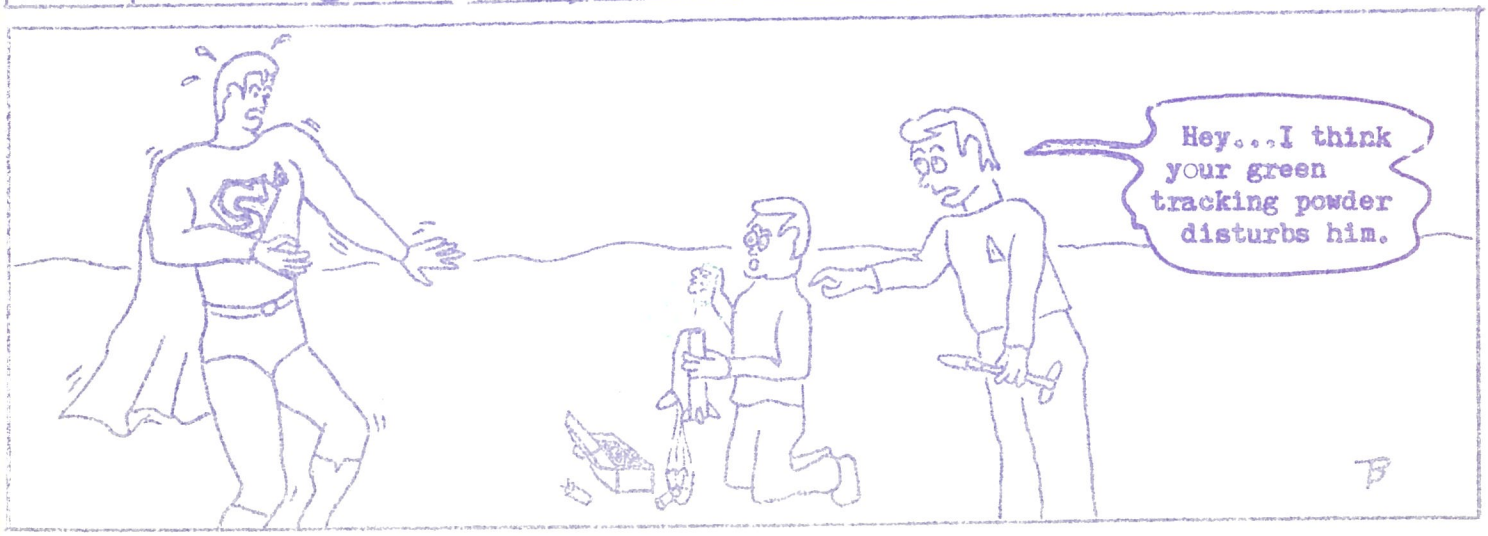
SUPERMAN THE MODEL ROCKETEER

"YOU WILL BELIEVE A MAN CAN FLY ROCKETS"





ANSWERS...

Here are the answers to the Logic Problem from last issue. Below are listed the final standings in the MESCON Apollo Triple Eggloft event.

PLACE	FIRST NAME	LAST NAME	ROCKET
1	Bill	Carson	Splinters
2	Linda	Harris	Crackers
3	Ron	Miller	Shards
4	Cindy	Baker	Buster
5	Jim	Smith	Boiler

If you got the right answers you can consider yourself an expert. If you got the last contestants mixed up, you are still doing good. If you didn't do the Logic problem at all, you should be ashamed of yourself!

****

KNOW YOUR ROCKETEERS

by Tom Beach

TYPE 3: THE COMPETITION ROCKETEER

The Competition Rocketeer is actually a rare species of rocketeer. It is estimated that only a few hundred of them exist in the United States. There are several signs that can identify a competition rocketeer: If he instantly recognizes the term CMR but has to think a second about ESTES; if he is caught performing unnatural acts with mylar; if he is all broken up over the death of dual egglofters; if he constantly talks like a biology major (hornets, sparrows, dinosaurs); or if he is constantly mumbling "thermal, thermal"; then you have found one.

BRAIN: Never knows what town he is in; is only aware of certian code phrases like NARAM, ECRM, ROBOT, MAZE, ETC.

EYES: Constantly observing the competition, scanning for thermals, and eyeing attractive young females on the field (not in that order)

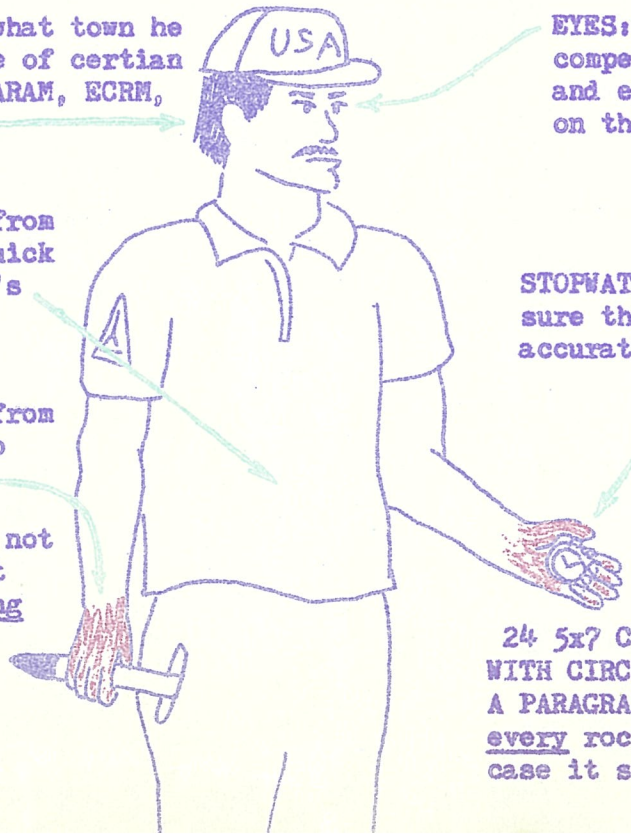
ROCKETS that he will fly at tomorrow's meet

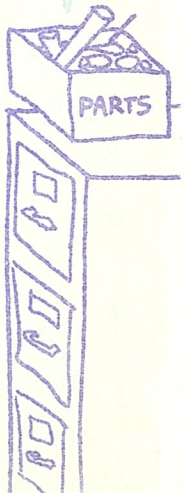
STOMACH: Going bad from catching too many quick meals at Mac Donald's

STOPWATCH: just to make sure the timers are accurate.

HANDS: Stained red from exessive exposure to tracking powder.

ROCKET GLIDER: Does not really like them but they have a weighting factor of 5!!





24 5x7 COLOR GLOSSY PHOTOS WITH CIRCLES AND ARROWS AND A PARAGRAPH ON THE BACK for every rocket he owns, just in case it sets a record.

RANDOM ACCESS 16

LAFF LAUNCH WITH CIVIL AIR PATROL...Sort of. On March 25 we set up launch operations at the old airport for a fun launch with the members of the Civil Air Patrol here in Mankato. The purpose of the launch was to give the civil air patrolers a chance to fly their models and watch us fly ours. Well, the launch went off quite well but none of the CAP boys flew any rockets. They were very impressed with several ZENITH rockets such as John Beach's cluster UFO (the only way to fly a UFO) and Donald Miller's V2 converted for SSRS F50-5 (I'm still impressed with that bird), and we may have the interest of at least a few of them.

MORE NEWSLETTER FUN. Believe me ZE-KNIGHTS, if all you read is the Model Rocketeer you are really missing out on a lot of great rocketry reading. Try section newsletters and you will never go back. I gave you the addresses of the NOVAAR Free Press and the Midwest Rocketeer last December and here are a few more:

LUBBOCK ROCKETEER
2010 5th Street Apt 11A
Lubbock, Texas 79401
$4.00 per year. A personal favorite of mine which is getting better with each issue.

ORBITAL REPORT
30 Lake Terrace Drive
Crawfordsville IN 47933
$3.60 per year. The newest Midwest Newsletter. Full of aerospace news and model rocketry.

IMPACT
P.O. Box 5712
Homewood AL 35209
$3.00 per year. Unbelievably funny and full of great plans and general craziness.

NEW STUFF FROM NARTS.
Narts has a few new items on their lists and here are two of them:
US RECORD SETTING DESIGNS
Ten record setting plans
Cat. no. RSD $1.25

PRANGER PATCH (NAR-3 $1.25)
Use this to warn your fellow rocketeer as to your true nature.

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*** SECTION SCHEDULE *** SECTION SCHEDULE *** SECTION SCHEDULE *** SECTION SCHEDULE *** ZENITH! ***

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APRIL 19	MEETING	LAC Model Rocketry slide show
MAY 17	MEETING	"How to" presentation on competition in a sanctioned meet. Very important!
JUNE 9-10	SKY HIGH 4	Regional meet in Tomah, Wisconsin. See inside for details.
JUNE 21	MEETING	
JUNE 24	ZENITH 1	First section meet. Events: Quadrathon, Superroc A Eggloft C, Design Efficency
JULY 19	MEETING	
AUGUST 5-10	NARAM 21	Johnson Space Center, Texas. See inside for details.

Section meetings are held at 7:00 o'clock PM in the basement of the Law Enforcement Center on Front Street in Mankato.
Section launches and demonstrations have not yet had dates set.

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View From
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MANKATO, MN 560
PM
MAR 31
'97

MANKATO,

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