OCTOBER 1973

MODEL ROCKETEER

OFFICIAL JOURNAL OF THE NATIONAL ASSOCIATION OF ROCKETRY

Vol. XV No. 9

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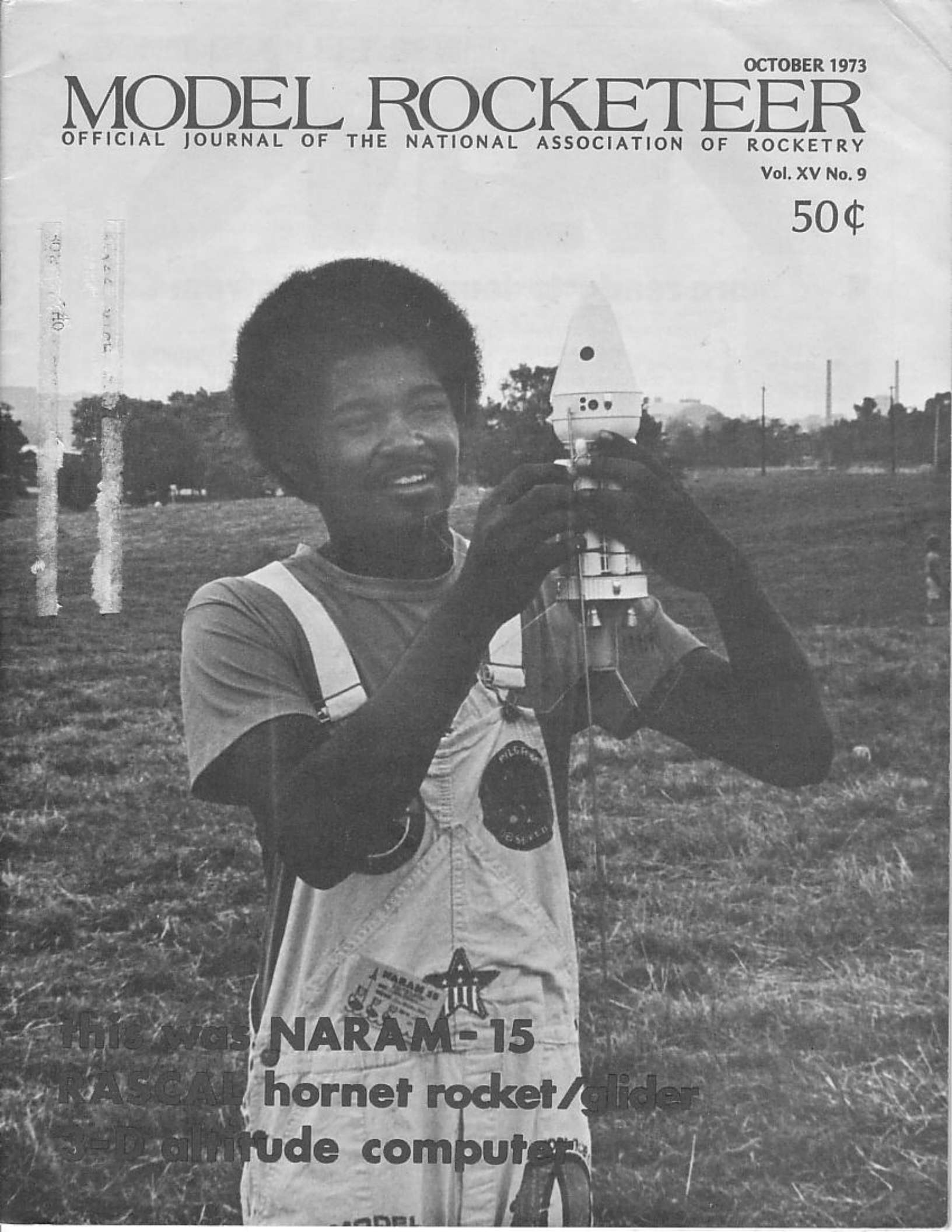

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COVER PHOTO

Second place in C Division Plastic Model at NARAM-15 went to "Fat Albert" (known to some as Greg Stewart), who flew a Pilgrim Observer Space Station. Complete NARAM coverage begins on page 6. (Photo by Tom Pastrick)

CONTENTS

EDITOR'S NOOK

NARAM-15, the National Association of Rocketry's fifteenth annual meet is over. We hope that this issue of the *Model Rocketeer* will bring memories of good times to those who attended the meet, and that it will give those who were not present a complete picture of the competitive events, meetings, and fun that occurred there.

We would like to thank all those people who helped with the NARAM coverage. Our reporters were a varied lot, ranging from a past president of the Association, to a Junior member attending his first NARAM. We hope that the many points of view will add texture to our NARAM report. A special word of thanks must go to Jan Blickenstaff, who helped put together both the October and September *Rocketeers*, and who should really have the title "Assistant Editor" for those issues. Thanks again to all our helpers.

Those of you who like to count pages have probably noticed that the *Model Rocketeer* has grown in recent months. You now have a twenty-four page magazine. The *Rocketeer* staff would like to keep NAR organizational material at its present level, increasing the number of plans, technical articles, and other features of wider interest. For this, however, we will need your help. Send us your plans, technical articles, and other materials. We know that there are things you would like to see in your magazine, so if you see someone with an interesting rocket (or if you have a good design yourself), ask him or her to send it to the *Model Rocketeer*. The same goes for technical and other articles. All you can lose is the price of postage, and if your article is published, your NAR membership will be paid for one year. If the quality of the material in your magazine goes down as its size increases, don't blame the staff. Our staff people can only write a limited number of articles and design a limited number of rockets; their primary function is to edit the material that comes in. Let us hear from you.

Elaine Sadowski

STAFF

Membership in the National Association of Rocketry is open to all rocketeers regardless of race, color, creed, or sex. Yearly dues; are Junior (under 16 years of age as of Janurary 1) $6.00; Leader (17-21) $7.00; Senior (21 and over) $8.00. (These membership dues include $2.00 for a year's subscription to *Model Rocketeer*). Send application for membership with remittance to: National Association of Rocketry, PO Box 178, McLean, Virginia 22101. Non-member Subscriptions to *Model Rocketeer* are available at $6.00 per year.

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NARAM-15

Jerry Gregorek, NARAM Contest Director, and Elaine Sadowski, MODEL ROCKETEER Editor, exchange sympathies on their difficult jobs. (Photo by Tom Pastrick)

NARAM-15 was held in a place and manner that should have stirred the memories of college alumni, reminded present students of the impending doom of college this fall, and given everyone else a glimpse of college life.

Housing was on the sixth, seventh, eighth, ninth, and tenth floors of a high rise dormitory, Taylor Tower, on the Ohio State University campus, with all the conveniences of college dorms—near absolutely nothing, far from everything (except pizza parlors and hamburger joints), and having no services (towels, soap, etc.) provided. There were, however, a room for Scale judging in the penthouse, and a workshop area in the dorm basement (though we don't think anybody used it). For those who preferred a softer life (or just wanted peace and quiet) there was a motel across the street.

Meals could be had in the cafeteria (a block away from the dorm), or one could visit the eating places within two blocks of the dorm, sampling hamburgers, pizza, roast beef sandweches, and vegetarian food, and never having to eat in the same place twice.

NARAM-15 opened with a discussion of engineering as a profession and an introduction to Ohio State. These were followed by a demonstration launch at OSU stadium which was open to the public and attracted quite a few spectators.

Most of the evening activities were held in Hitchcock Hall, a building about a ten minute walk from the dorm. An auditorium (for mass meetings) and several meeting rooms (for small mass meetings) were made available.

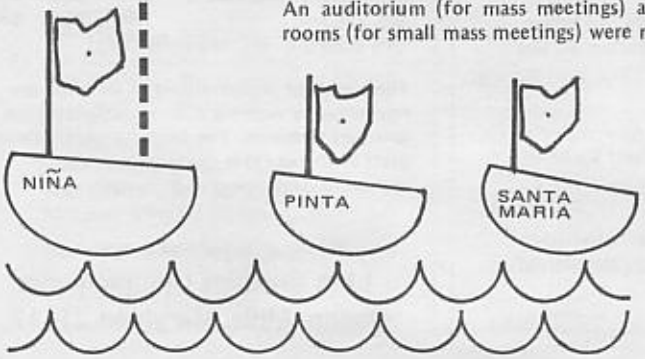
The launch site was an ex-cow pasture with a little stream flowing through it. Upon two knolls in this pastoral scene were the two launch systems. One was a rack and rail system from which all altitude events were launched. Next to it were the parking area and impact zone for several crippled egglofters. The central launch system was a two-wing satellite complex, around which were clustered the flags, prep tents, manufacturers' displays and range stores, Howard Galloway's red data reduction van, the refreshment stand, and the non-existent rest rooms. All the duration events (except PD and SD, two divisions of which were flown from one launch system, with the rest flown from the other), Plastic Model, Scale, and manufacturers' demos were launched from this site. Only 1/8-inch rods were provided at both sites. Contestants had to bring their own 3/16-inch rods or towers.

A demonstration in OSU Stadium officially opened NARAM-15. (Photo by Jan Blickenstaff)

The main launch system at NARAM-15 was the satellite system, around which the section flags flew. (Photo by Jan Blickenstaff)

Two launch systems made possible the launching of two events (altitude and duration) simultaneously without confusing the trackers and timers as to which bird was which. Because of the distance between the two sites, however, it was hard to watch everything, and people were so spread out that it looked like a non-meet. Only on Thursday afternoon and Friday morning did everybody gather in one spot on the range to watch Plastic Model and Scale.

Due to many factors, there was a lack of communication among contestants, officials, and spectators. An attempt at maintaining a central NARAM-15 office in the dorm was thwarted by vandalism which occurred when the office was left unattended, leaving participants with no way to locate people or have questions answered. This was overcome in some measure by full use of the bulletin boards, walls, and doors in the dorm. The distances on campus, while not prohibitive, certainly did not encourage participation in the various night activities, while on the range, the two launch sites with their two



not-too-loud PA systems (which makes sense, of course, since conflicting countdowns would cause confusion) made announcements next to impossible.

NARAM-15 came to a close with a banquet Friday afternoon in the Center for Tomorrow. After the chicken and ham dinner, the awards were presented. Jim Barrowman received a plaque and a standing ovation for his performance as NAR President during a time of crisis. Due credit and applause were given to the individuals and sections that made NARAM-15 possible.

"Tihi" (Tihomir Marjanac), a Yugoslavian modeler who competed at the World Championships and was visiting the U.S., was given a few mementos of his stay, in addition to a trophy for his unofficial first place Parachute Duration flight. After picking up their trophies,

NARAM award winners picked up loot from representatives of Ultrascale, Cox, Centuri, Estes, and FSI. (Photo by Jan Blickenstaff)

the winners gathered more loot from the manufacturers—Centuri, Cox, Estes, FSI, and Ultrascale. Missing were all the humorous awards, the Bumblebee, for example, that are usually given out at NARAM banquets. At the end of the banquet Jerry Gregorek took off his coat,

A variety of costumes turned up at the NARAM-15 banquet: Jerry Gregorek (top photo) wore his "Polish" t-shirt, (Photo by Jan Blickenstaff) and Mumtaz Sunderji wore her NAR sari and earrings (Photo by Gilbert D. Bullock)

tie, and shirt to display his beautiful yellow Polish t-shirt Superman fashion, offering it as an explanation for his ability to survive a week as NARAM CD.

Jan Blickenstaff, NAR 5768
and Elaine Sadowski, NAR 5800
(in alphabetical order)

THE WINNERS

Newsletter Award
"Zog 43", NARHAMS, Doug McMullen and Larry Larson, editors
Special commendation to "Impulse", Missouri Rocketry and Aeromodeling Club, Don Carlson, editor

Gregorek Memorial Award
Given this year for workmanship by a Junior member in Pee Wee Payload—Mark Wladecki

Sportsmanship
Dan Meyer

Team Champ—Barber Team
Reserve—Horn-Bland Team

A Division Champ—Wayne Gerhart
Reserve—Ken Poorman

B Division Champ—Mark Nagasawa
Reserve—Walter Page

C Division Champ—Bruce Kimball
Reserve—Peter Covell

D Division Champ—Jim Pommert
Reserve—Jon Robbins

Section Champ—South Seattle Rocket Society
Reserve—YMCA Space Pioneers

Special Award Winners: (l. to r.) Dan Meyer—Sportsmanship, Larry Larson (NARHAMS)—North American Rockwell Trophy, Newsletter Contest, Mark Wladecki—Gregorek Memorial Trophy, Craftsmanship Award. (Photo by Jan Blickenstaff)

National and Reserve Champs: (First row, l. to r.) Chris Flanagin, Walter Page, Ken Poorman, (Second row) Trip Barber, Bruce Kimball, Pete Covell, Jon Robbins, (Third row) Bob Parks, Wayne Gerhart, Greg Horn, Alan Bland, Jim Pommert. (Photo by Jan Blickenstaff)

First Place Winners: (Kneeling in front, l. to r.) Steve Kranish, Dave Lewis, Richard O'Hara, Mike Micci, Wayne Gerhart, Greg Hedman, (Second row) Bruce Kimball, Jeff Kobs, Paul Vandall, Trip Barber, Rick Ferris, Wayne Windsor, Don Larson, Jim Pommert, Ken Poorman, Walter Page, Tihi, (Third row) Dan Meyer, Bob Biedron, Mark Wladecki, Dale Long, Erik Davidson, Andrew Knutson, Mark Stutman, Mark Hopkins, Jim Gazur, Greg Horn, Alan Bland, Andy Elliott. (Photo by Jan Blickenstaff)

Congratulations!

(NARAM-15 continues excitingly on next page)

THE EVENTS

Monday

ROBIN EGG LOFT

Egg Loft has always been an interesting event from the standpoint of design and flying. Robin Egg Loft at NARAM-15 was no exception.

The CMR Kuhn capsule was used almost exclusively, with a number of models employing a paper shroud attached to the capsule. Most of the models using this capsule were of a single stage type using a C6-5. Many of the multi-stage birds had staging problems and did not achieve as perpendicular a flight path as the single stage types.

Ellie Stine hands out eggs while Jay Apt safety checks at the rack-and-rail site. (Photo by Jan Blickenstaff)

The anticipated battle between the standard egg capsule design and the new Humpty Dumpty never materialized, since few of the latter had successful flights. The CMR Humpty Dumpty, which took three firsts at MMRR-73, had stability problems in the form of coning, severe tip-off, and CP-CG problems due to unsatisfactory fin design. Approximately 30% of the racks seemed to contain a Humpty Dumpty or its derivative.

Launch systems included open tower types, closed breech launchers (including a mortar-type), zero-volume pistons, and the standard 1/8 and 3/16 inch rods. The tower, breech, and piston launchers were not successful due to a high angle of tip-off.

The Micci-Gressman Team hook up their egg-lofter. Gosh, there were a lot of CMR capsules! (Photo by Jan Blickenstaff)

Two designs distinctly different from the rest were the Alan Jones coasting rocket and John Langford's two-stage model which looked rather like a scaled-down baseball bat with fins. The Jones model (Alan never builds an orthodox egglofter) consisted of a booster stage with a C6-0 and a top Humpty Dumpty stage containing an egg, a parachute, fuse, and an ejection charge only. The idea was to boost with the C6-0, ignite the fuse, coast the upper stage, and eject the recovery system. The rocket misfired, so we didn't get to see whether or not it works.

The egglofter with the greatest overall altitude was a model built by Dan Meyer. A spectacular 288 m. was achieved by this design, which, according to Dan, was originally conceived by Mike Burzynski, who flew it to a first place at NARAM-13 with an altitude of 256 m. This model is single-staged, it uses an Estes C6-5, and has a plastic Easter Egg (or Nutty Putty capsule) for the egg capsule, with an adapter made by cutting the back portion of a Centuri Orion pod plastic cone. The capsule has no padding and is held together by tape. The body tube is a 7.75-inch length of RB74 with no finish of any kind and no sealer. The fins are of a straight trapezoidal design with sufficient area to achieve a perpendicular flight path and are made from 1/16-inch balsa with two coats of sanding sealer and two coats of clear dope. A pop launch lug was used, along with an Estes 10-inch chute. The overall length is 10.5 inches. In general, the Meyer rocket is a simple, minimum-weight design.

The results at NARAM-15 seem to indicate that the way to go in Robin Egg Lofting is minimum weight, single stage, with a straight flight path to achieve the maximum number of meters.

Tom Gressman, NAR 21257

The Winners

A Division

1.	Wayne Windsor	195 m.
2.	Ken Poorman	181 m.
3.	Richard Ferris	174 m.
4.	Mike Koepplinger	171 m.

B Division

1.	Horn-Bland Team	252 m.
2.	Andrew Knutsen	248 m.
3.	Mark Hopkins	199 m.
4.	Mark Mayhle	192 m.

C Division

1.	Bruce Kimball	255 m.
2.	Phillip Barnes	241 m.
3.	Peter Covell	220 m.
4.	David O'Neal	219 m.

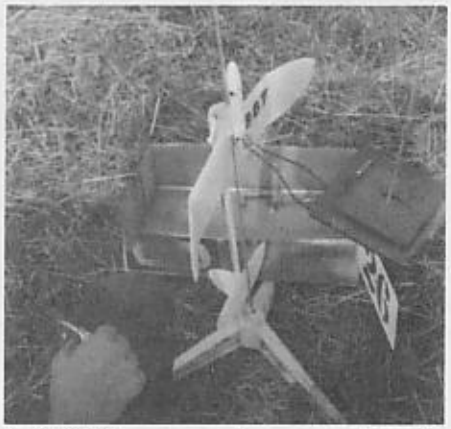
D Division

1.	Dan Meyer	288 m.
2.	Terry Lee	244 m.
3.	Philmon Team	221 m.
4.	Allen Hanawalt	216 m.

HAWK ROCKET/GLIDER

People are finally getting rocket/gliders to work reliably. In fact, rocket/gliders were even *more* reliable than boost/gliders at NARAM-15. Thirty-seven percent of all B/G flights were DQed, while only twenty-six percent of the R/G flights didn't make it. How can the super complex rocket/gliders be more reliable than the nice simple conventional boost/gliders, you ask? Well, look a bit closer. The swing wings, flop wings, sliding wings, etc. were very much in the minority. Most gliders were of the standard hand launch glider-type layout, with quite a few based on the M&P Enterprises glider kits or the ready-to-fly styrofoam "Super Glider". The HLG-type gliders used one of three methods of effecting boost to glide transition: first, some sort of sliding engine arrangement to shift the CG at ejection; second, a fixed engine and a variable incidence stabilizer actuated by ejection; or, finally, no moving parts, but engine downthrust and careful trimming. The gliders with a fixed engine position seemed to be doing the best. The Micci-Gressman Team won D Division honors using a Super Glider with a variable incidence stabilizer. The best time of the meet was turned in by Steve Kranish's R/G, which was originally designed to use a sliding engine, with the engine in the aft position. It needed quite a bit of nose weight, so Steve flew it with the engine fixed in the forward position.

The simpler types did trade off complexity of operation for the need for more critical trimming, and many gliders showed it by poor performance in the boost and/or glide. There were many times in the 30 to 60 second range as a result. Thermal activity began quite early and lasted most of the day. Most of the good flights were turned in before the wind started. Anyone who flew after 10:30 a.m. or so got to watch his glider get blown out of sight in less than 90 seconds. Since there was a freeway on one side of the field, and most of the good flights were heading across it, the return rule was not enforced.



Rocket/Glider, as usual, was an interesting event. (Photo by Bob Parks)

The quality of workmanship seemed to be improving. There were very few shredded

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models, and some of the more advanced construction techniques, such as tissue covering and built up wings, were in evidence. There were also a few gliders with good, lightweight finishes, such as those seen on competition hand launch gliders. At least one entrant was using a swinging weight type dethermalizer to get his glider back.

Considering the high times and good reliability achieved by rocket/gliders at NARAM-15, we may soon be seeing more R/Gs in the boost/glider events.

Bob Parks, NAR 7871

The Winners

A Division

1.	Wayne Gerhart	177 sec.
2.	Gregg Roe	129 sec.
3.	Margaret Pommert	89 sec.
4.	Mike Koepplinger	84 sec.

B Division

1.	Eric Davidsen	168 sec.
2.	Marc Nagasawa	105 sec.
3.	Mark Wladecki	86 sec.
4.	Doug Kushnerick	68 sec.

C Division

1.	Kranish-Lewis Team	356 sec.
2.	John Langford	289 sec.
3.	Don Perko	226 sec.
4.	David Kusterer	196 sec.

D Division

1.	Micci-Gressman Team	233 sec.
2.	Jim Pommert	161 sec.
3.	Nehring Team	115 sec.
4.	Philip A. Slaymaker	111 sec.

Tuesday

PEE WEE PAYLOAD

A low haze cover lingered over the field for the better part of the day on NARAM Tuesday, with only brief periods of blue sky, much to the consternation of contestants and trackers alike. The battle cry of the morning, "More tracking powder! More tracking powder!" was heard resounding through the tents.

No earthshattering rocket designs appeared in this event. Most contestants were using single-stage or two-stage models with a mini-engine power plant. Also, many contestants opted for commercially manufactured payload sections, either the CMR "Kuhn" capsule or the Estes equivalent.

Typical of the entries was Paul Vandall's "Mini-Munk", which took a first in D Division with an altitude of 262 meters. This was a 6-inch version of his "Chipmunk" design constructed with an RB52 body tube, using a CMR body tube, and launched with a B3-5m engine.

Wayne Gerhart, with his last-minute entry built the night before, got a first in the A Division with an altitude of 180 meters. His was a single-stage bird with a BT20 body, CMR capsule, swept elliptical plywood fins, powered by a B14-5.

Ron Wright, NAR 9350

The Winners

A Division

1.	Wayne Gerhart	180 m.
2.	Marc Medina	177 m.
3.	Gregg Roe	165 m.
4.	Mike Koepplinger	159 m.

B Division

1.	Andrew Knutsen	201 m.
2.	Steve Richmond	198 m.
	Mark Wladecki	198 m.
3.	Brian Warren	192 m.
4.	Leslie Lindgren	191 m.
	Steve Hutcherson	191 m.

C Division

1.	Andrew Murphy	218 m.
2.	John Langford	213 m.
3.	Jess Feeback	210 m.
4.	Kranish-Lewis Team	206 m.

D Division

1.	Paul Vandall	260 m.
2.	Micci-Gressman Team	213 m.
3.	Lindgren-LaCroix Team	212 m.
4.	Terry Lee	207 m.

Trackers had a less confusing time with Pee Wee Payload because of the two-launch-system setup. (Photo by Jan Blickenstaff)

The rack-and-rail launch system was manned by Mumtaz Visram Sunderji (left) of the Star Spangled Banner Section, Frank Long of the Upper Arlington Section, and Karl Hassel of of the Columbus Society for the Advancement of Rocketry. (Photo by Tom Pastrick)

Tihi (right) and Jon Robbins check a glider on the Satellite system. (Photo by Tom Pastrick)

SWIFT BOOST/GLIDE

Swift B/G at NARAM-15 was the last such contest to be flown with no return rule. The satellite launch system worked very well, better than any other I have encountered at a large contest. It may eventually be necessary to develop more elaborate ways of deciding who gets to fly when, since this sort of system encourages tactical flying (thermal hunting).

At the start, the wind drift was fairly low—about 1½ m/sec. It picked up gradually along with thermal activity. By about 10:30 there was lift all over the place. Most of the good flights were made during these first two hours or so. Later the wind was strong enough to blow models, especially the smaller ones, out of sight before they could match the times set earlier. Also, the thermals became more difficult to get.

A large majority of the gliders were the convential Renger-type. People seemed to be getting the knack of going through the tricky boost phase pretty well, but glide trim was often haphazard, and a disturbing number of models came apart during boost. (Flying hand launch gliders is a good way to learn trimming techniques.) Many of the best flights were turned in by relatively large (over 2.3 dm^2) gliders, which had the advantage of good visibility. Jim Pommert's modified HLG design had about 3.6 dm^2. The only unconventional design present in any number was the Manta (in all its different forms). Several different flex wings showed up; a very simple one by Robert Staehle got one of the longest flights of the day after the wind got going. The model looked a little lopsided and didn't appear to have much glide ratio, but the low wing loading and a thermal kept it up, and the large reflective mylar wing kept it in sight. Flexies seem to be on the rise, but may be discouraged by the return of the return rule.

"Tihi" Marjanac, a fine Yugoslavian flier I met at the World Championships, was visiting the U.S. and brought along several beautifully constructed gliders to NARAM. He likes to use the "egg-crate" geodetic wing or the built-up sheet covered wing. While the Europeans take for granted the sophisticated technology they

(NARAM-15 continues excitingly on next page)

borrow from model aviation, it is gratifying to see an increasing number of modelers in the States who use the free flight approach as a springboard to launching better B/Gs.

Bernard Biales, NAR 6716

The Winners

A Division

1.	Margaret Pommert	136 sec.
2.	Kenneth Poorman	129 sec.
3.	Richard T. Ferris	74 sec.
4.	Dale Long	46 sec.

B Division

1.	Marc Nagasawa	180 sec.
2.	Erik Davidsen	164 sec.
3.	Scott Pearce	155 sec.
4.	Steve Behrends	124 sec.

C Division

1.	Gregg Hedman	374 sec.
2.	Staehle-Friederick Team	277 sec.
3.	Kranish-Lewis Team	214 sec.
4.	Mark Stutman	160 sec.

D Division

1.	Jim Pommert	303 sec.
2.	Barber Team	216 sec.
3.	Ed Hayes	202 sec.
4.	Bernard Biales	198 sec.

Wednesday

CLASS II STREAMER DURATION

Tracking powder in Streamer Duration? Yes, when you have haze at 300 feet and are using B engines. The timers were losing the small, light, SD birds on the way up and could time only those with large dark streamers. After the first rack went off, cries for tracking powder resounded across the range. Another first for NARAM-15.

Both launch complexes were brought into play to get over 300 flights into less than 2½ hours. Second flights were accomplished only after contestants jogged across cow pastures, climbed fences, and stared down would-be rocket-nappers in the nearby apartment complex.

Most entries were of the mini-engine variety, with half-inch diameter body tubes. It's amazing what was stuffed into those skinny rockets! Streamers came out over ten to fifteen feet long on many flights. Just as many were wide with a 10:1 aspect ratio. Mylar, plastic, and crepe paper were all used. The long ones were all mylar. Unlike that of the birds themselves, no real pattern of streamer design has yet developed.

Fin designs tended toward the elliptical and clipped delta, with most models using three fins. Thin plywood (1/32 inch and 1/64 inch) and 1/32 inch sheet plastic were popular fin materials.

The full range of launching systems was in evidence. There were more piston launchers than at NARAM-14, mostly used by Midwest modelers. Launch towers tended to be machined metal affairs with various forms of adjustment.

What were the winners doing? A survey of the first four place winners in each division indicated that all used AVI B3-5 or 7 engines in one-half inch diameter body tubes. Fins were primarily elliptical planform with 1/32-inch thickness, clipped deltas being the next most popular type. Mylar and crepe paper streamers were used with equal frequency by the winners. The aspect ratios were primarily 10:1, with 4 and 5-inch widths giving the best times. The top places were equally divided among competitors using pop lugs, towers, piston launchers, and regular launch lugs. (See Table)

James S. Barrowman, NAR 6883

The Winners

		STREAMER	FINS	LAUNCHER	BODY DIA.
A Division					
1. Dale Long	166 sec.	Mylar 4" x 104" (SA)	El. 1/32"	Pop Lug	0.5"
2. Wayne Gerhart	80 sec.	Crepe 3" x 64" (SA)	Sw. Tapered	Tower	1.0"
3. John Hopkins	79 sec.	Mylar 4" x 60" (FA)	Cl. Del. 1/16"	Zero Vol. Piston	0.5"
4 Richard Ferris	77 sec.	Mylar 2" x 120" (SA)	El 1/32"	Pop Lug	0.5"
B Division					
1. Mark Hopkins	147 sec.	Mylar 5" x 50" (SA)	Cl. Del. 1/64"	Zero Vol. Piston	0.5"
2. Stuart Hill	131 sec.	Mylar 4" x 120" (FA)	Sw. Trap 1/16"	Piston	0.5"
3. Karl Runge	127 sec.	Mylar 2" x 60" (FA)	Sw. Trap 1/16"	Lug/Rail	0.5"
4. Horn-Bland Team	106 sec.	Crepe 3½ x 40" (SA)	Sw. Clip Del. 1/16"	Lug/Rail	0.5"
C Division					
1. Kranish-Lewis Team	128 sec.	Crepe 4" x 40" (SA)	El. 1/32"	Lug/Rail	0.5"
2. Jim Gazur	108 sec.	Crepe 5" x 50"	El. 1/16"	Pop Lug	0.5"
3. Jim DeMarco	102 sec.	Crepe 2" x 20" (SA)	Sw. El. 1/16"	Dual Lug	0.5"
4. Bruce Kimball	98 sec.	Crepe 4" x 40" (SA)	Sw. El.	Tower	0.5"
D Division					
1. Richard O'Hara	146 sec.	Mylar 4" x 120" (SA)	Cl. Del. 1/64"	Tower	0.5"
2. Philmon Team	104 sec.	Crepe 4" x 40" (SA)	El. 1/16	Tower	0.5"
3. Robert Dowd	100 sec.	Crepe 2" x 40" (SA)	Cl. Del.	Pop Lug	0.5"
4. Jon Robbins	98 sec.	Tissue 6" x 180" Break-away	El. 1/16"	Zero Vol. Piston	0.5"

FA = Front attachment of streamer SA = Side attachment of streamer

Don Larson prepares to launch his beautifully finished Streamer Duration bird. (Photo by Tom Pastrick)

Thursday

CLASS 0 PARACHUTE DURATION

Parachute Duration was flown Thursday morning. In order to move things more quickly, B and D age divisions were flown off the rack system, and A and C flew from the Satellite system. The weather conditions were continually changing, with periods of overcast skies and air without lift or sufficient thermal activity. The wind was out of the south and southwest, which put models into the apartments and construction site north of the field. The Contest Director and Range Safety Officer, therefore, decided that they would *not* enforce the return rule on duration birds in order to have a qualified flight.

Most of the models flown were very small and utilized the mini-motors. The parachute material was either aluminized mylar or cleaner bag plastic, and it looked like a lot of people were having trouble getting their chutes to deploy.

Gleda Estes times a Parachute Duration model. (Photo by Tom Pastrick)

Considering the size of the field, the visibility, and the wind, the winning times were competitively good. The best time of the day was turned in by Jeff Kobbs in B Division with 417 seconds.

Ellie Stine, NAR 1955

The Winners

A Division

1.	Ken Poorman	143 sec.
2.	Mark Medina	101 sec.
3.	Mike Koepplinger	95 sec.
4.	John Hopkins	64 sec.

B Division

1.	Jeff Kobbs	417 sec.
2.	Steve Behrends	202 sec.
3.	Mark Hopkins	192 sec.
4.	Edward Kubicz	156 sec.

C Division

1.	Rick Ferris	350 sec.
2.	Bruce Kimball	239 sec.
3.	Jim Gazur	201 sec.
4.	David Kusterer	197 sec.

D Division

1.	Lindgren Team	228 sec.
	Tihomir Maranjac	228 sec.
2.	Terry Lee	155 sec.
3.	Rick Evans	141 sec.
4.	James Backlas	130 sec.

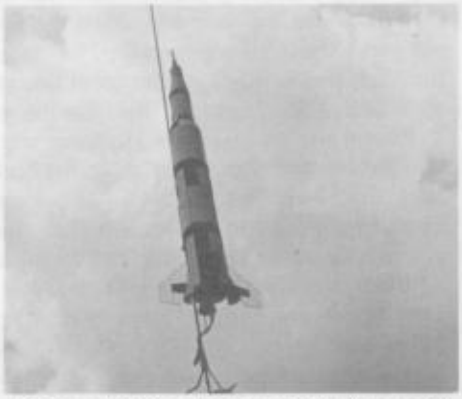
PLASTIC MODEL

Despite the increasing difficulty in finding plastic models to convert, this year's NARAM featured a wide variety of models, with very few duplications. Aside from the usual Saturn V's, V-2's, and X-15's, some notable, well done models included the Barber Team's E-104 Starfighter, a Russian Soyuz, a couple of Vostok capsules, a Pilgrim Observer done by "Fat Albert", Lunar Modules, an F-111 complete with moveable swing-wings, and a super-clean Douglas X-3 Stilletto featuring a parallel mini-engine cluster. Also represented were the Nike Ajax and Pan Am's (Where the going's great!) 2001 Space Clipper. The most unique model was a "screaming red" 14-inch Zeppelin, an English kit done by the LaCroix-Lindgren Team and powered by a C6-3. Into the bunkers for that one! A Gemini capsule powered by a D12 also promised a little action for Thursday's event.

After static judging had been completed on Wednesday night, the top four spots were as follows:

A Division – Dale Long – 635 points
B Division – Mark Nagasawa – 740 points
C Division – Robert Staehle – 800 points
D Division – Barber Team – 775 points

All but one of these holdings were to change on Thursday, however, when the actual flying was done. Among the notable flight performances was the Barber Team's zipping straight-up boost on the F-104 Starfighter. Fat Albert (sometimes known as Greg Stewart) did his thing by getting a boost as beautiful as his Pilgrim Observer model, and if the Vostok capsules did as well for the Russians as they did for our NARAM-15 competitors, we would be losing the space race! The going *was* great for one of the Pan Am Space Clippers, for after a clean



A Saturn V takes off dramatically. (Photos by Tom Pastrick)

vertical boost, it actually seemed to glide, leveling off just before chute ejection and safe recovery.

Final results were tallied by flight judges Jon Robbins and Howard Kuhn.

Plastic Model proved to be the enjoyable, diverse, and interesting challenge that most had expected, with few total wipe-outs for the number of models flown.

Paul D. Vandall, NAR 21208

The Winners

A Division

1.	Ken Poorman	704 pts.

B Division

1.	Horn-Bland Team	560 pts.
2.	Mark Wladecki	532 pts.
3.	Andrew Knutson	501 pts.
4.	Steve Behrends	477 pts.

C Division

1.	James Gazur	781 pts.
2.	Greg Stewart	757 pts.
3.	Peter Covell	655 pts.
4.	John Starks	591 pts.

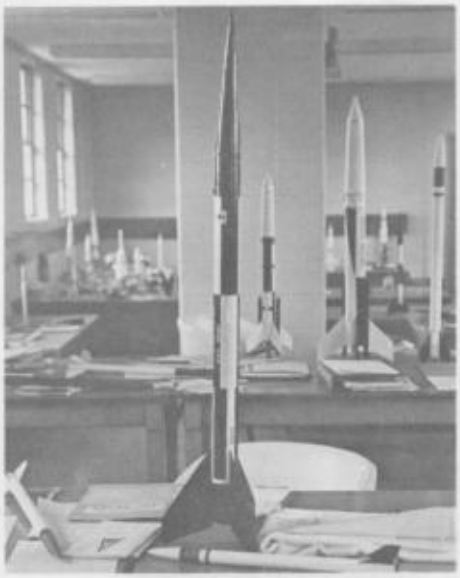
D Division

1.	Barber Team	846 pts.
2.	Robert Bruce	822 pts.
3.	Phillip Slaymaker	621 pts.
4.	Englund Team	547 pts.

Friday

SCALE

The Scale event at this year's NARAM proved once again to be exciting. Raindrops and dark clouds were added just to make sure that the flights would keep everyone's interest. Quite a variety of models could be seen, ranging from Chuck Krallman's huge Astrobee 1500 down to the AVI Astrobee D. Perhaps the two "strangest" models entered were a skylab and a one-half scale model of Centuri's Enerjet 2250 sounding rocket.



Scale was judged in the penthouse of Taylor Tower, the official NARAM residence. (Photo by Tom Pastrick)

In A Division the first place trophy went home with Wayne Gerhart of Seattle, Washington, for his very nice model of the D-Region Tomahawk. The model was scratch-built and included all the needed detailing. Greg Roe of Columbus, Ohio finished second with his Operation Redwing Asp.

The only model to receive all 240 dimension points, a HAD 110, was the B Division winner built by Walter Page of Columbus, Ohio. The model was so good that one of the judges spent nearly an hour looking at the scratch and cradle marks trying to find something wrong—he couldn't! Second place in B Division went to the eventual B Division National Champion, Mark Nagasawa for his D-Region Tomahawk.

This year C Division had a one-tenth scale Javelin built by Bob Biedron of South Plainfield, New Jersey. Bob had planned to fly his model on an Enerjet E24; but when he discovered he was well over the one pound weight limit he removed a parachute, cut off some of the shock cord, and put in a D12. It worked—he made it under the one pound limit and the model flew to first place. Dave Gloger of Cleveland Heights, Ohio, captured second place with his extremely well-detailed D-Region Tomahawk.

Don Larson of Fairfax, Virginia, topped D Division with his immaculate Nike-Tomahawk. Every inch of the model was superbly constructed and every little nut and bolt was in its place. Don put much effort into the model and

(NARAM-15 continues excitingly on page 15)

RASCAL

by Paul Conner, NAR 5787

The Rascal is a small rocket/glider for the Hornet event utilizing the Estes 1/2A3-2. Times average around one minute and, with a little thermal help, can be much higher. Study the plans thoroughly before starting to build.

My usual building habits dictate that I collect all the tools and materials before I begin. Handy tools will be a modeling knife, assorted grits of sandpaper and some blocks of wood to make sanding blocks, a felt tip pen, some masking tape, a celluloid glue such as Sig-bond or Ambroid, and a paint brush and some clear dope. For your wood you will need a strong, straight piece of 1/8-inch balsa for the pylon and body stick, a 1/8-inch piece of balsa sheet for the wing panels, and a strong, straight piece of 1/20-inch balsa for the tail feathers. To this list add the body tube, a suitable nose cone, and a piece of ever-present launch lug.

After you have studied the plans and understand them, cut out all the parts. Using a felt tip pen, mark the high point on the wings, making sure that you make a right and left hand panel. Lay the tape on the leading edge side of the line on one panel, and, using a sanding block, taper the trailing edge. After you are satisfied with the shape, remove the tape and, using the line as a reference, shape the leading edge. Do not make the leading edge sharp, for this will cause bad stall characteristics. Repeat for the other panel. Block up the panel tips to the proper dihedral angle and bevel the root edges with a sanding block. Pre-glue the root edges and set aside the dry.

Round the leading edge and taper the trailing edge of the pylon to form a symmetrical airfoil, and glue the pylon to the body stick. Round the edges on the stab and fin, mark the center line for the fin on the stab, and glue the fin in place, making sure that it remains vertical as it dries. When the two assemblies are completely dry, glue the tail assembly in place, keeping an eye on the alignment while the glue dries.

Block the wing tips up again and glue the panels together, placing a piece of plastic wrap under the joint to keep from attaching the wings permanently to the building board. While this is drying, (about two hours) place a spent engine casing in the body tube that you have cut to the proper length, and, using the casing as a backing, drill three small vent holes in the tube. Clean up the holes with sandpaper and glue the nose cone in place. If you choose a large cone, hollow it before you glue it in place. Allow all parts to dry thoroughly.

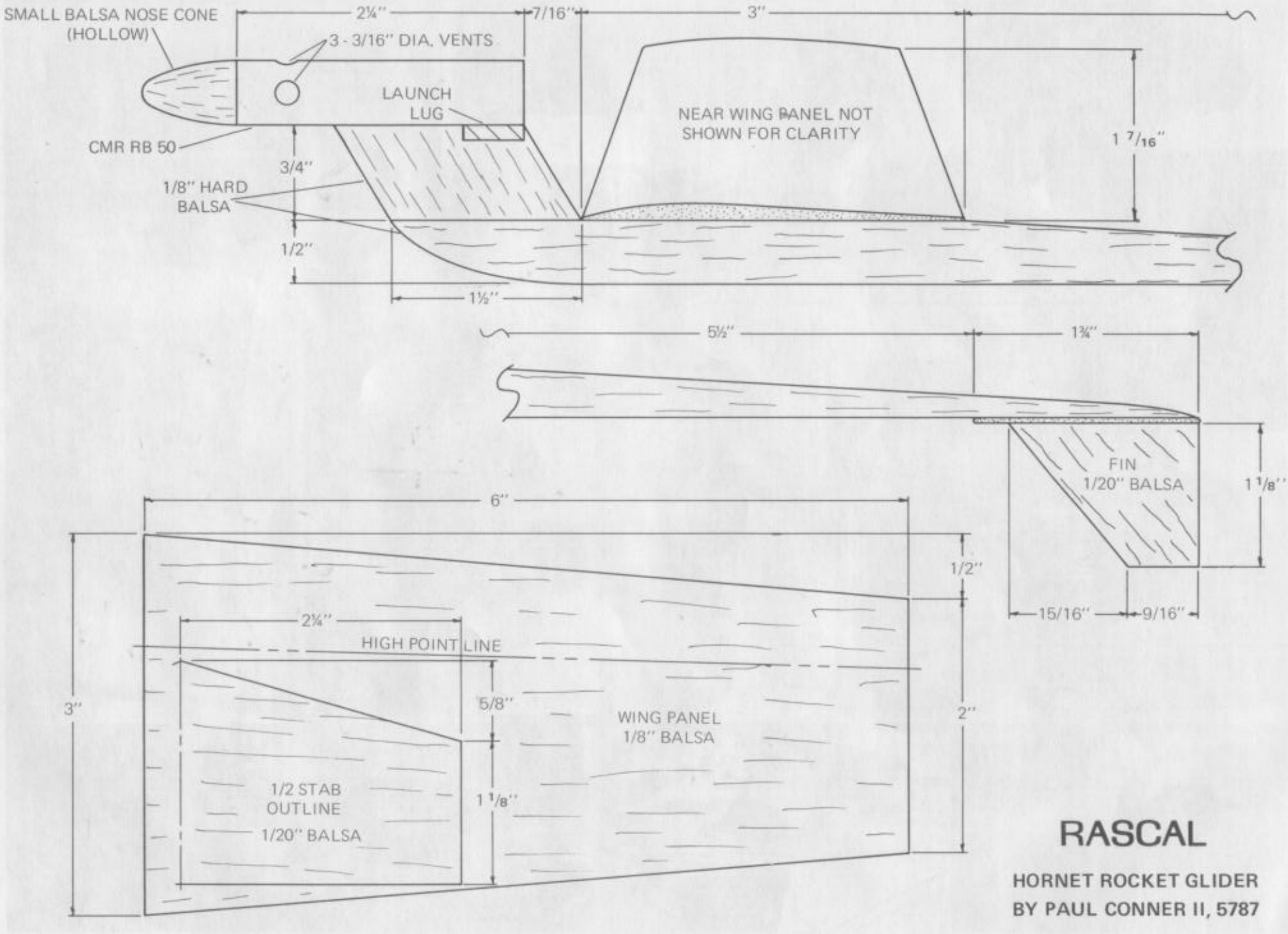
Glue the wings in place, making sure to get a strong joint. Block the wings in place to ensure proper alignment. When the wings are completely dry, glue the body tube and launch lug in place. This completes the building.

When all glue is dry and you are satisfied with the glue joints, mix a batch of 50/50 clear dope and apply a light coat to the entire glider. When this is dry give it a light sanding using 400 grit sandpaper. Apply a second coat and as it dries watch out for warps. If a warp does occur, hold the offending part over a pot of boiling water (a tea kettle is the best) and twist it in the opposite direction. Repeat the procedure if needed. The final step is to give the body tube another coat of dope.

Unlike the more critical boost/glider, the rocket/glider is easy to trim for glide because the overall weight is greater, giving the glider better penetration and less susceptibility to the wind. Place a spent engine casing in the body tube so about 1/4 inch of the casing is protruding from the rear. Lightly tape the casing to keep it from sliding around. Launch from shoulder height into the wind, keeping the nose slightly down to prevent a stall. Observe the glide, and if the glider stalls move the casing forward; if it dives move the casing back out of the body tube. Repeat the procedure until you are satisfied. When you are finished measure the position of the engine and write the position on the pylon where you can always find it.

For powered flight use an Estes 1/2A3-2 as mentioned at the beginning of the article. Tape the engine firmly in place, making sure it is in the proper position. The boost phase of the flight should be relatively straight with a smooth transition into a flat glide. Erratic powered flight is usually caused in this case by the flight surfaces warping under power. The only cure for this is to build another glider, this time picking stronger materials. Surface warping will also keep the glider from transitioning into a glide.

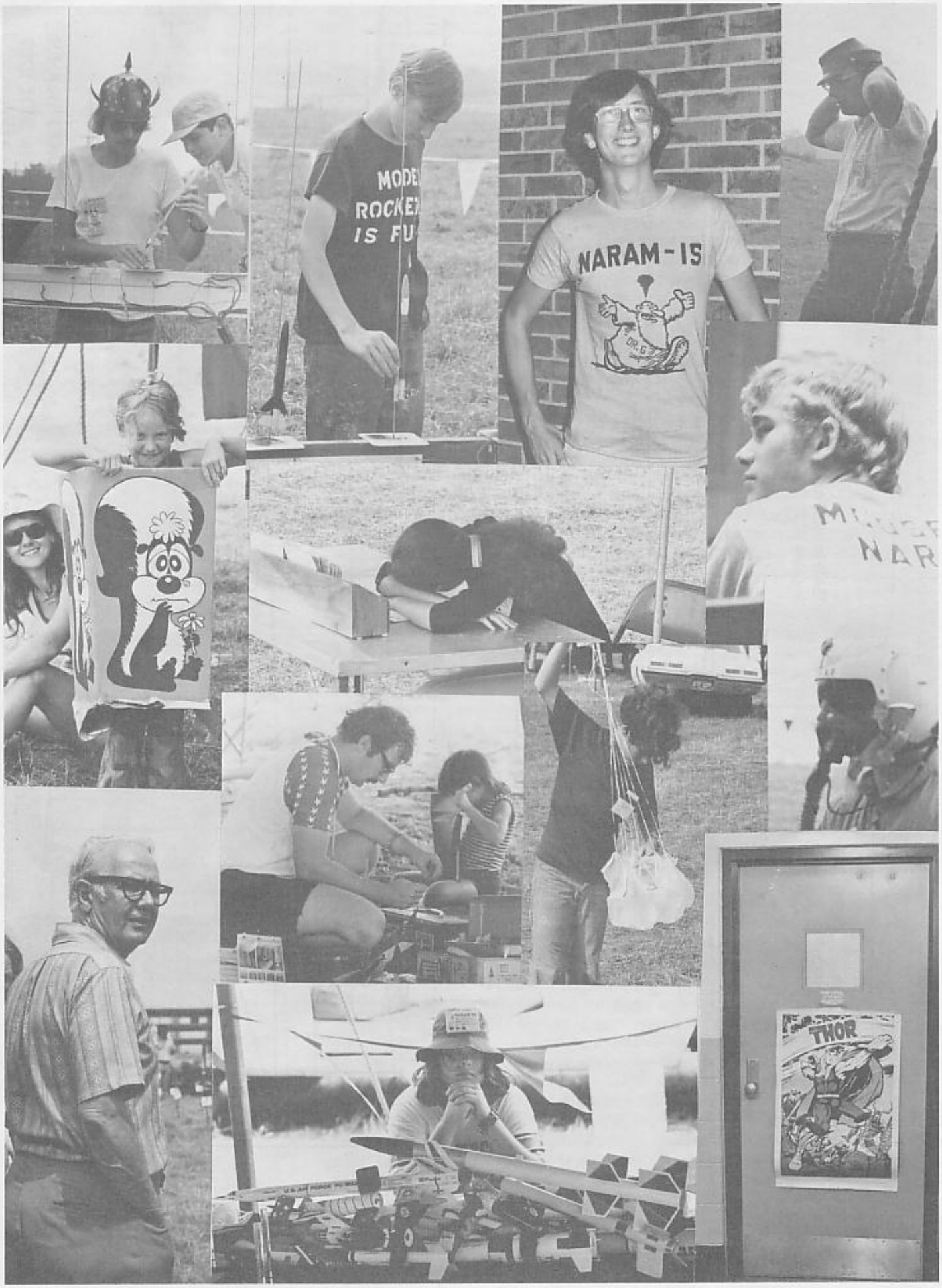
Because the glider is simple and relatively strong, it is durable and highly reliable. Many flights can be obtained before you will have to replace it. More likely, you will have a fly-away when that heavy thermal is found. With all this going for you, why don't you build a few?



RASCAL

HORNET ROCKET GLIDER

BY PAUL CONNER II, 5787


NARAM-15
THOR

(SCALE - continued from page 11)

he truly deserved first place. Second place was won by a very beautiful (and very large) Nike-Smoke built by the team of Gary Lindgren and Ed La Croix.

Douglas Ball, NAR 9338

The Winners

A Division

1. Wayne Gerhart	680 pts.
2. Gregg Roe	543 pts.
3. Dale Long	450 pts.
4. John Hopkins	432 pts.

B Division

1. Walter Page	818 pts.
2. Marc Nagasawa	761 pts.
3. Mark Hopkins	695 pts.
4. Horn-Bland Team	688 pts.

C Division

1. Robert Biedron	786 pts.
2. Dale Gloger	714 pts.
3. James Gazur	678 pts.
4. Brian Anderson	642 pts.

D Division

1. Don Larson	856 pts.
2. Lindgren-LaCroix Team	780 pts.
3. Philmon Team	737 pts.
4. Philip Slaymaker	709 pts.

RESEARCH AND DEVELOPMENT

The Winners

A - B Division

1. Wayne Gerhart
2. Larry Shenosky
3. Mark Hopkins
4. Walter S. Page

C Division

1. Mark Stutman
2. John Langford
3. Geoffrey Landis
4. Jim Rea

D Division

1. Andy Elliott
2. Barber Team
3. George Pantalos
4. Micci-Gressman Team

A-B Division, 1st Place

BETTER GLIDER PERFORMANCE

by Wayne Gerhart, NAR 19894

My project was to help better understand what causes looping and pranging and how we can eliminate them for better boost performance in rocket/glider competition.

To carry out this experiment I built eight gliders: three dealing with negative stabilizer incidence; three dealing with pylon height; and two additional gliders with greater fuselage length.

A glider jig was used to make all the gliders uniform. I introduced only one variable at a time: stabilizer incidence, pylon height, and added length, respectively. The gliders were all trimmed for glide before flight.

Three flights were planned and flown for each glider except where they were damaged too seriously to be flown again.

Results were tabulated for boost, transition, and glide, together with approximate measurements of heights obtained. These were taken with an altitude finder.

The gliders that had no negative incidence damaged themselves upon return, because having no stabilizer incidence, they had poor transition and dived into the ground.

The gliders that had one degree of negative stabilizer incidence either pranged or looped excessively.

The differences in pylon height seemed to have little effect upon boost characteristics.

The glider with one-half degree incidence had good boost, transition and glide in each of four flights.

From this project, I have reached the following conclusions:

1st Conclusion: A rocket glider will glide best with negative stabilizer incidence and boost best with zero incidence.

2nd Conclusion: Rocket/gliders give best overall performance with about one-half degree stabilizer incidence.

3rd Conclusion: Stabilizer incidence over about one-half degree causes serious looping and pranging.

4th Conclusion: Pylon height variation in the range used here has very little effect on boost performance.

No conclusion could be drawn on fuselage length because of the destruction of the models.

A - B Division, 2nd Place

POP LAUNCH LUGS

by Larry Shenosky, NAR 21460

This project is an investigation of the performances generated by the use of pop-off launch lugs as opposed to standard fixed lugs. The rocket utilized in the experimentation showed a large increase in altitude as a result of the use of a pop launch lug.

For the flight experimentation, it was decided that a two-mode, six flight program would be best for the report's general purpose. The first mode would consist of three flights of the same rocket, employing a pop launch lug marketed by Competition Model Rockets of Alexandria, Virginia. Then, using the same rocket, the three mode-two flights would be flown. The mode-two flights would be accomplished through the addition of a standard fixed launch lug to the side of the vehicle. The resulting altitudes from modes one and two could then be compared to find out which mode was superior.

A model that employs a pop launch lug does not have to carry the extra drag of a fixed lug, because the pop lug becomes detached from the model when the rocket passes a "catch" at the top of the launch rod. The only drawback to the system is that a small slit needs to be cut in the side of the body tube so that the pop lug can be secured to the model on the rod. Also, in some cases, pop lugs have caused the model to hesitate at the top of the rod while the lug slips off. The whole point of this investigation, then, would be to discover whether or not these drawbacks cancelled out the decrease in drag found by the use of the pop-off device.

In actual flight testing it was found that the model in its mode-one configuration (with pop launch lug) flew to a consistently higher altitude than the mode-two flights that employed a fixed lug. The increase was notable (some 28.6 percent) enough to form the conclusion that a pop-off launch lug can actually increase the total performance of a given model rocket, as opposed to the use of the same rocket employing a fixed lug.

A - B Division, 3rd Place

STREAMER PERFORMANCE

by Mark Hopkins, NAR 15577

The objective of my report was to find out what length-to-width ratio of streamer would give the longest time between two points. My two points were ejection and the ground. It has obvious application in contests.

The model was a standard 3/4" body tube adapted to a mini-engine with a plastic boattail. The model was not important though. My engines were Estes A3-4T mini-brutes dated 3-16-73 and 8-25-72. I had to abandon the earlier dated engines because of a fireball in one and no ejection in the other. The rocket was launched from a standard 36-inch steel rod. My launch site was a 100 acre cow pasture, wind 0-5 mph, temperature 70°-80°F. The day was fairly clear.

I went about my test by using a standard area of 100 sq. in. for my streamer. My streamer material was a Boy Scout rescue blanket. I used 3 sizes of streamers; 80 x 2 inches or 40:1, 53 x 3 inches or 18:1, and 40 x 4 inches or 10:1.

The results were as follows: for the 80 x 2 inch streamer a time of 43 sec.; for the 53 x 3 inch streamer 49.4 sec.; and for the 40 x 4 inch streamer it was 57.1 sec. As you can see the times increased greatly when the streamer was shortened and widened. I have used this knowledge to hopefully better my chances in Streamer Duration. I hope others who may not have discovered this in other ways will become aware of it now.

A - B Division, 4th Place

FIN AND TUBE STABILIZED ROCKETS

by Walter S. Page, NAR 19068

My Research and Development topic was comparing two designs: the fin stabilized rocket and the tube stabilized rocket. I used three

Larry Shenosky's use of visual aids made the results of his tests easier to understand. (Photo by Jan Blickenstaff)

Photo montage on opposite page by Jan Blickenstaff

(NARAM-15 continues excitingly on next page)

methods of finding which was the more efficient design. The methods were the following: (1) find the C_{Do} and total drag of each model, (2) find areas of turbulence on the two models, and (3) have both models tracked a number of times.

Both models were standard BT-5 rockets, each weighing nearly the same so that weight would not play a part in finding which was the better design. The fin rocket weighed 10 grams, and the tube rocket weighed 10.5 grams. The CG of the fin rocket was 5.32 inches from the nose, and its CP was 5.75 inches from the nose. The CG of the tube rocket was 5.39 inches from the nose, and its CP was 5.55 inches from the nose.

The fin rocket had a C_{Do} of .543 and a total drag of .0177245 lbs. The tube rocket had a C_{Do} of .581 and total drag of .02145545 lbs. The fin rocket had a C_{DoF} of .182 and a C_{Dint} of .075. The tube rocket had a C_D of the stabilizing tubes of .195 and a C_{Dint} of .1. The C_{Dint} of both rockets and the C_{DoF} and the C_D of the stabilizing tubes were high because of the small S_{BT}.

Using a mixture of kaolin and kerosene to generate smoke, I did three flow tests on each design. The three tests on the tube-stabilized rocket showed areas of separation on the leading and trailing edges of the stabilizing tubes, and a slight shock wave around each stabilizing tube. The three tests on the fin-stabilized rocket showed small areas of separation on the leading and trailing edges of the fins, a small tip vortex on each fin, and a shock wave around two of the fins.

I had each model tracked a number of times. The fin-stabilized rocket had a minimum altitude of 101.5 m., a maximum altitude of 133 m. and an average altitude of 122 m. The tube-stabilized rocket had a minimum altitude of 84.5 m., a maximum altitude of 90 m., and an average altitude of 88 m.

I have found from these tests that the fin rocket is the more efficient of the two designs.

C Division, 1st Place

THE PREDICTION OF MODEL ROCKET ENGINE PERFORMANCE

by Mark B. Stutman, NAR 18569

The purpose of this investigation was to devise a workable method of non-destructive testing that would enable the rocketeer to predict the burning characteristics of individual model rocket engines with a reasonable degree of accuracy. The procedure would have obvious uses. Model rocketeers would be able to control the performances of their model rocket engines (within the limitations of their seemingly random variations) in the same way they could control the performances of their models. The following Estes engines were tested:

4 ½A3-0t	4 A3-0t
4 ½A3-2t	4 A3-2t
4 ½A3-4t	4 A3-4t
	4 A3-6t
8 A10-0t	3 D12-0
4 A10-3t	3 D12-3
	3 D12-5
	3 D12-7

The engines were carefully massed, and Xerographs (an x-ray process) of the engines were made in order to measure the grain length of each engine. A modroc thrust stand was built around a transformer known as a Linear Variable Differential Transformer. The thrust stand was used to perform the usual series of destructive tests on the engines.

The data were collected and arranged in tables. Simple statistical manipulations were performed, and then the non-destructive parameters were paired against the destructive ones, and the ones yielding the most potential were plotted on graphs. After the graphs were plotted, they were checked for linear correlations on an eye-hand basis. If a linear correlation existed, a line was sketched in free hand that would approximate the maximum number of points with a minimum of overall error. The equation of each line was calculated, and the equations were back checked for accuracy.

The data seems to support previous work. The engines did not appear to be strictly predictable. The fact that grain length, and therefore the amount of propellant, is not directly proportional to the total impulse seems to indicate that the specific impulse of the propellant must vary from engine to engine. Given this inherent variability in engine performance, the equations go one step further than simple tables of average values of engine performance in that they help take this variability into account. Half of the equations have an average error value of less than five percent, while only three go higher than ten percent.

The formulas do fulfill the objectives of the project in that it is possible to roughly predict the performance of certain engine parameters. The working hypothesis is not disproved by the investigation, although it is obvious that there are other factors involved that were not included in the investigation. It is not known how accurate the equations will be when used with other engines of the same type.

Mark Stutman won a first place in R&D with his "Prediction of Model Rocket Engine Performance". (Photo by Jan Blickenstaff)

C Division, 2nd Place

TEMPERATURE INVERSIONS AND THEIR EFFECT ON AIR POLLUTION

by John Langford, NAR 13672

The temperature inversion is an atmospheric situation where, instead of air temperature decreasing with altitude, (which it usually does at around 5.4 degrees every thousand feet) for a distance it actually increases with altitude. When this occurs in the lower level of the troposphere it can seriously affect air pollution conditions within that distance.

Since low level air is warmed by the ground around it, it rises, carrying with it air pollutants emitted near the ground. As it rises, it cools, but slowly enough so this pollution-carrying air is always a little warmer than the surrounding air. As long as this condition remains, the air rises, dispersing the pollutants. Other clean, cool air sinks to replace it.

When an inversion occurs, however, and it can for any of several reasons, warm air cannot rise into warmer air. Likewise, the top of the inversion then acts like the ground and a normal flow is established above it. Though usually occurring in the morning and then "breaking up", inversions can sometimes last several days, allowing huge amounts of pollution to build up within a relatively small airspace. This was the case in London, England, in 1953, when over 4,000 people died.

As it has been recognized only within the last twenty years as a major factor in air pollution meteorology, the inversion has not been fully explored. If, and they currently cannot, local meteorologists can measure an inversion, they can then predict, or at least have an idea about, the immediate future as to air quality. To measure inversions requires a vertical temperature reading throughout the inversion, and a wind reading. With calculations it can be determined how great an area local pollutants have to mix, what the quality is currently, and what it may be in a few hours.

A sounding program was undertaken to build on already existing means of sounding inversions, of which there is currently only one. A Colorado company, Colspan Environmental Systems, offers package balloon and rocket sounding equipment for inversions at over $3,000.

Using equipment (some donated by sources such as Estes, Enerjet and Colspan) commonly used in the model rocketry hobby, a project was begun to develop a means of sounding using this "model rocket technology".

A four part report was prepared on this subject. The first report is an in-depth look at inversions and what affects them. The second (not presented at NARAM-15) deals with past inversion-caused air pollution disasters. The third is a report on various soundings actually conducted during the project, and the fourth is the story and details of sounding procedures and equipment.

Soundings are scheduled to continue after NARAM-15.

Geof Landis' R&D presentation was probably the most entertaining one of the evening. (Photo by Jan Blickenstaff)

C Division, 3rd Place

EXPERIMENTAL TESTING OF STABILITY THEORY

by Geoffrey A. Landis, NAR 14193

In order to discover experimentally if "gravitational" stability is a valid concept, a series of four test flights were run on the

"Sham-roc", a gravitationally stabilized rocket. The tests included weighting the nose of the rocket to bring the CG ahead of the engine; weighting the tail of the rocket and flying it with a long burning i.e., C, engine; flying it off a shortened rod; and launching it at a 30 degree angle. Each experiment led to the result not predicted by gravitational stability theory.

Conclusion: Gravitational stability does not work.

C Division, 4th Place

DEVELOPMENT OF AN INSTANT ENERJET IGNITER

by Jim Rea, NAR 22492

I originally got the idea of an instant Enerjet igniter from Larry Brown at NARAM-14, who felt that such an igniter was needed for professional uses. The most practical method for developing the igniter that I could determine was flight testing. Eight flight tests were made on rockets of a Nike-Ram type. Judging of ignition time was determined by observers.

I was not able to find any earlier work on ignition of Enerjet-type motors, but I did find that amateur rocketeers nearly always use a burst diaphragm, which is a device that plugs the nozzle to allow quick pressure buildup in the combustion chamber. When sufficient pressure is obtained, the burst diaphragm is ejected from the nozzle.

The most obvious approach to an instant igniter seemed to be taking a normal Enerjet igniter and lighting it directly at the folded portion. Tests of this type of igniter were made both with and without a burst diaphragm. These tests showed that a burst diaphragm is necessary for instant ignition. Tests without a burst diaphragm indicated that it takes one-half to one second for pressure to build up in an Enerjet with an open nozzle. These tests also showed that using more than a normal amount of wick will cause the igniter to blow out without igniting the engine. This also occurs with E24 motors due to the small chamber and nozzle exit dimensions.

So far, eight successful flights have been made with these igniters in F motors. The most important factors in successful ignition of F motors seem to be the amount of wick and use of a gas-tight burst diaphragm. These igniters do not appear to work in E motors.

There is a lot of further research that could be done in this field. Due to a lack of tracking equipment, I was not able to determine how these igniters affect performance. Much other work could also be done.

D Division, 1st Place

THE USES OF TURBULATORS ON WINGS IN THE RE=30,000 RANGE TO AVOID FLOW SEPARATION AND INCREASE GLIDING PERFORMANCE

by Andrew Elliott, NAR 7419

It has been previously thought that flow separation may be a serious problem in wings flying in the low Reynolds number range characteristic of boost-gliders and other model aircraft. This report showed that the problem does exist and that effective turbulators can relieve it.

Using a Zhukovsky airfoil of some undercamber and 12% thickness, at a Reynolds number of 30,000 in the MIT low turbulence wind tunnel, and a strain gauge balance, data was taken from this section over a wide angle of attack range with six different turbulators.

Marked performance increments were observed with all turbulators, the following changes in values observed for a ten degree angle of attack using the vibrating string in front of the leading edge type of turbulator:

	Clean	*Turbulators*
C_L	0.85	1.30
C_D	0.20	0.13
L/D	4.1	10.6
$C_L^{3/2}/C_D$	3.8	12.0

D Division, 2nd Place

THE PRESSURE AND TEMPERATURE DEPENDENT PROPERTIES OF BLACK POWDER PROPELLANTS

by the Barber Team, NAR T-151

This project has measured with considerable precision the variation of the burning rate of black powder model rocket propellant with the chamber pressure and ambient temperature at which it is burned. This variation is expressed by:

$$r = .099\ e^{.00103\,(T-78)}\ p_c^{.462}$$
$$(p_c \leq 75 \text{ psia})$$

$$r = .408\ e^{.00103\,(T-78)}\ p_c^{.133}$$
$$(75 \text{ psia} < p_c \leq 400 \text{ psia})$$

where T is ambient (local) temperature in °F. Burning rate, in other words, increases as chamber pressure and local temperature increase. Chamber pressure may be varied by varying the ratio of propellant burning surface area (A_b) to nozzle throat area (A_t), according to the expression:

$$\frac{A_b}{A_t} = 0.43\ p_c^{0.89} \quad . \ (T = 78^\circ F)$$

Some measurements of specific impulse as a function of this pressure and temperature showed that it increases with both of these, but no exact expression describing this could be derived.

The apparatus used to obtain variations in chamber pressure was a small 3-piece metal pressure vessel silver-soldered to a short cantilever beam. The vessel held specially-made uncored, nozzleless grains of Estes black powder, exhausting through drop-in graphite nozzle sections with various throat diameters. A transducer was used to measure chamber pressures to an accuracy of about 5%, while strain gauges on the cantilever simultaneously measured thrust to 2% accuracy. The response time of both systems was better than 0.01 seconds when connected to a Sanborn chart recorder. Twenty-four charges were fired in this phase of the project, with chamber pressures ranging from 23 to 400 psia.

For the measurement of variations with initial temperature, 52 C6-0 engines from the same batch were obtained to minimize the effects of engine variation. 8 or 9 of these were stored for a period of one hour at each of 6 different temperatures, from −50°F to 158°F, and then fired within 10 seconds of being removed from the temperature-controlled environment. The cantilever portion of the pressure-variation apparatus was used to measure thrust versus time. From these data were obtained the temperature-variation terms in the burning rate equations above. In addition, it was determined that the thrust of the engines varied 0.136%/°F of variation from the manufacturers' standard 70°F values. It increases with temperature.

D Division, 3rd Place

MODEL ROCKET DRAG REDUCTION BY BOAT-TAILING

by George M. Pantalos, NAR 10620

One of the prime concerns of an aeromodeler when designing a rocket is the model's aerodynamic efficiency. Boat-tailing or tapering the base of the model is one suggested method of reducing drag, thus increasing the efficiency of the vehicle.

The concept of the boat-tail is first illustrated to demonstrate how a boat-tail works. Using expressions derived by Dr. G. M. Gregorek, the drag reduction of three models (one without a boat-tail, one with a boat-tail, and one with a boat-tail between the payload section and the engine tube) is predicted.

Qualitative smoke tunnel analysis and quantitative wind tunnel analysis is then presented. The results yield that boat-tailing does indeed reduce aerodynamic drag significantly. Further computer analysis depicts the variation in model altitude and velocity as a function of time to give a comparative prediction of model performance. No flight testing was reported although similar work by Dr. G. M. Gregorek is cited as flight verification.

D Division, 4th Place

STUDY OF BOOST/GLIDER WING DESIGN

by Micci-Gressman Team, NAR T-167

The purpose of this study was to determine the optimum wing design. An accurate wind tunnel balance was designed and built for use in the University of Illinois low-turbulence wind tunnel. Thirteen wings were built and tested in the wind tunnel at both low speeds (glide) and high speeds (boost). Lift and drag were measured at the low speed while the zero-lift drag was measured at the high speed. The wings were designed to study the optimum wing thickness, aspect ratio, sweep ratio, and surface finish. The glide wind velocity was 18 ft/sec while the boost wind velocity was 95 ft/sec. The lift and drag were measured over a wide range of angles of attack to determine the angle where the maximum $C_L^{3/2}/C_D$, a measure of the glider's descent velocity, occurred.

The results of the wind tunnel tests were then placed in a computer simulation of a boost/glider's flight. The computer program calculated the flight duration of a boost/glider from its altitude and descent velocity. Various wing combinations and wing areas were simulated to determine the optimum wing design.

Models were then built and flown to test the wind tunnel and computer results. A series of models was flown to test the determination of the optimum wing area and another series of

(NARAM-15 continues excitingly on next page)

models was flown to determine the optimum wing planform.

Results and conclusions:

1. A thin, high aspect ratio wing with boundary layer turbulation will improve the performance of a glider. Results are still inconclusive as to the effect of increasing the sweep angle.

2. Doped finishes and symmetrical airfoils do not improve the performance of a wing.

3. Although the optimum wing area of a boost/glider increases as the performance of the wing increases, an approximation can be made to an optimum wing area which will improve the performance of a boost/glider.

4. Wings which are good performers at glide velocities are for the most part good performers at boost velocities.

OTHER ACTIVITIES

Monday

NAR MEETING

The 1973 meeting of the Association was convened by President Jim Barrowman on August 6, 1973 in Hitchcock auditorium on the campus of Ohio State University. Eighty-one voting NAR members were in attendance.

The Treasurer, Al Lindgren, reported that the Association's financial picture had greatly improved in the first two quarters of 1973, with a $3000 balance at the end of 1972 turning into a present balance of $7000.

The meeting proceeded to the election of Trustees. In addition to those members whose names appeared on the ballot in the July issue of the *Model Rocketeer*, the following members were nominated from the floor: Terry Lee (Southland Division), Cody Hinman (Mountain), Tom Pastrick (Mid-America), and Howard Kuhn (Southland). The Secretary appointed the following members as tellers: Joseph V. Persio, Ellie Stine, and Jan Blickenstaff. He reported that 52 valid mail ballots had been received.

The President read the text of the three proposed amendments, and pointed out the nature of the changes they would entail. Votes by paper ballot were then taken on the Trustee election and amendments.

While the vote tally was in progress, the meeting was opened for business, comments, and questions. No motions were made at the meeting. Some of the comments and questions are reported below.

Cody Hinman asked why there was not a standing subcommittee of the Contest and Records Committee for Pink Book revisions; Jim Barrowman replied that this idea has been under consideration, and that it is a good one.

Several members commended the staff of the *Model Rocketeer* and the publisher, Norm Ward.

It was asked whether a Section can get a list of NAR members for their area. Jim Barrowman replied that by sending HQ a list of the Zip Code numbers that the Section is interested in, they will receive a list of members promptly and be billed at cost ($2.00 plus 2¢ for each name over the first 100 names).

S&T Chairman Jerry Gregorek was asked whether he will publish the actual performance figures for engines he tests. He replied that he is hoping to set up such a system, but that it is still in the future. He added that after one year, he has received 403 MESS forms, and that he hopes members will continue to send them in. He was asked why the FSI engines that are not up to standards have not been reclassified or decertified. He said that he is on the verge of decertifying all FSI engines after all efforts at getting FSI to correct the problem have failed.

A question was asked about NARAM site selection. Jim Barrowman replied that the NAR is actively looking for sites for future NARAMs, and that any Section wishing to host the meet should ask Dottie Galloway for the memo "NARAM Site and Support Proposal Guidelines"; no firm decision has been made on NARAM-16.

Jim Barrowman was asked about the NAR policy on night flights. He replied that: 1) insurance is void for night flights; 2) they are not authorized by the NAR; and 3) the possibility for setting fires is large.

The new Records Subcommittee Chairman, Don Larson, requested that any member having suggestions for simplifying records procedures contact him immediately.

A member of the Canadian Association of Rocketry asked about CAR-NAR meets, and was told that the FAI sanctions not only world championships, but any inter-country meet.

Jim Barrowman put in a plug for submitting articles and plans to the magazine, saying that the *Model Rocketeer* requires only accurate drawings, not inked drawings. George Flynn said that publication in section newsletters of articles that originally appeared in *Model Rocketry* magazine is all right as long as credit to MRm is given. Norm Ward asked members who submit records to remember that the photos should be of high enough quality to be published in the *Model Rocketeer*.

The tellers returned with the following results, certified by the Secretary: Jay Apt, Lloyd Armstrong, Jim Barrowman, Manning Butterworth, John Dressel, Roland Gabeler, Howard Galloway, Jerry Gregorek, Al Lindgren, Jess Medina, Elaine Sadowski, John Worth, and Ron Wright were elected Trustees. All three amendments passed by more than the required 2/3 majority.

Jay Apt, NAR 4554

Tuesday

TRUSTEE MEETING

The first meeting of the newly-elected Board of Trustees was held on Tuesday evening, August 7, in Hitchcock auditorium on the campus of Ohio State University. The following Trustees were present: Jay Apt, Jim Barrowman, Manning Butterworth, Roland Gabeler, Howard Galloway, Jerry Gregorek, Al Lindgren, Jess Medina, Elaine Sadowski, and Ron Wright.

After certification of the election results, nominations for the officers were accepted. A. L. Lindgren was elected president, Manning Butterworth Vice-President, Jay Apt Treasurer, and Roland Gabeler Secretary, all unanimously.

Al Lindgren, after taking over the chair, recommended that the Board name G. Harry Stine an honorary Trustee. The Board did so unanimously.

Al Lindgren, Jim Barrowman, Jerry Gregorek, Manning Butterworth, and Howard Galloway were elected to serve as the Executive Committee.

Al Lindgren appointed Honorary Trustee Les Butterworth to the chair of the new Senior Citizens Committee. The appointment was ratified by the Board. This committee will look for ways of involving senior citizens in model rocketry, drawing up a program that can be used by senior citizen groups.

The Board also, noting higher paper, production, and postage costs, as well as the desire for a larger *Model Rocketeer* magazine, voted to raise the amount paid by the NAR from 15¢ per issue to 25¢ per issue. To help defray this cost increase, as well as increased costs in Headquarters operation, new educational programs and other Association activities, the Board voted to increase Junior dues to $7.00, Leader dues to $8.00, and Senior dues to $10.00, effective on renewals coming in on December first and thereafter. The Trustees noted that these increases would not serve to entirely cover those costs, and that contributions and magazine subscriptions are still much needed.

Ronald Gabeler, NAR Secretary

NAR members wishing a complete set of the minutes should write to NAR Secretary, Roland Gabeler, 5105 W. Franklin Street, Richmond, Virginia 23226. There will be a nominal charge to cover postage and copying.

Wednesday

AIR FORCE MUSEUM TOUR

On Wednesday, after flying Streamer Duration, approximately one hundred fifty model rocketeers boarded four late buses and proceded to the U.S. Air Force Museum in Dayton, Ohio. The tour, arranged by Dr. Gregorek, was cut short by slow traveling, which forced reducing the time for the actual museum stay to a very short one hour.

The museum itself is a collection of both old and new airplanes, spacecraft, and bombs. Aircraft range from an original Wright Brothers military observation plane to a B-52 bomber. Mock-ups of the Hiroshima "Fat-Man" bomb and air-to-air missiles were also objects of interest to members of the Association.

Larry Shenosky, NAR 21460

Wednesday afternoon's highlight was a trip to the Wright-Patterson Air Force Museum in Dayton, Ohio. (Photo by Tom Pastrick)

MANUFACTURERS' RAP SESSION

This year's Manufacturers' Rap Session began at 9:00 p.m. on Wednesday, August 8, at Hitchcock Auditorium. Several manufacturers were represented, Estes Industries by Dane

Boles and Bill Simon, Centuri-Enerjet by Randy Gilbert and Bob Del Principe, CMR by Howard Kuhn, FSI by Lonnie Reese, and Cox by Doug Malewicki.

Dane Boles served as master of ceremonies and handled most of the questioning. The question-and-answer period opened with a question put to Dane Boles and Bill Simon concerning the status of Solar igniters. Bill replied that eventually the igniters will be included with all Estes engines, replacing the present igniters.

A question was raised about the reliability of the Estes D engine ejection charge and if it was truly powerful enough to pressurize a body tube and insure ejection. Dane Boles recommended the utilization of a stuffer tube in large body tubes, but he assured the modelers that there should be enough pressure. Dane also denied any rumors that Estes was planning large thrust E and F engines.

Doug Malewicki answered a question about the Cox D8 engine. Doug said that manufacturing problems and low sales accounted for its termination.

Randy Gilbert and Bob Del Principe revealed plans for both D Enerjets (in a standard casing) and booster Enerjets. No further information is available. They also said that with present costs, labor, and parts available, a cheaper Enerjet will not be possible, at least for the time being.

A new company called Protec is experimenting with high-impulse composite propellant. A spokesman for the firm said it may be possible to produce D, E, and F engines in a standard 18 mm casing.

This session was basically centered on engines and quality control. While the engine discussion was going on, Col. Howard Kuhn of CMR was peacefully dozing when awakened by a rocketeer inquiring about the new CMR dual egg capsule. Howard stated that the capsule is just in its experimental stages, and rocketeers are invited to comment on the idea.

Lonnie Reese of Reese Industries announced a new engine called the GR-2. This has a peak thrust of 300 Newtons. It was demonstrated on Sunday and has tremendous altitude capabilities. The GR-2 will be made available some time in the near future.

Randy Gilbert assured those in attendance that all Centuri orders will be filled as soon as possible, but there will be a delay with the Centuri mini-motors.

With time running short, Dane Boles adjourned the meeting, allowing modelers to come up and talk to the manufacturers' representatives.

Paul Eichenberger, NAR 18164

Thursday

CONTEST BOARD PINK BOOK REVIEW

NARAM-15 contestants and participants got a chance to comment on the new Pink Book as well as quiz the Contest Board about rulings on Thursday night. CB Chairwoman Dottie Galloway fielded most of the questions, with Pink Book Revision Chairman Sven Englund, Northeast CB Chairman Al Lindgren, Southland Chairwoman Judy Barrowman, and Mid-America Chairman Scott Dixon helping out.

The return rule was simultaneously a major item of discussion at this meeting and the subject of a petition being circulated at a glider discussion in Taylor Tower lobby. The Contest Board took no action on the return rule at the meeting.

A suggestion from the floor that Rule 35.1 in Plastic Model Conversion Competition be changed so that rocket-like vehicles could be used instead of only "guided missiles, rocket vehicles, or space vehicles" was considered by the Board. Plastic rocket kits are often difficult to find, and this scarcity would limit competition.

The idea of establishing minimum qualifying standards for placing in various events (minimum altitudes, times, etc.) was brought up by the Board members. This was tossed around a bit, with some people feeling that it would raise the standards of competition and others that it would make things too difficult.

Dottie Galloway clarified Rule 6 by stating that no more than one-half of the contestants at a Regional meet can be members of the same section, *even if some of them are flying as independents.*

The problem of finding a substitute for lead payload weights, which can sometimes be dangerous, came up. Water has been suggested as a replacement. Anyone having ideas about this subject should contact the Contest Board.

In response to a question about whether or not records can be set in Altitude Efficiency, the Contest Board and Dr. Englund replied that this event is included in the "All Class Altitude" designation, and therefore records can be set in it. (Predicted Altitude is *not* included, however.) Records may not be set in any event that involves judgement, such as Scale.

The CB Session ended with a rather spirited discussion of the meaning of "reasonable construction" of a model (see Rule 9.5). Some people thought that rockets employing stick-on plastic fin units should be excluded from competition, while others felt that such an action would discourage beginners from competing. The Board has left the decision up to the Contest Director for the meet in question. ⅄

Elaine Sadowski, NAR 5800

Thursday night's Contest Board session was chaired by Contest Board Chairwoman Dottie Galloway (second from left). Other participants were (l. to r.) Al Lindgren–Northeast CB Chairman, Judy Barrowman–Southland Chairwoman, Sven Englund–Pink Book Revision Chairman, and Scott Dixon–Mid-America Chairman. (Photo by Jan Blickenstaff)

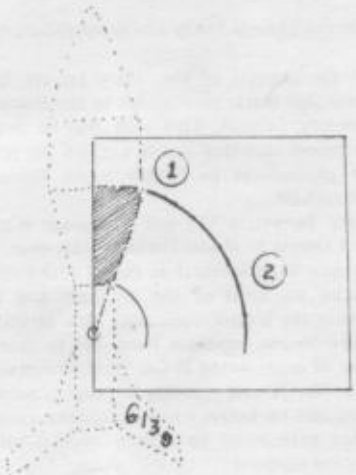
FROM RECORDS SUBCOMMITTEE:

If unable to contact me, Don Larson, at (703) 591-3629 when applying for a world and/or U.S. record, call Howard Galloway at (301) 987-4395.

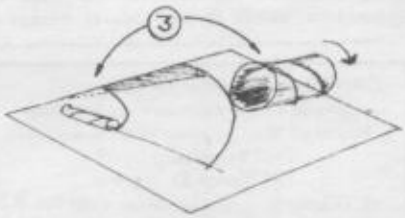
Don Larson, Chairman
Records Subcommittee

MODEL ROCKET TIPS

This one is by request! Some friends asked me to print my easy way to make conical sections. So: (1) Sketch a half view on the edge of a piece of paper. Draw a line from the wide to the narrow end of the cone and to the edge of the paper. (2) From this point strike off two arcs with a compass.



(3) Using a section of tubing the same size as one on the rocket, roll off a distance on the arc equal to one turn of the tube. Start this at the edge of your sketch and you will end up with a piece of cardboard that will act as a conical section and have an easy to glue tab.



NAR IN ACTION

NAR in ACTION

(EDITOR'S NOTE: The following article was written by Bruce Bell, who is currently the President of the STAR-ROVERS section in Fresno, California.)
Photos by Bruce Bell, NAR 20636 and Mary Jarrett.

Fresno School Starts Rocketry Program

At the request of Mrs. Mary Jarrett, Bruce Bell and Bill Matts paid a visit to the Roosevelt Elementary School. This visit was to demonstrate model rocketry and to explain the proper safety procedures to follow when launching model rockets.

Mary Jarrett, a 5th and 6th grade teacher, began a course in model rocketry this year. This was highly experimental as model rocketry was unknown to most of the students and their parents in the West-Fresno area. Mrs. Jarrett got the idea to use modrocs from her husband, a teacher of engineering at Cal State University at Fresno. Mr. Jarrett recently became acquainted with model rocketry when a student came to him for permission to launch rockets on the University Campus.

Mrs. Jarrett was intrigued by them and inquired further at the local hobby store, Fresno Hobby. She found that it was an activity in which "kids" of all ages participated. She gathered up a considerable amount of information on model rocketry and after a great deal of study on her part, announced that she would be offering a course in model rocketry during the spring semester. All the students were very enthusiastic about flying rockets except for perhaps two. During the semester the students were taught in the classroom about how to build and fly modrocs.

The parents were still a little skeptical and wanted someone who was experienced in launching modrocs to come and show everyone how to properly launch the rockets before they would let their children continue with the course. Mrs. Jarrett went back again to Fresno Hobby and asked owner Bill Matts for help. Bill mentioned that there was a NAR section in Fresno, and that its President, Bruce Bell, was about as experienced as you could get in Fresno when it came to flying modrocs and adhering to the safety rules. After a little shuffling of schedules, Bruce and Bill were set to visit the school on Friday, June 1, 1973.

Mr. Mallory, Roosevelt School Principal, discussing the many educational facets of modrocs. Pat Gorman and Robert Baderstcher are also being helped with their many questions by Bill Matts.

Jamie Stacy launches Pat Gorman's "Starlight".

A crowd gathers as Bruce Bell prepares his "Groundhog" for flight. Bruce explained the workings of rocket/gliders to the students at Roosevelt School.

Upon arriving, Bill and Bruce were greeted by two 6th graders who directed them to a room where about 10 parents and about 20 5th, 6th, 7th, and 8th graders had gathered, with more waiting outside. Bruce began with an oral presentation on the safety of model rocketry, after which he showed the group two of his R/Gs, a "no-shift" "Vulture" and a "Groundhog". Bruce passed around several issues of *Model Rocketry* and the *Model Rocketeer* explaining that there is a variety of events in which rocketeers compete in national and international competition. He also mentioned that rocketeers come in all ages from a 4-year-old in Hawaii to Leslie Butterworth, who is 70. But, the key issue through the entire talk was safety.

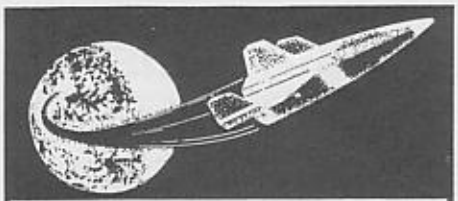
Now came the time to go out and actually launch some rockets. After Bruce cleared everyone away from the launch area and explained the need for an RSO, the first rocket off the pad was Tommy Macagno's Alpha powered with a C6-7. The model worked perfectly as the parachute came out at apogee and gently brought the model back just over the fence at the edge of the school-yard. The whole crowd of some 20 to 30 chased the model over the chainlink fence. Mr. Mallory, Roosevelt's Principal, was thoroughly impressed; after at first being apprehensive about allowing rockets to be launched from the school grounds.

Troubles began to arise as mini-models were flown. The problem was in the shock cord mounts—they were being put in, but weren't pressed against the body tube enough to provide the proper clearence, so the parachute would jam up against the mount and not eject. Later, Bruce explained the problem to the crowd and showed everyone how to properly mount shock cords.

The enthusiasm of these beginners was overwhelming. Bruce launched his "Vulture" R/G and the whole school was out to chase it down! He then launched his A3-2T-powered "Groundhog." As the 3½-foot span Sparrow R/G circled overhead, 20 to 30 kids circled right underneath it as it stayed aloft for 78 seconds. While things were being cleaned up, the kids were actually circled around Bruce, Bill and Mrs. Jarrett begging to help carry things and help clean up.

The demonstration won the approval of the parents and everyone thanked Bill Matts and Bruce Bell for their interest and assistance. There were 3 more launchings by the school during the remainder of the school year—including one on the last day of school in which the entire school participated, the first through the 6th grades! Some 7th, 8th, and 9th graders, who attended Roosevelt in past years, also got the word and were present.

Sections take heed. Those having problems keeping their membership up should follow the STAR-ROVERS' lead. By conducting school demonstrations and assisting in starting school programs, the section not only lays the groundwork for future members but publicizes model rocketry to the general public as well. ▲



CHECK ACCURACY AND HOLE ALIGNMENT USING THESE SAMPLE PROBLEMS WITH A 1000 FOOT BASELINE.

E_2	A_1	A_2	$A_1 + A_2$	ANSWER USING 5-PLACE TRIG TABLES	YOUR SLIDE RULE ANSWERS
20	45°	40°	95°	258.35 FT	
20°	60°	40°	100°	320.07 FT	
30°	50°	80°	130°	577.34 FT	
45°	30°	20°	50°	652.70 FT	
60°	20°	60°	80°	601.55 FT	

ASSEMBLY INSTRUCTIONS

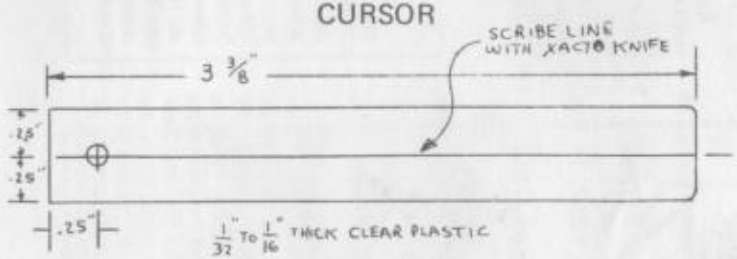
INNER DISK

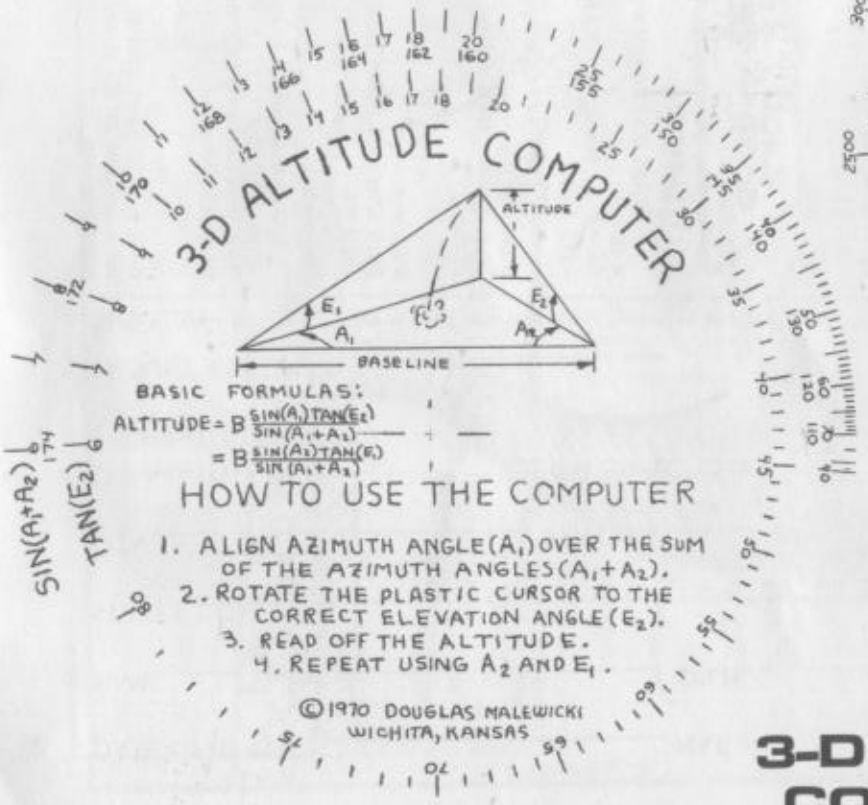
1. Cut out to approximate size.
2. Bond to paper (postcard thickness).
   Use CONTACT CEMENT only.
3. Cut out carefully to exact size.
4. Spray with Crystal Clear Krylon.

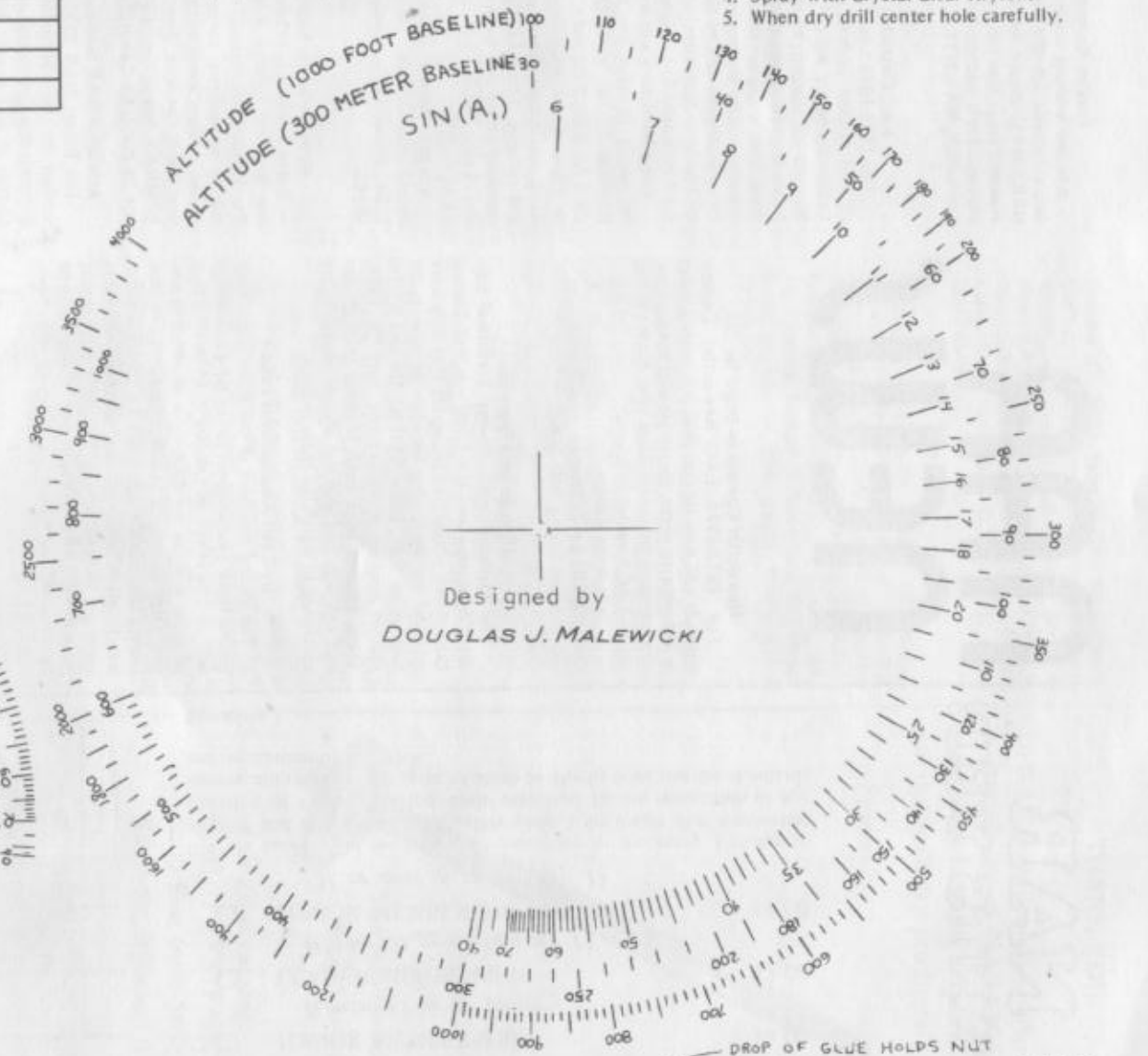
MAIN DISK

1. Cut out carefully to exact size.
2. Bond to 1/8" thick plywood (available from Hobby Shops in 6" x 12" sheets). Use CONTACT CEMENT only!
3. Cut out wood disk and sand edges.
4. Spray with Crystal Clear Krylon.
5. When dry drill center hole carefully.

CURSOR







Designed by
DOUGLAS J. MALEWICKI

3-D ALTITUDE COMPUTER

NAR WANTS YOU!

DATE OF BIRTH _____ NAR No. _____

NAME _____ DATE _____

STREET _____

CITY _____ STATE _____ ZIP _____

☐ Family Plan Membership (Deduct $2.00) ☐ FAI Stamp $2.00

AMOUNT ENCLOSED _____

MEMBERSHIP CATEGORY (Please check one box only)

☐ JUNIOR MEMBERSHIP $6.00
(Under 17 as of January 1)

☐ LEADER MEMBERSHIP $7.00
(Under 21 as of January 1)

☐ SENIOR MEMBERSHIP $8.00
(21 or over as of January 1)

If I am accepted in the National Association of Rocketry, I pledge to observe and follow the NAR safety code. I am aware that a reported violation of the NAR safety code may lead to the revocation of my membership right. I also agree to abide by the by-laws and the standards and regulations of the NAR

Signature _____

$2.00 of your membership fee is for a one-year subscription to MODEL ROCKETEER

NAR NEWS

Newsletter Contest to Begin for '74

The 1973-1974 LAC Newsletter Competition is on! Any section that publishes a sheet is welcome to enter. Please send all entries (one copy of each issue published after NARAM-15) to:

LAC Newsletter Award
c/o Andy Elliott
10203 Leslie Street
Silver Spring, MD 20902

MESS Issues a Warning

The Malfunctioning Engine Statistical Survey Committee and the Standards and Testing Committee would like to report that they have received an increasing number of reports on failures of MPC (now AVI) B3-5m and B3-7m Minijet engines manufactured July 26 1971. These engines have been blowing through the end cap side and also the nozzle. Modelers are cautioned to watch for these engines.

By-Laws Amendments Passed

The voting members of the Association have passed three amendments to the By-Laws which will go into effect on January 1, 1974. The first of these reduces the LAC term of office to one year (this actually is in effect now). The second lowers the Leader age from 17 to 16, a move which gives some of our younger members more say in NAR affairs. The third amendment allows mail votes by the voting membership to be counted as special meetings of the Association.

Record Filings

PEE WEE PAYLOAD

C Division

Jon Robbins—Paul Vandall Team, T pend., 15 July 1973, 282 m.

CLASS 0 STREAMER DURATION

A Division

George E. Meese, Jr., NAR 12972, 15 July 1973, 51 sec.

CLASS 1 STREAMER DURATION

C Division

Tom Hoelle, NAR 19103, 14 July 1973, 214 sec.

HAWK ROCKET/GLIDER

B Division

John Chapman, NAR 23055, 15 July 1973, 163.5 sec.

Dues to Rise

Effective on memberships and renewals received December 1, 1973 and thereafter, the NAR dues will be $7.00 for Junior members (those 15 and under), $8.00 for Leaders (those 16 through 21), and $10.00 for Seniors (those over 21). The dues rise was necessitated by the rising costs of paper, postage, etc., as well as by the expansion of the *Model Rocketeer* to 24 pages a month.

Trustee Records Available

Anyone wishing a copy of the NAR Secretary's records for the last three years (up to NARAM-15) should write to Jay Apt. They are available from him for the cost of copying and postage. Jay's address is 370 Concord Avenue, Cambridge, MA 02138.

LAC Elected at NARAM-15

The 1973-1974 Leader Administrative Council was elected at NARAM-15. The following Leader members will serve on the LAC: Andy Bennett (Chairman), Mark Griffith (Secretary), Steve Decker, Steve Kranish, Dave Lewis, Andrew Mitchell, and Doug McMullen. Jim Barrowman will be the group's Trustee advisor, and Doug McMullen will be the liaison to the Board of Trustees. Steve Decker will act as liaison to NAR President Al Lindgren.

Doug McMullen will work on the Scale Paks. He hopes to have one ready by MARS-VIII (October 13-14). Steve Decker will check out the LAC Slide Sets and see what has happened to them. Steve Kranish will look into advertising solicitation, means of recruiting members and surveys. The LAC Newsletter Contest will continue to be run by Andy Elliott, and Mike and Leslie Wolfe will continue to compile MESS forms.

Anyone having suggestions for the LAC should contact LAC Secretary Mark Griffith, 1104 Phoenixville Pike, West Chester, PA 19380.

BCMRA Wants Newsletter Exchange

Larry Shenosky, Section Liaison Officer for the Broward County Rocketry Association in Ft. Lauderdale, would like all sections publishing newsletters to send him a copy of a recent edition along with a return address, so that Larry can send them a copy of CAPCOM, BCMRA's newsletter. Larry's address is 8610 NW 26 Place, Ft. Lauderdale, Florida 33313.

Attention NAR Members in Pennsylvania!

Jon Buser, NAR 23246, is trying to form a section in the Stroudsburg-Pocono area of Pennsylvania. Interested modelers should write to him at 613 Bryant Street, Stroudsburg, PA 18360.

PLATO Teaches

Any modelers having access to the University of Illinois' PLATO IV educational computer system are invited to try out the lesson called "modroc". There are now terminals in many colleges and some high schools all across the country; check with the computer science department for instructions. Please report all experiences to Greg Smith at the address given in the lesson.

Modroc Ecology Contest

Any modelers interested in entering the Model Rocketry Ecology Research and Development Project Contest should send *post cards only* with their name, address, NAR number (if applicable), birth date, and project title to Pat Stakem, Environmental Measurement Committee, 101 E. 2nd Street, Frederick, Maryland 21701, by November 1, 1973. This contest is open to all model rocketeers, not just members of the National Association of Rocketry. For more details, see September issue of *Model Rocketeer*, or write to Pat Stakem.

CONTEST calendar

SEND EARLY FOR CALENDAR!

All sanctioned contests will be entered by the NAR Contest Board if recieved at least two months in advance. Notice of all special events and unsanctioned meets should be typed and sent directly to Elaine Sadowski, Editor, *Model Rocketeer* at 1824 Wharton Street, Pittsburgh, Pa. 15203.

Contest Event Abbreviation Key

Class 00 Altitude	Cl.00A	Hornet Boost/Glider Duration	HoB/G
Class 0 Altitude	Cl.0A	Sparrow Boost/Glider	SpB/G
Class 1 Altitude	Cl.1A	Swift Boost/Glider	SwB/G
Class 2 Altitude	Cl.2A	Hawk Boost/Glider	HkB/G
Class 3 Altitude	Cl.3A	Eagle Boost/Glider	EB/G
Class 4 Altitude	Cl.4A	Condor Boost/Glider	CB/G
Predicted Altitude	PA	Hornet Rocket/Glider Duration	HoR/G
Design Efficiency	DE	Sparrow Rocket/Glider	SpR/G
Class 0 Altitude Efficiency	Cl.0AE	Swift Rocket/Glider	SwR/G
Class 1 Altitude Efficiency	Cl.1AE	Hawk Rocket/Glider	HkR/G
Class 2 Altitude Efficiency	Cl.2AE	Eagle Rocket/Glider	ER/G
Pee Wee Payload	PWP	Condor Rocket/Glider	CR/G
Single Payload	SP	Parachute Spot Landing	PSL
Dual Payload	DP	Streamer Spot Landing	SSL
Open Payload	OP	Open Spot Landing	OSL
Robin Egg Lofting	RbEL	Quadrathon	Q
Pigeon Egg Lofting	PEL	Scale	S
Ostrich Egg Lofting	OEL	Class 0 Scale Altitude	Cl.0SA
Roc Egg Lofting	RcEL	Class 1 Scale Altitude	Cl.1SA
Dual Egg Lofting	DEL	Class 2 Scale Altitude	Cl.2SA
Class 0 Parachute Duration	Cl.0PD	Class 3 Scale Altitude	Cl.3SA
Class 1 Parachute Duration	Cl.1PD	Class 4 Scale Altitude	Cl.4SA
Class 2 Parachute Duration	Cl.2PD	Super Scale	SS
Class 3 Parachute Duration	Cl.3PD	Space Systems	Sats
Class 0 Streamer Duration	Cl.0SD	Drag Race	DR
Class 1 Streamer Duration	Cl.1SD	Plastic Model	PM
Class 2 Streamer Duration	Cl.2SD	Research and Development	R&D
Class 3 Streamer Duration	Cl.3SD		

The following are contests that have been *sanctioned* by the National Association of Rocketry. Points earned at these contests are credited toward national standings.

October 8, 1973 – Huntington, New York. Name: EAR-74. Host: Section EAR 254. Events: HoB/G, SpB/G, Cl.00PD, Cl.3SD, SwR/G, OSL. Contact: Tom Whymark, 17 Eltona Place, East Northport, NY 11731. Phone (516) 864-4943.

October 13 - 14, 1973–Aberdeen Proving Grounds, Maryland. Name: MARS - 8. Host: Star Spangled Banner Section 165. Events: Q, S, HoB/G, HoR/G, HwB/G, RbEL, Cl.0PD. Contact: Howard L. Galloway, Jr., 428 Ben Oaks Dr., West, Severna Park, MD 21146. Phone (301) 987-4395.

October 14, 1973–Ft. Lauderdale, Florida. Name: South Florida Open Meet 2, 1973. Host: Broward County Model Rocketry Association, Section 217. Events: S, Cl.0PD, REL, Gnat B/G, OSL. Contact: Richard A. Barnard, 1107 Waverly Road, Ft. Lauderdale, Florida 33312. Phone: 523-0818.

October 20, 1973–Glen Ellyn, Illinois. Name: GEM-2 (Glen Ellyn Meet-2). Host: Glen Ellyn Rocket Society 117. Events: GR/G, HkR/G, SpB/G, Cl.00PD, Cl.3SD. Contact: Joe Rogers, 2N112 Virginia Ave., Glen Ellyn, Illinois 60137; phone (312) 682-0515.

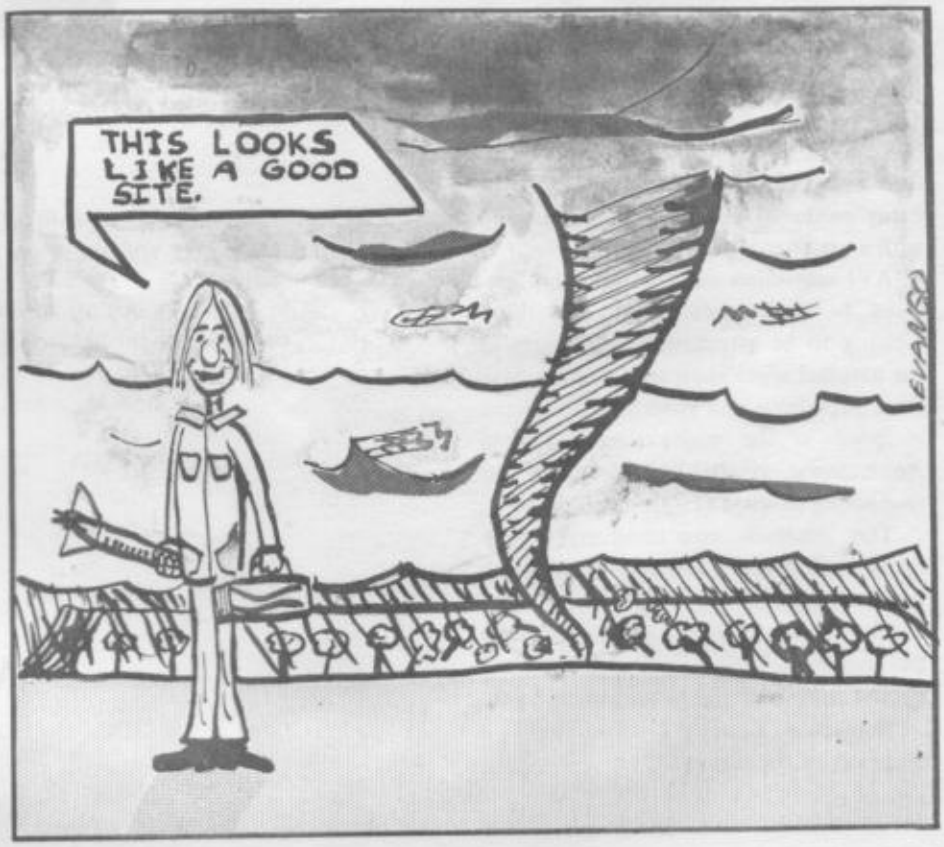
October 22, 1973–John H. Glen High School, Huntington, N.Y. Name: Boris Norman Oswego Milton Cumquat Seymour Makossa Bftspk I. Host: EAR 254. Events: EB/G, GB/G, MDEL, OSL, SpR/G. Contact: Don O'Grady, 3 Elspeth Lane, East Northport, N.Y. 11731. Phone (516) 864-4527.

November 3-4, 1973–St. Charles, MO. Name: St. Charles Area Tournament of Technical Engineering and Rocketry II. Host: St. Charles Aerospace Research Engineering (SCARE). Events: Q, MEL, HkB/G, Cl.2A, Cl.0PD, DR, PA. Contact: Donald H. Somerville, 612 Maran Drive, St. Charles, MO. 63301. Phone: (314) 723-0640.

April 27-28, 1974–Bowling Green, Virginia. Name: ECRM-VIII. Host: NARHAMS Section 139. Events: S, Mercury Dual EL, Cl.0SD, PM, EB/G, ER/G, Cl.3PD, HoR/G. Contact: Judith A. Barrowman, 6809 97th Place, Seabrook, Maryland 20801. Phone (301) 459-5261.

CONVENTIONS, SYMPOSIUMS, UNSANCTIONED AND FOREIGN CONTESTS

October 18, 19, 20, 1973–USAF Academy, Colorado. Name: Model Rocket Science and Engineering Symposium. Host: USAFA NAR Section. It is hoped that we can bring together those of us who are interested in research involving model rockets. NAR members and non-members of all ages are invited to share ideas in this symposium by presenting their own research in a 20-minute presentation. A banquet and possibly a tour of Martin-Denver as well as a tour of the USAF Academy aerospace laboratories is planned. For further information contact: Captain Robert A. Golobic, FJSRL/NH, USAF Academy, Colorado 80840.



AVI—A MINI-GIANT OF INDUSTRY

(GP) The Space Age has spawned another success story. Aerospace Vehicles Incorporated of Mineral Point, Wisconsin is a company created to serve a very important sector of the Aerospace Community: the enthusiasts that lobby for the future exploration of space by their involvement in model rocketry and other space age hobbies.

The company has established itself as an innovative leader in its promotion of the National Association of Rocketry (NAR). AVI programs are currently aimed at aiding the NAR in its drive for new members.

To keep the general public and its customers informed of the worlds of science and technology, and model rocketry AVI has launched a new publication, the GALACTIC CHRONICLE. The philosophy of this monthly is that man is evolving into a new species (sub-species?) as he extends himself into space, and he requires a distinctive news-organ.

To meet the needs of this new breed, Homo Galacticus, AVI has formed a unique organization, the GALACTIC FRATERNITY. The GF exists to promote a logical development of the species consistent with the general constraints of the Universe.

Not all of AVI's projects are as far out. They have just released a new catalog of their latest products. At the same time they are continuing a half price sale of items produced during their relationship with a major company.

AVI customers range in age from preteens to the retired. There are those aspiring to be astronauts, key figures in the national space programs, doctors, lawyers, paperboys and government officials included in the wide cross-section of Americans supporting the growth of this fascinating concept-oriented company.

This relatively new company has already circled the globe with its rocketry products.

The creative concepts being applied by this leader in its field can well be noted by the industrial giants of planet Earth.

Aerospace Vehicles Incorporated is a company of the future.

AVI

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