MODEL ROCKETRY

OCTOBER 1970
60¢

The Journal of Miniature Astronautics
Incorporating THE MODEL ROCKETEER

The "Minimitter"
Modroc Homing Beacon

NEW 1971

Centuri

Model Rocket CATALOG

NEW! SERVO LAUNCHER!

No more cumbersome cables, heavy batteries, etc., every thing built-in! Light and compact.

NEW! enerjet ROCKET ENGINES!

The most powerful engines ever built! Imagine! One "F" Engine equals the power of 16 "B" engines.

NEW! ROCKET KITS!

New concepts in Rocket Planes, Space Shuttles. Exciting new flight patterns. New patented parts.

NEW! JOIN THE CENTURI AEROSPACE TEAM

and receive Valuable BONUSES, CENTURI BONUS BUCKS! — Full information with CATALOG.

Don't Delay—Mail Today!

CENTURI ENGINEERING CO.
P.O. Box 1988 Dept.M100, Phoenix, Arizona 85001
Enclosed is 25¢ for the NEW 1971 CENTURI CATALOG.
(Refund on 1st order.) (No Stamps Please.)

NAME ....
ADDRESS ....
CITY ....STATE..................
ZIP CODE ....AGE..................

Model Rocketry

Volume III, No. 1
October 1970

Cover Photo

A semi-scale Polaris breaks the surface in a test of the underwater launching system described in this month's *Escape Tower.* A complete description of the techniques used begins on page 20. (Photo by Bob Parks.)

From the Editor

Just recently US Senator Barry Goldwater called the attention of the Congress to the growing difficulties of the National Air and Space Museum of the Smithsonian Institution. In a statement before the House Committee on Library and Memorials Senator Goldwater testified that the "National Air and Space Museum . . . [is] the victim of a shocking lack of attention by the Smithsonian's Top Brass." He cited the facts that 1) The museum receives "an extremely meager share of the Smithsonian's Federal Budget — about 1.7%. 2) The professional support departments of the Flight Departments are seriously undermanned. . . . 3) The Museum has no Director. It has had no Director for nearly a year, even though it has been 24 months since the last Director gave notice of his planned retirement." The Flight museum exhibits are house in a World War I temporary hanger erected in 1917 and another building which is 90 years old. In spite of this at least 4.1 million persons went through the National Air and Space museum in 1969 of a total of 12.4 million visitors to the entire Smithsonian.

Since the museum is to be "the nation's center for exhibition, education, and research in the history and principles of air and space flight" and the home of the "world's greatest collection of objects related to flight," Senator Goldwater called on the Committee to support appropriations for construction of a permanent home to house the Air and Space Museum exhibits. In 1966 the construction of such a building, already planned and designed, was "postponed until there is a substantial reduction in our military expenditures in Vietnam." Since that time appropriations to renovate and construct other Smithsonian buildings and exhibits have passed the Congress, and the Senator contends "that the Flight museum should not be singled out from all other Smithsonian projects and told that its new building must be deferred until Vietnam expenditures ease off."

(Continued on page 39)

Regular Features

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

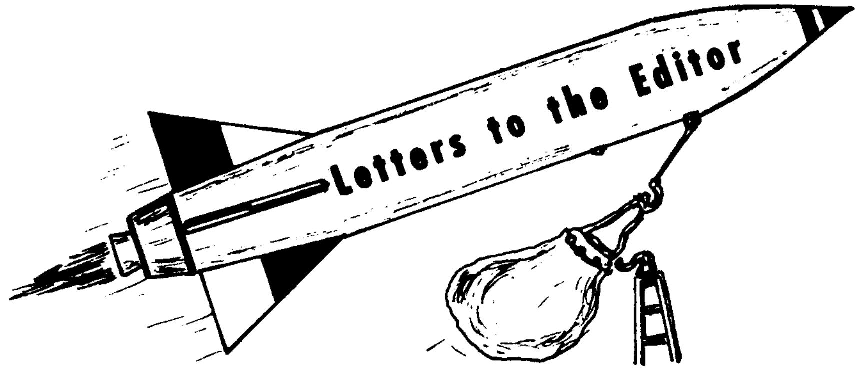
Second class postage paid at Boston, MA and at additional mailing offices.

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

Subscription Rates: US and Canada $6.00 per year, $3.00 for 6 months, 60 cents for single copy; Foreign $9.00 per year, $5.00 for 6 months, $1.00 for single copy. For change of address please notify Subscription Department, Model Rocketry, Box 214, Astor Street Station, Boston, MA 02123 at least 6 weeks in advance. Include former address or mailing label with the new address.

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

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



North Carolina Activities

About a year ago a new model rocket club was formed in Raleigh, North Carolina to serve model rocketeers in the Research Triangle area. The first few meetings were, of course, somewhat disorganized, and our early club launches fully lived up to the reputation of our namesake. Since then club and range operations have been streamlined, and meetings, although fewer, are now more productive. Club membership has expanded to about 15 members, and the club is presently conducting a membership drive.

Research and development projects, in various stages of planning or execution by our club members, include:

- Computer programs, for use on IBM and GE equipment, relating to various phases of model rocketry,
- Construction of an SCR-controlled multiple position launch system,
- Construction of a miniature multi-channel telemetry transmitter, using digital time-sharing and multi-plexing,
- Development of a model rocket engine test stand,
- Compilation of an instructional film on model rocket basics for use in lectures.

In addition to work on these projects, club plans for the future include an exhibit in a local hobby shop, a field trip to the nearby SEMROC facilities in Ayden, NC, local lecture/demonstrations, construction of club launch facilities in a nearby member-owned field, formation of an NAR section, and sponsoring of local and area competitions.

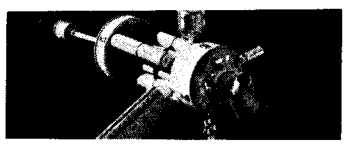
Members have access to IBM facilities in the city and in the nearby Research Triangle, and, through school curriculum, access to GE equipment at a local data-processing firm. Launches are currently held in a 1000' x 1000' field surrounding NC State U's Carter Stadium.

Any model rocketeers in the Triangle area interested in joining the club may do so by calling the club's president, Howard Penny, at 787-6561.

William E. Mixon, Jr.
Secretary
Vanguard Rocket Club
Raleigh, North Carolina

MIT Press Book

In *Technical Notes* of the September issue of **Model Rocketry** the book *Topics in Advanced Model Rocketry* was mentioned as a future publication of the M.I.T. Press. I'd appreciate knowing if the book is now available, and if so, where and how it may



be obtained. If it has not yet been published, when is it expected to be made available?

Robert C. Forbes, Jr.
Arlington, Virginia

The Book "Topics in Advanced Model Rocketry" has been prepared and is now in the hands of the M.I.T. Press. Presently the final manuscript is "out to readers". No word is available from M.I.T. Press on when they expect to introduce the book.

Research & Development

First off I would like to say that your magazine most certainly gave model rocketry something it needed badly . . . a chance for model rocketeers to communicate with each other about the research and developments going on in model rocketry. This fact alone makes your magazine worth while, and, as I believe, is helping model rocketry grow stronger, and is giving it a chance to show its true educational value.

Secondly, I would like to make a suggestion. Why not have a "Recent Programs of Research" column included in your magazine, where model rocketeers could write in and tell about their experiements with rockets so others might benefit from it, as well as the experimenter who would then be in a better position to communicate more readily with others also interested in that field of research. The report on the experiment need not be that lengthy, as all the experimenter would have to do is briefly explain his experiment and include his name and address so other rocketeers could write to him and ask him for more information on the experiment, or else compare notes with him on progress they have made in that field. This way, the communication barrier set up between model rocketeers working on experiments on their own might begin to break down and badly needed communication can begin, helping model rocketry unite its followers.

It seems that others I know are claiming that it isn't a good idea, since they say that any rocketeer working on an experiment has a tendency to jealously keep the results to himself, feeling that he has nothing to gain by giving away his results and everything to lose by losing the credit for the experiment for himself. This, they claim, is true in any field of science. I hope model rocketeers see this danger in our hobby, and the terrible effect it could have on the future of model rocketry by this deliberate attempt of retarding the growth of model rocketry. I hope every rocketeer will try to be open with their research and findings and will try in every way to help model rocketry advance, for by deliberately holding back and keeping to themselves, rocketeers may find that they really gave everything to lose, and nothing to gain at all.

Mark Wakely
Bensenville, Ill.

Perhaps there already exists a place in **Model Rocketry** *for the type of communication Mark is describing. Gordon Mandell's semi-regular column — The Wayward Wind — is an attempt to discuss recent projects being undertaken by R&D types, and to put their work into historical perspective. Gordon has received many communications from modellers regarding their work; and there seems to be little or no secretiveness or jealousy among the people writing to him. Many of the ideas they have proposed and developed will be discussed in future Wayward Wind columns. In the works now is an article on Rockoons, to be followed in the winter by a discussion of the historical development of the boost/glider.*

Little Joe I Plans?

Your Czech Competition coverage got me interested in the Little Joe I. How about some scale data?

Rick Lindholtz
Davis, California

At one time, when the Little Joe I was being used for Mercury capsule testing, it was a popular rocket at NAR competitions. Anyone out there still have a good set of data?

Bumble-Bee

Me, an experienced (???) model rocketeer, finally got up enough courage to build the Bumble-Bee (MRm, December 1969). Unlike some other B/G's, this one was FUN to build. And it actually FLEW, which is a great accomplishment for me. On its first flight it hung up there for 105 seconds. Congrats to Bob Singer for a great article.

As for your magazine, there is none other like it. Keep up the good work!

Mike McLoughlin, NAR 17263
Narrows, VA

Six Meter Transmitter

I noticed the piece about the "six-meter band" transmitter in your July *From the Launching Pad* column and I would like to know where to write for the plans. I am currently studying for my technician's license, and will soon be constructing a new transceiver capable of being used with the transmitter mentioned.

Dale Meyer
Fonda, Iowa

The six meter transmitter mentioned was featured in the May 1970 issue of **73**, *an amateur radio magazine. Copies of the magazine may still be available in your local "ham" shop, or by mail from 73, Inc. Pine Street, Peterborough, New Hampshire 03458.*

Rocket Team

Congratulations on the many improvements in **Model Rocketry**. My 13 year old son and I have been actively involved in building and flying model rockets since October 1969. He does the building. I act as adviser and RSO.

We currently have a Camroc system in preparation and would like to obtain a copy of the November 1968 issue of **Model Rocketry** to study the article *High Quality Aerial Photography*.

John E. Bahnke
Monticello, Illinois

E Engines

I buy your magazine every month and read many articles and see many pictures about "E" engines and "E" engine rockets. I would like to know if you know any dealers in Chicago which carry these types or where I can order them.

I would like to congratulate you on the information gathered on the "Vostok" in the May issue. I hope to build a semi-scale version of it.

Peter Foltz
Chicago, Illinois

NAR certified "E" engines are manufactured by Flight Systems, Inc. (Box 145K, Louisville, Colorado 80027). Write to them for information on a dealer in your area. Enclose 25¢ and FSI will send you their complete catalog. If the hobby shop in your area does not stock FSI engines, you can ask him to write directly to FSI for information on their dealer sales terms.

Computers

Glad to see the fine articles on computers applied to model rocketry. But I must note a few corrections in the April issue. A statement was made that mistakes in cards wrongly punched cannot be plugged. I have noted computer users using a plastic square with adhesive backing for just this purpose. These can probably be purchased from any card supply company.

Also mentioned was that 26 keypunches can not be used with the 1130 system. The 1130 I use will read characters from either the 26 or 29. In fact, I have run programs that were punched partially on the 26 and partially on the 29.

Tom Rygasewicz
Computer Operator
Racine, Wisconsin

Canadian Note

The Burnaby Model Rocket Club in British Columbia was formed late last year and to date has some 75 members. My father and I felt there was an urgent need for boys and girls to be able to pursue their hobby in a safe manner, so we got busy and obtained all the necessary approvals as required by the Canadian Association of Rocketry. Then we approached the Parks and Recreation Commission of Burnaby, and were granted permission to use the Burnaby Central Sports Complex as their launch site. This in all likelihood is the only rocketry club, at present, using Municipal park land as a launch site in B.C.

The club now launches regularly each Sunday afternoon, and probably has set some kind of a record for consistent launchings, having only missed two Sundays since opening day last September.

The B.M.R.C. is planning to have meets with various clubs in Washington State and are also hoping that they will be allowed to enter the Washington State Meet, to be held in Spokane. Future plans include hosting a 1971 Canadian Conference, if there is sufficient interest, at which time we would welcome our nearby neighbours in the states to participate and exchange ideas.

The club has some very hard working members who at the present time are working towards putting on the largest public display of Model Rocketry even seen in Western Canada. All this to take place at the Abbotsford International Airshow in August.

We enjoy your magazine very much here in British Columbia, however find it very hard at times to find copies, as all available copies are soon snapped up at the newsstands. We will try to keep you informed of our activities here in Western Canada. Keep up the good work!

Mark Sanders, President
Burnaby Model Rocket Club
6714 Hersham Ave.
Burnaby, BC. Canada

WHAT'S YOUR FAVORITE ARTICLE THIS MONTH?

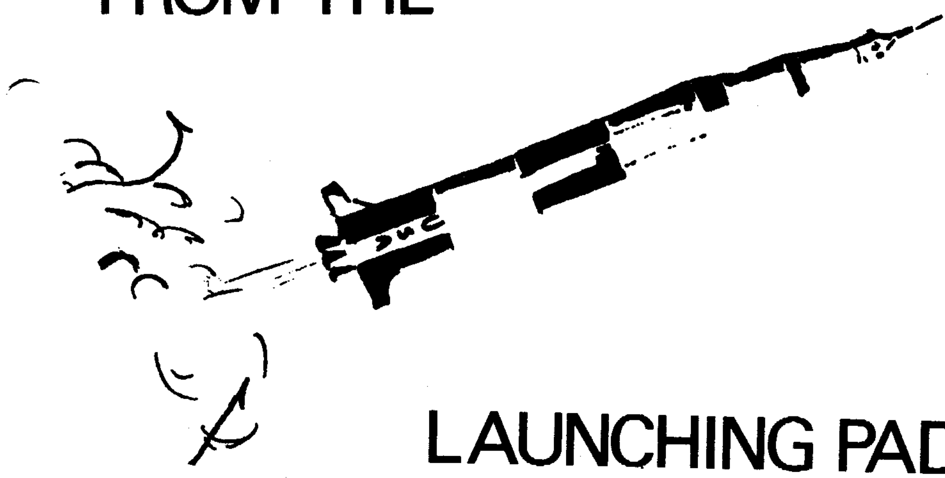
Vote here for your favorite articles. List them in order - the most-liked first, etc.

1.________________
2.________________
3.________________
4.________________
5.________________
6.________________
7.________________
8.________________
9.________________

Clip this section out or use a facsimile. Paste on a postcard or enclose it in an envelope and send to:

Reader Survey
Model Rocketry Magazine
Box 214
Boston, Mass. 02123

FROM THE

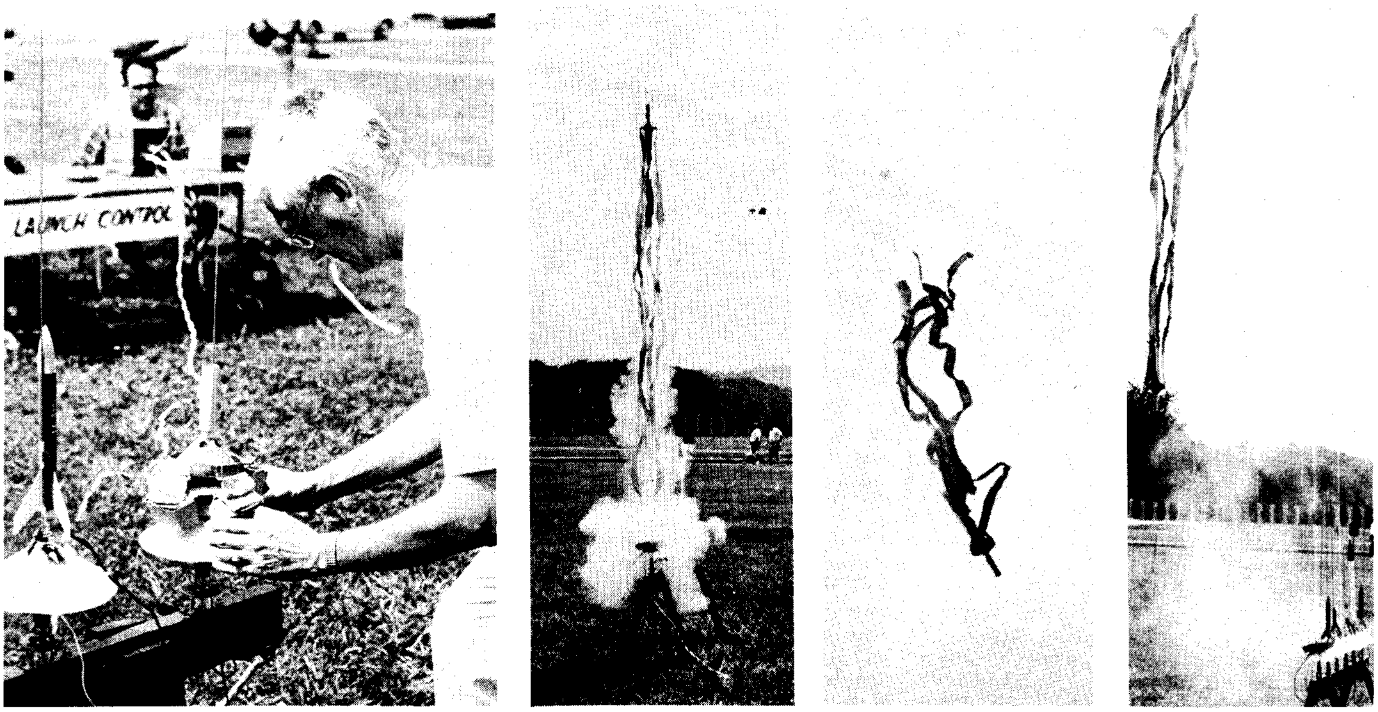


LAUNCHING PAD

This year's Smithsonian demonstration launch got off to an interesting start with Howard Kuhn of CMR and Tag Powell of SAI engaging each other in a friendly debate on the topic: "Who had the first kit specially designed for competition?" Tag claimed that his *Tempus Fugit* designed by Bryant Thompson and holding several US records, was the first. "That is not a fact," Howard replied. The entire CMR line from the *Manta* B/G, to the *Elo* Egglofter, and the *Break-Away* PD bird are all designed for competition, and have proven themselves by winning at many meets. At about this time Bruce Paton from Cox joined the group with the suggestion: "I guess we could claim to have the first ready-to-fly designed for competition." Their Honest John in fact was designed to accept a standard NAR payload. Not yet heard, since they weren't a part of the discussion, are the claims from Estes, Centuri, MPC, and FSI. But each of these companies can probably make good claim to having the "first rocket kit specially designed for competition." I guess my choice would have to be the Model Missiles *Aerobee-High* kit, introduced in 1958, and suitable for competition in scale modeling events.

Also at the Smithsonian, George Meese, Sr., of the Annapolis Association of Rocketry, gave a demonstration flight of his unusual Drag Race rocket. Under the Drag Race rules two rockets compete against each

Unfortunately, in our haste to bring you coverage of the Condor event at NART-1, one roll of film went undeveloped. But one frame on that roll was too good to just let it sit in our photo files. Above Guppy (in cape) tries to convince his Condor, the Gargoyle, that it's really a rocket. NAR Trustee Jim Kukowski (without cape) stands by watching in disbelief that the RSO will actually let that "thing" off the ground. Actually Guppy didn't succeed in convincing the Gargoyle that it was a B/G, or even a rocket, as you'll recall from August's coverage of NART-1. But he did give it several valient attempts, and certainly added excitement to the meet. One spectator, who dove out of the way to avoid being hit by the twin-D powered Gargoyle, was reported to be particularly excited by Guppy's rocket!



George Meese, Sr. of the Annapolis Association of Rocketry preps his unique Drag Race bird at the Smithsonian. Note the four streamers attached to the sides. As the bird lifts-off, the streamers deploy, and the drag slows the rocket down. It's a tangled mess at arc-over, about 30 feet in the air but everything works out all right as the rocket returns slowly to the ground. Now that's designing the bird to fit the event!

other. One point is awarded to the first off the pad, the lowest altitude, and the last to land. The rocket getting two or three points wins, and goes on to compete against the winner of another heat. So for Drag Race you want a rocket that will get moving quickly, and then develop a lot of drag to keep it low. George Meese has come up with just such a design. He's got a rocket body with streamers attached to each of the four sides. The streamers are rolled up in a pan on the launch pad. As the engine ignites the rocket moves fast, but it starts to unroll these 10 foot long streamers. By the time it gets 15 feet into the air, the bird is dragging about 40 feet of deployed streamer up with it. (See photo sequence.) It quickly looses velocity, and starts down. At the Smithsonian, the Meese Drag Racer made it to perhaps 30 feet before arching over. On the way down the rocket once again has 40 feet of deployed streamer draging behind it to slow it down. This looks like quite an interesting Drag Race design.

We've received a letter from the makers of Hobbypoxy products giving some additional hints on the *Quick and Easy Finishing Method* described in last month's **Model Rocketry**. "If Hobbypoxy Formula II glue is applied within ten minutes after mixing, we have found that it actually *brushes* on smoother and in a thinner film than when applied by a flexible knife. I have found that a cheap ¾" or 1" enamel brush with the bristles cut down to a length of approximately 1" serves as an ideal Formula II applicator.

"For faster curing application, I would much rather suggest the use of our Formula I rather than our Formula IV or another competitive five minute epoxy. The reason for this is that our Formula IV is designed for flexibility after a thorough curing. Consequently, within a day or so after it is used, although it has excellent strength, it is somewhat difficult to sand."

I have been doing some experiments with this method lately, and it does in fact give a harder and easier to apply finish than the many coats of dope normally used. Give it a try!

Rich Brandon of Pittsburgh's Three Rivers NAR Section suggests an unusual new method of "clear plastic fin" stabilization for finless scale models. Writing in the latest issue of the TR newsletter, *Con-Trail*, Rich discusses the use of clear plastic stabilizing *tubes*, such as those employed on the Infinite Loop design in the May 1969 issue of **Model Rocketry** instead of plastic fins. He suggests that a ring of plastic tubes be made from the plastic payload tubes offered by various manufacturers, and that this ring could then be slipped on and off of the finless scale model. Take a look at the manufacturer's catalogs and you'll see a number of clear tubes that will fit.

With B/G's flying, beautifully detailed Super Scale, and very few broken eggs in Egglofting, the second Midwest Model Rocket Regional showed evidence of a new level of modeling skills just emerging in the hobby.

MMRR-70

by George Flynn

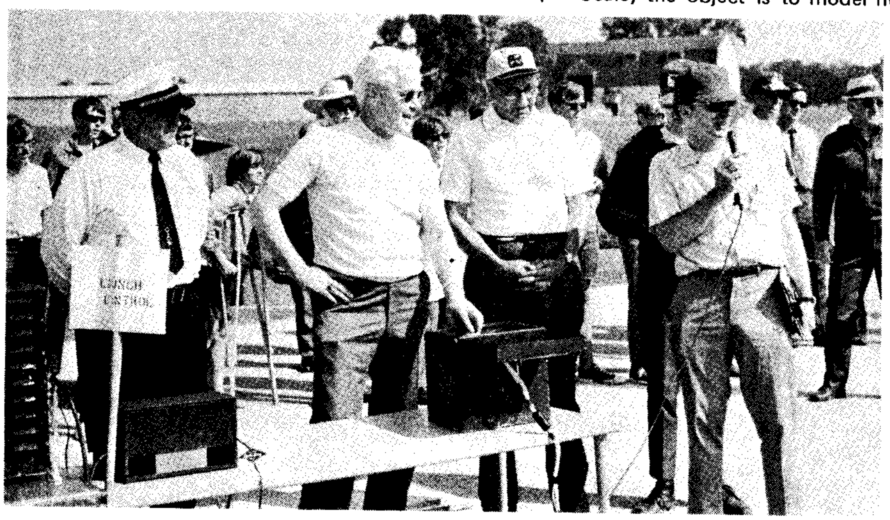
If only one word were to be used to sum up the contest, MMRR-70 would have to be termed *FANTASTIC!* It may not have looked that way to CD Jerry Gregorek or the members of the host Section, Ohio's CSAR Section, most of whom were running around so fast that they may not have gotten a chance to look at the range. But the 78 rocketeers from the Midwestern states who gathered at the new Southwest Columbus Airport were treated to a contest not soon to be repeated. Even a quick glance indicated that the field was huge, the B/G's were flying well, the Super-Scale looked better than some of the real birds at Wallops, and even the weather was cooperating.

The field for MMRR-70 was a "soon to be opened" airport just outside of Columbus, Ohio. The concrete runway and parallel taxiway provided the thermals that were needed to keep the B/G's and PD birds aloft. Like most airports, the field was absolutely flat, with no trees, and at least a mile long in the direction of the runway. The hangar facilities, already completed, provided an excellent storage area for range equipment and Super Scale entries. Just in case of rain, the launching area was located right on one of the concrete taxiways — eliminating even the hazard of getting your feet wet. Only the trackers, whose stations were located in waist high grass, could claim any inconvenience. The field was beautiful, but MMRR-70 almost didn't happen there. . .

A week before the meet the final details for use of the airport site had been worked out. But on Monday morning, just five days before the contestants from seven states were scheduled to converge on Columbus, the CD received a phone call from the police department advising that the launch would not be permitted from the field. Some hasty negotiations . . . launch day was getting closer . . . and finally on Thursday the City of Columbus finally agreed to permit the use of the field . . . but only if Dr. Gregorek would assume *personal responsibility* for any damage, injury, etc. occuring during the meet. He agreed, and true to their word, early on Saturday morning a city official accompanied by two witnesses arrived at the field with an official release form for the CD to sign.

By 8:30 AM on Saturday most of the CSAR range crew had arrived at the field. The range, using three launch racks and three independent firing systems, included launch equipment from the CSAR and Hilliard clubs. The MASA club provided the Ball-Hagedorn rear-pivot tracking scopes and a support crew to man them.

As soon as the range was opened, Super Scale check in began at one of the hangars. In Super Scale, the object is to model not only the missile or rocket but also its launching facility. Even at large Regional meets there are generally only one or two outstanding Super Scale entries, but MMRR was an exception. There was no clear winner, no best entry. Almost all of the Super Scale models were good enough to place at any other meet in the country. There was no strong dominance of any particular model in this event. Four Asps, two Astrobee 1500's, a Nike-Tomahawk, a Nike-Apache, a TAD, a Tomahawk, and a converted Countdown Saturn V, all complete with their scale launch towers were seen in the hangar. Two modelers even went so far as to provide motorized launchers which could automatically raise their scale



The first official aeronautical activity at the new Southwest Columbus Airport — the launch of Craig Streett's Camroc to open MMRR-70. (L to R) Chief Security Officier Weaver looks on as Airport Supervisor Dan Ginty presses the firing button. Launch Control Officer Charles Krallman observes the firing, while CD Jerry Gregorek provides commentary for the spectators.

birds into firing position. The modeling was so good that NAR Trustee Jim Kukowski remarked "beautiful, absolutely fantastic" when he looked around the room at the entries.

The first event on the schedule was Egglofting, with a 20 nt-sec total impulse limit. Working within this limit a majority of models were single-staged and powered by one C or D engine. These flights were unusually good, with few failures. A number of good two-staged models were also flown, but there were almost no clusters.

One of the few cluster Eggloft flights was part of Dave Crafton's R & D project. Dave devloped a simple method of assuring that a cluster model will take off only if all its engines ignite — a system analogous to the tie-down clamps employed on real missles. What Dave did was to run a piece of string from the model past the engine nozzle and to the pad. This was repeated for each engine. Only if *all* the engines ignite, burning through all of the strings, is the model released for flight. The system's effectiveness was proven when one of the three engines was a bit slow to ignite and the other two lifted the pad six inches off the ground before the third engine lit, burned through its string, and the rocket took off . . . at about a 20 degree angle from the vertical. All that needed is to attach the pad more firmly to the ground.

Another R&D project also saw use in Eggloft. Charles Krallman used a thrust augmenter tube of the type enployed several years ago by Wes Wada to increase the thrust of the engine. Essentially his device was a 3" long closed-breach launcher which slip-fit around the engine. Constructed of 1/16" wall thickness aluminum tube and capped on the rear end, the augmenter tube fits around the engine, and the engine exhaust gas pressurizes the tube, with the engine itself acting as the piston. Chuck reports about a 10% increase in effective thrust by using this device.

The tracking was poor in the Eggloft competition, with no Leader closed tracks, John Robbins took first in the Senior Division with 335 meters, while B Hurd topped the Juniors with 278 meters. Fortunately, by afternoon the tracking had improved for the Design Efficiency competition.

Just about *everything* was being flown in this event from a BT-50 size PD birds, to Hypers, to NARWHALS, and many home deisgns. The weather was windy, and the sky was 75% overcast, but there was no threat of rain. On outstanding flight — 171.5 meters with a ½A engine — came early in the event. With a Design Efficientcy of 137, this flight by Jacques Adnet became the target for the Seniors to beat . . . but none of them even came close. Ed Piburn took second in Senior with an 88 m/nt-sec. In the Leader Division George Pantalos took

MMRR-70 RESULTS

EGGLOFT

Junior	1st	B. Hurd	278 m
	2nd	B. Paniccia	251 m
	3rd	M. Marchlewski	222 m
Leader		(No Returns)	
Senior	1st	J. Robbins	335 m
	2nd	J. Mechtly	325 m
	3rd	Ball-Hagedorn Team	172 m

DESIGN EFFICIENCY

Junior	1st	M. Richter	104 m/n-s
	2nd	E. Zeldin	96 m/n-s
	3rd	D. Paniccia	74 m/n-s
Leader	1st	G. Pantalos	31 m/n-s
	2nd	J. Hickman	29 m/n-s
		(No other closed tracks)	
Senior	1st	J. Adnet	137 m/n-s
	2nd	E. Piburn	88 m/n-s
	3rd	J. Gregorek	80 m/n-s

OPEN SPOT LANDING

Junior	1st	T. Secrist	6'11"
	2nd	M. Marchlewski	37'4-1/2"
	3rd	D. Copley	41'10-1/2"
Leader	1st	G. Pantalos	39'4-1/2"
	2nd	E. Hayes	62'9-1/2"
	3rd	J. Hickman	111'5"
Senior	1st	L. Streett	34'1-1/2"
	2nd	J. Kukowski	47'1-1/2"
	3rd	J. Gregorek	59'8-1/2"

RESEARCH & DEVELOPMENT

Junior	1st	D. Crafton	—
	2nd	B. Dolezal	—
	3rd	P. Greenberg	—
Leader	1st	G. Pantalos	—
	2nd	C. Russell	—
		(No Other Entries)	
Senior	1st	J. Gregorek	—
	2nd	Ball-Hagedorn Team	—
	3rd	R. Fox	—

SWIFT BOOST/GLIDE

Junior	1st	C. Pearson	267.4 sec
	2nd	B. Osburn	227.8 sec
	3rd	C. Krallman	73.0 sec
Leader	1st	E. Hayes	93.8 sec
	2nd	C. Russell	74.2 sec
	3rd	G. Pantalos	12.8 sec
Senior	1st	Ball-Hagedorn Team	232.0 sec
	2nd	L. Streett	191.2 sec
	3rd	R. Allen	145.5 sec

CLASS I PARACHUTE DURATION

Junior	1st	J. Laydon	262.7 sec
	2nd	T. Sunthemeir	171.8 sec
	3rd	D. Gloger	124.0 sec
Leader	1st	G. Pantalos	219.6 sec
	2nd	R. Deconnick	70.5 sec
		(No Other Qualified Flights)	
Senior	1st	J. Ruth	206.4 sec
	2nd	J. Mechtley	117.2 sec
	3rd	J. Gregorek	101.9 sec

SPARROW BOOST/GLIDE

Junior	1st	C. Krallman	140.5 sec
	2nd	J. Laydon	99.0 sec
	3rd	J. Kasper	81.0 sec
Leader	1st	G. Pantalos	116.3 sec
	2nd	C. Russell	94.8 sec
	3rd	E. Hayes	28.1 sec
Senior	1st	R. Allen	98.0 sec
	2nd	J. Mechtly	94.2 sec
	3rd	L. Streett	86.1 sec

SUPER SCALE

Junior	1st	C. Krallman	Astrobee 1500
	2nd	J. Kasper	Nike-Smoke
	3rd	C. Streett	Nike-Apache
Ldr/Sr	1st	Ball-Hagedorn Team	Astrobee 1500
	2nd	R. Allen	Asp
	3rd	J. Randolph	Asp

OVERALL WINNERS

Junior	1st	C. Krallman (CSAR)	264 pts
	2nd	D. Crafton (SCS)	231 pts
	3rd	J. Kasper (MASA)	180 pts
Leader	1st	G. Pantalos (CSAR)	333 pts
	2nd	C. Russell (CSAR)	189 pts
	3rd	E. Hayes	108 pts
Senior	1st	Ball-Hagedorn Team (MASA)	321 pts
	2nd	J. Gregorek (CSAR)	225 pts
	3rd	R. Allen (Metro-Cleve.)	186 pts

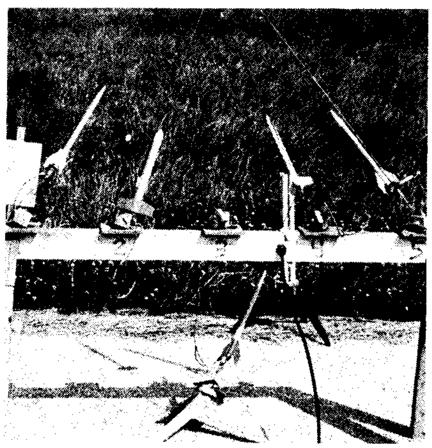
first with 31 m/nt-sec, while Art Richter took first in Junior with 104 m/nt-sec.

The Open Spot Landing event followed next on the schedule, and the CD had a suprise for the Leaders and Seniors. Their target was *directly upwind* from the launch area . . . so you had to shoot long into the wind and let the model drift back into the target area. "You can't get there from here" remarked one of the contestants . . . and that proved to be true. Halfway through the event Ed Hayes turned in a flight to 62 feet which caused the CD to remark "that's close" . . . and for quite a while that remained the mark to beat. Finally, on one of the last flights of the event, Leader George Pantalos came up with a spectacular 39' 4½" flight just to prove that it really was possible to get somewhere near the target. At one point the judges ran out of measuring tape! In the Leader Division it was necessary to go out to 111'5" to find the third place rocket. The CD, who picked that "impossible" target location, was rewarded with a third place for his 59' 9" flight. In the Senior Division Lee Street topped all the competition with his flight to within 34' 1½" of the target.

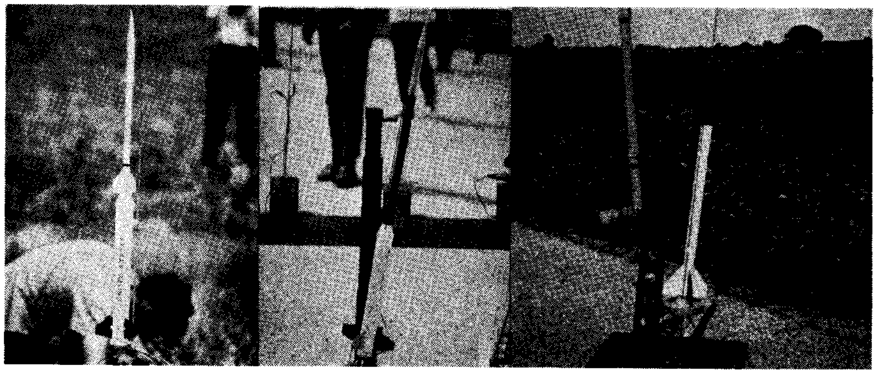
The flag placement for the Juniors was a bit more favorable – directly downwind from the launch site. It was an easy target as Tom Secrist proved with his 6' 11" flight for first place. The quick-to-build MPC Pioneer was one of the more popular rockets in this event, but almost everything, including rockets designed for most other events in the contest, was flown.

Following dinner there was a tour of the Ohio State University Aeronautical and Astronautical Engineering facilities. The rocketeers had an opportunity to examine the hyper-, trans-, and super-sonic wind tunnel test facilities.

Research and Development reports were presented on Saturday evening. Dave Crafton's aforementioned cluster tie-down technique took first place in the Junior competition. Brian Dolezal, who investigated the effects of surface finish on B/G performance, took second place. His project involved measurement of ballistic data, the altitude achieved as a function of surface finish. After flying 12 B/G's with various qualities of finsih the result was "generally inconclusive."



"You can't get there from here" just about sums up the spot landing event.



Photos by G. Pantalos and C. Russell

Super Scale entries were many and varied. (Left) Craig Streett's 1/12 scale Nike-Apache, beautifully detailed down to the antennas, took Junior third, Vikki Lundberg's 1/10 scale Nike-Tomahawk (center), and Chas. Russell's IQSY Tomahawk (right) also in 1/10 scale also showed above average detailing.

In the Leader Division George Pantalos took first place with his studies of drag the type of body taper required for optimum performance of a payload vehicle. Starting with a payload of a diameter significantly larger than that of an engine, George determined that the most effective configuration was a taper immediately behind the payload section. This configuration was superior to a standard cylindrical rocket and a boattail also tested in the equipment. Chas Russell took second in Leader R&D with an investigation of the characteristics of an X-shaped parachute – consisting of two rectangular pieces of material overlapped to form a chute.

In the Senior Division Dr. Gerald Gregorek took first place with the development of a method of multiple flash strobe photography for the investigation of B/G parameters. Second place was awarded to the Ball-Hagedorn team for their development of the rear-pivot tracking theodolite.

Sunday morning the range crew arrived at 9AM and, due to a change in the wind, found that they had to move the flying area about 400 feet down the taxiway. With the entire US B/G team for the International Championships entered in the Sparrow and Swift events, B/G competition was expected to be intense. Jerry Gregorek, who had spent most of his spare time planning the contest, had to stay up until 3AM Sunday putting his Swift together.

Swift was the first event on Sunday's schedule. The initial flights were not spectacular but most were over thirty seconds. Then Lee Streett, in the Senior Division, put up his SAI Mini-Bat for a 3 minute 11 second flight, and that became the flight to beat. The B/G competition was uniformly the best seen at any recent Regional competition. There were few DQ's and most of the gliders were reasonably well trimmed. Several styrofoam B/G's, a built-up wing or two, FlatCats, Swifts, Mantas, Mini-Bats, and just about everything else was flown . . . and flown well. Chris Pearson turned in a 4 minute 27 second flight to capture the Junior title with what may be a new US record. In the Senior Division the Ball-Hagedorn team captured first place with 3 minutes 52 seconds. Only in the Leader Division was it possible to win with under three minutes, with Ed Hayes taking first with a 1 minute 34 second flight.

After lunch the PD event was flown. By this time the wind had calmed down to a gentle breeze, and the thermals from the concrete runway were building up. All the timing teams were frequently busy watching birds in the air, and flights of over 1 minute and 30 seconds were not uncommon. Again the Junior competition dominated with J. Laydon's 4 minute 32 second flight taking first place. George Pantalos topped the leaders with 3 minutes 39 seconds, while J. Ruth took first in the Senior Division with 3 minutes 26 seconds. Alan Stolzenberg flew the same rocket with the same chute that had netted him first place at NART-1 . . . but this time it went unstable. Any explanations? Rockets certainly are unpredictable. Towards the latter part of the event, a group of RC airplane modelers started overflying the firing area raising shouts of "shoot him down," but the CD restrained the firing officer.

Not too many of the Sparrow B/G's were catching thermals, but in general the boosts were straight and the glides were reasonably good. Chuck Krallman took first in the Junior Division with a 2 minute 20 second flight, the only returned flight to top two minutes. There were, however, over a half-dozen flights that toppped a minute. Three gliders managed to catch the now weak thermals, but their times go unrecorded since the gliders left the large field and were not returned.

Following the Sparrow competition came the last event, Super Scale, which everyone had been waiting for. The launchers were quite impressive, and most of the flights were good. Since most of the models were of sounding rockets with good fin area, there were few stability problems. In the Leader/Senior Division the Ball-Hagedorn Astrobee 1500, launched from a pad that included an electric motor to raise the rocket into firing position, had a beautiful flight for first place. A pair of Asp models, by Bill Allen and Jon Randolph, each using well constructed metal launch pads, took second and third respectively. In the Junior Division, first place went to Charles Krallman, also flying an Astrobee 1500.

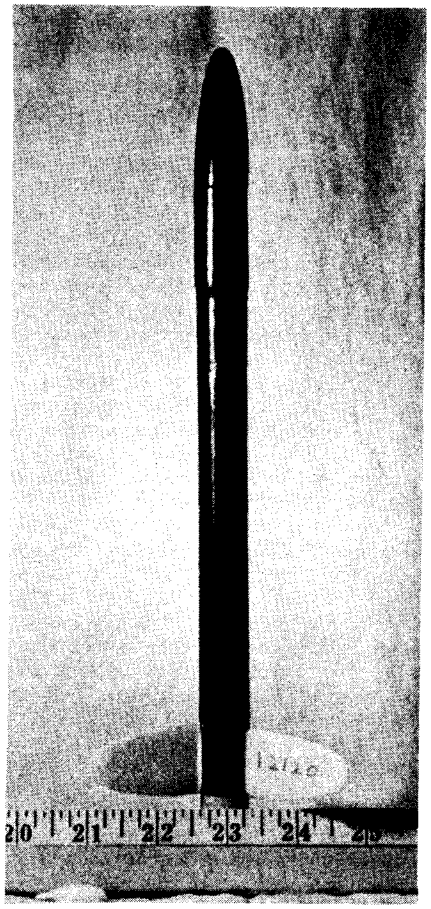
MMRR-70 concluded on a highly successful note with a banquet and presentation of awards.

Four events – Class 1 Altitude, Class 1 PD, Pee Wee Payload, and Streamer Spot Landing – comprise the difficult Quadrathon event. It takes a strong model just to survive the contest! A good design, the MZ-2 incorporates the minimum frontal and base areas, and high-efficiency elliptical fins to achieve maximum performance. For competition flying, try ....

The MZ-2

Quadrathon Design

by Douglas Plummer



The MZ-2 was specifically designed for NAR Quadrathon competition. A BT-20 engine tube is used to provide a minimum base area, while a T-20 tube accommodates the payload.

Undoubtedly many of you are familiar with Quadrathon. For those of you who aren't, I'll briefly describe the event. Quadrathon is an event comprised of four categories: Class 1 Altitude, Class 1 Parachute Duration, Pee Wee Payload, and Streamer Spot Landing. The altitude in meters and time of the former three are added and the distance from the spot of the latter is subtracted and the result is your score. The entrant with the highest score is the winner. Sounds simple, eh? Not always!

At MARS-IV, my nose cone was last seen heading in the direction of the Chesapeake Bay, the tracks missed closing by something like 300%, my PD time was 8 seconds, and I was so busy getting the right angle in spot landing I forgot to attach the leads to the igniter (four years and still don't remember that)!

Quadrathon takes a competitor of determination, nerves, and *plenty of luck*! The model must be durable, a good altitude and duration model, and one capable of escaping the "Quad curse." The MZ-2 was designed to be such a model.

For construction, first gather up the parts in the parts list. Cut a body tube (BT-20) to 185mm length. If you have a need to cut a lot of body tubes, the greatest thing I've found is the body tube cutter from Competition Model Rockets. I bought one last March and have been using it ever since. Anyway, glue in the engine block so that the engine will be flush with the rear of the body.

Trace the fin pattern onto 1/16" sheet balsa and cut out. Sand each fin to an airfoil and glue on 120° apart. Add glue fillets when the fins have dried in place.

The nose cone and adapter must be turned since no one makes adapters to go from Estes to MPC tubes. First get the following: a 1" x 1" x 3" hunk of balsa, a ¼" wooden dowel, a ¼" drill bit, white glue, a sharp modeling knife, a ¼" long section of BT-20, a ¼" long section of MPC or SAI T-20, and an electric drill or lathe.

Cut off a 1" hunk off the 3" balsa block. This will be used as the adapter. On one end of each piece draw a diagonal line connecting opposite corners. This marks the exact center of the block. Using the ¼" drill bit, drill halfway into each block. Pour glue into the holes and insert the 1/8" dowels so that about 1" sticks out. Let dry overnight.

Now, clamp the drill into a vice or use a C-clamp on a solid workbench. Whittle the blocks to a cylindrical shape. The ¼" body tube pieces are guides for the shoulder. The MRI T-20 must be modified to allow passage of a payload. Inside you will see a spiral line. Using the modeling knife, loosen the layer of paper under the line. When loose, pull out with tweezers. This should now be big enough for a payload. Slip this over the dowel and attach to the drill. Start the drill and check how much it wobbles. If it does, correct it by whittling on the side furthest from the wobble. Now sand with a medium grit to a cylinder. Don't apply too much pressure or the dowel may break. Round the end away from the drill. When the cone approaches the size, cut the shoulder with an emery board. Stop when the shoulder guide fits over it. Slip it over and finish the cone with fine sandpaper. Hollow out the nose cone to decrease the weight.

The adapter is a little harder. Use the T-20 guide and sand to a cylinder, then cut a shoulder for the T-20 on one end and the BT-20 on the other. The slope between the two is best sanded with an emery board cut to a width of 5mm. When both are done, cut off the dowel.

The payload tube is cut to a length of 25mm and hollowed out the same way as the shoulder guide. Check the adapter by installing the adapter, a payload, and the nose cone. Sand the end of the shoulder down if it all doesn't fit in.

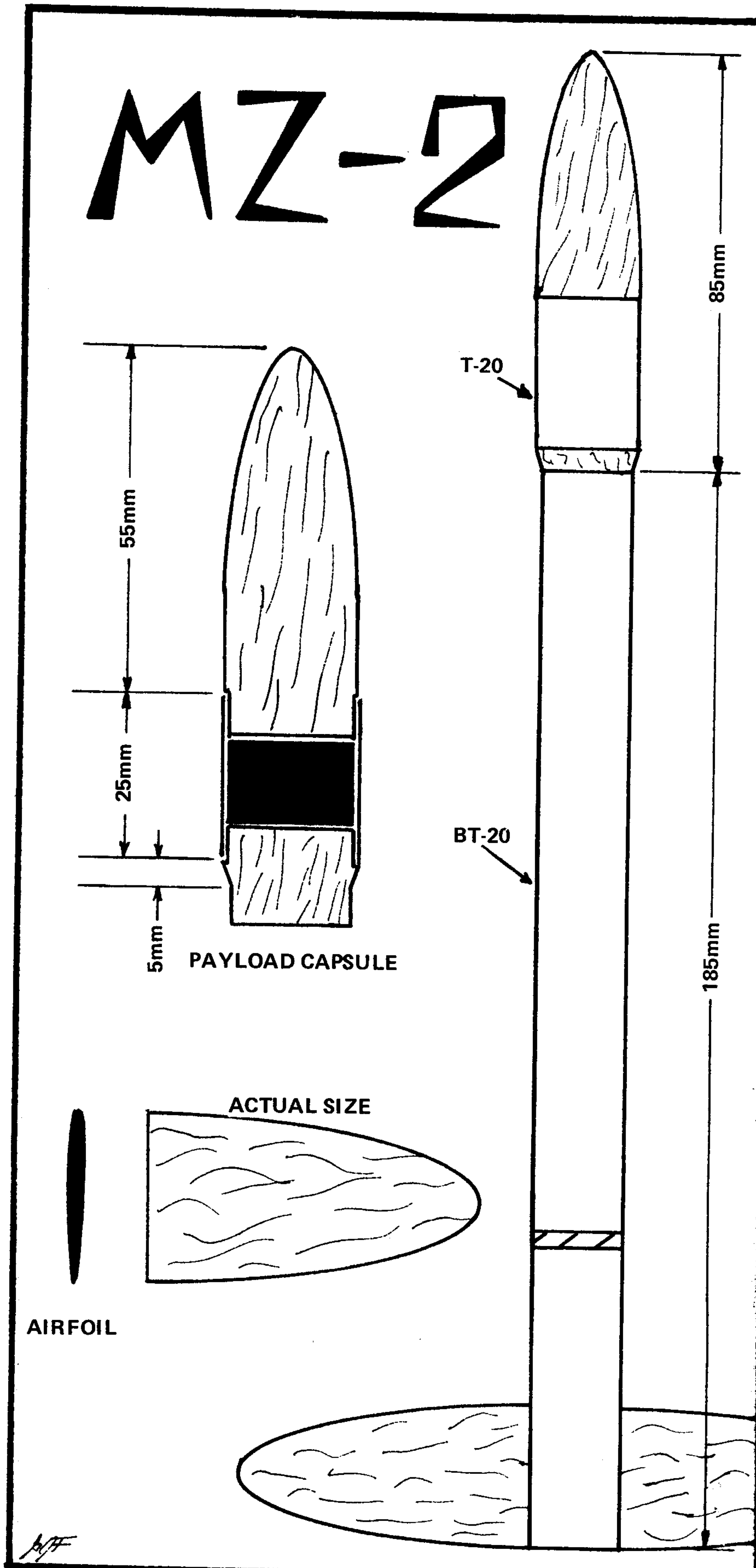
The shoulder is glued to the T-20 payload tube. The nose cone is not glued in place to allow removal of the payload, be sure it's a tight fit however. Mount a shock cord, a screw eye, and it is ready to finish. I prefer to use 8 to 10 coats of sealer painting it on and then fine sanding to the wood until no grain can be seen. When sealed, brush or spray final coat.

This model was built for use with a tower launcher to eliminate parasite drag from the launch lug. If however, this is not satisfactory, two ¼" lugs may be mounted on standoffs and attached.

May you place in the next meet with it, unless it's me you beat!

MZ-2 Parts List

7.25" BT-20 Body Tube
1.25" T-20 Body Tube
3" x 1" x 1" Balsa Block
¼" Dia. Wood Dowel
1/16" Sheet Balsa
Engine Block EB-20
Screw Eye
Shock Cord



For Greater Strength With Little Weight Increase

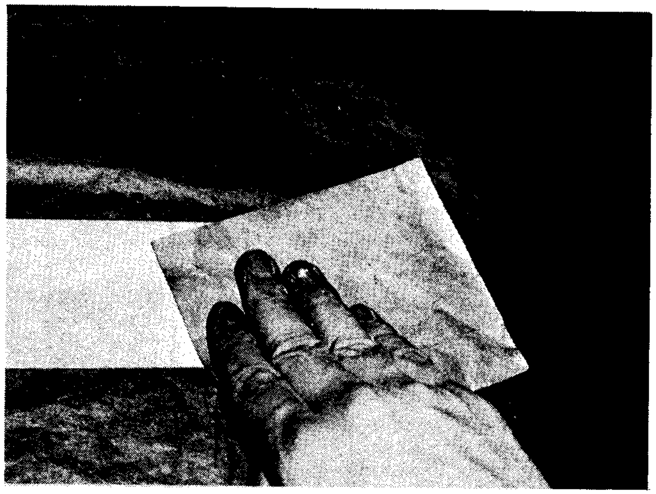
Tissue Covering B/G Wings

by Bob Parks

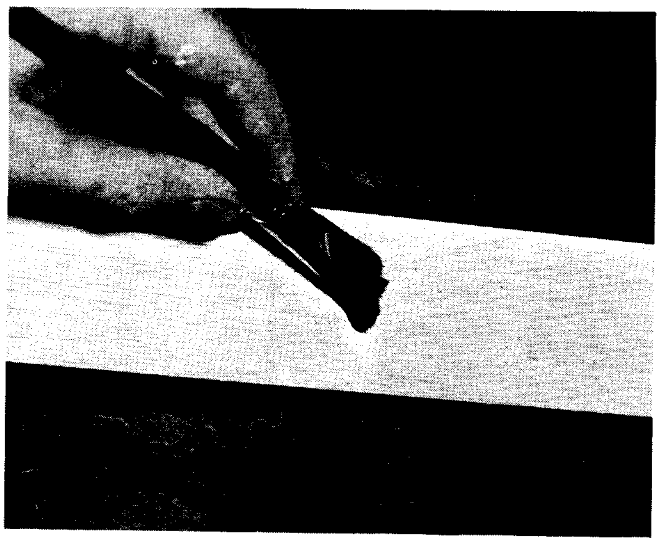
●●●●●●●●●●●●

Covering balsa wood parts with tissue paper is a technique long used by model airplane builders, but only very rarely used by rocketeers. A tissue covered wing is generally stronger, lighter and has a smoother finish than the plain balsa wing. It does take a little practice to be able to cover a wing without wrinkles, but the results are well worth it. It takes a lot more force to snap a tissue covered wing than an unfinished one, and there's only a small weight increase.

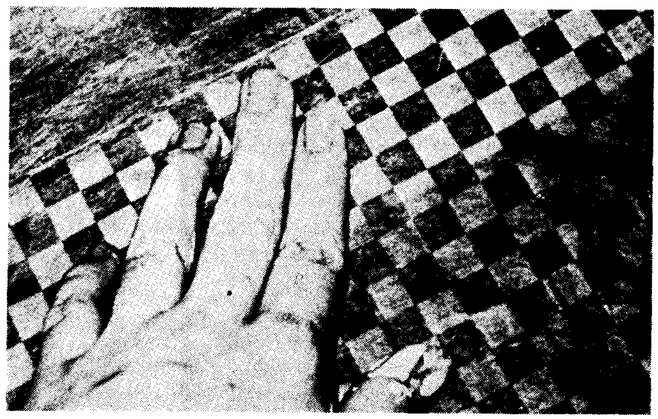
●●●●●●●●●●●●



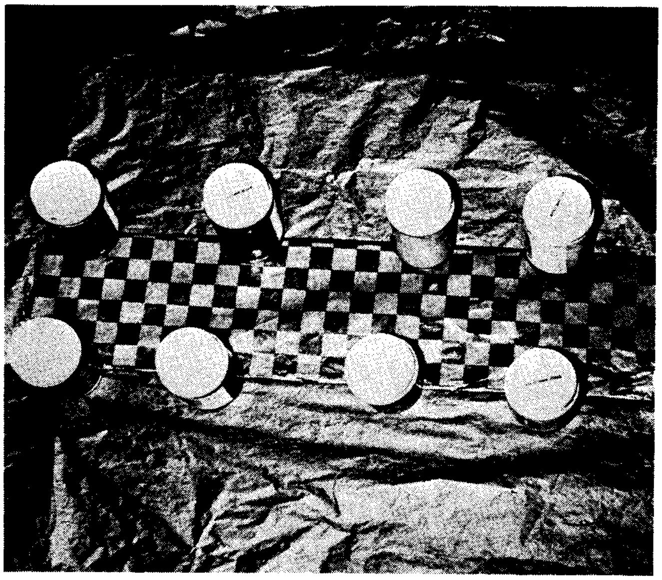
1. Select a piece of C-grain balsa for your wing. It can be up to 50% lighter than the wood you would normally use. Carve and sand in the airfoil you want. Fine sand the wing using #400 sandpaper.



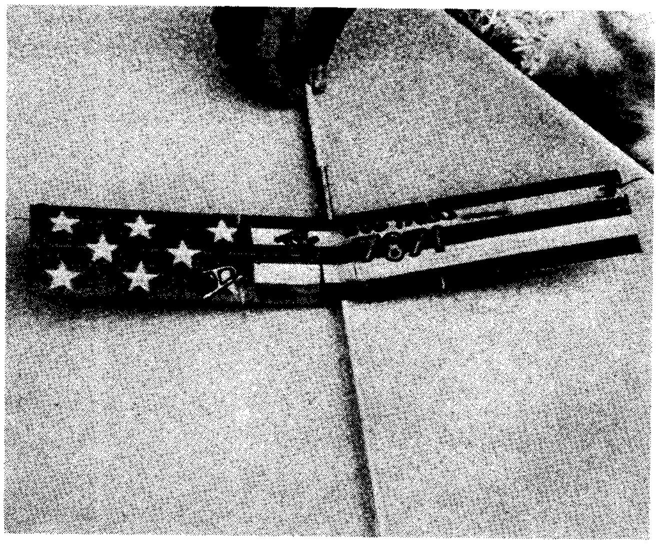
2. Apply a coat of clear dope. I would recommend that you use a brush at least ½" wide for the entire covering procedure. Sig Lite-Cote dope seems to be about the best for covering purposes. It allows more working time, and it does not tend to warp the wing as much as other dopes. If you are using normal clear dope, it should be plasticized by adding about 3 or 4 drops of castor oil per ounce of dope. This will help to prevent warps. Do not use colored dope since it is much heavier than clear. After the dope is dry, lightly sand the wing.



3. Use Jap Tissue to cover the wing. It comes in a wide selection of colors, including a few pre-printed checkerboards such as in the photos. Cover the bottom of the wing first. Cut a piece of tissue, leaving about ½" extra all around. Apply a heavy coat of dope. Lay the tissue on the wing, shiny side up. Now, starting in the center and working outwards, rub the tissue with your fingers to smooth it and stick it to the wing. Minor wrinkles can be removed by gently pulling on the edges of the tissue. If you really mess up, lift up the tissue and try again. Thinner brushed on the places where the tissue is pretty well stuck will loosen it. Use a sharp razor blade to trim the edge of the tissue. The top of the wing is covered in the same manner, only leave about ¼" of tissue around the edges when you trim it. This is wrapped around the edges of the wing and stuck down on the bottom.



4. **Brush on another coat of dope. As soon as it is dry to the touch, place the wing on a FLAT board. (Laying a sheet of wax paper down first will prevent sticking.) Set weights on top of the wing to keep it flat. Allow to set overnight. This is done because dope tends to shrink after it is dry, thus causing warps.**



5. **After some practice, it is possible to do rather elaborate decorations using colored tissue. This wing for a Sparrow was done with red and blue tissue. The lettering was done using gold leaf and black paint. The design is "borrowed" from one of Tom Peadon's hand launch gliders.**

I ran a few tests to find out about weight and strength of tissue covered wings. Two 3/4" x 9" x 1/16" strips of balsa were cut. They were identical in strength and weight. One was covered on both sides with tissue, the other was left bare. There was a very slight weight increase on the tissue covered strip, on the order of 0.008 oz. Both strips were then tested to find how much force was required to break them. The uncovered strip required about 2 oz. while the covered strip required well over 3 oz. It appears that considerably *lighter balsa wood* could be used when covering the wing, thus reducing the weight and increasing the strength, while getting a smoother surface at the same time.

International Scale Data

The SKUA

British Sounding Rocket

by Tancred Lidderdale

Bristol Aerojet manufactures a range of complete rocket systems for upper-atmosphere research. The Bristol Aerojet 'SKUA' is a typical example and the rocket has been successfully flown from a launch site in Hebrides. The Skua is at present in service with the British Meteorological Office, and is used by France, Spain, Canada, Germany and Australia.

Missile Design

The design of the Skua is simple and efficient. It consists of a helically welded steel rocket motor case filled with a solid propellant; four stabilizing fins are fitted at the rear end and a payload compartment is provided within a glass fiber nose cone; and pre-set time switches activate a payload compartment separation system and are set to operate at a pre-determined height or at apogee.

Helical welding is a method of fabricating tubes from metal strip to give extremely high dimensional accuracy, straightness and strength at an economic cost. This process, developed by Bristol Aerojet, is now being used increasingly throughout industry — particularly in the nuclear power sector. The standard dimensions for these strips are 6-in. wide strip for tubes up to 17-in diameter and 14-in. wide strip for tubes above 17-in. diameter. These tubes are, however, manufactured to individual requirements.

Launching

A boost system is incorporated to increase the launch velocity and this results in a small dispersion. The boost carriage separates from the main rocket at an altitude of 50 feet and is fitted with a parachute for recovery purposes. The basic launch system consists of a 21 inch diameter tubes mounted on an ordinary commercial vehicle.

Payload

A payload of 500 cu. in. is available and payloads up to 15 lb. may be accomodated. The standard British Meteorological Office equipment is an Irving metallised radar reflecting parachute of 15 feet diameter and a sonde operating in the 28 mc/s band. Alternative payloads can be incorporated, and a type 465 telemetry giving 24 channels of information has been designed for the Skua by E.M.I. Electronics Ltd. The Skua can carry a payload of 7 lb. to an altitude of about 328,000 feet using an 85° launch angle.

Paint Pattern

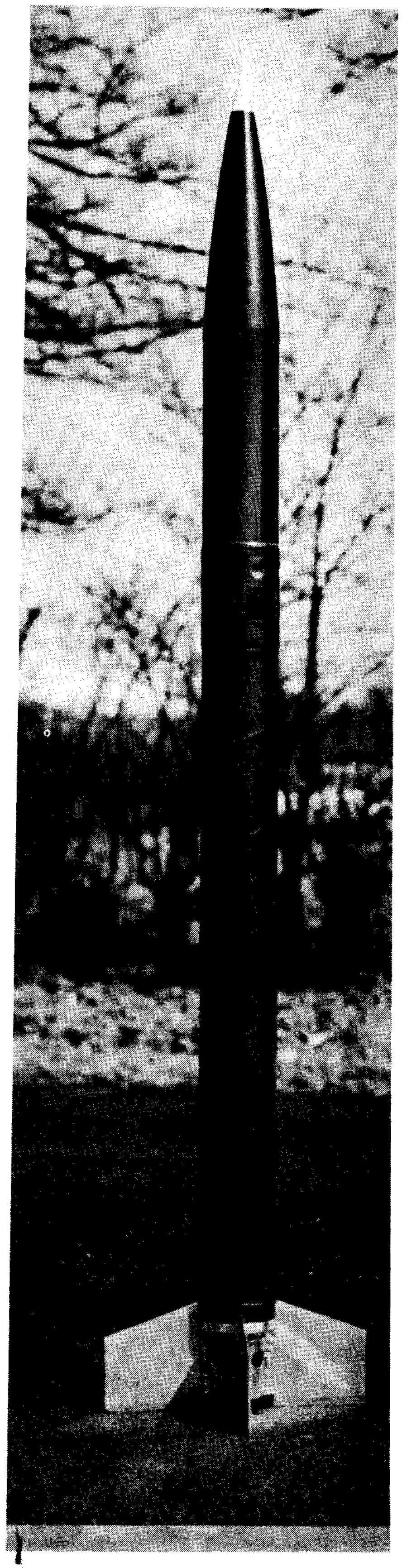
The Skua rocket is a deep bronze green with the tip of the nose cone white and the fin assembly natural aluminum. In certain applications a polished bare metal finish is used when a conducting surface is required.

Modeling Information

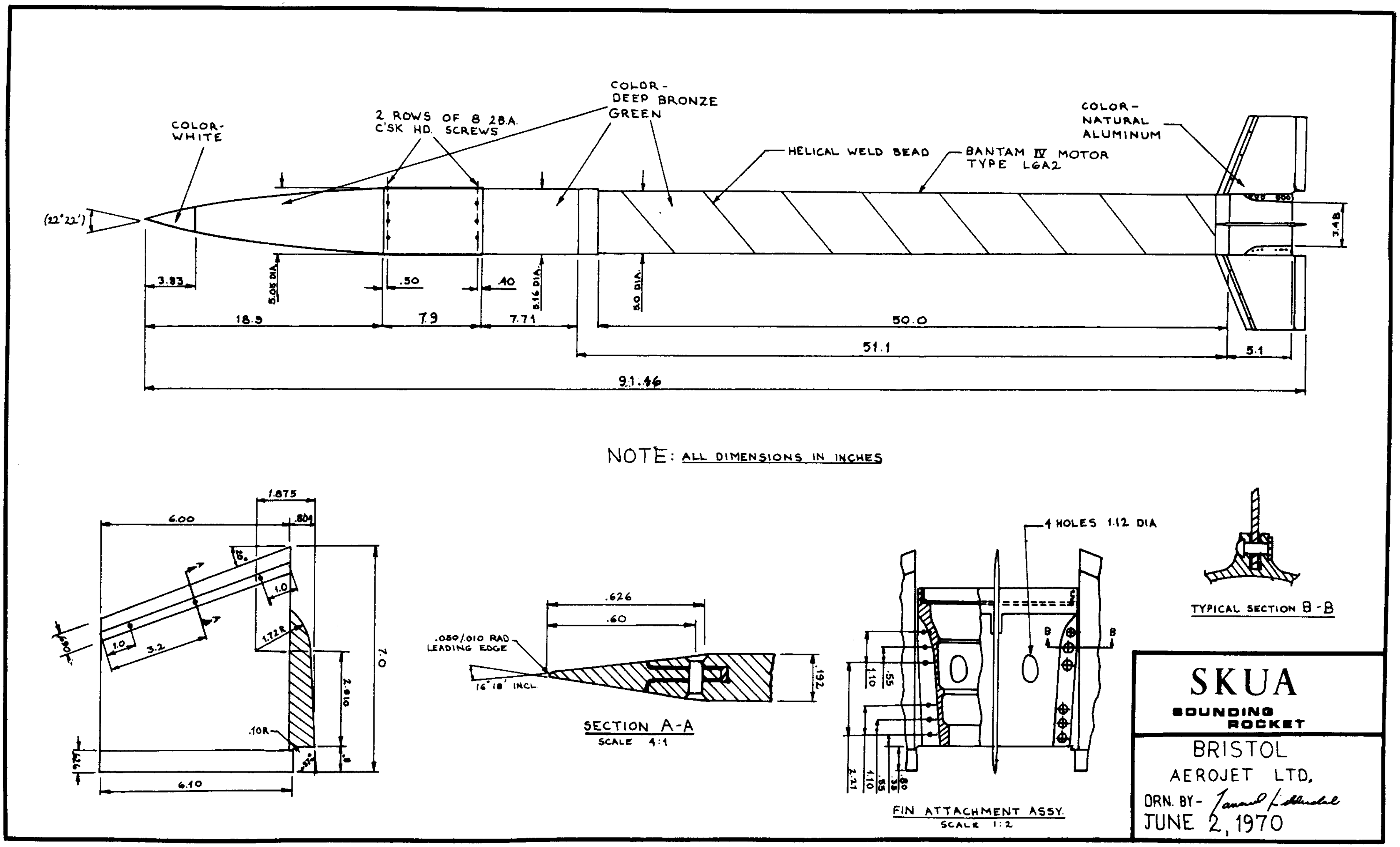
The Skua rocket is relatively a difficult model to scale making it an excellent scale subject. The nose cone on the Skua is an ogive of a size not available from any manufacturer. If you don't mind a little sanding and shaping, the Centuri BC-107, a 5 to 1 ogive, is a good approximation for the nose cone and forward payload section. An Estes BT-50 tube, with a 0.976" OD, can then be used for the Bantam IV Motor tube. Scaling the model to the BT-50 motor tube, the Suka model will be 1:0.194 scale.

The helical weld band can be simulated by marking the spiral down the side of the BT-50 motor tube. A length of sewing thread should be soaked thoroughly with white glue or clear dope and wrapped around the body over the pencil line. Apply several coats of clear dope to the tube to simulate the smooth metallic surface. Airbrush with a mixture of bronze and green paints over the whole tube.

In this scale the fins will be about 1/25th inch thick. Use 1/16" sheet balsa and sand it to the thickness and airfoil shown in the fin pattern and in Section AA of the plans. The Suka fins are natural aluminum. Finish the fins with several coats of clear dope, fine sanded between each application, to simulate a shiny metallic finish. Three coats of aluminum (silver) paint should be airbrushed over the fins.



The Suka sounding rocket is shown in Bristol Aerojet photo 6211. Note the weld lines around the motor casing.


COLOR-WHITE
2 ROWS OF 8 2B.A. C'SK HD. SCREWS
COLOR-DEEP BRONZE GREEN
HELICAL WELD BEAD
BANTAM IV MOTOR TYPE LGA2
COLOR-NATURAL ALUMINUM
(22°22')
3.83
5.05 DIA.
.50
.40
5.16 DIA.
5.0 DIA.
3.48
18.9
7.9
7.71
50.0
51.1
5.1
91.46
NOTE: ALL DIMENSIONS IN INCHES
1.875
6.00
.804
20°
1.0
3.2
1.72R
.10R
2.810
7.0
6.10
.080/.010 RAD LEADING EDGE
16°18' INCL.
.626
.60
.192
SECTION A-A
SCALE 4:1
4 HOLES 1.12 DIA
1.10
.55
2.21
.85
.38
.80
FIN ATTACHMENT ASSY.
SCALE 1:2
TYPICAL SECTION B-B
SKUA
SOUNDING ROCKET
BRISTOL AEROJET LTD.
DRN. BY-
JUNE 2, 1970

The most difficult job on this scale model is making the fin-nozzle assembly (see plans). For a good finish the assembly can be ground and drilled from a cylinder of clear plastic (available from a plastic supplier). Use a Dremel tool to speed up the work. If you want, the fin-nozzle assembly can also be made from a hard wood dowel.

Data Sources

Bristol Aerojet Drawings No 15141, 151402, 151409, 151418, and 151427. Bristol Aerojet photos 6211 and LH 2388. Suka Fact Sheet and other brochures distributed by Bristol Aerojet, Ltd., England.

Enlargement shows the detail of the fin-nozzle assembly of the Suka. This is the most difficult part of the rocket to model.

New Product Notes

Centuri Engineering has supplemented their already impressive scale line with the introduction of a scale MX-774 missile. The actual MX-774, designed and built by Convair, was test flown three times during 1948 from the White Sand Missile Range. It served as a "test-bed" for many of the design advances incorporated in Convair's later Atlas ICBM. The Centuri model, standing 11 inches tall, weighs only 1.1 ounces. It features a single piece, plastic nose cone, and can be flown with A8-3, A5-4, B4-6, B6-6, and C6-5 engines. Flights to 1600 feet can be attained with the C engine. Included in the kit is a historical sheet on the MX-774 project, as well as complete painting instructions. The MX-774 kit, catalog #KA-3, is available for $1.50.

Competition Model Rockets has made some alterations to its line of competition birds. The new Elo, designed for egglofting competition, can now be configured to take any size engine from an FSI E to a standard A, B, or C in the upper stage, and an FSI D or standard B14 in the booster. The kit contains all parts necessary to build the model with either an 18mm or a 21mm engine mount in the booster and upper stage. The Elo is priced at $4.25. The basic construction has been redesigned to make assembly simpler, lighter, and stronger than previously. The egg capsule has an improved molded foam lining which is lighter in weight. (The egg capsule can also be purchased separately at $2.00.)

The Manta B/G has also been redesigned. The pop-pod system is entirely new and more positive in action. All balsa wing parts are now supplied pre-cut, making construction easier. The new construction is lighter, making the model a good performer with even an ½A6-2. The price is still $2.50.

Rocket Equipment Co. (10 Mulberry Ave., Dept. RS, Garden City, New York 11530) has expanded their line of B&W "Scalephotos." Photos of many sounding rockets including the Black Brant III, Iris, MT-135, and Nike Cajun, as well as a Pershing, Little Joe I, Scout, and Saturn V are now available. These photos are priced at 60¢ each for 4 x 5 prints or $1.25 for 8 x 10 prints. REC plans to expand its line of B&W and color "Scalephotos" each month.

SKI AT ASPEN
PARTY IN PARIS

TWA's Youth Passport offers you a world of fun... at fantastic discounts.*

(And you use it on over 20 airlines in the United States including Alaska and Hawaii, [illegible] countries overseas.)

- * **40 [illegible] regular coach fares** on any TWA plane. Even the 747! On a standby basis in the continental U.S.
- * **Hotel discounts**—up to 50%—at Hilton, Sheraton and Pick hotels in the U.S. and Caribbean.
- * **Discounts at Aspen and Vail.** On lift tickets, meals, ski lessons and rentals.
- * **Car discounts in Europe.** On renting, buying or leasing.
- * **Travel check discounts**—⅓ off Thomas Cook Cheques.
- * **300 exclusive discounts** at hotels, shops and restaurants around the world.

PLUS

Free TWA hospitality parties in Paris, London and Amsterdam. Every week during the summer.

One free day in Europe on any Arthur Frommer $5-a-Day Tour booked through TWA.

TWA Youth Passport†

•

YOUTH FARE IDENTIFICATION CARD APPLICATION FOR AGES 12 THRU 21

Mail to: Trans World Airlines
P.O. Box 2952
Clinton, Iowa 52732

†Service mark owned exclusively by Trans World Airlines, Inc.

Name (please print) ____________________

Address ____________________

City ____________________ State ________ Zip Code ________

Date of Birth ________ Month ________ Day ________ Year ________

Hair Color ________ Eye Color ________ Male ☐ Female ☐

$3.00 Fee paid by: Check ☐ Money Order ☐

MAKE CHECKS PAYABLE TO: TWA (Not refundable—DO NOT MAIL CASH)

Signature ____________________

1—067—8—2 0 3 3 9

the Escape Tower

BY BOB PARKS

UNDERWATER LAUNCHING

SEMI-SCALE POLARIS A-1 MISSILE

Looking for something different? Why not try launching a modroc from underwater? It is not really difficult, and as the photos show, it can be very spectacular.

The first underwater launchings that I know of occured in 1961. One was entered in R&D at NARAM-3. The rocket was encased in a tube. Over the top of the tube was a rubber diaphram, which permitted the entire assembly to be submerged. A toothpick was affixed to the nose of the model to break the diaphram during launch. A launch rod which extended out of the water was used for guidance. I have no idea as to how the rod was passed through the diaphram without leaking.

An entirely different method of launching was used by a club at the Woodberry Forest School in Virginia. They used a normal rocket and sealed the ignitor in place with wax, thus waterproofing the engine and rear of the rocket. They used the feather weight recovery system. No attempt was made to keep the outside of the rocket dry. Their launch rod also extended above the water.

In 1963, I developed a dry silo type launch system. It employed a delay fuse ignition, complete with a chemical oxygen generator system. This involved tanks, regulators, reaction chambers, residue dumps, etc. Although the system worked, it was rather unreliable, and was never actually used to launch a rocket.

Since all of the methods produce similar results, the "wet rocket" system will be described since it is by far the simplest.

The Rocket

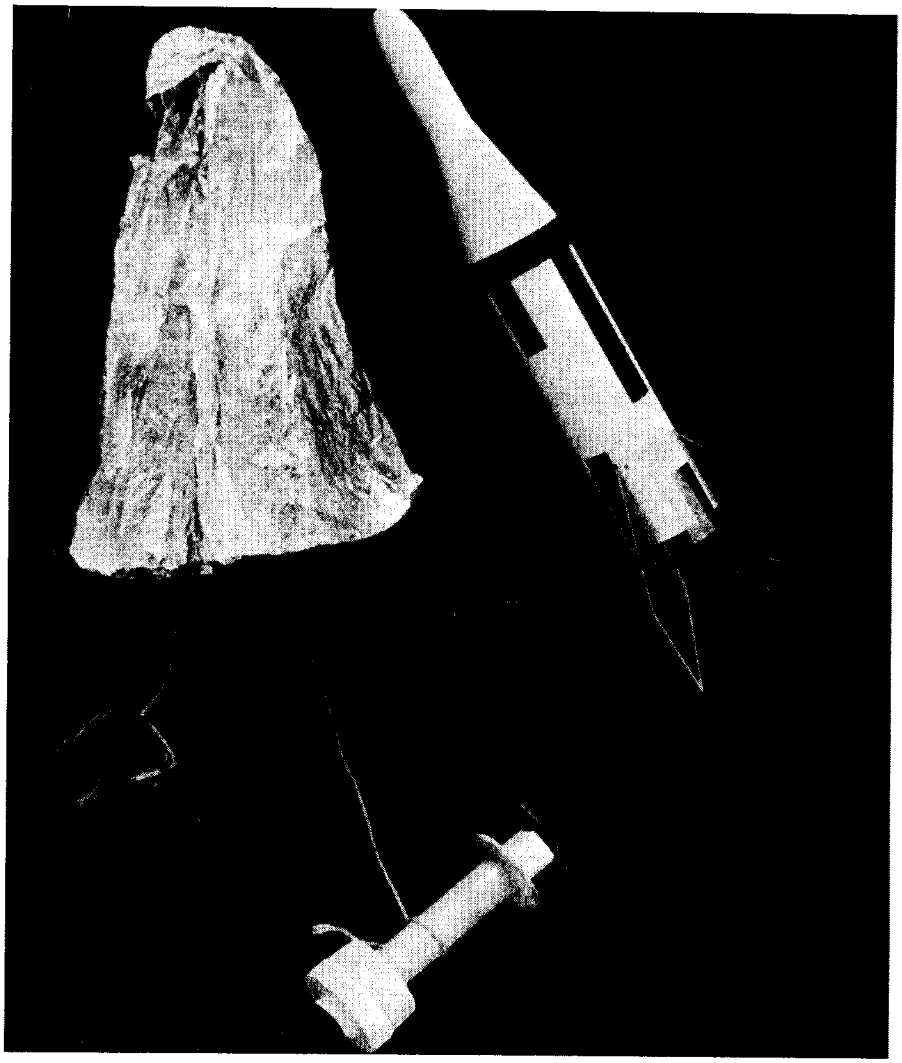
Almost any small model rocket can be used, however, for a better effect I built the semi-scale Polaris A-1 shown in the plans. Rear ejection was used in hopes of making the job of waterproofing easier. Front ejection would probably work as well if you are careful when sealing everything. *Waterproof* glue should be used for construction. *DON'T USE WHITE GLUE!* The rocket is pretty simple and the necessary construction details can be gathered from the plans. However, the procedure for building the engine mount will be described. First, cut off the front of a BT-60 nose cone. I used a BNC-60L, but any nose cone will do. The cut should be made about 3/8" in the front of the shoulder. It will be used for a tail cone. Cut a hole through the center for the BT-20. The BT-20 is now cut to length and the engine block is installed. Two RA-2060 rings are glued together and then attached to the BT-20 as shown. Sand the rings to be an easy slip fit in the BT-60. The tail cone is glued onto the BT-20 and the entire assembly is inserted into the BT-60 to keep it aligned until the glue dries. Apply glue filets for strength to all joints on the engine mount. The tail cone should be a snug fit in the main body. There should be no problems with the rest of the construction.

Any rocket to be launched from underwater should be well painted, both inside and out. If you really have something against paint you can coat the entire rocket with wax as described below.

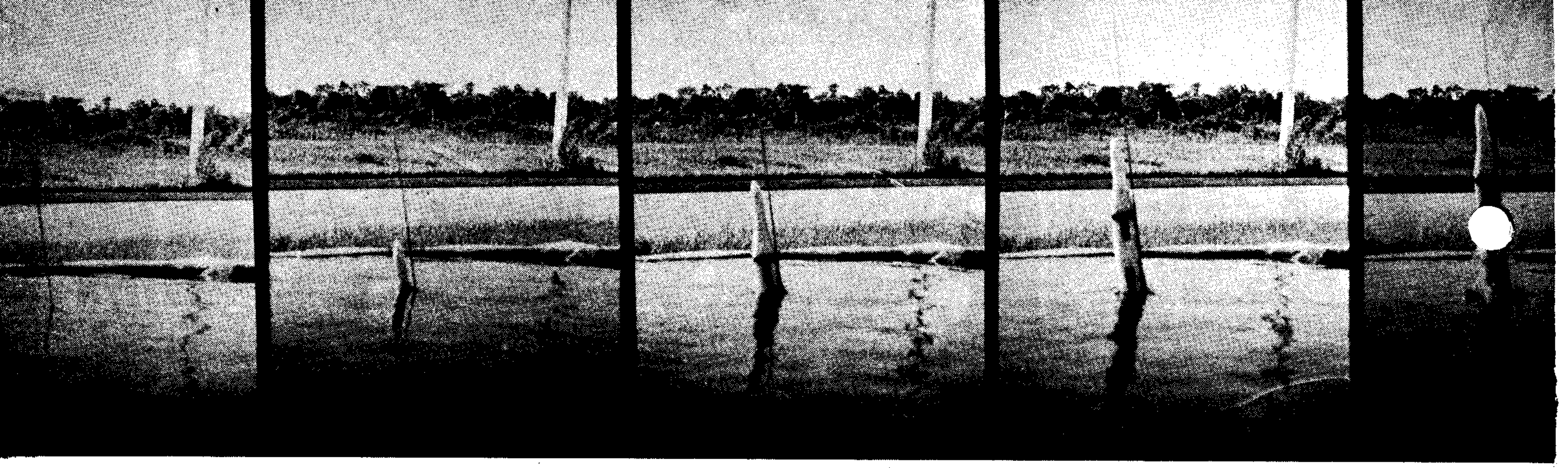
Flight Prepping

First, select an engine. It should have a shorter delay than normal. I have been using B4-2's in the Polaris. The engine is inserted into the engine holder as usual. Fold the parachute, and place it between the RA-2060 rings and the tail cone. Carefully slide the engine mount assembly into place.

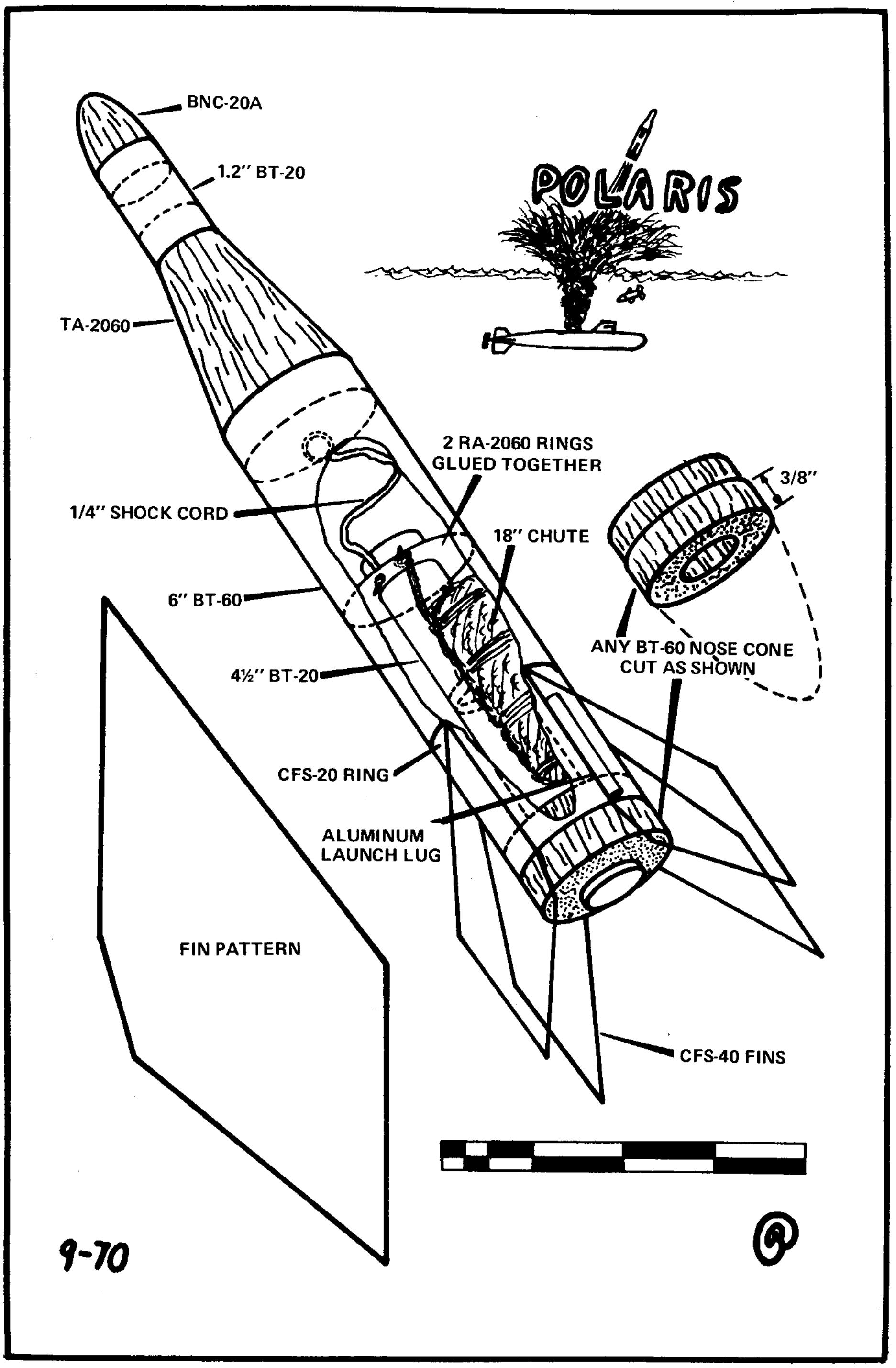
Since attaching micro-clips underwater without shorting is a near impossibility, extension leads are required. These should be made of the same type of wire used in the firing system (Usually, #18 two conductor stranded wire.), and at least long enough to reach out of the water. About ½" of insulation is removed from the end of the wire. The end of the ignitor is passed



The Polaris uses a rear-ejection system. The parachute is wraped around the engine mount. This system allows the nose section to be sealed and water proofed.

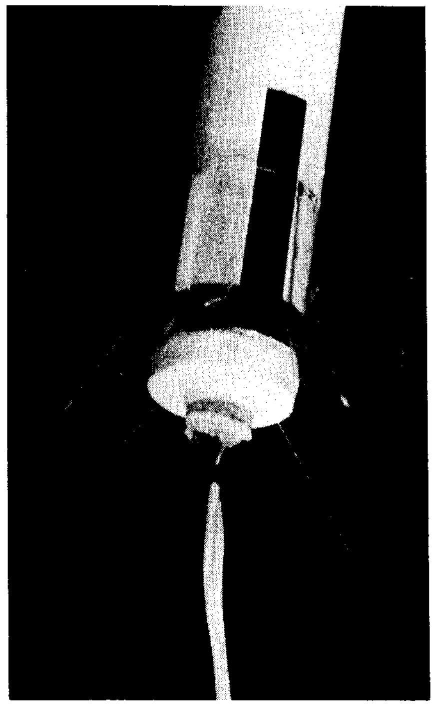


Photos by John Andersen, Dan Durranc

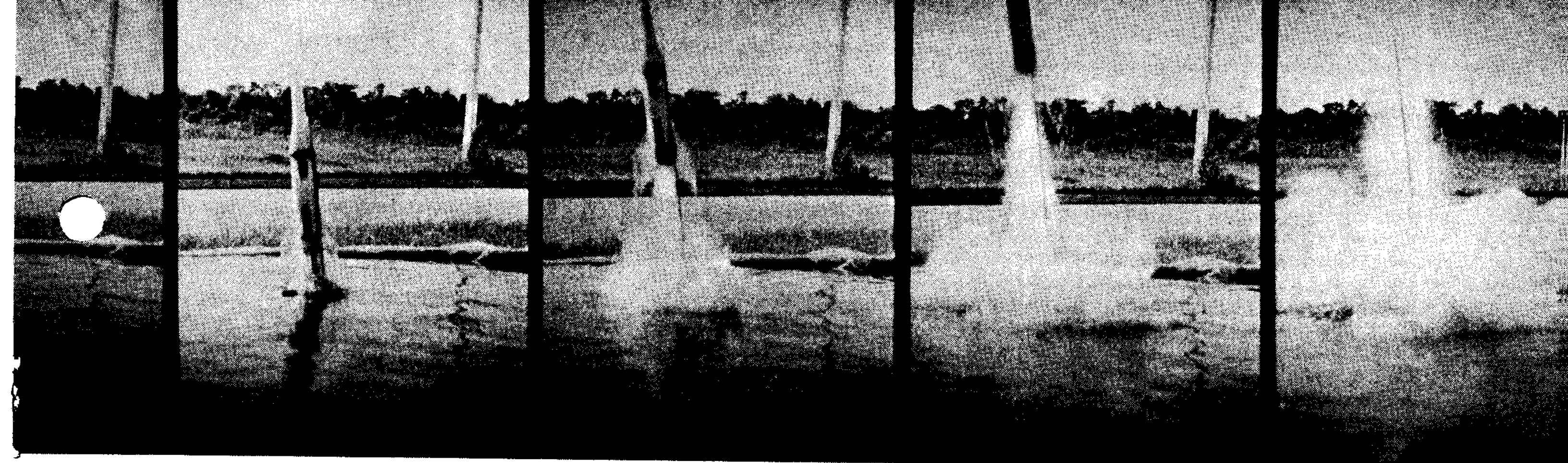


through the wire, then wrapped around it. Flowing some solder onto the joint will improve the reliability of the connection. Wrap the joint with tape to prevent shorting. Insert the ignitor into the engine and tamp in plenty of wadding to hold it in place. A piece of waterproof tape over the nozzle will help keep the water out.

Now all the joints have to be sealed with wax. I usually buy some cheap dime store candles for this purpose. The candles are cut up, the pieces placed into a tin can, and the can placed in a sauce pan. About 1" of water should be poured into the pan. Heat the pan until the water boils, and adjust the temperature so the water just stays at the boiling point. The wax will melt, and then can be applied with a cheap paint brush. Be careful not to drip any wax on the stove, because it is hard to clean up, or on you, because hot wax is rather painful. Build up a layer of wax about 1/16" thick over th engine, wadding and ignitor. 1/32" of wa over the body-tail cone joint should be



To keep the water out, the engine and the tail cone body joint are covered wit wax. Extension leads are soldered to th igniter to make hook-up easier.



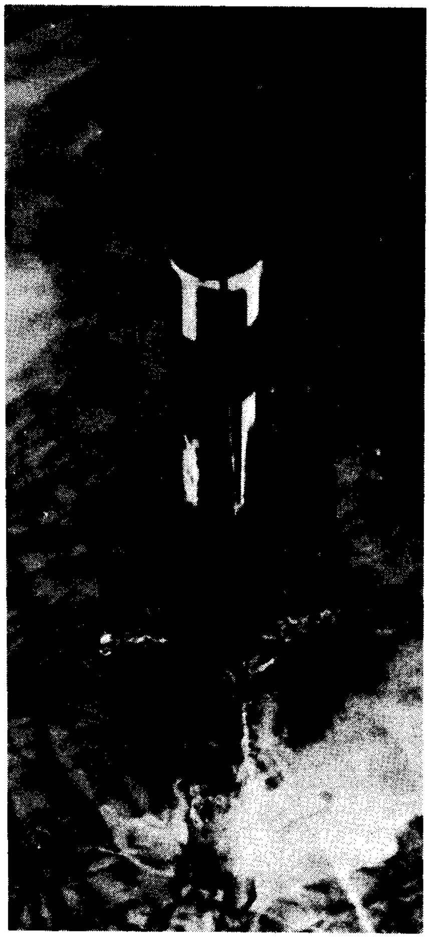
e, Howard Hornsby, and Bob Parks.

enough. The rocket is now ready to fly, and should (hopefully) be waterproof.

Launching

Now that you have a waterproof rocket, the only other requirements for an underwater launch are some water and a launcher. Since the type of launcher depends on the type of water, I'll discuss the water first.

It is absolutely necessary that the water be between the temperatures of 32° F and 212° F. Any colder than this, the drag on the rocket to the point where it probably won't even move during the engine burn, or at any other time for that matter. Above 212° F, all of the normally spectacular splash goes up in smoke, or more properly, steam. Also your sealing wax will melt! However, most rocketeers will not have any trouble with the temperature extremes.



The Polaris just as it breaks the surface. Note the water flowing off the fins.

The body of water you launch from should generally be outside. In other words, no, you can't launch it from your bathtub! If you are planning to launch from a lake, river, pond, etc., it might be a good idea to check the pollution level first. If the rocket, launcher, your hands, and other related equipment does not dissolve on contact with the water the polution level is probably OK. If you don't have a lake handy, you can launch from a tank of some type. A large ice cream container (the 5 gallon size is about right) can be used. A plastic garbage can will also work nicely (remove the garbage first). In some cases it will be necessary to use a jet deflector to keep the exhaust from producing a rather large leak where the bottom of the tank used to be. Because a rocket launching leaves a scum on the surface of the water, I don't suggest launching from a swimming pool unless you are prepared to do some cleaning.

The main requirement for the launcher is that at least 6" of launch rod must protrude above the surface. In shallow water or in a tank this is no problem. I generally use a piece of wood with a hole drilled in it to hold the rod. Enough bricks to sink the whole thing are then piled on top of the wood. In deeper water, the launcher can be suspended from floats, or anchored at the proper depth.

The rocket by itself will probably float, if not you are probably violating the safety code somewhere. To counteract this, the extension leads should be anchored. This can be done either by taping them to the launch rod or by passing them under one of the bricks.

The rocket should be launched as soon as possible after submersing it. From my experience it is going to leak no matter what you do to it. But anyway, the less time under water the better. The ignition battery should be in good condition because the water and the wax tend to cool the ignitor. The result of this should be a very spectacular liftoff.

There is one other type of launcher that can be used, namely a scale submarine, all it takes is ten feet of BT-999 and a parabolic nose (bow?) cone and . . .

For Ease of Recovery

THE MINIMITTER

Modroc Homing Beacon

by Richard Fox

How many times have you lost a model rocket in a woods or a field? How many times was that rocket a prize winning contest bird or a valuable payload rocket? Now there is a way to 'TAG' those important model rockets so that you will not lose them! This article describes the Minimitter, a miniature homing beacon transmitter for use with model rockets. The output of the Minimitter is a strong radio frequency signal which can be tracked down with walkie-talkies. The Minimitter transmitter measures less than 1/2 inch by 3/4 inch by 3/4 inch, and weighs about one ounce. It can easily be added to the payload compartment of a large rocket without any noticable effect on the rocket's performance. The transmitter has a range of over a mile when in the air, or when hanging from a tree, and it has a range of several hundred feet when sitting in wet grass.

The idea for the Minimitter developed during the testing of the Foxmitter sensor moldules. The test flights for the Foxmitter modules were conducted from some very small fields which are surrounded by dense forests. On no less than 15 flights during the past year, transmitter rockets drifted into the woods. Recovery of those rockets was possible only because they carried a radio transmitter which produced a signal that could be tracked down.

As pointed out in the June 1970 issue of **Model Rocketry**, the Foxmitter-2 can be combined with the beacon tone module for use as a rocket homing beacon. Though, the Foxmitter-2 can be combined with the beacon tone module for use as a rocket homing beacon, primarily, the Foxmitter-2 was designed for use as a telemetry transmitter of data obtained during the flight of the rocket. The circuitry of the Foxmitter-2 contains extra components which have the specialized function of converting data monitored during the flight into transmittable electrical signals. While the Foxmitter II does work as a homing beacon, it is a little *large*, and rather *heavy* for such use.

The Minimitter System

The Minimitter was born as a result of the need for a small homing beacon transmitter. The idea is to transmit a signal from the rocket, using as few electronic parts in the rocket as possible. This goal is accomplished by employing extremely simple circuitry in the rocket, and using complex circuitry on the ground to receive the transmitter's signal.

Three pieces of electronic equipment are necessary for the operation of the Minimitter: 1) the rocket-born Minimitter Transmitter; 2) a 27 m.c. Citizen's Band walkie-talkie receiver, and 3) a Minimitter signal Decoder. The secret of the small size of the Minimitter is the Decoder. Most of the circuitry necessary for the operation of the Minimitter never leaves the ground. It is contained in the Decoder, which converts the Minimitter's signal into a usable audio signal.

The Minimitter transmitter is, in effect, a stripped down version of the Foxmitter-2. All the battery holders, connecting plugs, and modulation circuitry have been removed. All that remains is a single transistor 100 milliwatt r.f. stage, which is powered by a small 9 volt battery. The transmitter produces an unmodulated carrier wave on one of the 27 megacycle Citizen's Band channels. This carrier wave is picked up by the walkie-talkie receiver, but since the signal is not modulated, the walkie-talkie does not produce any noise from its speaker. The Decoder converts the signal received by the walkie-talkie into an audio tone which can be recognized by humans. The Decoder consists of some electronic circuitry commonly referred to as a "BFO", which is mounted on a small board and held in the vicinity of the walkie-talkie. There are no connections between the decoder and the walkie-talkie, but the electrical signal produced by the Decoder interacts with part of the walkie-talkie circuitry, and causes the walkie-talkie to produce an audio tone when it is receiving the Minimitter signal.

If the walkie-talkie antenna is made direction sensitive, then the walkie-talkie-Decoder combination can be used to pinpoint the location of the Minimitter transmitter.

Construction

Because the Minimitter circuitry is actually a small part of the Foxmitter circuitry, reference should be made to the June 1970 issue of **Model Rocketry** for a complete description of the construction, testing, and troubleshooting of the transmitter circuitry. Construction should begin with the placement of the parts on a piece of perforated phenolic board, commonly referred to as vector board. The board should be cut to fit into a BT-50 or similar size body tube. Figure One shows a suggested parts lay-out. The parts should be packed together as closely as possible. Figure Two shows the interconnection of the parts on the underside of the board, and Figure Three shows

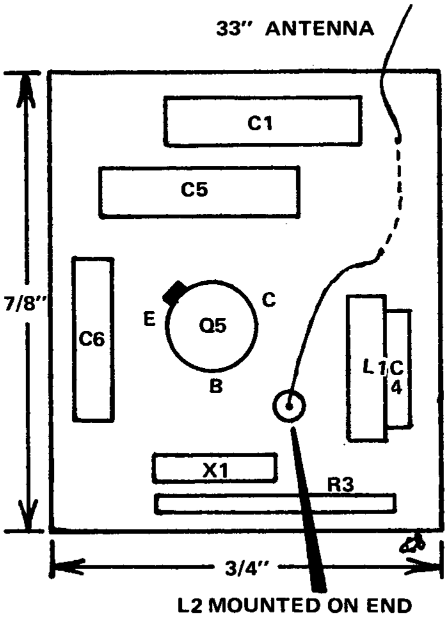


Figure 1: SUGGESTED PARTS LAYOUT. Note that the antenna wire is looped through holes in the board to prevent strain on L2. The entire Minimitter is built on a 7/8" by 3/4" piece of vector board.

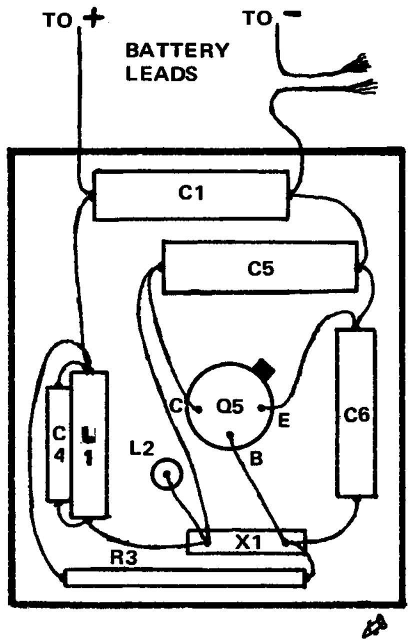


Figure 2: SUGGESTED PARTS WIRING (BOTTOM VIEW). The components are shown here for reference only. They are mounted on the top side of the board.

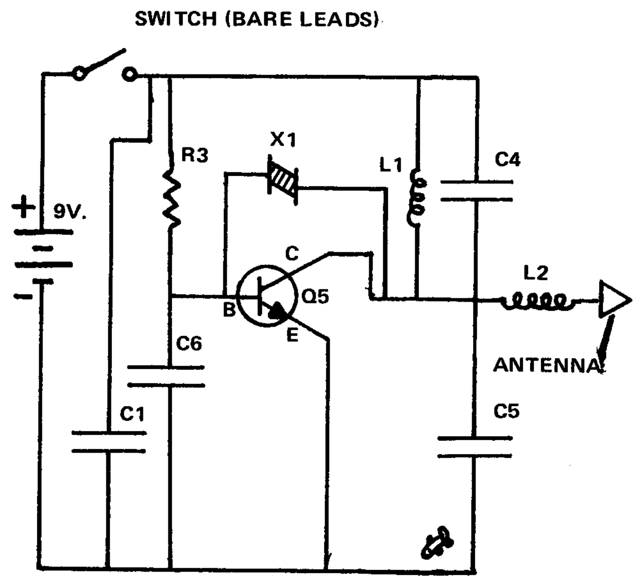


Figure 3: MINIMITTER SCHEMATIC DIAGRAM. The switch is merely two pieces of bare wire which are twisted together to establish contact.

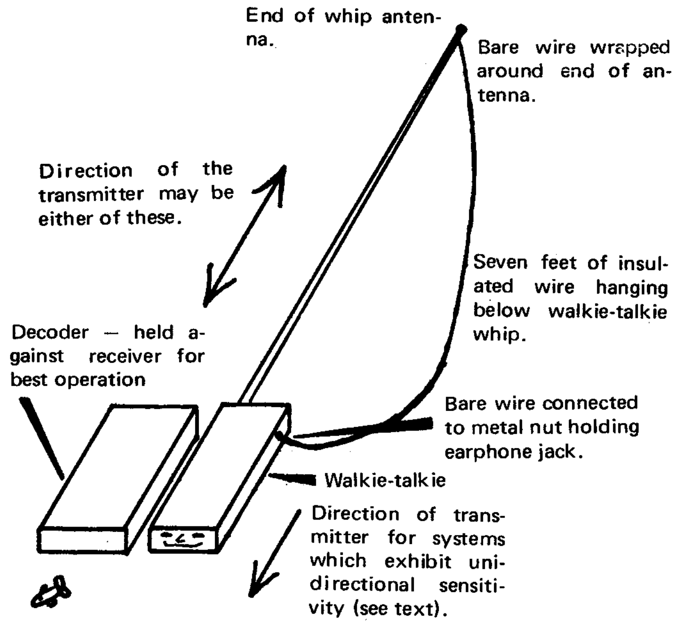


Figure 4: DIRECTIONAL FINDER. A simple direction finder can be made by attaching a wire loop to your walkie-talkie. (See text.)

the schematic diagram of the circuitry.

Two wires run from the circuit board to the battery. One of these wires should be used as an On/Off switch by placing a break in it as shown in Figure Two. The antenna wire should be tied securely through one of the holes in the board in order to prevent any strain on inductor L2. The antenna's length should not be any longer than 33 inches. The antenna may be made shorter if the builder feels the wire will interfere with the performance of the rocket, however the strength of the signal will be reduced proportionally.

The Decoder is constructed by modifying a kit which is currently on the market: the Radio Shack "Science Fair" AM Wireless Microphone Kit #28-103. This kit was chosen as the base for the Minimitter Decoder because it contains all the necessary parts, its price is reasonable, and it is readily available throughout the country. Start construction by building the AM Wireless Microphone exactly according to the instructions provided with the kit. Test the completed kit by tuning an AM radio to a frequency where there are no radio stations. Bring the AM Wireless Microphone next to the radio, and tune its coil until a hissing or a squeal are heard over the radio. If all these tests work, you are now ready to convert the AM Wireless Microphone into a Minimitter Decoder.

The conversion will cause the AM mike kit to produce an unmodulated signal at 456 kilocycles. Start the conversion by removing and discarding the microphone and antenna from the kit. Next solder the .001 mfd. capacitor supplied with the Minimitter parts to lugs "A" and "C" of the Decoder inductor L1. The .001 mfd. capacitor will be in parallel with a 120 pfd. capacitor which is part of the AM Wireless Microphone kit. This completes the conversion of the AM Wireless Microphone into a Minimitter Decoder.

Parts List

R3	27,000 ohms
C1	.01 mfds.
C4	3 mmfds
C5	47 mmfds
C6	10 mmfds
Q5	RCA 40080 transistor
L1	27 uh r.f. choke Miller 9230-54 Do not make substitution
L2	10 uh r.f. choke Miller 9230-44 Do not make substitution
X1	27 m.c. Citizen's Band Walkie-talkie crystal Lafayette #46E15 or similar
B1	9 volt battery Burgess Y6
C	Capacitor for conversion of AM Wireless Mike to Decoder .001 mfds
Antenna	for Minimitter: 33 inches thin stranded hook-up wire
Antenna	for loop antenna: 84 inches thin stranded hook-up wire
Decoder	Radio Shack "Science Fair" AM Wireless Microphone Kit #28-103
Vector Board	

A complete kit of all the above parts is available from Astro-Communications, 3 Coleridge Place, Pittsburgh, Pa. 15201, for only $10.95. Additional Minimitters, WITHOUT THE DECODER, are available for $7.40.

How it Works

The Minimitter is a simple 100 milliwatt radio frequency transmitter using a single stage oscillator which feeds through a loading coil, L2, into a 'whip' type antenna. The optimum antenna length is 33 inches, however the antenna may be shortened if necessary. Of course a shorter antenna will result in a weaker signal.

The Decoder is a single transistor radio frequency oscillator operating at 456 kilocycles, as determined by the value of Decoder coil L1 and the .001 mfd capacitor placed in parallel with it. This oscillator is allowed to interfere with the signals as they are processed by the i.f. circuitry of the syperhetrodyne walkie-talkie. The result is a 1000 cycle per second beat frequency which is emitted by the walkie-talkie speaker as an audio tone. The Decoder walkie-talkie combination will produce this tone whenever the receiver is picking up any transmission on the receiver's frequency, however only the continuous unmodulated signal of the Minimitter will result in a constant tone output. Signals from Citizen Band transmitters will produce Donald Duckish speech from the walkie-talkie.

To test the Decoder, place it against a 27 megacycle Citizen's Band SUPERHETRODYNE walkie-talkie receiver. Turn both units on, and tune the coil of the Decoder until a hiss is heard over the walkie-talkie. This hiss indicates that the Decoder is working. The Decoder will work with walkie-talkies on any channel on the 27 megacycle Citizen's Band, provided the walkie-talkie uses superhetrodyne receiver circuitry (almost all walkie-talkies costing over $12.00 do), and provided the walkie-talkie has a receiver i.f. frequency of 455 kilocycles. Almost all superhetrodyne walkie-talkies use 455 k.c., however you can determine the i.f. frequency of your walkie-talkie by subtracting the frequency of the receive crystal from the frequency of the transmit crystal. For instance, a walkie-talkie with channel 9 crystals will have a transmit crystal marked 27.065 megacycles, and a receive crystal marked 26.610 megacycles. The difference between these two frequencies is .455 megacycles, or 455 kilocycles, indicating that the walkie-talkie will work the with Decoder.

The remaining construction involves a direction sensitive antenna for the walkie-talkie. The simplest direction sensitive antenna is a large loop of wire. This type of antenna is insensitive to signals traveling through its loop, as shown in Figure Four, but it is sensitive to signals traveling along the loop. The direction from which a signal is coming can be determined by rotating the orientation of the loop antenna. A walkie-talkie whip antenna can be converted to a direction sensitive loop antenna by the following procedure. Obtain a seven foot length of insulated 22 gauge wire. Strip one inch of insulation off of each end. Wrap one end around the tip of the fully extended walkie-talkie antenna, making sure that the wire makes good electrical contact. Connect the other end of the wire to the metal case of the walkie-talkie or to the metal mounting nut of the earphone jack of a plastic walkie-talkie. Again make sure that the wire makes good electrical contact. Allow the wire loop to hang down as shown in Figure Four.

Testing the System

The next step is to verify that the Minimitter will produce an audio tone from the walkie-talkie when the Decoder is turned on. Turn on the walkie-talkie and the Minimitter. The Minimitter should produce a noticable silence (as opposed to the usual background noise) or maybe a soft hiss from the walkie-talkie. Next turn on the Decoder and place it against the walkie-talkie. The walkie-talkie should produce an audio tone if the Decoder is adjusted properly. Try adjusting the slug in the Decoder coil until the walkie-talkie does produce a tone when the Minimitter is turned on and the Decoder is against the walkie-talkie. More than one position of the slug in the Decoder will produce the audio tone. Try them all until you have found the position which produces the loudest and most pleasing tone.

Next place the Minimitter several hundred feet away from the walkie-talkie-Decoder combination. Try walking around with the walkie-talkie-Decoder and verify that the loop antenna on the walkie-talkie is direction sensitive. Do not expect the antenna to be direction sensitive at a distance of less than ten or twenty feet.

The loop antenna inherently is bi-directional. That is, it will indicate that the transmitter is in one of two opposite directions, however the walkie-talkie-loop antenna arrangement has displayed a uni-directional quality on a number of walkie-talkies. In those cases, the received signal was strongest when the walkie-talkie whip antenna was held parallel to the ground and the transmitter was located closer to the walkie-talkie case than to the antenna tip. This orientation is also shown in Figure Four.

Using the System in the Field

The flight procedure is simple. Turn on and test all three components of the system. Place the Minimitter into the rocket and launch it. When the rocket has landed, start to walk in the direction in which it was last seen. Listen for the transmitter tone from the walkie-talkie-Decoder combination. When you are close enough for the tone to be heard, slowly rotate the walkie-talkie loop antenna, and listen for the loudest signal. Walk in the direction indicated by the orientation of the antenna when the signal is loudest, and continue to make minor adjustments in your path as your proceed. When you are within a few hundred feet of the transmitter, the signal may be so strong that you will have to rely on manual sighting to pinpoint its location.

The Minimitter is great for Camroc, Cineroc, Egg Lofts, and even large B/G birds. Since it weighs just about the same amount as a standard NAR payload, perhaps we need a new event substituting miniature instrumentation for the payload weight. Once you have constructed a Minimitter you will reduce the number of lost payloads and boosters when flying from small fields.

NEWS NOTES

Goldwater Calls for Air-Space Museum

On May 19, 1970 Senator Barry Goldwater called for Congressional action to bring about construction of the long postponed National Air and Space Museum of the Smithsonian Institution. "The construction of a permanent building for its National Air and Space Museum," Senator Goldwater said, " . . . should be one of the major components of the world-famous Smithsonian complex . . . The concept for this building can truly be said to date back nearly 25 years, to August of 1946, when Congress first established the National Air Museum as a bureau of the Smithsonian Institution.

"As part of the 1946 law, Congress expressly included provisions for selecting a site for an air museum building. . . . In 1958, Congress authorized a Mall site . . . and allowed funds to be spent on detailed plans for the proposed building. . . . Finally, in 1966, Congress concluded this series of authorizations by giving the Smithsonian a firm statutory basis for proceeding with the construction of the museum building. . . . Yet, as of today, not one dollar has been funded for the construction of the museum.

"The reason for deferring the project is found . . . in the report of the Committee on Rules and Administration. The language reads as follows: 'The committee expressly recommends . . . that appropriations should not be requested pursuant to H.R. 6125 unless and until there is a substantial reduction in our military expenditures in Vietnam.' . . . This is the only legislative holdup on the program. It was recommended in June of 1966, before the first manned lunar landing had taken place.

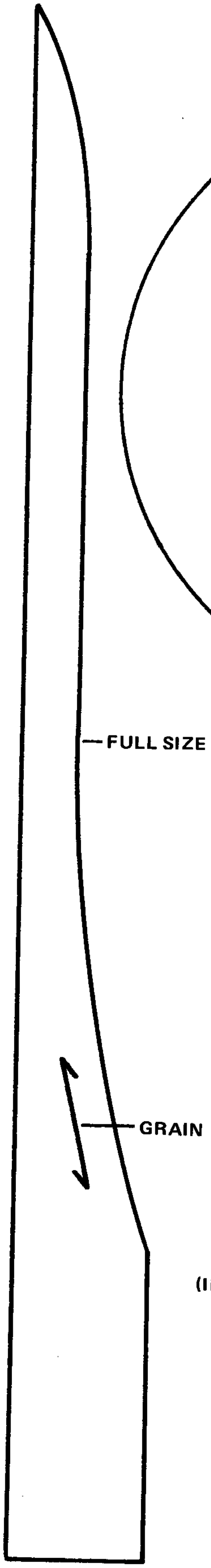
"Now that this landmark has occurred and public excitement about space achievements has catapulted, I believe the time has arrived when the American people want to have a decent home for the national center where the world's greatest collection of aircraft and space objects can be shown. . . . I do not know of any better investment for the Nation's celebration of its 200th anniversary than the establishment of a permanent building for the National Air and Space Museum. Aviation and Astronautics are America's triumph. Let us recognize it."

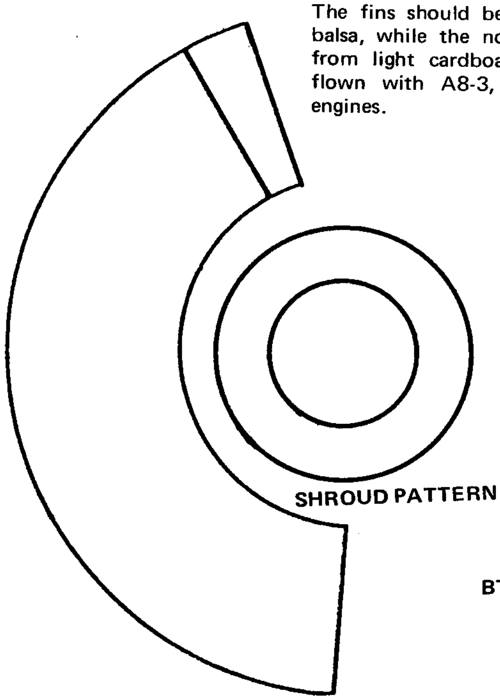
NAEC Annual Conference Scheduled

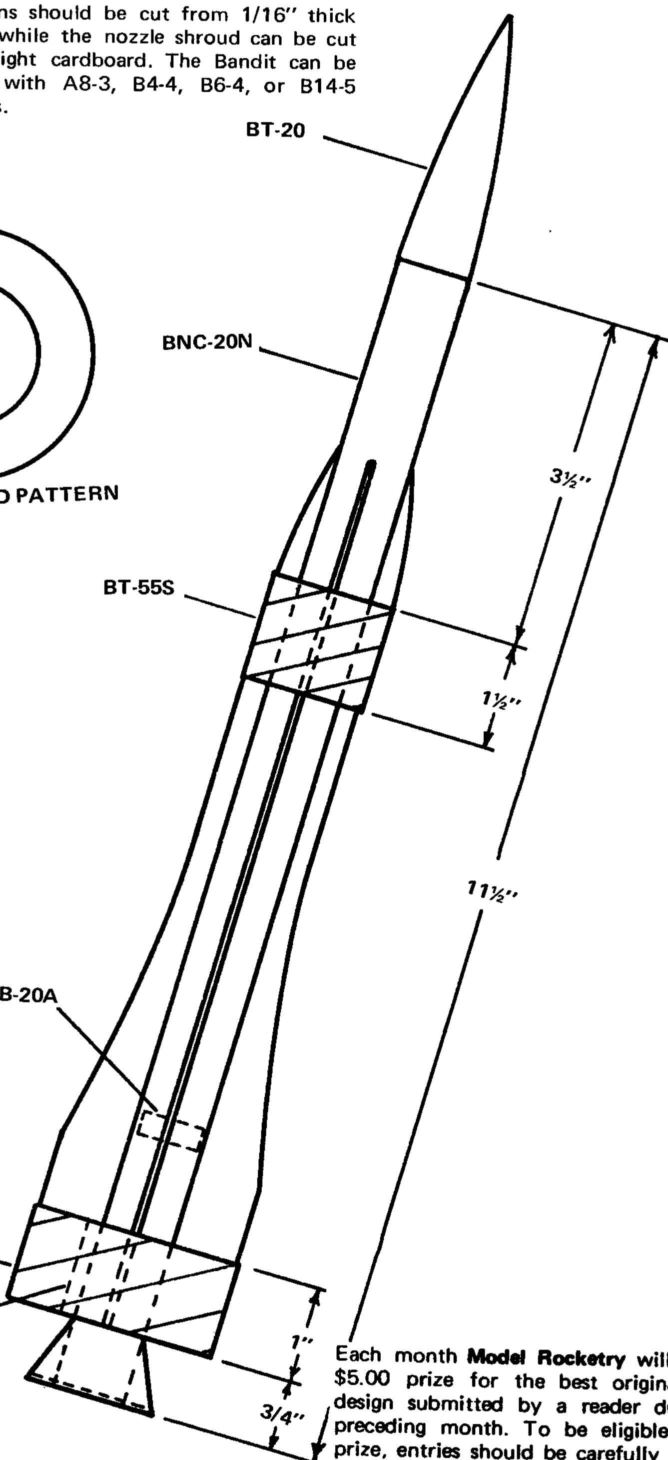
The National Congress on Aerospace Education will be held on April 28-30, 1971, at the Embry-Riddle Aeronautical Institute in Daytona Beach, Florida. The program, for teachers in all areas of science and aerospace education, includes a special one-day NASA program at the John F. Kennedy Space Center. Teachers at all levels can write for more information to Walter Zaharevitz, National Aerospace Education Council, Suite 310, 806 15th Street, N.W., Washington, D.C. 20005. Last year's program, held in Seattle, Washington, included two sessions, one by Norm Avery of Estes Industries, on the use of model rockets in education.

Reader Design Page

This month's Reader Design, the Bandit, was submitted by Scott Welborn, of Farmington, Minnesota. Its futuristic design makes it ideal as a demonstration model. The fins should be cut from 1/16" thick balsa, while the nozzle shroud can be cut from light cardboard. The Bandit can be flown with A8-3, B4-4, B6-4, or B14-5 engines.







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

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

On the Scene Report: CANADIAN CONVENTION

by George Flynn

The first major model rocket event in Canada, a joint Convention-Competition sponsored by Montreal's Atmospheric Rocket Research Association, was held over the July 4 - 5 weekend. The site of the gathering was the Maisonneuve Sport Center just outside downtown Montreal. Canadian rocketeers from as far away as Toronto as well as US rocketeers from New York, New Jersey and Massachusetts participated in the Convention.

It was raining on the morning of the 4th, and all of the participants were glad that the indoor Convention activities had been scheduled for Saturday, with the competition launching set for Sunday. An ambitious program of lectures and launchings had been planned for this first Canadian model rocket Convention. Things got underway with an introduction and welcome by Convention Chairman Steven Kushneryk of ARRA.

The first speaker was Don Cruickshank of Bristol Aerospace in Winnipeg — manufacturer of the Black Brant series of sounding rockets. He traced the history of Bristol's and of Canada's involvement in the aerospace field. As Canada's only manufactuer of solid propellent model rocket engines, Bristol has produced a complete family of sounding rockets which have been used worldwide. Presently they are working on two small meterological sounding rockets, one of which was recently tested at White Sands Missile Range.

Following the Bristol presentation, Hillel Diamond of the Canadian Rocket Society in Toronto demonstrated his home-designed model rocket thrust stand. The stand, similar to the old RDC thrust stand (no longer on sale) was designed to be built from commonly available components. A standard slot-car hobby motor was used to drive the recorder — a pen, mounted on the engine holder, which traced the thrust on a rotating ice cream container. The total cost of the thrust stand is less than $10, with not more than five hours being required for construction.

Following lunch Hillel Diamond discussed model rocket telemetry. He started with a presentation on the basics of electronics, and then described a four transistor transmitter which was developed and test flown by his club. The complete transmitter weights only 10 grams (under ½ ounce) plus battery. Presently the transmitter has only been tested with a photocell spin-rate sensor, but development work on additional resistive type sensors is continuing. He also suggested that a simple horizon scanning sensor could possibly be developed. Such a sensor, when fixed to a rocket of known attitude, would detect the angle to the horizon, and thus give a measurement of the rocket's altitude. Following this discussion group the ARRA showed films of their recent launches, and the Convention adjourned for dinner.

A sport launch from the lot outside the Convention center followed dinner. This launch provided a final opportunity for ARRA members to give the launch system a final checkout before the competition, on Sunday morning, and it performed perfectly. Fritz Gnass' Camroc, using a single-stage carrier vehicle, arched over nicely, and looked like it might have gotten a good picture of the convention and launch sites.

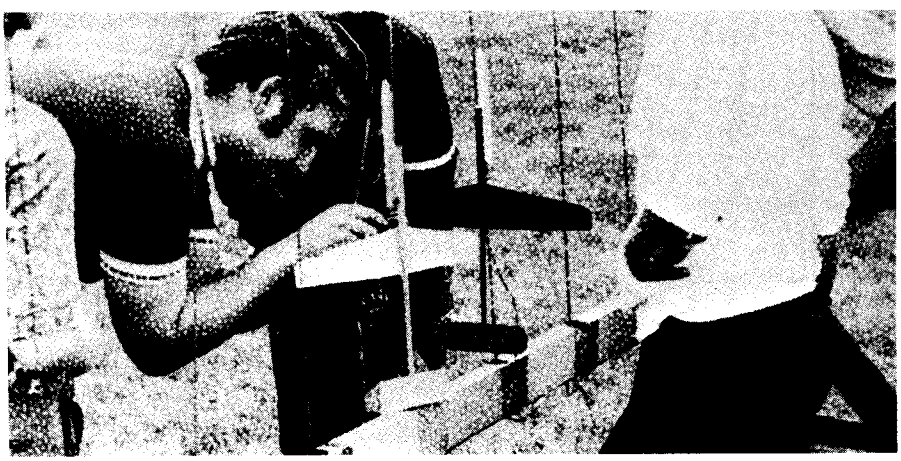
The evening session concluded with discussions of the Canadian aerospace industry's participation in space exploration. R. White of Heroux, Ltd. discussed Canada's cooperation with Grumman on various projects. Mr. Mathews of RCA Victor of Canada followed with a presentation on the Canadian "Alouette" topside-sounding satellite program.

Sunday's events got underway with a discussion of the future of model rocketry by Martin Uczen of Bo-Mar Development Company — the only manufacturer represented. He emphasized the need for R&D in the hobby, and described the rigorous testing program each Bo-Mar kit is subjected to before marketing. What good is it, he asked, to have a payload that "beeps" or "flashes" unless you can do something with it. Unless individual rocketeers adopt serious R&D goals, or undertake other sophisticated projects, he predicts that "model rocketry will go the same way as slot cars."

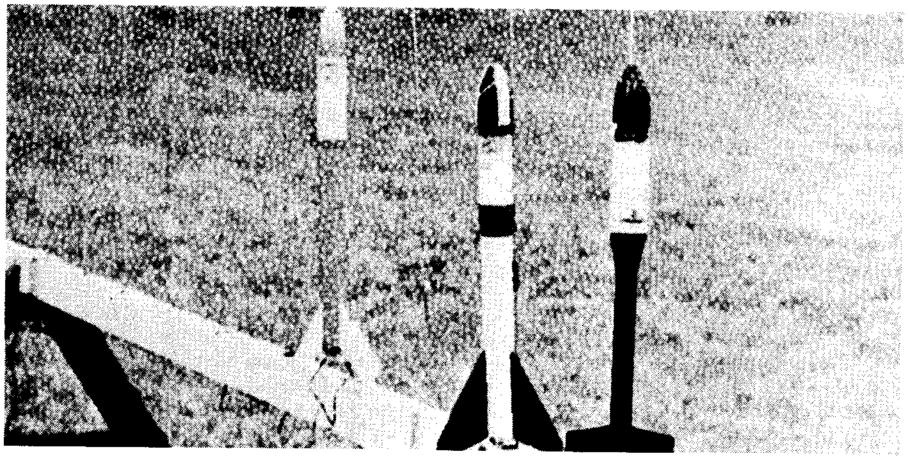
By 12:45 PM everything was set up for the competition launchings from a large open field right behind the Convention center. Perhaps the most unusual rocket of the whole competition was Max Yablonovitch's Class 1 Altitude bird. The body tube was nothing more than a tube rolled from a piece of notebook paper. Fins were attached to the tube, and a paper nose cone was used. The object — *light weight*, and he got that with a weight of only 3.5 grams (including the nose weight required for stability). There was plenty of discussion of how this paper rocket was going to rip itself apaprt . . . but it didn't. In fact its straight-up flight surprised everyone. It actually stayed together, and was in condition for another flight.

After lunch it started to rain lightly at the launch site, but since most of the contestants had traveled a considerable dis-

Fred Gnass took first place in the scale event with a conversion of the highly detailed Revell X-15 to flight.



There were only two entries in Sparrow B/G — both Flat Cats. Steve Klousner's (right) took first place with a flight of about a minute, while Fritz Gnass' glider (left) missed qualifying when it didn't pull out from a "death dive."



The egglofters were of standard designs, but chute difficulties caused many scrambled eggs to be returned.

tance for the competition no thought was given to cancellation. In the scale flights there were several very nice rockets — Marti Goodman had a kit-built Saturn 1B, Fritz Gnass an MPC Vostok, while his brother Fred Gnass had converted the Revell X-15 for flight. Hillel Diamond flew the only scratch built scale model — a very nice Black Brant III in the Bristol display colors.

Only two B/G's, both Bumble-Bees from the **MRm** December 1969 plans, were entered in the Hornet event. Fritz Gnass' Bumble-Bee beat out Max Yablonovitch's though both had good flights. The Gnass Bumble-Bee was well trimmed for flight and caught one small thermal, while the other Bumble Bee needed just a bit more nose weight and lost a little altitude in a series of gentle stalls across the sky.

The Sparrow B/G event was a different story! Again there were only two entries, as B/G's don't seem to have "caught-on" in Canada yet, but both were FlatCats. Unfortunately, Fritz Gnass' didn't pop its pod until after it had passed peak altitude and was on its way down. The glider reached the ground before its pod. S. Klouser took first in the Sparrow event with a good FlatCat flight.

By 3:30 the rain had stopped, and the sky seemed to be clearing. Then eggloft began . . . and we got to see another color rain — yellow egg yoke. Suffice to say that Richard Carmel took first, and only, place in the event with the *only* egg recovered intact.

Both Parachute and Streamer Spot Landing events were flown — with the target, in both cases, up-wind from the launch site. The trick was to fire the rocket into the wind and then let it drift back over the target. Very few entries made it close to the target areas.

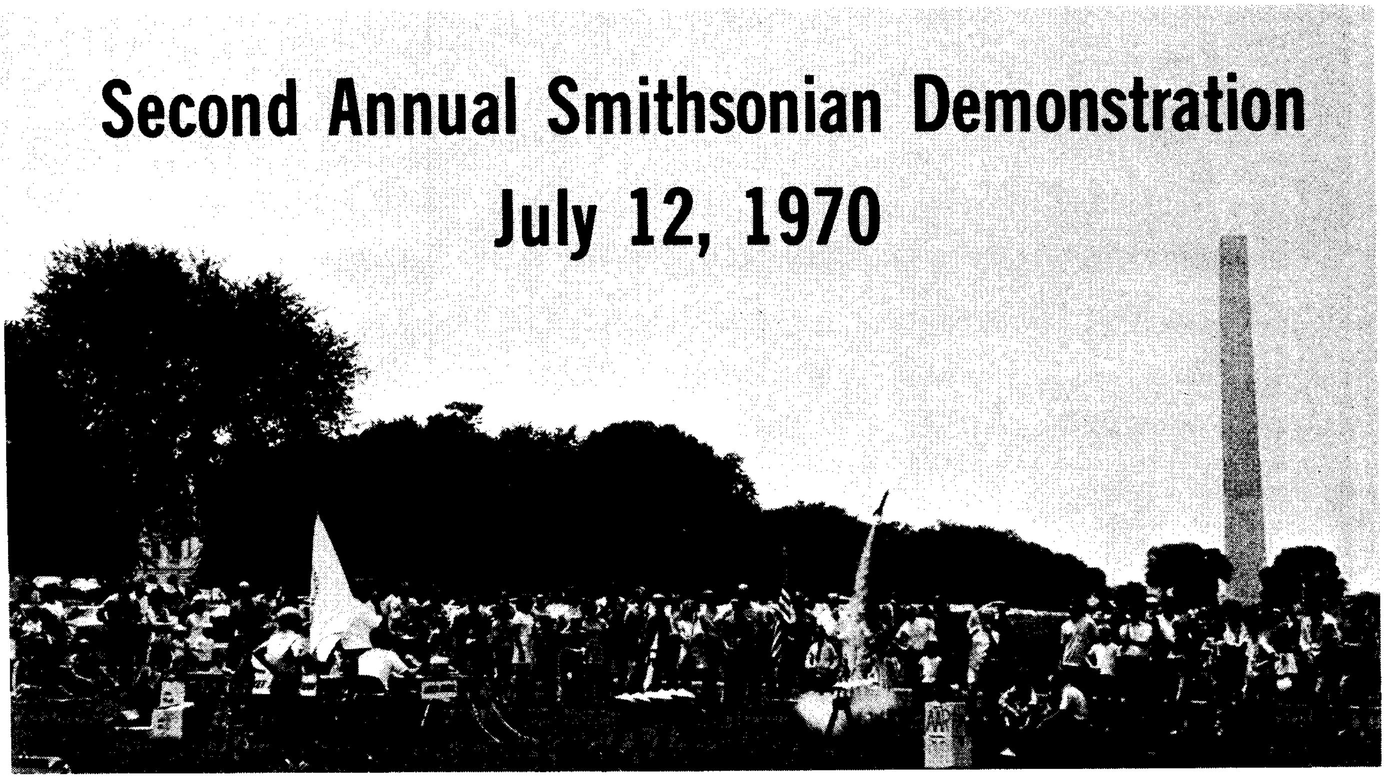
During the afternoon Hillel Diamond flew the transmitter rocket he had described during the previous day's session. Following the flying session a banquet was held in the Convention Center, and awards were presented to the winners in the competition. Canada's first major model rocket gathering came to a close after two days, but it suggested a new effort by Canadian rocketeers to work together in solving the many problems faced by the newly developing hobby in Canada.

CANADIAN CONVENTION RESULTS

Class O Altitude — Junior	**Peter Sauer**	**—**
Class 0 Altitude — Senior	**F. Roka**	**MARS**
Class 1 Altitude — Junior	**F. Rabzel**	**—**
Class 2 Altitude — Junior	**C. Brown**	**—**
Pee Wee Payload — Junior	**L. Lightstone**	**MWMRC**
Single Payload Junior	**(tie) E. Dadd**	**NSMRC**
	J. Rabzel	**—**
Egg Lofting — Senior	**R. Carmel**	**ARRA**
Scale — Junior	**F. Gnass**	**—**
Sparrow B/G — Junior	**S. Klouser**	**PMRS**
Hornet B/G — Senior	**F. Gnass**	**—**
R&D — Senior	**M. Yablonovitch**	**ARRA**
Parachute Spot Landing — Sr.	**F. Roka**	**MARS**
Streamer Spot Landing — Jr.	**J. Rabzel**	**—**
Streamer Spot Landing — Sr.	**F. Roka**	**MARS**

Club Code: **ARRA — Atmosphereic Rocket Research Assoc. (Montreal)**
MARS — Monroe Astronautical Rocket Soc. (Rochester, NY)
MWRC — Montreal West Model Rocket Club (Montreal)
NSMRC — North Shore Model Rocket Club (NY)
PMRS — Phillipsburg Model Rocket Society

Second Annual Smithsonian Demonstration July 12, 1970



Once again, on July 12th, model rockets lifted off from the mall linking the US Capitol to the Washington Monument in the District of Columbia, which only this year legalized kite flying. Under the sponsorship of the Smithsonian Institution, the second annual Aerospace Modeling Activities got underway with the first demonstration launching shortly after 10AM. Though there was little advance publicity, the day was warm and sunny, and at least an average number of tourists were walking down the mall. Many of them were curious enough to stop, ask questions about those "silly little rockets", as one spectator referred to an egglofter, and in many cases became interested enough to pick up some of the literature offered by the manufacturers and the NAR.

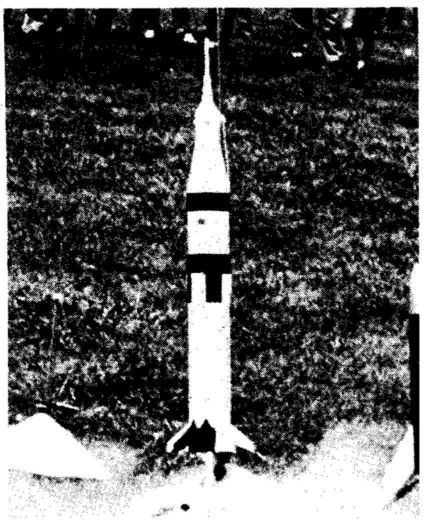
The range operations were under the direction of NAR Trustee Robert Atwood and his Annapolis Association of Rocketry, with assistance from the Metropolitan Area Rocket Society (MARS) and Baltimore's Star Spangled Banner Section. In all about thirty rocketeers assisted in the launchings, which were held hourly until late afternoon.

This year was a year for the manufacturers at the Smithsonian launch. In contrast to last year when no manufacturers participated, this year's demonstration attracted representatives from Cox, SAI, and Competition, while MPC, Estes, Centuri, and Vashon provided literature and rockets for display. Cox used the opportunity to display one of their soon to be released rockets — the Saturn 1B. Powered by an experimental Cox D-engine the Saturn turned in three spectacular flights.

By noon, with launches coming as frequently as every half hour, there were about 90 to 100 spectators gathered around the firing area. For a demonstration launching there were an abnormally high number of failures, perhaps as many as 60%, mostly due to unstable rockets being flown. At one point it got so bad that the RSO remarked to the crowd: "I ask the same question as you. Do we know if it's stable or not. Keep your eye on it and we'll find out." Just for the record it wasn't! The rocket climbed about 15 feet, then wandered aimlessly all over the sky, popping its chute a foot above the ground. The RSO quickly added: "They have problems like that down at Cape Kennedy too. But down there it costs more money when theirs fails."

The Academy of Model Aeronautics (the NAR's equivalent in the airplane modeling field) was having an airplane contest upwind from the firing area. By about 1PM the stiff wind was blowing all of their good flights into the roped off firing range, causing them some difficulty in recovery of their planes. Thanks to the alertness of the RSO, we didn't manage to shoot down any Delta-Darts, but some of the rocketeers seemed to be in favor of trying out the new Cox semi-scale Nike-Zeus on a simulated combat mission.

During the course of the day at least one thousand visitors and residents in Washington had an opportunity to see a model rocket launch, and have their questions about the hobby answered. Even with the few unsuccessful flights, the day was a very successful publicity effort.



Manufacturers' demo flights dominated this year's Smithsonian activities. At left the new Cox Saturn 1-B, powered by their prototype D-engine, lifts off. At right a Vashon Valkyrie II flys from the mall.

RADIO-CONTROL ODD-BALL MODEL ROCKET ELECTRONICS COMPETITION TECHNICAL ARTICLES BOOST-GLIDERS TRACKING SYSTEMS CAMERA ROCKETS FINLESS ROCKETS SCALE MODEL ROCKETS CLUB NEWS PAYLOAD ROCKETS LAUNCH SYSTEMS

Back Issues!!!

TO ORDER JUST CHECK THE DESIRED ISSUES

November 1968 $.75 ☐
Model Rocket Recovery by Extensible Flexwing . . . . High Quality Aerial Photography: Part I . . . . Calculating Drag Coefficients . . . . Scale: MT-135 . . . . Project Apollo . . . . XR-5C: Three-Stage Cluster . . . . The Versitex: A Payload Rocket ....

February 1969 $.75☐
Zeta: Single-Stage Sport Rocket . . . . The Flight of Apollo 8 . . . . Non-Vertical Trajectory Analysis . . . . The Old Rocketeer: Spotlight on the Manufacturers . . . . Cosmic Avenger: A Model for Class E Engines . . . . Scale Design: Nike-Deacon . . . . Model Rocketry for the Depraved ....

March 1969 $.75 ☐
The Old Rocketeer: Saffek's Saturn . . . . High Quality Aerial Photography: Part III . . . . The Biurificon: Rocket Design . . . . Constructing a $25 Club Launch Panel . . . . How to Finish a Model Rocket . . . . Scale Design: Genie MB-1 . . . . The Dynaflora: Single-Stage Sport and Payload Rocket ....

April 1969 $.75 ☐
Scale: Arcas . . . . Report on Apollo 9 . . . . Demonstration Launches . . . . R. H. Goddard: Payload Rocket . . . . Multistage Altitude Calculations . . . . Tower Launching . . . . Torsion Wire Experiments . . . . The Skyray . . . . Chicago Trade Show ....

May 1969 $.75 ☐
Staged vs. Cluster Model Rocket Performance . . . . The Fra-jyle: Sport Rocket . . . . Astroscale Data: The ASP Rocketsonde . . . . Transmitter Construction Plans . . . . The Infinite Loop: Oddball Design . . . . The WRESAT: Australian Satellite . . . . Pittsburgh Convention . . . . The Hawk: Sport Rocket . . . . Closed Breech Launching ....

June 1969 $.75 ☐
Ignition Technology . . . . Build a Temperature Sensor for Transmitter Use . . . . Body Tube Guide . . . . The MIT Convention . . . . The Candelabra: Oddball Design . . . . The Thumba Rocket Range . . . . Scale Design: IQSY Tomahawk ....

July 1969 $.75 ☐
Soviet Space Program . . . . Scale: Astrobee 1500 . . . . ECRM Results . . . . F Engine Saturn . . . . Misfire Alley System . . . . The Goliath . . . . The Why(!)gion . . . . Spin Rate Sensor and Direction Sensor for Rocket Transmitter ....

August 1969 $.75 ☐
Radio-Controlled Boost/Gliders . . . . A History of Retro-rockets . . . . An Accelerometer for Transmitter Use . . . . Results from WAMARVA-1 . . . . The Dynamite . . . . Scale: Rohini RH-75 . . . . The Old Rocketeer: Flat Cat B/G ....

September 1969 $.75 ☐
Color Aerial Photography . . . . The Flight of Apollo 11 . . . . Astroscale Plans: Black Brant III . . . . South west Model Rocketry Conference . . . . Payload Section for the Transmitter . . . . Czechoslovakian National Championships . . . . Plastic Scale Modeling . . . . Radio Controlled Boost/Gliders: Part II ....

October 1969 $75☐
Conical Model Rockets . . . . Astroscale: Nike-Smoke . . . . Fin Test Vehicle. . . . Foxmitter Microphone . . . . NARAM-11 Coverage . . . . R/C B/G: Part III . . . . Japanese Activity . . . . Dragbrakes Revisited ....

November 1969 $.75 ☐
Scale: Nike-Apache . . . . Midwest Regional Report . . . . Arcturus: Finless Design . . . . Ball-Hagedorn Open Payloader . . . . Jupiter-C Conversion . . . . Washington State Championship . . . . Krushnik Effect ....

December 1969 $.75 ☐
Yugoslav Championships . . . . Relay Ignition Systems . . . . Coefficients . . . . The Bumble Bee: Hornet B/G . . . . Aerial Photointerpretation . . . . Designing with Computers . . . . B/G Performance: Part I . . . . PVARM Regional Report ....

January 1970 $.75 ☐
Return to Green Mountain . . . . Tilt-A-Tower . . . . B/G Performance . . . . MARS-IV Regional Results . . . . Retro-Rocket Designs . . . . Calculating Drag Coefficients . . . . USSR Championships . . . . Modrocs in Vietnam . . . . Fly the Micron II . . . . Pershing 1 Scale Data ....

February 1970 $.75 ☐
Ram-Air Guidance . . . . Yugoslavian Parachute Duration Design . . . . Computer Altitude Calculations . . . . Build the Warwick II . . . . B/G Performance: Part II . . . . Body Tube Construction Techniques . . . . Helicopter Recovery Techniques . . . . Super-Swift Tandem B/G's ....

March 1970 $.75 ☐
Converting the Revell LEM to Flight . . . . B/G Performance: Part III . . . . Plastic Fin Modifications . . . . Parallel Fins for Modrocs . . . . Ram-Air Guidance: Part II . . . . Fly the Super-Titan . . . . D-Engine Flight Performance Charts ....

April 1970 $.75 ☐
Modroc UFO's . . . HAD Scale Australian Rocket . . . . Trade Show Report . . . . Rear Ejection Clip . . . . Psionic Control of Modrocs . . . . C_D Determination . . . . D-Engine Performance: Part II . . . . Fly the NARWHAL For Design Efficiency ....

May 1970 $.75 ☐
Thunder Bird Eagle B/G Plans . . . . The First Model Rockets . . . . Vostok USSR Scale Plans . . . . Paint Compatibility . . . . The Omega Quadrathon Design . . . . The Trojan Fint Test Vehicle . . . . Optical Tememetry . . . . Lift, Drag, and Pitching Moment Coefficients for the Nighthawk B/G ....

June 1970 $.75 ☐
The S S Orion Flying Saucer Rocket . . . . Plastic Conversion: The Countdown Saturn V . . . . Saffek's Hiskra B/G . . . . Simplified Parachute Duration Analysis . . . . Oberon XBG-111 Styrofoam Wing B/G . . . . Build the Sport . . . . Pittsburgh Convention Report . . . . The Foxmitter II Modroc Transmitter ....

July 1970 $.75 ☐
ECRM-4 Report . . . . Korolev RD-107 Vostok Astroscale Plans . . . . The "Triad" Odd-ball Design . . . . MIT Convention Coverage . . . . Custom Plastic Parts! . . . . Czech Competition Coverage . . . . Foxmitter Breathing Rate Sensor . . . . Strap-On Wind Tunnel Plans . . . . Experimental Parachute Duration Results . . . . Plans for the Tipsy ....

August 1970 $.75 ☐
Flop Wing B/G's . . . . Titan III-M with Operational Strap-Ons . . . . Boeing Wind Tunnel Plans . . . . NART-1 Contest Coverage . . . . "Bio-1" Payload Rocket Plans . . . . Foxmitter II Temperature Sensor . . . . Pivot Launch Tower Plans . . . . RD-107 Vostok Scale Data: Part II . . . . EFA Pauloader Sport Design...

September 1970 $.75 ☐
Plastic Conversion: Revell "Vostok" . . . . Quick and Easy Balsa Finishing . . . . The Dove III Flop Wing Sparrow B/G . . . . Falcon (AIM-4 E) Scale Plans . . . . PAR-1 Regional Meet Coverage . . . . Accelerometer Plans for the Foxmitter II . . . . "Bio-1" Payload Rocket: Part II . . . . The Flying Bowling Pin..........

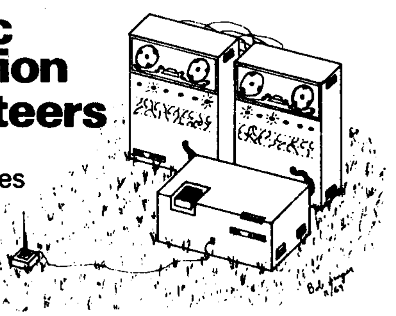
TO

Model Rocketry Magazine
Box 214
Boston, Mass. 02123

Name..........
Address..........
City..........**State**..........**Zip**..........

Automatic Computation for Rocketeers

by Charles Andres



DRAG COEFFICIENT AND CENTER OF GRAVITY PROGRAMS.

Ever since model rocketry began to be concerned with stability, there arose a need to compute stability before designing since the "cut-and-try" method is not only degrading, but downright unscientific. As everyone knows by now, the center of pressure must be behind the center of gravity in order to have the model fly stably. In the December issue, I published a program for computing the center of pressure of a rocket which originated with the Barrowman Report. This program will accurately determine the center of pressure of a given rocket. However, if one does not know where the center of gravity is, it is of limited value to know where the center of pressure is. Fortunately, the center of gravity can be calculated very easily by the age old method of moments and centroids as presented in the Estes TR-9 Stability Report. One merely breaks the model up into its various components, finds the weight and the center of gravity of each component, and then finds how far each individual CG is from a given point — say the nose cone. By multiplying the weight of each part by the distance its CG is from the reference point, one arrives at a number which determines the relative influence each component has on the entire model's center of gravity. By merely adding these values together and dividing the sum by the weight of the total model, one can compute the location of the center of gravity. But if one is infinitely lazy, he can have the computer perform this feat much faster. Its accuracy is totally dependent upon the data supplied. The more parts considered and the more accurate each weight and computed distance is, the more accurately one can determine the center of gravity and prototype weight. If one has a model accurately designed and a manufacturer's catalog, one can determine the CG fairly accurately if net weights of each item are given. However, this accuracy is limited to finding the CG to about 1/10 inch. This is because individual weights of items vary to small extents and one usually neglects to calculate weight and relative concentration of glue and finishing materials, not to mention balsa sanded off during construction. One must also guess at the center of mass of each component. This is not very difficult because each individual fin, nose cone, body tube, etc. is more or less uniformly constructed of one material, and thus when half the area is on either side of a given point, that point is reasonably close to the center of mass. The exception is the loaded engine which has a concentration of weight in the rear.

Of course, if one already has all of the parts necessary for construction, he can weigh each one and by balancing them, determine the approximate CG of each. As stated before, the center of gravity point can only be considered as accurate as the data used in computing it. There is no sense in obtaining its value to any more than two decimal places, since accurately measuring to the hundredth of an inch or centimeter is almost impossible when working with balsa and an unpredictable amount of sealer and paint. But if one uses manufacturer's net weights and builds his model accurately to the design used in computing the center of gravity, a reasonably close approximation can be made. One should always understand that the results are only as accurate as the data employed, and the center of pressure should always be behind the center of gravity by at least one body diameter. I have had results surprisingly close to actual models' CG, although they sometimes have been off by as much as ½ inch.

Figure 4

```
M.0076 BEGIN ACTIVITY

/input
/insert center(1234)M.0073 ACTION IN PROGRESS
M.0070 ACTION COMPLETE
/displayM.0073 ACTION IN PROGRESS

/JOB GO
/FTC NAME=ROCKET
C          CALCULATION OF CENTER OF GRAVITY
           DIMENSION I123(8)
38         READ(5,26) (I123(J),J=1,8)W2,W3,W4,W5,W6,W7,W8,W9,W10,D1,D1A,
      1    D2,D3,D4,D5,D6,D7,D8,D9,D10
26         FORMAT(8A4/10F7.3/10F7.3)
           T1=910*D1
           T1A=.471*D1A
           T2=W2*D2+W3*D3+W4*D4+W5*D5
           T3=W6*D6+W7*D7+W8*D8+W9*D9+W10*D10
           Y=T2+T3
           Y1=T1+Y
           Y1A=T1A+Y
           WT=W2+W3+W4+W5+W6+W7+W8+W9+W10
           WT1=.910+WT
           BOWT=.471+WT
           CGE=Y/WT1
           CGL=Y1/WT
           CGB=Y1A/BOWT
           WRITE(3,36) (I123(J), J=1,8),WT,CGE,WT1,CGL,BOWT,CGB
           FORMAT('NAME "8A4/'EMPTY WEIGHT = ',F7.3,'OZ.',15X,'EMPTY CG
      1    = ',F7.2,' INCHES'/'LIFTOFF WEIGHT (W) C 6-5 = ',F7.3,'OZ.',3X,
      2    'LIFTOFF CG (W) C 6-5 = ',F7.2,'INCHES'/'BURNOUT WEIGHT (W) C 6
      3    -5 = ',F7.3,'OZ.',3X,'BURNOUT CG (W) C 6-5 = ',F7.2,' INCHES'/
      4    'ALL DISTANCES MEASURED FROM TIP OF NOSECONE.')
           GO TO 38
           END

DATA
WAC CORPORAL

 0.070 0.240 0.040 0.039 0.138 0.005 0.032 0.009 0.078 10.50
10.30  2.10  3.05  3.15  3.60  7.075 6.4   10.7  8.6   5.5
M.0070 ACTION COMPLETE
/end runM.0073 ACTION IN PROGRESS
END OF COMPILATION ROCKET

WAC CORPORAL
EMPTY WEIGHT = 0.651 OZ.
EMPTY CG = 4.61 INCHES
LIFTOFF WEIGHT        (W)   C 6-5 =   1.561 OZ.
LIFTOFF CG            (W)   C 6-5 =   8.04  INCHES
BURNOUT WEIGHT        (W)   C 6-5 =   1.122 OZ.
BURNOUT CG            (W)   C 6-5 =   6.99  INCHES
ALL DISTANCES MEASURED FROM TIP OF NOSECONE.
```

VARIABLES IN CG PROGRAM

W2, W3, etc.	—	Weights of Individual Rocket Components
D1	—	Distance of Loaded Engine CG from nose cone
D1A	—	Distance of Empty Engine CG from nose cone
D2, D3, etc.	—	Distance of Component's CG from nose cone
T1	—	Wt times Dis. of Loaded Engine
T1A	—	Wt times Dis. of Empty Engine
T2, T3	—	Subtotalling of Moments
Y	—	Totalling of Moments minus Engine
Y1	—	Total of Moments plus Loaded Engine
Y1A	—	Total of Moments plus Empty Engine
WT	—	Weight of Empty Rocket
WT1	—	Weight of Rocket with C 6-5
BOWT	—	Weight of Rocket with Empty C 6-5
CGE	—	Center of Gravity of Empty Rocket
CGL	—	Center of Gravity of Loaded Rocket
CGB	—	Center of Gravity at Burnout

The program is another simple straight forward one with easy to follow steps. The program illustrated allows for ten different parts of a rocket to be analysed. This number can be increased to an infinite amount, although some computers will only allow a total of ten variables to a line. If this is the case, the program should call for a subtotalling of each group of ten variables, with a totalling of all groups carried out on the next line. The computing time on a short simple program like this is so small, the extra lines will not produce a noticeable delay. The program illustrated will list the name of the rocket being considered, followed by six computed values: weight and CG minus the engine, weight and CG with a loaded engine, and weight and CG at burnout. One must remember that although the engine is generally behind the CG and burning results in greater stability, this is not always the case. An engine in a front engine boost/glider for example, may be ahead of the CG, and burning propellant could in some borderline cases cause a model to go unstable.

Also, too great a margin between the CG and CP points can result in excessive weathercooking. Thus, it helps to know what the parameters of the rocket will be at all stages. Notice that a C6-5 is used in the sample program for computing liftoff CG. This is because this is the heaviest engine available for small rockets. One can of course substitute the given C6-5 value for a variable which is to switch engine weight from rocket to rocket, or substitute another constant such as the weight of an F100-8.

If the program is to be used in computing a rocket with any engine the standard values should be removed and replaced with variables W1 and W1A which correspond to engine weight and empty engine weight respectively. This will require a routine change in the read and format statements to accommodate the new variables. A "/2F7.3" should be added to the read format statement between the last "/10F7.3" and the final parenthesis. Of course W1 and W1A should replace all "C" engine constants throughout the program. If the Metric system is to be used, it should be used throughout with grams and centimeters replacing the ounces and inches in the write format statement. Again, the set values for the "C" engine will have to be changed, this time to 25.8 grams loaded weight and to 13.32 grams burnout weight.

For those who wish to combine the program with the Center of Pressure program printed last December, this can easily be done by merely inserting the lines of this program in between the "X=(2*(XN+ etc." statement and the "Write" statement on the CP program. The "Write" and "Format" statements will have to be changed in order to accommodate and print out the extra data, and both the 'READ' and data 'Format' statements will have to be altered. In addition, a line which subtracts the CP from the CG could be inserted after the CG program lines to give the margin of stability. Another which divides the margin by the body diameter would give the margin in terms of "calibers". If the program is to be used in conjunction, some variables should be changed so as not to conflict with those in the CP program. Those in the CG program which must be changed are the 'D' series of variables. In changing these from D1, D2, D3, etc. it is recommended that C1, C2, C3, etc. be used in their place. Other changes follow standard Fortran updating procedures.

The program shown in Figure 4 uses a WAC Corporal as an example for computing the center of gravity. In Figure **4**, this model is shown with a table listing the required variables for the nine main parts of the rocket. Interestingly enough, the computer missed the actual measured model CG by less than .1 inch, although it underestimated the weight by .3 oz. This was due to the paint and sealer which were not added into the problem. A constant value for paint and finishing supplies could be added to increase the accuracy of program, but this would have to be determined experimentally by every modeler depending on the average weight of his finish and the size of the rockets being considered.

One parameter which is constantly under attack in the model rocket world is the *drag coefficient.* There have been several methods given in the past for determining drag coefficients, one of which was presented by George Caporaso in the November, 1968 issue of **MRm**. (This issue is still available.) The equations presented in that issue make up the computer program in Figure 6, and is another straight forward case of translating equations into Fortran. I will not go into the accuracy of this particular program since the reasoning behind the equations is provided for by George's comments in the original article. I *assume* that his equations have been correctly reproduced and that his method of computing the drag coefficient is sound. But results which I have received from the program have always seemed a little low — averaging out to be around .6 rather than .75. Doug Malewicki's recent wind tunnel studies, however, indicate this lower value may be more accurate. This method makes no allowance for the finish of the model, though I expect that George assumes it has an optimum finish with sanded fins, a well sanded, sealed, and polished finish, and no turbulence resulting from exterior details. As one can see from Doug Malewicki's graph on page 49 in Centuri's **TIR-100** Report, the drag coefficient is very dependent upon these factors. Therefore, the value which one receives from George's calculations must be assumed to be the lowest drag coefficient ever possible on a given design. This can still be quite useful for judging relative possible performances of two design configurations. If one shape is calculated to have a lower drag coefficient, than it is probably a more high performance design, and should be favored, as long as it retains good dynamic and static stability characteristics.

VARIABLES IN DRAG COEFFICIENT PROGRAM

N — Number of fins
BL — Body Length
R — Diameter at base of rocket
D — Diameter at nose of rocket
AFN1 — Area of one side of one fin
AB — Base cross-sectional area
AF — Nose cross-sectional area

Figure 6

```
M.0076 BEGIN ACTIVITY

/input
/insert dragoo(1234)M.0073 ACTION IN PROGRESS
M.0070 ACTION COMPLETE
/display M.0073 ACTION IN PROGRESS

/JOB GO
/FTC
C           CALCULATION OF DRAG COEFFICIENTS
            DIMENSION I123(8)
38          READ(5,26) (I123(J),J=1,8),N,BL,R,D,AFN1
26          FORMAT(8A4/5F11.5)
            AB=((.5*R)**2)*3.1416
            AF=((.5*D)**2)*3.1416
            ABD=( BL*D)*3.1416
            AFN=N*(AFN1*2)
            CDS=.22842–(.20*(1-(AB/AF)))
            RN-186200*BL
            CDBD=(.455*(ABD/AF))/(ALOG10(RN)**2.58
            CDFN=(1.327*AFN/AF))/SQRT(RN)
            CD=CDS+CDBD+(CDFN*2)
            WRITE(3,36)(I123(J),J=1,8),CD
36          FORMAT('NAME ',8A4/'THE DRAG
              COEFFICIENT = ',F7.4)
            GO TO 38
            END
/DATA
```

ABD — Total surface area of body
AFN — Total surface area of fins
CDS — Shell Resistance Coefficient
RN — Reynolds Number
CDBD — Friction drag component for body
CDFN — Friction drag component for fins
CD — Drag coefficient of rocket

In the program I have taken the liberty to plug in a few constants to make matters simpler. In the equation which computes Cds, the shell resistance coefficient, George has 4860K(V) — 0.20(1−Ab/Af). One can compute K(V) from the accompanying graph in the article, but George assumed an average rocket velocity of 350 ft/sec, which corresponds to a K(V) value of $.47 \times 10^4$ or $.47 \times 10^{-4}$. (Although the article says 10^4, I am assuming that he meant 10^{-4} since if the converse were true, the shell resistance Cd would be in the millions, an obvious impossibility.) Therefore my Fortran statement in standard math would read:

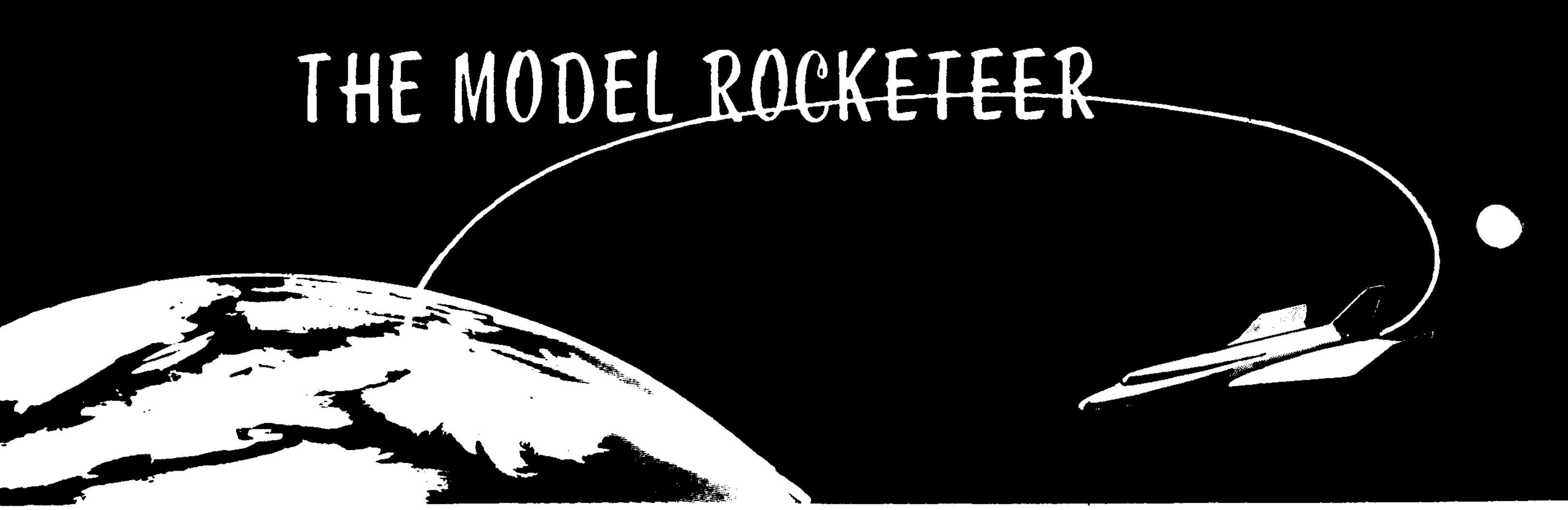
$$Cds = .22842 - 0.20(1 - Ab/Af)$$
$$\text{where } 4860 \cdot .0047 = .22842$$

My other assumption was concerned with the value of the Reynolds Number (RN). According to the article, the Reynolds Number is equal to 532 x V(ft/sec) x length of body in inches. If an average velocity value of 350 ft/sec. is assumed again, then the equation for the Reynolds Number becomes:

$$RN = 186200 \times BL$$

There are two other things to keep in mind when programming this. (a) George says: "If Ab is smaller than Af and there is no abrupt change in cross section over the rocket body from Af to Ab, then the shell resistance is given by (2)." ("2" refers to the Cds equation.) I interpret this to mean that no conical shoulders can be analysed. Of course, he may be referring to a more abrupt change in cross section but this is a matter for debate. (b) For rockets with more than one set of fins or various repeating sections, some of these equations can be duplicated or eliminated depending upon the use intended for the program. Again, I will stress that these programs may be merely used as guidelines and can be altered as much as necessary to perform an individual task. Although one should have an idea of what one is doing before endeavoring to change the program to any large degree.

The program as illustrated only gives a final value of the theoretical drag coefficient. However, if the individual drag coefficient calculations are of interest, they may be printed out as well by changing the 'Write' and 'Write Format' statements to accomodate the extra printout. The illustration gives the drag coefficient for the Excalibur 1 as computed from the data input. This value of .4656 seems a little low, but as explained earlier, it is probably the minimum drag coefficient for this shape.



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

N. Y. Court Decision

by James Kukowski

On May 14th the Honorable Angelo Mauceri, Judge of the First District Court, Suffolk County, State of New York, rendered a decision in the case of THE PEOPLE OF THE STATE OF NEW YORK vs. ROBERT JOHN BOCHTER, Defendent.

Mr. Bochter was "charged with wrongfully, intentionally and knowingly violating section 270 of the Penal Law in that he did offer and expose for sale MPC model rocket engines and did sell a package containing three engines " . . . said engines did contain sulfer, carbon and sodium or potassium nitrate which are the components of black powder which constitutes fireworks."

After defining section 270 of the Penal law which defines "fireworks" Judge Mauceri continued, "The court has considered the arguments of counsel and now must decide the validity of this complaint. There is no precedent directly in point with regard to model rockets and an exhaustive analysis of the statute is necessary. The definition of "fireworks" are specific and listed in great detail in the statute."

Judge Mauceri in his decision was critical over the fact that the prosecution did not state with clarity whether the chemical constituency of the propellant was sodium nitrate or potassium nitrate. He stated that without either it was not black powder, but for purposes of argument he assumed that the engine contained black powder. Then he quoted the penal code that bluntly stated that "black powder" constitutes "fireworks". He concluded that to state that, emphatically, is ludicrous, because black powder is not commonly used and sold as fireworks.

The Judge then wrote, "To label these engines as fireworks in this day and age would reduce our highly technological society to the level of juvenile pranksters. They are used in schools as experiments and in industry for testing. If the People's contention is sustained, that it is black powder, ergo, it is an explosive or combustible and therefore it is fireworks, it would have prevented the ignition of the engine of the Wright Brother's airplane at Kitty Hawk and prevent Henry Ford from ever establishing the automobile as a means of transportation."

Judge Mauceri then continued, "The Court is well aware of the danger attendant upon the use of these devices by children, but it is also cognizant of the fact that this should be an area of parental direction and concern. It is for the legislature to prohibit the sale of these devices by proper statutory restraints if that be the will of the People of our great State".

He did point out the following, "It is worthy to note that the package of engines . . . contains a great amount of technical information and warnings on its use printed on the package. In fact, clearly printed on its face in bold letters are "WARNING, FLAMMABLE, DO NOT INCINERATE, KEEP OUT OF REACH OF CHILDREN". This same language appears on any common spray can located in our homes and we feel very safe that these warnings suffice both to adults and children alike and protects both adults and children from any unnecessary harm."

In conclusion, the Judge summarizes, "These engines are not fireworks by definition, but I am sure that if they were sold directly to a child in spite of the warning on its package the seller would be open to an infinite variety of criminal charges under the penal law but not the sale of fireworks".

Judge Mauceri's decision is being appealed to the New York State Court of Appeals. The date of the appeal hearing is not known at this time. The above decision is no doubt a landmark for model rocketry. Careful analysis shows that it is not a firework in New York State, becuase of a poorly defined law, so this cannot be a flag waving victory, it still may fall into the firework category in states where pyrotechnics codes are better defined. But . . . it is still an important document.

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

Central Illinois Model Rocket Association Gives Major Midwest Demonstration

by Stanley Engelhardt

The Central Illinois Model Rocket Association NAR Section participated in Airport Days July 11 and 12, 1970, at the Decatur Municipal Airport.

The event marked the sixtieth anniversary of the first heavier-than-air flight in Decatur. The first flight in Decatur took place in Hess Park, a far cry from the three million dollar airport facilities now in operation.

On Saturday, the C.I.M.R.A. displayed eighty-one single engine, clustered, and multi-staged rockets. Of these, forty-eight rockets were launched between 3:00 and 4:00 p.m. There were forty-one members of the C.I.M.R.A. present on Saturday. On Sunday, the C.I.M.R.A. displayed sixty-five rockets and launched thirty-two rockets between 3:15 and 4:00 p.m. On both days, both starter kits and experimental rockets were shown and launched.

The size of the rockets launched ranged from four inches high to six feet, eight inches high. Engine sizes varied from an ½A to an F. Generally, parachute recovery rockets led the recovery crews a merry chase across the airport field. The rocket flights which relied on ribbon and gyro recovery techniques were less tiring.

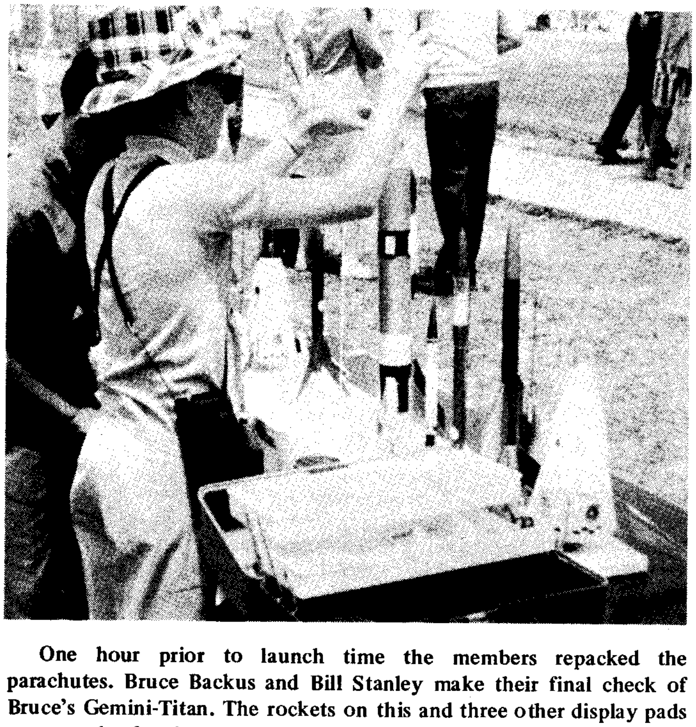
On Saturday, approximately four thousand people watched the model rocket launch. On Sunday, approximately nine thousand people observed the launches. Of the eighty rockets launched on the two days, there were only four malfunctions. The crowd moaned when each malfunction occured. This was especially evident when one eight year old boy's rocket failed to fire, bringing a long, long face from its youthful builder.

C.I.M.R.A. members served as display guards, launch crews, recovery crews, and spotters. The Decatur Noon Optomists, the sponsors of the C.I.M.R.A. section, assisted in the launch and recovery phase of the operation and helped man the large sixty foot display table. Promotional literature from the NAR and major model rocket manufacturers were on display, as well as a representative sampling of kit and experimental rockets.

Each rocket was carefully inspected for stability and safe construction prior to being launched. Three multiple launch pads were used as well as numerous display pads. Members of the C.I.M.R.A. received a good round of applause during and after the demonstration flights.

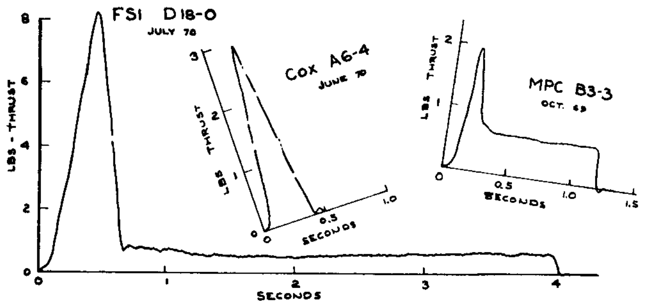
The Airport Day committee and the Airport authorities were well pleased with the C.I.M.R.A. rocket displays and launches, and were impressed with the safety arrangements of the C.I.M.R.A. members.

At present, the relatively new NAR section has fifty-six members, with three adult advisors, and numerous Noon Optomist observers. The friends and publicity gained from this major demonstration is sure to swell their ranks even further.



One hour prior to launch time the members repacked the parachutes. Bruce Backus and Bill Stanley make their final check of Bruce's Gemini-Titan. The rockets on this and three other display pads were ready for launch at the CIMRA airport demonstration. Each rocket had an assigned place on the launch pad so that proper recognition could be given to the builder and so that it could be announced to the public properly.

Tables were set up in the display area. CIMRA members (left to right behind the table) Jeff Meyerholz, Dan Gollohan (under the umbrella), Robert McLaughlin and Martin Baker assist in explaining rocketry to the spectators.



THE STANDARDS AND TESTING COMMITTEE

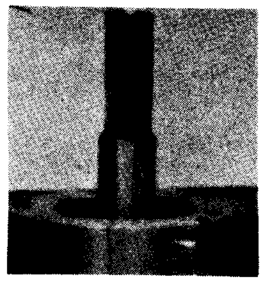
Article XI, Section 4 of the NAR By-Laws . . .

The Standards and Testing Committee shall have as its duties the establishment and revision of the standards and regulations of the Association, the establishment and revision of the Safety Code of the Association, and the testing and certification of equipments as called out in the standards and regulations of the Association.

These two pages show the S&T Committee at work at one portion of its duties – rocket engine certification. The test equipment shown has been designed and assembled by G. M. Gregorek, the Chairman of the S&T Committee and an Associate Professor in the Department of Aeronautical and Astronautical Engineering of The Ohio State University. Helping Dr. Gregorek in the tests are two Ohio State Aero-Engineering students, Charles Russell (NAR 10920) and George Pantalos (NAR 10620) both Leader members of the Columbus Society for the Advancement of Rocketry (CSAR). The thrust-time curves shown are tracings of data taken with this equipment during the past year.

Charles Russell, left, places a calibration weight on the small rocket thrust stand as George Pantalos, below, adjusts a plotter to record the electrical output of the test stand. The strain gauge bridge circuit (shown schematically at the lower left) produces a voltage that is proportional to the weight or force applied to the stand. Weights are added with the stand vertical to find what voltage corresponds to a given load. For an engine test the stand is rotated to a horizontal position so that the loss of rocket weight, as the propellant burns, will not affect the results. The thrusting rocket pushes against the stand the same as the calibration weight; the electrical signals generated move the plotter pen correspondingly, producing the thrust vs. time curve for the rocket being tested.

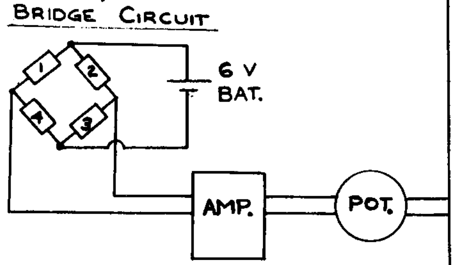
The small thrust stand Charles is calibrating above is used for rocket engines with thrusts less than 10 lbs. For E and F engines, a stronger thrust stand is required. The high thrust stand shown below can handle thrust levels up to 50 lbs.

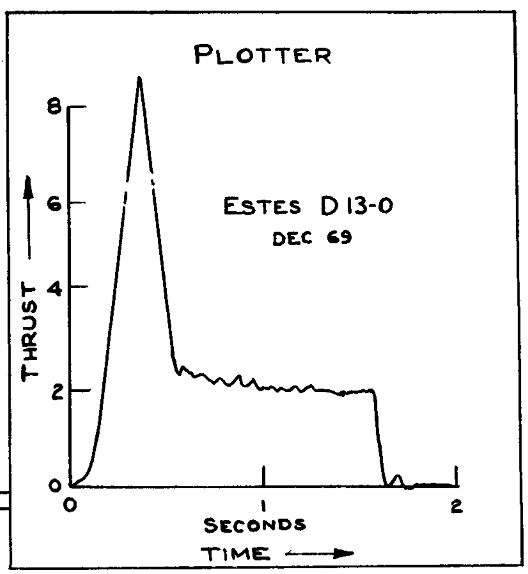


Four strain gauges are cemented to a beam supporting the engine holder. When the rocket fires, the beam is strained so that gauges 1 and 3 are placed in tension and gauges 2 and 4 experience compression. The resistance of each gauge to the 6 volt battery depends upon this strain – when a tension or stretching load is applied to a gauge, the resistance increases; when a compression or squeezing load is applied, the gauge resistance decreases (that's why they're called strain gauges). With no load, all the gauges on the stand have the same resistance; therefore, the voltage in each lead to the amplifier is the same. However, with a load, there is a change in resistance of the gauges and a voltage difference in the amplifier leads exists. The amplifier increases this millivolt signal and the potentiometer adjusts the voltage so that the plotter pen moves an even number of inches for each pound of thrust.

Before an NAR Safety or Contest Certificate is issued to a model rocket engine, the Standards & Testing Committee tests several samples of the new engine. The thrust-time curve and delay time are measured on the thrust stand, and the data used to determine the peak thrust, the average thrust, and the total impulse must vary less than ± 10% of the mean value, for the Safety Certificate a variation of ± 20% is allowed. Delay times can vary ± 20% from the nominal value – this relaxation is necessary to prevent manufacturing difficulties with more precise delay trains from raising engine costs. If the engines exceed the total impulse for its class, or if a catastrophic engine failure occurs, the engine type is denied certification until a correction is made by the manufacturer.

BRIDGE CIRCUIT

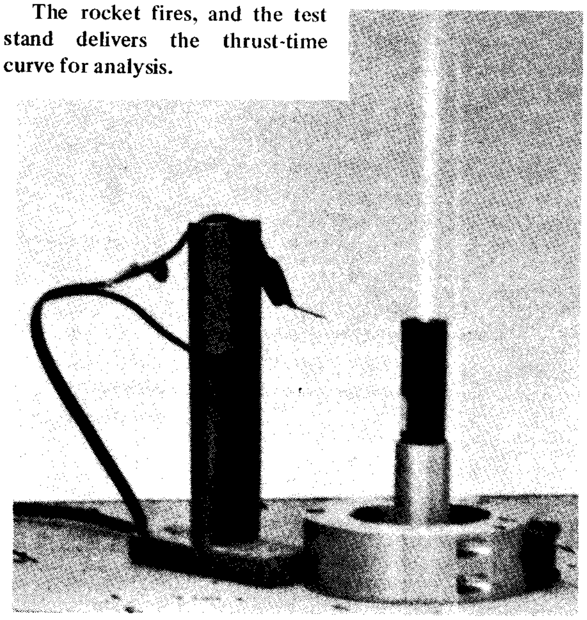


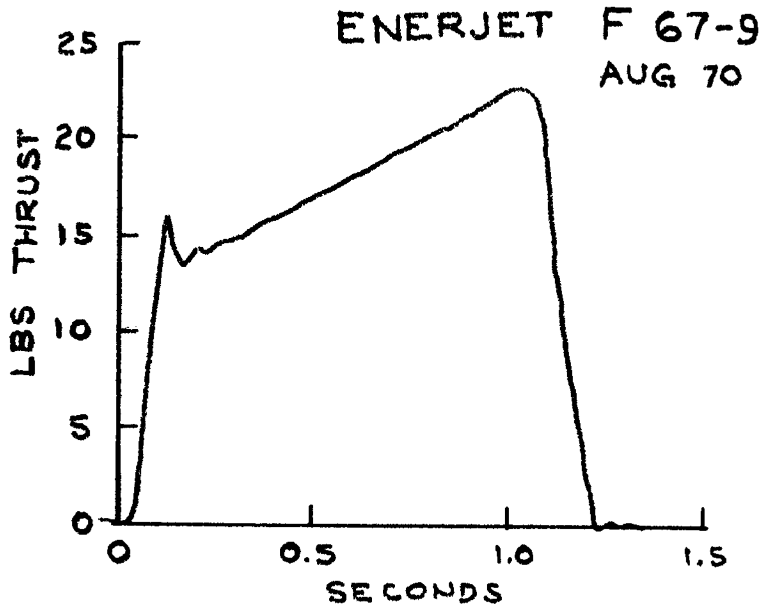


The Standards and Testing Committee is in constant letter and telephone communication with all the engine makers. In addition, during the past year representatives of Cox Manufacturing Co., Estes Industries, Model Products Corporation, and Centuri Engineering have visited the S&T Chairman, to inspect the testing equipment and to observe the certification testing. At the right, Mr. Irv Wait of Enerjet, a subsidiary of Centuri Engineering connects the engine leads to an F-engine installed in the test stand used to test E and F engines. →

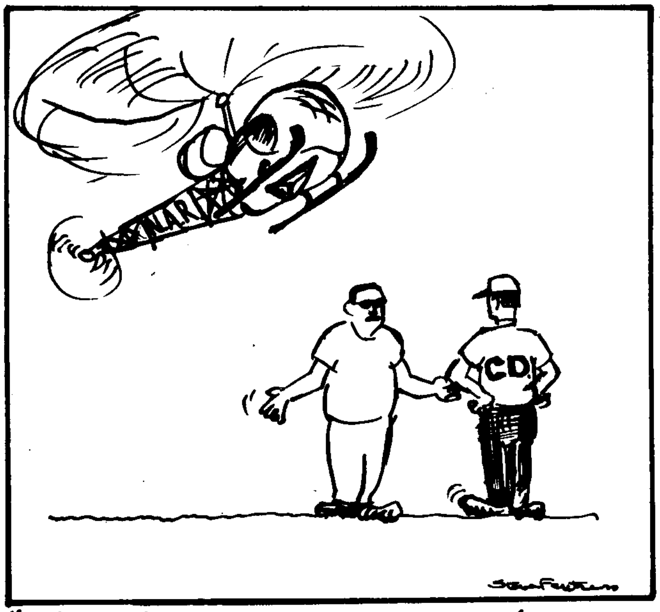
Prior to the outdoor firing of an F engine, Dr. Gregorek, right, confers by intercom with George Pantalos in the data center, while the Firing Officer, Chas Russell listens. Teamwork, as well as precision, is necessary for accurate measurements.

The rocket fires, and the test stand delivers the thrust-time curve for analysis.





Tests like these go on continually, both to certify the many new engines coming on the market, and to monitor the previously certified engines to assure the standards of the NAR are maintained.



"IT'S ONLY A LITTLE TECHNICALITY! IS THE NAR GONNA COME AND GET ME OR SOMETHING?"

NAR TRACKING DATA REDUCTION TABLE

One of the NAR services that seemed to have been lost in the conversion to the metric system was the NAR Range Flight Sheet altitude data reduction table for use with contest altitude data. Although Mr. G. Harry Stine made up a metric version of the Range Flight Sheet table and sent it to the NAR, the new version has never been printed. With the advent of the new NAR flight cards, it is no longer necessary to have the Range Flight Sheet. However, a Tracking Data Reduction Table is still needed for use with flight cards. The new table is used the same way as the old one. A complete explanation of altitude determination and the use of the NAR data reduction table is given in Chapter 12 of the Second Edition of the **Handbook of Model Rocketry**. The new table has been generated for a baseline of 300 meters. Also, it has been expanded to include azimuth and "B" angles greater than 90 degrees.

The new NAR tracking data reduction table is computer generated. The FORTRAN computer program used to generate the table is shown below:

```
C   NAR TRACKING DATA REDUCTION TABLE GENERATION PROGRAM
      INTEGER Y,Z,COPYS,A(180),V(180)
      DIMENSION S(180),T(90),DASH(30)
      DATA Y,Z/8,5/
      DATA BASE  /300./
      DATA A(180),S(180),T(90),V(180)/180,0.,1.E6,32767/
      DATA DASH /6*'----','--- ',2*'    ',6*'----','--  ',2*'    ',
     *          4*'----','-   ','    ','  --',4*'----','-   '/
      DATA DTR,PI/.0174532925,3.14159265/
C
      ROUND(X,A) = A*IFIX((X+.5*A)/A)
C    READ NUMBER OF COPIES DESIRED AND BASELINE LENGTH
      READ(Y,1) COPYS, IBL
    1 FORMAT(I2,I4)
      IF(IBL) 51,50,51
C   IF NO BASELINE INPUT USE 300 METERS
   50 IBL=BASE
      BASLN=BASE
      GO TO 52
   51 BASLN=IBL
C
C    COMPUTE TABLE VALUES
   52 DO 100 I=1,179
      A(I)=I
      RAD=I*DTR
      S(I)=SIN(RAD)
      IF(S(I)-.9999) 54,53,53
   53 S(I)=1.
      GO TO 55
   54 S(I)=ROUND(S(I),.001)
   55 V(I)=BASLN/SIN(PI-RAD)
  100 CONTINUE
      DO 200 I=1,89
      RAD=I*DTR
      T(I)=SIN(RAD)/COS(RAD)
   60 IF(T(I)-.9999) 197,61,61
   61 IF(T(I)-1.) 62,200,197
   62 T(I)=1.
      GO TO 200
  197 IF(I-45) 198,198,199
  198 T(I)=ROUND(T(I),.001)
      GO TO 200
  199 T(I)=ROUND(T(I),.01)
  200 CONTINUE
C
C    PRINT OUT TABLE(S)
      DO 300 N=1,COPYS
      WRITE(Z,2) IBL,DASH
    2 FORMAT('1',T44,'****** NATIONAL ASSOCIATION OF ROCKETRY ******'/
     *       '0',T52,'TRACKING DATA REDUCTION TABLE'/
     *       '0',T56,'BASELINE =',I4,' METERS'/' '/
     *'0ANGLE   SIN     TAN       V',10X,'ANGLE   SIN      TAN    V',11X
     *,'ANGLE  SIN      V' ,10X,'ANGLE   SIN      V'/' ',30A4)
      WRITE(Z,3) (A(I),S(I),T(I),V(I),A(I+45),S(I+45),T(I+45),V(I+45),
     *            A(I+90),S(I+90),V(I+90),A(I+135),S(I+135),V(I+135),
     *I=1,44)
    3 FORMAT(' ',I4,F8.3,F8.3,I7,10X,I3,F8.3,F8.2,I6,11X,I3,F7.3,I6,
     *10X,I3,F8.3,I7)
      WRITE(Z,4) A(45),S(45),T(45),V(45),A(90),S(90),V(90),
     *A(135),S(135),V(135),A(180),S(180)
    4 FORMAT(' ',I4,F8.3,F8.3,I7,10X,I3,F8.3,' INFINITY',I5,11X,
     *I3,F7.3,I6,10X,I3,F8.3,' INFINITY')
  300 CONTINUE
      STOP
      END
```

Those members and sections who have access to a computer may want to use the above program to generate tables to suit their particular baseline length. Remember, the minimum allowed baseline length is 300 meters.

A copy of the new table is included in this issue of the Model Rocketeer. Copies are also being sent with contest sanction packets. Either way, using the new table with the NAR flight cards will simplify altitude data reduction.

****** NATIONAL ASSOCIATION OF ROCKETRY ******

TRACKING DATA REDUCTION TABLE

BASELINE = 300 METERS

ANGLE	SIN	TAN	V
1	0.017	0.017	17189
2	0.035	0.035	8596
3	0.052	0.052	5732
4	0.070	0.070	4300
5	0.086	0.086	3442
6	0.105	0.105	2870
7	0.121	0.122	2461
8	0.139	0.140	2155
9	0.156	0.157	1917
10	0.173	0.176	1727
11	0.191	0.194	1572
12	0.208	0.212	1442
13	0.224	0.231	1333
14	0.242	0.249	1240
15	0.258	0.267	1159
16	0.275	0.287	1088
17	0.292	0.306	1026
18	0.309	0.324	970
19	0.326	0.343	921
20	0.342	0.363	877
21	0.357	0.383	837
22	0.374	0.403	800
23	0.391	0.423	767
24	0.406	0.445	737
25	0.422	0.465	709
26	0.437	0.487	684
27	0.454	0.510	660
28	0.468	0.532	639
29	0.485	0.554	618
30	0.499	0.577	599
31	0.515	0.601	582
32	0.529	0.625	566
33	0.545	0.648	550
34	0.559	0.675	536
35	0.574	0.699	523
36	0.587	0.726	510
37	0.602	0.754	498
38	0.615	0.781	487
39	0.629	0.810	476
40	0.642	0.839	466
41	0.656	0.868	457
42	0.669	0.899	448
43	0.681	0.932	439
44	0.695	0.965	431
45	0.707	1.000	424

ANGLE	SIN	TAN	V
46	0.719	1.04	417
47	0.731	1.07	410
48	0.743	1.11	403
49	0.755	1.15	397
50	0.766	1.19	391
51	0.777	1.23	386
52	0.788	1.28	380
53	0.799	1.33	375
54	0.809	1.38	370
55	0.818	1.43	366
56	0.828	1.47	361
57	0.839	1.54	357
58	0.847	1.60	353
59	0.857	1.65	349
60	0.865	1.72	346
61	0.874	1.79	343
62	0.882	1.88	339
63	0.891	1.95	336
64	0.898	2.05	333
65	0.906	2.14	331
66	0.913	2.25	328
67	0.920	2.36	325
68	0.926	2.48	323
69	0.934	2.61	321
70	0.940	2.75	319
71	0.945	2.90	317
72	0.951	3.08	315
73	0.955	3.27	313
74	0.960	3.49	312
75	0.965	3.72	310
76	0.970	4.01	309
77	0.973	4.33	307
78	0.977	4.70	306
79	0.981	5.14	305
80	0.985	5.66	304
81	0.987	6.31	303
82	0.989	7.12	302
83	0.992	8.14	302
84	0.994	9.51	301
85	0.996	11.42	301
86	0.998	14.30	300
87	0.998	19.08	300
88	0.998	28.64	300
89	0.999	57.29	300
90	1.000	INFINITY	300

ANGLE	SIN	V
91	0.999	300
92	0.998	300
93	0.998	300
94	0.998	300
95	0.996	301
96	0.994	301
97	0.992	302
98	0.989	302
99	0.987	303
100	0.985	304
101	0.981	305
102	0.977	306
103	0.973	307
104	0.970	309
105	0.965	310
106	0.960	312
107	0.955	313
108	0.951	315
109	0.945	317
110	0.940	319
111	0.934	321
112	0.926	323
113	0.920	325
114	0.913	328
115	0.906	331
116	0.898	333
117	0.891	336
118	0.882	339
119	0.874	343
120	0.865	346
121	0.857	349
122	0.847	353
123	0.839	357
124	0.828	361
125	0.818	366
126	0.809	370
127	0.799	375
128	0.788	380
129	0.777	386
130	0.766	391
131	0.755	397
132	0.743	403
133	0.731	410
134	0.719	417
135	0.707	424

ANGLE	SIN	V
136	0.695	431
137	0.681	439
138	0.669	448
139	0.656	457
140	0.642	466
141	0.629	476
142	0.615	487
143	0.602	498
144	0.587	510
145	0.574	523
146	0.559	536
147	0.545	550
148	0.529	566
149	0.515	582
150	0.499	599
151	0.485	618
152	0.468	639
153	0.454	660
154	0.437	684
155	0.422	709
156	0.406	737
157	0.391	767
158	0.374	800
159	0.357	837
160	0.342	877
161	0.326	921
162	0.309	970
163	0.292	1026
164	0.275	1088
165	0.258	1159
166	0.242	1240
167	0.224	1333
168	0.208	1442
169	0.191	1572
170	0.173	1727
171	0.156	1917
172	0.139	2155
173	0.121	2461
174	0.105	2870
175	0.086	3442
176	0.070	4300
177	0.052	5732
178	0.035	8596
179	0.017	17189
180	0.000	INFINITY

DEALER DIRECTORY

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

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

CONNECTICUT – Bridgeport
Model Rocketry & Radio Control
is our only business
FRED'S VARIETY
184 Success Ave. Bridgeport

CONNECTICUT – Bridgeport
Complete Rocketry Supplies
Is Our Specialty
Estes - Centuri - etc.
BOB'S HOBBIES
1542 Wood Avenue Bridgeport 06605

DELEWARE – Wilmington
All Major Rocket Lines
SIMPSON'S HOBBIES, INC.
709 Foulk Road
Wilmington, Deleware 19803
Mail Orders Ph: 654-5022

DELWARE – Wilmington
HOBBI-ART, INC.
4713 Kirkwood Highway
(302) 994-0281
9:30 AM to 5:30 PMWed, Th, Fri to 9 PM

FLORIDA – Gibsonton
Save!!! All Brands
Write for Lists and Discounts
PAT'S PLACE
P.O. Box 118
7:30 - 6 Mon. to Sat. 813-677-6310

GEORGIA – Smyrna
MILTON BRADLEY
2152 So. Cobb Dr.
Ph: 436-1581
Open 10 AM to 6PM
Mon, Thurs, Fri to 9:30 PM

ILLINOIS – Chicago
M & G HOBBY SHOP
3443 N. Pulaski Rd.
Chicago, Ill. 60641 Phone 539-5310

MARYLAND – Wheaton
HOBBIES UNLIMITED
Wheaton Plaza
Mon/Fri 10-9, Sat 10-6 949-3539

MASSACHUSETTS – Cambridge
CROSBY'S HOBBY CENTER
1704 Massachusetts Ave.
(617) KI7-4389
9 AM - 5:30 PM Thursday to 8:30 PM

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

MASSACHUSETTS – Walpole
Rocket Supplies by Fast Mail
Estes, Centuri, MPC, Cox
LAWCO SALES
PO Box 244
Walpole, MA 02081

NEW JERSEY – Burlington
FREEDMAN'S GIFT & HOBBY SHOP
228 High Street
Thurs - Fri: 9-9
Mon, Tues, Wed, Sat: 9-5:30

NEW JERSEY – Edison
Complete Rocket Supplies
EDISON CYCLE SHOP
238 Plainfield Ave.
Estes, Centuri, MPC, Bo-Mar, SAI, etc.

NEW JERSEY – New Brunswick
STEVE VARGA'S HOBBY SHOP
57 Easton Ave.
(201) 545-7616
Daily 10 AM - 7 PM Closed Sunday

NEW JERSEY – Princeton
Complete Rocket Supplies
Centuri - Estes - MRI - Space Age Ind.
NASSAU HOBBY
142 Nassau St. Princeton, New Jersey

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

NEW YORK – East Meadow
"World's Leading Hobby Store"
POLK'S HOBBY DEPT. STORE
2072 Front Street
East Meadow, Long Island
(516) 489-1166

MODROC CALENDAR

New Jersey Mini-Convention – October, 1970, the one day long convention will include discussion groups, a flight session, and post flight analysis. Open to all rocketeers. Contact: Mini-Convention, c/o Bob Mullane, 34 Sixth Street, Harrison, New Jersey 07029.

WESNAM-2 – October 4, 1970. Area meet open to NAR members from Mass., N.H., and Maine. Events: Hawk B/G, Egg Loft (20 N-sec limit), Class 2 Parachute Duration, Plastic Model (if this event is eliminated from the new "Pink Book", Streamer Spot Landing will be substituted). Site: Bridgewater, Mass. Contact: Trip Barber, MIT MRS, MIT Branch PO Box 110, Cambridge, Mass. 02139.

RASM-1 – October 17, 1970. Section meet sponsored by the Rockville Rocketeers, open to all NAR members not affiliated with any other Section in the Rockville, Maryland area. Contact: 949-3640.

PVARM-2 – October 18, 1970. Pascack Valley Annual Regional Meet. Events: Egg Lofting (10 nt-sec limit), Scale, Super Scale, Class 1 PD, Design Efficiency, Hornet B/G, and Open Spot Landing. Contact: Al Lindgren, 15 Hunter Ave., Fanwood, NJ 07023 or phone (201) 322-2248 in advance for entry forms.

MARS-V – October 23-25, 1970, Regional Meet sponsored by SSB Section, open to all NAR members from Maryland and neighboring states. Events: Sparrow Rocket Glider, Class 1 Drag Eff., Class 2 Streamer Dur., Robin Eggloft, Class 2 PD, Condor B/G, and Open Spot Landing. Site: Aberdeen Proving Grounds, MD. Contact: Howard Galloway, 428 Ben Oaks Dr., W. Severna Park, MD 21146.

ECRM-5 – April 16-18, 1971. Regional meet, sponsored by NARHAMS NAR Section, open to NAR members from Maryland, Virginia, North Carolina, Delaware, West Virginia, and Pennsylvania. Events: Scale, Sparrow B/G, Swift Rocket Glider, Class I PD, Class II Streamer Dur., Hawk B/G, Parachute Spot Landing. Site: Camp A. P. Hill, Va. Contact: J. Barrowman, 6809 97th Place, Seabrook, MD 20801.

ATTENTION
CONTEST DIRECTORS
Mail notices of your contests at least 90 days in advance for listing in Model Rocketry's "Modroc Calendar":
Modroc Calendar
Box 214
Astor Station
Boston, Mass. 02123

Rocketeers at the University of Alabama, or in surrounding areas, who are interested in forming an NAR Section should contact Mark Barkasy, PO Box 2564, University, Alabama 35486.

The Skylighters, a club in Covina, California, held a "science fair" on August 1, 1970. The exhibit featured actual missiles put on display by a number of aerospace manufacturers. Several local hobby shops gave away model kits in drawings, and members of the club brought their own models for display. Later at night the club had a "pot luck" supper, and after dinner a night launching was conducted.

An NAR Section is being formed in the Central Kentucky area. Interested rocketeers are urged to contact Mark Wells (NAR # 14472), 111 Circle Dr., Greensburg, Ky., or phone 932-4617.

The first issue of *Coundown,* newsletter of the Rockville, Maryland, Rocketeers NAR Section contains information on their planned Section Meet scheduled for October 17th at Fort Meade, Maryland. All NAR members not affiliated with any other club are invited to participate in the Rockville Section Meet (RASM-1). The scheduled events are Class 1 PD with an 18" parachute limit, Hornet, B/G, Sparrow B/G, Parachute Spot Landing, Streamer Duration, and Rocket Glider. See this month's "Modroc Calendar for info on who to contact for information.

The Advanced Rocket Studies of Hampton, Virginia, is looking for new members in the Hampton area. Interested rocketeers can contact Mike Conley, 99 Fort Worth, Hampton, VA 23369, or call 851-2338.

New Canaan, Connecticut's YMCA Space Pioneers have graduated another class of young rocketeers. In this year's graduating class were Bill Fraser, Dr. Alan Fraser, Edwin H. Goodwin, Rick Goodwin, David Heneberry, Mike Henneberry, Dave Mead, Mike Mooney, and Peter Way. New members are accepted into the Space Pioneers only once each year, in September, and they are required to attend a model rocke training course taught by the club's more experienced members.

Pittsburgh's Steel City Section has spent the last few months preparing a 16mm color, sound film documenting the club's activities. The five minute film, now completed, describes briefly the model rocket hobby and the Steel City Section. It will be used to introduce potential rocketeers to the club.

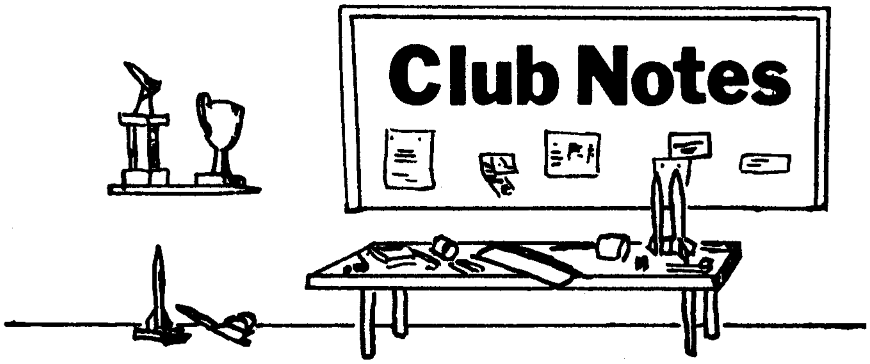
Send your club or section newsletters, contest announcements and results, and other news for this column to:

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

(From the Editor, cont.)

We can only speculate how many potential acquisitions the Smithsonian has turned down because of lack of space for storage or exhibition. The collection of relics from the US space program is particularly weak. Aside from the three missles currently on display in the driveway next to the Arts and Industry building, the Smithsonian's collection of missles and rockets consists of an A-4 (V-2) missle, several of Goddard's early rockets, an Agena, and the Mercury capsule flown by John Glenn on the first US manned orbital space flight. In some ways however, the missile exhibits are in better shape than the aircraft exhibits. At least the missiles are on display! Many, in fact most, of the aircraft owned by the Smithsonian remain in storage at the Preservation and Restoration Division at Silver Hill for lack of adequate display space and funds to finance restoration.

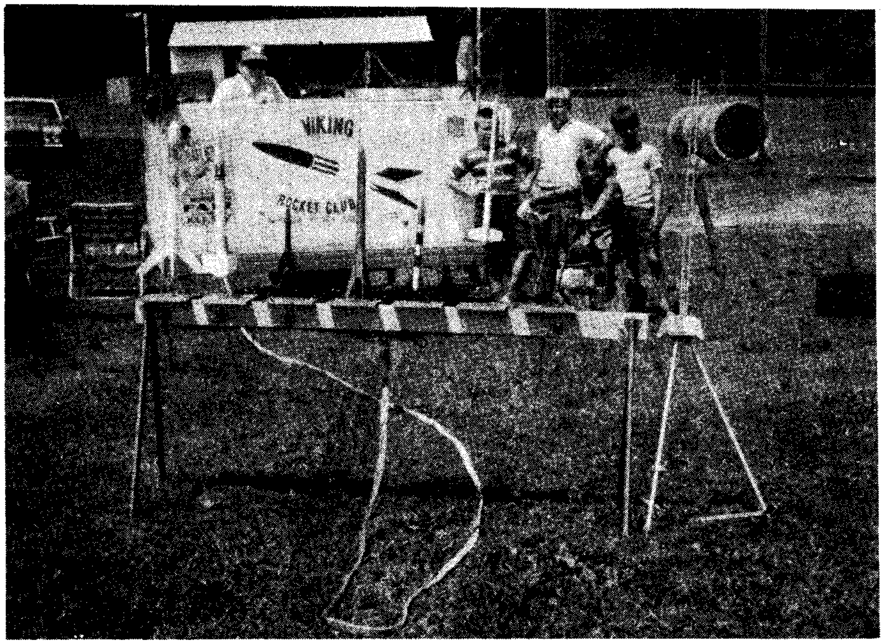
Anyone with a serious interest in the aerospace field must be concerned with the preservation of these historical aircraft and missiles. Concerned citizens are urged to write to their Representatives and Senators expressing their position on this question. Reference can be made to Senator Goldwater's discussion in the *Congressional Record* of May 19, 1970. As Senator Goldwater said in his discussion before the House Committee: "Who can say the true worth of preserving for future Americans the opportunity to behold the actual aircraft in which Lindberg crossed the Atlantic or the Apollo spacecraft in which man reached the Moon?"



The Rosenberg Aeronautical Society in Rosenberg, Texas, held its Second Annual Championship Meet on July 21, 1970. Three events were flown – Design Efficiency, Class I PD, and Workmanship. John Pendarvis took first place overall with 542 points. David Pendarvis was second with 402 points, and John Zodrow won third place with 241 points. The RAS is starting its fourth year of operation, and is interested in forming an NAR Section. Interested rocketeers and adults are invited to contact John Pendarvis, 2615 Sequoia Lane, Rosenberg, Texas 77471 or phone 232-6643

Terry Dean (NAR #161158) would like all NAR members in the state of Kentucky to contact him and "let him know of their existance and whereabouts." He is interested in the organization of an Ohio Valley Section in the State. Contact him at Lot 138, Morgan Street, Radcliff, Ky. 40160.

The latest issue of *The Modroc Flyer*, newsletter of the South Seattle Model Rocket Society, contains the results of SEA-MEE-III. In Swift B/G Jim Worthen topped the seniors with 1:41.5, while Mike Medina took first in junior with 1:20.9. In Design Efficiency Jim Worthen's 97 took senior first place, while Randy Sprague topped the juniors with 69.5. In Scale Jim Pommert took first in the junior division with an Asp, but the senior division could not be judged since there was only one entry. Plastic model saw a number of unusual conversions (along with the standard ones). In first place was Jim Schuchman with a Revell LM, while Jim Pommert took second with a Revell Mercury Atlas which employed no clear plastic fins and nonetheless proved stable, and Randy Sprague took third with a Lindberg Mars Probe. In Open Spot Landing Phil Berg triumphed among the juniors with a 8'5", while Ron Pera took first in Senior division with 45'5".



During its first year of existance the Viking Model Rocket Club of Morris County, New Jersey, has launched over 2,000 model rockets. The club's 63 members meet on Sunday afternoon at Heistein's Pond in Randolph Township for launching activities. The club now owns two 8 position launchers which were specially designed so that they can be mounted on a trailor for easy transport. Rocketeers interested in more information about the Viking Model Rocket Club can contact Floyd Beebe, 1 Oak Street, Wharton, New Jersey.

Rocketeers interested in forming an NAR Section in the Champaign, Illinois area are invited to contact Gregory Smith, 917 W. Columbia, Champaign, Ill. 61820.

The Wolverine Rocketeers of Detroit recently held their annual election of officers, and Paul Serowik was selected Advisor; Frank Mathison, Chairman; Larry Simon, Activities Coordinator; Paul Serowik, Treasurer; Woodrow Woo, Recording Secretary. Presently the club is planning a large demonstration launch. Rocketeers in the metropolitan Detroit area are invited to contact Larry Simon at (313) 398-9842 or 12661 Hamburg, Detroit, Michigan.

The Salisbury-Allentown Rocket Club (SARC) in Allentown, Pennsylvania is conducting a membership drive. Interested rocketeers should contact Jeff Risberg at 2924 Meadowbrook Circle, Allentown, or call 435-5425. Among the club's planned activities is a "Wacky Rocket" contest in which "entries will be judged on wakiness, originality, and craftsmanship" according to the announcement in their newsletter *The SARC Spark*.

The Evanston Model Rocket Association of Evanston Illinois, is looking for qualified NAR members from the area in order to form a Section. Presently, EMRA has at its disposal ample tracking and communications equipment. R&D projects underway by members of the association include transmitters, computer programs, and the construction of a wind tunnel. Interested rocketeers in the Evanston area should contact John Fox, 1103 Sheridan Road, Evanston Ill. 60202 or call 864-4454.

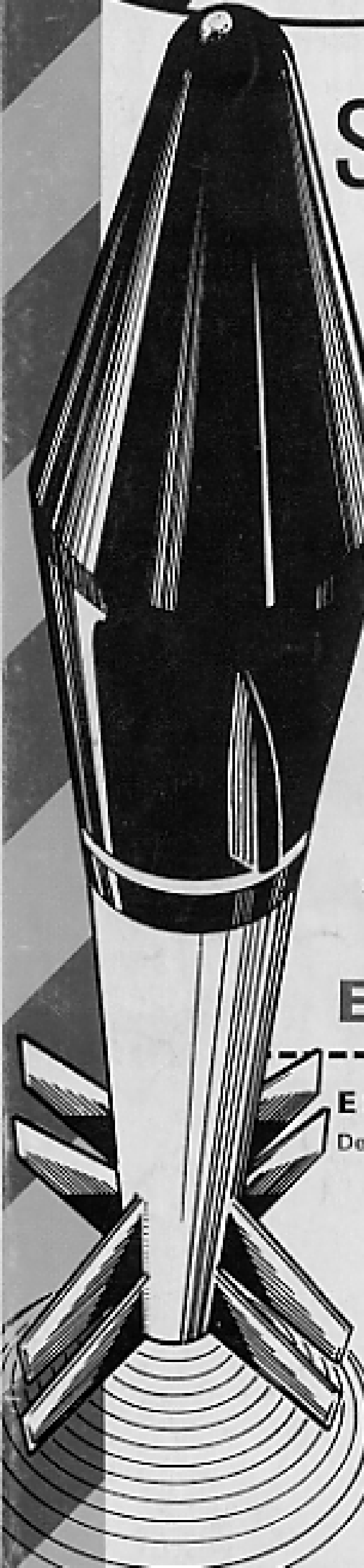
The Annapolis Association of Rocketry reports the results of their second NAR sanctioned Area Meet – a meet between AAR and the Washington DC area MARS Sections. The contest, held June 27th, was flown at Southern High School in Harwood, Maryland, in clear weather but with wind gusting up to 20 mph. The best PD time turned in was 58.2 sec. by Jim Joines, a new Senior member of AAR. Don Larson of MARS took the B/G event with 41.3 seconds. In Spot Landing Fred Clark, another AAR Senior, took first with 30'6". Overall AAR edged out MARS by a score of 468 points to 442 points.

The Point Place Model Rocket Club was formed in Toledo Ohio, during the spring. Presently the club has 60 members, and is in the process of chartering as an NAR Section. Thus far they have had two Trophy Meets as well as six Fun Meets under the direction of president Bill Kuehling, and vice-president Roy Bailey. Rocketeers in the Toledo area interested in joining the club should contact Barbara Bailey, 4608 262nd Street, Toledo, Ohio 43611, or call 726-7564.

(Continued on page 39)

ESTES

launches a SPACE SPECTACULAR *with* FREE ROCKET KITS *for you!!*



You can get Free Rocket Kits at your participating hobby dealer during the Estes Space Spectacular.

Your hobby dealer – in cooperation with Estes, the leader in model rocketry – has a special Customer Bonus Plan for you. With every $5 purchase – you get another kit, FREE! The more Estes rocket kits you buy, the more free kits you get!!

Get the best value from your hobby dollar from Estes, the company that makes four out of every five model rockets sold.

Estes has sold more than five million rockets – from the simplest kits that get you started to the ultra-sophisticated rockets that qualify you as an expert in the model Space Age.

Check it out with your dealer. Tell him you want to get in on the

ESTES SPACE SPECTACULAR!!

ESTES INDUSTRIES, INC.

Dept. 31-G / Penrose, Colorado 81240

If no dealer near you, write us direct.

Payment enclosed. Please send me:

- ☐ **KS-2:** Alpha Kit, 3 engines, design manual, instructions **$2.25**
- ☐ **KS-7:** Same as above plus porta-pad and launch control system . . **$7.00**
- ☐ New color-illustrated 144-page catalog (free with order) . . . . **$ .25**

NAME ______________________________

ADDRESS ______________________________

CITY ______________ STATE ______________ ZIP ______________