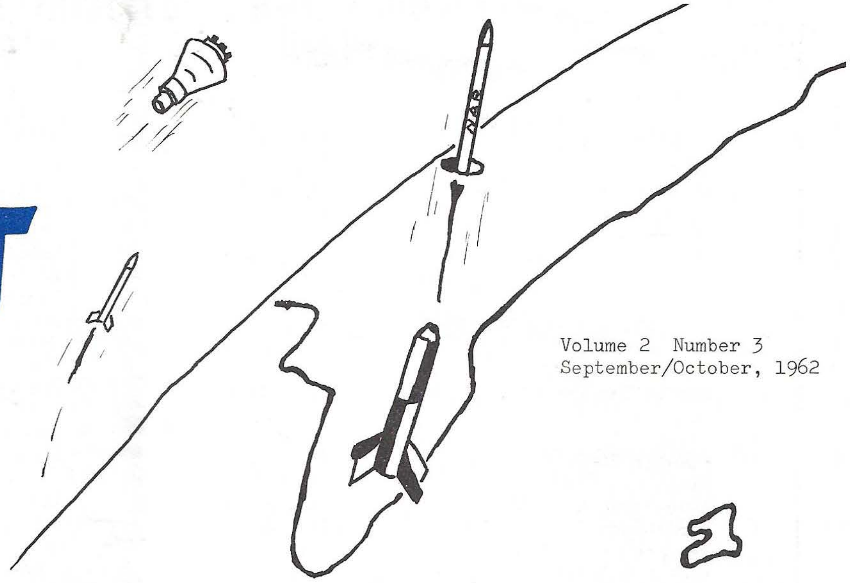
MODEL ROCKET NEWS



Volume 2 Number 3
September/October, 1962

NARAM-4: Biggest Yet

The Peak City Section of the NAR remained the champion section for the second year in a row as it emerged from NARAM-4 with 1912 points. Members of the section, Doug Hylton and Tom Rhue, became the Senior and Junior champions with 357 and 217 points respectively.

This year's contest was held on the newly constructed Red Sands rocket range at the Air Force Academy near Colorado Springs. The meet began at 8 am, Thursday, August 23 and closed with the presentation of trophies and awards at 3 pm on the 26th. NARAM-4 was the largest NARAM to date, with more contestants and more rockets than any other rocket competition ever held.

The first events of the meet on Thursday morning were spot landing and parachute duration. During the course of Thursday morning all contestants were issued small pink cards inscribed NARAM-4 MOMWATS. They were instructed to keep the cards with them at all times, and present them to any official on request. The contestants soon learned that presenting the card to an official resulted in a distinctive hole punched in the card.

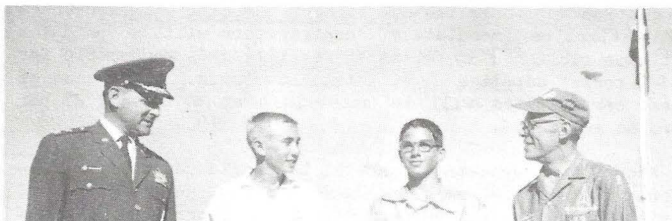
Thursday evening the adults met at the Roe residence for their annual meeting, while contestants were conducted on a tour of the NORAD blockhouse south of Colorado Springs.

Friday was a day for breaking records, with new records set in each of the five events flown on that day: Open Altitude, Open Payload, Open Scale Altitude, Class B Payload, and Double Pee Wee Altitude. An an example of what it takes to be competitive at a NARAM, the Double Pee Wee (A booster, ½A upper stage) record, set by Paul Hans, was 1960 feet.

Saturday brought the Research and Development event, which contained some research second in intensity only to that carried out by rocketeers whose birds were declared unstable by the safety officer. Lt. Bryant (Red) Thompson took a second with his rocket which had three engines, one on top of the other, all in the same body. Third place in the Senior division went to Capt. David Barr for his work on the use of feathers for fins. Wesley Wada took a second in the Junior division with his work on rudders for boost gliders, and third place in that division went to Gordon Mandell, who carried out an exhaustive research program on canard wing boost gliders. Junior division first place was taken by the Hans-Scott team with their movie camera rocket, while first in the Senior division went to Doug Hylton for his work on tandem engines.

Sunday brought the event which had excited the most interest of the meet -- Boost Glide Duration. This was the first boost glide contest held at a NARAM. In fact, the first recorded successful boost glider had been an R&D entry at NARAM-3 (MRN, October, 1961). Speculation as to the outcome of this event had begun many months before, and quite a number of people intended to break the record of 1:02, held at that time by Vern Estes.

YOUNG ROCKETEERS AT WORK PREPARING TO CHECK THEIR MODELS FOR STABILITY IN THE ESTES INDUSTRIES WIND TUNNEL, A PART OF THE ESTES INDUSTRIES DISPLAY AT NARAM-4. AT THE FAR LEFT IS THE 3-D ALTITUDE COMPUTER, THE ONLY ONE OF ITS KIND, WHICH GIVES INSTANT, DIRECT, THREE DIMENSIONAL READINGS OF ROCKET ALTITUDES.



AIR ACADEMY SUPERINTENDANT MAJ. GEN. WARREN, SENIOR CHAMPION DOUG HYLTON, JUNIOR CHAMPION TOM RHUE, AND CHAMPIONSHIP SECTION ADVISOR WILLIAM ROE, SHORTLY AFTER THE PRESENTATION OF AWARDS.

NARAM-4 Official Results

EVENT	FIRST PLACE	SECOND PLACE	THIRD PLACE
Spot Landing	James Scott	Tom Rhue	Paul Hans
Parachute Duration	Paul Hans	David Bell	Gary Wright
Class B Altitude	Gary Wright	Greg McBride	Ted Walford
Class F Scale Alt. (J)	Chuck Mauro	Jim Petrenas	- - - - - - -
Class F Scale Alt. (S)	Bryant Thompson	Doug Hylton	David Barr
Class BA Altitude	Wesley Wada	Harry Stine	- - - - - - -
Open Altitude (J)	Tom Rhue	Gary Wright	- - - - - - -
Open Altitude (S)	Harry Stine	David Barr	- - - - - - -
Open Payload (J)	Jim Petrenas	Wesley Wada	Paul Hans
Open Payload (S)	David Bell	David Barr	- - - - - - -
Open Scale Alt. (J)	Paul Hans	Gordon Mandell	Don Scott
Open Scale Alt. (S)	Bryant Thompson	Harry Stine	Charles Hans
Class B Payload	Greg McBride	Gordon Mandell	Harry Stine
Double Pee Wee Alt.	Paul Hans	Gordon Mandell	Chuck Mauro
Scale (J)	John Essman	Dick Roebken	James Scott
Scale (S)	Bryant Thompson	David Barr	- - - - - - -
Plastic Scale (J)	Paul Hans	John Essman	Gordon Mandell
Plastic Scale (S)	Harry Stine	- - - - - - -	- - - - - - -
Aero-Space Systems (J)	Paul Hans	Gordon Mandell	Chuck Mauro
Aero-Space Systems (S)	Bryant Thompson	Doug Hylton	Harry Stine
Research & Dev. (J)	Hans-Scott Team	Wesley Wada	Gordon Mandell
Research & Dev. (S)	Doug Hylton	Bryant Thompson	David Barr
Pee Wee Altitude	Chuck Mauro	Ronney Webster	Charles Hans
Class A Scale Alt. (J)	Paul Hans	Don Scott	Gordon Mandell
Class A Scale Alt. (S)	Charles Hans	Doug Hylton	Bryant Thompson
Boost-glide Duration (J)	Ted Walford	John Essman	James Scott
Boost-glide Duration (S)	Vernon Estes	Charles Hans	Leroy Piester

Somehow, though, the challengers may have failed to consider the thin air of Colorado, for only one glider broke the one minute mark on the first round: Vern's Space Plane with a record breaking 72 seconds. The second flights on boost gliders came up, and again, only one flight over one minute. This time Vern's glider went out of sight, still several hundred feet up, setting a new record of 1:22.

Sunday afternoon brought another event which aroused great interest: the eggonaut event. This was a non-contest event brought on by Dave Barr's opinion that no one should attempt to launch a live payload until he has successfully launched and recovered a grade A large, fresh hen's egg, with the shell uncracked and the yolk undisturbed. G. Harry Stine and Dave Barr proceeded to scramble their eggs when their rockets landed a little too hard. Then Paul Hans and Don Scott brought out their converted camera rocket. The rocket reached an altitude of ten feet on its first flight, due to the lug binding on the rod. However, the egg was still intact. Not satisfied, the rocket was loaded again, and the boys took steps to insure that the rocket would not bind on the rod again. This time the rocket rose to an estimated 1,000 feet, the capsule drifted slowly back by parachute, landed gently, and was carried back to the firing area for inspection. Not only was the shell uncracked, but further examination revealed that the yolk was also undisturbed.

The contest was closed with the presentation of awards by Major General Robert H. Warren, Superintendant of the Air Force Academy. The final award, following the championship awards, was a large decorated bath towel, inscribed NARAM-4 MOMWATS (My Oh My, What A Tough Situation). This was the crying towel, awarded to Steve Kushnir, the man with the most holes on his card representing the most complaints to the judges. In all fairness to Steve, though, it must be admitted that several of the officials had more holes in their cards, but being officials, were ineligible for the award.

Writer's Program Announced

In order to encourage the development of the literary skills needed by America's future scientists in the communication of their ideas, the Model Rocket News announces that effective immediately, contributors will be paid for articles published by means of certificates redeemable for model rocket supplies from Estes Industries. The value of these certificates will be determined at a rate of 2¢ per word as published.

Among the subjects which will be considered for publication are technical reports, news stories, explanations of various facets of space science, and reports on various model rocket construction projects. The rocketeer is encouraged to submit any article which he feels will be of general interest to other modelers.

Manuscripts should be typed double spaced on 8½" x 11" paper, and cannot be returned unless accompanied by sufficient postage. All articles must be accompanied by a statement signed by the contributor, and if he is a minor, by his parent or guardian, certifying that the article is his own original work. Articles published become the property of the Model Rocket News. The Model Rocket News reserves the right to edit or alter any articles published, and will not be responsible for lost manuscripts and photos.

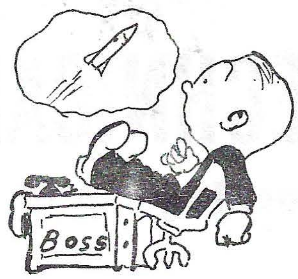
The Model Rocket News

Vernon Estes, Publisher — William Simon, Editor

The Model Rocket News is published approximately 6 times annually by Estes Industries Inc., Box 227, Penrose, Colorado. It is distributed free of charge to all of our mail order customers from whom we have received substantial orders within a period of one year. The Model Rocket News is distributed for the purpose of advertising and promoting a safe form of YOUTH rocketry, and for informing you of new products and services available from our firm. You rocketeers can contribute in three ways to help us in advancing this scientific hobby.

(1). Write us concerning things you and your club are doing in this field which you think would be of interest to others.
(2). Keep supporting us in our development program by purchasing your rocket supplies from us. We are working as fast as we can. Every spare dime we get goes back into research and development, but it takes a heck of a lot of dimes to develop a new kit or a new rocket engine.
(3). Write us about our products, what you like, what you don't like, new ideas, suggestions, etc. We may not have time to answer all of you personally, but we will read every word.

NOTES FROM THE BOSS



We had a great time at NARAM-4, flying rockets, making new friends, getting together with old friends, and getting sunburned. Looking back, though, one thing stands out: NARAM-4 couldn't have been held if it weren't for the people who carried out all the many tasks necessary, who looked after the many details, and thought ahead so that the meet could be run in an orderly manner.

Among those deserving recognition for their work are Capt. Van Vonderen, the contest director; Capt. Barr, who handled data reduction; Mr. Roe, who was generally busy doing everything all at once; Capt. Barnes, who arranged for the academy site; and Mr. Hylton, who built the range almost singlehandedly.

Steve Kushnir, who won the MOMWATS crying towel did more than complain to the judges. Preliminary reports indicate that he logged more hours than anyone else manning tracking scopes, a necessary and thankless job. There are many others who deserve the highest praise for the way they quietly did their jobs, and the fact that NARAM-4 was a success is a monument to them. These people, who without expectation of reward or applause get out and do what needs to be done have made the sport of model rocketry what it is today and will make it even more in the years to come.

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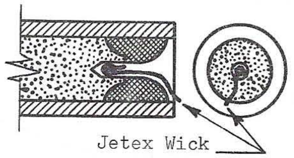
During the past few months since the writing of the Multi-Stage Report several changes have become necessary. Engines have been changed slightly since the original report was written, and now have somewhat longer nozzles. The longer nozzle gives more uniform thrust, but the ignition gasses from the booster engine now have a harder time getting through the upper stage engine's nozzle to ignite it. As a result, the reliability of upper stage ignition has dropped slightly. To increase reliability, a method of using jetex wick has been evolved.

A piece of wick about 1" long is folded at one end and inserted into the upper stage engine nozzle in a manner similar to that used with the old Electro-Launch system. The protruding tail of the wick is bent over to follow the curve of the expansion section of the nozzle and leave a clear path to the folded section which is in contact with the fuel of the engine.

In operation, when burnout in the lower stage engine occurs, the blast of hot gases and burning particles is sent forward, and the ignition flame can ignite any section of the wick, or can go into the nozzle and ingite the folded section of the wick. In this way the time delay between lower stage burnout and upper stage ignition is kept to a minimum, while the reliability is increased to almost 100%.



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Penrose is now the home of a new NAR section, the Astron Rocket Society. With a section close at hand, we'll be able to develop more new designs and equipment. Already developmental work on firing systems is being carried out in connection with the section, and should result in a complete article within the next few issues. We'll be passing on other things to you as they come up, including information on the shop equipment of the section.

If you would like to see a model rocket group established in your area, and need some help to get it going, send us the name and address of your science instructor and we'll send him extensive information on model rocketry. We feel that this information will speak for itself and should encourage an active program in many areas. Already model rocketry is in use in classrooms in Pueblo, Colorado; Kansas City, Missouri; Burke, South Dakota; Elkhart, Indiana, and many other places. If your area isn't one of these, why not see about starting a program in your area? Fill out the space on the Clip 'n' Mail page, and we'll see what we can do.

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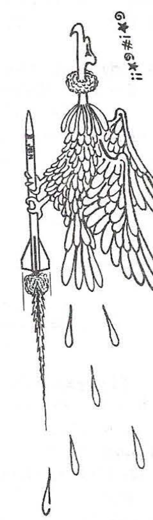
The Plan Exchange Program announced on the Clip 'n' Mail page should provide a good opportunity for rocketeers to share ideas. This program is something like a game of roulette: You don't know what will turn up in the mail. Of course, if every rocketeer sends in a good design, every rocketeer will get a good one back. But we can't say in advance what you will receive. However, if you build the rocket and it prangs in under power on the first flight, you can always write to the person who designed it and chew him out. In fact, if you're interested in finding a rocketeering pen pal, this should provide a good opportunity. So good luck and good flying.

BOOST-GLIDER DESIGN CONTEST

Send us your own boost-glider model rocket design and win one of these great prizes!

1st Prize--$50 in merchandise credit
2nd Prize--$25 in merchandise credit
3rd Prize--$10 in merchandise credit
4th Prize-- $5 in merchandise credit

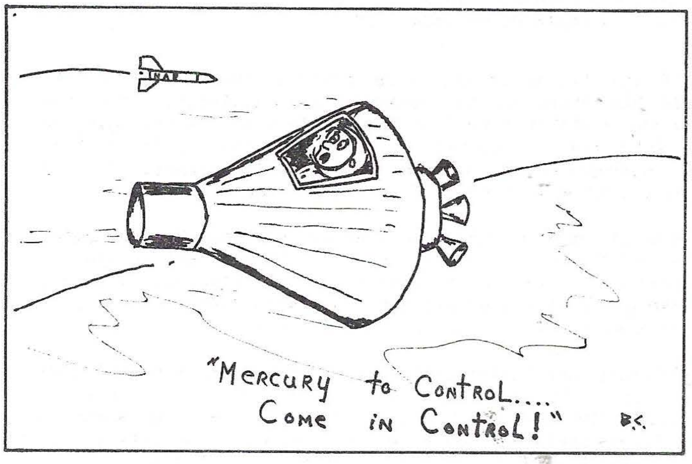
Winners will be notified by mail



CONTEST RULES

1) All plans must be drawn to scale. Pencil or ink drawings are acceptable.
2) A parts list must accompany entry.
3) All entries must be flight tested to assure that they have suitable flight characteristics.
4) Only boost-glider designs will be qualified.
5) The decision of the judges is final.
6) All plans submitted become the property of Estes Industries, Inc.
7) Entries must be postmarked no later than midnight, December 31, 1962.
8) No plans or designs will be returned.

If you do not have any experience with boost-gliders, you might be wise to study and build a Space Plane Kit to gain experience before designing your own glider.



ESTES INDUSTRIES TECHNICAL REPORT

Altitude Tracking

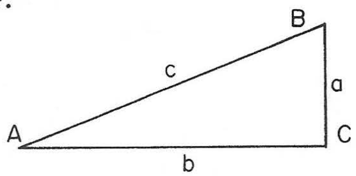
Part 1

Every rocketeer asks the question: "How high did it go?" However, previously few model rocketeers had facilities to determine altitudes with any reasonable degree of accuracy. Some have attempted to find the altitude achieved by their rockets by the use of a stop watch, but this method is so highly inaccurate that the computed altitude may fall anywhere within 200% of the actual altitude. Several years of experience among model rocketeers have proven that optical systems are the only practical systems for finding altitudes with any reasonable degree of accuracy.

The use of an optical tracking system requires the use of mathematics. The particular field of mathematics which is used the most in altitude computation is trigonometry. While this field is normally considered an advanced high school subject, any rocketeer can master its basics and apply them to his rocketry activities. If the rocketeer masters a few simple processes, he is ready to solve almost any problem in altitude computation.

One of the first principles of trigonometry is that all of the angles and sides of any triangle can be found if any three of its parts, <u>including</u> one side are known. Now every triangle has six parts: three angles and three sides. So if we know two angles and one side, we can find the other angle and the other two sides.

In determining the height of a rocket we collect two types of data: Distances and angles. This data is used to create a triangle which is a model of the lines which would join the tracker and the rocket, the rocket and a point directly below it on the ground, and the point on the ground and the tracker.



In the diagram above, point A represents the tracking station, B the rocket at its maximum altitude, and C a point on the ground directly below the rocket. The angle formed by the lines at C is then a right angle (90°). Since there are 180° in the angles of a triangle, if we know angle A, we can find angle B, since B = 180° - (A + C), or B = 90° - A. (In trigonometry, a capital letter represents an angle, a small letter represents a side. The small letter "a" will always be used to represent the side opposite angle A, "b" the side opposite B, etc. Two capital letters together represent a distance. Thus BC represents the distance from angle B to angle C, or side "a.")

At the firing range, A is found by the tracker when he locks his scope at the rocket's peak altitude. If we now know the distance from A to C, or side b of the triangle, we can find side c and side a. Side a is the one in which we are interested: It is the height of the rocket. This of course assumes that angle C is a right angle.

Now if we only use one tracker, we have the problem of knowing only one angle and one side. This is not enough information to solve the other sides of the triangle. However, we can guess at one of the unknown angles, and obtain a good approximation of the height achieved by the rocket.

If only one elevation tracker is used, it is a good idea to station him at a right angle to the wind flow. For example, if the wind is blowing to the west, the tracker should be either north or south of the launcher. In this way we will keep the angle at C as close to a right angle as possible. By experimenting with a protractor and a straight edge, the rocketeer can demonstrate why the error would be less if the tracker is on a line at a right angle to the flow of the wind.

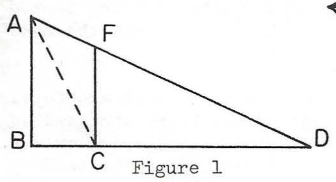


Figure 1

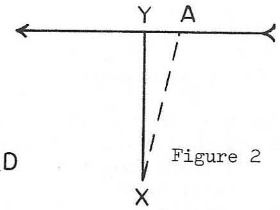


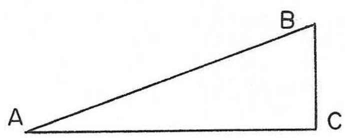
Figure 2

In the diagram above, the wind is blowing from B to D. The rocket is launched at point C, weathercocks into the wind, follows approximately line CA, and at its maximum altitude is at point A. If the tracker is downwind from the launcher, he will see the rocket at point F, and compute the altitude as the distance from C to F. So his computed altitudes will be considerably lower than the true altitude. On the other hand, if the rocket drifts toward him, his computed altitude will be considerably higher than the true altitude.

However, if the tracker is at point X in figure 2 and the launcher at Y, then the rocket will appear to be at point A as in figure 1, although the distance from the tracker to point A will be slightly greater than the baseline used in computing the altitude, the error will not be nearly as great. Also, the small additional distance will serve to make altitude readings more conservative, as the baseline is increased.

So by observing the proper relation between wind direction and the position of the tracker, we can generally determine within 90% accuracy the altitude the rocket reaches from data given by only one elevation tracker. Of course, the closer the rocket flight is to the vertical, the more accurate will be the figures obtained. Thus on a calm day with a good model, we can approach almost perfect accuracy.

The method used to determine altitude with one tracker is outlined in the next section. Bear in mind that this system assumes that the flight will be almost vertical, if not completely vertical. The rocketeer would do well to master this system before going on to more complex systems, as this method is used as a part of the more complex procedures.



Assuming a vertical angle of flight, we can proceed to call angle C a right angle or 90°. In that case, B would equal 90° - A, since the sum of the angles in a triangle is 180°. Hence to determine distance BC, or the height achieved by the rocket, we take the tangent (abbreviated tan) of angle A times the distance AC (distance from tracker to launcher). For example, if the distance from the tracker to the launcher is 250 feet, and the angle observed at the rocket's maximum height is 62° (read from the scope after it has been locked), we look in the table of trigonometric functions and find the tangent of 62°, or 1.88, multiply this times 250, which gives us 470'. Standard practice dictates that all altitude figures be rounded off to the nearest ten. So if the angle observed at 250' is 53°, we have 1.33 x 250 = 332.5, which is rounded off to the altitude 330 feet.

Table of Tangents

Degree	Tangent	Degree	Tangent	Degree	Tangent
0	.00	30	.58	60	1.73
1	.02	31	.60	61	1.80
2	.03	32	.62	62	1.88
3	.05	33	.65	63	1.96
4	.07	34	.67	64	2.05
5	.09	35	.70	65	2.14
6	.11	36	.73	66	2.25
7	.12	37	.75	67	2.36
8	.14	38	.78	68	2.48
9	.16	39	.81	69	2.61
10	.18	40	.84	70	2.75
11	.19	41	.87	71	2.90
12	.21	42	.90	72	3.08
13	.23	43	.93	73	3.27
14	.25	44	.97	74	3.49
15	.27	45	1.00	75	3.73
16	.29	46	1.04	76	4.01
17	.31	47	1.07	77	4.33
18	.32	48	1.11	78	4.70
19	.34	49	1.15	79	5.14
20	.36	50	1.19	80	5.67
21	.38	51	1.23		
22	.40	52	1.28		
23	.42	53	1.33		
24	.45	54	1.38		
25	.47	55	1.43		
26	.49	56	1.48		
27	.51	57	1.54		
28	.53	58	1.60		
29	.55	59	1.66		

Why do we use the tangent to determine altitude? The tangent of an angle is the ratio of the opposite side to the adjacent side, or in other words, the opposite side divided by the adjacent side. In this case, the adjacent side is the distance from the tracker to the launcher, and the opposite side is the distance from the launcher to the rocket's peak altitude.

Kind souls of many years ago were nice enough to determine the tangents for all angles of right triangles, so we have a table which lists them. Since the tangent of the angle equals the opposite side divided by the adjacent side, or in the case of our first example, 470 divided by 250, by multiplying the quotient times the divisor we find the dividend. In our case, the quotient or tangent is 1.88, the divisor 250, and the dividend 470.

There are other places where the tangent can be used. If we know sides a and b of a right triangle, but do not know either angle A or B, we can determine these angles by dividing the side opposite from the unknown angle by the side adjacent to the angle to find the tangent of the angle. We can then find the nearest tangent in a table of trigonometric functions, and find the corresponding angle.

SUMMARY

(1) In single station elevation tracking, we make sure that the line from the tracking station to the launcher is 90° from the direction of wind flow.

(2) The angle of flight is assumed to be vertical.

(3) The tracking scope is locked at the rocket's maximum altitude, the angle read, and the tangent of the angle found.

(4) The tangent is multiplied times the distance from the tracker to the launcher, giving the rocket's altitude.

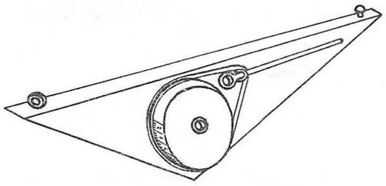
Part II of this report, which will appear in the next issue of the Model Rocket News, will cover the use of two elevation trackers. For additional information on the trigonometric methods used to determine altitudes of rockets, consult your math teacher, any encyclopedia article on Trigonometry, or books in your school and public libraries such as school texts. The many other applications of trigonometry, such as determining effective thrust obtained from engines mounted at angles will also prove interesting.

New Products

Altiscope

The new Altiscope is the optical elevation tracker designed especially for use with the tracking system described in this issue. The Altiscope is easy to use, durable, accurate, economical, and versatile. An attached table of trigonometric functions allows easy conversion of angle readings to altitude figures. Altiscope is unique among tracking devices, as it has been designed especially for the use of model rocketeers. The Altiscope comes in kit form, requires less than 15 minutes to assemble, and will add greatly to the enjoyment and scientific possibilities of your model rocketry program.

The Altiscope can also be used for finding heights of trees, poles, buildings and similar objects, for measuring inclines and grades, as an aid to mapping, and for many other purposes. In kit form, complete with instructions for use and trigonometric tables, the Altiscope costs only $2.50, and is ordered by Cat. #261-A-1.



WHITE GLUE

This is the glue especially recommended for use in constructing model rockets. It sets quickly, and will give a super-strength joint with all porous materials such as wood, paper, and cloth. This glue comes in a reusable plastic squeeze bottle, costs 40¢ for approximately 2 oz., and is listed as Cat.#261-WG-1.

BATTERIES

These are high quality size D photoflash batteries, and are the type specified for best results with the Electro-Launch. These batteries, when fresh, will deliver up to 16 amperes of current on a dead short, and will quickly and continually heat the #32 nichrome wire used in the Electro-Launch. These photoflash batteries are listed as Cat. #261-PFB-1, and cost 30¢ each post paid. (Four batteries are required for the Electro-Launch.

SANDPAPER

This sandpaper is especially good for shaping balsa parts for model rockets, and is available in three grades, medium, fine, and extra fine. Four different assortments of this high quality abrasive are available, three sheets medium, Cat.#261-SPM-1, 10¢; three sheets fine, Cat.#261-SPF-1, 10¢; three sheets extra fine, Cat. #261-SPEF-1, 10¢, and nine sheets assorted (three of each) Cat.#261-SPA-1, 25¢. All sheets are 3" x 3".

PRODUCTS NOT SO NEW ANY MORE, BUT NOT LISTED IN THE CATALOG:

MULTI-STAGE REPORT

This is the technical report on multi-stage rockets, a must for model rocketeers who wish to build high performance rockets. Cat.#261-TR-2, 25¢ each.

BALSA REINFORCING MATERIAL

A treated paper material with a strong adhesive on one side for reinforcing balsa surfaces. Use of it easily doubles the strength of balsa parts, and eliminates the need for sanding the surface, as well as providing a good surface for painting. In 3 x 9 inch sheets, Cat.#261-BRM-1, 10¢ per sheet, 20¢ for three sheets.

MODEL ROCKET GLOSSARY

Acceleration: The rate of increase in the speed of an object. Acceleration is generally measured in terms of "G's," one "G" being the rate at which a dropped object accelerates under the force of gravity, or 32 feet per second per second.

Accelerometer: A device for the measurement of acceleration.

Average Thrust: The total impulse of a rocket engine divided by its time duration; this is the thrust that an engine would have if its thrust were constant from ignition to burnout.

Blow Through: An engine failure in which the nozzle is retained and the propellant blown out the forward end of the casing. Lower stage engines have a certain amount of blow through designed into them to provide hot gases for the ignition of the following stage.

Booster: A separate, detachable portion of a rocket containing its own engine, used to impart an initial velocity to the rocket before the ignition of the upper or main portion of the rocket. The booster separates from the rocket when the following portion is ignited. For further information, see technical report TR-2.

Boost Glider: A rocket design type which ascends vertically during the powered phase of its flight and becomes a gliding object after the activation of the ejection charge.

Burnout: The point at which a rocket engine ceases to produce thrust; generally the point at which all propellant has been burned.

Burnout Velocity: The speed of a rocket at the time of burnout.

Burnt Weight: The weight of a model rocket engine alone after all propellant has been expended. The weight of a model rocket engine after propellant, delay, and ejection charges have been expended.

Center of Gravity: The point in a rocket around which its weight is evenly balanced. The point at which a model rocket will balance on a knife edge.

Center of Pressure: The center of all external air pressure on the complete rocket including the body and fins. See TR-1

Chamber Pressure: The pressure exerted on the walls of the combustion chamber of a rocket engine by the burning propellant gases. Usually measured in pounds per square inch.

Cluster: A group of rocket engines set up to work as a unit. The total thrust of a clustered unit is equal to the thrust of all the individual engines added together.

Deceleration: The rate of decrease in the speed of an object. Deceleration is generally measured in "G's."

Delay Charge: A slow-burning hemical composition loaded into a model rocket engine during manufacture to provide a time delay between burnout and the activation of the recovery system.

Direct Ignition: A system of igniting the rocket engine propellant grain which is completely electrical, using no fuse, squib, or wick.

Drag: Aerodynamic forces acting to slow an object in flight. Because of their low weight to area ratio and high velocities, model rockets are especially susceptable to these forces.

Ducted Propulsion: A system of producing thrust in which air is drawn into a tube and accelerated by the exhaust gases of the engine to increase the thrust normally given by the engine. Any propulsive system which passes the surrounding atmosphere through a channel or duct while accelerating the mass of air by a mechanical or thermal means.

Duration: The length of time during which a model rocket engine produces thrust. The length of time during which a model rocket is airborne.

Elevon: The control surface on a single wing boost glider. This surface is designed to change, upon activation, the attitude of the craft from a stable rocket to a gliding object.

Ejection Charge: A gas generating charge loaded into a model rocket engine by the manufacturer to produce a rapid generating of gas pressure for the purpose of activating the recovery system.

Engine Block: A hollow bulkhead placed in a model rocket body to prevent the engine from moving forward during acceleration while allowing a free forward travel of the ejection charge.

Exhaust Velocity: The speed of the exhaust gases of a rocket engine. May be determined by multiplying the specific impulse of the engine times the acceleration of gravity (32 ft/sec/sec).

Fin: An aerodynamic surface projecting from the rocket body for the purpose of giving the rocket directional stability.

Igniter: An electrical device which initiates the combustion process in a rocket engine.

Ignition: The instant at which a model rocket engine begins to produce thrust.

Jet Pump: A method of model rocket propulsion in which air is ducted in towards the exhaust of the engine and heated to add to the engine's thrust. (Also see Ducted Propulsion.)

Krushnik Effect: The loss of effective thrust from a model rocket engine occuring when the engine is recessed forward in the body tube more than one diameter of the body.

Loaded Weight: The weight of a model rocket engine with propellant, delay charge, and other chemical and integral physical components in place, but without igniter.

Mach Number: The ratio of the speed of an object to that of sound in the medium being considered. At sea level in air at the normal atmospheric pressure a body moving at a Mach number of one (M-1) would have a velocity of approximately 1100 feet per second, the speed of sound in the air under those conditions.

Momentum: The impetus of a moving object; equal to its velocity times its mass.

Multi-Stage Rocket: A rocket having two or more engines, each used during a different portion of the flight. (Also see Booster.)

NARAM: National Association of Rocketry Annual Meet; the annual national model rocket competition held by the National Association of Rocketry.

Nozzle: The exhaust duct of a rocket engine in which the gases are accelerated to higher velocities.

Nozzle Blow: A model rocket engine failure in which the nozzle is forcibly expelled from the rear of the engine.

Payload: The load to be lifted by the rocket; not a functioning part of the rocket.

Payload Capsule: A compartment in the rocket designed to hold and protect a payload.

Peak Thrust: (Also Max Thrust) The greatest amount of thrust developed by a rocket engine during its firing.

Pink Book: The booklet published by the NAR containing all their contest rules and regulations.

Pound Seconds: The measure of the total impulse given by a rocket engine. It is determined by multiplying the average thrust times the total burning time.

Propellant Weight: The weight of the propellant in a model rocket engine.

Recovery System: A device incorporated into a model rocket for the purpose of returning it to the ground in a safe manner. All model rockets must employ recovery systems.

Reynolds Number: A dimensionless ratio used in predicting changes in the flow characteristics of air about an aerodynamic surface. For further information, consult the Aerodynamics section in your encyclopedia.

Shock Cord: An elastic cord used to attach nose cones and parachutes to a model rocket body and to absorb the shock force of the ejection charge.

Sounding Rocket: A research rocket used to obtain data on the upper atmosphere.

Specific Impulse: The ratio of fuel consumed to thrust developed, determined by dividing the total impulse by the propellant weight. The higher the specific impulse, the more efficient the engine will be.

Stability, Inherent: The tendency of a rocket having the proper center of gravity / center of pressure relationship to maintain a straight course despite rotating forces caused by variations in streamlining, pressure, etc. (See TR-1 for additional information.

Static Firing: A test of a rocket engine in which the engine is restrained from leaving the ground. Static firings are conducted for the purpose of determining an engine's performance and reliability characteristics.

T-Max: The time from the instant of ignition to the instant of maximum thrust.

Telemetering System: A means of measuring, transmitting, and receiving data from the rocket while in flight.

Throat: The portion of a rocket engine nozzle having the smallest cross-sectional area.

Thrust: The propulsive force developed by an operating rocket engine, caused by the rearward ejection of gasses during the combustion process.

Thrust-Time Curve: A graphic expression of the relation of thrust produced by a rocket engine to the time during combustion. A graph showing the thrust produced by a rocket engine at each instant of its firing.

Time Delay: The time between burnout of a model rocket engine and the activation of the ejection charge.

Total Impulse: The total amount of thrust developed by a rocket engine, determined by measuring the area under the engine's thrust-time curve or by multiplying the average thrust by the burning time.

Trajectory: The path followed by a ballistic object under free-flying conditions. Strictly speaking, a model rocket does not follow a trajectory, as its direction and rate of travel are determined more by atmospheric conditions. A model rocket is instead said to have a flight path.

Whamadoodle: Any object for which the model rocketeer cannot remember the proper name.

Wilson Wins With Aries II

RIC WILSON OF SEA GIRT, NEW JERSEY, WITH HIS CONTEST-WINNING TWO STAGE ROCKET, THE ARIES II.

The "Aries II," designed by Ric Wilson of Sea Girt, New Jersey, was the first place entry in the recent multi-stage design contest sponsored by Estes Industries. The "Aries II" was selected from the other entries as a highly efficient and aesthetically pleasing design.

Second place in the contest was awarded to Al Yokota of Santa Cruz, California for his two stage payload design, "The Shrike." "The Red Arrow," designed by Anthony W. Meiss, Bordentown, New Jersey, was selected for third place, while fourth place honors went to Victor Sedrick, St. Petersburg Beach, Florida, for his "Miler II" design.

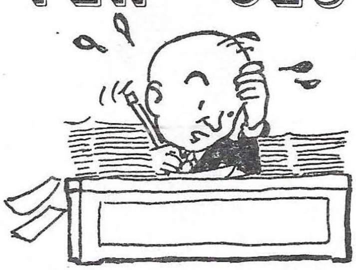
Preliminary judging for this contest was performed by members of the Peak City Section of the NAR, and the final selection of winners was undertaken by members of the Estes Industries staff. Testing of the winning designs was performed on the Astron Rocket Society firing range.

Vernon Estes, President of Estes Industries stated that the designs submitted for this contest were of a far greater quality than would have been expected. He continued: "The entries in this contest all displayed a high degree of sophistication that is unbelievable for the five short years the sport of model rocketry has existed. Not only the winners, but all entrants deserve the heartiest congratulations on their designs."

Space Travel Booklet Offered

Through the courtesy of World Book Encyclopedia, Estes Industries is able to offer a twenty four page booklet on space travel. This is an exciting and fascinating publication written by noted U.S. Government scientist and author Harold L. Goodwin, critically reviewed by Dr. Wernher Von Braun, famous rocket expert, and with illustrations and charts by Dr. Dan Q. Posin, CBS-TV science expert. The booklet covers an amazing range of material, including sections on cosmonauts and astronauts, famous space flights, the nature of space, major satellites and space probes, proposed methods for reaching the moon and the planets, America's space vehicles, a short history of space travel, and many other fascinating subjects. This book is a must for every model rocketeer's library. Best of all, this exciting booklet is yours for free. Just fill out the coupon on the Clip 'n' Mail page, enclose either 3¢ third class or 8¢ first class postage, and Estes Industries will rush the booklet to you.

LETTER SECTION



Dear Mr. Estes:

Encouraged by the success of the flight of astronaut John Glenn and the two crickenauts in the Bug-A-Bye rocket described in the first issue of Model Rocket News, my friend (Ron Ledbetter) and I decided to initiate our own Mouse-In-Space program.

On Saturday, March 10, we attempted to launch George Washington (our mouse) on his ride into the blue. The rocket was a modified Skybird with a payload compartment. The engine was a B .8-4. Well, anyway, the engine ignited, but the rocket didn't rise. We don't know if it was our fault, the Russian's, or the engine's. We rushed to the rocket after the ejection charge to see if the mouse was all right. I removed the plastic nose cone. There were no effects on George Washington and he had no comment.

Since that was the only series one engine we had, we graduated him to a B16-5 without a flight test in a B.8-4.

On Sunday, using a new rocket with a BNC-3A, and two BT-3's, we again tried to launch G.W. The rocket took off like I-duno-what for the sky above. The rocket arced over to begin its descent. At about 375 ft. the parachute ejected and partially opened. It remained this way for the entire fall. We recovered the rocket about 200 yards from the launching site, removed the nose cone, and watched as the mousetronaut emerged from his little capsule.

The only apparent effects were a severe case of hiccups and a slightly bloody nose. Today he has completely lost the hiccups and his nose isn't pink any more. Still no comment.

Sincerely,
Scott Werner

P.S. George Washington says hello!

Dear Scott:

It's quite possible that the lug became stuck on the rod. I've seen that happen a number of times. Give George our greetings.

Sincerely,
Vernon Estes

Dear Sirs:

I am building a two stage rocket in which the two engines do not have any contact with each other. This rocket is the "Terrapin," NAR 110. There are about ten inches between the booster engine and the upper stage engine. In order for the second stage to fire is it necessary to have some sort of a separate firing mechanism hooked up to it?

Truly yours,
Roy Wilson
NAR 1418

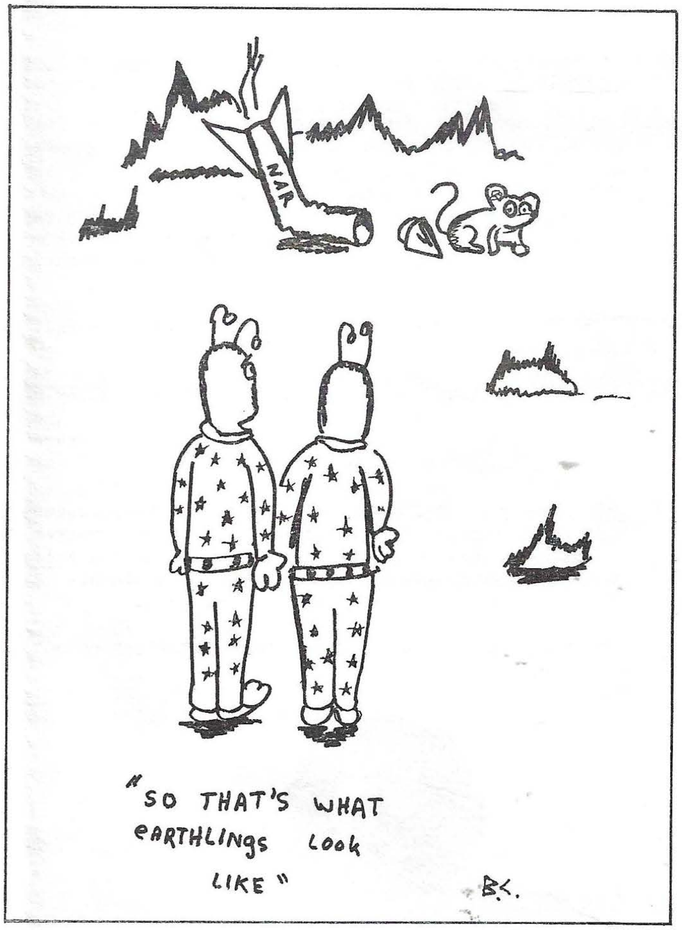
Dear Mr. Wilson:

As long as the passage between the two engines is not obstructed the upper stage should ignite. If there is any failure, a length of jetex wick sticking from the nozzle of the second stage will assure ignition. The Multi-Stage Report (TR-2) carries more information on this.

Sincerely,
Vernon Estes

Rocketeer of the Month

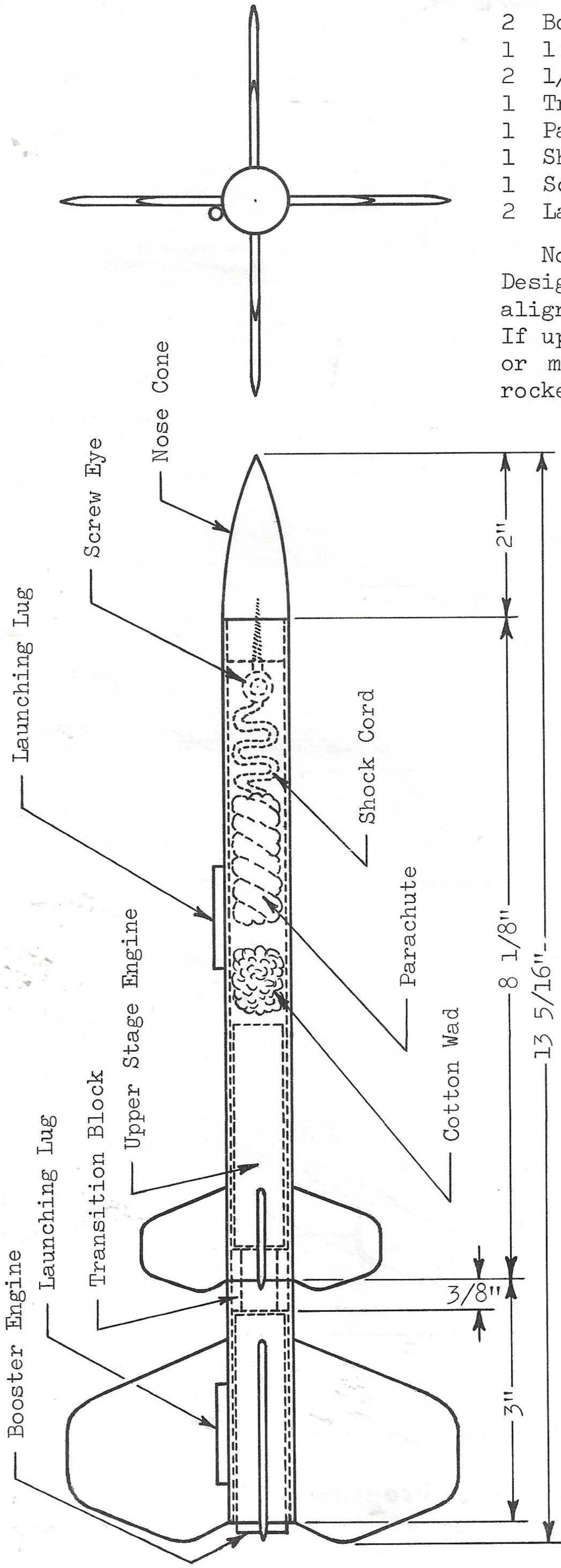
Bill Burrows, President of the PUYALLUP ROCKET SOCIETY and the Astron Scout, Astron Mark, and Astron Space Plane which he built and launched for the Bill Endicott television film (KTNT-TV, Channel 11) on model rocketry. Burrows acted as Technical Advisor for the film, as well as performing in it. For this, and for the many other things he has done to further the cause of model rocketry in the State of Washington, The Model Rocket News is proud to name him the "Rocketeer of the Month."

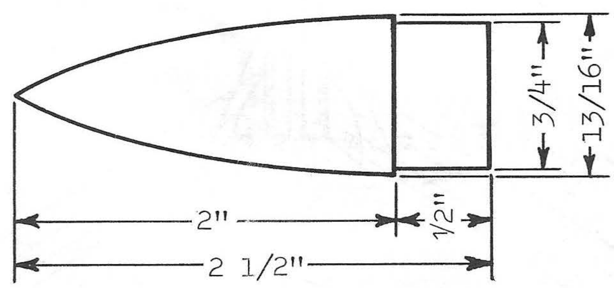


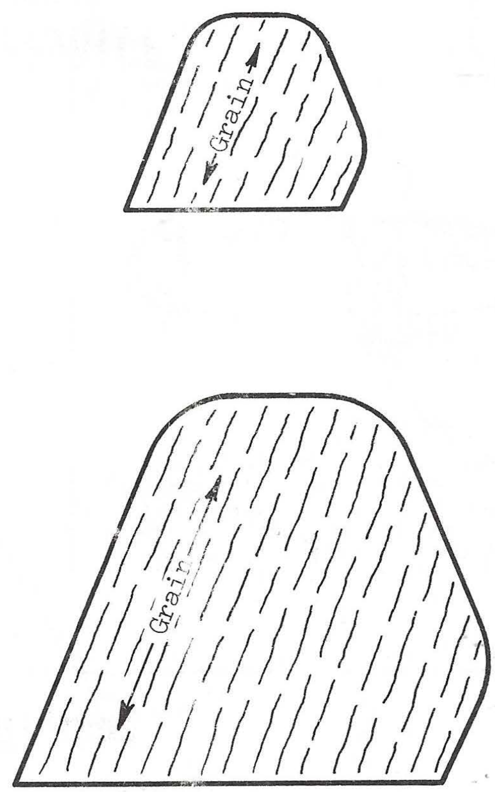
Aries II

2	Body Tubes	(BT-3)
1	1 x 1" Nosecone stock, Balsa	(NCS-1)
2	1/16" Fin stock, Balsa	(BFS-2)
1	Transition block, Balsa	(EB-1A)
1	Parachute material	(PM-1)
1	Shock Cord	(CR-1)
1	Screw Eye	(SE-1)
2	Launching Lugs	(LL-1A)

Nosecone may be made by method described in the Design Booklet, or BNC-3A may be substituted. Fin alignment must be perfect if rocket is to perform. If upper stage is flown as a single stage rocket, one or more nosecone weights may be necessary. This rocket may be built following standard procedures.

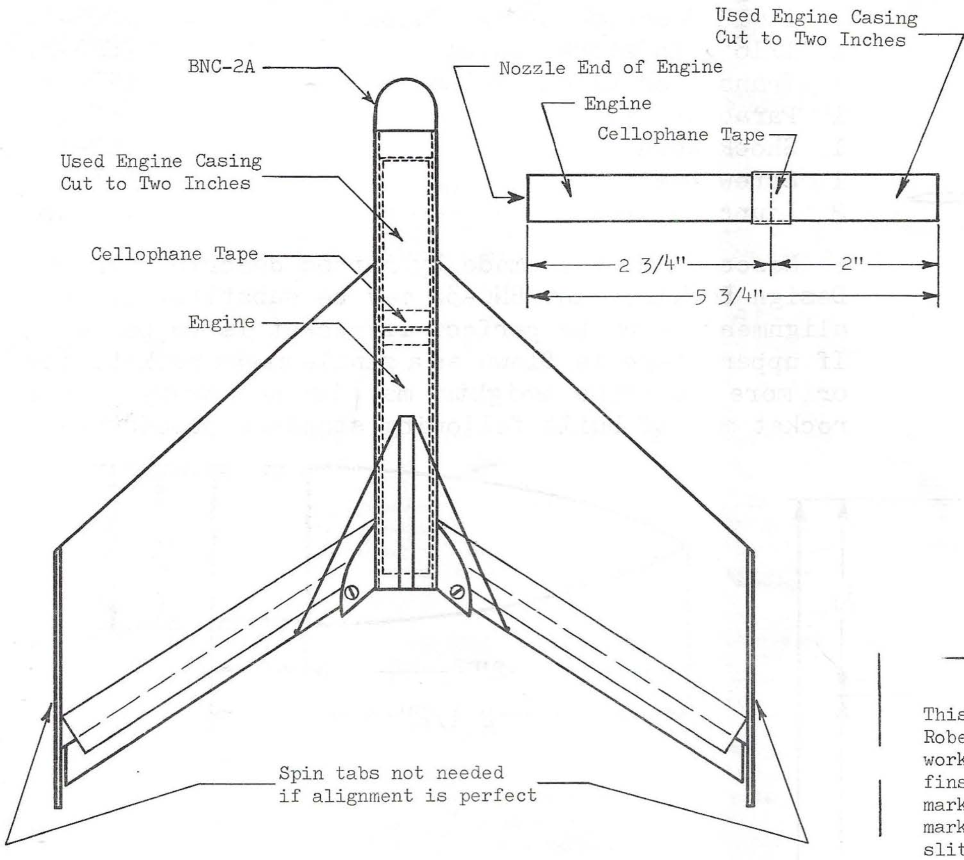






design by Ric Wilson

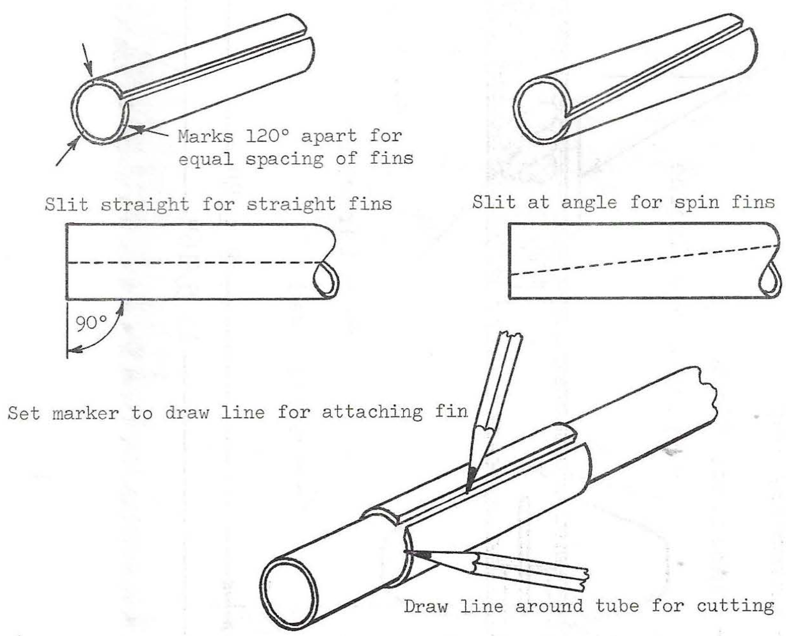
The Idea Box

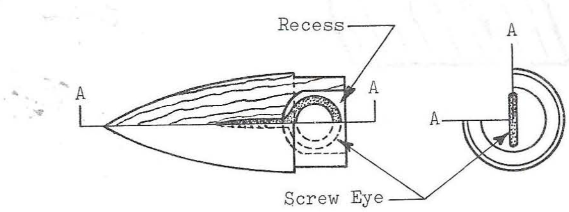


Here are the modifications which were made in the Space Plane that set the world's record at NARAM-4. A BNC-2A is glued in, replacing the BNC-3A, the nose block is left out, and a two inch section of a used engine is taped to the front of the engine to provide additional stability and to space it down in the body. Make sure that the added section of casing is not obstructed so the ejection gases have a free travel.

Spin tabs can be left off if the wing alignment is perfect, and the elevons will require only a very small up setting for proper glide. A good glide will require careful setting of the elevons, and glide testing should be carried out thoroughly. It may be necessary to weight the nose by attaching a small sliver of lead to prevent stalling. In a good glide the Space Plane will be just barely under the stall point.

This body tube marking guide, suggested by Robert Simpson, Laurel, Md., makes short work of cutting body tubes and aligning fins. Drawing around the end produces a mark for cutting body tubes squarely, the marks at the end give fin spacing, and the slit is used to get the fins on straight.





For a more compact rocket, Terry Schmidt of Paradise, Calif. suggests hollowing out the base of the nose cone with a knife, inserting the screw eye, and attaching parachute and shock cord. For added strength, screw the eye in place, remove, inject white glue into the hole, replace the eye, and let dry.

Coming Soon!

Tracking Report Part II

Launching Systems New Plan Program

Clip 'n' Mail

Plan Exchange Program

Do you have a favorite design? Would you like to see someone else's favorite design? To promote the exchange of design ideas Estes Industries now offers the PLAN EXCHANGE PROGRAM. To participate, send your favorite design to Plan Exchange Program, c/o Estes Industries, Box 227, Penrose, Colorado. Include with your design the coupon below and ten cents to help cover the cost of postage, an envelope, and handling, and we'll send you the favorite design of some other rocketeer, selected at random from those on hand.

Designs submitted should be neatly done on 8½" x 11" paper, with a parts list and the designer's name and address on the plan. Please make sure that the design you send in has been thoroughly flight tested. Remember that some other rocketeer will receive your design and will want to build and fly it. If it doesn't fly properly, you can bet that you're going to hear about it. However, if the person who receives the plan finds that it is the best rocket he has ever built, you will probably hear about that also.

Estes Industries cannot guarantee anything about the design you receive in exchange for your design. The plan you receive will be selected at random from those we have on hand, but we'll try to make sure that it will be good.

My favorite design is enclosed. Please send me a fellow rocketeer's favorite design. I enclose 10¢ to help cover the cost of postage, an envelope, and handling. I would prefer a

() Single Stage Design
() Multi-Stage Design

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(NAME)

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Please send to my science teacher complete information about the use of model rocketry in our classroom.

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For plans, information, and data, fill out this form and mail to: → Estes Industries, Inc.
Box 227
Penrose, Colorado

CHECK DESIRED ITEMS

() Plans for Cloud Buster, Single Stage Rocket
() Plans for Li'l Augie, Jet Pump Rocket
() Plans for Dirty Bird III
() Plans for Bug-A-Bye--Payload Rocket
() Plans for Pee Wee--Two Stage Rocket
() Order Blanks
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If you have a friend who is interested in rocketry, fill out the form below and we will send him a catalog free of charge.

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Please enclose a stamped, self addressed envelope with this request. Enclose an extra four cent stamp with requests for more than three items. This offer expires December 31, 1962.

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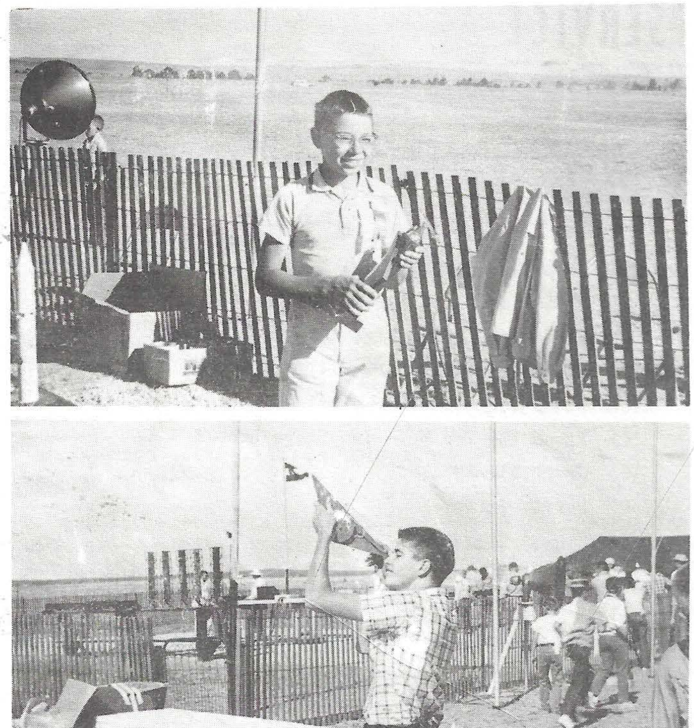

Top: Ted Walford, who won Junior Division Boost-Glide Duration with a Space Plane. Bottom: Bob Coon tries out new Estes Industries elevation tracker.

The prep area, processing table, and launch area at Red Sands Rocket Range, familiar scenes of NARAM-4