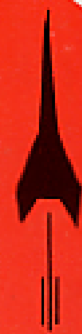
MODEL ROCKETRY

September 1969
50¢

The Journal of Miniature Astronautics
Incorporating THE MODEL ROCKETEER

Astroscale Data:
Black Brant III



ALTITUDE OPTIMIZATION

RC B/G

APOLLO 11

PLASTIC SCALE MODELING

RENEGADE EGGLOFTER

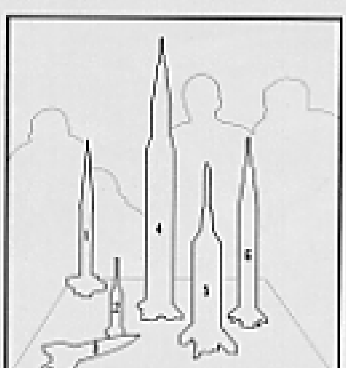
LIGHT FLASHER

CZECHOSLOVAKIAN CHAMPIONSHIP

EXPERIENCE

builds a line of SCALE MODEL ROCKETS

Build and fly these SUPER-SCALE models!



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engines not included in kits.

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

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Model Rocketry

Vol. I, No. 11
September 1969

Cover Photo

The color Camroc photo taken somewhere over Pennsylvania indicates the results you can obtain by following the instructions given in *Color Aerial Photography* beginning on page 19. The Camroc photo was taken by Richard Q. Fox.

From the Editor

How scale is scale? What constitutes a good scale model has been a subject of continual debate for a number of years in this hobby as well as in many other modeling hobbies. Some rocketeers have contended that certain deviations from "true scale" should be permissible in order to conform to the restrictions imposed by the hobby. For example, it's very hard to construct an accurate scale model of the Jupiter IRBM, which in the prototype has no fins for stability, since the model rocket (lacking gimbaled engines or deflection vanes) would be unstable wihout fins. Thus the concession is made (in the NAR Sporting Code and in most other scale competition rules) to permit clear plastic fins to be added to the model for stability. This does not detract from the points awarded for adherence to scale. Some purists might argue that even this concession on plastic fins is too much of a compromise.

In the development of scale rules, each hobby has found it necessary to permit some deviations from scale in order to allow any form of working model to be constructed. Model railroaders, for example, permit their scale models to have oversize wheel flanges (to keep the models on the tracks) and non-scale couplers (to allow automatic uncoupling by standard model equipment). Any other deviations from scale on model railroad cars are penalized. Similar relaxation of the requirement of conformity to true scale is necessary in the case of models of jet-powered airplanes. The

(Continued on page 47.)

Regular Features

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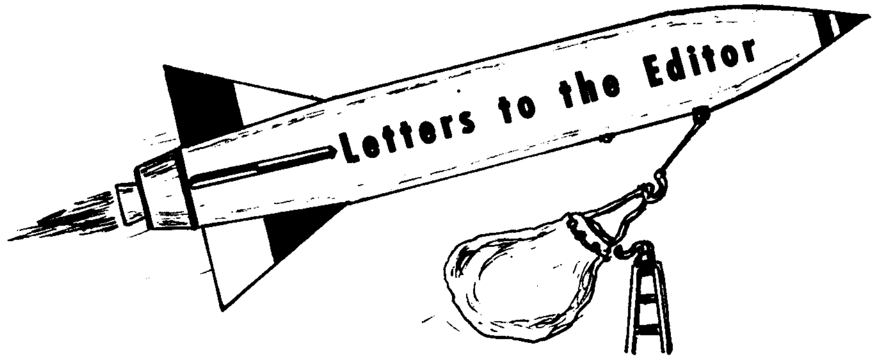


INFINITE Loop/Glider

In the May issue of your magizine I was fascinated by Ed Uchno's oddball design, "The Infinite Loop". So appealing was it that I went to the nearest hobby shop that same day in quest of the parts that I would need for its construction. Unfortunately, many of the parts that I needed were out of stock; hence I constructed the model from MRI parts (Size T-20). I built the entire model twice as large as the one described in **Model Rocketry**. A T-20 tube was used for the main body, while another tube of the same size was cut into six equal pieces, each piece 3 inches long.

The following Saturday, out on the launch range, I slid my finished "Loop" onto the club launch rack, unwittingly committing the "2nd. Sin of Model Rocketry" -- failure to install a shock cord. I realized this embarassing error instantly following ejection. The nose cone slowly began to descend, suspended by a 12" chute. Then my gaze shifted to the main body, which I assumed would be in free fall for about 5 seconds before it made contact with the earth. To my surprise (I almost had a heart attack) the "Loop" was *gliding* back to earth, *aft end first!* Although the model's performance was spectacular, to say the least, I am sure that with proper balancing, and minor adjustments its performance could be improved considerably.

After approximately 15 flights I established that location and varied weather conditions did not affect the model's performance appreciably. I also discovered that, although any type of engine will work satisfactorily, best results were obtained using C6-0 booster engines (flight times with these engines ranged from 1-3 minutes, depending upon the thermals present).

Our club hopes to pioneer the development of these new and interesting B-G's. At the conclusion of our research program on these "Hoop Gliders" we shall submit a full report of our findings to **Model Rocketry** magazine for publication.

Scott Brown
President
Gemini Model Rocket Society
New Castle, Deleware

Product Reviews

I think a column on model rocketry products based upon information submitted by rocketeers could be very adventageous for others. If every month letters were published or summaries of many letters on new or expensive products, bring out the facts about degree of difficulty, quality of parts, design efficiency, or if the 'gimmick' was worth the money. This could help others save money and get pointed in the right direction besides keeping manufacturers in place.

George Helser
Troy, New York

Electronic Gadgets

I have recently become interested in model rockets again, mainly through my teen-age brother and his school model rocket club. Many years ago, a friend and I built rockets from home-made propellants and paper tubing(carefully supervised by his father, a chemist). I was amazed at the degree of refinement that this field has developed and am again trying my hand at building rockets. Much more successfully, may I add! I have found your magazine very informative and have enjoyed especially the more technical articles. I am in the electronics field and am always building gadgets for my rockets. I have tried several transmitters with varying degrees of success and am now building an electronic shutter release for my camera to eliminate the luck factor in taking pictures of my rockets from scratch and have several designs I think you might consider for your reader design page.

Dale W. Kline
Jamison, Pennsylvania

Into the Future

An interesting comparison can be made between the hobby of model airplanes and our hobby, model rocketry. Model planes became popular naturally after fullsize aircraft were numerous enough to inspire the imaginations of those who would work with their hands. References are often made in model airplane magazines to those who, in the 1930's and 40's, sat in dark workshops laboriously bending bamboo strips over candles and painstakingly built actual models of the magnificent planes then in the air.

Those modelers of the 40's are now wondering where the juniors are in their hobby. Young modelers want to make models like the jets flying overhead, yet it's almost impossible to effectively model a jet: props look phoney, and ducted fans are too technically complex. So the juniors turn to something else– something more interesting and realistic. What? Model rocketry, of course, since with the occurence of man's first flights to the moon, rockets are in the news. Models are fast, exciting, attractive, and educational. But are we losing young rocket hobbyists for the same reason that the model airplane hobby is losing theirs; that is, a technology gap between fullsize and model? As it is, we are using solid propellants, while liquids give better performance and are used more often on operational rockets. Practical safety and cost considerations rule out liquid engines immediately, but nevertheless a gap exists. Another gap is fins: fullsize rockets have small fins or none at all, while fins are required on models for stability. Plastic fins are poor substitutes, even on scale models. What will happen when nuclear and ionic engines become operational? Admittedly, this will be far in the future, but one day we may wake up to the fact that we are losing hobbyists to an even newer, as yet nonexistent, hobby.

The rapid turnover in model rocketry is evidence that something occurs to draw modelers away. The only thing that can retain modelers is challenge: an intellectual and actually physical challenge to improve, experiment, and learn. This spirit of creative response to challenge must be instilled in new modelers, and the best method for doing this distribution of technical advances and results of prior experiments to the modeling public. Model Rocketry has taken a great step in that direction, as have the manufacturers. It is up to us now to work, experiment, and write of our work, so as to let other interested people know what we have done. After all, in a decade or so, those who have grown up with the hobby and found a permanent challenge in model rocketry do not wish to look around and wonder where the juniors are.

Mark Johnston
Lackland AFB, Texas 78236

B/G Contests

All of the eighty model rocketeers in our club read and enjoy your magazine. It is really full of the backbone information in model rocketry. Articles such as *Technical Notes* and *The Wayward Wind* deserve credit for the amount of work that goes into them. Astroscale Data is one column which I believe, at least one-half the members in our club use. All of the other articles include highly established literature also.

Would it be possible to print some information on the divisions of events in model rocket contests, especially of gliders? There seems to be confusion on this topic in our club.

Thank you very much for you fab' magazine.

Brian Smyth
Saskatoon Model Rocket Association
Saskatoon, Saskatchewan
Canada

There are several accepted catagories of boost/glider competition. All of the B/G events sanctioned by the National Association of Rocketry and the Federation Aeronautique Internationale (FAI) are flight duration competitions. The recovered model with the longest time of flight is the winner. There are four FAI sanctioned B/G classes: Swift, 60 grams maximum weight, with 2.51 to 5.00 nt.sec. total impulse; Hawk, 120 grams maximum weight, with 5.01 to 10.00 nt.sec. total impulse; and Condor, 500 grams maximum weight, with 40.01 to 80.00 nt.sec. total impulse. In addition, there are two other NAR (but non-FAI) competition classes: Hornet, 60 grams maximum weight, with 0.00 to 1.25 nt.sec. total impulse; and Sparrow, 60 grams maximum weight, with 1.26 to 5.00nt. sec. total impulse.

A boost glide payload event is scheduled to be flown at the Washington State Model Rocket Championships, and we await a report on how this new event works out. It will be flown as an "open" event (any engine total impulse permitted), but the entry must carry a standard FAI one ounce payload. As with the standard B/G events, the winning glider will be the one with the longest time of flight.

Technical Notes

George Caporaso

Altitude Optimization of Single-Staged Designs

The need for high altitude performance at NAR sanctioned meets as well as the desire to be the first kid on your block to have your rocket fly out of the ionosphere seem to be evidence for the need of establishing design criteria based on knowledge of theoretical altitude calculations, coupling of the dynamic oscillations to the vertical equations of motion and drag. The present column will draw on the results of material in the manuscript of **Topics in Advanced Model Rocketry**, a book to be published in the near future by M.I.T. Press, and on an article to be published in a later issue of **Model Rocketry**.

Ballistically Optimum Mass

By now everyone and his rocket launching grandmother should have seen a copy of the Malewicki altitude curves. Everyone should also realize (as did Malewicki himself in his original manuscript) that they are inaccurate for several reasons. They, as all other current approximations suffer from the neglect of the variation of drag coefficient with Reynold's number, and hence velocity. However, by far the most serious errors arise from the inability of the Fehskens-Malewicki solutions to take into account the *varying mass* of the rocket. Modern, second generation approximations take this difficulty into account but the only detailed study of the properties of these solutions is contained in the aforementioned **Topics in Advanced Model Rocketry**, a work not yet available to the model rocketeer.

Although the altitudes acheived as computed by the more accurate methods are consistently higher than those arising from the Fehskens- Malewicki equations, *all the methods have the same ballistically optimum mass*. That is, the optimum masses of the new equations are in the same places as those predicted by the old equations. So, optimize the weight of the vehicle according to the Malewicki curves. This will complete the first part of the optimization process for single staged rockets.

Dynamic Parameters For Minimum Response

Gordon Mandell, in his five part series on the *Fundamentals of Dynamic Stability* appearing in the first five issues of **Model Rocketry**, presented methods for computing the restoring and damping moments from Cna, Barrowman's "normal force coefficient," and critical dimensions of the rocket. It has been found analytically by the author that all reductions in altitude caused by dynamic oscillations or overdamped and critically damped motions of the vehicle are linearly proportional to the factor Cna/Cd where Cd is the drag coefficient and Cna is the aforementioned normal force coefficient. The normal force coefficient can be computed from the material in an excellent technical report written by Barrowman for Centuri Engineering Company. After examining the equations in question, it becomes clear that the critical factor in determining the normal force coefficient is the *aspect ratio of the fins. The aspect ratio should be made as large as is practicable.* Care should be taken, however, to insure that the damping moment is not too small or a very long natural restoring time will result which will allow any oscillations to continue for many cycles before being damped out. This situation will, of course, result in a umongous reduction in altitude, so be careful! Once the aspect ratio has been set at a (safe) large value the dynamic optimization step is complete.

Drag Minimization

This subject has been belabored often in the literature of model rocketry, but never definitively. Thus I will present only rather well known helpful hints.

First, in conjunction with the previously mentioned rules, attempt to make the body tube (and the entire length) of the rocket short, but watch your longitudinal moment of inertia and resulting natural frequency very carefully. A reduction in length is sought for the purpose of reducing the friction drag, which is directly proportional to the surface area of the tube.

Next, select a nose cone with an approximate ellipsoidal or parabolic shape that is the shortest. Mercer's test results in Centuri's TIR-100 show that parabolic nose cones have less drag the shorter they are. Presumably, the smaller length means less friction drag on the nose cone while the actual *pressure drag* component of the different nose cones is about the same.

Next, if at all possible, use a rearward engine ejection recovery system. That is, solidly glue the nose cone to the body tube and fill the joint until it appears perfectly smooth. This will stop boundary layer turbulence and/or separation at the joint and will preserve the laminar flow further down the tube. (Such a system is described in Charles Andres' Excalibur construction article in the August issue of Model Rocketry.)

Next, use three fins instead of four and round their leading edges. This will reduce the interference drag by 25% and will impart a better pressure drag coefficient to the airfoil (see Mercer's results in Centuri's TIR-100).

Next, in the area of not-so-well-known and proven hints, it has been pointed out in several aerodynamics books that *a turbulent boundary layer clings more tenaciously than a laminar one* (Schlicting, **Boundary Layer Theory**). Thus it would seem to be a good idea to try to figure out where the boundary layer might possibly separate from the rocket and *put an obstacle in its way to actually cause the flow to become turbulent, thus preventing separation.* As to where and what this is to be done with, I wonder if anyone knows for certain. The Old Rocketeer once mumbled something secretive about placing a strip of Scotch Tape around the body tube about an inch and a half in front of the leading edge of the fin joint, but I'd never divulge that.

Other little juicy tid-bits should also be remembered. The side edges of the fins, opposite the root edges, should have the "proper" shape so as to minimize vortex drag. Information on this can be found in the **Handbook of Model Rocketry** by God, I mean Stine. Mercer's results also reveal that a well sanded and finished rocket as a considerably lower drag coefficient that an unsanded, unpainted one. The launch lug should be made as small as possible since Mercer shows that it contributes a massive component to the drag. If at all possible, the model should be launched from a tower. There is no question that two rockets which are identical except for the presence of the launch lug will have substantially different altitudes.

And lastly, select the engine with care. If you are forced to launch on a windy day, a B-14 might be better than a B-4 or B-6.

The field of single stage optimization is not closed by any means. There are many more intricacies hidden in the dynamical coupling equations which have not been presented here. The field of multistaged optimization is virtually wide open. I have run one altitude series on a computer and found that for a two stage rocket, once the upper stage weight is set at some optimum value, the first stage weight can be varied from 3 centigrams to 1010 metric tons without a noticeable difference (the actual range of values attempted was smaller but the statement *is* qualitatively correct, *the sensitivity of the altitude to the booster stage weight was incredibly low*). Who knows what evil awaits us in the partial derivatives of the altitude equations?

Astroscale Data.....

BLACK BRANT III

Canadian Sounding Rocket

by G. Harry Stine

The Black Brant III is a single-staged, fin-stabilized free-ballistic research sounding rocket designed and manufactured by Bristol Aerospace, Limited of Winnipeg, Canada. It utilizes a Bristol Aerospace Ltd. 9KS11000 solid propellant rocket motor and has the capability of carrying a payload of 88 pounds to an altitude of 114 statute miles when launched from sea level at a launch elevation angle of 85 degrees from the horizontal.

Launchings have been conducted from Ft. Churchill, Canada; Resolute Bay, North West Territories, Canada; NASA Wallops Station, Virginia; and USAF Eglin Gulf Test Range, Florida. The Black Brant III may be launched from an overhead rail launcher, a zero-length overhead rail launcher, or a modified Nike rail launcher.

The Black Brant III features single stage simplicity, ease of handling, large payload volume, low longitudinal acceleration, adjustable roll rate, a pressurized payload compartment, a separate igniter compartment with access door, wide operational temperature capability, and a proven rocket motor.

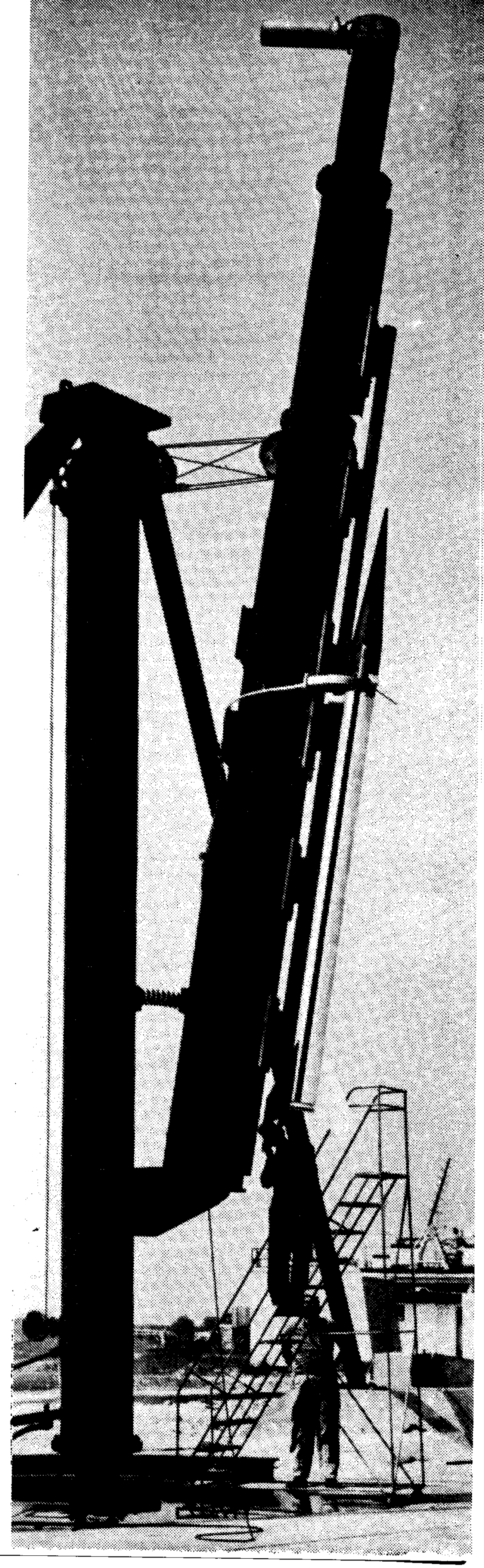
Astroscale Data is drawn from the most accurate and reliable sources. It is checked for historical and technical accuracy. Every effort is made to call out all data sources. Since Astroscale data is not official NAR Plans or information, it may be used as the total scale substantiation data in NAR and FAI competition. Please DO NOT attempt to obtain original copies of photographs, drawings, and other data referenced because it has been supplied by the sources with the understanding that publication such as this will relieve them of the expense and effort of supplying additional copies of original data, much of which is of no use whatever to modelers. In addition, some Astroscale data has been extremely difficult, if not impossible, to obtain for many reasons.

History:

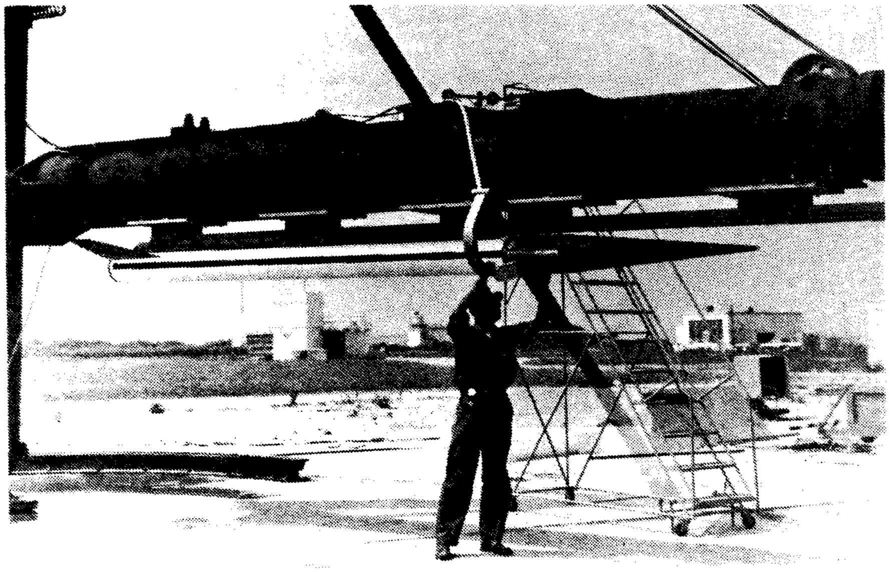
The Black Brant series of rocketsondes was developed specifically for the varied requirements of scientific space research in a joint Canadian government-industry program. The team which developed the vehicles in the series -- named after a species of Canadian goose – included the Canadian Department of Defense Production, the Defense Research Board, the Canadian National Research Council, and Bristol Aerospace Limited. Motor development was carried out initially by the Canadian Armament Research and Development Establishment (CARDE), while production motors were made at the Rockwood solid propellant plant of Bristol Aerospace Limited located in the Winnipeg area. Flight testing was conducted jointly by Bristol Aerospace Limited and CARDE.

The initial Black Brant vehicle was designed to a CARDE specification in 1956 to enable evaluation of the solid propellant motor to be carried out under dynamic conditions. The success of this Black Brant I vehicle led to its acceptance as an operational rocketsonde and encouraged the development of an advanced version, Black Brant II, capable of carrying 300 pounds of payload to 100 miles. Black Brant III was designed around the 10.2-inch-diameter solid motor originally as the upper stage of a two-staged vehicle.

The initial flight of the Black Brant III took place at Ft. Churchill, Canada on June 15, 1962, carrying a payload of 58.2 pounds to an altitude of 61.1 miles as a flight test or "diagnostic" round. By the end of 1966, a



A U.S. Navy evaluation round for Naval Research Laboratories ready for launch at NASA Wallops Station, Virginia on November 7, 1963. Black Brant III reached 72.5 miles with 66.1 pounds of payload. (NASA photo) ⟶



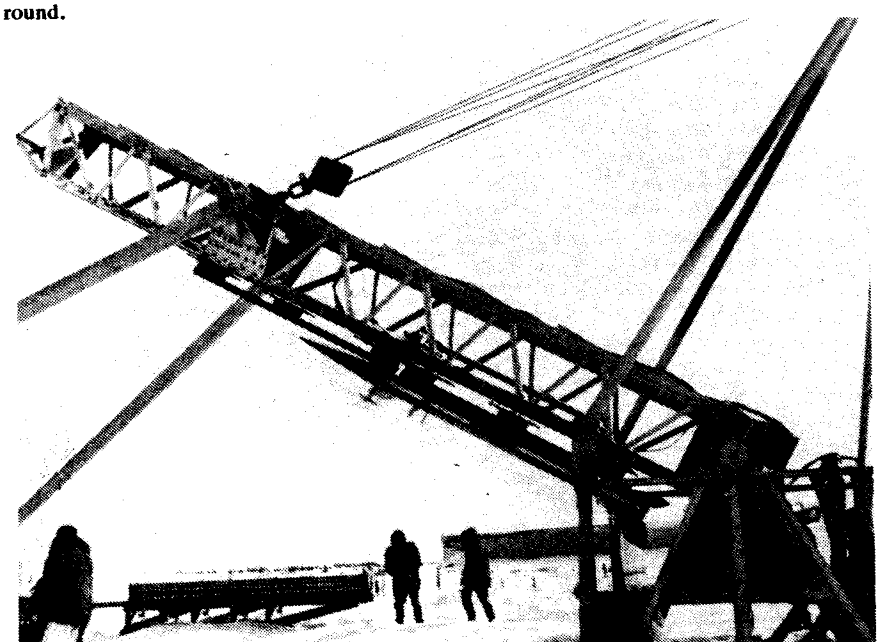
Black Brant III on the boom launcher at NASA Wallops Station, Virginia. Arm coming around side of igniter compartment is to shield umbilical pullaway plug. Note difference in color scheme from Canadian rounds.

total of 19 Black Brant III vehicles had been launched with the last 10 of these flights carrying users' scientific payloads. Users have included the U.S. Naval Research Laboratory; the National Research Council of Canada; the University of Bonn, Germany; and the Heidelberg Division of the Max Planck Institute, Germany.

Black Brant III was the first rocketsonde ever launched at the north magnetic pole of the Earth. On July 18 and July 20, 1966, two Black Brant III rocketsondes were launched straight up from the airport at Resolute Bay on Cornwallis Island, North West Territories, Canada carrying instruments to measure galactic radiation.

The vehicle is a three-finned unguided research rocket. The standard nose fairing is a cone with an extended cylindrical section. See drawing for dimensions. Approximately 1.4 cubic feet of pressurized payload space is available for experiments and telemetry. Variations in nose configuration can be provided to meet payload requirements within broad limits of weight and center of gravity. Non-magnetic Type 321 stainless steel material 0.0625 inches thick is used to fabricate the nose fairing. To protect the payload from excessive heat, a reflection shield or insulation can be used over the instrument package. For payloads where electrical transparency is required, the nose fairing can be sectionalized for partial or complete ejection.

Black Brant III being raised on launcher at Ft. Churchill, Canada. This was early flight test round.



The igniter housing is a cast aluminum cylindrical section with an integral pressure bulkhead at the forward end to separate the pyrotechnic elements of the igniter from the payload compartment. A telemetry quadraloop antenna, the forward launch lug, the umbilical connection, and solar aspect sensors are usually mounted on this section. Arming and disarming of the igniter is accomplished through an igniter access door on the housing.

The motor is made of 0.06-inch thick AMS 6435 stretch-formed sheet steel with machined steel forgings at the ends. The nozzle is machined from an AISI 4130 steel forging and is fitted with a graphite throat insert. An aluminum oxide ceramic coating is applied to the interior surface of the expansion cone skirt. The aft body is an all-magnesium cylindrical structure which is mounted over the nozzle and cantilevered from the aft end of the motor casing. It provides attachment points for the three fins and the rear launch lugs.

The three fins are made of solid aluminum with a double-wedge airfoil and have a titanium leading edge cuff for protection against aerodynamic heating. A plastic ablative material is also applied to the fin surface to provide heat protection. The fins are attached to the aft body by bolts. By simply canting the fins, the desired roll rate can be obtained.

There are two standard telemetry packages for the Black Brant III. One package is conical in shape and is intended to occupy the top section of the standard conical nose fairing. The other package can occupy the cylindrical section at the base of the nose. The system operates as a standard PAM-FM/FM system conforming to IRIG specifications.

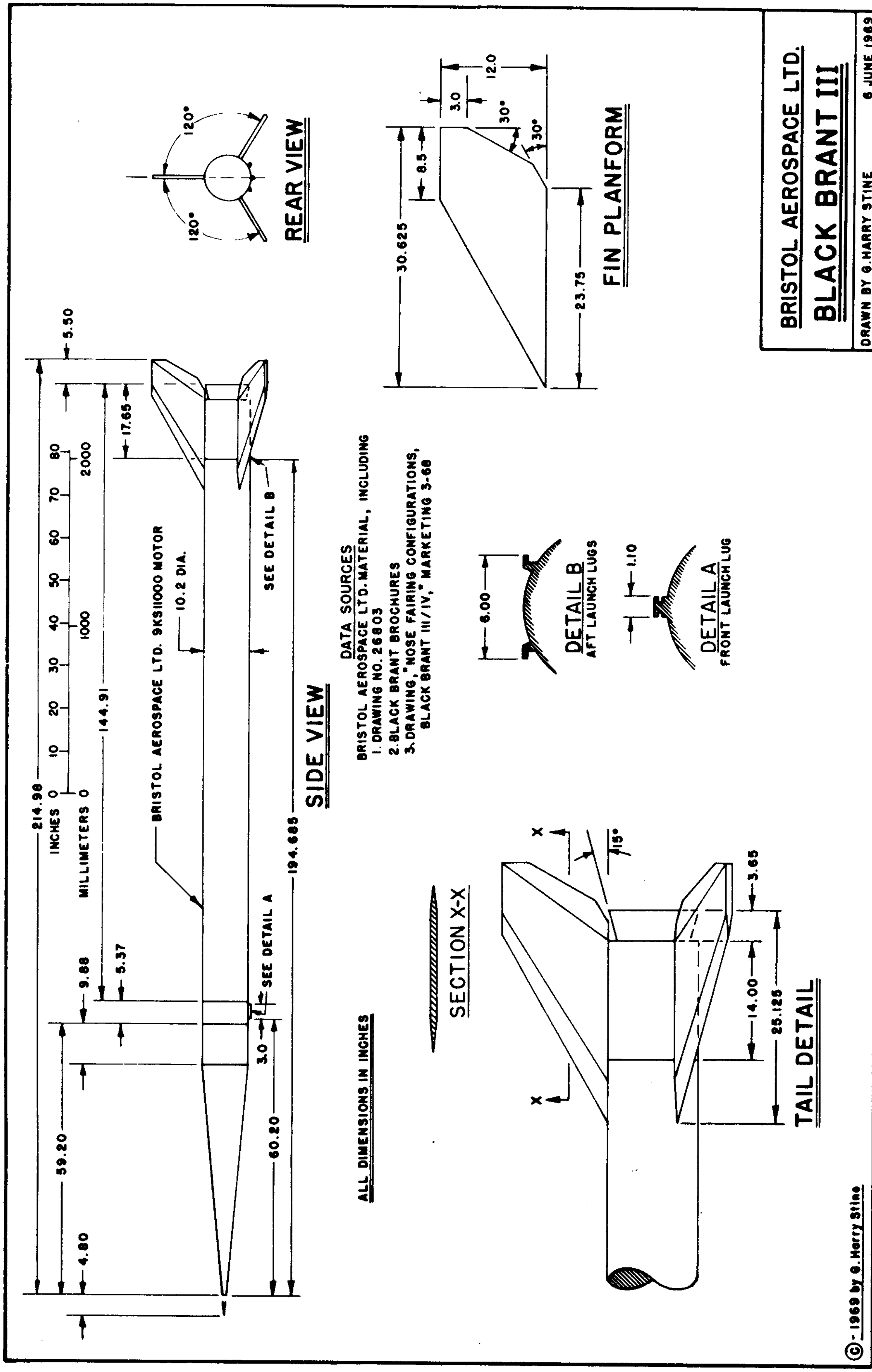
The antenna system consists of a pair of quadraloop radiators mounted on the igniter section and designed for operation in the 215-260 mHz IRIG telemetry band.

The Black Brant III accelerates to relatively high velocities early in flight with motor burn-out occurring at about 42,000 feet with a Mach Number between 7 and 8. The high initial acceleration results in low dispersion of the flight path.

No attempt is made to recover the vehicle or payload.

Weights: (nominal)

Nose fairing: 26 pounds
Igniter Housing: 8 pounds
Motor, loaded: 560 pounds
Propellant: 450 pounds
Tail Assembly: 29 pounds
Gross weight less payload: 623 pounds
Burnout weight less payload: 173 pounds
Payload weight range: 50 to 90 pounds.


BRISTOL AEROSPACE LTD.
BLACK BRANT III
DRAWN BY G. HARRY STINE
6 JUNE 1969
REAR VIEW
120°
120°
FIN PLANFORM
12.0
3.0
30°
30°
8.5
30.625
23.75
SIDE VIEW
214.98
INCHES 0 10 20 30 40 50 60 70 80
MILLIMETERS 0 1000 2000
5.50
17.65
144.91
194.685
9.88
5.37
59.20
4.80
3.0
60.20
BRISTOL AEROSPACE LTD. 9KS11000 MOTOR
10.2 DIA.
SEE DETAIL A
SEE DETAIL B
DATA SOURCES
BRISTOL AEROSPACE LTD. MATERIAL, INCLUDING
1. DRAWING NO. 26803
2. BLACK BRANT BROCHURES
3. DRAWING, "NOSE FAIRING CONFIGURATIONS, BLACK BRANT III/IV," MARKETING 3-68
DETAIL B
AFT LAUNCH LUGS
6.00
DETAIL A
FRONT LAUNCH LUG
1.10
ALL DIMENSIONS IN INCHES
SECTION X-X
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X
X
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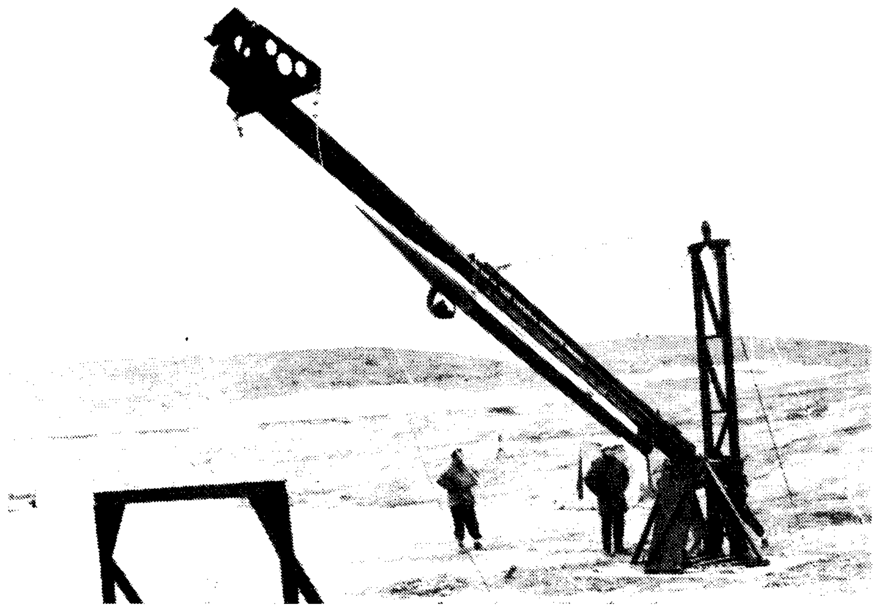
3.65
14.00
25.125
© - 1969 by G. Harry Stine



Special mobile launcher was airlifted into Resolute Bay, N.W.T. Canada, for Black Brant launching at north magnetic pole on July 18, 1966.

Performance: (assuming 88 pound payload)

Altitude: 114 statute miles
Apogee deterioration rate: 0.5 miles per payload pound
Maximum acceleration: 29g
Maximum velocity: 6600 ft/sec
Burn time: 7.5 seconds
Burnout altitude (approximate): 42,00 feet MSL
Roll rates: 0 to 8 rps
Range at impact: 48 miles
Total flight time: 400 seconds.

Propulsion:

Type: Bristol Aerospace Ltd. 9KS11000
Total impulse: 98,800 lb-sec
Average thrust: 10,800 lb.
Average chamber pressure: 990 psi
Burning time: 7.5 sec.
Propellant: Ammonium perchlorate oxidizer with polyurethane-aluminum fuel cast in six-pointed star configuration, core burning.

Color Data:

Color varied from round to round. However, Bristol Aerospace Limited states that there is a general color pattern for the Black Brant III as follows:

For Canadian flights: Bright gloss red overall with one gloss white fin and two gloss white stripes down opposite quadrants of the motor casing from the base of the igniter housing to the front of the tail ring (14.00 inches forward of the aft end of tail shroud). Lettering and insignia in bright red as indicated in photos.

For Wallops flights: Flat white motor casing with gloss red stripes down opposite quadrants of motor casing from aft end of igniter housing to forward end of tail shroud. Two gloss red fins; one flat white fin on downrange side. Nose cone varied; some were red, some were natural aluminum.

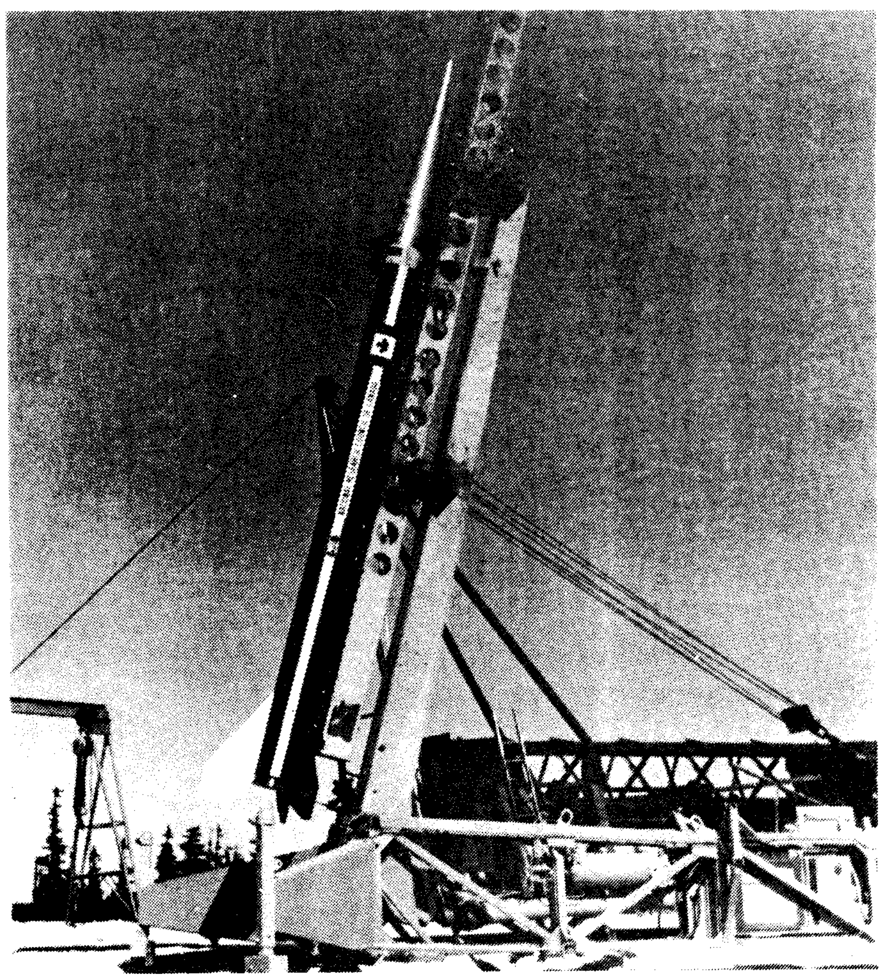
The white fin is usually the one on the side away from the launcher.

Color has been verified from color photos and from Bristol Aerospace Limited.

Data Sources:

Bristol Aerospace Limited material including:
BAL Drawing No. 26803
Black Brant Brochures (several)
Drawing, "Nose Fairing Configurations, Black Brant III/IV," Marketing 3-68.
"Black Brant Progress," Flight International, February 9, 1967.
Private communications and conversations with Bristol Aerospace Limited personnel at AIAA meetings.
BAL photo 5456-2
BAL photo 6307-1
BAL photo 5557-1
BAL photo 5908
NASA photo 63-Black Brant-1

Black Brant III on standard Nike launcher at Ft. Churchill for flight with payload by National Research Council of Canada flown November 29,1966.



The Theory and Construction of a

Transistorized Tracking Light

for Night Launched Model Rockets

by Capt. Forrest M. Mims

With a simple tracking light assembly, it is possible to launch, track, and recover model rockets flown at night. Certain experiments, particularly those involving micrometeorology or guidance and control benefit from night launchings. Altitude and velocity determinations can also be made by photographing the rocket- borne light.

Several approaches to a tracking light exist, the most common being: (1) Steady source, (2) Mechanical blinker system, and (3) Transistorized flasher. The steady source design has been used successfully by the author on several occasions. It consists of a small incandescent lamp and a dry cell. The method works fine for tracking rolling rockets if the lamp is visible from only one side of the rocket. In this configuration, the lamp appears to flash as the rocket completes each revolution of roll. Unfortunately, this simple sytem has a very short battery life due to the large amount of current drawn by the lamp.

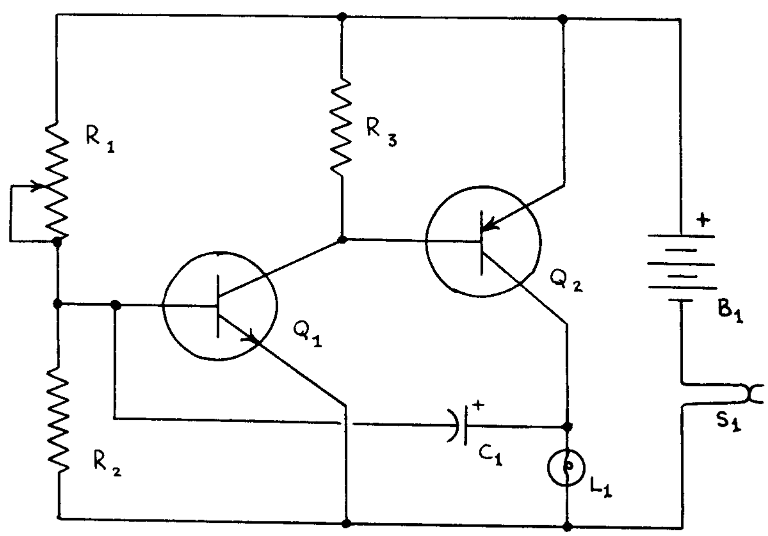
The mechanical blinker system has several configurations, the most common being a small electric motor and wiper arm which alternately makes and breaks contact with current supplied to a small lamp. The result is a flashing lamp which requires less current than the steady source method but which is mechanically unreliable and requires a heavy, bulky power source to supply both motor and lamp.

The most efficient approach to a flasher is the transistorized method. Numerous circuits can perform this duty. The author has found the one shown in Figure 1 to be simple, reliable, and economical.

Construction

Readers with a knowledge of electronics will recognize the circuit as a free running multivibrator. Construction of the device is straight-forward. However, if extreme miniaturization is desired pay particular attention to the possibility of shorted leads.

The author's original device was miniaturized and encapsulated in transparent silicone rubber. For the purpose of this article, an almost identical unit was constructed on a small 5/8" x 1 1/2" perforated phenolic board as shown in the accompanying illustration. Experienced electronics



Parts List

B1	1½ to 6 volts (see text)
C1	20 uF, 6-volt electrolytic capacitor (sprague Type 30D)
L1	1.2 to 3 volt lamp (see text)
Q1	2N 4400, 2N 4401, or similar NPN Transistor
Q2	2N 4402, 2N 4403, or similar PNP Transistor
R1	100,000-ohm miniature trimmer resistor (Allied 46 F 1809 or similar)
R2	5,600-ohm, ¼ watt resistor
R3	1,200-ohm, ¼ watt resistor
S1	Exposed leads (see text)

Miscelaneous small perforated phenolic board, hookup wire, solder, silicone rubber (see text), transparent payload section, and small amount of foam plastic.

Figure 1. Circuit diagram for tracking light assembly.

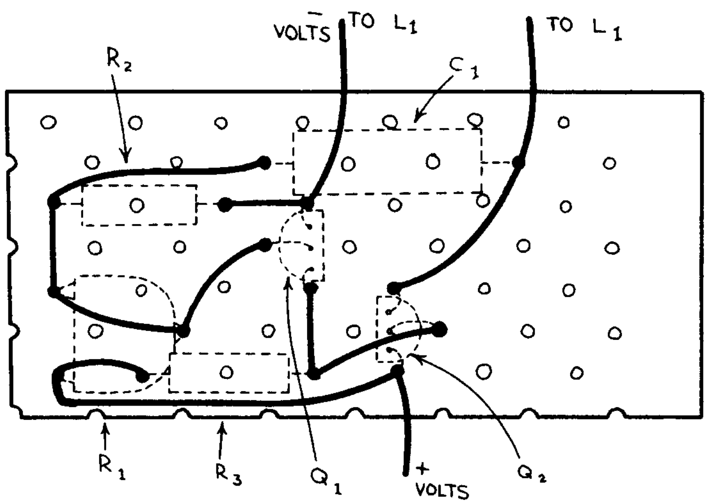


Figure 2. Tracking light wiring board (view of underside).

hobbyists may wish to modify the circuit or construct the unit to suit the specifications of a particular payload section. However, those inexperienced in electronics should follow the general guidelines provided below for best results.

Begin construction by cutting a piece of phenolic to slightly less than the diameter of the payload section in which the flasher will be mounted. The length of the phenolic is not critical (1 1/2" should be more than adaquate). Place the prongs of the trimmer resistor through holes in the phenolic board at the location shown in Figure 2. Notice that the moving contact corresponds to the arrow in the circuit diagram. Solder a short length of hookup wire from this terminal to one of the other trimmer terminals.

Bend the leads of the two resistors at right angles to the resistor and insert at the locations shown in Figure 2. Solder one lead of each resistor to the trimmer terminals as shown in the Circuit Diagram. Next, carefully examine the transistors. Note that each of the three leads is labelled "E" (emitter), "B" (base), or "C" (collector) on the plastic case. *Carefully* spread the leads of each transistor so that they will readily fit into a triangle of holes on the phenolic board. Insert the transistors and carefully loop each lead around its proper connection point as shown in Figure 2. Solder the connections with care to prevent damage to the transistors. Next, bend the leads of the capacitor and insert the component into the board making solder connections to the points shown in Figure 2.

Connect the small lamp to the collector of transistor Q_2 and the emitter of Q_1. The lamp should be a small incandescent type rated at from 1.2 to 3 volts. Flashlight lamps will do, but the author prefers the small grain of wheat lamps used in model trains and available in most hobby shops for about $.25. If necessary, adjust the trimmer resistor so that the rotating contact is closest to the side to which R_2 is soldered. This should be done to prevent possible damage to the transistors. A 5,600 ohm resistor may be connected between R_1 and R_3 if it is desired to provide permanent protection, but this is not necessary if care is used when adjusting the trimmer. Connect the positive terminal of a 1 1/2 or 3 volt battery to the emitter of Q_2 and the negative terminal to the emitter of Q_1. If the lamp fails to flash or stays "on," adjust the trimmer resistor until the desired flashing rate occurs. If the circuit still does not flash, disconnect the battery and carefully recheck the wiring. Two leads may be shorted together, there may be an improper connection, or the transistors may be reversed. Also check the battery and lamp to insure that they are both good.

It is extremely important that the circuit be carefully checked to insure its proper operation before the next step – encapsulation of the unit – is undertaken. It is far better to detect a malfunction at this stage than after "potting", for then it will be much more difficult to correct.

When the circuit is properly operating, solder stranded, insulated hookup wire to the circuit board for permanent battery connections. Extend the lamp and battery leads to one side and pot the unit with silicone rubber. Silicone rubber is sold as "Silastic" or "Silicone Seal" in most hardware or variety stores. It comes in a tube and is available in black, white, and transparent. Do not pot the adjustable protion of the trimmer resistor. Encapsulating the unit in silicone rubber is not absolutely necessary, but does provide a great amount of protection in the event of a parachute failure.

The completed flasher is mounted in a payload section as shown in Figure 3. The type of battery used is not critical as the circuit will operate on 1 1/2 to 6 volts. If long battery life is desired and the additional weight can be tolerated, use a 4.2 volt mercury cell (Burgess H 163 or equivalent). With this battery, the flasher will produce 3-5 flashes per second (adjustable with the trimmer resistor) with a flash duration of about 0.2 seconds. A strong solder joint from the battery leads to the battery is important. The shocks of acceleration, parachute ejection, or landing will invariably separate a poor connection.

To solder leads to a mercury battery, first roughen each end cap with a file. Using a hot soldering iron or gun, heat a corner of each end and apply a small amount of solder. Do the same for the battery leads and with the battery supported in a vise or by a clothes pin carefully solder the leads to the battery. Observe polarity to prevent damaging the flasher circuit. Some readers may have difficulty with the above step. If so, try the following approach: Apply a small pool of molten solder to each end cap. Cut a small square of copper foil (available in hobby and craft shops), apply a coating of solder, and place it on the molten solder pool at each end of the battery. The copper squares will readily adhere to the end caps and are very easy to solder. Important: whichever method of soldering is employed, use care and do *not* cause the entire mercury battery to become heated as

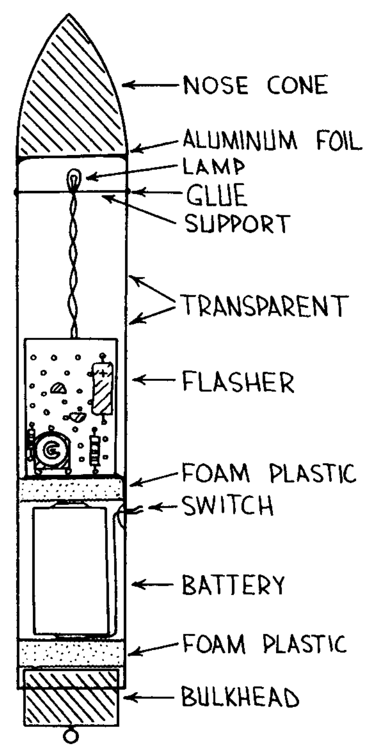


Figure 3. Tracking light assembly installed in transparent payload section.

extreme heat may cause these devices to explode. A good idea is to keep a small container of cold water handy. If the soldering process begins to heat the entire battery, simply dunk it into the water for a minute. If the 23 gram weight of the 4.2 volt mercury cell is excessive, use a pair of penlight cells in series (Burgess N or equivalent). This will provide 3 volts with somewhat less weight than the mercury battery.

After the flasher circuit is soldered to the battery, cut one of the battery leads at midpoint and extend the two ends through a small aperture in the side of the payload section. Remove a small amount of insulation from each lead. At launch, the exposed ends are twisted together and pushed into the payload section. Use a stiff length of wire with a small hook at one end to remove the twisted leads to permit switching the unit off at recovery.

Applications

The transistorized flasher described here weighs a scant 4.2 grams minus battery and silicone encapsulent. Using the relatively heavy mercury battery, the entire assembly should weigh no more than an ounce. The author's original unit was used in a series of 16 flights conducted during a 5 hour period on a dark night. The flasher operated perfectly during each flight and recovery. Ground recovery was relatively easy, the flashing light being visible in relatively tall grass for about 50 feet. Visual tracking of the descent by parachute was also easy. Note, however, that the tracking light of a normally descending rocket will be inverted and not necessarily as visible as in the normal configuration. The rocket assembly may therefore have to descend to a fairly low altitude before the light becomes visible. If this is the case, determine wind direction by observing the sparks from the ejected parachute wadding. A perpendicular from a line in that direction to the ground will eventually reveal the tracking light of the descending rocket. Of course, the model rocketeer may wish to design his particular tracking light assembly so that the rocket may be tracked during its entire flight (sometimes important in micrometeorology experiments involving determination of wind velocities at various altitudes).

In order to derive quantitative information from flasher carrying rockets, photographic techniques are recommended. Any camera which can be set to "time exposure" or "bulb" will do. Recommended films are Kodak Hi Speed Ektachrome for color and Tri X Panchromatic for black and white. Other film will also work, and the rocketeer is encouraged to experiment in order to find the best film for a particular situation.

The author uses two photographic techniques. The first is to mount the camera on a tripod or immovable surface several hundred yards from the launcher. The camera is focussed to infinity and aimed so that the lower edge of the viewfinder is centered on the launcher. In the second technique, the camera is mounted about a meter from the launch apparatus and faced vertically. The rocketeer will want to experiment with both methods in order to determine which provides the best coverage for a given experiment. Also, the rocketeer will probably wish to employ port burning engines in order to prevent the long lasting fire trail of end burning engines from obscuring the tracking light.

Conclusion

The author's flasher was used in a series of experiments which provided important data about a miniaturized guidance and control system for model rockets. The model rocketeer is urged to investigate the numerous possibilities of using a tracking light to provide quantitative data or to provide a recovery beacon in experiments involving telemetry or night photography. Careful construction and proper padding will insure a working flasher for each launch.

q & a

You have mentioned that there were several good designs on transmitters. Could you please tell me where I could find these?

Tom Cuetan
Brookfield, Wisconsin

A transmitter design was published in the May issue of **Model Rocketry**. Other designs can be found in the **Handbook of Model Rocketry** (page 213ff.) and in several of the semiconductor handbooks available from most radio supply stores.

I have preliminary designs for sensors using the variable resistance sensor transmitter as illustrated in *The Handbook of Model Rocketry*, second edition, page 214. I have some questions and requests to make. For one, I would like to know if there are any plans available for other types of information transmitters suitable for model rockets, and if so, where could I get them? Also, do you know where I could get plans for a suitable ground reciever and demodulater to make an input into a tape recorder? I would also like to know where I can get the mentioned micro-miniature radio parts.

One more thing that I would like to know is the details of recording telemetered data on a tape recorder. You have a great magazine! I am very happy to see a magazine that just talks rocketry.

Robert Staehle
Rochester, New York

We are indeed pleased to hear of your activities in the field of telemetry. The surprisingly large numbers of rocketeeers, such as yourself, who are active in electronic work and other advanced, technical aspects of model rocketry, who have written to **Model Rocketry** in the past few months have confirmed the correctness of our philosophy of the hobby.

There do, in fact, exist plans and specifications for model rocket transmitters other than that featured in *The Handbook of Model Rocketry*, and such plans will be published in **Model Rocketry** from time to time (see this month's issue for a good example). You should know that there is an error in the circuit diagram of the transmitter featured in the *Handbook*, such that the transmitter will not operate properly when built as instructed. Do not, therefore, become discouraged if your transmitter will not work at first; a few minor changes in the values of some of the components will correct the difficulty, as the basic design is sound.

Any radio receiver capable of receiving frequencies between 26.995 and 27.255 MHz (such as an all-band radio or a walkie-talkie) will function satisfactorily as a ground receiver for model rocket telemetry. In order to provide input to a tape recorder, it is not necessary to demodulate the signal in the sense of removing the audio frequency heard through the loudspeaker of the radio; the radio itself provides demodulation of the audio from the carrier wave. The recording can either be made through the microphone of the tape recorder (crude) or (much better) by taking the input to the loudspeaker of the radio and feeding it directly, by means of a phono plug, into the recorder. The final demodulation of the data contained on the tape can be accomplished when the tape is brought home from the field to the laboratory, where such instruments as frequency-meters and oscilloscopes are available for this purpose.

By microminiature components, we generally mean integrated circuits. Complete stages of amplification, for instance, which are constructed from a single piece of semiconductor material are available. One of these is the RCA CA3035, manufactured by the Radio Corporation of America, and available in many electronics stores, which can amplify a signal with a gain of 132 decibels in the steady state or 129 decibels when the frequency of the signal is 40 KHz. Dean Black of the University of Utah brought this one to our attention and says he has found it suitable for several projects in model rocket electronics work. Doubtless, there are other such items which will serve a rocketeer's purpose.

GPO Offers APOLLO 11 Photographs

Full-color pictures issued by the National Aeronautics and Space Administration showing the historic Apollo 11 mission, including the first man setting foot on the Moon, will be sold by the Superintendent of Documents, Government Printing Office, Washington, D.C.

Purchases can be made by mail order or in person at the U.S. Government Printing Office bookstores in Washington, San Francisco, Chicago, and Kansas City, Missouri.

The first photographs brought back from the Moon by the Apollo 11 Astronauts were released to the press and television about four days after splashdown. This was a bit later than on earlier manned missions because the astronauts' film first underwent a two-day decontamination procedure as part of the quarantine measures being taken. The Superintendent of Documents anticipates filling orders for these pictures around the end of August.

Pictures will be available in both a set of twelve 11" x 14" full-color lithographs, selling for $1.75 per set, and also a single full-color lithograph 16" x 20" overall, showing man on the Moon for the first time; it will cost $1.00. All pictures will be suitable for framing.

Two other sets of NASA color pictures are already available for purchase from the Superintendent of Documents. They are:

NASA Picture Set 1 – "Apollo - In the Beginning" – a set of seven 11" x 14" pictures covering various scenes of the Apollo missions, including the thrilling Earthrise over the Lunar horizon. The set sells for $1.25 postpaid.

NASA Picture Set 2 – "Men of Apollo" – a set of five 11" x 14" lithograph pictures of the crews of Apollo 7, 8, 9, 10, and 11. The set sells for $1.00 postpaid.

A third group, which will be available about the same time as the photographs of the first manned Lunar landing, is the initial group of a series of reproductions of paintings by well-known American artists, who make their talents available to record the space program.

Called "Eyewitness to Space", the set of twelve 16" x 20" (overall) color prints includes interpretations of space subjects as seen by painters Mitchell Jamieson, Peter Hurd, James Wyeth, Lamar Dodd, George Weymouth, Nicholas Solovioff, Hugh Laidman, Fred Freeman, Billy Morrow Jackson, Paul Calle, and Franklin McMahon. This NASA Picture Set 3 may be ordered for $2.75 per set.

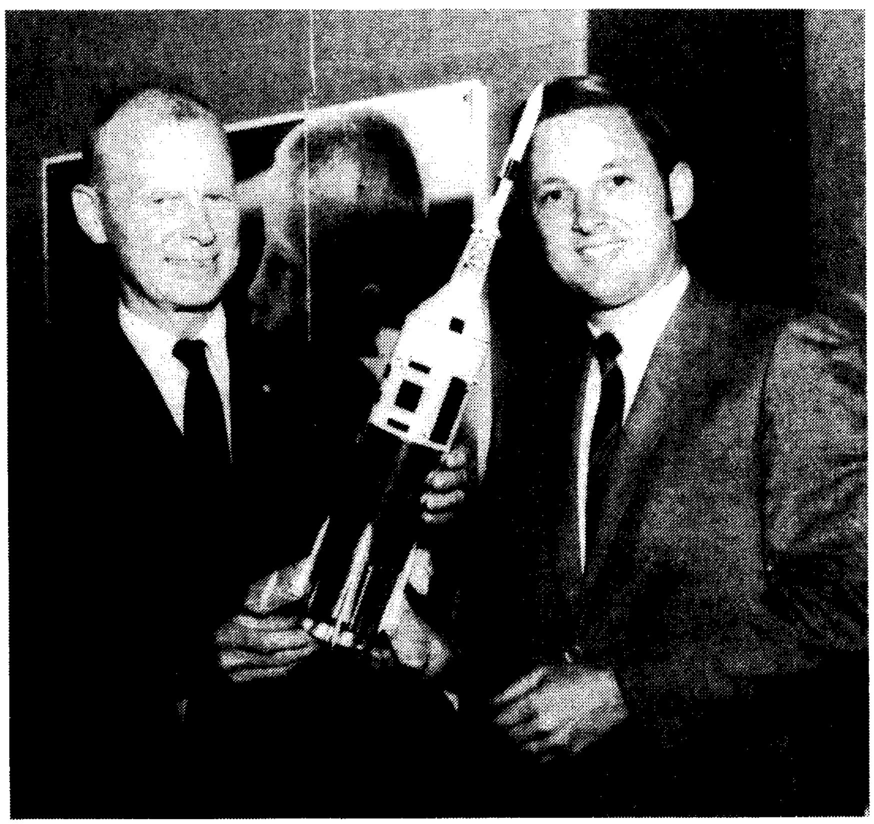
Model Rocketry Expanding in California

Last fall, Robert J. Sampson, a 6th grade teacher at Carver School, Fresno, California organized a model rocket club for his class. Shortly thereafter, Alan Harrison, head teacher at Wolters School, and Ed Parrish, a 5th grade teacher at Vinland School, also started model rocket programs at their schools. Since then, more than 200 students at more than a half-dozen schools in the Fresno area have started building model rockets.

The program has been so successful that a number of other schools as well as a church youth group have asked for more information about it. Sampson, who says he is continually learning more and more about

NEWS NOTES

Centuri Little Joe II Presented to



Six scale models of rockets created by the Centuri Engineering Company of Phoenix, Arizona, were presented to the Smithsonian Institution by Leroy Piester, Centuri President (right). They were accepted by Fred Durant, III (left), Assistant Director, Astronautics, of the National Air and Space Museum at the Smithsonian.

Elementary Schools

rockets as a result of the program, believes the activity has unlimited possibilities. He recently told The Fresno Bee: "I would like to see the program continue to grow. It has the enjoyment and excitement and the type of study involved would become more advanced as time goes by."

Sampson hopes to continue the program, but the young rocket enthusiasts face one problem -- they have lost their launching site. All year the group launched from Sampson's five acre ranch in Clovis. But because of the fire danger, the local fire marshal asked the group to find another site. No new site has yet been found. Potential sites must be outside the city limits, since model rocket launching is prohibited in the city of Fresno.

Though the program began with the students building rockets only from kits, they have now advanced to the stage of designing their own rockets. A number of Carver students have tested their new designs in a wind tunnel to determine stability prior to flight.

the Smithsonian

PHOENIX, Arizona – Six scale models of United States and German rockets created by the Centuri Engineering Company of Phoenix, Arizona, went on display in June in the Smithsonian Institution, Washington, D.C.

They were presented by Leroy Piester, president of Centuri, and Keith Niskern, the company's dealer sales manager, and were accepted by Fred Durant III, assistant director of astronautics, of the National Air and Space Museum at the Smithsonian.

At the same time, Mr. Durant invited Centuri to provide a selection of rockets for sale in the Museum's shops. The Museum is holding a three-month sales promotion on model rockets which will end August 31.

Models given to the Smithsonian were:

Saturn V, launch vehicle of the Apollo 10 spacecraft, at 1/100th scale;

Saturn 1B, at 1/100th scale;

Little Joe, at 1/45th scale;

Little Joe, at 1/100th scale;

Nike Smoke, at 1/10th scale;

German V-2, at 1/40th scale.

While on their trip to Washington, Mr. Piester and Mr. Niskern also attended an open competitive rocket meet at Andrews Air Force Base at which 125 outstanding rocketeers–all members of the National Association of Rocketry–launched over 800 model rockets in attempts to set world and national records. The rocketeers were from Washington, Maryland, and Virginia.

HIAA Issues Statement to Manufacturers

The Model Rocket Division of the Hobby Industry Association of America has issued the following policy statement to all manufacturers and importers of model rocket supplies:

"Rocketeers and manufacturers of model rocket supplies have, in the past twelve years, established an enviable safety record; manufacturers, wholesalers and dealers are deeply interested in maintaining this record. Precise procedures and highly developed skills in the manufacturing of solid propellant engines are chiefly responsible for the present status of model rocketry.

The National Association of Rocketry (NAR) has set specific standards for solid propellant engines, relative to safety and performance. All engines meeting these standards qualify for NAR certification. The NAR has recently announced its intention to extend its testing program into the area of materials used in rocket kits.

Three national Associations are presently concerned with the safety aspects of both kits and solid propellant engines. To assure the continued healthy growth of model rocketry as a hobby, it is essential for all manufacturers and importers considering model rocketry as a business to secure all pertinent information on the subject. Ignoring established guidelines can prove to be costly.

Information on safety standards can be secured from the Model Rocket Division of the Hobby Industry Association of America.

Tim Skinner
Chairman
MR Division, HIAA"

New Product Notes

The new Estes catalog is now out. If you have not yet received a copy, it's available from Estes Industries, Penrose, Colorado for 25 cents to cover the postage and handling costs. The catalog includes a 32 page center section filled with information on model rocket construction techniques, clustering, stability, and much more.

Also new from Estes is the C6-3 engine. Priced at three for 95 cents, these engines are employed in the Saturn V, home-designed payload rockets, and high-powered boost/gliders. An 8-inch diameter parachute, for those rocketeers with small flying fields, is available in five different color combinations. The price is 20 cents each.

The Centuri Engineering *Sky Track* altitude tracking outfit is now in production. Each tracker comes complete with an adjustable tripod and features a peep-sight tracking scope. A single tracker is priced at $16.95; a set of two goes for $29.95.

The new AMT Man in Space plastic scale model kit is now available at local hobby shops. In a constant 1/200 scale, AMT's kit contains models of all five manned rockets flown by the United States – the Saturn V, Saturn 1B, Gemini-Titan, Mercury-Atlas, and Mercury-Redstone. Priced at $5.00, the collection of rockets is intended for static display; both Saturns, however, are big enough to be adapted for flight.

Two new products have been announced by Space Age Industries. The first is a spring which is adjusted to any position on the launch rod to allow the rocket or boost glider to sit above the pad. This makes it easier to connect micro-clips to your engines, and eliminates the danger of shorting the leads together on metal launch pads. The springs are priced at 6 for 25 cents. A second, as yet unpriced item, is a clamp which slides onto the bottom of the launch rod, is fastened by a setscrew, and makes it impossible for the rod to be pulled from the pad if the rocket gets hung up on the rod.

WHAT'S YOUR FAVORITE ARTICLE THIS MONTH?

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

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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

Photos by George Flynn

Above: Don Stone, President of the ARC-Polaris Club, checks the rockets to be flown in the competition at the First Annual Southwestern Model Rocketry Conference.

Right: Col. Bruno Larsen, Educational Director of Centuri, uses the Nike-Smoke to explain the functioning of a model rocket to reporters from several New Mexico newspapers covering the conference.

THE SOUTHWESTERN MODEL ROCKET CONFERENCE

The First Annual Southwestern Model Rocketry Conference, held on the campus of the Eastern New Mexico University (ENMU), opened on Sunday, July 27th. Rocketeers from seven states participated in this first large scale gathering of model rocketeers from the Southwest. The Conference, sponsored by the ARC-Polaris Rocket Club of Portales, New Mexico, opened with a reception in the ENMU library. A NASA display which included one-third-scale models of the Apollo Command and Lunar Modules proved very popular just three days after the Apollo 11 crew returned to Earth.

The reception was followed by a safety inspection of the rockets to be flown in the competition. It was immediately evident that some unusual flights could be expected. Lt. Melville Boyd of Oklahoma displayed a variation on the "Infinite Loop" which incorporated six short stabilizing tubes surrounded by one very large tube. Another entry was a three-staged rocket constructed entirely of paper and balsa wood. The body tube was hand-rolled, the nose cone turned on a lathe, and all other parts were cut from sheet balsa. Gary Schwede of Las Vegas, New Mexico entered a single-staged rocket which the other contestants immediately conceded would take first in the altitude event. Gary's rocket, employing rearward streamer ejection, was finely finished so that there was no evidence of a ridge at the body tube - nose cone joint. Contestants really started worrying when Gary produced a booster stage to allow the same rocket to be entered in two-stage altitude. Two rockets employing forward-mounted engines and rear payload sections (similar to Dr. Robert Goddard's first liquid-fuelled rocket) were entered by rocketeers from Albuquerque. Boost/glide and E-engine altitude proved unpopular, however, with only two entries and one, respectively.

The Conference got down to business on Sunday evening with the opening of technical sessions. Rocketeers were invited to discuss R&D projects in their field of interest. Mike Vinyard of the Albuquerque Model Rocket Club opened the session with a discussion of model rocket tracking at night. Mike's system employs a flashing light, of the type used in some Christmas lights and automobile emergency warning flashers. He mounts the light and battery assembly in the rear payload section of the "Goddard" rocket in order to insure visibility of the bulb during the entire boost phase of the flight. Low-voltage flasher light bulbs of the type used in this project are available in most hardware stores. Ford Davis, also of the Albuquerque Club, described a prototype transmitter which weighs less than two ounces complete with battery. Operating on the 27 mHz Citizen's Band, the transmitter can be modulated to relay data from on-board instrumentation. Later this year he plans to launch the payload section carrying a photocell spin rate sensor, in order to determine the roll rate of his rocket in flight.

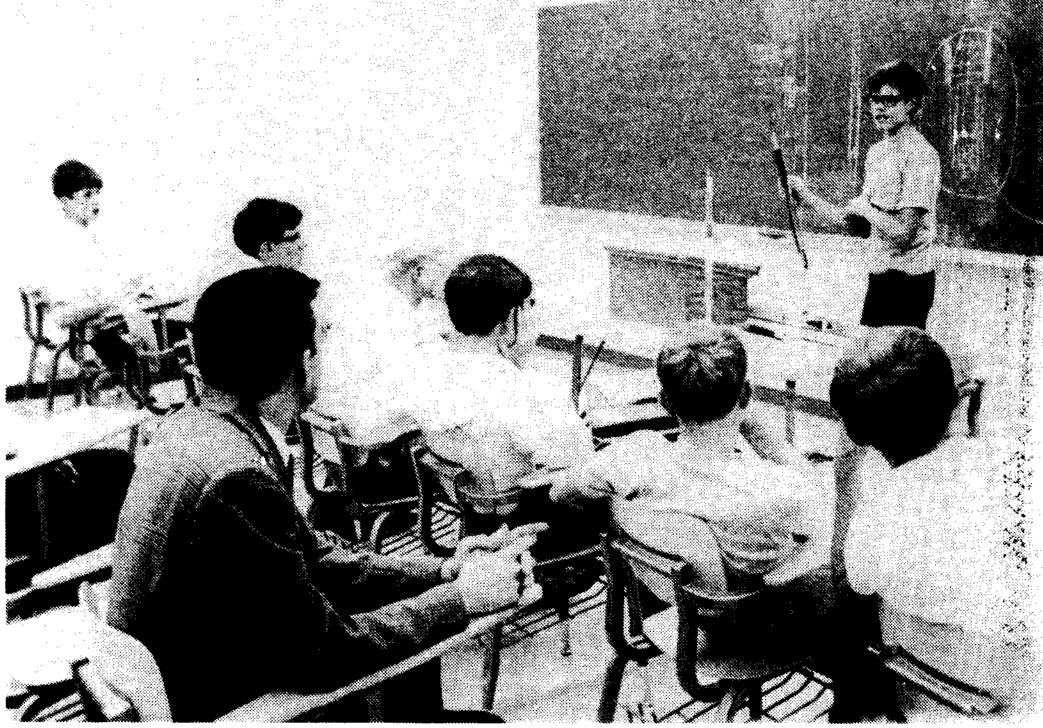
Captain Forrest Mims, senior advisor to the Albuquerque Club, discussed other methods of data transmission. He employs a transistor multivibrator (see his article elsewhere in this issue of Model Rocketry) to regulate the flashing rate of a miniature light bulb. The bulb is photographed during night launchings, and the velocity and acceleration of the rocket can be determined from the light streaks on the film. Captain Mims also described a method of telemetry by infrared radiation. He uses a Light Emitting Diode in a night-launched rocket. The diode is modulated from the sensor, and its infrared output is detected in standard IR detection devices. Since IR is present in normal sunlight, data transmission by Light Emitting Diodes during the day is presently impractical. It would be possible by using carefully tuned circuits to detect the modulated IR; however such devices would be expensive and difficult to construct.

Gary Schwede presented a report on the determination of stability and drag coefficient characteristics of conically-shaped rockets. His data confirm the location of the center of pressure of a cone as 2/3 the cone length back from the nose. He determined that the conical shape is suitable for payload vehicles. Their efficiency, for a given internal payload volume, is slightly higher than that of a standard cylindrical rocket design. Gary's analysis and results will be printed in a future issue of Model Rocketry.

All of the rockets to be flown in the competition had their relevant parameters recorded, and the maximum altitude expected for average rockets of that weight, frontal area, and engine impulse was predicted by the ENMU IBM 360-40 computer. James Miller, Corresponding Secretary of the ARC-Polaris Club, explained the operation of the altitude prediction computer program which he wrote. In the competition, each rocket was scored on how well it did in comparison to the computer's prediction of an average rocket of the same weight and frontal area's altitude.

Mr. Gale, of the ENMU Mathematics Department, described the general operation of a computer to the conference participants. He also explained simple programming in the FORTRAN language. Then he adjourned the session to the computer room and printed out "Snoopy" cartoons, always popular with computer hackers, for all the participants.

Monday's session opened with a discussion by Col. Bruno Larsen, Education Director of Centuri Engineering. Col. Larsen, pointing out that the conference participants represented a dedicated group of model rocketeers, stated that they had an obligation to explain the hobby to the as yet uninformed general public. The difference between fireworks – designed to impress spectators with a pyrotechnic display



Mike Vinyard explains the light flasher mounted in the payload section of his "Goddard" type rocket.

– and model rockets, which have a built-in provision for safe recovery, must be continually emphasized, he told the participants. Model rocketry has one of the best safety records of any sport. He warned, however, that the introduction of "ready-to-fly" rockets onto the market could endanger that safety record. Right now, the major manufacturers and responsible hobby shop owners provide excellent safety instructions to all new rocketeers. "Ready-to-fly" rockets available on the shelves of discount and department stores would be available to young potential rocketeers without adequate safety instructions. This could jeopardize the hobby's future, particularly in those states where it has only recently been legalized or where it is still illegal. Col. Larsen encouraged the participants to join the National Association of Rocketry in support of its efforts to maintain a favorable legal climate for the hobby.

Norm Avery of Estes Industries followed with a film tour of the new Estes Industries plant in Penrose, Colorado. Among the items of interest to the rocketeers were the views of engines coming off Mable, the Estes engine machine, production of nose cones on another machine, and the size of the mail order handling facilities. He disclosed that Estes is developing a model rocket movie camera expected to be on the market sometime next year. The camera will shoot Super 8 movie film, and weigh less than six ounces. A redesigned Camroc, employing a wide-angle lens for even more spectacular pictures, will be introduced for use with color film sometime next year. Ed Brown of the Estes Engine Department described the new D engines which should be in full production very soon. Combining core and end burning grain to produce a high initial thrust followed by a long sustainer thrust, the D's will have a total impulse of 4.5 pound-seconds. Peak thrust will be 10 pounds, sustained thrust will be 2 pounds. The engine will burn for 1.3 seconds and will be available in a zero-delay booster as well as sustainer engines of 3, 5, and 7-second delays.

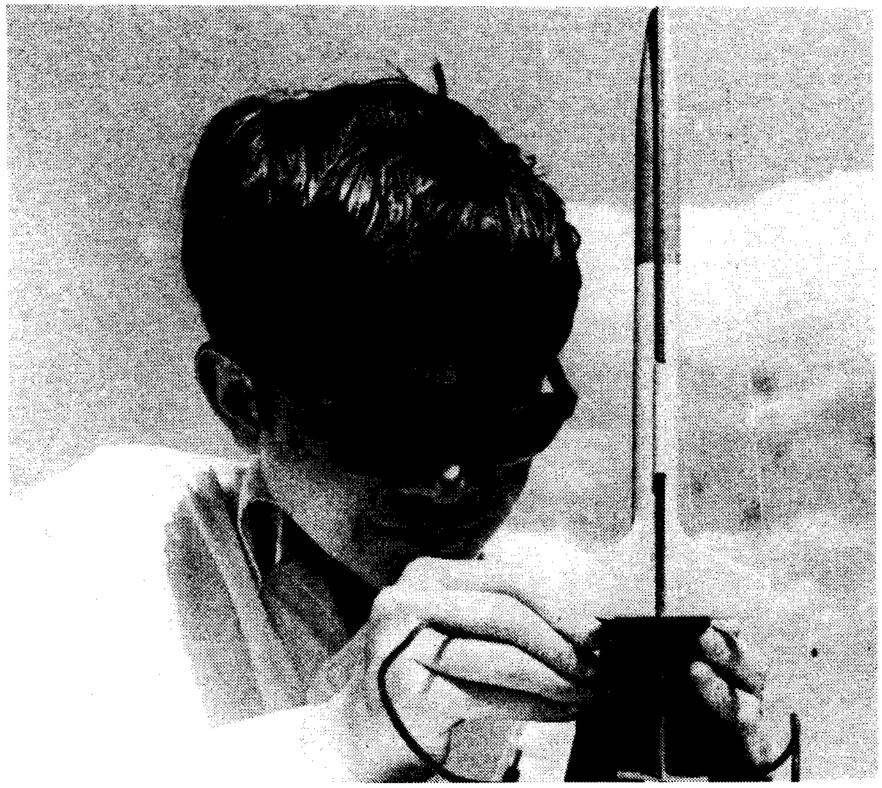
By popular demand, Gary Schwede presented a model rocket finishing discus-

Ford Davis displays the transmitter developed by the Albuquerque Club.

sion. He described the technique used in finishing his altitude rockets which drew praise from all the modelers in attendance. All rockets entered in the competition were judged by Norm Avery, Ed Brown, and Col. Larsen on the quality of their overall finish. Gary's altitude rocket was awarded 298 out of a possible 300 points. His technique, which essentially amounts to applying eight to ten coats of sanding sealer, and sanding each coat almost to bare balsa wood to fill in the grain and give a smooth surface for final painting, requires about eight hours of effort for a 12-inch long model.

I.D. Smith, a technical assistant from the NASA Apollo Test Facility at the White Sands Missile Range, was the guest speaker at the evening banquet. He described the facilities used for static testing of the LM ascent and descent engines as well as the SPS engine on the Command Module. Unfortunately, he underestimated the technical sophistication of the audience when he described accelerometers as "little devices about so big (gesturing) to show motion".

The flight competition from the ARC-Polaris launch complex, four miles out of Portales, began early Tuesday morning. The ARC-Polaris club maintains a one-acre launching site, complete with a blockhouse to house the firing panel, and a large recovery field for use by the club. The launch was a little late getting started, and many of the contestants wandered into the trailer/range store adjacent to the firing area. So many contestants crowded into the trailer, in fact, that the pillar supporting the front end collapsed. The situation was quickly corrected, however, and the launch got underway.


Gary Schwede prepares his altitude rocket for launching.

Prototypes of the new Centuri "Sky-Track" trackers were employed to track the altitude events. The first rocket off the pad was an Estes D-engined demonstration bird. The larger surface area of the D engine's grain results in more delay smoke, giving a dense, white trail for tracking.

Competition got underway with the most popular event – Single Stage, Medium Weight Altitude. As expected, Gary Schwede's single-staged bird topped all the others, with 1509 feet. His rocket was powered by a B4-4 engine. Recovery was easy, even on the windy field, since Gary used a streamer rather than a parachute for recovery.

Competition was light in B/G, with only two entries. Any engine was permitted, and the longest flight time determined the winner. Lt. Boyd managed 58 seconds with a B-engine-powered Estes Nighthawk to take first in the B/G event. The competition continued throughout the afternoon, but the results were not reported until the closing banquet in the evening.

At the banquet the winners were announced and awards presented. Each first place winner received a certificate from the ARC-Polaris Club as well as a model rocket kit donated by Centuri. Gary Schwede's first place in single Stage, Medium Weight Altitude netted him an Apollo Little Joe II kit. Keith Baler received a Nike-Smoke kit for first place in Spot Landing. Lt. Melville Boyd's B/G victory brought him a V-2 kit. The small Centuri Little Joe II kit was awarded to Robert Hogge for his 2 Engine Cluster Altitude victory. Brian Morris received a rocket kit for taking first place in Single Stage Heavy Weight Altitude. Glen McClosky was awarded a Laser-X kit for his 3 Stage Altitude flight. And as expected, Gary Schwede's booster stage added to his winning single stage entry gave him first place and a Saturn IB kit in the 2 Stage Altitude competition.

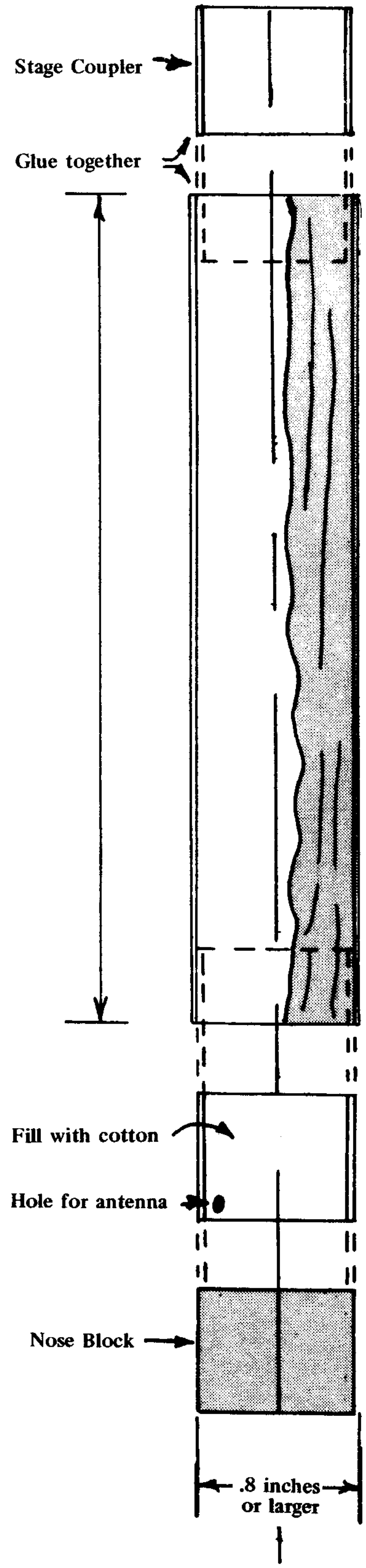
A Certificate of Accomplishment for outstanding R&D was presented to the Albuquerque Model Rocket Club for their technical presentations at the Conference. A special award, for the modeler who exhibited the most potential, was given to Lt. Boyd, whose unusual rocket designs livened up the meet considerably. He received a trophy as well as the Centuri Saturn V kit.

The ARC-Polaris Club presented two special awards to their leadership, who guided the Conference to success. Club President Don Stone and Corresponding Secretary James Miller were awarded plaques from the club. The enthusiasm of the rocketeers present caused club officers to commit themselves to a Second Annual Southwestern Model Rocketry Conference, to be held next summer. If the second conference is run as well as the first then it, too, will doubtless be a resounding success.

Payload Carrier Design

for your Foxmitter

by Richard Q. Fox



This article describes a modular payload carrier designed to maximize the performance of the transmitter described in the May, June, July and August issues of this magazine.

Flying a transmitter in a model rocket is a very strenuous test of the transmitter. The transmitter, and its antenna, are whipped around into all kinds of unusual configurations. A transmitter of the type described in the May issue of this magazine is likely to stop transmitting if the radiation characteristics of the antenna change noticably. This article describes a payload carrier which is designed to accomodate all of the different transmitter sensors which have been described in previous issues of Model Rocketry, and at the same time to improve the stability of the transmitter. The main features of this payload carrier are electrical shielding of the transmitter circuit board, and a recovery system which keeps the antenna hanging straight down, below the transmitter, throughout the flight. This payload carrier is a must for those rocketeers who have experienced difficulty receiving continuous signals while flying their instrumented rockets.

The payload carrier consists of two sections: the transmitter section (see figure 1), and the transducer section (see figure 2). The transmitter section is covered with aluminum foil which is electrically connected to the negative side of the transmitter battery. The foil, which acts as part of the radiating system, stabilizes the transmitter and makes it much less sensitive to

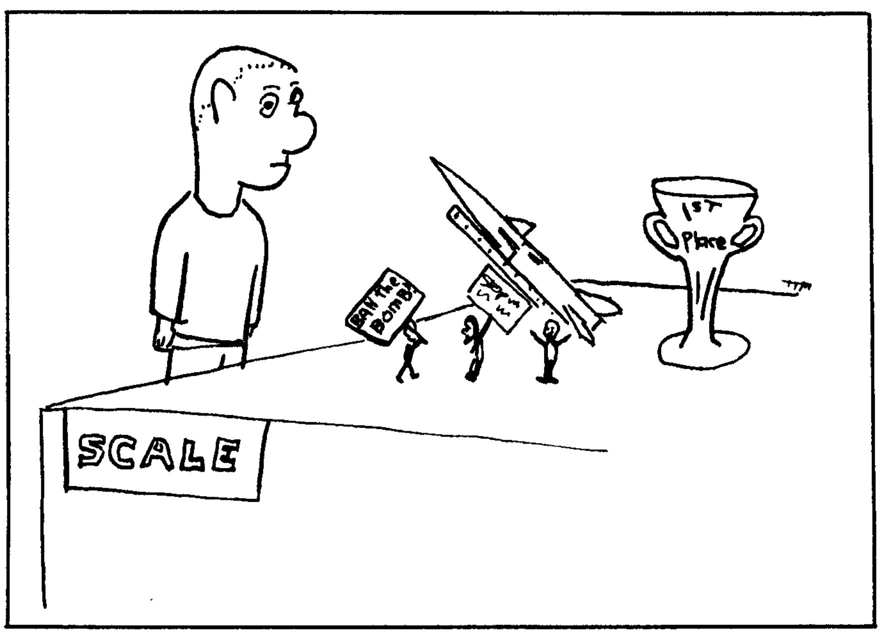


Figure 2

Transducer Section

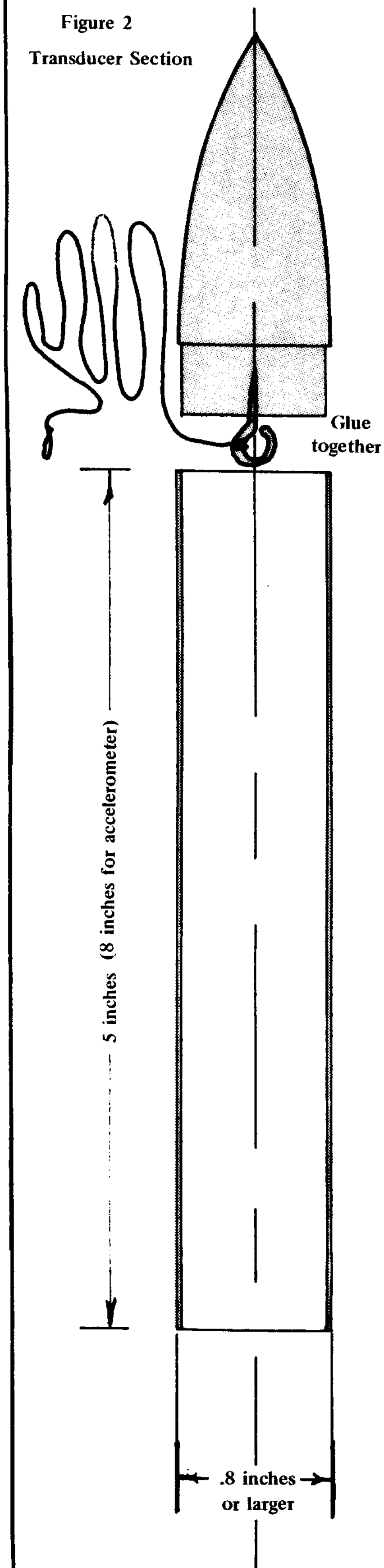
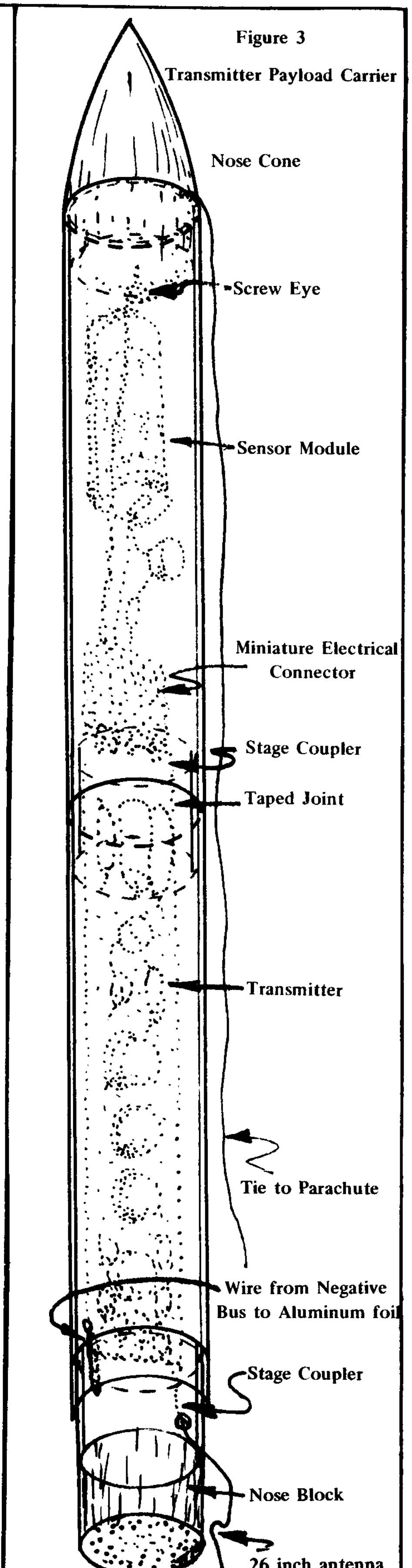


Figure 3

Transmitter Payload Carrier



the electrical properties of external objects.

The transducer section is designed around the specific transducer to be used.

Construction

The payload carrier is constructed from any body tube with a diameter of .8 inches or larger. The transmitter section is prepared by gluing a sheet of aluminum foil to a 4½ inch length of body tube. A stage coupler is glued to one end of the tube. The device which will mate the payload to the carrier vehicle is prepared by gluing a stage coupler to the end of a nose block of the same diameter. Fill the stage coupler with cotton to cushion the transmitter and keep it well inside the foil covered tube. A small hole should be pierced at the bottom of the stage coupler for the antenna. Run *as short a wire as possible* from the negative bus of the transmitter to the aluminum covering the tube.

The transducer section is prepared by covering a 5 inch length of body tube with paint or Super Monokote. A hole should be cut in the side of the tube if a temperature sensor or spin rate indicator is used. Mount a screw eye in the nose cone, and attach an 18 inch length of string to the screw eye. With the string on the outside of the body tube, glue the nose cone to the tube.

If the accelerometer sensor is employed, the body tube should be 8 inches long instead of 5.

Flight Procedure

The transmitter always remains in the transmitter section. It is never removed. The antenna should be cut to exactly 26 inches, and it should be fed through the hole in the stage coupler at the bottom of the transmitter section. (Note: The accelerometer may work better with a slightly shorter antenna.) Plug the sensor module into the transmitter just before the flight , and slip the transducer section of the payload carrier over the sensor module. Tape the two sections of the payload carrier together. Attach the string tied to the nose cone to the recovery system.

When the rocket is launched, the antenna will trail along side the body of the lifting vehicle. At ejection, the payload carrier will hang underneath the parachute by the string tied to the nose cone. The nose cone will be on top, with the antenna trailing beneath. This recovery configuration keeps the antenna away from the transmitter circuit board, thus eliminating one cause of loss of signal.

When the rocket is recovered, the transducer section of the carrier should be separated from the transmitter section by removing the tape. This allows easy removal of the sensor module and battery.

COLOR Aerial Photography

by George Flynn

The Estes Camroc rocket camera is a simple, reliable device for taking black and white aerial photographs from altitudes to several thousand feet. Anyone who has seen a good Camroc photograph can't fail to be impressed with the resulting views. If color film is employed in the Camroc, even more spectacular results are obtained.

B&W vs Color

Inherent characteristics of the films involved make it considerably easier to use black and white than color materials in the Camroc. Black and white film has a wider latitude than color film, making acceptable exposures considerably easier on you. The lack of commercial processing facilities for color Camroc disks makes home processing necessary.

The amount of light which reaches the surface of the film is related to two factors–the shutter speed (length of time the shutter remains open) and the "f-stop" (size of the lens opening). Both of these values are fixed in the Estes Camroc. The shutter speed of about 1/1600 of a second is determined by the strength of the rubber band. The f-stop of about 16 is determined by the focal length and diameter of the lens. Thus a film must be selected which is sensitive to the proper amount of light to give a satisfactory picture from the amount of light available. In the case of the Camroc, a film with a speed of ASA 1200 to 1600 is necessary.

No black and white film currently on the market has a film speed of ASA 1200 or higher. In order to produce an image on the Camroc film, either the film is force developed by leaving it in the developer longer than normal, or a high-power developer such as Acufine or UFG is used. Color Camroc film is processed using the first of these methods. The developing time is extended to increase the film speed from a normal ASA 160 to approximately ASA 1200. Some loss of color balance is noticed, but this does not affect the overall quality of the picture.

The film employed in the initial color experiments was Kodak High Speed Ektachrome Daylight. (See cover photo for results.) Circular film disks suitable for the Camroc should be cut from a 120 roll of this film using the method described in *High Quality Aerial Photography* (Model Rocketry, November 1968). Approximately 18 film disks can be cut from a single 120 roll of film.

Since the latitude (range of incident light which will produce acceptable images) of color film is considerably smaller than with black and white film, it is necessary that at least two disks of color film be flown under the same lighting conditions. One disk is developed, and the resulting color transparency is used to determine the corrections necessary for processing of the second disk. Thus at least two, and preferably three of four color Camroc flights should be flown in as short a time as possible. This is accomplished by loading several film holders with the High Speed Ektachrome film prior to a flying session, and then flying them all in quick succession.

Preparing the Chemicals

In warm or humid areas, the color film should be developed as soon after exposure as possible. Kodak High Speed Extachrome is developed in a Kodak E-4 Processing Kit. The kit is available at most large photo stores. If unavailable, it can be special ordered at most photo stores. A half-gallon kit contains enough chemicals to process about 500 color Camroc film disks. However the chemicals, except for the developers, last only about one month. The developers last 2 weeks, but are packaged in four separate one pint packages in the half-gallon kit. The E-4 kit in the half-gallon size retails for about $10.00 or about 2 cents per photo – if you process all 500 of them! More likely, however, you will fly fewer than 500 Camroc flights in the one month period. You can also use the E-4 kit to process the Ektachrome film you use in your normal photography. This will reduce the waste involved from not using up the complete half-gallon kit. Color Camroc photos must be processed at home, since their unusual shape makes them incompatible with commercial photo finishing equipment.

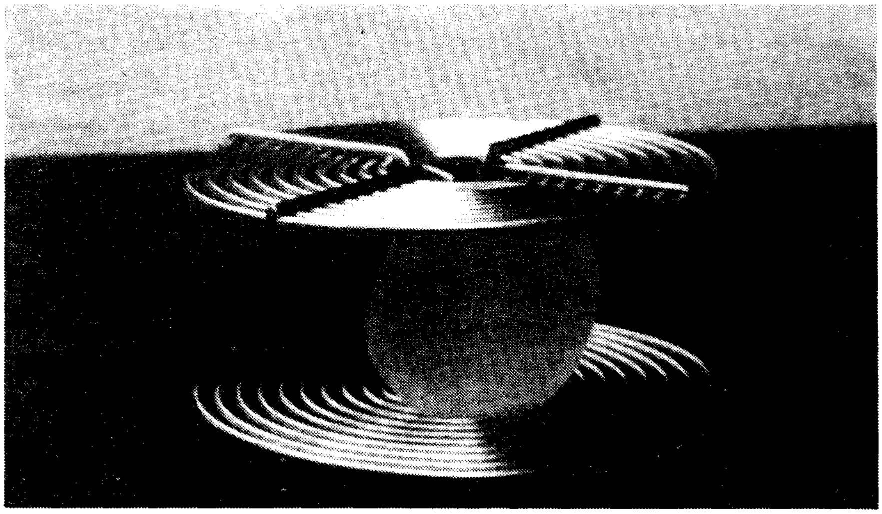
Mix the chemicals according to the directions contained in the kit. *Observe the danger warnings.*

Table 1

Summary of Steps for
Color Camroc Processing in Kodak E-4 Chemicals

Solution	Temperature (degrees F)	Time(minutes)
	FIRST 4 STEPS IN TOTAL DARKNESS	
Prehardener	85 +/- 1	3
Neutralizer	83-87	1
First Developer	85 +/- ½	14
First Stop Bath	83-87	2
	Remaining steps can be done in normal room light.	
Wash	80-90	4
Color Developer	83-87	15
Second Stop Bath	83-87	3
Wash	80-90	3
Bleach	83-87	5
Fixer	83-87	6
Wash	80-90	6
Stabilizer	83-87	1
Dry	Not over 110	until dry

Agitate for 5 seconds every 30 seconds.
Include time required to drain film each step.



Mount film disk in stainless steel reel as shown.

Processing the Film

Process the first Camroc disk in accordance with the directions given in Table 1. *Do not follow the processing instructions given in the kit.* The kit directions will result in processing the film to a speed of ASA 160, rather than the necessary ASA 1200.

With color processing, strict adherence to standard processing temperatures is necessary to assure correct color balance. For example, Table 1 indicates that the first developer temperature must be held at 85 degrees F, with a variation of no more than ½ degree permitted. To maintain these temperatures, photographers generally store all the solutions in plastic bottles and imerse the bottles in a sink full of water which is at the correct temperature. A good thermometer, available at any photo store, will cover the 80 to 90 degree F temperature range.

To prevent contamination of one solution with another, a ten second drain time between each step must be used. Even small amounts of contamination will adversely affect the color balance of the resulting transparency.

Due to the non-standard size of the film, no commercial film holders are available. In order to hold the film during processing, there are two alternatives available. The film can be inserted into the innermost spiral of a standard Nikkor, Kindermann, or Acurra 35mm stainless steel processing reel. The film is slightly bent, emulsion side in, and allowed to seat itself between the spokes of the reel. (See photo.) This method will usually result in a slight defect appearing on the film in the area in contact with the reel. Such a defect is evident on the lower edge of the cover photo. Alternatively, a film box 2 inches on a side can be constructed from galvanized screening. The film is placed in the box, and processing is done by placing the box into the various chemical tanks. If you choose this method, first check to see that the particular screening you are using is compatible with the color processing chemicals.

Processing should be done in 1 pint tanks. Such tanks can be purchased from a photo store. Plastic juice dispensers and other plastic containers also make excellent developing tanks. Again, check for compatibility of your tank with the color chemicals if it is not a commercial photo tank. Since the first four steps must be done *in total darkness*, it is convenient to use at least four processing tanks. All four tanks should be filled with chemicals prior to turning out the lights. In darkness it is only necessary to transfer the film from one container to another, without pouring solutions from the processing tank back to the storage bottle.

Unless the film is properly agitated during processing uneven transparencies will result. As soon as the film is inserted in each chemical, the tank should be tapped on a tabletop a few times to dislodge any air bubbles clinging to the film. In each solution, the reel or box should be moved gently up and down in the chemical (*without removing the film from the solution*) three or four times at the end of every 30 second period. Timing of each step begins when the film is completely covered by the chemical. The time for each processing step includes a ten second drain time at the end of every step. Processing times are listed in Table 1.

After the first disk is completely dry, examine it to determine how to process the remaining disks shot with the same Camroc under identical lighting conditions. If the image is too "thin" (light) the time in the First Developer should be decreased. Try about 11 minutes instead of the 14 minutes shown in Table 1. If the image is too dense (dark) the time in the First Developer should be increased to about 17 minutes. *All other processing times should remain unchanged.*

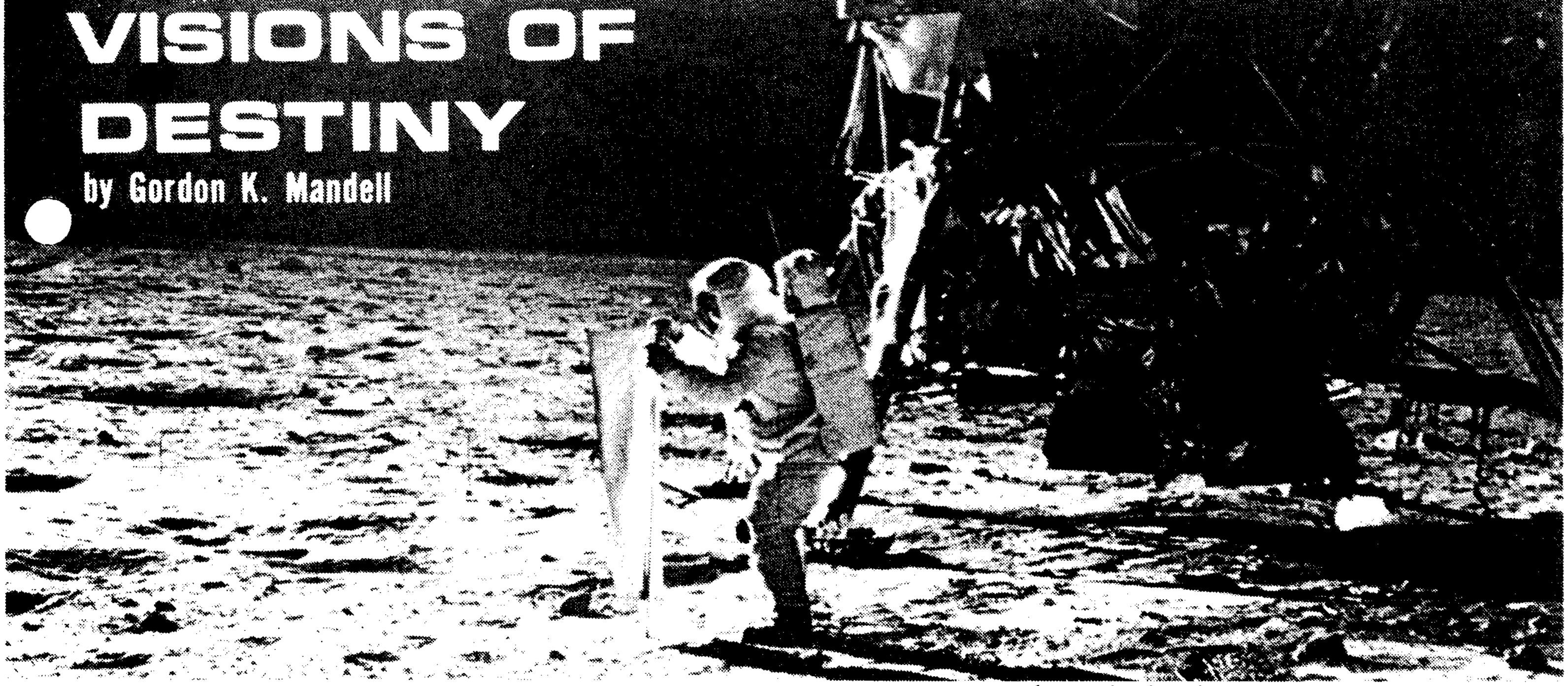
Mounting the Transparency

The 1½" diameter Camroc transparency obtained can be projected with most standard 35mm slide projectors. However, a non-standard slide mount must be made. Two sheets of thin cardboard should be cut to the pattern given in Figure 1. The transparency should be centered on the first sheet of cardboard, and the second sheet of cardboard should be placed over the transparency. Both sheets of cardboard should be glued together, being careful not to get any glue on the transparency.

Before you attempt your first color Camroc photograph, you should be familiar with the principles of black and white Camroc photography. If you have never processed color film before, seek help from a local photographer (perhaps your local high school photo club). With practice, you should be able to determine the correct First Developer time without running a test photo through the chemicals.

VISIONS OF DESTINY

by Gordon K. Mandell



I

Our Spirit Ariseth

Kennedy Space Center, Florida, 16 July 1969
Model Rocketry exclusive..............................

It is now several hours since the oppressive, semitropical night gave way to the shimmering heat of dawn over Merritt Island, a dawn so still that, as the Sun carefully probed to find a spot through which it could burn before rising full above the dull-blue cloud deck lying hull-down on the Atlantic horizon, one could not help but feel that Nature herself must be waiting in silent awe to witness the events of the coming day. The Sun having presently succeeded in freeing itself from the sea-clouds, it has become full morning on a bright, humid day of pale blue skies and high, drifting cumulus.

It is shortly after nine o'clock in the morning of July 16th in the year 1969 of the Christian calendar. It has been some six thousand years since the dawn of Man's first great civilizations; fifty thousand since his first intentional use of fire; one million since his first appearance on the Earth. The significance of what is about to happen here cannot be reckoned but in terms such as these.

For the hour draws near when he shall free himself with absolute finality from the chains of gravity which have, this past millenium of millenia, bound him to the planet of his birth. We are soon to be embarked upon a great and neverending journey, a journey in whose course our inborn destinies as a species shall attain to their highest fulfillment. Man of Earth is about to begin his first voyage to another world. to take that first small step along a mighty road whose end will not be reached until the star-flung civilizations of Man and his fellow races of the Universe are spread in one vast and magnificent polity the full length and breadth of the Galactic Lens -- and, perhaps, not even then...

> Note: In order that **Model Rocketry** might bring its readership this special narrative of the flight of Apollo 11 it has been necessary to delete the *Wayward Wind* column from this month's issue. *Wayward Wind* will return as a regular feature next month. All chronology in *Visions of Destiny* is given in U.S. Eastern Daylight Time.

The ship which is to bear him on this momentous voyage lies in her berth a bare fifteen thousand feet distant; no closer may we who stand watching approach, lest we be deafened by the violence of her departure. Her name is Saturn V and she is the sixth of her kind to set out from this port -- this port called, rather pragmatically, Launch Complex 39, Kennedy Space Center. Five before her have gone, and three have carried men. Four of the five have used the same berth -- Pad A, it is called, while her immediate predicessor left from the more distant Pad B. Five before her have gone, and three have carried men, but the ship standing now before us is the purpose for which the others all were built.

Her destination is the surface of the Moon.

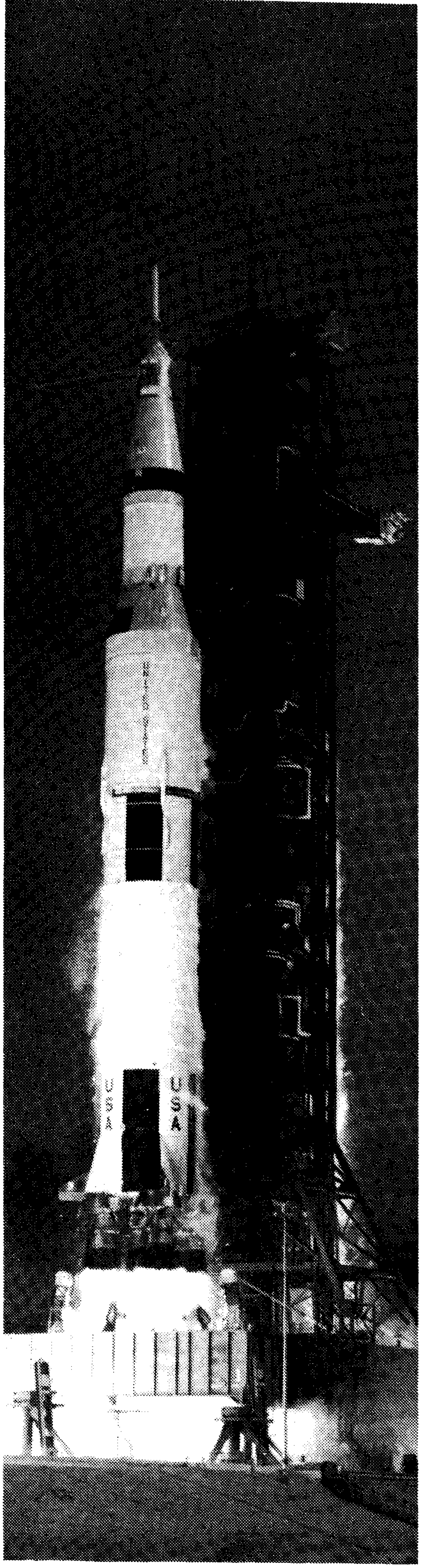
She is the culmination of the labors of half a generation, the product of the expenditure of fifty thousand man-lifetimes and twenty-four billion dollars, the pride of a large and powerful state. But all this is as nothing compared to what she truly is in this hour: the bearer of human destinies out to the stars. Three hundred sixty-three feet she stands, three hundred sixty-three from the tip of her launch escape tower to the exit bells of her five mighty F-1 engines, each capable of generating more than a million and a half pounds of thrust. Thirty-three feet in diameter at her base, not counting finspan or engine skirts, she is a great, alabaster needle with jet-black bands gleaming through the misty morning at the right of her dull-red Launch Umbilical Tower. Not many hours ago, in the blackness of night, the mighty beams of billion-candlepower xenon searchlights illuminated the ship and her berth while nearly a million and a half pounds of high-grade kerosine and more than four and a half million of steaming liquid oxygen and hydrogen were pumped aboard. The venting of the cryogenics and the thirty-mile stab of the xenon beams, a cosmic display of living light, created a nightlong heavenly splendor that overwhelmed the mortal eye. Now, in the light of day, the mighty rocket betrays the living energies within her only by the snowy plumes from her LOX and LH2 pressure relief ports.

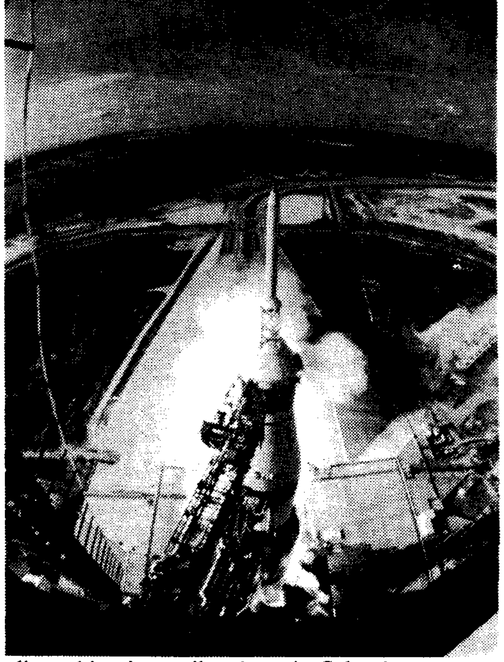
The rocket.

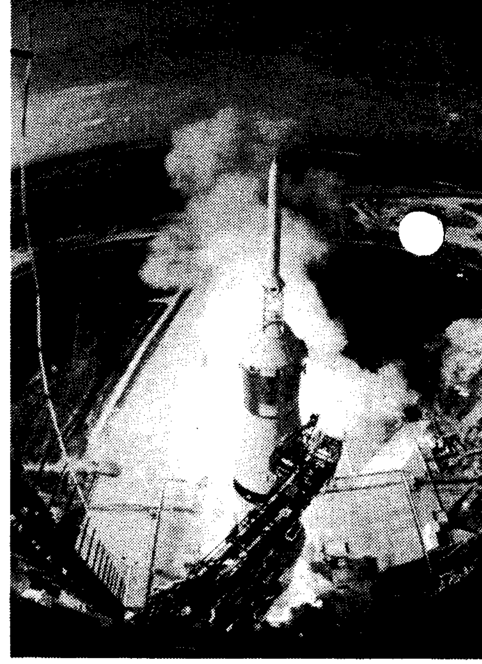
Whose lower two hundred eighty-one feet of length are called, with cold precision, "Saturn V Launch Vehicle".

Whose remaining eighty-two feet are collectively identified by a single word: "Spacecraft", a word whose full meaning cannot be explained to those who do not feel it in the innermost depths of their being.

The major constituents of that which is called "Spacecraft" are the Command, Service, and Lunar Modules. Two of these have been christened with names of their own by the men who will fly them. Edwin E. Aldrin, Jr., is to pilot the Lunar Module *Eagle*, bearing himself and Spacecraft Commander Neil A. Armstrong on the expedition to the surface of the Moon, while Command Module Pilot Michael Col-







lins orbits sixty miles above in *Columbia*. It is fitting indeed that, on such a voyage of exploration and discovery, names like those of the ships of another Age of Discovery should be given these ships of space.

Aldrin, Armstrong, Collins.

The flightcrew.

Discoverers, explorers of Mankind's first landfall on the way to the far stars, doers of deeds of which sagas are sung, whose names shall be graven upon History alongside Ericsson, Columbus, and Magellan. They have been in their vessel for just over two hours.

Three miles to the west-southwest, on the third floor of the building known as the Launch Control Center, an hundred and fifty of their fellows are completing the final phases of that incredibly complex operation called "countdown", an operation whose steps must follow in ritualistic precision if the mighty engine whose proper functioning is their life's purpose is to keep her appointment with Destiny. It is from here that each and every system and function of the great ship is monitored and checked time and again to insure that its operation will be as her builders have planned. It is from here that the vital decisions affecting the continuation of the mission and bearing upon emergency procedures will be made during the first ten seconds of the flight of Apollo 11 (thereafter decisions of this nature will originate at the Mission Control Center in Houston, half a continent away). And it is from here that the voice of the Public Affairs Officer is carried to the loudspeakers at the press site. That voice has just announced the time remaining to liftoff as twenty-one minutes, fifty seconds.

Of the thirty-five hundred persons at the press site, more than a thousand have moved forward several hundred feet from the main press facility to the edge of the turning basin where, not many months ago, the mammoth stages assembled for today's

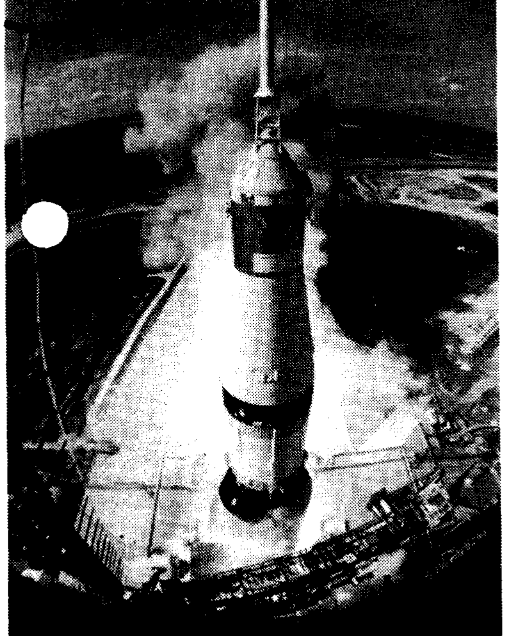
NAR Modelers Represent U.S. Youth in Japanese Interview

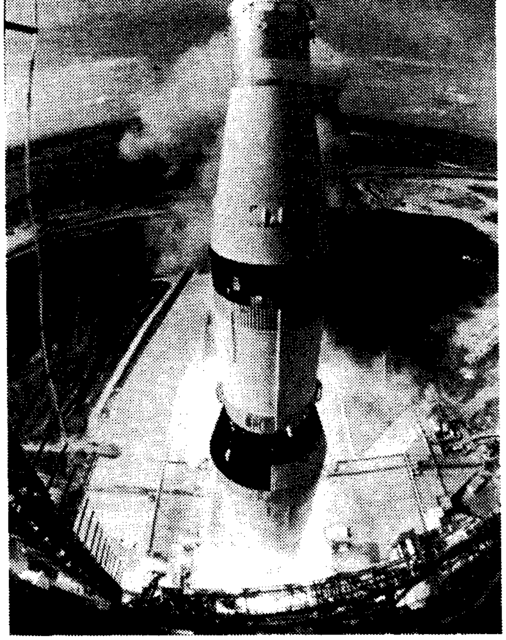
During the Apollo 11 mission it was not only America's space achievements but every aspect of our society, with its unique blend of advanced technology and frontier spirit, that came under the scrutiny of a waiting world.

The publishers of the Japanese magazine *Asahi* (roughly equivalent to our *Newsweek*), in particular, wanted a story on the feelings and attitudes of America's young people in this hour of her technological triumph – and they chose a group of young NAR rocketeers as emblematic of the spirit that has propelled the United States to a position of preeminence in the exploration of space.

Reporter Jin Uyeda, accompanied by translator Peter Kamura, attended a model rocket launch conducted by the NARHAMS Section on the afternoon of July 20th and spent the evening of July 20th - 21st at the home of NAR Publications Committee Chairman James S. Barrowman. Jim, his Japanese guests, and ten members of the NARHAMS sat before the screen of the Barrowmans' TV set during the Lunar landing and extravehicular activities of Astronauts Neil Armstrong and Edwin Aldrin while newsman Uyeda took copious notes on the reactions of the young rocketeers to the historic occasion.

Complete coverage of this and other news media reporting of NAR activities in conjunction with Apollo 11 will appear in next month's *Model Rocketeer*.





NASA Photos

launch were removed from the great barges which brought them in by sea. The murmuring of the newsmen fills the air as they query each other on the status of the mission and complete finals adjustments to their equipment. It is difficult to hear the PAO from this advanced position, and many rely on portable radios tuned to the major networks for countdown information. As the count proceeds the anxiety to obtain good viewing positions increases; the yellow nylon safety rope is trampled underfoot as reporters and cameramen move to within five feet of the low cliff that drops off into the murky depths. Many have attended prior launches. They are no strangers to the sights and sounds of liftoff. But the mood today is different, the concentration more intense, the tension more evident. This is it...the big one. Never again in all the history of Man will there be such a moment as this. More than a million people now line the beaches of Brevard County in hopes of capturing but a tiny fraction of that moment for themselves; to watch from fifteen, twenty, even thirty miles away as the fiery needle that is Apollo 11 climbs toward the stars.

"Mark. T minus 10 minutes and counting. We are aiming for our planned liftoff at 32 minutes past the hour. This is Kennedy Launch Control."

The voice, echoing tautly over field and basin, reiterates the immediacy of Eleven's departure. The level of conversation diminishes; the sounds of photographic equipment increase in frequency and intensity.

"We are now passing the 4-minute, 30-second mark in the countdown."

This time the PAO is clearly audible; there is very little conversation. The people here are professional journalists, famed for their cynicism, but even they cannot avoid being caught up in the excitement of these last few moments before Man sets out on the pathway to the stars.

"T minus 2 minutes, 45 seconds and counting."

Nearly quiet now; very little movement as the count proceeds.

"T minus 60 seconds and counting."

At minus 50 seconds the launch vehicle is transferred to internal power by the automatic launch sequence that has controlled the countdown since minus 3 minutes, 10 seconds. When Apollo 11 is bound away for the Mare Tranquilitatis it will be one of the most precisely controlled, as well as significant, events in history.

"30 seconds and counting."

A dark-gray mist begins to envelop the Launch Umbilical Tower; this is the start-up of the water quenching system that will be used to minimize damage to the pad area at liftoff. Shortly after minus twenty a chorus of whirrs is heard...the sound of moving picture cameras anticipating ignition.

"T minus 15 seconds, guidance is internal....12, 11, 10, 9, ignition sequence starts..."

Dead silence in the press area, but for the soft whirring of the cameras...

"...6, 5, 4..."

The flame is visible now: a bright, rich orange, it grows from a flicker to a ball, a cloud, a living explosion of light and heat,

NASA Nixes Stine's Scale Moon-Launch

Ah, for the trials and tribulations of a TV network science consultant! The Old Rocketeer, G. Harry Stine, found himself in such a position for CBS News during the recent Apollo-11 mission. Harry arranged a special flight session in New Canaan for CBS, which they spent all one Sunday afternoon filming, and which they never used at all... much to the dismay of about 50 model rocketeers.

However, Stine managed to get an advance copy of the Estes Saturn-V model in 1/100 scale for the film demo, and it flew beautifully. The CBS network brass were so delighted with the model that they immediately packed it up and sent it to Cape Kennedy...along with Stine, his launcher, and a box of motors. The big deal was to launch the model Saturn-V from Cape Kennedy on July 16, 1969, shortly after the *real* Saturn-V lifted off some three miles from the Press Site.

Well, Apollo-11 blazed on its way moonward, and Stine proceeded to unpack the "little" Saturn-V, prep it for flight, and get everything set up.

But NASA said "NO."

Seems that the Stine-CBS-Estes Saturn-V did not (a) have an approved flight plan, (b) have an approved mission, (c) have a scheduled range launch time, and (d) had no range safety clearance from the Air Force and NASA! Also, the little Saturn-V did not have the 30-pound range safety destruct radio receiver installed so that the flight could be terminated... no doubt in case the model headed toward the Cape Colony swimming pool!

So the Estes Saturn-V went back into its box and was sent to the New York studios.

According to an interested bystander who wishes to remain anonymous, it didn't really happen that way at all, however. "It was like this: July 16th was NASA's day to fly *their* Saturn-V, and *nobody else* could fly their Saturn-V from the Cape that day...not even CBS!"

It was also rumored that the Old Rocketeer breathed a sigh of relief, too. CBS wanted to run the model Saturn-V lift-off on live camera over the entire CBS network. Who could blame him for being a little bit chicken? Rumor has it that even Vern Estes wouldn't do it either!

causing the smoke at its periphery to glow with a seeming radiance all its own.

"...3, 2..."

A sound breaks from the assemblage at the water's edge, a gasp-sigh-exclamation that cannot be even approximately described and which I have never heard on any other occasion before or since.

"...1, zero, all engines running, LIFT-OFF."

Even though the PAO has shouted this last, it can barely be heard. A thousand men and women are shouting, screaming, praying a single word:

"Go...*go*...*GO!*"

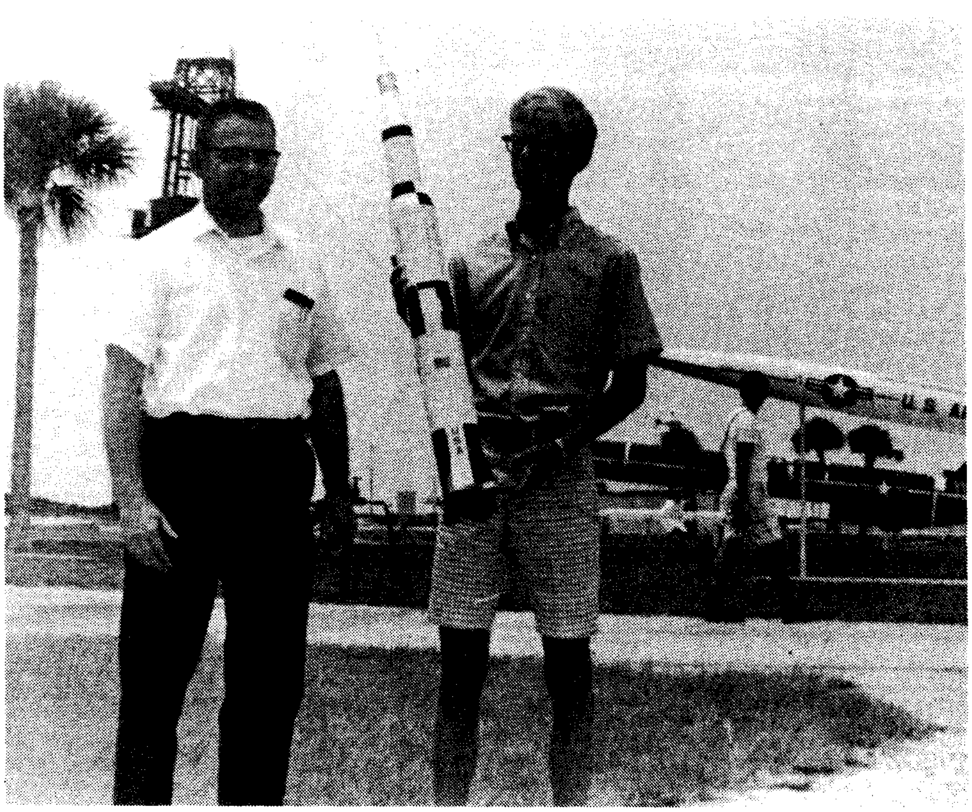
And she does. At three-quarters of a second past 9:32 in the morning, Apollo 11 leaves the Earth behind. The service arms swing back to permit her passage; she rises above the Launch Umbilical Tower like a living thing, her six million, four hundred thousand pounds borne light as a feather by a force of more than *seven million, six hundred fifty thousand* pounds. The throng falls silent for a second or so...many are taking pictures; others cannot speak. Then the cheering begins, the cheering and the lone Rebel yell that tears loose before the sound of the rocket itself drowns everything in an earsplitting, staccato roar that drives every recording instrument in the area into saturation. It seems that the heavens themselves are being rent asunder to let Eleven through....the sound beats on one's face; every particle of the air for miles around mounts a savage attack on its neighbors in the fury of the sonic assault. Even at that it is quieter than usual for a Saturn V launch, as a fresh breeze is blowing seaward. The mind rejects the possibility of the effect that would ensue, were the wind to blow toward the press site...

Apollo 11 is now standing free of the pad on the full length of her thousand-foot flame, pointing proud and true along her prescribed trajectory; the required roll maneuver has been completed and and pitch program is in effect. She begins to tip perceptibly downrange, accelerating ever more rapidly. There is but one small cloud in her path and, as she passes 15,000 feet, the mighty vessel burns a five-hundred-foot hole right through its center. For a brief instant the fleeting shadow of the rocket can be seen on the cloud's dazzling face...

One minute since first motion; the brilliant, white vapor contrail appears and the sound of the engines begins to diminish. Eight miles high and 2.7 miles downrange, at a velocity of 2640 feet per second, the condition of maximum aerodynamic pressure is reached and left behind. Foreshortened by the pitching angle and diminished by distance, Eleven is rapidly dwindling to a point of light atop her flowing contrail.

Two minutes, fifteen seconds. Right on schedule, the central F-1 engine of the first stage shuts down. The ship is nearly 28 miles high now, and 25 downrange. The contrail ceases for a few seconds, then reappears, still heading arrow-straight into a clear, blue sky. The flame is still bright orange, still clearly visible, now spreading into a great fan behind the rocket as the pressure of the surrounding air diminishes. The engines' once-mighty roar has dwindled to a barely-audible muttering in the dist-

MODEL ROCKETEERS WITNESS APOLLO 1



Vernon Estes (left) with Sven Englund on the grounds of the U.S. Air Force Space Museum. Sven holds 1/100 scale Estes Saturn V. In the background may be seen Hound Dog, Snark, and Sparrow missiles and (just behind Vern) the gantry from which Explorer I was launched. Museum is on Cape Kennedy Air Force Station.

When Apollo 11 thundered heavenward on July 16th there were those among the multitudes who stood watching to whom spaceflight is more than just a spec or a front-page story. There were s .tists, engineers, and technicians who had labored unceasingly for ten years to develop the great Saturn booster and its Apollo spacecraft. There were executives of the corporations in whose factories the great ship had been built. There were officials of the government whose support had made the historic voyage possible. And there were two generations of model rocketeers.

At the press site, in addition to Jay Apt, George Flynn, and Gordon Mandell of Model Rocketry there was G. Harry Stine, the "Old Rocketeer" who has been with the hobby since its earliest days, now serving as Science Consultant to CBS News for the Apollo 11 mission. Terry Schmidt, the first model rocketeer to successfully fly and recover live fish (back in 1962), was present as a reporter for the Washington state journal *Helix*, and Joel S. Davis, whose ultrahigh-thrust clustered designs have broken the sound barrier on several occasions, was down as a representative of WGBH-TV in Boston.

From the parkway observation site one mile south of the Vehicle Assembly Building and just three and a half miles from the pad Sven Englund, 16, his sister Laura, 13, and their parents, of New Canaan, Connecticut, winners of a week-long Florida v on as first prize in the Estes Industries o 11 ance.

Two minutes, forty and eight-tenths seconds. The titanic energies of the S-IC are consumed; the thrust of the four remaining F-1's dies away. Apollo 11, now more than 41 miles up and nearly 50 downrange, prepares to jettison the spent stage. The cessation of contrail, the puff of smoke as the separation retrograde rockets fire, and the springing to life anew of the orange point of light in the sky as the five J-2 engines of the S-II stage complete by their ignition the first staging sequence of the flight are all clearly visible to observers on the Earth more than sixty-seven miles distant. The drama is enacted in utter silence now, as if the atmosphere were too badly beaten to transmit sound any longer. Those without binoculars or telephoto lenses are beginning to lose sight of the ship, whose progress their companions relate to them in running commentary:

"That's it....they've got it...staging, ignition, this one doesn't have a contrail...no – wait...it's back again, a nice, bright, white one... beautiful, it's beautiful...the most beautiful thing I've ever seen!"

The PAO again: "At 3 minutes, downrange 70 miles, 43 miles high, velocity 9300 feet per second." Eleven is now more than a third of the way to orbit; the underexpanded exhaust of the S-II traces out a snowy contrail fan half as wide as the ship is long, slowly contracting to a single, alabaster thread and fading into the hazy distance. A few seconds later this, our last vision of the human spirit arising on the winds of Eternity's dawn, is lost in the heavens' vastness.

Our eyes fall slowly to the steaming pad; to the Launch Umbilical Tower, still wrapped in gray vapor; to the towering mixture of water vapor and kerosine smoke, seething gray and white, now compacting up against the base of the lone cloud pierced by Eleven's passing. As we stand thus gazing at the traces of her leavetaking, at eleven minutes, fifty seconds into the mission, Apollo 11 achieves Earth orbit. No longer of us, no longer of Earth, Apollo 11 from this moment on will be subject to the eternal laws that govern the paths of planets and stars.

History alone can follow her now.

It is a moment each of us is to remember for the rest of his life.

II

...For All Mankind

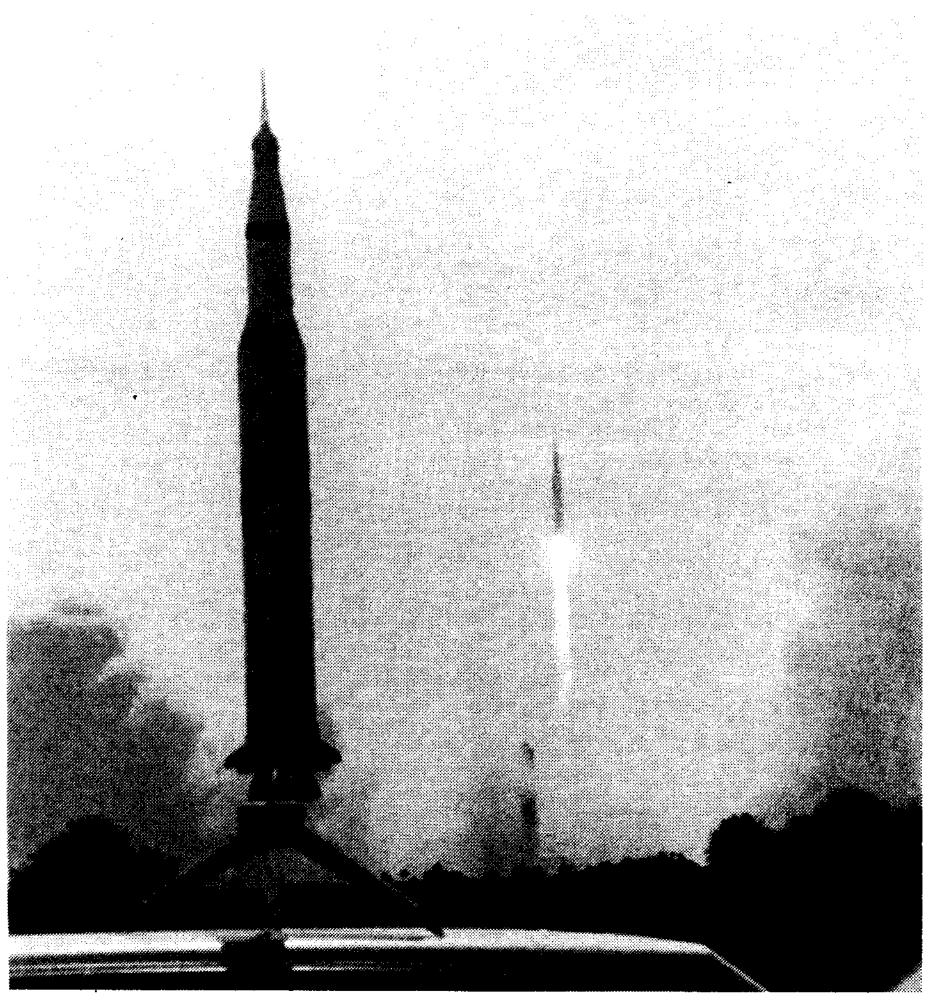
Shortly after 4:17 in the afternoon of July 20th, 1969 a squat, articulated space vessel named *Eagle* passes low over a rock-strewn wasteland and comes lightly to rest on the surface of the Moon in a place known to her builders as Site 2: Lunar latitude 42 minutes, 50 seconds North; longitude 23 degrees, 42 minutes, 28 seconds East. The figures describe a spot on the Eastern equatorial part of the Moon in the southwestern region of the Lunar plain men call Mare Tranquilitatis...Sea of Tranquility. Sixty-two miles to the westward lies a geological feature known as Crater Sabine; 118 miles to the northeast is

l LIFTOFF

Sweepstakes, saw the launch right from the moment of ignition until after the first staging, when Apollo 11 was better than a [illegible] of the way to Earth orbit.

Arriving in Florida on the 11th of July, the Englunds picked up Vern Estes, his wife Gleda, and daughter Betty Ellen, 17, at McCoy Field outside Orlando on the 14th. The two families then drove eastward toward Kennedy Space Center, where together they stopped at the Visitors' Information Center to browse and pick up some souvenirs of "Moonport, U.S.A.", and toured Kennedy Space Center and Cape Kennedy Air Force Station on the 15th. One of the highlights of their tour was a stop at the huge VAB, where the Saturn rockets are assembled. Within the building, in the shadow of the partly-stacked Apollo 12 and 13 vehicles, Sven and Vern took time to pose for some pictures with the new Estes Saturn V model, a precision-engineered 1/100 scale replica of the "real thing". The Estes and Englund families were together at the parkway viewing site at 9:32 the next morning, front-row spectators at the launching of Man's first voyage to another world – one of the most memorable events of this or any other century.

The Englunds returned to New Canaan on the 18th, laden with souvenirs and photos – and a lifetime of memories ... [illegible]tesy of the Estes Industries Apollo 11 [illegible]epstakes.



1/100 scale model Saturn V built from Estes kit poses in the foreground as full-scale Apollo 11 Moon rocket lifts off. Photo was actually taken by Vern Estes at KSC on 16 July, 1969.

another, Maskelyne.

The landing, primary goal of the voyage from Earth begun more than four days earlier, is the first contact of a manned vessel from Terra with the soil of an alien world. The historic moment is marked by a single, terse sentence from Spacecraft Commander Armstrong: "Houston, Tranquility Base here. The *Eagle* has landed."

Tranquility Base. A name to live in legend beside Vinland, San Salvador, Plymouth Rock...

Precisely six hours, thirty-nine minutes later Armstrong's booted left foot touches the powdery dust of the Lunar surface. In all probability, it is the first living thing ever to do so. From *Eagle*'s footpad to the surface of the Moon, Armstrong observes, is "...one small step for a man; one great leap for Mankind." In the course of the subsequent exploration and emplacement of experiments Neil Armstrong is destined to spend two hours, fourteen minutes on the Mare; Edwin Aldrin is to be out of the ship one hour, forty-eight minutes. Brief moments, indeed...but how incalculably portentious for all the future ages!

At Apollo 11's port of departure nearly a quarter million miles away the night passes and yields to another dawn while the explorers sleep for the first time in more than twenty-four hours. Then, as the Sun ascends the soft, blue sky of their distant homeland, they make ready their departure. At 1:54 in the afternoon of the twenty-first of July Aldrin ignites the *Eagle*'s ascent propulsion system, lifting her ascent stage from the surface of the Sea of Tranquility to her appointed rendezvous with *Columbia* manned by the patient Collins, orbiting sixty miles above. With them the Lunar explorers take some sixty pounds of geological samples destined for painstaking analysis by 542 scientists from nine nations of the Earth – analysis that, among other things, will aid in guiding the course of Man's permanent colonization of the Moon.

Behind them the spent descent stage of the *Eagle*, scarred and discolored by the heat of their departure, stands stark and lonely against the near horizon; an eternal monument to the indomitable spirit of humanity. Fastened to one of her landing legs the men have left a small plaque bearing a map of the Earth and the simple inscription:

HERE MEN FROM THE PLANET EARTH

FIRST SET FOOT UPON THE MOON

JULY 1969 A.D.

III

Home Is the Sailor

Three more days have passed; it is now thirty-seven minutes past noon on the twenty-fourth of July. *Columbia*, traveling at a speed of nearly seven miles per second, touches once more the outermost reaches of her home planet's atmosphere. Slowing her breakneck pace in a precisely-executed maneuver that walks a delicate tightrope between deadly heat and crushing deceleration on the one hand and a disastrous skipout on the other, she flies a blazing, thirteen-hundred-mile course behind the protective insulation of her heat shield.

Her journey ends some 950 miles southwest of the Hawaiian Islands, at 10.6 degrees North latitude by 172.4 degrees West longitude, with a landing in the Pacific Ocean nine miles from the aircraft carrier *Hornet* just twenty-one seconds after the predicted instant of splashdown.

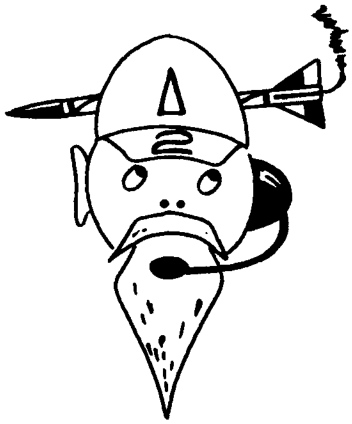
Columbia hits the water at 12:50 in the afternoon, as time is reckoned at the site from which she left the Earth just eight days, three hours, and eighteen minutes ago. It is early morning at the site of her homecoming, and as *Columbia* is brought aboard *Hornet* the dawn light reveals a surface blackened and eroded by the searing heat of atmospheric friction. Of the mighty six million-pound vessel that set out from Complex 39 barely twelve thousand pounds remain. The rest has been sacrificed to the laws of gravity and rocketry, that *Columbia* alone might return.

Columbia alone: one small ship and her heroic crew, tired and cramped from their eight days of confinement and destined for twenty-one days of quarantine before they are allowed to rejoin their fellows, but alive and well in their moment of triumph.

Columbia alone: one little ship in which men have dared to cross the first small gulf in that greatest of oceans, the eternal frontier of the skies. Her voyage has been but one saga of an epic that reaches from the first range of hills to beckon the wanderlust of Man in his infancy to the limits of Infinity and the end of Eternity itself. Over the mountains, across the plains, the seas, the polar ice, to the ends of the Earth and beyond has the spirit of Man striven and prevailed; nothing can confine him. *Columbia* has sailed, as all vessels of humanity before her and all will forevermore, for the preservation and furtherance of this heroic spirit, for the conquest of a hostile and inanimate Universe by the power and glory of Life.

This is our true way of life.

This is our destiny.



The Old Rocketeer

by G. Harry Stine NAR#2

Plastic Scale Modeling

"Plastics" are invading the field of model rocketry!

"Nobody is going to have to know how to cut balsa fins, how to fill and sand and fill and sand balsa nose cones and fins, how to make small scale details out of old toothpicks, or how to use common-garden-variety household tools to modify and change and customize wooden and paper parts!

"*Horrors!* The hobby will obviously be shot down! No longer will rocketeers have to exhibit craftsmanship and technique and expertise to assemble a model rocket from the classical and well-loved materials such as balsawood, paper, or cardboard! Plastics are going to ruin the hobby!"

Obviously, the above statements are not only highly emotional, but also incorrect and lacking in historical perspective. They are echoes of the shouts of anguish that were heard widely in other hobbies such as model airplanes and model trains.

The advent of a "new material" into a hobby such as model rocketry does not "ruin" the hobby; it expands it far beyond the constraints imposed by its "classical" materials.

I can well remember building model airplanes -- yes, Virginia, the Old Rocketeer can be accused of that unspeakable vice -- when I had to carve everything from wood. During World War II, that wood was basswood, which often had the characteristics of case-hardened steel when you tried to work with it. I can also remember building the very first plastic model airplane kit to appear on the market, a polystyrene Stearman PT-17 made by Testors. When Hawk followed suit a few years later, the hue and cry went up that plastics were ruining the hobby of model airplanes.

Today, plastic model airplane kits are an accepted part of model aviation, and there is even the International Plastic Modelers Society (IPMS) that oversees the field. The IPMS and plastic model kits have done more than anything else to improve scale modeling and to bring to light some hitherto unknown historical area of aviation.

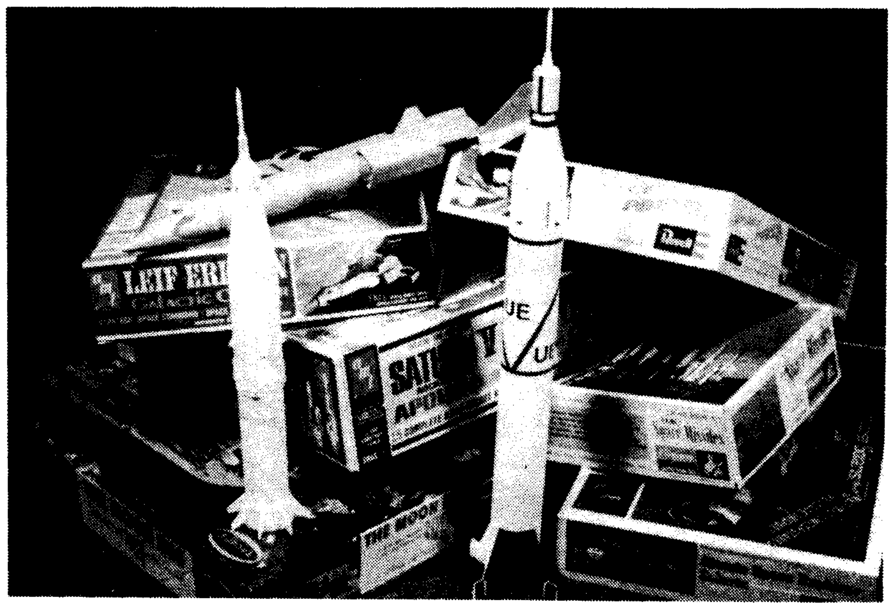


Photo by Stine

More and More non-flying plastic kits are becoming available that can be converted to fly. Jupiter-C model is flight-converted, will be subject of how-to article next month.

The same holds true of model railroading, a field wherein scale modelling really gets detailed and down to the nitty gritty.

The simple facts of the matter are that the "invasion" of these hobby fields by plastics has expanded the fields, brought in more modellers, and greatly improved the lot of the "purist" in those fields. Plastics have resulted in an unbelievably varied commercial source of parts and equipment.

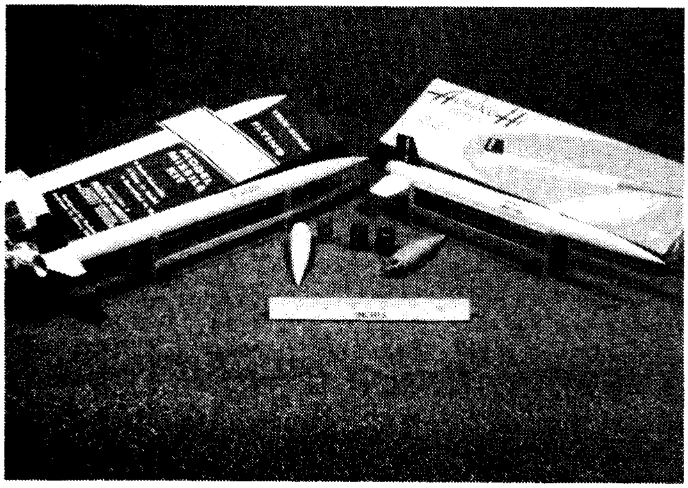
And the advent of plastics in model rocketry will have no less of an impact . . .

Except that we have been used to plastics in model rocketry since 1959 . . . and nobody has really yelled very much. Maybe this is because we are just now developing our nucleus of "purists" in model rocketry.

The very first model rocket I ever saw -- a Carlisle Mark 2 Rock-A-Chute -- had a plastic nose cone.

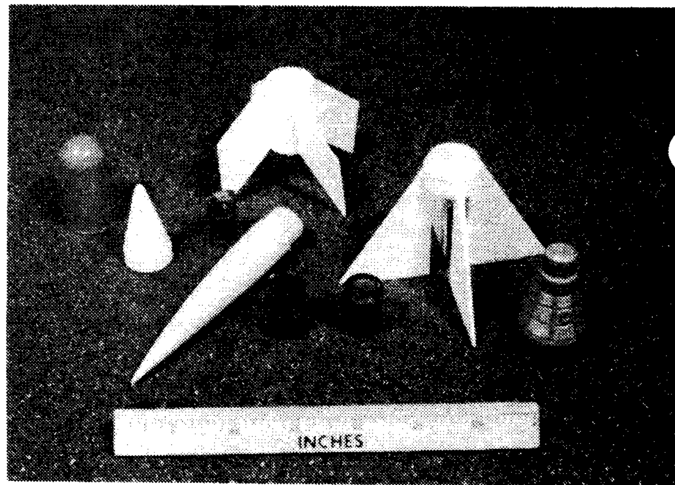
Although the first model rocket kits -- Model Missiles Inc. "Aerobee-Hi" Kit 001 and MMI's "Arcon" Kit 002 -- had wood and paper parts, within a year they were featuring polyvinylchloride plastic nose cones that were rubbery, plus styrene plugs that snapped into the nose cone base to hold the shock cord and the like . . . *plus* a motor mount sleeve injection -- molded from butyrate plastic (so it could be used with model airplane glue) that was tapered so that a motor could be jam-fitted into it.

The plastic PVC nose cone hung around for many years, being available from Estes



Photos by Stine

Pioneer kits from Model Missiles, Inc. were Aerobee-Hi (right) and Arcon (left) which used PVC plastic nose cones and base plugs as well as butyrate plastic motor mounts (center). Kits and models from Stine archives.



These are a few of the plastic parts that have been available to model rocketeers during the past decade. Some were for other purposes but were adapted by modelers; these include "Mercury capsule" pencil sharpener at far right. None of these parts are currently available.

Industries until about 1967. The butyrate motor mount apparently went the way of all flesh many years ago when Model Missiles Inc. went out of business.

When today's major model rocket firms – Estes and Centuri – went into business in the early 1960's, plastics were by-passed for balsa parts, although Estes continued to sell MMI PVC nose cones as PNC-2, plus two different plastic fin assemblies.

There is a basic economic reason why MMI started with wood and paper and why Estes and Centuri both dropped plastics and reverted to balsa: money. MMI's original intent was to make a trial run of 3000 kits to see if they would sell. In the case of Estes and Centuri, it was a matter of starting literally from scratch in the garage and the backyard.

If I recall correctly, the injection molds for the MMI PVC plastic nose cone cost something more than $5000 – in 1959!

In other words, the initial investment in molds for plastic parts is so high that a company must figure on selling tens of thousands or even hundreds of thousands of those parts. You don't get something for nothing, and each piece that comes out of an injection mold must carry with it as part of its price structure a fraction of the cost of the mold itself, otherwise known technically as an amortization or "killing" of the mold cost. If a mold costs $5000 and you run only 5000 pieces out of it, the price will kill you, man, even though there may be only a couple of cents worth of plastic itself involved. So, when you do a plastic item, you must talk in terms of making and selling 10,000 of them . . . or 50,000 . . . or 150,000. The more you can make and sell, the smaller the percentage of mold amortization each part carries and therefore the lower its basic cost to the manufacturer and to the customer.

MMI converted to the PVC nose cone and other plastic parts when they made the decision to go big, turning out runs of 10,000 kits or more. But even at that size of production run, the PVC nose cones had to retail for about 75 cents each!

On the other hand, making nose cones and other parts from balsawood doesn't require a very expensive machine and certainly not very expensive tools to make the parts. They can be easily and quickly changed or modified. Balsawood prices are higher than plastic prices, and the grainy nature of balsawood poses some very serious problems occasionally, but a company can turn out small production runs of balsa parts very cheaply.

I don't know of any model rocket kit at this writing that has sold more than 100,000 copies, but I suspect I will be summarily notified by any manufacturer who has exceeded this run.

NOW, however, model rocketry is growing so rapidly and there are so many kits being sold that it becomes economical to begin to re-introduce plastic parts again . . . and I predict that we are going to see a lot of them.

Plastics are nothing to be afraid of. Today's types of plastics offer some real advantages to model rocketeers. And, as any slot car addict, model car customer, or IPMS model airplane builder will tell you, it is possible to do lots of things with plastic materials to form them, shape them, modify their appearance, paint them, etc. to your heart's desire.

Plastics have been with us for a long time in very limited fashion; they are with us now as can be attested by anybody who has built some of the kits that have appeared in the past year; and they will be with us more and more in the future.

There is a clan of model rocketry types who have been plastic fans for years. The NAR has long had in its rule book a competition category for plastic models. Several years ago, this category was called "Plastic Scale". Objective: Take a non-flying plastic scale model of a rocket and convert it for flight with a model rocket motor. In 1967, this event was re-written as the "Plastic Model" event when it was thought that a modeler had no control over the scale qualities of a plastic kit . . . which we now believe to be an incorrect assumption based on what we have learned you can do with plastics to tailor or customize them. The situation with regard to plastic non-flying models got so bad about 1965 that the NAR Contest Board allowed as how maybe the Plastic Scale event should be dropped from the pink book . . . which resulted in a 180-decibel scream of anguish from the plastic model addicts: "Half the fun is searching through rural hobby stores and toy stores to find old kits!" I have been numbered as being one of these types, having successfully converted to flight a Revell V-2, a Revell X-17 (both no longer available) and a Hawk Jupiter–C. Today, the lot of the plastic model rocketeer who competes in this category is much improved because Hawk, Revell, Monogram and others are dusting off the old molds from a decade ago, much to our delight. And several new plastic kits have been introduced that can certainly be modified for flight.

But modifying non-flying plastic models for flight is only one small area of the growing field of plastic model rocketry. Kits carefully designed to fly with special plastic parts are now becoming available. To mention but a few of these and running the risk of leaving out the pet project of one of our friendly manufacturers, these include (but are not limited to) the Estes Cameroc, Centuri's 1/14th Little Joe II and 1/100th scale Apollo series, the forthcoming Estes Saturn-5, and the unbelievably light vacuum-formed nose cones, plugs and fins from Competition Model Rockets.

Looking technically (and economically) at model rocketry, there is no reason why most balsawood parts cannot be replaced with plastic parts . . . usually with much improvement. It's now becoming economical to cough-up the price of injection molds because of the fact that production runs of kits are getting bigger, thereby requiring larger numbers of parts fast and permitting the amortization cost of molds to be carried by a larger number of pieces. Also, injection molding is fast, producing large numbers of parts in a very short period of time. Vacuum-forming techniques have greatly improved over the past few years, although vacuum-forming is slower and thereby more costly . . . but the molds are cheaper. Expanded polystyrene plastics (foamed plastics) have appeared upon the scene and in reality are capable of being very light as well as having an excellent finish.

Already, we are seeing balsawood parts being replaced by plastic – nose cones, transition pieces, plugs, motor mounts, fins, launch lugs, and even body tubes in some isolated instances.

The beauty of these parts is that they do not require the tedious filling and finishing that must be done with balsawood parts to eliminate the wood grain. Their shortcomings are that they have a higher density than balsawood, do not have the strength-to-weight ratio of balsawood, and require a different technique to modify them. They also require new and different adhesive and bonding materials and techniques than wood.

In actuality, working with plastic materials is no more difficult than working with balsawood. You just have to use different tools in some cases. You must use different techniques. And you must not treat it like balsawood. This last-mentioned thing causes more grief to modelers than anything else.

Most plastics can be cut, sawn, sanded, milled, and butchered just like wood. But balsawood is softer, and therefore plastic usually require more rugged tools. To shape plastic, you can file it, whack at it with a Moto-Tool, and sand it. You can even carve some types of soft styrene.

Plastics must be bonded differently than wood. With today's adhesives, you can glue just about anything to anything else with a joint that is stronger than the materials themselves. Bonding together two parts made of the same type of plastic requires that you "weld" them; styrene plastic cements actually melt the plastic by adding a solvent to it so that when you stick together the two plastic parts the plastic flows together to make what is essentially a single piece.

Plastics can usually be painted...except for polyvinylchloride rubbery plastics and teflon. Model airplane dopes will usually melt or "craze" the surface of most plastics except the butyrates. If in doubt, test the paint first on the scrap plastic of the "runner" or "tree" to which the plastic parts were attached originally in the kit. Most modelers put too much paint on plastics, causing the paint to run or glob-up. This is pretty difficult to do with a new type of plastic paint made by Floquil and called "Polly-S." This new stuff is a water-soluble acrilic that can be thinned with water but which is completely impervious to water after it dries...a good point to remember if you happen to spill some on your pants.

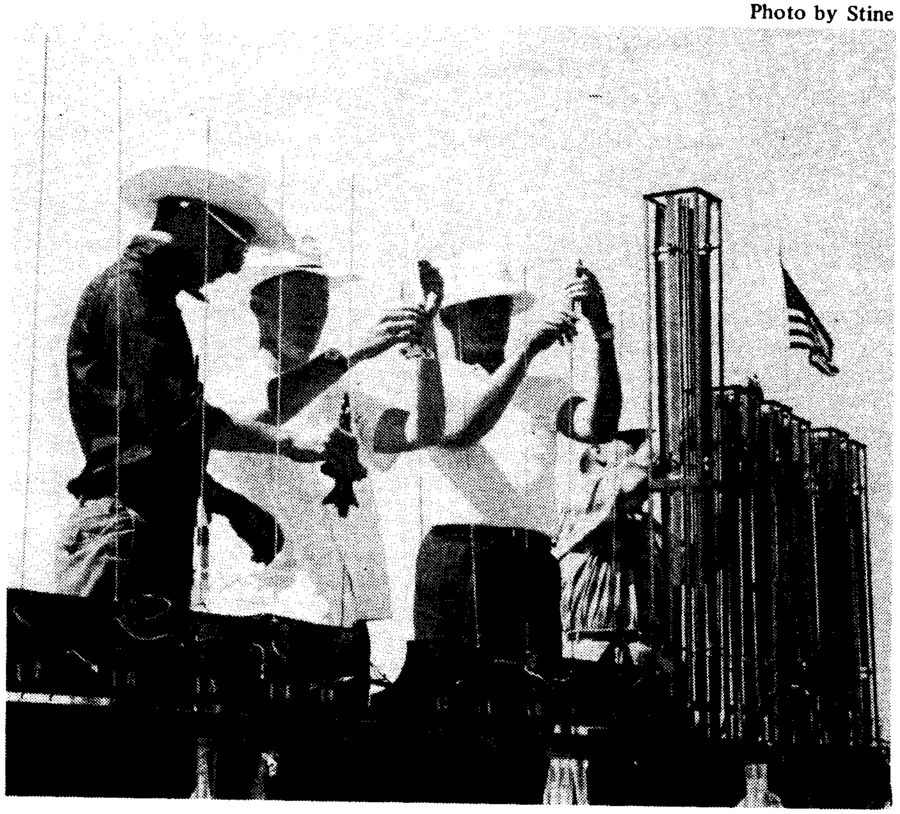
Unless you are a purist like I am, you really don't have to paint plastics at all because nearly all of them have color in them to start with. However, if you want a more realistic model, and if you want decals to stick better, you should paint your plastic models. It makes a great deal of difference in their appearance, and here is why: colored plastic is actually semi-transparent. Incident light falls upon it and is NOT reflected from the surface. It penetrates the plastic and is reflected back from the interior of the material. This fact makes a small plastic model look like a small plastic model and not like a very small version of the real thing. After all, the real thing reflects light back from its surface, doesn't it?

As you may be able to see from just this short dissertation on techniques of working with plastics, we're tangling with a new technology here that is certainly no less difficult and challenging than the technology of balsawood and paper. It's just different. If we realize that from the beginning, we will not run into the Great Schism between plastic and balsa models that has often plagued other hobby fields. If we understand from the outset that plastic is just a different material requiring different methods, the new technology of plastic model rocketry will slip right into our hobby like it was there from the beginning...which it was. And, as with other hobbies, plastics will have the same impact and results that include more people working in the hobby, a greater variety of parts and equipment, some change in price structure both up and down, and a wider availability of model rocketry equipment. Model rocketry started in this direction over a decade ago, but didn't make the grade then because there weren't enough model rocketeers to justify the economics. Today, things are different. We're heading into the real "second generation" of model rocketry.

I can see it all now. Scene: a hobby shop in the year 1980. Camera zooms in to close-up of hobby dealer extolling the virtues of a new model rocket kit to a neophyte model rocketeer. Sez the dealer, "This an absolutely new concept in model rocket kits! It has *balsawood* fins! And a *paper* body! You won't have any trouble building it because balsawood can be cut, sawn, drilled, and sanded just like plastic!"

1962 saw "plastic scale" models flying at USAF Academy and NARAM-4. Loading rack from left to right are Bill Simon with Revell X-15, NAR Vice President Tommy Thompson with Revell Nike-Hercules, and Brent Norlem with unknown model.

Photo by Stine



If you're one of

Egg Lofting has become one of the most exciting events in model rocketry today. I can say from experience that this is a very difficult event. For example, over 60% of the birds flown at NARAM-10 at Wallops Station bit the dust. At NARAM-10, my egg model was a cluster design and it took its place with the other 60% of mutilated rockets and that was the last time I ever trusted a cluster model. The Renegade was designed for use with the Flight Systems D or E engines. However, the Centuri Mini Max engines can be used by omitting the engine holder assembly.

If you plan to build this model using the Flight Systems engines, an engine holder is needed. To build the engine holder assembly, first glue the centering ring (for use as an engine block) in the ST-86 body tube. You should insert the engine block using the E engine and if you want to use a D engine, just add several more centering rings and then take them out when you want to change back again. When the tubing coupler and centering rings have dried, insert the body tube and glue the two together.

The payload section can be bought as one whole unit (adapter, nose cone, and payload body tube) from Centuri Engineering Co., catalog number PC-175B. The base of the adapter is a bit smaller than the 1.3" body tube, so it is necessary to wrap tape around the shoulder of the adapter until a good slip fit is achieved. The payload body tube should be glued to the adapter, and the nose cone should have a very tight slip fit.

The Renegade should be flown with two parachutes. One 18" chute should be attached to about 10" of shock cord to the top of the ST-13 body tube. The second 18" parachute should be attached directly to the screw eye. The body tube and payload compartment should not be attached during recovery.

Cut 3 fins from 1/8" balsa as shown and sand them down to the desired airfoil shape. Round the leading edge and taper the trailing edge. After they have been glued onto the body tube, put a fillet of glue along each fin joint to reduce the interference drag and strengthen the fin.

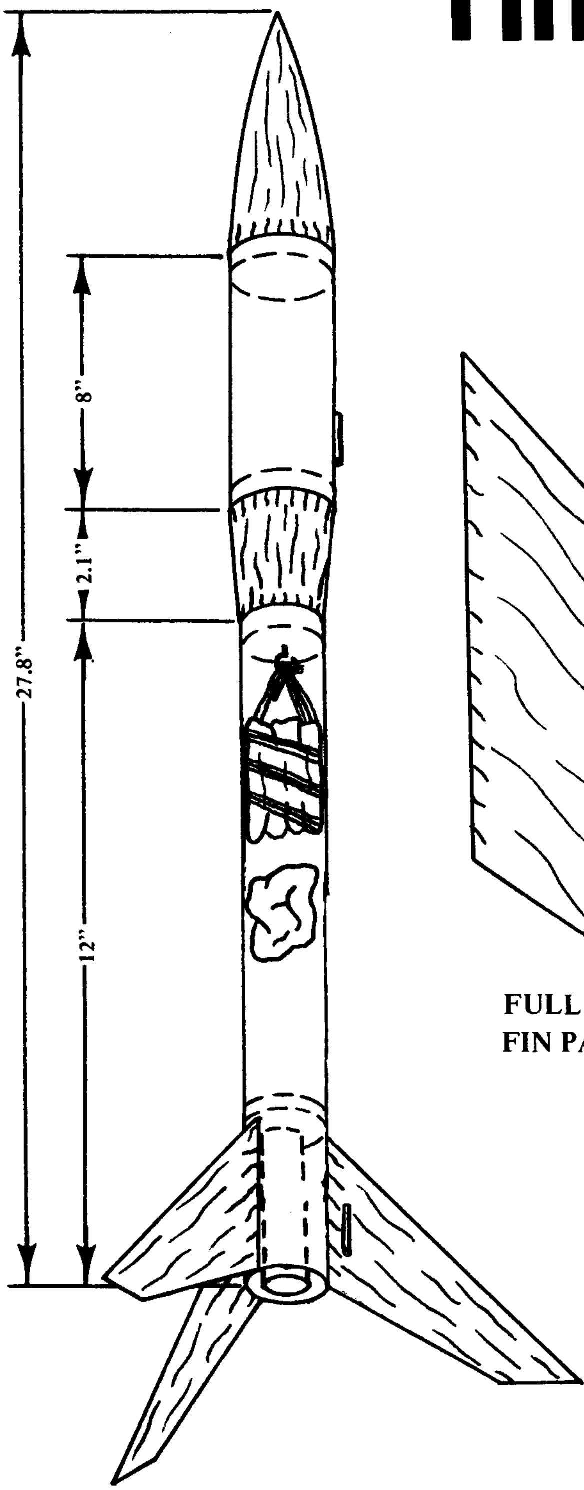
To prepare for flight, put a 2" layer of cotton or foam padding in the payload section and pack it down tight. Insert the egg and fill the remaining section of the payload compartment with cotton or foam. Make sure the nose cone fits very tightly, because if the egg has any room for movement, it could break very easily.

the daring rocketeers who enjoy egg-lofting,

here's the design for you.....

THE RENEGADE

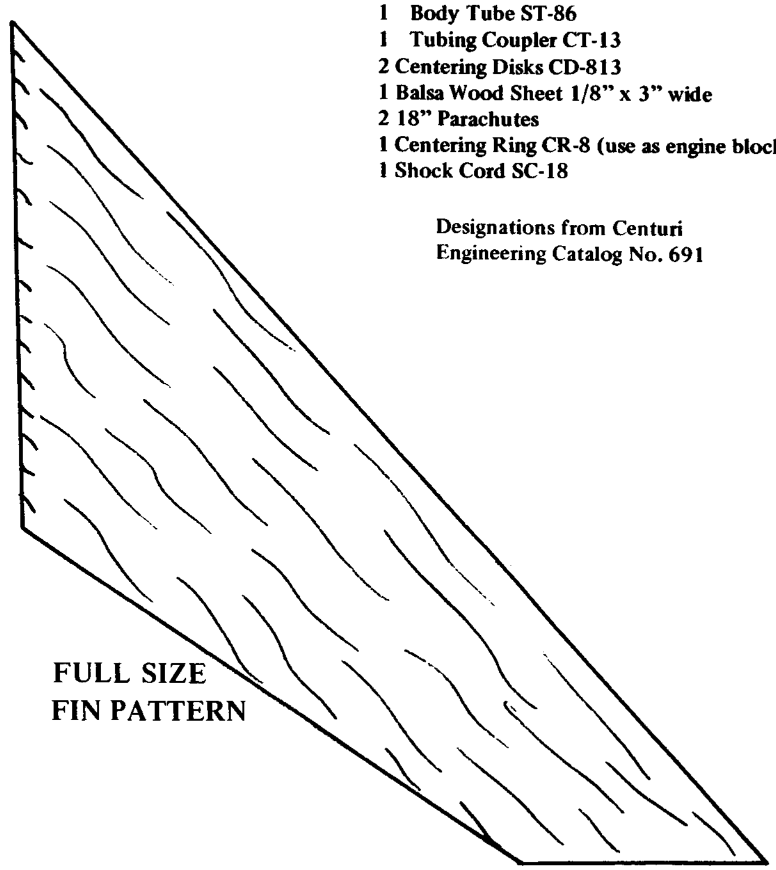
by Tancred Lidderdale



Parts List for Renegade

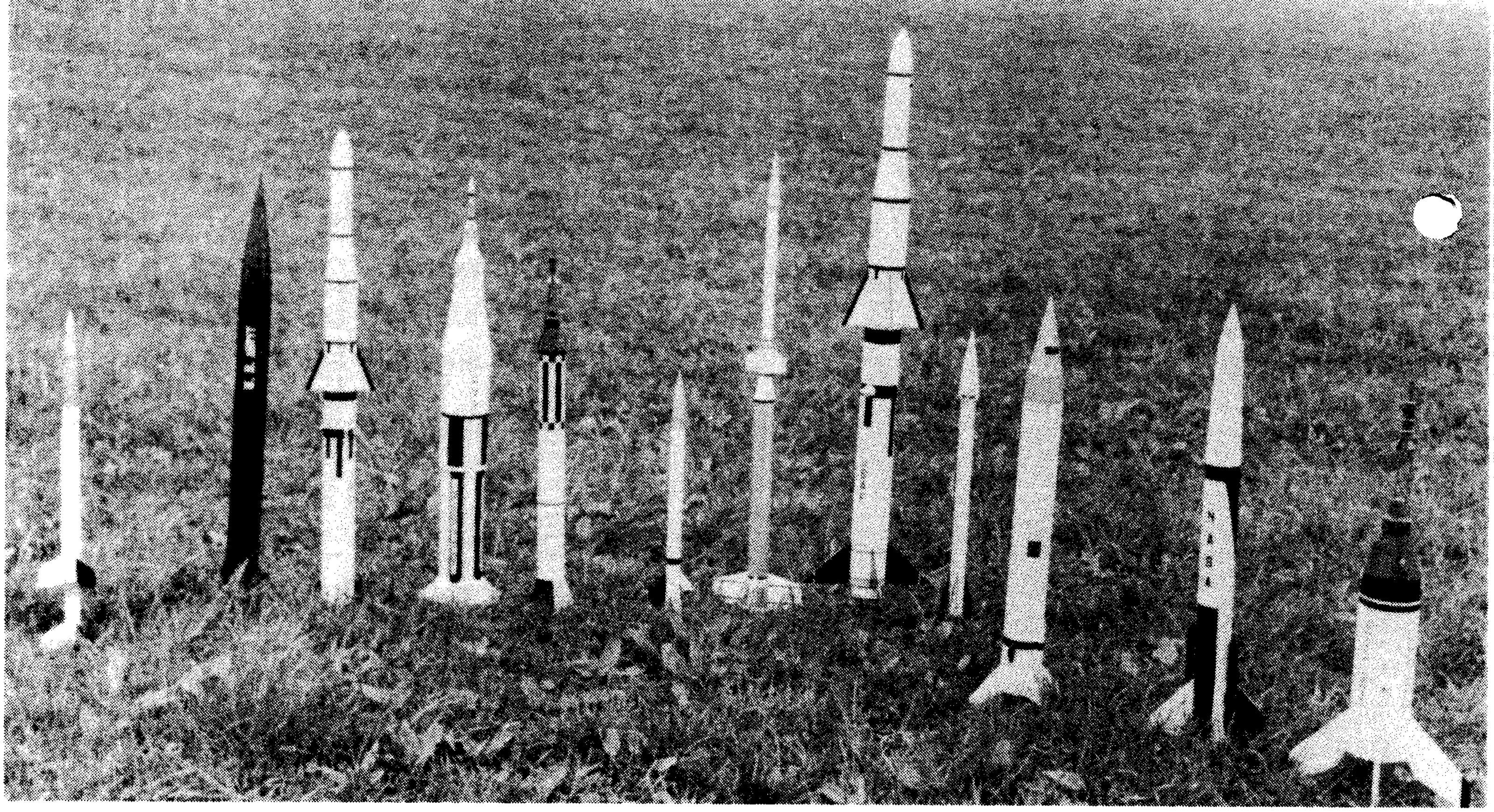
1 Payload Section PC-175B
1 Body Tube ST-1318 (cut to 12")
1 Body Tube ST-86
1 Tubing Coupler CT-13
2 Centering Disks CD-813
1 Balsa Wood Sheet 1/8" x 3" wide
2 18" Parachutes
1 Centering Ring CR-8 (use as engine block)
1 Shock Cord SC-18

Designations from Centuri Engineering Catalog No. 691



FULL SIZE
FIN PATTERN

3 FINS: 120 degrees apart



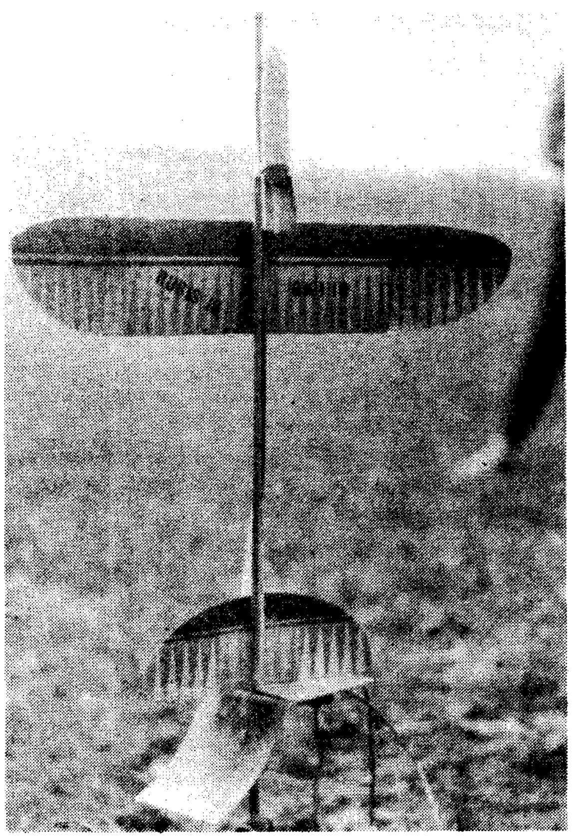
The scale modeling events at the 1969 Czechoslovakian National Model Rocket Championships proved especially popular.

Czechoslovakian National Championship

Vrchlabi May 7-9, 1969

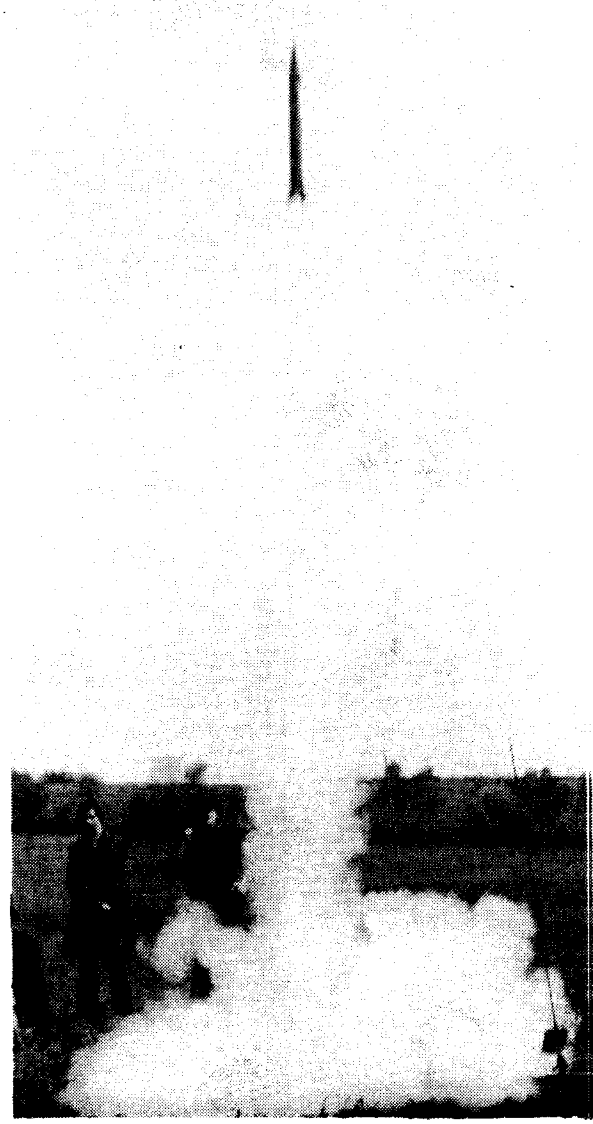
All photos by Otakar Saffek

Jaroslav Divis's FAI Class II B/G -- Rubis II -- was second in Sr. B/G at Vrchlabi.

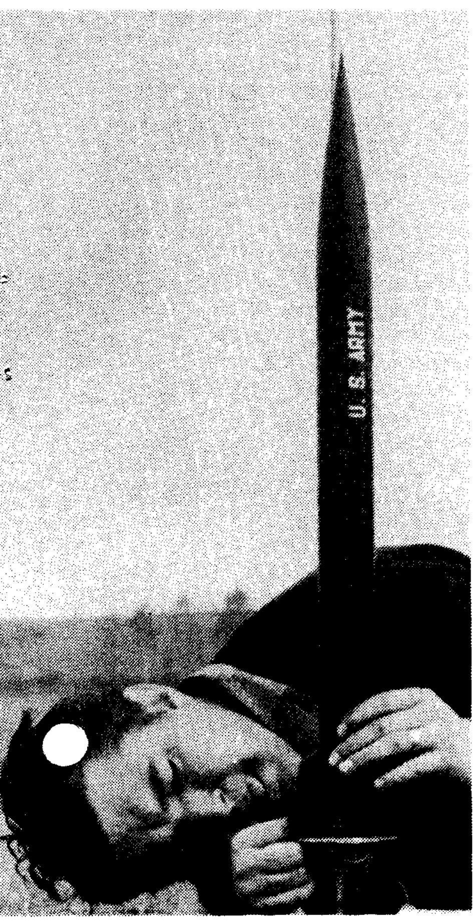


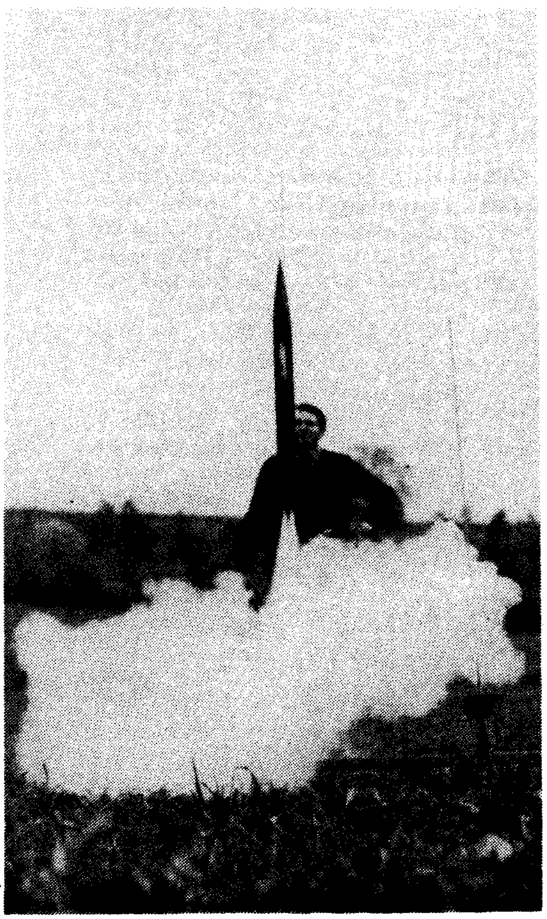
Liftoff of Frank Brehovy's scale ASP powered by a single 10 Newton-second engine.

Thomas Sladek (left) and his friend Vlado "Baby" Hadec (right) return with Sladek's FAI Class II B/G after a record-setting 472-second flight. Above, judges compare their watches and confirm Sladek as the new Czech junior B/G champion.



Jaroslav Divis of Praha prepares his scale Class III Sergeant. This model employs a cluster of four 10 Newton-second engines, as can be seen from the second photograph. A 50-inch parachute was used on the model, and a six-second delay was employed in the engines.

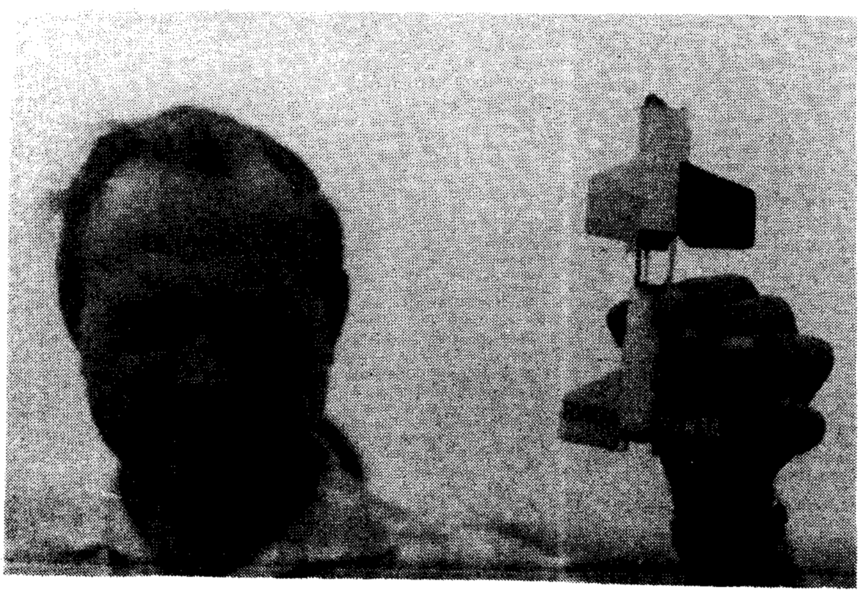


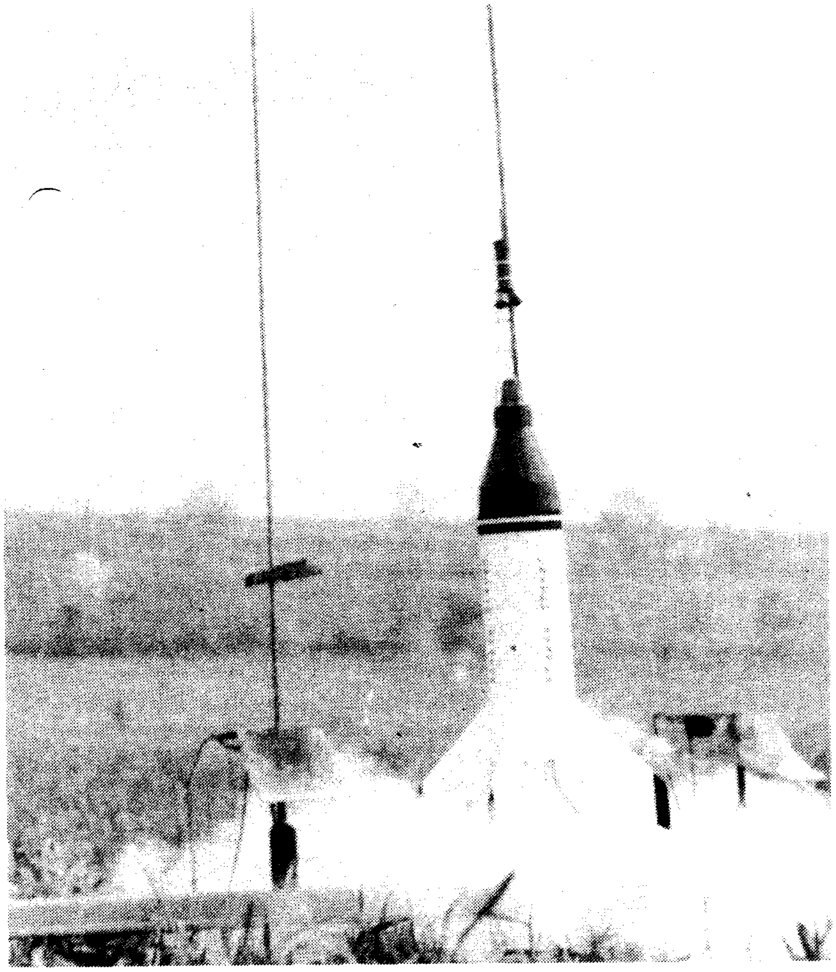


Pavel Bares of Prahna loads his scale Little Joe I onto the rod at the Czech National Championship meet. Note the fine detailing on the capsule being held by his mascot "HAF". This Little Joe I took first place in the scale competition. Powered by eight engines of 10 Newton-seconds total impulse each, the liftoff was quite spectacular. After catching the rocket, shown in his left hand, Bares went on to catch the capsule. Both were recovered undamaged.

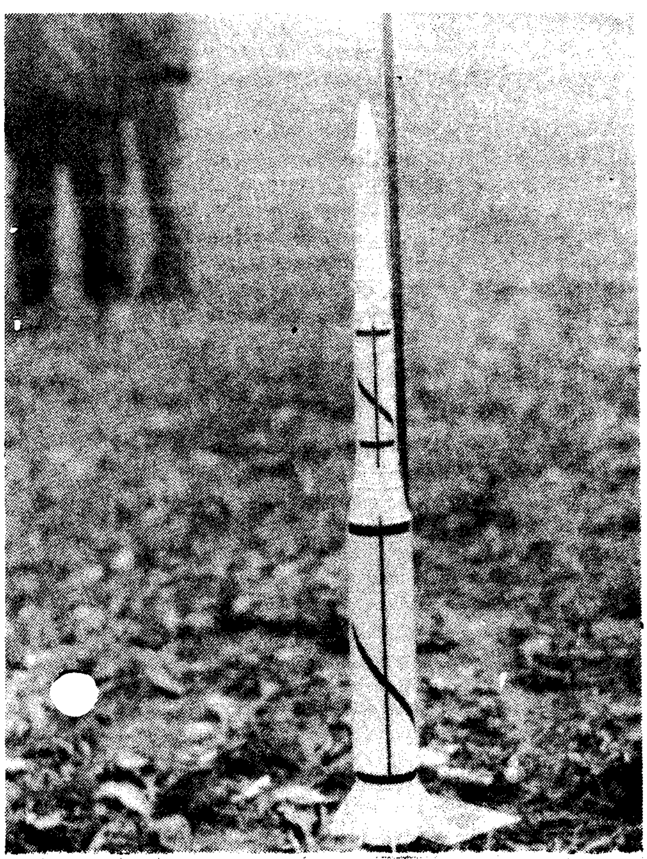
Premysl Kynel (below) of Radotin displays a destructed scale Aerobee-Hi. The Class II scale model had been flown with a 5 Newton-second engine in each stage.

Frantisek "BACHUS" Werner (right) of Praha shows his "flying wing" Class II B/G.





Alois Klein's beautiful scale Diamant flies with a single 10 Newton-second engine.



THE RADIO CONTROLLED BOOST/GLIDER

Part II

by Douglas Malewicki

STEP1—CONSTRUCTING THE BASIC HAND LAUNCH GLIDER

The standard 36 inch balsa and spruce lengths that you will have to purchase to construct one glider really contain enough material to complete two gliders. I have found that building two at once only takes about 50% more time than building one by itself. If you think it is worth the extra effort to you at this time you can be guaranteed better performance. Since no two gliders ever perform the same due to minute alignment, airfoil shape and weight distribution differences, one of the two will naturely be slightly superior to the other and it can be used for your initial radio control flights.

The Body

Use the full size plans to lay out the body on the 1/8" X 1/2" X 36" piece of spruce. The body is 19½" long, but you can obviously get two from the 36" length by overlapping the patterns tail to tail.

Prior to cutting the body out it might be wise to first drill the 3/32" diameter hole for future pop-pod use. Mark and center punch the hole location, then clamp the spruce in a vise at a 45° angle so you can drill more or less straight down to the proper depth. If you botch the drilling, you can cut that section of the spruce off and try again.

An electric jigsaw should be used for cutting out the body pattern. The desired cross-sections of the body at various places are indicated on the plans. Be sure to keep the cross-sections flat in the areas where the wing, horizontal tail, R/C POD, and pin pod will be attached. Lastly, round the nose and notch it at the front for future positioning of the antenna wire.

The Wing

The wing is a composite structure of both hard and soft balsa. The hard dense balsa helps protect the wing leading edge from the inevitable impacts, while the soft balsa main portion keeps the overall weight to a minimum. Start by gluing the ¼" by 1" hard strip of balsa to the ¼" by 3" soft piece of balsa. Use lots of rubber bands to hold the pieces together under pressure.

My favorite glue is Franklin's Titebond, an alphatic resin. Its strength *and* drying time is very superior to regular white glue. In fact, after getting used to Titebond you will feel that regular white glues are like water in comparison. *And*, best of all Titebond can be sanded without balling up as white glue often does. If your local hobby shop does not carry it as yet, you might like to know that Centuri sells it as Superbond.

The Titebond gluing procedure is identical to using white glues—namely the pre-gluing technique. An initial coat is applied to each joint and allowed to soak into the wood for about 5 minutes. Then a thin coat of glue is applied and the parts are joined. This pre-gluing technique is especially important for wing dihedral joints and the main wing to body joint.

Once the hard to soft balsa joint is dry, lay out the wing pattern and polyhedral break lines on the bottom surface of the wing to be. Use the jigsaw to cut it out. Coarse, medium, and fine sanding blocks are indispensable to the all important airfoil shaping. An Xacto modeling plane speeds up the shaping process, whereas an abrasive sanding disk for your electric drill (clamped rigidly in a vise or drill press attachment) is a must for real high speed wing shaping. I have completed wing shaping in as little as one half hour using this last method; but also have dug in and ruined good balsa on several occasions.

Regardless of your shaping method, always keep the airfoil you want in mind as you are sanding. Also note that the wing thickness tapers from a maximum at the center span to a minimum at each tip. When you are satisfied with the airfoil shape and smoothness, finish the job off with several minutes of sanding with superfine no. 600 grit sandpaper.

The next step is to cut the four wing panel sections apart using a sharp Xacto and straight edge. In order to have a flush fit for each polyhedral joint, it is necessary to use a sanding block to bevel the joints to the proper angles. Again using the pre-gluing technique join each tip to its center panel. Weights or pins can be used to keep the center panels flat while the tips are propped up to 7/8" and allowed to dry for at least an hour. Next, join the center panels together, propping both sections of the wing up to provide 7/8" as shown on the plan. When thoroughly dry, add a fillet of glue to each wing joint.

While this is drying you can cut a slight V-notch in the top of the body to match the wing dihedral angle and thus provide a stronger joint. Pre-glue the wing and body joint surfaces and when dry glue them together. Be sure to carefully check wing-to-body alignment while the glue is drying.

Next, cut out a FINGER REST from 1/32" plywood and glue it to the bottom surface of the right wing as shown on the plan. Your right index finger will be pushing against the wing trailing edge at this location during hand launches and would crush the soft balsa without this extra plywood support. After drying, add a fillet of glue to the entire wing-body joint.

The Horizontal Stabilizer

The stabilizer is cut from 1/16" sheet balsa and sanded to a symmetrical airfoil shape. Finish the sanding with no. 600 sandpaper. Place the stabilizer back on the full size plan and with a pencil lightly draw the two body alignment lines right on the balsa. Glue the stabilizer to the body using the above pencil lines for centering purposes. Then check that the stabilizer is aligned with the wing by sighting from the rear.

The Rudder

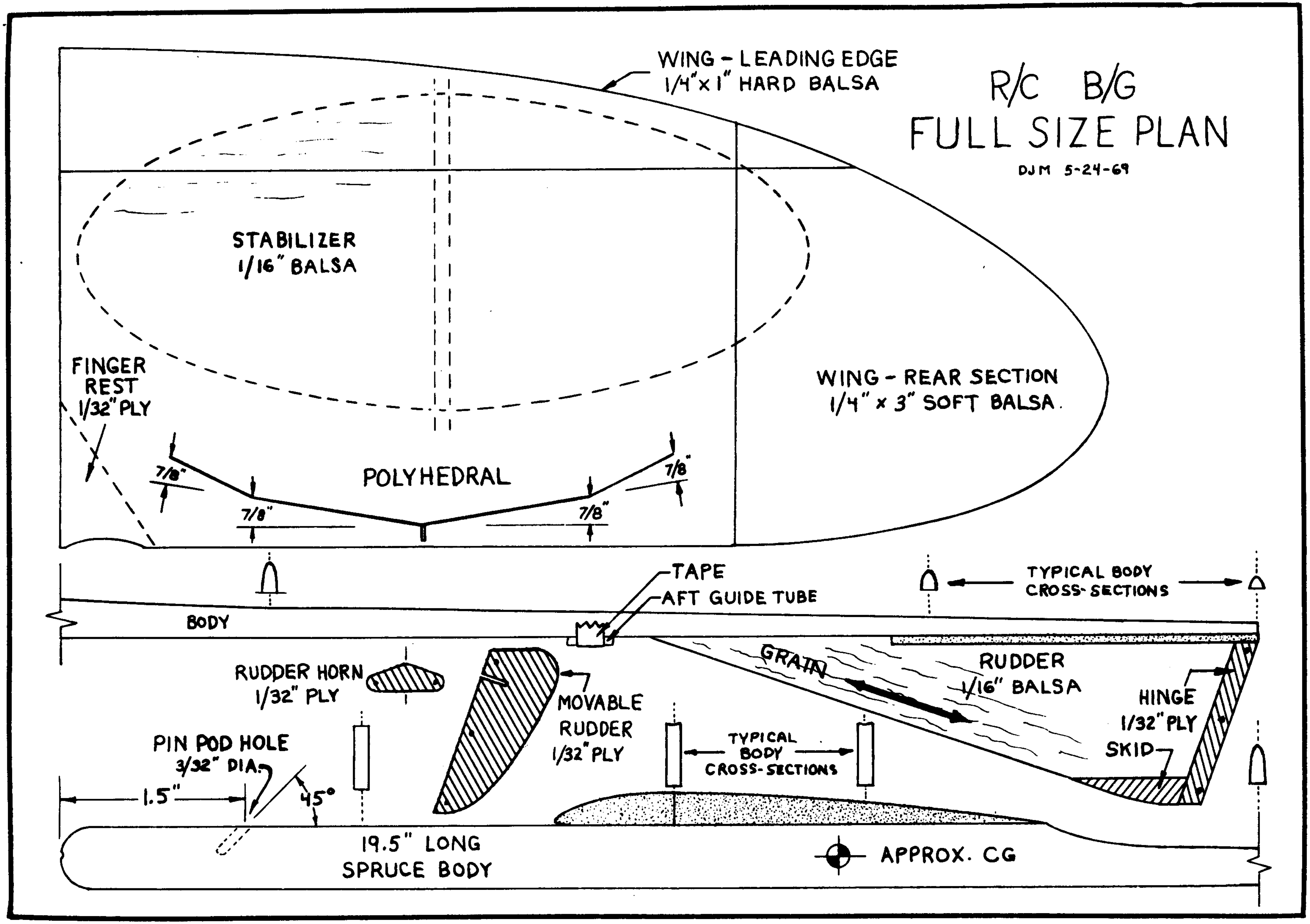
The fixed rudder used on the hand launch glider is composed of three pieces: the main portion which is cut from 1/16" balsa sheet; the skid which is cut from 1/32" sheet plywood; and the hinge attachment which is also cut from 1/32" sheet plywood. Be sure to note the grain direction before laying out the balsa pattern and the 1/16" step which accommodates the horizontal stabilizer.

The three holes for the future movable rudder hinges are simply made by forcing a straight pin through the 1/32" plywood. Glue the three pieces together and sand as a unit when dry. Glue the completed rudder to the body and align it at right angles to the horizontal stabilizer.

Painting the Glider

UGH—it adds too much weight! All I ever paint is the upper surface of the wing and that is with two coats of clear dope mixed half and half with thinner. This, of course, is followed by a careful final sanding with no. 600 sandpaper.

One can find articles recommending 15 coats of paint for best results with a hand launch glider, but the majority of articles


R/C B/G
FULL SIZE PLAN
DJM 5-24-69
WING - LEADING EDGE
1/4" x 1" HARD BALSA
WING - REAR SECTION
1/4" x 3" SOFT BALSA
STABILIZER
1/16" BALSA
FINGER
REST
1/32" PLY
POLYHEDRAL
7/8"
7/8"
7/8"
7/8"
BODY
TAPE
AFT GUIDE TUBE
TYPICAL BODY
CROSS-SECTIONS
RUDDER HORN
1/32" PLY
MOVABLE
RUDDER
1/32" PLY
GRAIN
RUDDER
1/16" BALSA
HINGE
1/32" PLY
SKID
TYPICAL
BODY
CROSS-SECTIONS
PIN POD HOLE
3/32" DIA.
1.5"
45°
19.5" LONG
SPRUCE BODY
APPROX. CG

seem to be minimum weight conscious (or is it really minimum effort conscious?). Both boost gliders and hand launch gliders have initial portions of their flights occurring at very high speeds. There are obviously some definite tradeoff studies to be made which would compare the extra altitude gained during the launch phase (hand or rocket) of a super-slick finished glider with the degradation in glide performance due to carrying the extra paint weight penalty during glide. As you can see, I'm leaving myself a back door in case my own personal philosophy on minimum weight is proven dead wrong in the future!

Hand Launch Glider Test Flights

Attach enough modeling clay (ballast) to the glider's lower nose to bring the center-of-gravity location marked on the plans. This is an average from several of my gliders and is intended only as a starting point for your glider.

As you learn more about trimming hand launch gliders, you will discover that for a specific single model that the best CG location actually moves around. If it is a perfectly calm day, you can obtain better glide performance with your CG further aft then normal. Similarly, if you tighten the turn on a given glider you will also have to remove some weight from the nose to obtain best performance. With this in mind, you can see that it is a must to take some clay along for trimming your test flights. A stop watch is also very useful as it gives you a standard of comparison so you can decide if the changes you make between flights have actually improved duration or not. Also, before going out to test fly you might like to weigh the glider to see how close you've come to the 3/4 ounce figure.

It will probably take two or three separate one hour sessions to get the glider really trimmed out perfectly. Rushing won't give optimum results. Even if your glider is as high up in weight as an ounce, you'll probably be pleasantly surprised to see what a floater this bird is especially if most of your balsa glider experience has been limited to 25 cent slip togethers.

Start the trimming process with very gentle straight throws. Correct obvious stalls, dives and overly tight turning characteristics with wing tip and nose ballast. You can now proceed to somewhat more energetic launches, but *be sure* that the glider leaves your hand in a bank rather than straight ahead. Initially the plane should leave your hand in about a 45 degree bank to the right and be aimed at a point in the sky of about 20 degrees elevation. This will produce a climbing turn to the right. After about 180 degrees of turn, most of the forward speed will dissipate and transition to slow glide should be smooth. If thrown straight ahead, the high speed excess wing lift produces a loop right over your head and back into the ground, whereas in a bank, the high speed excess wing lift merely "tilts" this loop into the desired spiral climbing turn.

Note that the lighter the glider, the faster and smoother is its transition to slow glide. The reason for this is mainly due to reduced moment of inertia about all three axes (pitch, yaw, and roll). That is to say, a given magnitude of aerodynamic correction force has more effect on a light mass than a heavier one. If built light enough and trimmed properly, you will be able to eventually heave it with all you've got, almost straight up, and half of the time it will snap into a slow glide right at the top. To keep the glider from drifting too far, put some clay on the left wing tip. This will produce a circling left turn instead of a straight path.

In good trim the glider will reach a height of 40 to 50 feet with a good heave and will consistently stay aloft 30 seconds. Durations of 40 to 60 seconds are not at all uncommon and if she happens to fly into a thermal it can be up several minutes or even good-bye.

The more time you spend with hand lauch gliders, the more of a knack you will develop for making changes that immediately give the effect on performance you desire. If you review model airplane magazine articles on hand launch gliders you will soon find that every author has different opinions on trimming and you won't know where to start. Trial and error learning by doing is still the best bet.

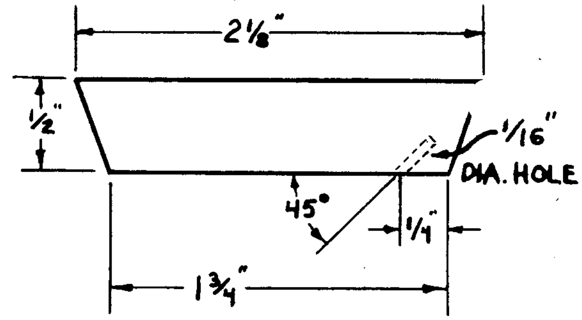
One last comment on the hand launch gliders regards the strength of this type of construction. More than likely this strength will have been demonstrated several times during your flight testing. It is inevitable that she will prang in a half dozen times in any good testing program. *You are experimenting* to find the best bank and launch elevation angle for a particular glider and some combinations just won't work. More often than not, after a really disastrous appearing flight you run over to the impact site to pick up the expected pile of balsa pieces and find instead an intact glider with maybe a new chunk missing from the wing tip.

Scarfed up wing tips are a status symbol implying a thoroughly tested glider—the kind you'll have to worry about competing against if you are contest oriented. Success with gliders is 25% good construction and 75% trimming and testing!

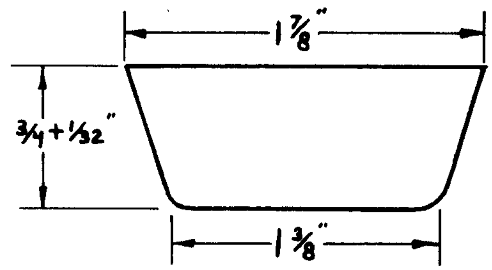
STEP 2—CONVERTING THE HAND LAUNCH GLIDER TO A POP-POD BOOST GLIDER

If you drilled the angled 3/32" diameter hole in the nose of the spruce body, you have already converted the glider for pop-pod use and all that remains is to build the pod itself.

POD SUPPORT
1/8" SPRUCE



POD SUPPORT SIDE PLATE
1/32" PLYWOOD (MAKE 2)

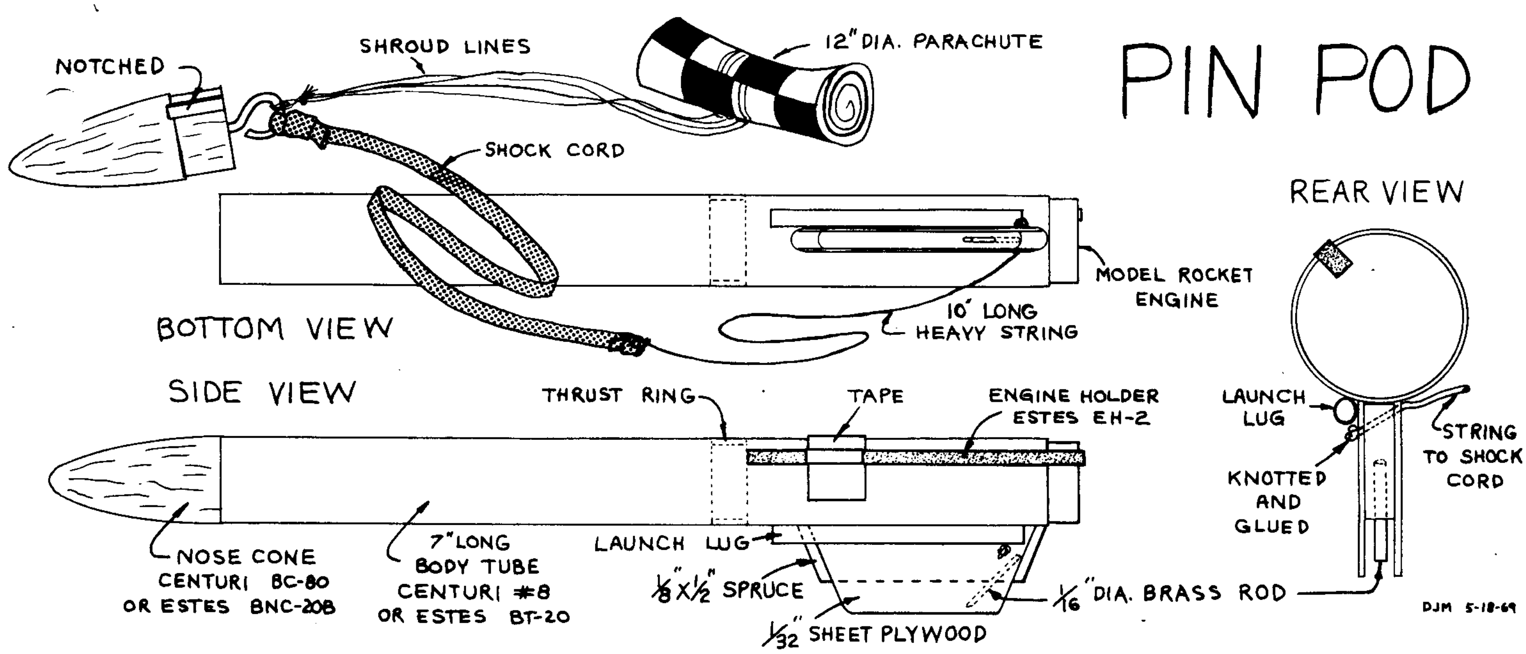


The pop-pod construction for the large part is fairly conventional. The only innovation being: 1) the use of a 1/16" diameter brass rod to transmit the thrust forces to the glider structure, and 2) attachment of the parachute to the rear of the pod. A 1/16" pin set in a 3/32 " hole in the body will allow separation at ejection to occur much more reliably than the usual 1/8" dowel set in a 1/8" hole in the body. In addition, having the parachute attached and pulling from the rear of the pod (rather than up front) effectively gives the pop-pod a pretty good "second chance" to reliably separate.

Mike Poss of California and myself developed this so called "PIN-POD" back in early 1967 and I have only incurred two Red Barons since then (i.e., either the pod does not separate or the chute lines become entangled with the glider. The whole conglomeration falls wildly out of the sky and all one can do is shake his fist in futile desparation and yell "Curse You Red Baron").

Building the PIN-POD

Start by drilling a 1/16" hole (at a 45 degree angle as shown on the PIN-POD drawing) in a piece of the same type 1/8" by 1/2" spruce used in building the glider body. If this comes out reasonably well on center, you can proceed by cutting out the spruce pod support and its two 1/32"



plywood side plates according to the plan.

Next, cut 1/2" length of 1/16" diameter brass to form the pin and sand or file the end that will hook into the glider socket so that it is round and smooth. Glue the pin into its hole and then glue the plywood side plates to the spruce. Note that the side plates should extend about 1/32 of an inch above the spruce and 1/4" below on the pin side.

When dry, wrap a piece of sandpaper around the body tube and use this to obtain a matching contour fit between the pod support and the body tube. Also, for improved streamlining, round the front and back of the pod support with a sanding block. Next, drill a small hole through the pod support for the parachute string. Be sure that this hole goes through at an angle as shown so that the knot will not interfere with the launch lug and launch rod. The remainder of the PIN-POD construction should be familiar except for the nose cone shoulder which has to be notched as shown to prevent the heavy string from jamming the nose cone in the tube.

Flying the Pop-Pod Boost Glider

Start by marking the glider's center-of-gravity location on the side of its spruce body. Next, shift any ballast clay which might interfere with the pop-pod slip fit to a lower position on the nose and then scrape the top half of the nose clean. Initially these pop-pods usually fit too tight and the inside faces of the 1/32" plywood must be carefully sanded to obtain a proper fit. My test for this proper fit is to hold the glider vertical as if it was being launched and attach the pod (less engine). The pod should barely remain in place and slight tap on the wing should jar it loose.

At this point re-check that your CG location has not changed, then prepare an A5-2 engine *as* you are now ready to try a rocket powered launch. An "A5-2" motor will get the glider up to a peak altitude of about 100 feet with ejection occurring a split second before "going over the top". Using a longer delay "A" engine is inviting disaster as the glider will be in a well developed death dive by the time ejection and pod separation occurs.

Prior to launching you will have to attach a piece of masking tape to the launch rod to support the pod. The tape must be high enough on the launch rod so that the glider's tail will not touch the launcher base after you hook it in place on the pop-pod. Slide the pop-pod over the launch rod and then attach the micro-clips to the igniter. Depending on your individual launch set-up, it may or may not be necessary to prepare a pair of extension micro-clip leads in order to reach up to the engine.

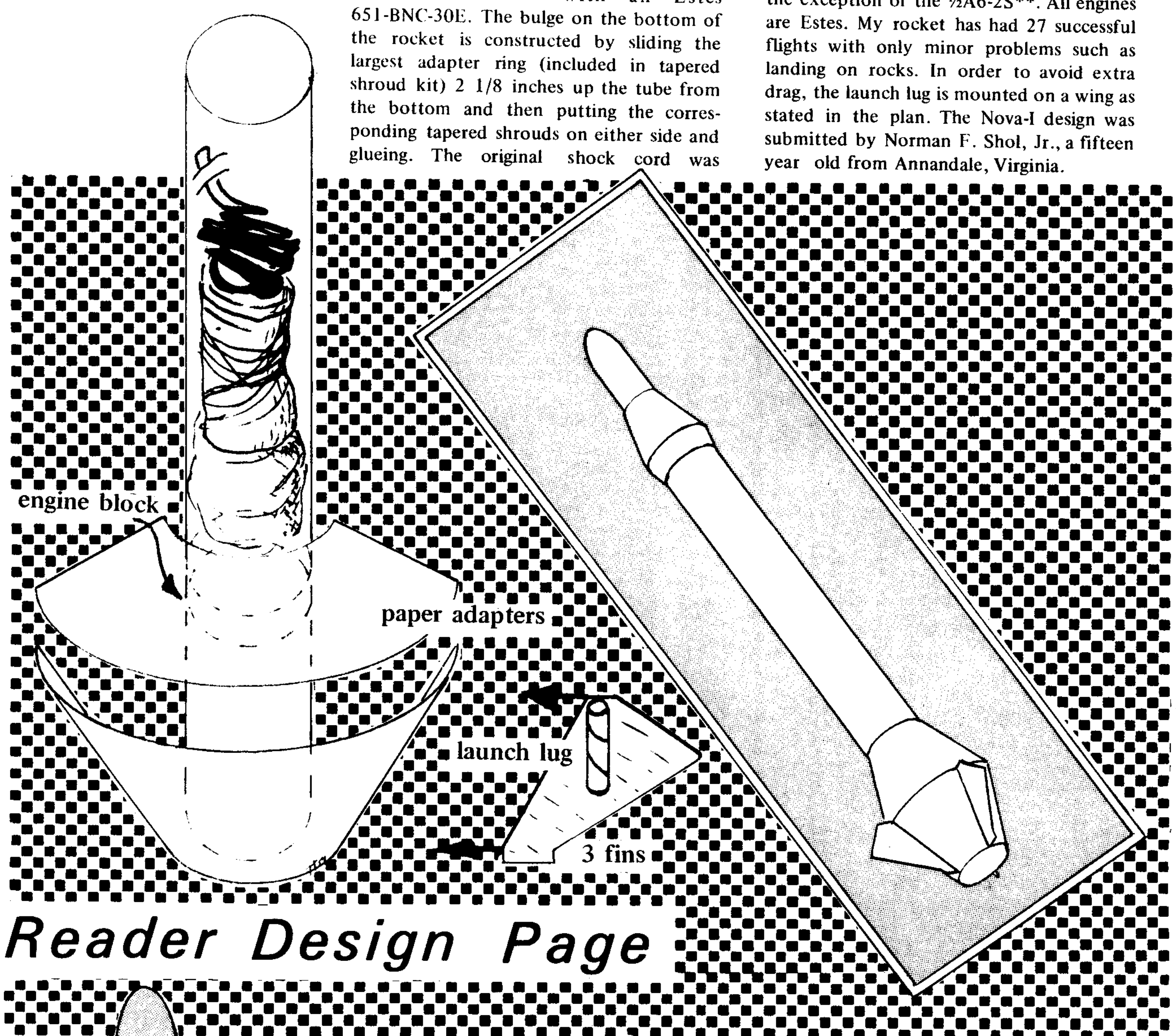
OK, now we should be all set to start the countdown and get it in the air! 5–4–3–Stop! Whoa! Etc. This isn't a launch for kicks, but a flight test for a vehicle which will eventually be carrying some expensive components. Think about this ahead of time and be ready to observe and verify that: 1) the boost phase is straight up and has no wild looping tendencies, 2) pod separation is clean, and 3) transition to glide is not erratic. Having the PIN-POD mounted so far ahead of the glider's CG virtually eliminates the first concern, and if you did a good job in your hand launch trimming, the transition should be no problem. This leaves the pod separation to pay special attention to. Also, if you have a stop watch be sure to get a record of the flight duration.

With the A5-2 motor the glider will give consistent one minute flight times. This really isn't too impressive compared to just hand launching it, but we are getting nearer to our goal.

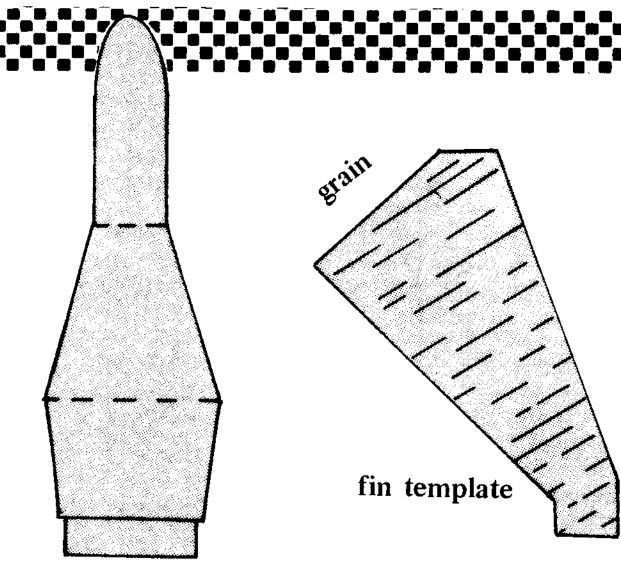
After a half dozen successful A5-2 launches, you are ready to try a B4-2 launch. Don't use a longer delay time than 2 seconds for the same reasons as before. The pod will separate somewhat over 200 feet up and glide durations now will be about 2 minutes long. Don't get carried away with B4-2 flights as even in a mild wind it will usually land at least a half a block away—and if she catches a mild thermal that high up you might as well wave good-bye to it. C6-5's can't be used because of the ejection time delay problem. According to Centuri's TIR-100 performance charts, the glider would have reached its peak and been diving for over 2 seconds when ejection finally occurred with a C6-5.

Next month Model Rocketry *will publish the concluding article in this series. Complete plans for the modification of the pin-pod glider to accept the radio control unit will be included.*

The Nova I rocket was constructed with a plastic nosecone but can be turned out on a lathe with the template included in plans. If a nosecone cannot be constructed, the rocket flies well with an Estes 651-BNC-30E. The bulge on the bottom of the rocket is constructed by sliding the largest adapter ring (included in tapered shroud kit) 2 1/8 inches up the tube from the bottom and then putting the corresponding tapered shrouds on either side and glueing. The original shock cord was mounted through a slit in the side, but a paper anchor can be used. The parachute is a 12 inch Estes 651-PK-12. The engines that can be used are from ½A6-2 to B6-4 with the exception of the ½A6-2S**. All engines are Estes. My rocket has had 27 successful flights with only minor problems such as landing on rocks. In order to avoid extra drag, the launch lug is mounted on a wing as stated in the plan. The Nova-I design was submitted by Norman F. Shol, Jr., a fifteen year old from Annandale, Virginia.



Reader Design Page



Each month **Model Rocketry** *will award a $5.00 prize for the best original rocket design submitted by a reader during the preceeding 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

Legal.....Illegal.....AAGHH

by James Kukowski

Quite often NAR Headquarters receives queries about the legal aspects of model rocketry, e.g., pyrotechnics, Food and Drug Administration, Federal Aviation Administration, state laws, etc. As a service to our readers here is a Q and A article that, hopefully, will answer many of the most often asked questions.

Q. Are model rockets legal in my state?

A. The legality questions depend entirely on which state, county or city you live in. Most states, but not all, have some form of "fireworks" code. As a model rocket engine is a chemical exothermic reaction device, you may have to conform to the state code to be absolutely legal. To the best of our knowledge the following states have adopted a model rocket code that exempts them from the pyrotechnic code: Connecticut, New Jersey, Michigan, Colorado, California and Maryland. Codes are pending in Pennsylvania and Massachusetts. But be aware that each state may have a different set of parameters. Some states do not enforce the current pyrotechnics code in respect to model rocketry. Others enforce it with teeth.

Q. How do I go about getting permissive legislation in my state?

A. Such action should be done by adults in a unified effort. Screaming and hollering just compound the problem. The interest and assistance of a state legislator is almost mandatory. Get a copy of the National Fire Protection Association's Code for **Model Rocketry, 41L**. This is an accepted guideline for a code.

Copies of the code may be obtained from:

Publications Office
National Fire Protection Assn.
60 Batterymarch Street
Boston, Mass. 02110

Copies of the code are $.50 each.

Q. What are the rules governing model rocket flights so far as the Federal Aviation Administration is concerned?

A. Under Federal Aviation Regulations, Part 101, Moored Balloons, Kites, and Unmanned Rockets, model rockets are exempted providing they weigh less than 16 ounces, use less than four ounces of propellant, are constructed of a non-metallic material, use a slow burning propellant and are operated in a manner that does not create a hazard to persons, property, or other aircraft.

Q. Do model rockets fall under regulations of the so-called "gun bill"?

A. No. The NAR saw to it that model rocket engines are exempted from the Crime and Safe Streets Act legislation, last year.

Q. There has been talk that the Food and Drug Administration may ban the sale of model rocket engines. What's the latest on this?

A. The NAR and several model rocket manufacturers have had extended discussions with the FDA. The NAR and manufacturer proposals are now in the hands of the FDA. Action is pending.

Q. Why doesn't the Boy Scouts of America get behind model rocketry?

A. Several times in the past five years the NAR has offered to assist the Scouts in establishing a model rocket program. The offer has been flatly refused. This is difficult to understand since the Scouts have a model airplane badge. The BSA also promotes riflery, cycling, and other merit badges that offer much more danger to participants than does model rocketry.

Q. Why has the American Rocket Society disapproved of amateur rocketry?

A. For the same reason the NAR opposes amateur rocketry. For your information the ARS is now the American Institute of Aeronautics and Astronautics (AIAA) and has been for a number of years. The AIAA does endorse the NAR model rocket program.

Q. Why don't all model rocketeers belong to the NAR?

A. That's a good question. NAR membership is strictly voluntary. The only thing the NAR has to offer is (1) membership in the largest non-professional rocketry organization in the world, (2) $300,000 personal liability/property damage insurance in the event any accident should occur during a rocket launch, (3) **MODEL ROCKETRY** magazine which contains the *MODEL ROCKETEER*, (4) competition in sanctioned model rocket meets against other modelers, (5) a respected reputation among astronautic, aeronautic, safety and engineering groups throughout the world, and (6) the knowledge that your membership fee helps in insuring that model rocketry will continue to flourish and grow despite the ignorance of many individuals and organizations who still wish to see model rocketry abolished.

EDITORS NOOK

Well, we made it into the second issue. Would you believe we had too much material for the first one? Hope you liked the August mag because this one won't be much different. We'll start making changes when we get feedback from you, the membership. You'll note that we are not giving all that we promised in the last issue; this will probaby occur again due to the virginity of our news and features system. This month's feature article was prepared by Jim "Casey" Kukowski, NAR trustee and Public Relations Director. Jim also handles NASA publicity and has had his arms, pockets and head full of Apollos these past months. Somehow he's found time to be around at the Smithsonian and the WAMARVA meet; so let's have no more gas about trustees not pulling their part of the load. Thanks for the article, Jim.

All of which brings to mind a noticeable gap. The Maryland area sections have become the center of NAR activity and far outshine the rest of the Association in variety and innovation. Where are the rest of you people? It's September and everybody's going back to school so how about showing some organization and real effort? There's much to be done between holding regular range launches and regionals and/or conventions. Get a copy of the Revised Section Guide from LAC (1824 Wharton St., Pittsburgh, Pa.) and look it over. It'll give you ideas for demonstrations, publicity, newsletters and other very valuable ways to help your club and NAR. When you decide to hold a demo or other affair, give us ample notice so we can give it a plug. Likewise, send us a note on its success (or whatever) and it'll go into Section News.

This month's issue contains several articles stolen from club newsletters: the scope article is from ZOG 43 the NARHAMS newsletter and the Little Joe II plans are from the convention issue of Starburst, the Steel City magazine. By now the LAC newsletter award has been given (a report on which will appear in the next issue) so one magazine will be judged best - but only for a year. So far, much of the originality in non-flying activity has shown up in newsletters. To those who have tried it, keep it up; to those who haven't, take a stab at publishing. You'll learn that there's more to rocketry than models. With school starting, there is ready accessibility to duplicating machinery and materials. Start small (one or two pages) and then try branching off into drawings or technical features. Do what you like; don't feel constrained by what others have done.

Well, that's enough for this issue. Next time I'll have more to say on non-contest activities and any contributed ideas are more than welcome. Address them to Lindsay Audin, Editor, Model Rocketeer, NAR HQ.

ATTENTION ALL SECTIONS

SECTION NEWS is real. Now, instead of three or four places to write with your news, there is only ONE. The official outlet for NAR News is now in the *MODEL ROCKETEER*, so send your material here. Has something happened in your section or group? If so, be sure your official news contact with NAR SECTION NEWS knows about it. If your contact knows, then I will find out.

Be sure and send all news to: NAR SECTION NEWS, c/o Charles M. Gordon, Editor, 192 Charolette Drive, Laurel, Maryland 20810. REMEMBER!!!! IF I DON'T HAVE IT - I CAN'T PRINT IT!

SMITHSONIAN HOSTS ROCKETRY

This summer the WAMARVA area sections of NAR participated in the Smithsonain Institution exhibition on modeling. This activity included Plastic Modeling, Model Aircrafting, and Model Rocketry.

On the first day of the official exhibition, June 7, 1969, model rockets were flown from the mall downtown for all the citizens of the District of Columbia and visitors to the Nation's Capitol to see.

Besides the rocket launch there was a display of model rockets inside the new Arts and Industries Building and also a booth. This booth was slightly different from regular model rocketry displays. Instead of just giving out information about model rocketry, modelers from the NARHAMS, MARS, UFO, Rock Creek, Annapolis, Randalstown, Star Spangled Banner, and Rockville Rocketeers Sections, ALL participated in building model rockets before the very spectators' eyes.

Congratulations on a job well done!

ODDS & ENDS

Congratulations to all winners at NARAM-11. Special regards go to the winning section with the best newsletter of the year.

The *MISFIRE*, newsletter of Metro-Denver Section, reports of educational lecture presented by Mr. Robert Cannon, Educational Director or Estes Industries, to 4th, 5th, and 6th graders at the Shaw Heights Elementary School. Much interest was said to have been shown.

On July 12, the NARHAMS Section held Head Quarters Section Meet no. 11. Launch included Class 1 P.D., Scale, and Plastic Model events plus two B/G events.

The Annapolis Association of Rocketry held a "Schools-Out-Fun-Rocket-Meet" on Sunday June 29. The meet included free hot dogs and hamburgers for members and their families. Launching ranged from single engine birds to a two stage - three engine per stage - bird.

Another bit from the *MISFIRE* of Metro-Denver. Estes Industries Education Director Bob Cannon, with two assistants, was at Arvada Sr. High on May 15 photographing all phases of model building, finishing, and flying for a new teacher information folder on model rocketry.

Reports have come in from the Arevalos Rocket Association of plans for the building of a static thrust stand to be used in the testing of 'F' type engines.

The Birch Lane Section plans to hold a rocket launch on September 13, 1969. Interested persons in the area should contact: Mr. Hills, 2429 Temple Dr., Davis, Calif. 95616.

Arevalos Rocket Association plans to hold a rocket launch on September 20, 1969. Interested persons in that area should contact: Marc Reynolds, 2402 Spruce, Santa Anna, Calif. 92704.

Congratulations to the following sections for publication of their first newsletters: *Vol. I, No. I.* The Metropolitan Area Rocket Society of Lanaham, Maryland has come out with the *MINI-MAG*. The Columbus Society for the Advancement of Rocketry Section of Columbus, Ohio has brought to light the *QUASAR*. And the Maj. Gen. Holger Toftoy Memorial Section of Maryland has come out with the *MISSILE MAN*. Good luck to all these new section publications. Hope you keep them coming.

New MODEL Rocketeers

On Monday the 23rd of June, 1969, a NASA splashdown party was held at Andrews Air Force Base for the crew of the Apollo 10 Mission. While at this party Colonel Tom Stafford, Commander Eugene Cernan, and Commander John Young were presented with honorary membership in the Annapolis Association of Rocketry, Annapolis, Md. All of the NAR welcomes these three new Model Rocketeers.

IF I WROTE THE PINK BOOK . . .

Following are proposed rules for a streamer duration event, developed by G. Harry Stine and the YMCA Space Pioneers (present NAR champs). It's an interesting, simple and creative event as discernible from the rules. Most rocketeers have noticed how slowly a streamer bird floats to earth in the summer, especially if the rocket has large fins. Within the framework of a Standard Streamer rule, it can be a real challenge to keep the missile aloft. This event (if adopted) is useful in small flying areas where Parachute Duration is too difficult due to drifting. If any group tries out these rules, let us or the Contest Board know how they worked out. It looks like much fun..

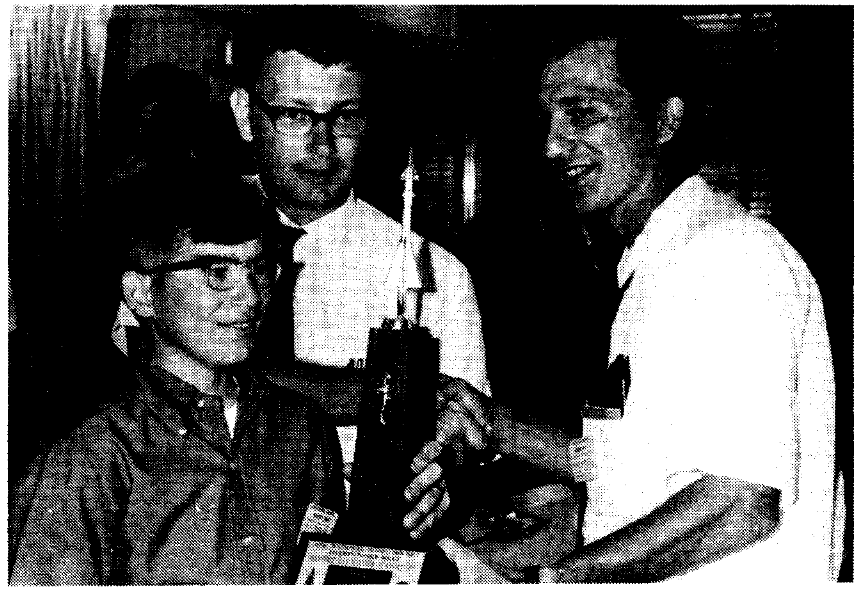
Proposed Rules for
Streamer Duration Competition

1.Streamer Duration Competition is comprised of a number of events for model rockets with varying gross weights and total impulse. The purpose of the competition is to determine which entry achieves the longest flight duration time using a Standard Streamer as a recovery device. 2. The Standard Streamer shall be fabricated from any suitable material and have dimensions as follows: (a) 25 millimeters (1.0 inches) wide and 1000 millimeters (39.25 inches) long, OR (b) 50 Millimeters (2.0 inches) wide by 500 millimeters (19.75 inches) long. The Standard Streamer shall be attached to the entry by only a single line attached to a single point on the Streamer. Dimensions of the Standard Streamer in each entry will be measured and verified by the judges before each flight of each entry. 3. The purpose of the event is to determine which entry achieves the longest flight duration time. Each entry will be timed from the instant of the first motion on the launcher until the instant any part of the upper stage or final stage of the model, excluding wadding, touches the ground. All timing shall be in accordance with Rule 15, U.S. Model Rocket Sporting Code, 1967 Edition. The entry with the longest flight duration time shall be declared the winner. 4. The following classes of Streamer Duration Competition are authorized:

Class	Total Impulse (Newton-seconds)	Maximum Weight (grams)
0	0.00 - 2.50	60
1	2.51 - 5.00	60
2	5.01 - 10.00	120

5. The weighting factor for the Streamer Duration Competition is 1.

NAR LOSES PROMINENT MODELER



David M. Gregorek, 15, son of Dr. and Mrs. G.M. Gregorek, 4451 Danforth Road, Columbus, Ohio passed away May 9, following a long illness.

Dave was a charter member of the Columbus Society for the Advancement of Rocketry (CSAR) of the NAR. He was recording secretary. With his dad, Dave won the Senior Egg Loft Competition at NARAM-10 at Wallops Island in 1968.

Despite his illness over the past several years, Dave never knew the word "quit". Shortly before his untimely death, he had nearly completed all his models for competition in NARAM-11. Just about a week before he died he was still studying Chemistry and had received an "A" in College Algebra.

Dave's determination and personal integrity should serve as an incentive to all of us to do the best possible job at all times, whether it be a hobby, such as model rocketry, or applying applying themselves to further their education and their future.

TRACKING PROBLEMS ?

Yes, someone has finally solved that everpresent problem of "track lost" with a system almost every section should be able to use. The credit for this feat goes to none other than Bob Singer. As usual with something this good, everyone wonders why nobody ever thought of it before. The editor, who is (or was) a hibitual complainer on tracking failures is afraid he doesn't know.

Anyway, this is what Bob did: he took one of the NARHAMS scopes, which were lying in his basement, and mounted his father's 7x50 wide angle binoculars on them. The NARHAMS scopes were typical open sight-on-a-beam optics. Bob just laid a washcloth over the beam for shock absorbtion and held the binocs in place with about five rubber bands. It wasn't even necessary to remove the old sights!

The editor was working the phone while Bob tracked Design Efficiency at WAMARVA-1. This is usually a difficult event to track, but out of about 60 birds launched, Bob followed all but two which went directly into the sun.

Then Bob had to pick up some scale judging sheets at Howard Kuhn's house, so I got to use the scope. It was really unbelievable. Each bird could be seen all the way up. In the end, I think we broke 90% tracked and closed.

With this record on its first time out, plus its availability and ease of use, the Singer scope is definitely the way to go. *(Credit for this article goes to Andy Elliot, Editor,* **ZOG 43***)*

FROM THE STANDARDS AND TESTING COMMITTEE

On the basis of static test raw data supplied and certified correct by Model Rocket Industries and tests conducted by this committee, the following model rocket engines are hereby granted both the NAR Safety Certificate and the NAR Contest Certificate:

Type A3-2

Type B3-3. This certification applies to MRI engines of these types manufactured on and after June 10, 1969.

MRI also has approved for contest use a Type A5-3 motor.

Neither Centuri Mini-Max nor RDC Enerjet engines have either the NAR Safety Certificate or the NAR Contest Certificate.

LITTLE JOE II

The Little Joe II is a versatile booster used by NASA to test the launch escape system. The solid fuel booster is designed and produced by the Convair division of General Dynamics. It uses a mixture of engines with a maximum of 7 Algol 1-D motors or a minimum of 1 Algol and six Recruit motors.

All tests were conducted at White Sands Missile Range between 8/28/63 and 1/20/66.

The Little Joe II may have a peak thrust of 860,000 pounds, depending on engine combination. The booster is capable of lifting its payload to an altitude of 200,000 feet.

The body of the Little Joe II is corrugated aluminum stiffened by ring shaped frames. Fins are designed to be bolted on at the launch site.

The Little Joe II is controlled in flight by two systems. The first is fins with controllable elevons. The elevon actuators are operated by electronic command signals from the guidance system. The guidance system interprets radio commands from the ground and sends them down the electrical system located under the external fairings. These signals activate the hydraulic system. The second flight control system is a reaction control system. The system is monopropellant and uses H_2O_2 (Hydrogen Peroxide) as fuel. Nitrogen is used to maintain pressure in the fuel tanks. A catalyst is used to decompose the H_2O_2 into O_2 and steam which provide 600 pounds of thrust. Nozzles are located back to back perpendicular to the fin plane. The reaction control system is controlled by the guidance system.

This plan is that of Spacecraft 002. It was launched January 20, 1966. It was the final test of the Little Joe II series. For the first time an actual Apollo Spacecraft was used. The purpose of the test was to check the LES during a full power tumble. 4 Algol and 5 Recruit motors were used to boost the rocket 51,000 feet. The pitch up signal was given and the abort took place at 61,000 feet. All systems functioned perfectly. NASA then announced the LES qualified for use. Drawings used were:

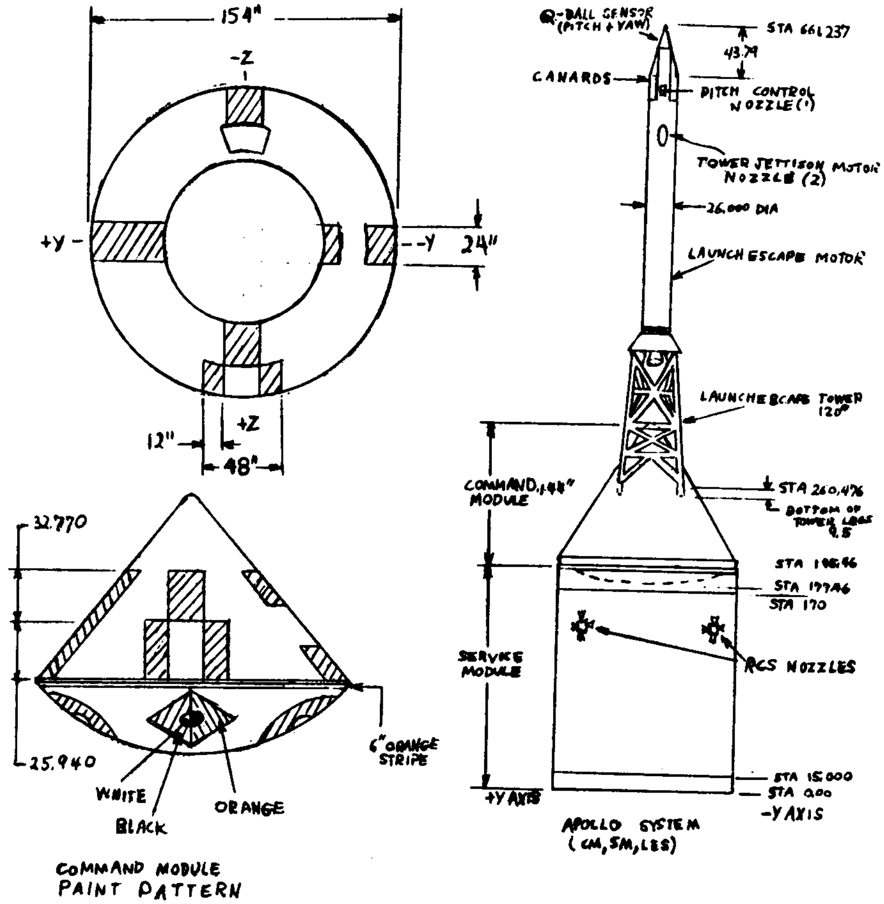
Convair 12-1.045

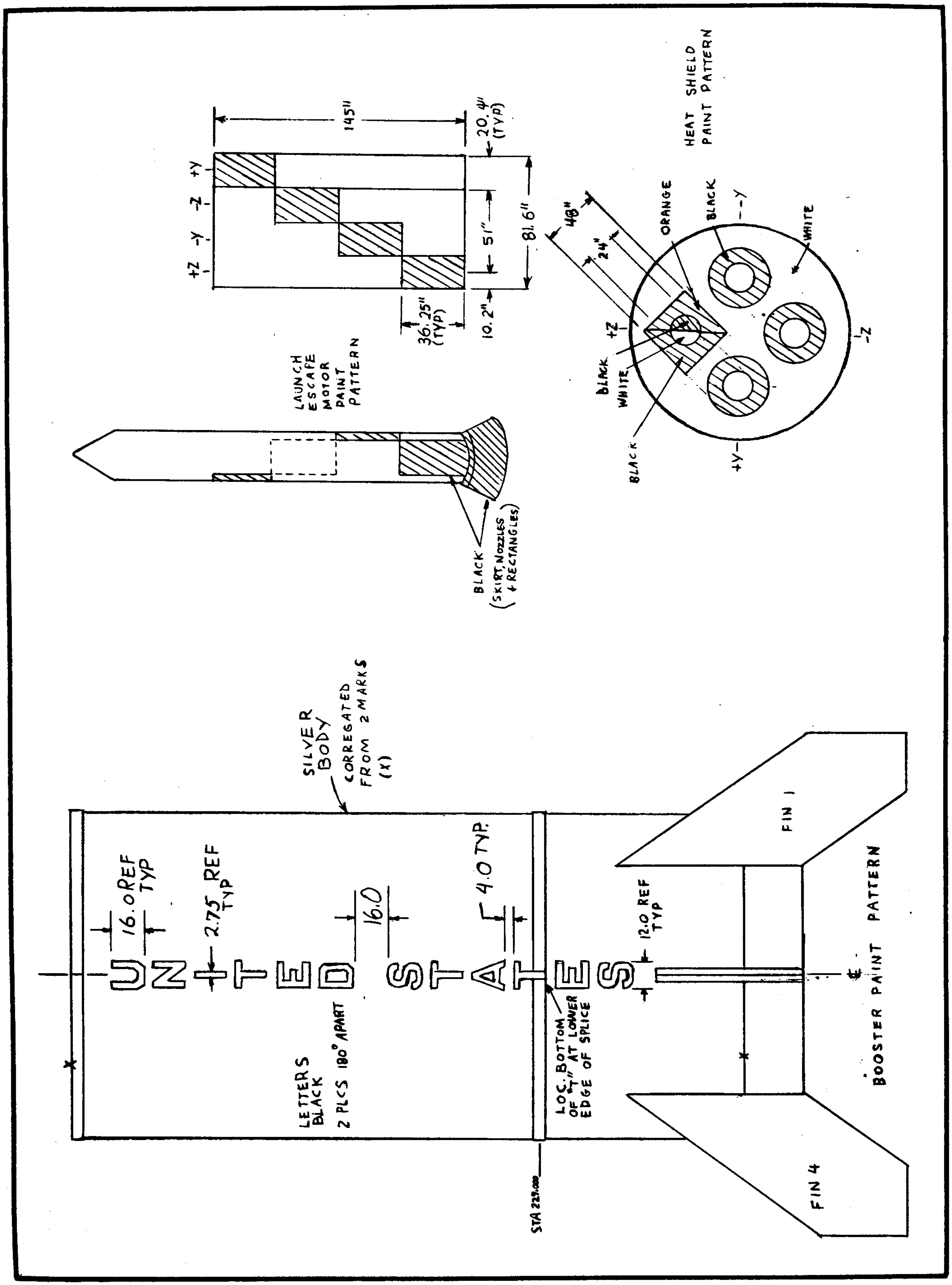
1.5.1.4

1.5.1.11

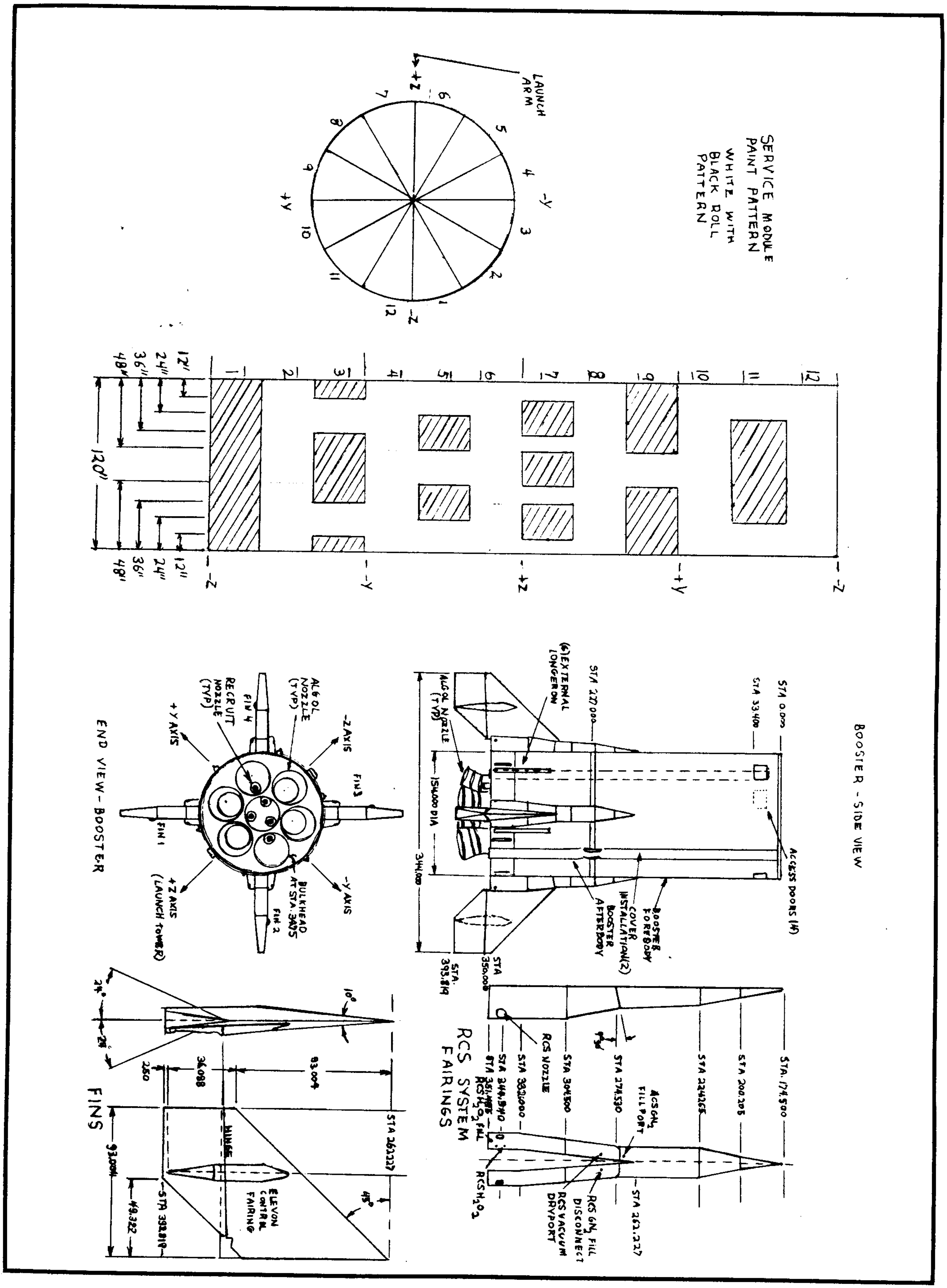
1.5.1.12

12-00005. Our thanks to Arnie Pittler, Alan Stolzenberg and Elaine Sadowski for making these fine drawings available to modelers.





HEAT SHIELD PAINT PATTERN
145"
20.4" (TYP)
81.6"
51"
10.2"
36.25" (TYP)
+Y
-Z
-Y
+Z
LAUNCH ESCAPE MOTOR PAINT PATTERN
BLACK (SKIRT, NOZZLES + RECTANGLES)
ORANGE
BLACK
WHITE
48"
24"
SILVER BODY
CORREGATED FROM 2 MARKS (X)
16.0 REF TYP
2.75 REF TYP
16.0
4.0 TYP.
12.0 REF TYP
LETTERS BLACK
2 PLCS 180° APART
LOC. BOTTOM OF "T" AT LOWER EDGE OF SPLICE
FIN 1
FIN 4
STA 223.000
BOOSTER PAINT PATTERN
UNITED STATES


SERVICE MODULE PAINT PATTERN
WHITE WITH BLACK ROLL PATTERN
LAUNCH ARM
BOOSTER - SIDE VIEW
ACCESS DOORS (4)
BOOSTER FOREBODY
COVER INSTALLATION (2)
BOOSTER AFTERBODY
(4) EXTERNAL LONGERON
ALGOL NOZZLE (TYP)
STA 0.000
STA 33.400
STA 227.000
STA 350.000
STA 393.819
END VIEW - BOOSTER
-Z AXIS
-Y AXIS
+Y AXIS
+Z AXIS (LAUNCH TOWER)
FIN 1
FIN 2
FIN 3
FIN 4
RECRUIT NOZZLE (TYP)
RCS SYSTEM FAIRINGS
RCS NOZZLE
RCS VACUUM DRYPORT
FINS
HINGE
ELEVON CONTROL FAIRING
STA 262.227
STA 393.819

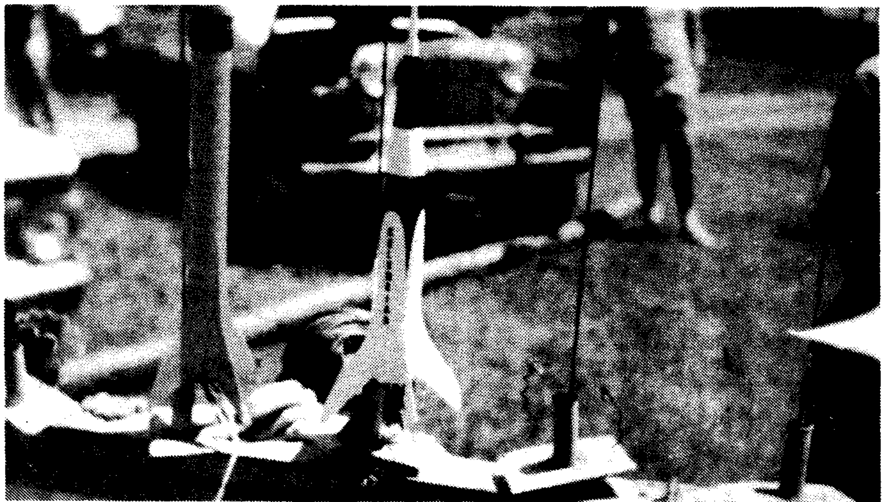


Photo by Dennis Brandl

Shown above is one of the entries in the June 29th Competition of the North Pittsburgh Rocket Club. Results for the first two events are in. In Parachute Duration Tom Wuellette took first with 82.5 seconds on his Alpha; Rich Baier took second with 54.6 seconds flying a Drifter; and Craig Martin placed third with 47.5 seconds flying an Astron Mark. First place in the Scale Competition went to Rich Baier's Little Joe II with 772.5 out of a possible 850 points. Rich Brandon took second with his Nike-Smoke; and Tim Bray placed third with a Mercury Atlas.

a model rocket. The mouse was recovered successfully and did not suffer any ill effects from the flight. Dennis will use this experiment for a science project next year.

Under the supervision of Science Instructor John Fleming, science students at Mona Shores School, Mushegon, Michigan launched 20 rockets to altitudes of up to 1000 feet in a recent demonstration firing.

A model rocket launch engineered by the Eastchester Junior High School Science Club, White Plains, New York, was part of the orientation program for incoming seventh graders to the school. Twenty-seven members of the Club took part in the launching and recovery which was designed to attract new members to the Science Club.

A horse pasture south of Great Falls, Montana served as the launch site for a group of sixth graders from Russell Elementary School. Under the direction of Mrs. Melinda Madison, the launching climaxed the students' study of science and space travel. Willis Huepel, the Russell School principal, and Dr. Harold Wenaas, superintendent of schools, viewed the launching.

Students at the three 6th grade classes at the Pine Street School, Palmyra, Pennsylvania recently staged a rocket competition. Each contestant was limited to entering three rockets. The rockets were judged on workmanship, flight characteristics, and distance of the landing point from the launch site. The contest was supervised and judged by sixth grade teachers Clair Drescher and Ronald Ditt.

Prizes were awarded in four different classes according to rocket size and weight. In Class 1 Darrell Eckert came in first flying a Sprite, while Tom Townsley placed second also with a Sprite. Class 2: first, Tom Townsley, with an Aerobee; second, Jim Snyder, with an Alpha. Class 3: first, Fred Bowman, with a Delta; and second, William Becker, with a Drifter. Class 4 resulted in a tie for first between Fred Bowman's Mercury Redstone and Kevin Shistel's Big Bertha.

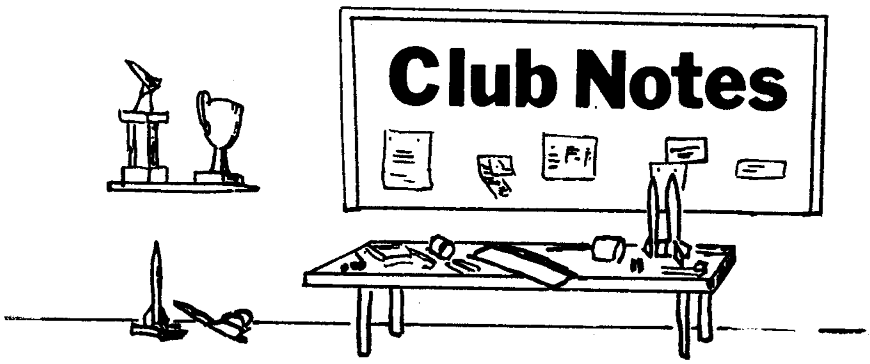
Rocketeers in the Madison, Wisconsin area interested in forming an NAR Section in that area should contact Evan Koenig, 2748 Kendall Ave., Madison, Wis. 53705.

(From the Editor, continued)
scale models are usually driven by piston engines.

In model rocketry, however, we are in a unique position. There are certain rockets that can be constructed and safely flown in a true scale configuration. All sounding rockets which employ fins for stability can be "exact-scale modeled", as can such vehicles as the Jupiter C, Mercury Redstone, Saturn IB, Saturn V, early Thor, and military vehicles such as the Sergeant, Corporal, etc., provided some noseweight is used. Other non-finned vehicles such as the Thrust Augmented Delta, Polaris, Minuteman, Titan IIIC, Mercury Atlas, etc., cannot be modeled except with the addition of fins to provide stability (or with the development of some form of guidance system for the model rocket).

This suggests that perhaps two areas of scale model competition should be available. In a "True Scale Model" event *any* deviation from scale, including the addition of plastic fins, would be penalized; however a second event – "Semi-Scale Model" – should be introduced to allow competitors to stabilize their rockets either with oversize fins or with clear plastic fins. In the Semi-Scale event deviations from prototype fin shape would be permissible.

Two categories of scale competition should satisfy both the purist who is disgusted by the sight of plastic fins and the competitor who wants to fly the TAD, or Polaris. Each can fly his rocket in competition and is not forced, as he is under the present system, to compete against the other.



The Saskatoon Model Rocketry Association would like to have the First Canadian Model Rocket Convention and Competition held in Saskatoon. There will be six events: egg loft, maximum altitude, spot landing, parachute duration, glider duration, streamer duration. The Aerospace Engineering Division of the Engineering Division of the University of Saskatchewan has promised them a tour of their plant. All interested rocketeers in Canada should send a self addressed envelope to Brian Smyth 219 Lake Cresc., Saskatoon, Saskatchewan, Canada, for more information.

An exhibit on model rocketry was displayed in the Traverse City Michigan Public Library during the summer. Local rocketeers Bob Roush, Mike Locke, and Pat Buckin prepared the display which was featured as part of the library's promotion of the aerospace reading program.

This year's Summer Adventures Program at the Helen Keller Middle School, Easton, Connecticut included a course in "Rocketry and Models." The principles of Aerodynamics, Newton's laws of motion, and other physical laws were taught in the context of model rocketry. The instructor, Roger Eliot, told the *Bridgeport Post* "that teachers and parents must be alert for ways to utilize youthful interests as 'tools' to help students become responsible, thinking adults."

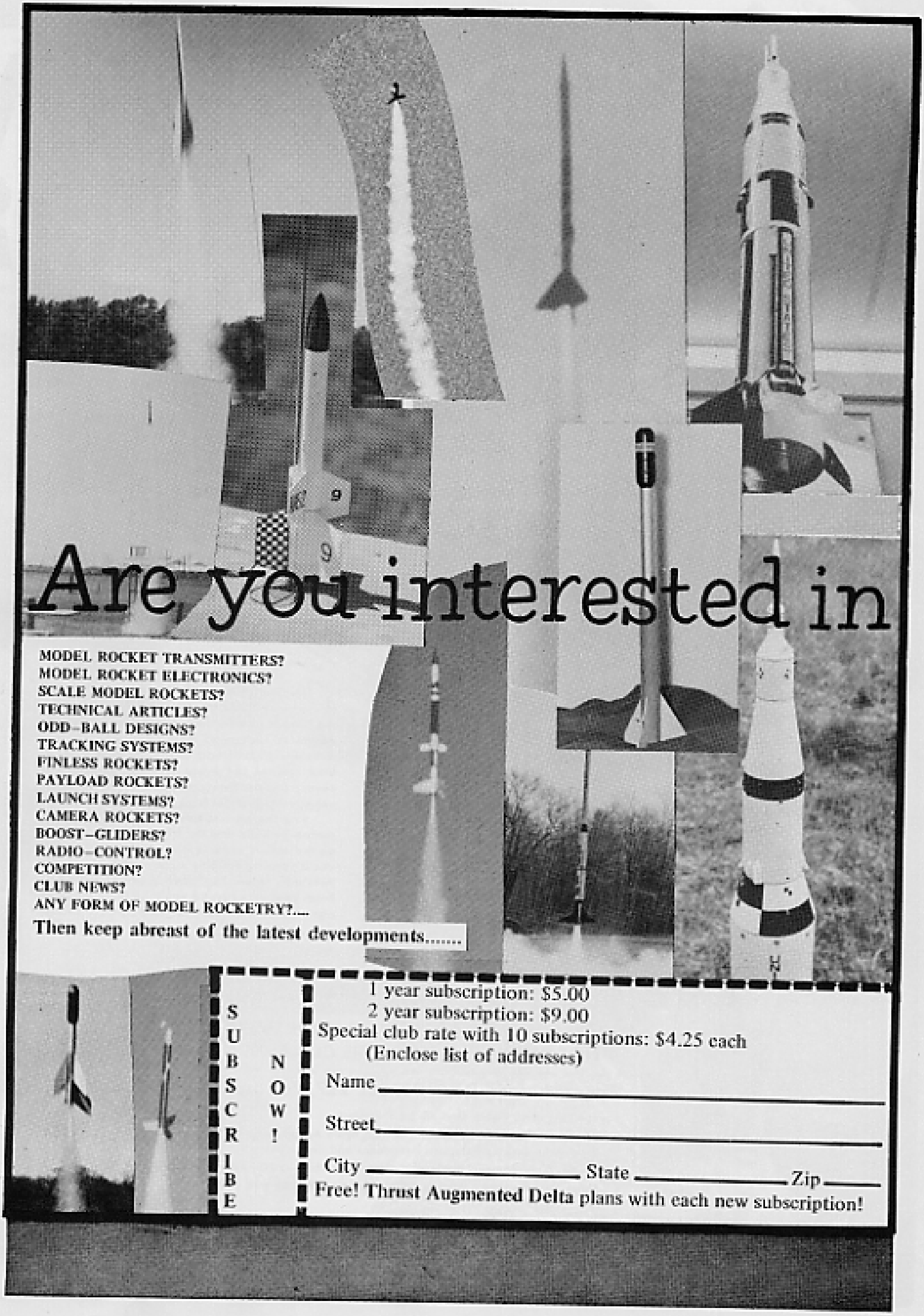
A model rocket club has been formed at the Holmes Junior High School, Colorado Springs, Colorado. The school's industrial arts shop has been made available to club members after school for kit construction. The club's 55 members, from all three grades, launch from a field adjacent to the school, under the supervision of faculty member Gary Reifschneider. A licensed pilot, Reifschneider says one of the club's major objectives is to develop student interest in a career in the aerospace industry.

The Statesville (North Carolina) Rocket Association has been formed by a group of five boys from that town. David Cole, Stuart Lingerfelt, Steve McLester, Jim Sherrill and John Simpson organized the association, and conduct launches about twice a month.

The whole student body of Cold Springs Elementary School in Montana turned out recently to witness a model rocket launching by members of that school's fifth grade class. Under the supervision of Ray Ziemkowski, fifth grade students launched and recovered six rockets during the demonstration.

A Memorial Day rocket meet was sponsored by Explorer Post 453 in Houston, Minnesota. In an altitude competition Chris Bunge placed first with 1,025 feet; Jon Peterson took second with 830 feet; and Peter Anderson and Allan Benson tied for third with 705 feet. In a separate event, Explorer Scout Dennis Loefler launched a mouse to 450 feet in the payload section of

(Continued on page 47.)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