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Model Rocketry

Volume II, No. 9
June 1970

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Cover Photo

Bob Hagedorn displaying the Ball-Hagedorn Team scale IQSY Tomahawk during the scale discussion group at the Pittsburgh Spring Convention. Complete coverage of this year's Pittsburgh Convention begins on page 31. (Cover Photo by Tom Pastrick.)

From the Editor

As late as last year it was estimated that only one person in twenty had any knowledge of model rocketry. A number of clubs have recently been active in promoting the hobby through demonstration launches and other public education programs, and this number of uninformed citizens is steadily decreasing in some parts of the country. In other areas, however, the rocketeers have made no effort in acquainting others of their activities, and the general public remains uninformed in these areas.

The upcoming summer months offer an ideal time to further the public awareness of model rocketry. Demonstration launches, arranged in conjunction with county and state fairs, public gatherings, sporting events, civic association picnics, etc. can do more to popularize the hobby than almost any other form of public exposure. Any club which needs new members, or which needs the support of public officials or civic groups, should look into the possibility of arranging a demonstration launching at some public gathering. The successful flight of a three-foot Saturn into the sky can be the most effective way of quickly interesting the uninformed public.

Another worthwhile summer activity is teaching a model rocket course in cooperation with the local parks department, YMCA, or even as part of the summer enrichment program at a local school. If you, or your club, have the qualifications to teach rocketry, check with town and civic leaders. In many areas they will be eager to support a model rocket program.

The benefits of increasing the number of model rocketeers in your locality are tremendous. As your numbers increase, public officials will generally be more willing to cooperate in providing launch sites, newspapers will more readily cover your activities, and civic groups will be more willing to support your activities. *Support rocketry this summer!*

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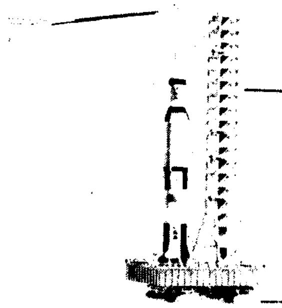

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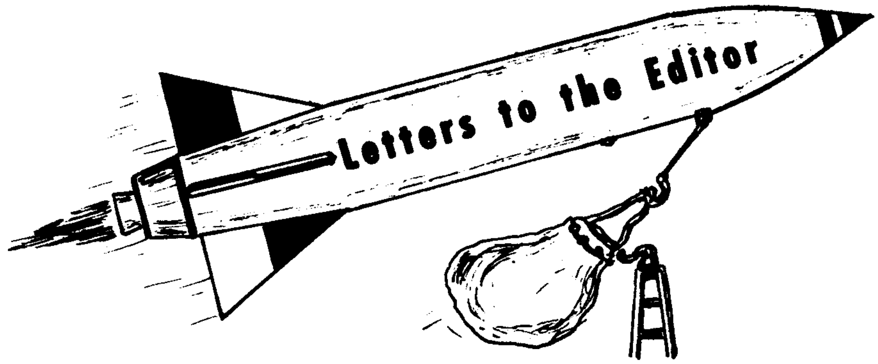

Cluster Techniques

I have a word of warning to fellow rocketeers with cluster models. For your sake, place a piece of recovery wadding in the ejection end of your engines. Unfortunately I haven't seen this stressed, but it's important. I know! I decided not to add the wadding on my Saturn V. She lifted off majestically . . . on two engines. Out came the chutes at about 50 feet. But I heard a mysterious hissing noise. Shortly after touch-down there was a roar as fire shot through the stuffer tube. The unlit engine had ignited and was burning the tracking charge backwards towards the propellant which then ignited. I now have a $16 burnt-out Saturn. I shoveled snow for four solid days to earn the money to buy that Saturn. I spent 18 solid work hours in building that model. Not to mention the mental anguish. All that, and it was destroyed because I didn't take the time to put four square inches of recovery wadding in the top of each engine.

Russell Schnapp, NAR 12638, Jr.
Flushing, New York

LM Conversion

Your March issue was terriffic. My congratulations go to Tom Milkie for his excellent job on plastic conversion of the Revell LM. *The Old Rocketeer* on modelling with plastics was also well done.

Chuck Winston, NAR 15286
North Miami Beach, Florida

Movie Camera

My big project of the past year has been the designing and (hopefully) the construction of an ultra-small rocket movie camera. Such a project is very difficult, and doubly so when I know that after the Estes Cineroc is released the model rocket movie camera will become a commonplace thing. It's really a "labor of love" for me, and I hope I can succeed in building it. I would like to trade ideas with anyone having a similar interest in building a modroc movie camera.

Jack Dunn, III
4709 19th
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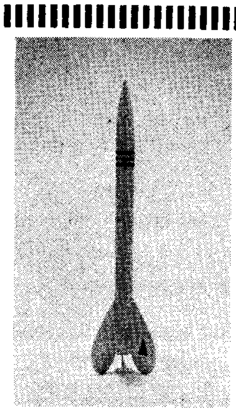

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Printing Improvements

I would personally like to commend you on your excellent magazine. The line copy and half-tone work have improved so much that it is almost impossible to tell whether the first issue was printed by the same people who do it today. Your color work is one of the best I've seen in a long time. Though I do think your ink drawings could be improved, your magazine covers the hobby better than any other to come along in a long time. I would like to see an article, perhaps by the editor, on your shop and how copy is taken care of. I think it would be very interesting to see what an article has to go through before it is printed.

Bob Westmoreland
Anchorage, Alaska

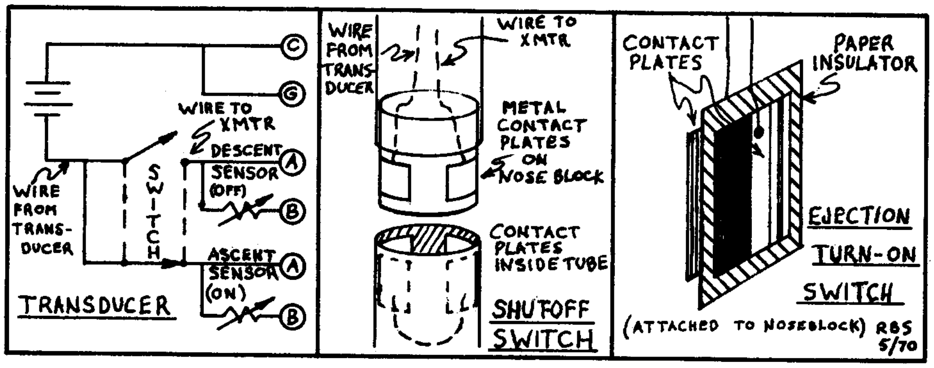
We are glad you find that **Model Rocketry** *is continually improving. The suggestion that we prepare an article on the preparation of copy for printing and other aspects of* **MRm's** *operation is quite interesting. We'll get to work on it, and perhaps have something ready for publication in early Fall.*

Modroc Songs

I just picked up my first **Model Rocketry** issue at a news-stand, and was ecstatic that we have our own magazine now! This is the greatest thing that's happened to model rocketry and the NAR since Jim Kukowski! Please keep up the good work.

In this February issue was the NAR underground song "Saturn B" which I wrote at NARAM-10. Many thanks are due to whomever submitted it, because seeing it again relaunched my rocket career. Incidentally, "Saturn B" should be sung to the tune of "The Lemon Tree." How about printing some requests like "NAR-Man Harry Stine" to the tune of "Secret Agent Man."

Doug Frost, NAR #3446
Mill Valley, California



Pershing Plans

Thank you for the Plans for the scale Pershing 1 missile in your January issue. I don't know where you got the information from (photos, measurements, and plans), but it is a relief to me. I've been searching for a year and a half for anything on the Pershing missile. The only thing I found was an off-scale silhouette of it in an old book on rockets and missiles published in 1960. I am glad to know that one of your editors has ESP.

Robert Kiefer
Belleville, Ill.

R&D Projects

In your February issue I read Peter O'Neill's letter concerning Foxmitter multiplexing. Dick Fox suggested such a system to me, and I am currently working on it. I'll let you know how the results turn out.

George Loewe's letter in the January 1970 issue also caught my eye. His suggestion of using the RCA 40081 instead of the 40080 sounds very useful. About his switching system, it sounds like a good idea, but maybe a little complicated and expensive. Previously I designed a system for turning off a transmitter at ejection to save batteries. After a little thinking I came up with a system which will turn off one transducer at ejection and turn on another.

As the rocket ascends, one transducer, say a roll rate sensor, is in operation. At ejection the ascent transducer is shut off and the descent transducer, say a temperature sensor, is turned on. For the shutoff switch, two foil contact plates are attached to the outside of the nose block. They match up with a single, large foil plate inside the rocket body which overlaps the two plates thus connecting them together. At ejection the nose block and the rocket body separate, opening the circuit to the ascent sensor.

The descent sensor is turned on by the following means. Two foil plates are attached, one on top of the other, to the nose block. They are not connected. A small piece of paper is attached in a matching place inside the rocket body tube. When the two sections (nose and body) are mated together, the piece of paper is slipped between the two plates, leaving the descent transducer circuit open until ejection, when the piece of paper is pulled out, thus completing the circuit. It may be necessary to put a piece of tape over the two foil plates to bring them together at ejection.

Care should be taken in matching the switch plates. Be sure to ground test the system by pulling the two sections apart on the ground several times before flying!

Robert Staehle
Rochester, New York

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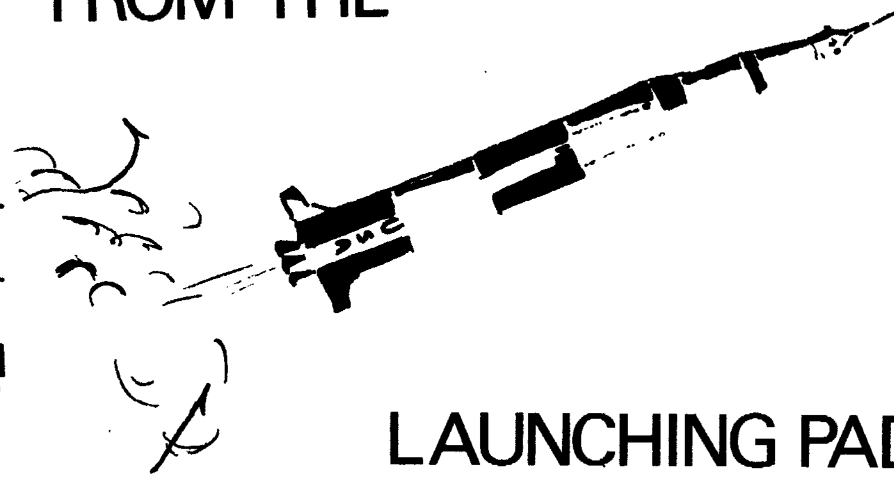
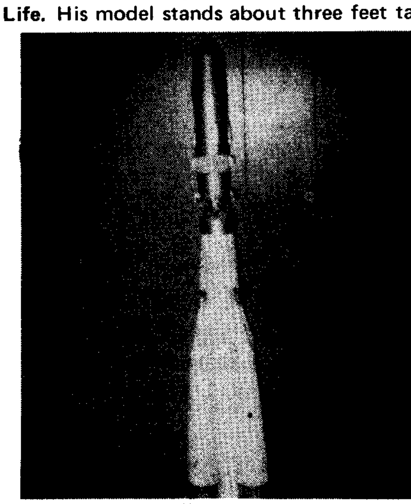


The Russian "Vostok" carrier vehicle seems to be quite popular with rocketeers. The cover photo on the December 1969 issue has provoked quite a few letters asking for scale plans, photos, information, and even a source of kits. Just wait another month or two . . . the scale plans are on Harry Stine's drawing board right now, and may be ready for publication next month. An excellent series of four color liftoff photos appeared in the August 1969 issue of **Soviet Life** magazine, a USSR magazine published in the United States under an exchange agreement. Copies of this issue are no longer available, but you may be able to find one at your local library. The entire issue is devoted to space flight, and in addition to "Vostok" color photos it contains photos of the "Soyuz" and other Russian spacecraft.

Dan Starr sent in a photo of his scale "Vostok", done entirely from June 12, 1967 *Aviation Week & Space Technology* article and the August 1969 issue of **Soviet Life.** His model stands about three feet tall

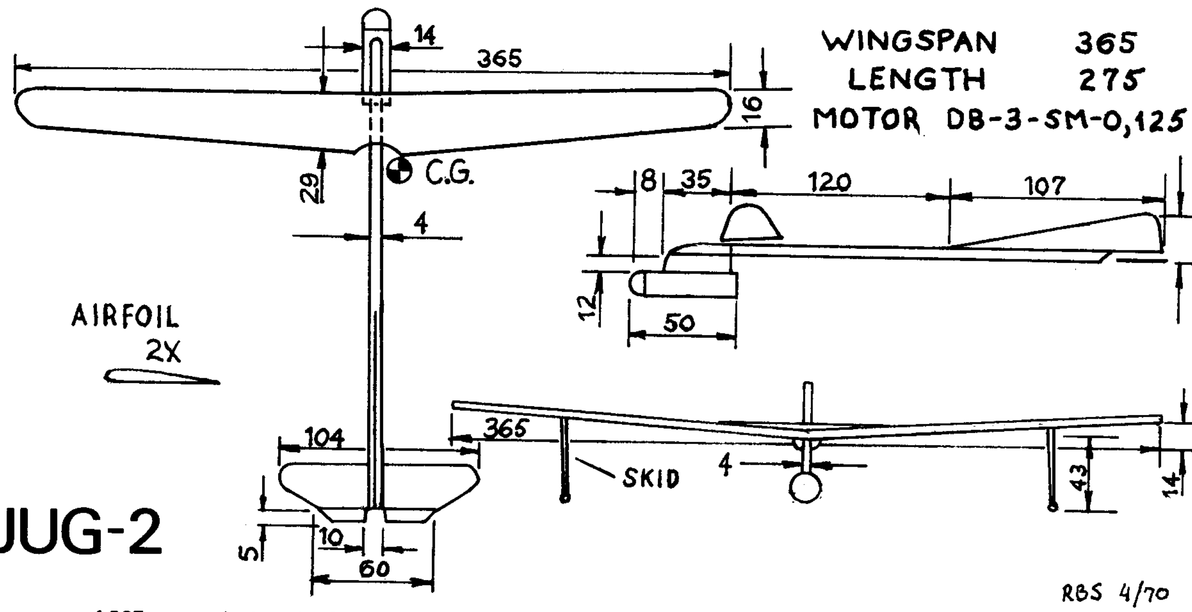


(see photo) and is powered by four class A through C engines. He suggests that a single F100 could also be used. With all the detailing necessary on the strap-ons and the interstage structure, a scratch-built "Vostok" will require a great deal of work. But just think of the points you'll get for degree of difficulty in the next scale contest.

Speaking of scale, I just had the opportunity to put together the Centuri Little Joe II in 1/100 scale. It's a beautiful kit which takes only about three hours to assemble. No painting or finishing is required, since pre-corrugated mylar skin, pre-printed roll patterns, and a decal for the capsule are supplied with the kit. You take the body tube out of the package, wrap around the roll patterns, put together the plastic Apollo capsule and then comes the hard part . . . you cut the fins from a pre-shaped balsa sheet. The 1/100 scale makes it hard to include small details, such as the thruster engines included on the 1/45 scale Centuri Little Joe II, but for it's size the detailing is excellent. If you've never tried a scale model before, this kit should be ideal. It seems to be designed so you can't make a mistake.

The Yugoslavians have come up with a B/G design using those 12mm X 40mm engines described previously. It's quite a novel bird, employing features that have not been seen on recent U.S. designs. Flying with a ½A engine, the JUG-2 has a wingspan of 365mm and a fantastically high aspect ratio (similar to that used on manned sailplanes). Use of such a high aspect ratio wing increases the boost phase drag while also increasing the gliding performance of the bird. Most U.S. designs recently have employed lower aspect ratio wings, thus assuring a higher boost, but sacrificing some glide performance.

Note also on the JUG-2 (shown below) that a fixed pod, not a pop-pod, is employed. This is also typical of the European designs. A novel feature on the JUG-2 is that the engine pod is mounted *below the wing* and at an angle to the centerline to allow for straight upward flight. As designed for a ½A engine, the



JUG-2

glider has a span of 365mm, and a length of 270mm. With a little redesign of the pod to take Series III, ½A engines, this looks like a great glider for Hornet B/G competition.

The original specifications are for 2mm thick sheet balsa wings (airfoiled as shown in the drawing), a 4mm thick pod mount, a 4mm X 4mm square cross-section boom, and 0.25mm thick wire skids extending below each wing. Two small trim tabs are located on the rear of the stabilizer, so that the glider can be trimmed for the appropriate angle of attack. Let's see what kind of times this one will turn in.

In the field of U.S. boost/gliders, this summer should see some interesting styrofoam B/G's in the skies. Two members of the U.S. B/G team competing in the Internationals this fall in Yugoslavia are planning on experimenting with this new B/G construction material this summer. Indications are that the use of styrofoam will allow the construction of stronger, and lighter B/G's. Keep your eyes open at this year's Nationals, and if you see this year's Internationals team flying styrofoam B/G's you'll know the results of their testing.

George

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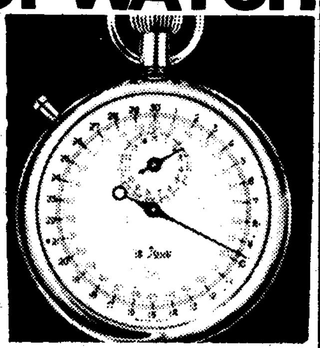

This stopwatch, with 1/10 second timer, was designed for contest timing. Separate start-stop and reset buttons allow you to stop the watch when the PD or B/G goes out of sight and restart it when it comes into view again. Sweep hand completes one revolution of the dial in 30 seconds. The 15 minute register allows long duration timing. Start-stop button is at the crown, and the return to zero is with a side push button. This watch has a seven jewel movement and chrome case.

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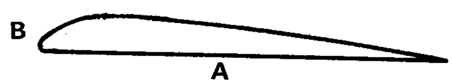

A	B	Length	Price
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3"	1/4"	16"	.50
1/4" x 1" x 16" Strip.			.20

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A new, improved transmitter design for improved performance and range

"FOXMITTER-2"

by Richard Fox

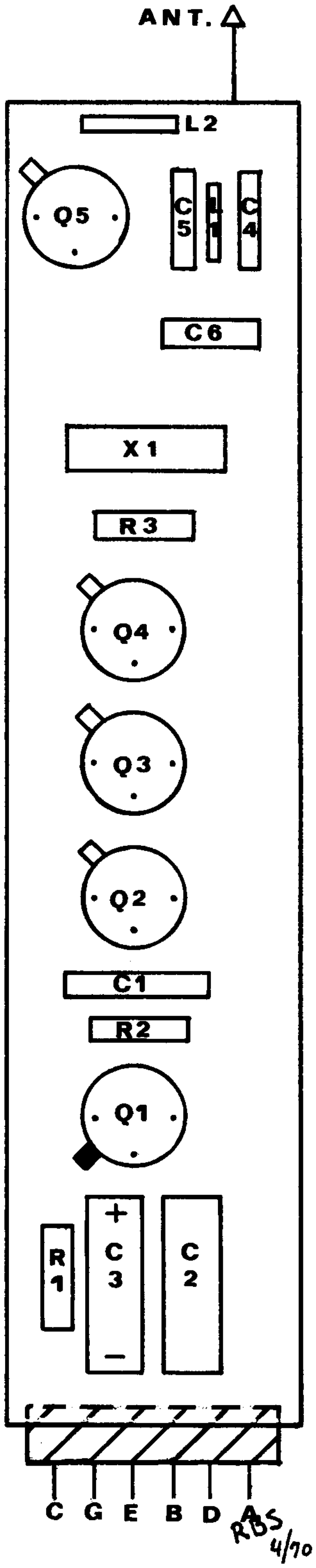


Figure 1: "Foxmitter-2" Parts Layout. View of top of vector board showing parts layout and transistor orientation.

This is the second series of articles in this magazine on a model rocket transmitter. The first featured the forerunner of this transmitter in the May through December 1969 issues. This new transmitter is the result of the information gathered from model rocketeers across the country who took the trouble to write about their experiences with the original *Foxmitter.* The new design is similar to the original one, but it features some important changes in the r.f. oscillator section, and in some of the sensor modules. Several new sensors have also been developed. Rocketeers who built the original *Foxmitter* will find that they can modify their transmitter to the new design without very much trouble. This design is much less sensitive to movements of the antenna, and it has a better signal.

As with the original Foxmitter, the data measured by the sensor which is plugged into the transmitter is converted to an audio tone, and this tone is transmitted to the ground where it is picked up by a receiver. The receiver converts the radio signal back to an audio tone, and the tone is recorded on a portable tape recorder. The tape recording is then used to determine what variations the sensor detected. The variations may be slow and subtle, as with a temperature sensor or the variations may be fast and of great magnitude, as with a rocket spin rate sensor.

The Beacon Tone Module

The "Sensor Module" described in this first article is the Beacon Tone Module, which creates a constant "beacon" signal. The Beacon Tone Module is the simplest module and therefore the most suitable for use in trouble shooting the transmitter after it is built. The module consists of a battery, battery holder, resistor, and plug. When assembled and plugged into the transmitter board, it supplies power to the transmitter, and its resistor causes the transmitter to produce a steady audio tone.

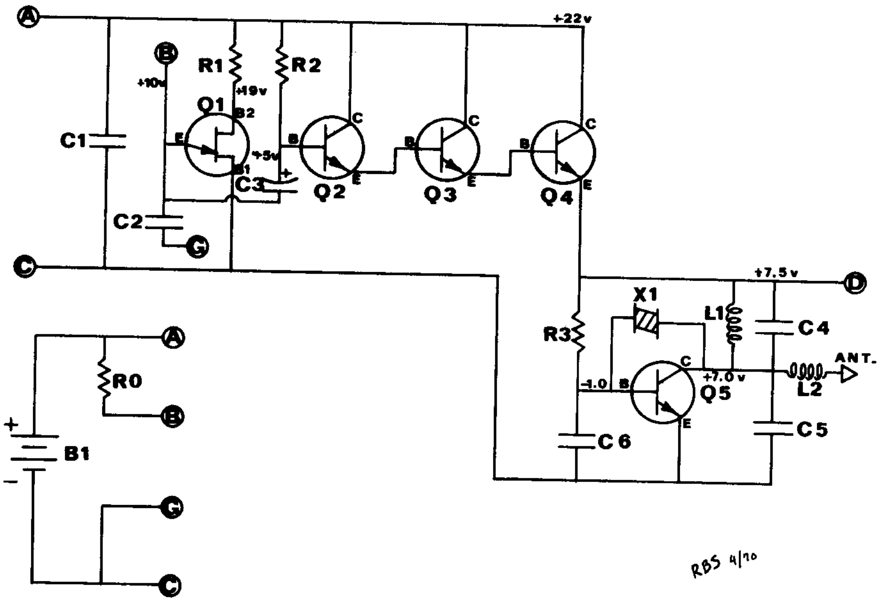
The parts for the beacon tone module are included in the parts list of the basic transmitter. One of these items is the micro-miniature male and female connectors which are used to plug the sensor and transmitter together. This item is not available from any national electronics mail order house, but hobby stores which sell radio control airplane equipment usually carry several models of them, and they are available by mail from Ace R/C as indicated in the parts list.

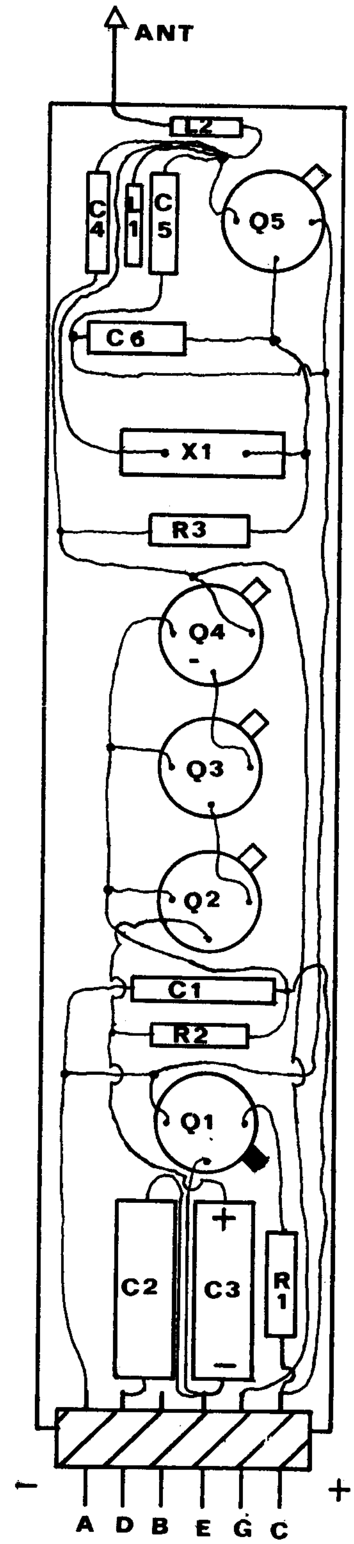
Construction

It takes only a few hours to build the basic transmitter. Construction involves placing the parts on a piece of perforated vector board, interconnecting the components with hook-up wire, soldering the connections, and cutting the excess wire off. The parts list gives the information necessary for obtaining the parts by mail order. As an alternative, a complete kit of parts, including wire, solder, and vector board may be bought from Astro-Communications, 3 Coleridge Place, Pittsburgh, PA 15201 for $14.95.

The transmitter is built up on vector board because this material is easy to repair in the event that it is broken. Transmitters built with printed circuitry look more professional, but they break easily, and are difficult to repair. The parts should be placed on the vector board as shown in figure 1, and wired together as shown in figure 2. The wiring should be kept neat and mechanically sturdy. Do not expect the solder to hold the wiring together! Wrap the wires which are to be soldered around each other, then heat them up and apply the solder, let the wires cool off without being moved, and then clip off any excess wire.

Poor soldering technique was the prime cause of difficulty in non-functional transmitters seen over the past year. One transmitter was soldered with acid core solder instead of the proper resin core solder. Within one week after it was built, the connections had all turned green, and within a few weeks they were corroded away. Another common problem was "cold solder joints". These are connections which are not heated enough, or are moved before they are cooled completely. Cold solder joints appear frosty and bumpy. They usually hold the joint together, but they do not provide a dependable electrical connection. The best way to avoid them is to heat the junction with the soldering iron, and apply the solder directly to the junction, not to the iron. When the solder has flown across the junction, remove the iron and let the junction sit for a few seconds until it has cooled below the melting point of the solder. When using this technique, be very careful not to let the electronic components become overheated. The transistors and crystal are especially susceptible to heat. To protect them while soldering them into the circuit, grip the lead to be soldered with a small pair of pliers between the junction which will be heated and the component





PARTS LIST

R0	100,000 ohms
R1	220 ohms
R2	4.7 megohms
R3	27,000 ohms
	all resistors 1/4 watt
C1	.01 mfds
C2	.02 mfds
C3	2 mfds, electrolytic, 25 vdc
C4	3 mmfds
C5	47 mmfds
C6	10 mmfds
	all capacitors rated at 25 volts or higher
Q1	GE-X10 or 2N2646
Q2, Q3, Q4	2N697
Q5	RCA 40080
B1	22.5 volt battery Burgess Y15
X1	27 m.c. Citizen's Band Walkie Talkie Crystal Lafayette #46E15 or similar

L1	27. uh r.f. choke Miller 9230-54 Do Not Make Substitution
L2	10. uh r.f. choke Miller 9230-44 Do Not Make Substitution
Antenna	33 inches thin stranded hook-up wire
Ultra-miniature Connector	R/C Craft connector model #19K61 6 pin $.49 from Ace R/C Higginsville, Mo. add $.50 for handling
Battery Holder	Keystone #50053 available from Lafayette as #34E50053
Vector Board	

A complete kit of all of the above parts plus solder and hook-up wire is available from Astro-Communications, 3 Coleridge Place, Pittsburgh, PA 15201 for only $14.95. When ordering, please specify which channel crystal is desired.

itself. The pliers will absorb any damaging heat which flows up the lead from the junction.

Some modelers prefer not to solder the crystal into the circuit. The crystal controls the frequency of the transmitter, and if the crystal is soldered into the circuit, the transmission frequency cannot be changed easily. A suitable mount can be made by simply wrapping the pins of the crystal with three or four turns of hook-up wire, and then soldering the other end of the hook-up wire into the circuit. This arrangement allows the crystals to be interchanged easily. A crystal socket could also be used.

The antenna should be made from approximately 33 inches of thin stranded hook-up wire. The length is not critical, but short antennas radiate a weaker signal than longer antennas, and antennas over 4 feet long have an undesirable effect on transmitter stability. Antennas over 5 feet long are illegal. The exact length of the antenna will depend on how carefully the transmitter was constructed. Some transmitters will work better with short antennas than others. The antenna length can be optimized once the transmitter is operational.

The antenna is subject to a lot of stress, so it is best to tie it through a couple of holes in the vector board, in addition to soldering it to inductor L2.

When wiring the transistors into the circuit, be sure to wire the leads as shown in the drawings. The unijunction transistor, Q1, has an emitter, and two bases, B1 and B2. These bases are not interchangeable. The other transistors have a collector, a base and an emitter. The arrangement of these leads is shown in figure 1. The capacitor C3 has polarized leads which are marked "+" and "−" on the capacitor case. This capacitor must be installed with the "+" lead connected to the base of Q2 and the "−" lead connected to the base of Q1. These are the only components with specialized leads. All of the other components may be installed in any orientation

Figure 2: "Foxmitter-2" Wiring Diagram. View of wiring on bottom of the vector board. Note that parts are mounted on the other side of the board, and are shown here for reference only.

desired.

After the transmitter is built, check it over for proper wiring, good solder joints, and proper insulation between wires.

Testing the Transmitter

To test the transmitter, you will need a receiver which is capable of receiving the Citizen's Band channel which you have chosen for your transmitter. Extremely cheap walkie-talkies will receive the transmitter signal, but do not expect them to pick it up at more than a few hundred feet.

Turn the receiver on and place the transmitter on a nearby wooden table. Plug the battery into the battery holder, and plug it into the transmitter. Stretch the antenna out along the table and step back from the table. A loud audio tone should be heard from the receiver immediately. If you do receive the tone, separate the transmitter and receiver and verify that the signal is strong enough to be picked up over a distance. If your transmitter passes this check you are ready for flying.

More than likely, the transmitter will not work the first time it is plugged in. If this is the case, make a quick check that the radio is tuned in properly and then remove the transmitter battery from its holder. The battery, or a component, could be ruined if the battery is left in a faulty circuit for an extended period of time. Feel the transistors. If they are excessively hot, double check the wiring going to them. Check that the battery was plugged in properly, and that the crystal was making good contact with its wires. Recheck the wiring for shorts or errors.

A few simple tests can help to isolate the problem. If plugging the transmitter into the battery causes a hiss on the receiver, but no tone, then the trouble is in the area of transistors Q1 or Q2, Q3, Q4. In either case, check that the unijunction transistor Q1 is oscillating. This is done by placing the leads of a cheap crystal earphone between Base 1 and Base 2 of transistor Q1, with the battery plugged in. If no audio tone is heard, the trouble is with the wires from the battery or with RO, C2, R1, C3, or Q1. If the tone is heard, place the earphone between the collector and emitter of Q4. A louder tone should be heard. If the louder tone is heard, then the trouble is associated with the r.f. section and transistor Q5. If no tone was heard, check the wiring of R2, C3, Q2, Q3, and Q4.

If the trouble has been isolated to the r.f. section, double check the contact between the crystal pins and the rest of the circuit. Check the wiring of R3, C4, C5, C6, L1, L2, Q5, and the antenna. Check the crystal for damage by plugging it into a walkie-talkie and broadcasting to the receiver. A damaged crystal will not work at all. Try touching the antenna of the transmitter directly to the antenna of the receiver. If this produces an audio signal, the problem is a weak battery or an antenna that is much too long or much too short.

If a voltmeter is available, check the voltages from the "–" side of the battery to the points shown on the schematic. The battery should put out at least 17 volts.

Most problems are caused by poor solder joints, wiring mistakes, dead batteries, and unintentional short circuits. If all else fails, have a friend check the wiring, and resolder all the connections.

Flight Preparation

The transmitter fits into a 9 inch length of 0.8 inch diameter body tube. The transmitter should be oriented with the battery towards the nose of the payload and the antenna trailing out from the rear of the payload section. This arrangement allows the antenna to hang straight during the upward flight, and minimizes damage to the transmitter if the rocket should crash. Place a small amount of cotton at the front and rear of the payload tube to act as a cushion, and place a wad of cotton between the battery holder and the transmitter board to keep them from being pushed together by the lift off acceleration.

The lifting vehicle should have a husky thrust. A single Enerjet-8, or a cluster of 3 C6-3's or a two stage combination of a D6-0 and a D6-6 all give satisfactory results. Do not use the low thrust long duration type E or F engines. The payload is too heavy for them.

Use separate parachutes for the payload and lifting vehicle. This practice will minimize the chances of having the antenna become entangled in the parachute shroud lines.

Flight Operation

The only extra pieces of field equipment necessary for the operation of the transmitter are a portable Citizen's Band receiver, such as a *GOOD* walkie-talkie, and a portable tape recorder. When preparing the rocket for flight in the field, leave the preparation of the transmitter until the end. The battery has enough power to last many flights, but it will be drained if it is left in the transmitter for long periods of time.

When the lifting vehicle is ready, place the battery in the transmitter, and check the receiver for a signal. Place the transmitter in the payload compartment of the rocket, and securely tape the nose cone onto the payload compartment. This step is important because the inertia of the transmitter at ejection of the parachute is enough to push the nose cone off, and let the transmitter fall to the ground.

The next step is to place the transmitter on the launch pad and position the antenna where it will not get entangled in the launch equipment. Turn the receiver on and check for a signal. Turn the tape recorder on and place its microphone next to the speaker of the receiver. Fire the rocket, recover it and remove the battery from the transmitter as quickly as possible. The tape recorder now contains a permanent record of the information transmitted during the flight.

The coupling of the tape recorder and the receiver by placing the microphone next

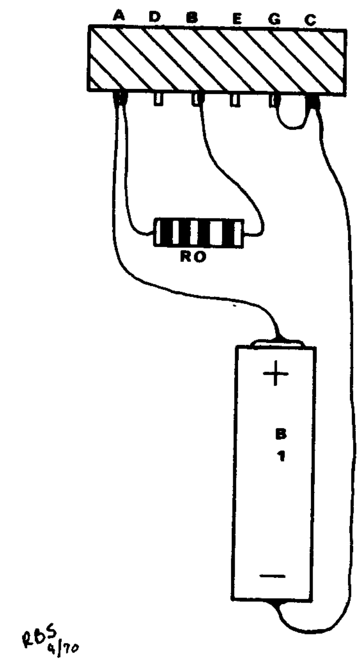


Figure 4: Beacon Tone Module Assembly

to the speaker is crude, but it lets the count down and lift off appear on the same tape. A more professional approach is to electrically connect the tape recorder and receiver. This can be done by making up a "Patch Cord". A Patch Cord consists of a plug which will fit into the earphone jack of the receiver, a plug which will fit into the microphone jack of the tape recorder, and the connecting pair of wires. This device allows the direct transferal of the output of the receiver to the tape recorder without losing any fidelity. The signal can be monitored by plugging an earphone into the earphone jack of the tape recorder.

There is an additional improvement to the received signal which can be made if the receiver is a walkie-talkie. Most walkie-talkies are more sensitive and produce stronger signals when they are hand-held than when they are sitting unattended on the ground. It pays to hold the walkie-talkie receiver during the flight, and to keep the antenna pointed straight up into the air.

The beacon tone module which is described in this article will not produce any scientific data, but it will allow you to test out the transmitter and the flight procedure. In addition it can be used in conjunction with a direction sensitive antenna for tracking the rocket transmitter. More will come on that later.

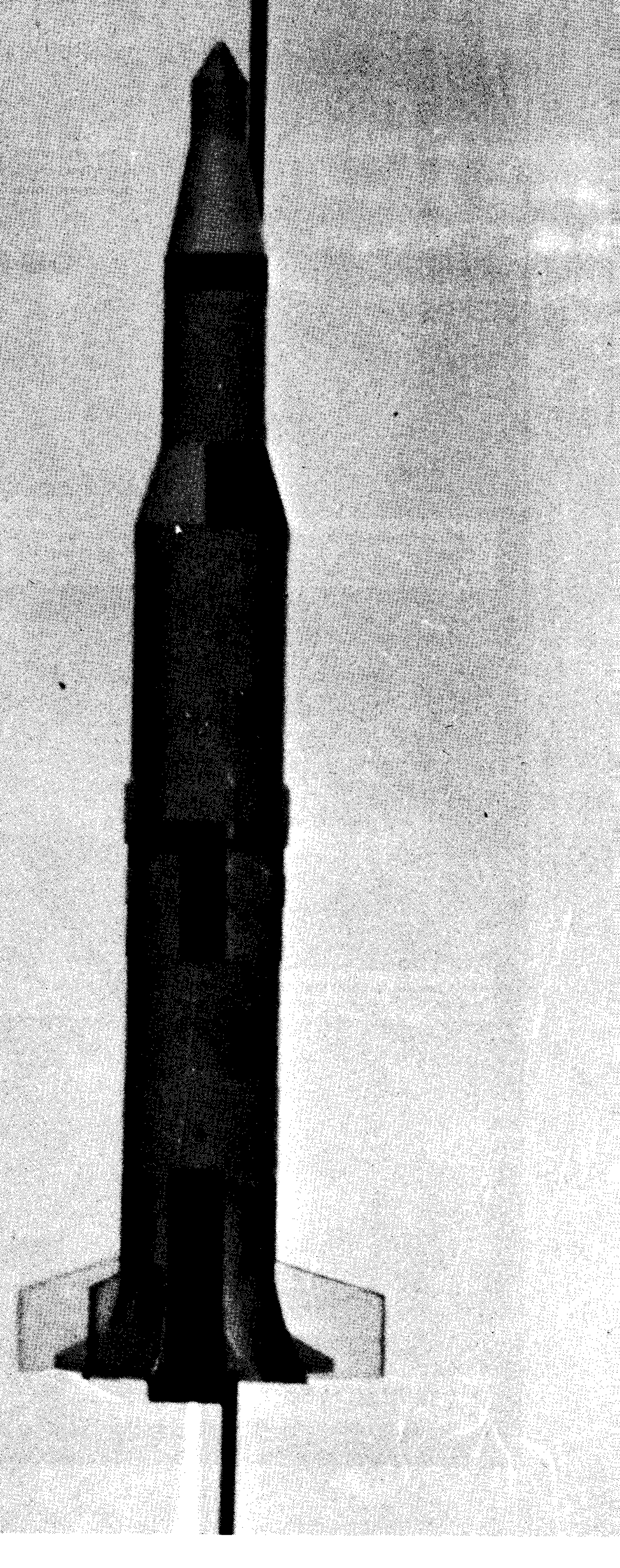
The sensors described in future articles will enable you to make scientific experiments on atmospheric parameters as well as rocket characteristics. Next month, this series will present a payload carrier for the transmitter, and will review the modifications necessary to use the Spin Rate Sensor with the Foxmitter 2.

Plastic Conversion:

Fly the Countdown Saturn-V

Photos and Text

by Bob Parks



This conversion was started with only one goal in mind, namely to build a plastic rocket that would really *FLY*. The project has succeeded most admirably. A C6-3 will put this converted Saturn-V nearly out of sight. It has been tracked to over 500 feet. With a B4-2 or a B6-4 it should reach about 250 feet. It also leaves the pad rather fast, so there is no problem when flying in windy weather. In fact it takes off so fast that it took me three tries to get the lift off shot.

The Countdown Saturn has a one piece molded body. This makes the rocket almost indestructable. Unfortunately, it means that some type of rear ejection system must be used. The ejection system that I used employs a loop of wire attached to a sliding engine mount to pull the chute out. This system has been 100% reliable to date.

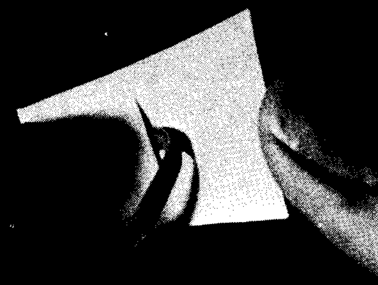
The Saturn kit is available postpaid for $4.95 from Countdown, Inc., P.O. Box 551, MRI, Jacksonville, Fla. 32201. The Mylar parachute material is available from Chromylar Industries.

Clear plastic fins can be obtained by cutting up a clear plastic box. These boxes are quite common now, and you should have little trouble finding one. The plastic I used was 1/16 inch thick polystyrene. The plastic can be cut with a razor saw. It should be cut slowly so as not to crack or scratch the fins.

The rocket should take only a few hours to build. Aside from the Countdown Saturn-V plastic kit, the following materials are needed to complete the conversion: 4½" BT-50, 2¾" BT-20, one NB-50, two AR-2050, and one LL-2a (all available from Estes); 12" mylar parachute, music wire, and clear sheet plastic.

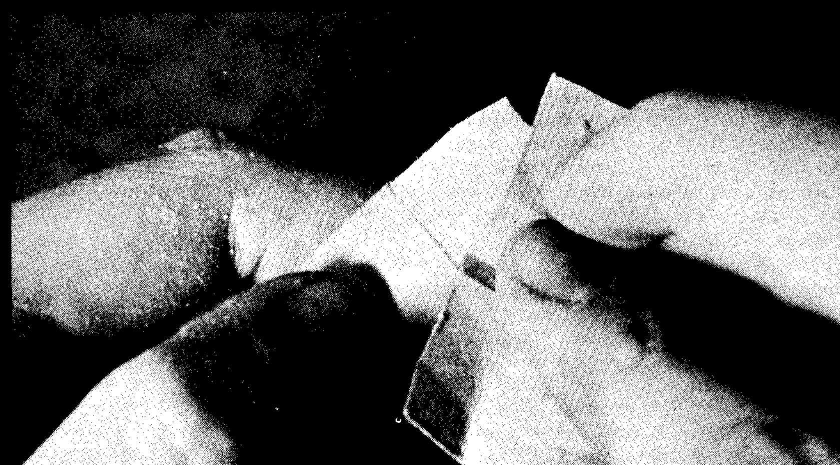
Begin construction by sanding off the parting line on the side of the plastic body with extra fine sandpaper.

Glue the Apollo capsule to the front of the body. Press, do not cement, the escape tower into place. Now, spray the entire rocket with flat white enamel.



Make up a paper shock cord mount, and attach it to the inside of the BT-50 about 1/2 inch from the front end of the tube.

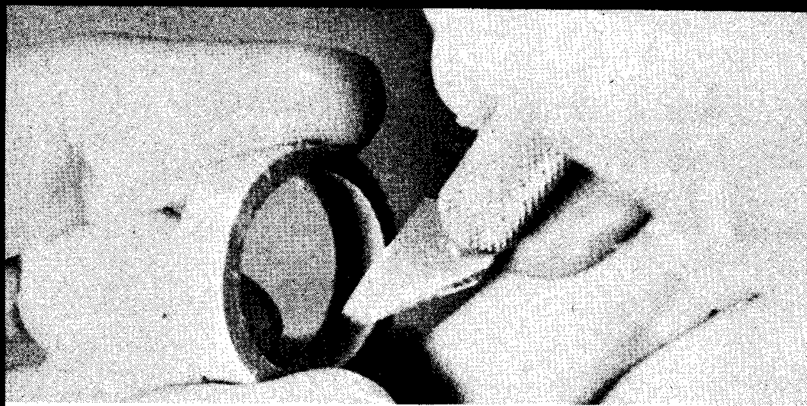
Glue the NB-50 into the front of the tube as shown. It should stick out about 3/4 inch.



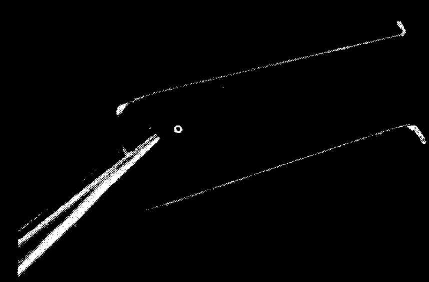
The BT-50 must fit entirely inside the plastic body so that its end is recessed about 1/8 inch. Sand the NB-50 until the proper fit is achieved.

Glue the engine block in place flush with the end of the BT-20.

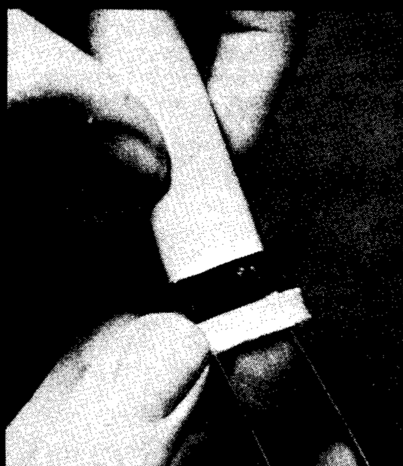
Glue an AR-2050 ring onto the outside of the BT-20 1/4 inch from the back.



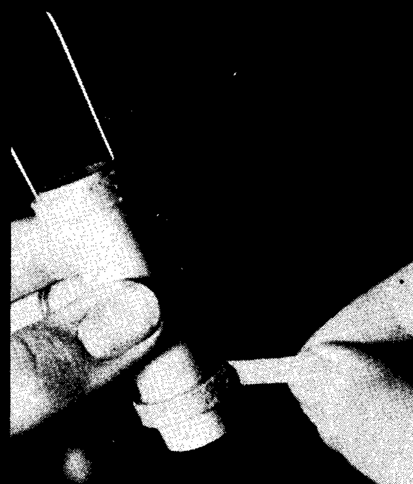
Cut 2 notches on the inside of the other AR-2050 ring. The notches should be about 1/32 inch deep and 1/32 inch wide. They should be placed on opposite sides of the ring.



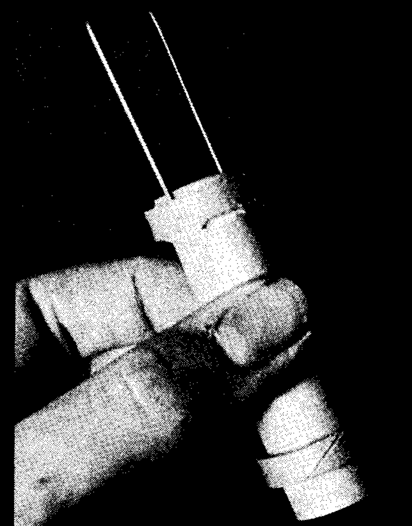
Cut a 4¾ inch long piece of music wire, and bend it to the shape shown above.



The wire is inserted in the notches of the ring so that the ends of the wire rest against the side of the ring. The ring is now glued onto the BT-20 flush with the end. Cover the ends of the wire with a glue fillet.

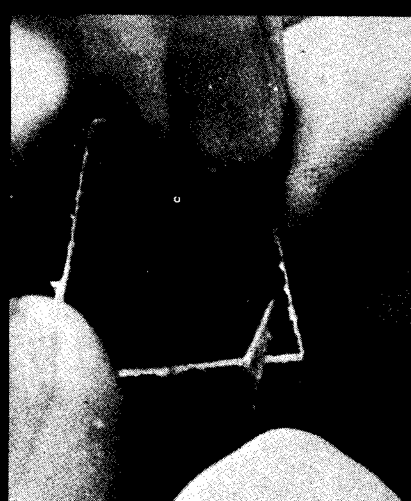


The AR-2050 rings are rolled paper. Using a knife loosen the upper layer and peel it off as shown. Continue until the engine holder assembly slides freely inside the BT-50.



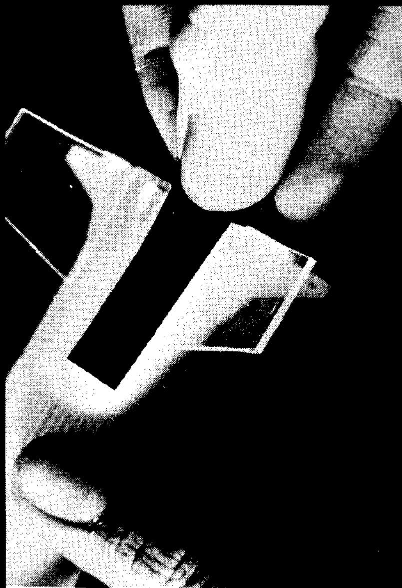
The finished engine holder. The shock cord and parachute are attached to the wire.

Cut the fins from the clear plastic using a razor saw. Be careful and cut slowly.

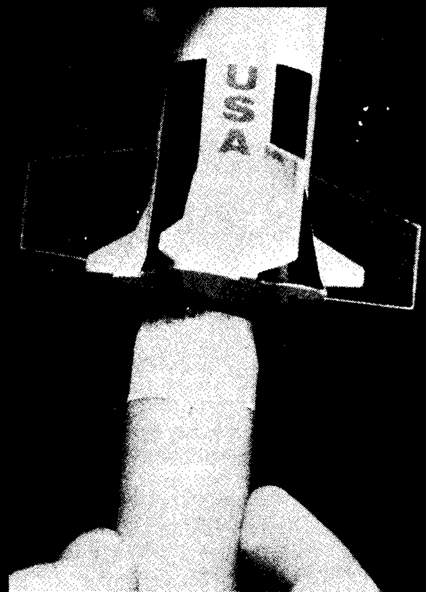


Clean up the edges of the fins by scraping with a knife. Leave the edges square.

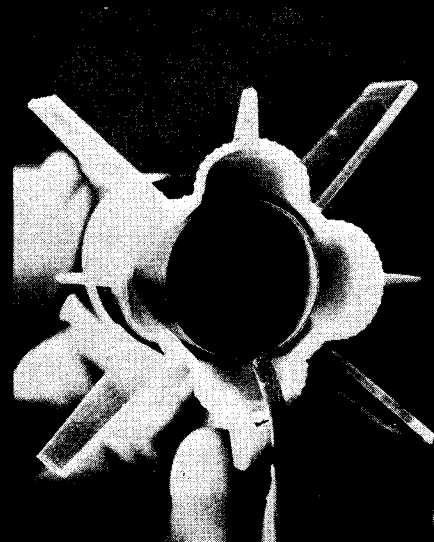
Using plastic cement, glue the fins in place.



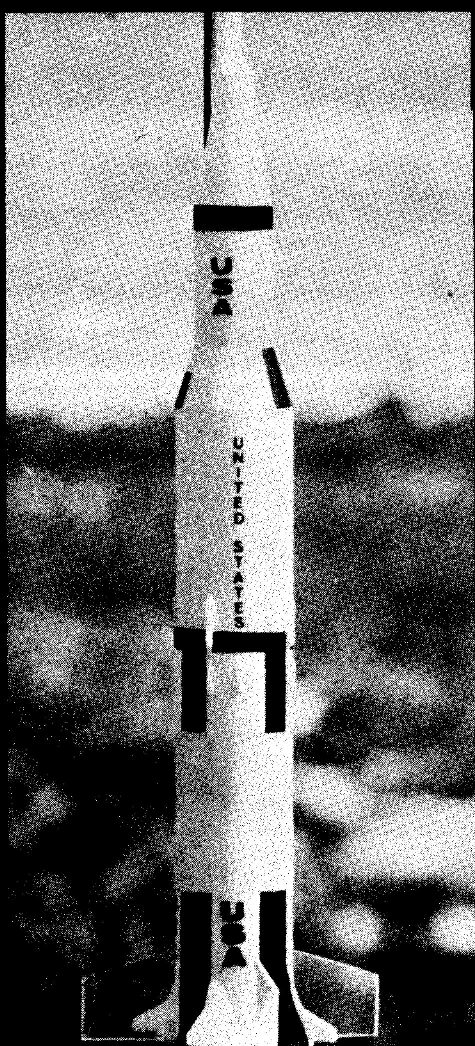
Apply the decals supplied with the kit, and epoxy the launch lug to the side of the rocket.

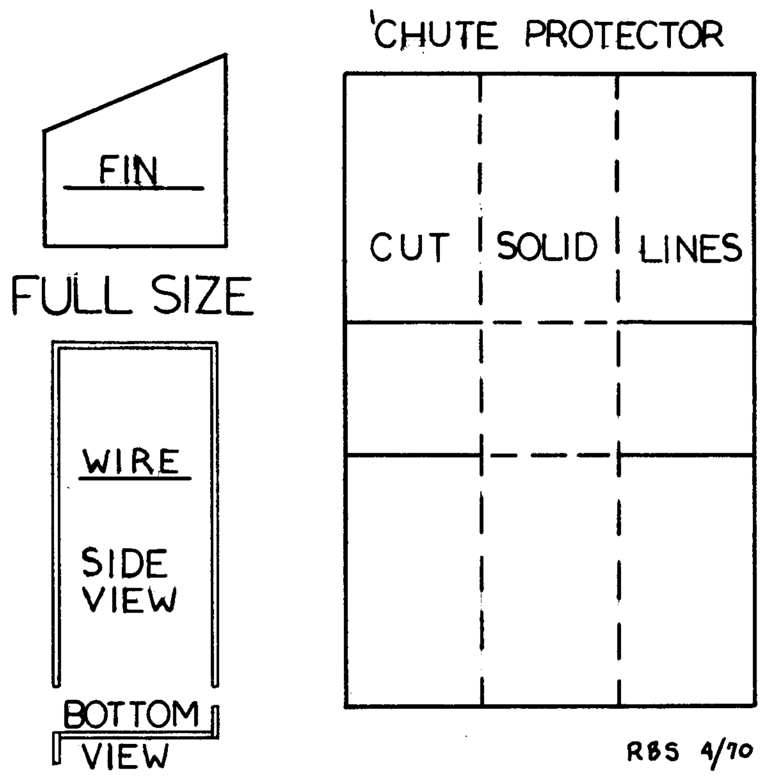


Smear epoxy glue over the NB-50 and the front 1/2 inch of the BT-50. Insert the BT-50 into the plastic body.



End view of the rocket showing the BT-50 in place. Note the amount the BT-50 is recessed. Also, make sure that the body tube is centered before the epoxy sets.





Launch preparation.
No wadding is used because of the rear ejection system. Instead, a paper parachute protector is used. These are made by cutting notebook paper to the pattern shown, and folding the paper up on the dotted lines. The result of this should be a paper tube that is closed at one end. The chute should be packed tightly and the shroud lines wrapped around it. It is then inserted into the protector. The protector is then inserted into the loop of wire, open end foreward. The engine must be firmly attached to the engine holder. Carefully insert the entire engine holder assembly into the rocket. The rocket is now ready to fly.

PHOTO GALLERY

Readers are invited to submit photographs of their model rockets for publication on this page. Our staff will select those photographs having superior quality and composition for inclusion in the **Model Rocketry** *Photo Gallery. Send your photos to:*

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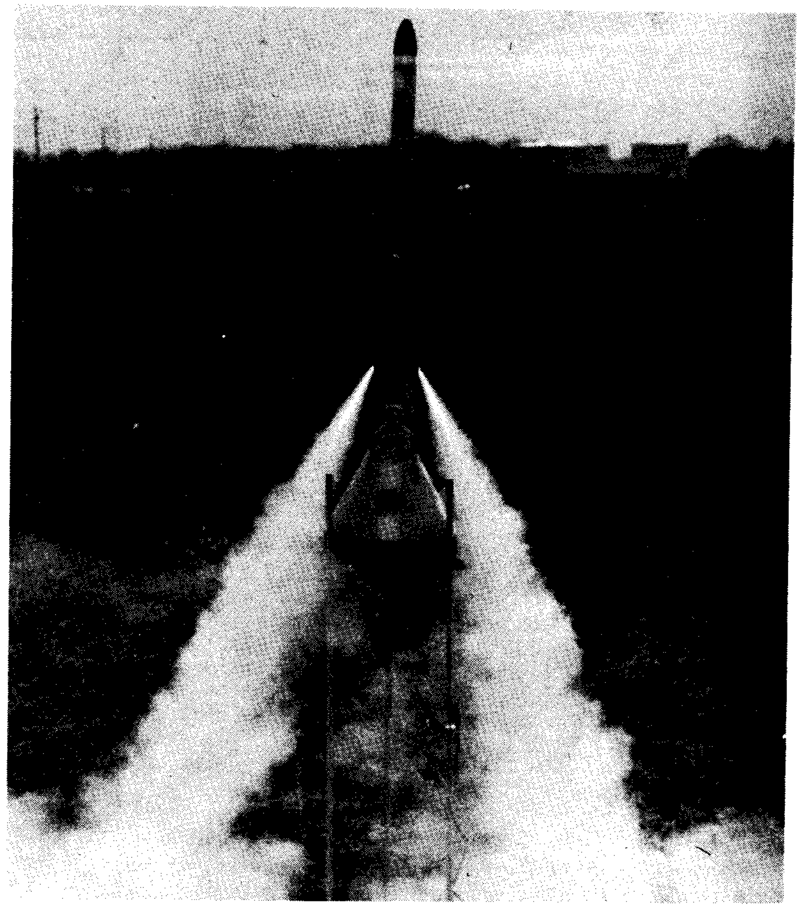


Photo by Stuart Zaharek, NAR 14656, Jr.
An Apollo capsule, built by Julius Zaharek, lifts off from a unique tower launcher.

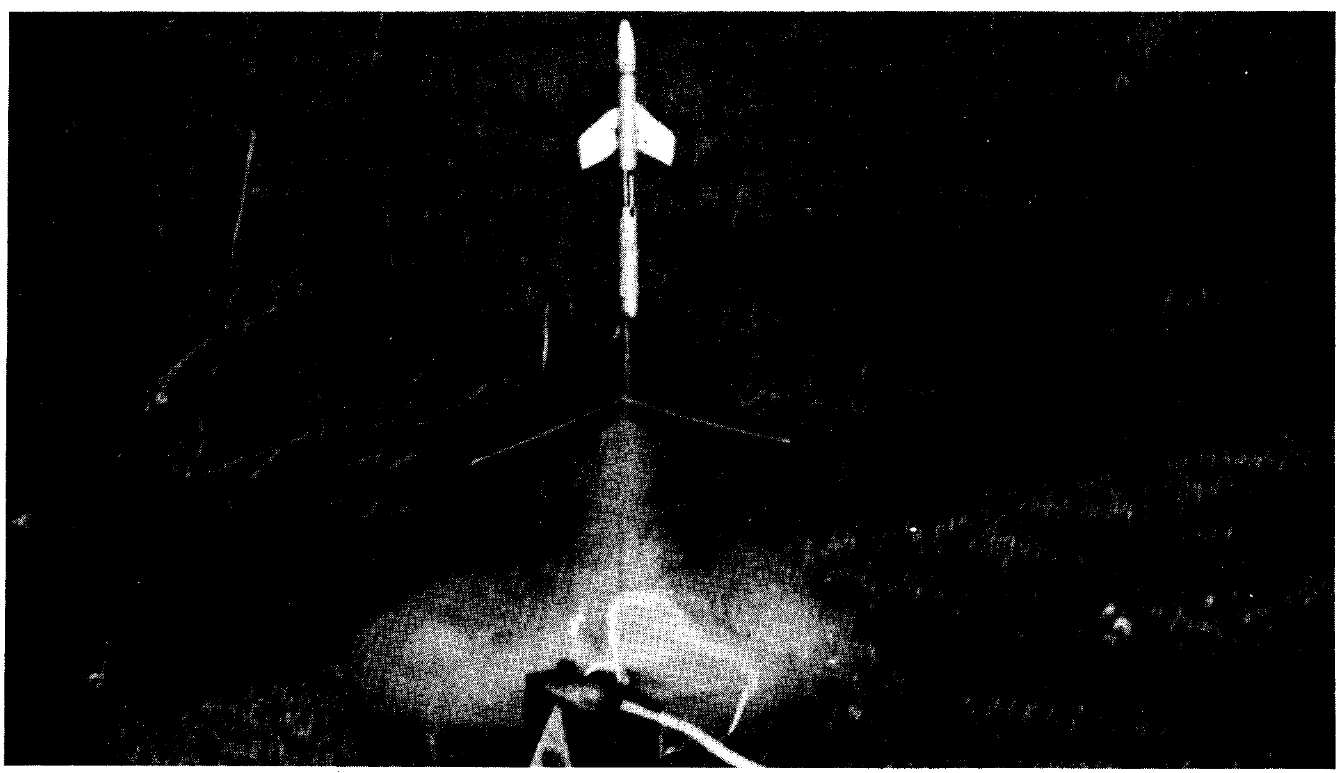
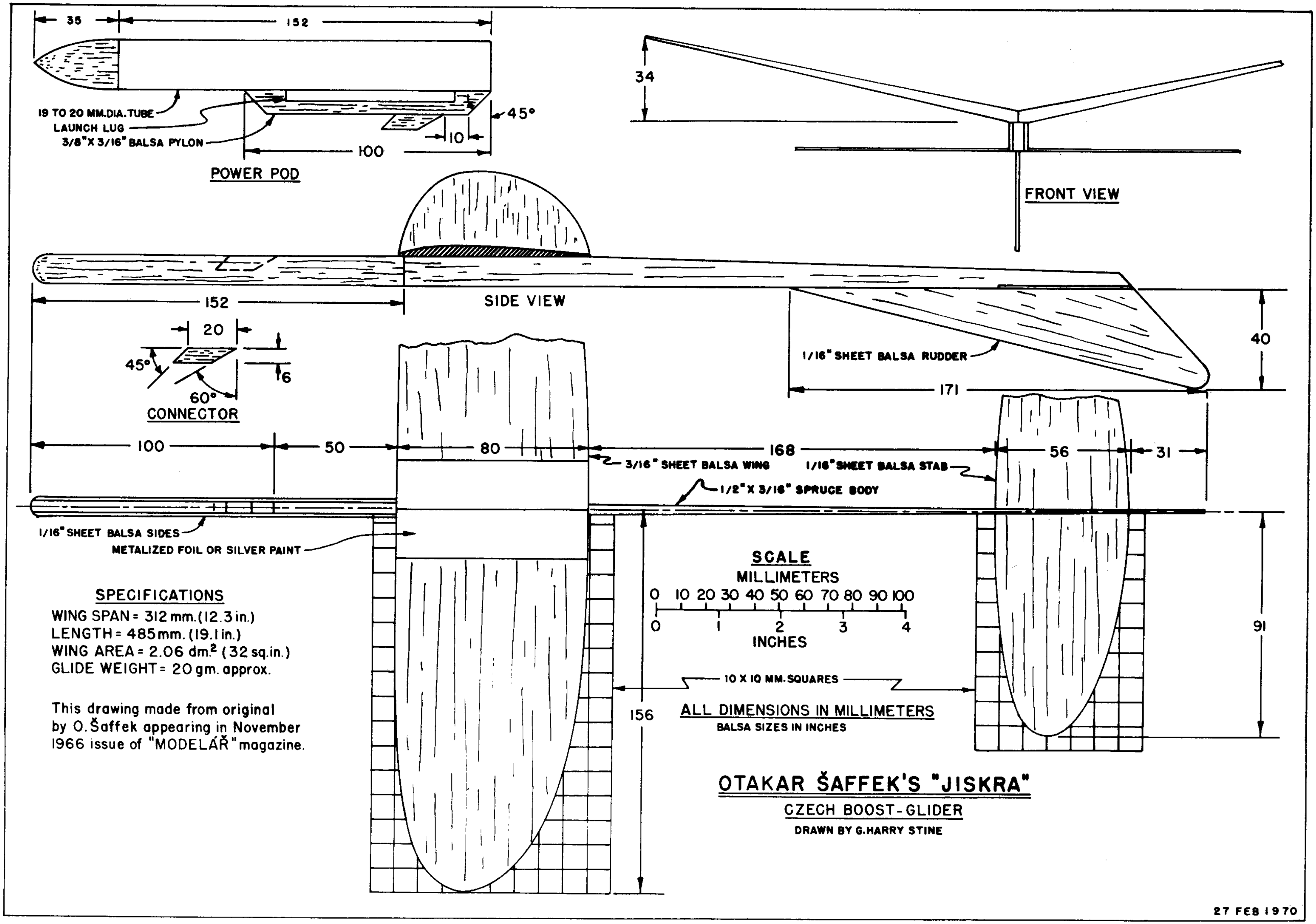


Photo by Neil Andrews
An Estes Nighthawk boost/glider caught at the moment of ignition.



35
152
19 TO 20 MM.DIA.TUBE
LAUNCH LUG
3/8"X 3/16" BALSA PYLON
45°
10
100
POWER POD
34
FRONT VIEW
152
SIDE VIEW
20
45°
6
60°
CONNECTOR
40
1/16" SHEET BALSA RUDDER
171
100
50
80
168
56
31
3/16" SHEET BALSA WING
1/16" SHEET BALSA STAB
1/2" X 3/16" SPRUCE BODY
1/16" SHEET BALSA SIDES
METALIZED FOIL OR SILVER PAINT
SPECIFICATIONS
WING SPAN = 312 mm. (12.3 in.)
LENGTH = 485 mm. (19.1 in.)
WING AREA = 2.06 dm² (32 sq.in.)
GLIDE WEIGHT = 20 gm. approx.
This drawing made from original
by O. Šaffek appearing in November
1966 issue of "MODELÁŘ" magazine.
SCALE
MILLIMETERS
0 10 20 30 40 50 60 70 80 90 100
0 1 2 3 4
INCHES
10 X 10 MM. SQUARES
156
91
ALL DIMENSIONS IN MILLIMETERS
BALSA SIZES IN INCHES
OTAKAR ŠAFFEK'S "JISKRA"
CZECH BOOST-GLIDER
DRAWN BY G.HARRY STINE
27 FEB 1970

The Old Rocketeer

by G. Harry Stine NAR#2

SAFFEK'S "JISKRA" BOOST/GLIDER

At the First World Championships of model rocketry in Vrsac, Yugoslavia this September, Americans will be competing in a boost/glider duration event against Europeans for the first time since the legendary Dubnica (Czechoslovakia) international meet in May 1966. B/G has come a long way in over four years. We have perfected a lot of our designs, and so have the Europeans. Not the least among these Old Country B/G's is the "Jiskra" ("spark" in the Czech language) designed by one of the best model rocketeers in Europe, Otakar Saffek of Prague, Czechoslovakia.

The Jiskra (pronounced Yis-kra) design was at the 1966 Dubnica meet, and A. W. Guill brought one of Saffek's early versions back across the Atlantic Ocean. The Czech magazine *"Modelar"* published Saffek's definitive Jiskra design in November 1966, and it has been built and flown all over eastern Europe. In fact, it was the Jiskra design that was hanging in the skies over Vrsac last September when I was there for the Yugoslav 5th Nationals. There were three basic B/G designs flying at Vrsac, and they are the ones our USA team of Kukowski, Gregorek and Pantalos will be up against: Jiskra, my own FlatCat, and the original Estes re-design of Larry Renger's Sky Slash.

Working from the drawings published by Saffek in the November 1966 issue of *"Modelar"* magazine, I prepared the drawing accompanying this text. To do this accurately, I had the *Modelar* drawing photo-enlarged up to full size, and then traced most of the critical shapes.

The Jiskra design appearing herein has a modification from the original: the power pod. The Czech power pod would not fit our USA engines; it was too big. So I took the liberty of re-designing Saffek's Jiskra for an American 18x70 mm. engine, preserving Saffek's original location of the thrust line and position of the engine exhaust nozzle. (After all, he did the same to me by publishing the FlatCat over there with modifications for the bigger Czech engines!)

Jiskra is quite straightforward as a B/G design goes. If you have built the MPC FlatCat, the Centuri Swift, or any of the other classical B/G kits, you will have no trouble with the Jiskra. Note that the body is made from spruce, although balsa can be substituted if you prefer less flexibility and lower strength but also ease of fabrication.

The wing planform is the classical elliptical shape of the British Spitfire of Battle of Britain fame. There is a reason for this planform: aerodynamic efficiency. The entire wing stalls at once rather than at the tips first as with the swept-back planform. The aerodynamic loading is constant across the entire span. The induced drag caused by tip vortices is kept to a minimum. It is a very efficient wing, and it showed this at Vrsac where it just hung in the air during glide.

The horizontal stab retains the elliptical planform for the same reasons.

Saffek, in common with other B/G designers, uses a ventral rudder that is underneath the fuselage and is elongated so

(Continued on page 47)

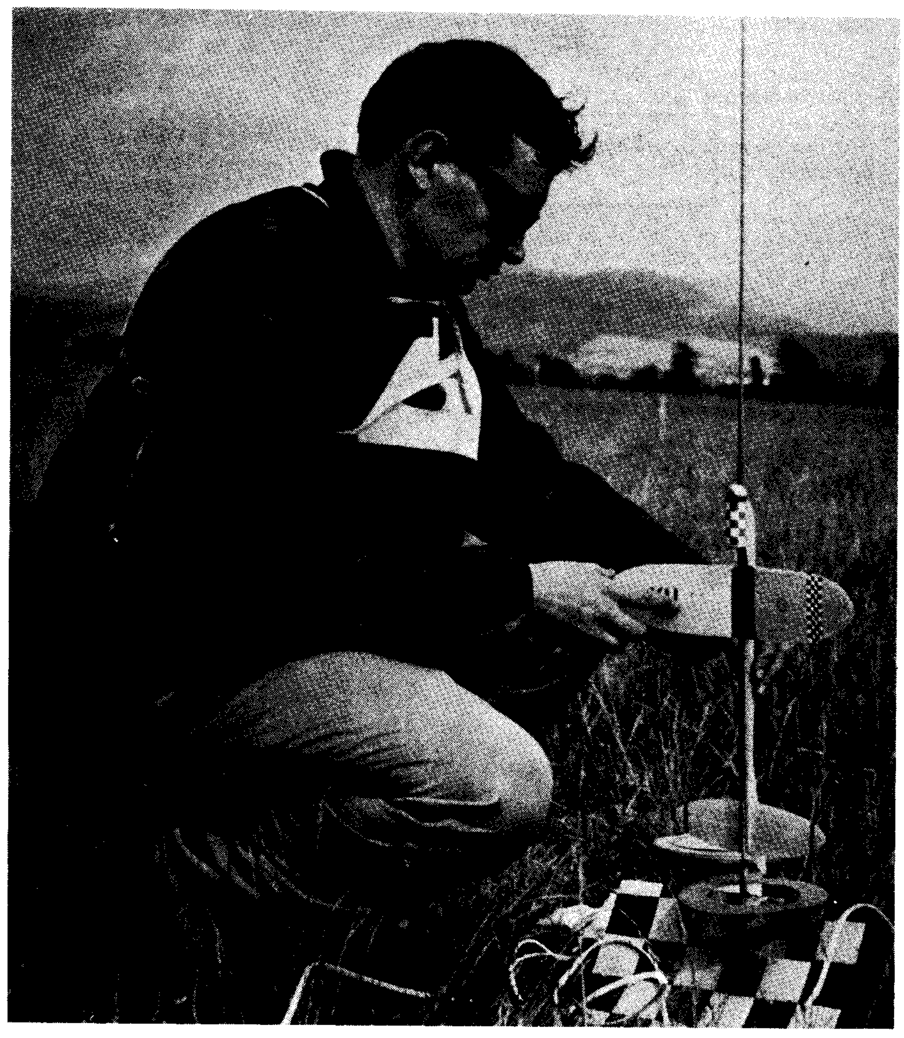


Photo by O. Saffek

Saffek's Jiskra design is one of the favorites in Europe. Here Dpl.Ing. Aleksandar Majarac of Yugoslavia preps his Jiskra for its contest flight at the 1967 Dubnica, Czechoslovakia international meet. Note European engine pod which is larger.

Simplified Parachute Duration Analysis

by Douglas Malewicki

In the February 1970 issue of **Model Rocketry** (B/G Performance, Part III), the steady free-fall motion of a rocket during parachute descent was analyzed. It was shown that the basic equation for the duration in seconds for each one hundred feet of altitude was:

$$\text{duration in seconds for each 100 feet of altitude} = \frac{1.1493\sqrt{\text{aerodynamic drag coefficient}}}{\sqrt{\dfrac{\text{weight in ounces}}{\text{surface area in square inches}}}}$$

or in equation form:

$$t_{100} = 1.1493\frac{\sqrt{C_D}}{\sqrt{W/S}}$$

It should be noted that this equation is only good for a standard day 59°F sea level atmosphere.

To make this equation more convenient to use, we can modify it so that it is directly a function of chute diameter instead of area. This eliminates the usual intermediate calculation of area.

The reference surface area (S) is based on the area of a circular parachute while lying flat:

$$S = \frac{\pi\,(DIA)^2}{4} = .785\,(DIA)^2$$

where DIA is the chute diameter in inches.
Thus, our duration equation now becomes:

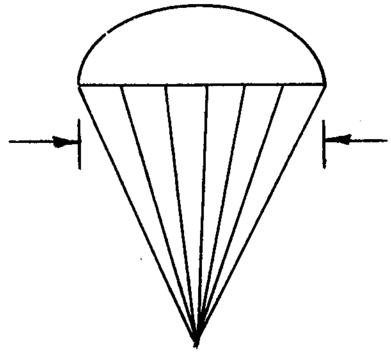
$$t_{100} = 1.1493\frac{\sqrt{C_D}\sqrt{.785\,(DIA)^2}}{\sqrt{W}}$$

$$= \frac{1.1493\sqrt{C_D}\,(.886)\,(DIA)}{\sqrt{W}}$$

$$t_{100} = 1.0183\frac{(DIA)\sqrt{C_D}}{\sqrt{W}}$$

Going one step further, we next assume that *all* model rocket parachutes have identical drag coefficients. In so doing we have reduced the number of variables in the equation – meaning that the theoretical duration now only depends on weight and chute diameter. A plot of the duration for various weights and chute diameters enables us to visually see *just* how these factors are interrelated and also eliminates the necessity of performing any future calculations of the equation itself.

We are now ready to ask, "What is a reasonable value to assume for the drag coefficient of a parachute?" Generally, full size fabric sky-diver chutes have a drag coefficient (C_D) of 1.2, but this is based on the equivalent frontal area of the actual chute while inflated as shown.



DIAMETER ASSOCIATED WITH C_D = 1.2

In view of the fact that fabric chutes are porous and model rocket chutes are a non-porous plastic film and also because we don't *know* what our diameter will be when the chute is fully inflated, I simply assumed that using the larger reference area based on the chute's *flat* diameter and a reduced drag coefficient of C_D = 1.0 that the overall drag form factor (C_D S product) would remain nearly the same.

Using C_D = 1.0 in the duration equation yields:

$$t_{100} = 1.0183\frac{(DIA)\sqrt{1.0}}{\sqrt{W}}$$

$$t_{100} = \frac{1.0183\,(DIA)}{\sqrt{W}}$$

The figure on the following page is based on the above equation. It shows the duration obtainable with a given weight rocket with a given diameter chute. The minimum possible weight is, of course, the empty weight of the engine casing as indicated on the graph. Also note that the minimum duration corresponding to NAR rules is shown, as is a W/S value of 1 ounce/500 square inches – which represents a desirable value for a competitive parachute duration bird.

Of course, the above theory is limited in accuracy in proportion to how accurate our knowledge is of the *true* drag form factor (C_D S product) of the actual chute plus rocket combination as it descends. Carl Kratzer has recently completed indoor parachute duration tests to help answer the above question. The drop tests consisted of 240 individual timings of a series of square, six-sided, and circular chutes ranging from 8 inches to 48 inches in diameter. At this writing I have already reduced his experimental measurements to duration per 100 feet of altitude on a standard 59°F sea level day (with the help of a computer).

Needless to say, comparing the experimental values to the theoretical C_D = 1.0 duration graph presented here has been quite intriguing. In the June issue of **Model Rocketry**, the actual results will be presented along with Carl's interesting observations and conclusions concerning the performance of the various types of parachutes. Deviations exist as expected, but the graph is still quite useable. As you will see, the affect of other C_D values can be found by simply multiplying the duration found with the existing graph as follows:

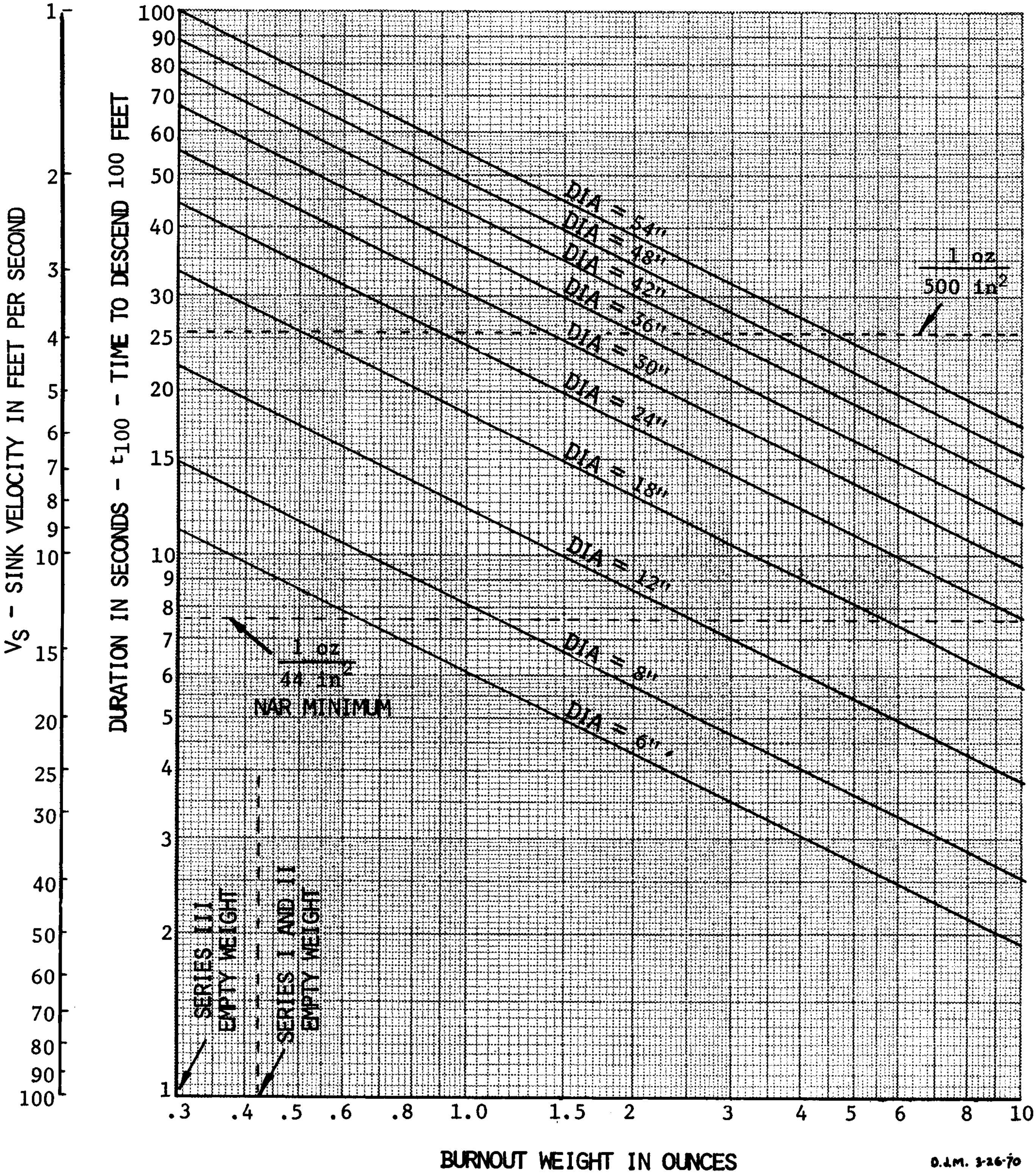
$$\text{actual } t_{100} = (t_{100} \text{ for } C_D = 1.0)\sqrt{\text{actual } C_D}$$

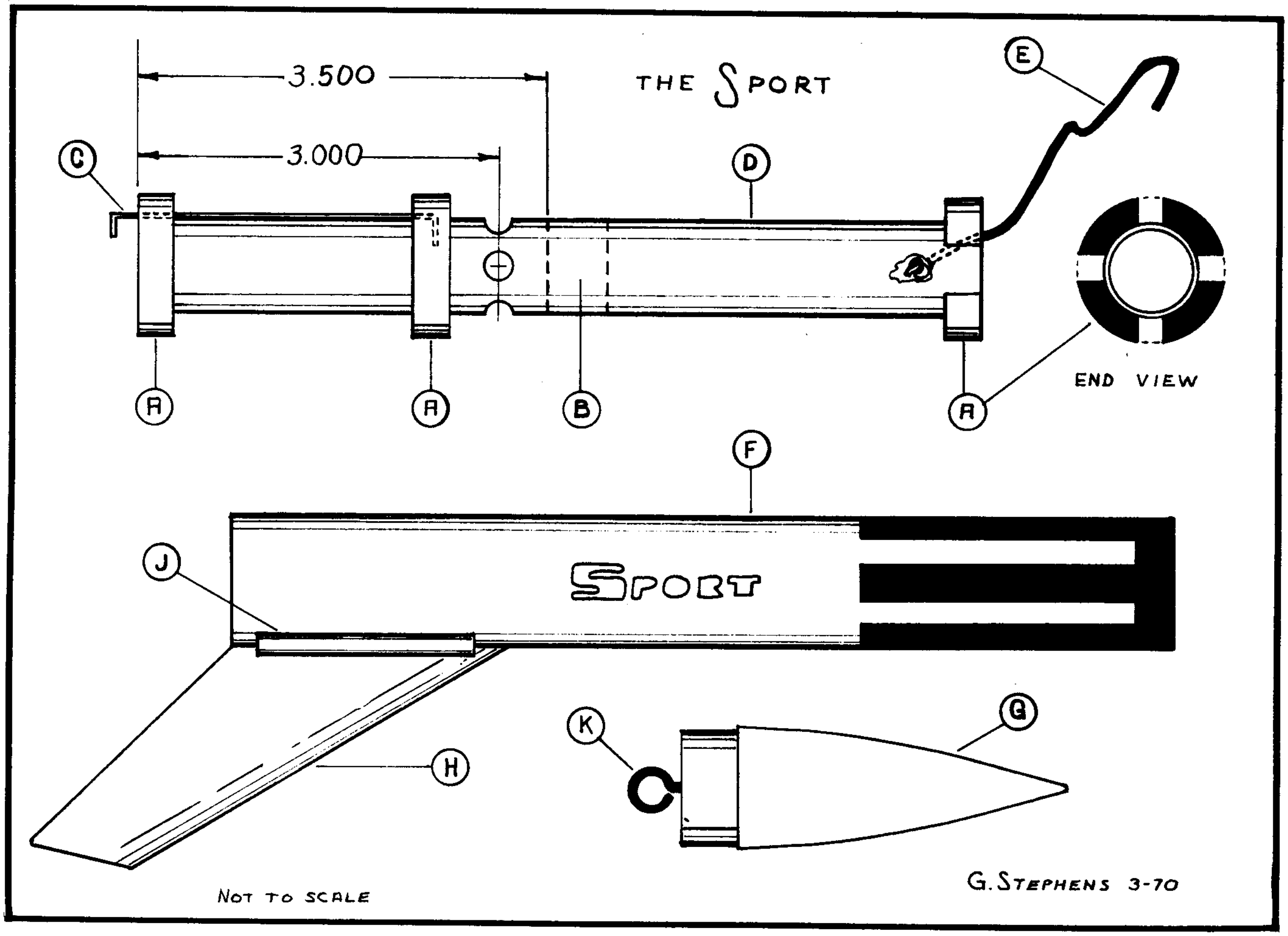
Corrections for non-standard temperatures and altitudes can also then be included with these results in a similar manner.

$$t_{100} = (t_{100} \text{ at sea level})\sqrt{\sigma}$$

where $\sqrt{\sigma}$ is the square root of the atmospheric density ratio, which was presented as a graph in the December issue of **Model Rocketry** (B/G Performance, Part I, Page 40).

PARACHUTE DURATION
IN STEADY STANDARD SEA LEVEL AIR
BASED ON $t_{100} = \frac{1.0183(\text{DIA.})}{\sqrt{W}}$





FOR SPORT FLYING FLY *THE SPORT*

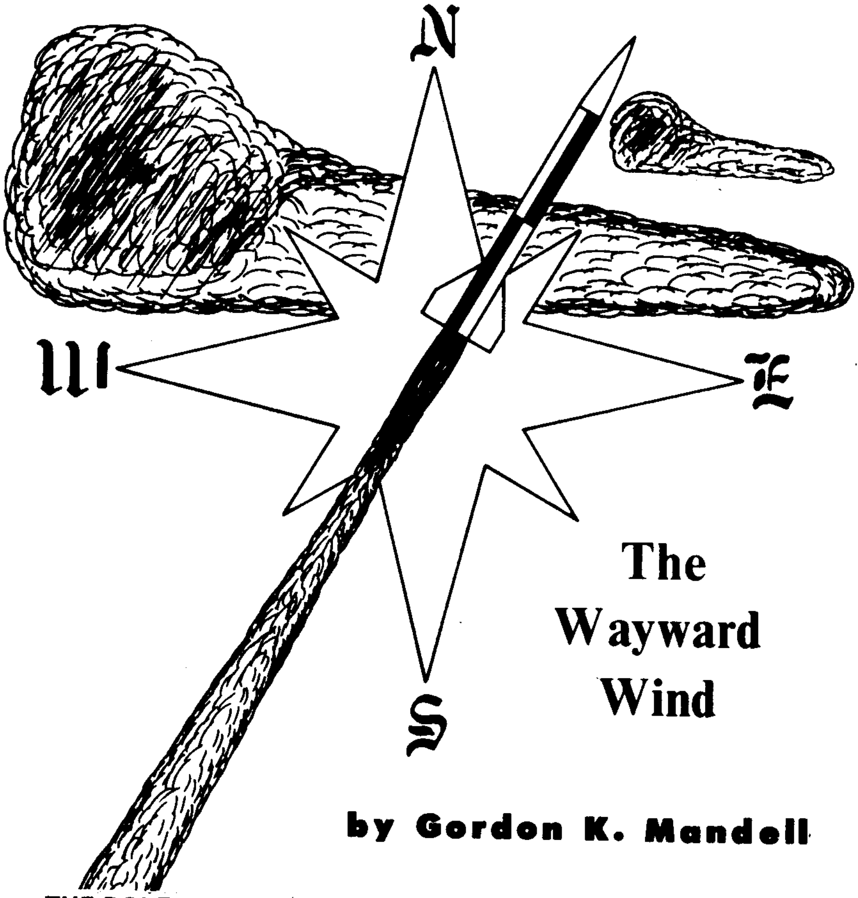
GERRY STEPHENS describes a model designed with sport flying in mind. Incorporating a unique ejection system to minimize wear-and-tear this model will give reliable performance after many flights . . . .

The SPORT was designed with a purpose, as the name implies, sport flying. To make the SPORT easier and faster to "prep", several features were designed in: 1) An engine clip is used to eliminate the usual tape required for a tight engine fit. 2) Built-in chute protection which allows elimination of the wadding generally used to protect the chute from heat. This was accomplished by routing the hot ejection gasses around the outside of the chute tube. When the ejection charge is ignited, gasses pass through the 4 holes cut in the forward end of the engine tube, (see Figure 1) around the outside of the chute tube, through the 4 slots cut in the forward engine mount, and blows the nose cone out. The nose cone pulls the chute clear. As the chute is not pushed out in this model, but pulled out by the nose cone, make sure the shock cord is long enough to allow this to work properly. The length specified in the parts list should work fine.

As shown in Figure 1, prepare the engine tube-chute tube, (Part D) by cutting to length. (See Parts List.) Next cut 4 holes 1/4 inch in diameter, 90 degrees apart 3 inches in from rear of tube. Cut a nose block, (Part B) to a length of 1/2 inch and glue in 3½ inches from rear of tube as shown. Install engine holder, (Part C) and 2 engine mounts, (Part A) as shown. Cut notch in the rear engine mount to clear engine holder. Glue the third engine mount, (Part A) flush with the forward end of the tube as shown. After the glue has dried, cut 4 notches about 1/4 inch wide as shown in the end view, to allow ejection gases to pass. Cut a small slit about 1/2 inch in from the forward end of the tube. Pass shock cord through this slit, knot and glue as shown, (Part E). Prepare 3 balsa fins from full sized drawing in Figure 1, (Part H) and glue to rear of body tube, (Part F) 120 degrees apart. Glue launch lug, (Part J) to body tube. After assembling nose cone, (Part G) and screw eye, (Part K) fasten shock cord, (Part E). Place the engine tube-chute assembly inside of the body tube, keeping the rear ends flush, and glue. The forward end of the chute tube should be down inside of the body tube about 1/2 inch to allow the nose cone to seat properly. Paint the SPORT to suit your tastes. Make certain to check the completed model for stability before launching. BE A SPORT . . . .

PARTS LIST

	Estes Part No.	Centuri Part No.
A	AR-2050	EM-10A
B	NB-20 (cut to 1/2 inch)	BTC-7 (cut to 1/2 inch)
C	EH-2	
D	BT-20B (cut to 7¼ inches)	ST-79 (cut to 7½ inches)
E	SC-1 (18 inches)	SC-18 (16 inches)
F	BT-50H (7¾ inches)	ST-108 (8 inches)
G	BNC-50K	BC-101
H	BFS-30	BFM-10
J	LL-2A	LL-1
K	SE-1	SE-12



The Wayward Wind

by Gordon K. Mandell

THE ROLE OF SCIENCE IN MODEL ROCKETRY

Of all the craftsmanship and model-building hobbies in the world, model rocketry is the most scientific, the most technological, the most analytical. The major model rocket manufacturers, the National Association of Rocketry, and numerous individual rocketeers all point with pride to our rapidly-advancing state of technological expertise and to our many scientific and engineering accomplishments. That model rocketry has developed an unusually strong emphasis on science is, I think, indisputable. Given that fact, I think it's proper to ask whether model rocketry should be as scientific and technical as it is, and if so, why. I feel very strongly that our hobby *should* have a strong technical component. I would like to defend that position, to try to construct some logical arguments for feeling as I do.

Anyone who has been involved with the legal problems of model rocketry would certainly be tempted to cite our technology's major contributions to our public and governmental relations. We are all participants in a hobby which involves the discharge of ballistic projectiles. Now, that's a pretty gruesome way to describe model rockets, but we had better learn to look at them that way if we want to understand what goes on inside the head of a police chief, fire marshall, legislator, or John Q Public when *he* looks at model rocketry. Accordingly, *safety* has been our watchword from our earliest beginnings. For thirteen years and twenty-five million launches we have been governed by the strictest code of safety ever to regulate a nonprofessional activity. There is literally nothing we have not done to document our excellent safety record, to prove beyond a shadow of a doubt to all who would question it that model rocketry is the safest aero-hobby in the world today. After all that, it may shock you a bit to learn that it hasn't been enough . . . that there remain public officials in the United States today who aren't convinced that model rocketry should be permitted and protected under the law.

The fact is that no amount of statistical evidence proving our safety has ever made a dent in these people, and it's not going to. The reason for this unfortunate state of affairs lies in the nature of the bureaucratic mind. There is nothing a public official fears so much as being held responsible for something that may reflect unfavorably on him at a later date. Sure model rocketry seems to be safe, but what if something happens anyway? Even if nothing does, what if someone challenges the wisdom of his decision, makes an issue of it? In order to make and keep model rocketry legal in an official's jurisdiction we must prove not only that it is *not harmful* to the community, but that it is *positively beneficial* to the community. To prove to an official that model rocketry is safe is not sufficient to prove that it is safe *for him* to make it legal. To do that we must show that its benefits outweigh any possible ill effects; only then will any governmental agency or officer have a positive motivation to help us.

Time and again, it has been the technical component of our hobby that has provided this essential ingredient in our arguments to win public and governmental support. I think it is safe to say that we would not have made one-tenth the progress we have on the legal front if it had not been for the fact that we can assert – and prove – that many of today's model rocketeers are tomorrow's space scientists and engineers. We have only to observe how many of the model aviators of the 1930's and 1940's are practicing aeronautical engineers today. We have only to relate the history of the League for Air Sports which, in the 1930's, trained German youth through model aviation and gliding for later service in Hitler's Luftwaffe – and to bring the point home we can casually mention that certain *other* nations today are already giving substantial support and encouragement to *their* model rocketeers. But, of course, if America doesn't feel like investing in her future by making a challenging, rewarding, and educational activity like model rocketry available to her young people within the structure of her society, doubtless many of those young people will find other challenging activities in which to participate. . . . *outside* of American society. These arguments were in fact used during a committee hearing of the Massachusetts state legislature at which I was present, and I can tell you they were quite effective. There happened to be a rather large demonstration going on outside the building at the time. Every representative in the room got the point.

It is the educational value of model rocketry that is indisputably both our tastiest carrot and our weightiest stick in dealing with public opinion and governmental agencies. And that educational value, both in image and in fact, is absolutely contingent upon a constantly advancing model rocket technology. For only by a continuous – and well-publicized – process of technical advancement can we prove to the public that we *are* being educated by our hobby, and only by such a process can we in fact continue to *be* thus educated. This role of science and technology – maintaining favorable public and governmental relations – would, by itself, justify the existence of a technical component in the model rocket hobby.

But it isn't the *real* reason that model rocketry is – and *should* be – as scientific and technical as it is. The main reason that model rocketry is, and must be, a science as well as a sport and a hobby, can be expressed by just two words: stability and continuity. Any hobby that wants to last long has to fulfil two major requirements besides keeping on the right side of the public and the government: it has to *attract* participants and it has to *keep* them. That is, it has to be interesting, exciting, and rewarding to beginners to get them to try it, and it has to be the same to more experienced hobbyists to keep them from quitting. Model rocketry has always passed the first of these tests without any difficulty, as witness the fact that there are well over a million and a half model rocketeers in America today. But until recently we had been flunking the second cold, with depressing regularity. Even today our hobby has a dangerously severe turnover problem, and everybody – from the manufacturers to the NAR – is hurting because of it. The hard statistics indicate that today's average model rocketeer will lose interest and quit in one to two years. We can only conclude that, up until now, most people haven't found our hobby worthwhile enough to stay with it any longer.

A look at a model rocket will help explain why. Aerodynamically clean, propelled by the simplest of prime movers, the average model rocket is literally child's play to build and fly. That's all to the good and it's what keeps bringing new, young blood into the hobby. But what of the rocketeer who's got some experience, who's watched a hundred or so go up and come down? What do we offer him? Until a year or so ago the answer to that was "next to nothing", and even now it's "not enough". Between 1962 and 1965 almost every one of my closest friends and associates in rocketry – people with whom I had learned and flown in everything from weekend sport launches to national competition – quit the hobby. Their comments at the time reflected what is still our most fundamental shortcoming, and we owe it to ourselves and to the future of the hobby to remember them:

"It's boring."
"There's nothing to it – nothing to go on to."
"You can only go so far, and then you've gotten everything you can out of it."
"They just go up and come down. You can only take so much of that."
"It's infantile. The manufacturers are all catering to 9-year-olds. I've outgrown it."
"I'm embarrassed to be seen with these toys. My girl makes fun of me, and I agree with her."
"There's just no challenge in it. Nothing worth an adult's time."

Of course these statements reflect the individual personalities involved as well as the actual issues, but each and every one of them had – and has – some basis in fact. The median age in the hobby is still less than 14 years. The average rocketeer quits before he's 15. That must say something about how interesting they find it. And the model rocket manufacturers do in fact aim most of their products and marketing effort at the 9-to-12 age bracket . . . for very good reasons: every time they do a market survey the results indicate that they can expect their greatest dollar-volume sales potential in this age group. It would be unreasonable to expect them to shift the major age-bracket emphasis of their entire product line when every visible indicator tells them it would be suicide to do so. But I am convinced that it is equally suicidal to concentrate sales appeal on one narrowly-defined group to the almost total exclusion of all others. It is indisputable that such marketing techniques will lead to maximum profits in the immediate future, but it is also indisputable, I think, that they are fraught with danger in the long run.

Any product designed to appeal to a narrowly-defined group of buyers, no matter how numerous this group may be, is in grave and constant danger of becoming a fad. Fads have occurred in the American hobby industry in the past, and they have been disasters. A fad is characterized by a rapid rise in demand – so rapid that both prices and sales seem to be increasing without bound – culminating in a peak which is followed by a precipitous drop that leaves distributors so overstocked that many are driven out of business, and leaves the producers who survive madly thrashing about in search of a new product line. A few unscrupulous characters may make a large profit on a small investment by selling cheap merchandise for a few months just before the peak, but that only makes matters worse for the great majority of honest manufacturers trapped within the fad-crazed industry. We saw all this and more happen to the model car people during the 1963-1967 slot-car craze. None of us– manufacturers or participants – want it to happen to model rocketry. But it *can* happen here, and there are some disquieting indications that it may be about to. The number of active model rocketeers is now doubling each year, and so is the industry sales volume. There has also been a rapid proliferation of both large and small manufacturers. But with 1.5 million already in the hobby, it doesn't take much of a mathematician to tell that this explosive growth has got to stop – *soon;* by 1973 or 1974 at the latest. What happens then will depend very much on how we plan for our future *now.* If we content ourselves with merely riding a rocket fad to its peak, we shall all go down to our common ruin when that fad dies, as it inevitably must. And those of us who remain model rocketeers will have to content ourselves with a greatly reduced selection of materials available from an industry that will be, with apologies to Arthur C. Clarke, "a pale wraith of its former glory". But if we plan now to develop a small, hard core of dedicated, advanced, and enthusiastic modelers who remain with the hobby from early adolescence up through adulthood and on into their working lives, we will never have to fear for the future of our hobby or the industry that serves it. The rapid-turnover component of our population is always bound to wax and wane with periodic shifts in the public mood, no matter *what* we try to do to keep people interested. The important thing is that those people we *do* succeed in keeping interested are the hobby's anchor and its foundation – an anchor to keep us from being swept away in the fickle tides of popular enthusiasm, and a foundation upon which to build for the future when each such tide has ebbed. They are, as I have said, our only hope of stability and continuity.

There is almost universal agreement that it *is* desirable to have these hard-core rocketeers in the hobby. There is also general agreement that we don't have enough of them now. The question of what

Gordon Mandell discusses "The Role of Science in Model Rocketry" at the 5th Annual Pittsburgh Spring Convention.

we must do to *correct* this deficiency has been hotly debated for a number of years. Some people say it can't *be* corrected, that model rocketry is essentially a child's hobby and will never be able to appeal to a substantial number of adults. If I believed *that* I'd have quit a long time ago. Some rocketeers see increasing the complexity and difficulty of construction – requiring a higher level of craft skill – as a means of retaining experienced modelers. There is some merit in this idea, but I think it's only part of the story for reasons I'll go into in a minute. Finally, there's the segment of opinion I represent, which holds that the only way model rocketry can create and maintain a hard core of long-term active, advanced, and perenially enthusiastic hobbyists is by maintaining, or even increasing, our present emphasis on science and technology.

Publishing plans and producing kits for rockets which require more extensive and highly-developed technical and manual skills to build and fly – in addition to the already abundant selection of beginners' materials – is certainly a step in the right direction. And it's a step which has in fact been taken by many of the manufacturers in the last two years. But I don't really think it's enough, all by itself, to do the job. Model rockets just aren't all that complicated or hard to build. Sure, we're proud of our scale Saturns and Falcons and Little Joes that take us a month or two to put together, and of scale launch complexes that may take six months. But before we get too stuck up let's remember the model aviator I met who spent 17 *years* on his scale B-25 to win a *second place* at the AMA Nats. I'm not suggesting that we ought to force our people to spend 17 years on a scale project; in fact, those who know the model airplane hobby also know that the airplane boys suffer from too much of that kind of thing. But the contrast does make a point. Compared to an airplane, a model rocket just isn't all that much work. Not even a

Saturn-V has much to offer in the way of detailing problems to a JN-4 biplane or even, for that matter, a World War II Corsair. And model aircraft do not have to conform to our one-pound weight limit, so they've got much more room to work with in the way of scale detail . . . and structure . . . and control systems . . . and on-board accessories. In short, we are limited by the very nature of model rockets and rocket flight in what we can offer in the way of challenges to craftsmanship alone. We haven't reached that limit by any means, and there's plentry more that can and should be done. But I still think science and technology are the real answer to our senior problem, because only science and technology are challenging and interesting enough to keep our experienced people with us – and I think the history of the hobby bears me out.

Science isn't new in model rocketry; it's been a part of the hobby since its beginning. It had to be, to make model rocketry work at all. A basic understanding of trajectory analysis, stability, launch and communications systems and tracking methods has always been prerequisite for full success and enjoyment in building and flying model rockets. This just isn't true of most hobbies; it's practically unique to ours. Virtually all the most outstanding people in model rocketry from 1960 on – who did the most, got the most out of it, and stayed with it the longest – have been those who did something along the lines of research and development. No one who does the required statistical research can fail to reach the same conclusions I do: that long-term satisfaction and achievement in model rocketry are inseparable from a strong interest in its scientific and technological aspects, and that the fact that there are only hundreds, rather than tens of thousands, of long-term, hard-core model rocketeers in America today is a direct consequence of our failure to make these aspects of the hobby readily apparent and available over a full spectrum of challenge and difficulty to the vast majority of the modeling public.

This is not to imply that there has been total neglect of science in model rocketry; there certainly hasn't, which is mainly why most of us here who were in the hobby five or ten years ago are still in it today. Starting with the crude beginnings of the technologies I have already mentioned, back in 1957, there has been a constant trickle of new ideas and developments. The boost/glider was developed back in 1961 by John Schutz for R&D at NARAM-3, and has since been refined and diversified by Larry Renger, Harry Stine, Doug Malewicki, myself, and many others. Radio control is now becoming practical on a routine basis. Electronic payloads were built as long ago as 1959. The first published transmitter plans appeared in 1962, and the first commercially available model rocket transmitter came out in 1967. There are other examples of early model rocket technology, but these two suffice to confirm the existence of the trickle I mentioned. Too bad that's all it was: a trickle. Not enough to keep most of our experienced people with us.

But I can honestly say that the last two years have been much more encouraging. The trickle has become a stream, and that stream is increasing daily in breadth and depth, due in part to the increase in the size of the hobby, in part to the fact that we now have a monthly magazine of our own whose policies reflect the views I have expressed here, and in part to the fact that the manufacturers themselves are beginning to recognize the value of retaining experienced modelers. The magnitude and extent of the developments in model rocket technology since 1968 are literally breathtaking. Closed-form analytical solutions to model rocket flight-path and stability problems have been developed and made available to model rocketeers in graphical and algebraic forms. Computer programs have been written to solve almost any problem of interest to model rocketeers. Motion-picture aerial photography has been added to single-shot photoreconnaissance. Electronic payloads are now available on a continuing, commercial basis, and high-efficiency composite-propellant rocket engines may be purchased for special applications. New materials and special-purpose components have appeared on the market. Aerodynamic research of professional quality is now being done by model rocketeers, and techniques are available that allow us to predict the drag coefficient of a model rocket to a high order of accuracy. Guidance and control of model rockets in both ballistic and gliding flight is fast becoming a practical reality, and radio-control gear specially designed for boost/gliders is a likely possibility in the near future.

This is by no means all that has been done, and it is certainly not even a tiny fraction of what *can* be done. Those are topics we'll be talking about later in the convention. For now, suffice it to say that the increasingly healthy and vigorous climate of research and development that exists in model rocketry today has already considerably improved our ability to retain advanced rocketeers. People who a year ago were complaining that the hobby was in a rut, and that they were thinking of giving it up, are today still with us and even more enthusiastic than when they were beginners. We are moving in the right direction – the direction we have to in order to protect our future, to insure the stability and continuity of our hobby. If we continue to move ahead in model rocket science and technology, if we continue to develop this most vital aspect of our hobby, then I have every confidence that, in the year 2057, people may say "remember hula hoops?" or "remember slot cars?", but they'll never say "remember model rocketry?" – because *we'll* still be around.

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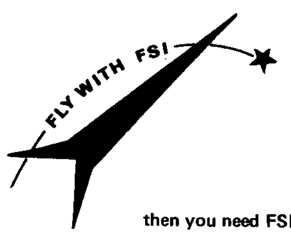

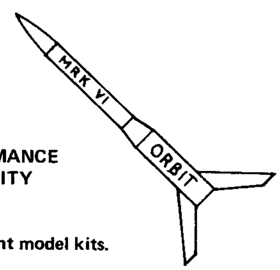

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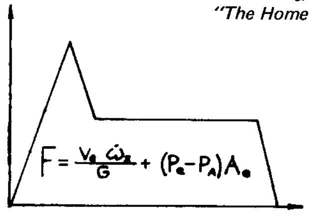

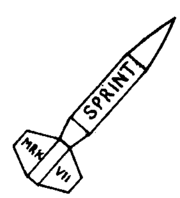

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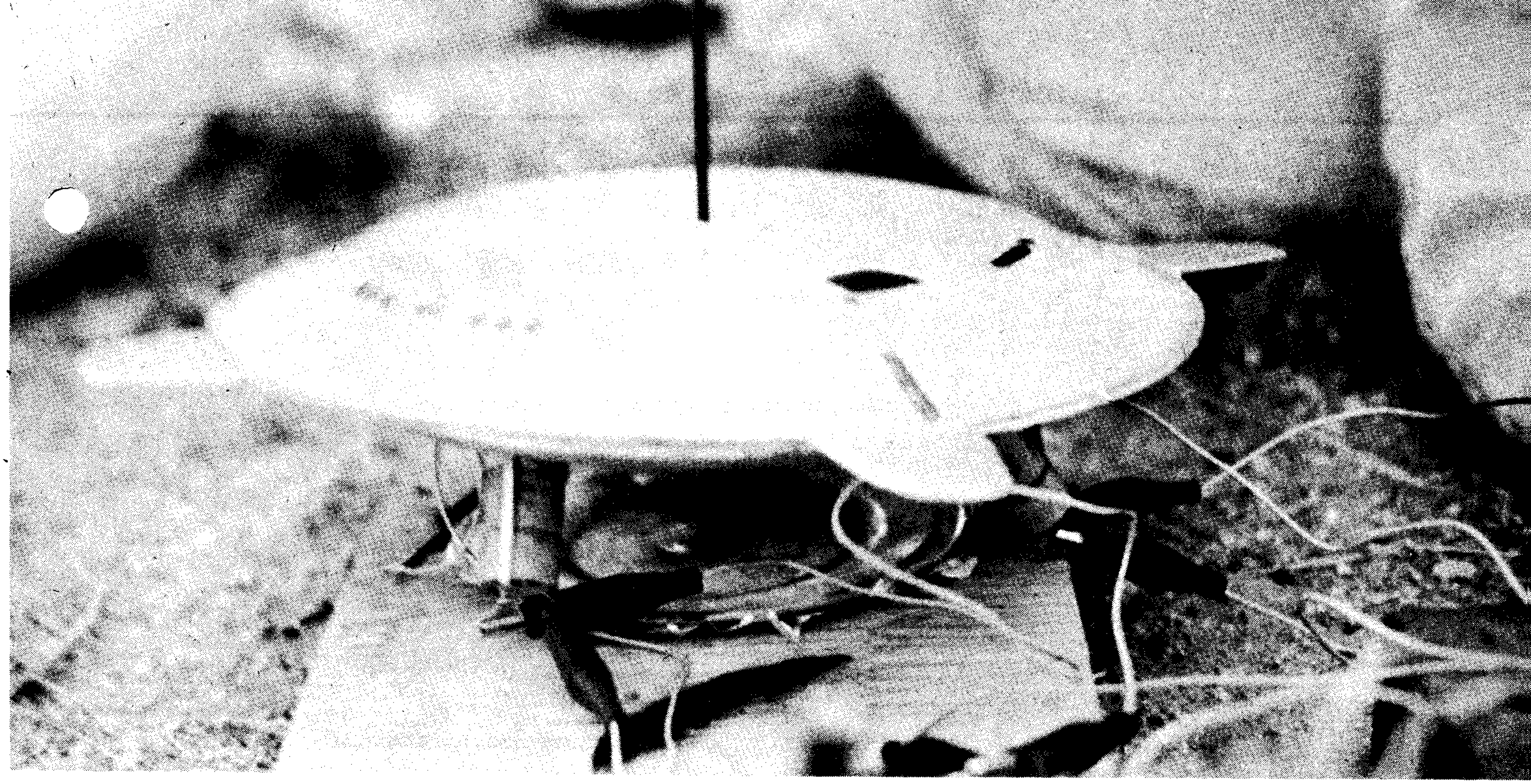


Photo by Forrest Mims

Build the Flying Saucer Rocket
S.S. ORION

by Bill Resnik

The *S. S. Orion* is a flying saucer type rocket, designed primarily, for research on this unusual type of design. It flys well, considering the amount of drag due to the large frontal area. The main principle involved is cocking the three engines at a 45 degree angle. This gives the correct proportion of lift and stability. (A full discussion of the history of "flying saucer" modrocs can be found in the "Wayward Wind," **MRm** April 1970.)

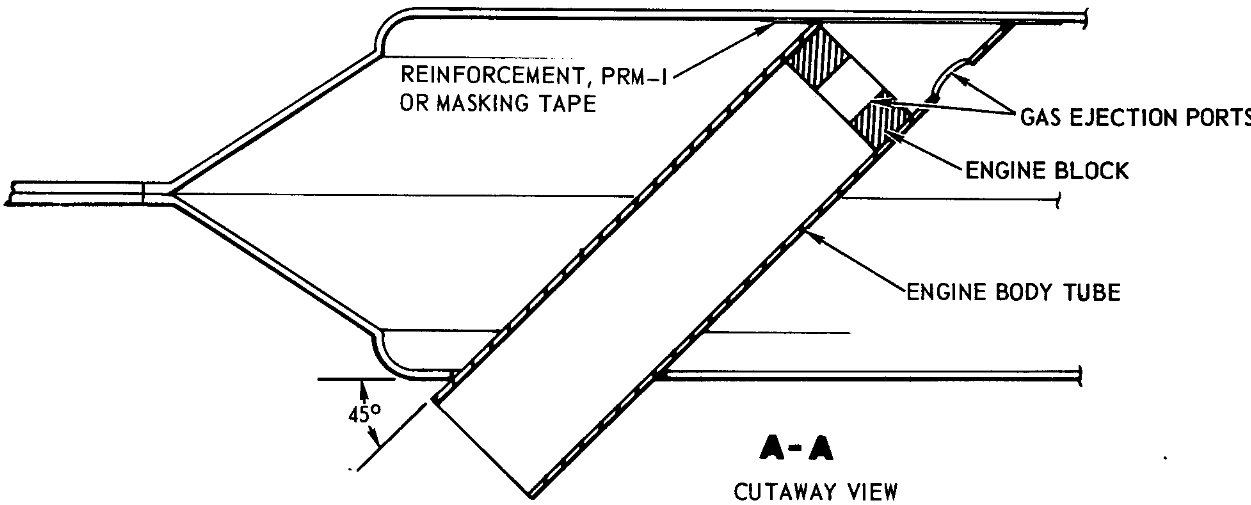
The design is relatively simple. An equilateral triangle is drawn on the body of the rocket (two common paper plates), making sure that the triangle is centered on the body. The points of the triangle determine where the rocket mounts will be inserted and the sides of the triangle determine the angle of deflection. Mounting the engines at an angle causes the rocket to spin. This spinning causes the rocket to be stable. For the best results each engine mount should be angled at 45 degrees, both vertically and horizontally. A slight deviation will probably not cause any serious problem, but since the rocket does not have any fins it must spin relatively evenly.

Recovery of the *S. S. Orion* is by the tumble recovery method. Originally helicopter recovery was planned. This was supposed to work using series III (short) engines. A long Estes engine holder was placed in the engine mount. The short engine was pushed all the way up to the end of the engine holder. The rear end of the engine came one inch short of touching the other end of the engine holder. After it was launched with a ½A6-2S engine and reached maximum altitude, the engine's ejection charge would push the engine to the lower part of the engine holder. This shifted the weight of the empty engine casing to the lower part of the flying saucer and the spin tabs, angled ten degrees from horizontal, would start the saucer spinning. This, of course, would slow the descent of the rocket. The spin tabs are also used for additional lift on ascent as they are angled up ten degrees from horizontal, coincident with the deflection of the engine holders.

The method of recovery was changed to tumble recovery, since the short engines did not provide sufficient thrust to attain much altitude. With the new series III A engines now available perhaps some modelers would like to experiment with this method again. The engine holders had built-in ejection gas ports at the sides, allowing the gasses to pass freely through many small ports on the outside of the rocket. This did not work. The engines were confined and the gasses did not pass through freely enough. The saucer ruptured on the outer rim. The engine holders have been replaced with engine blocks. This will enable the engines to eject and the pressure on the inside will not be as great as before. The saucer will not rupture or break when it hits the ground. Longer, more powerful Series I engines may be used.

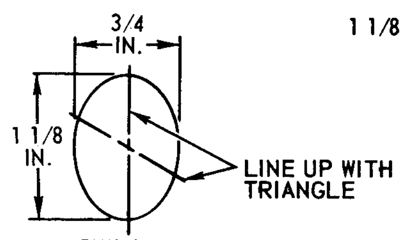
The first time the *S. S. Orion* was launched it took the launch rod with it. This was a 36 inch launch rod! The rocket now needs only a seven inch launch rod to assure stability. Be sure, however, that the rod is securely anchored to the ground.

The ignition is by a three engine cluster technique. Six jumper clips are needed. They can be made with twelve micro clips and six, twelve inch pieces of insulated wire. Pre-assembled jumper wires can be purchased at almost any electronics shop for about $1.00 per set. Three of the clips are hooked to the positive side of the power source and another three to the negative side. Then, making sure that the power is off, one negative and one positive lead is hooked



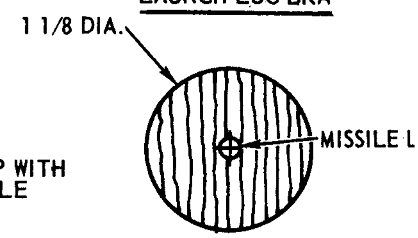
A-A

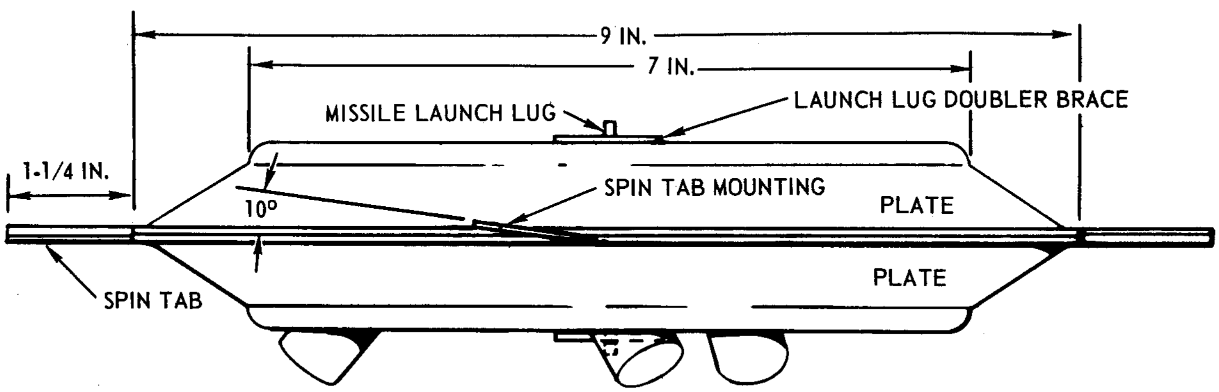
CUTAWAY VIEW



CUT-OUT

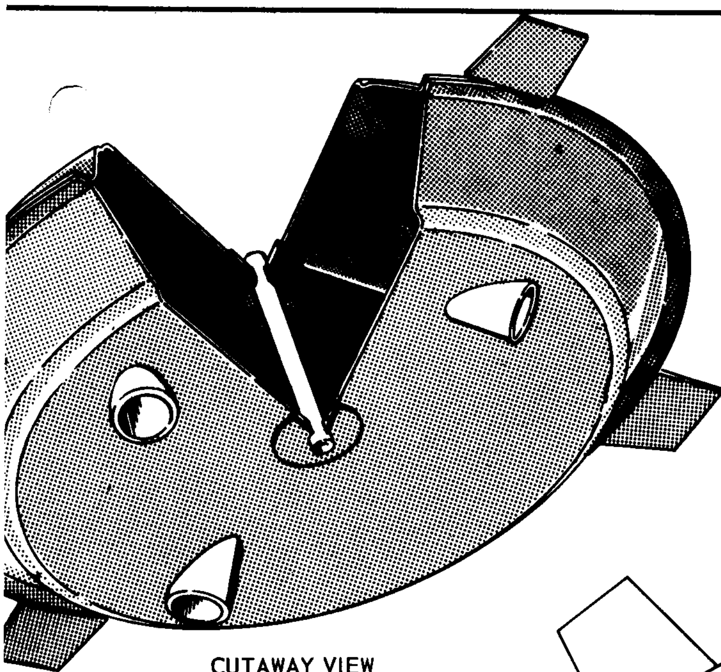
LAUNCH LUG BRA





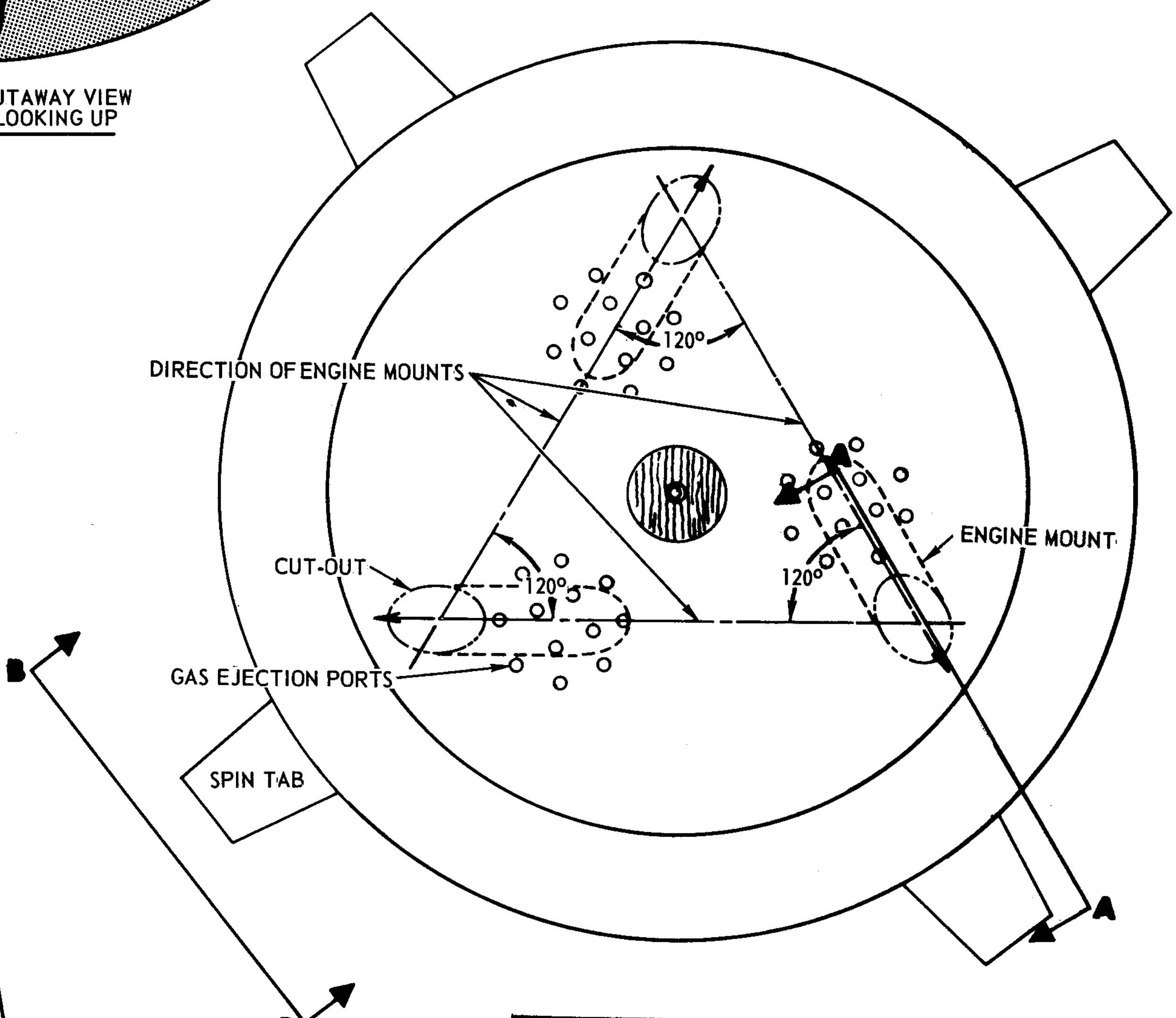
SIDE VIEW **B-B**

SCALE IN INCHES

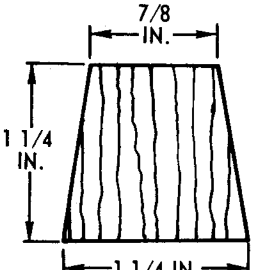


CUTAWAY VIEW
LOOKING UP

.AUNCH LUG HOLE



SPIN TAB



S.S. ORION

Designed By BILL RESNIK
Technical Art By Bill Blake

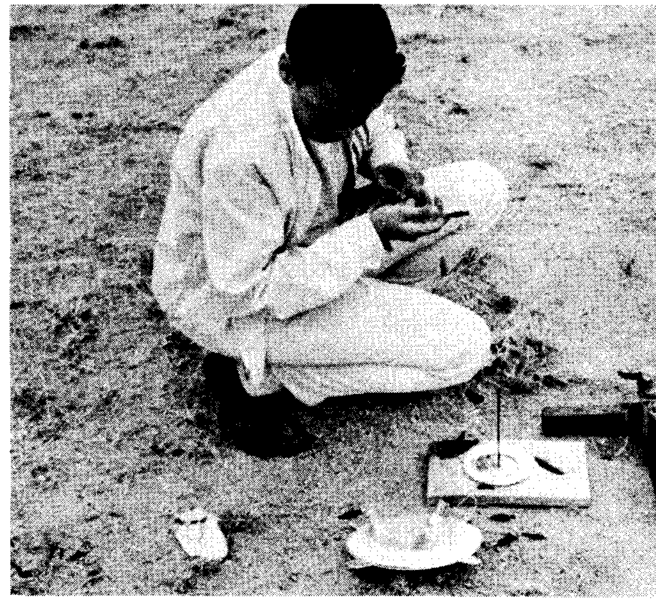
to each engine igniter. After this is done, the connections should be checked and rechecked to ascertain that no misfires occur. This is very important because, if one engine doesn't ignite, the saucer will go off the pad and do a cartwheel on the ground due to the static imbalance. A twelve volt car battery is preferred for ignition since the three engines together have a high resistance.

This rocket costs about $1.00 to build, not counting paints, using Estes parts listed below:

Estes Part No.	Parts Description	List Part No.	Centuri Description
BT-20B	One body tube	ST-79(9")	One body tube
9 inch	Two paper plates	9 inch	Two paper plates
LL-2C	5" launch lugs	LL-3	Two launch lugs
EB 20A	3 engine blocks	TR-7	Thrust rings
PRM-1	Paper reinforcement	– – –	Masking tape
BFS-30	Balsa fin stock	BFM-10	Balsa fin material

The following minor construction materials will also be needed:

1. Xacto knife.
2. Masking tape.
3. White glue.
4. Silver paint.
5. Black paint.
6. Sandpaper.
7. Sanding sealer.



Bill Resnik prepares the S. S. Orion for launching. Note that the engines are canted at a 45° angle, causing the "flying-saucer" to rotate.

Steps in Construction

The first step in constructing the *S. S. Orion* is to obtain two nine inch paper plates and draw the equilateral triangle on one plate to indicate the place and direction to insert the engine mounts. Next, find the exact center of the plates to determine where the launch lug is to go. Punch a hole through the center of both plates and reinforce each plate with a one inch circle of balsa wood glued over the center of the punched hole. Drill a 1/8" hole through the balsa to accommodate the launch lug. Next punch twelve 1/8" holes, clustered in a circle about 1½ inch in diameter, near where the engine mounts will be glued in the lower plate. Make a 45 degree angle cut off the end of each three inch body tube. Using one of these for a pattern, draw the angled end on each point of the triangle on the lower paper plate and cut out these holes. Now edge glue the two paper plates together. Next, drill a ¼" hole in each body tube and in each engine mount after the engine mount has been inserted inside the body tube. Glue each body tube, with engine mount, into the hole in bottom plate, making sure that the tube is correctly angled. Next, insert the 2½" launch lug thru the center holes in the plates and glue in place so that about 1/4" sticks out of either end. Glue the four spin tabs in place, angling them up 10 degrees from horizontal at the leading edge. Make a glue fillet around body tubes, launch lugs and spin tabs for added strength. The original *Orion* was painted silver and had black windows around the top part of the saucer. It flew well with three C6-5 engines.

The first time the *S. S. Orion* was launched it took a 36 launch rod ten feet into the air, using ½A6-2S engines! The second time, a misfire occurred and the model just rolled over on its side. The third time, using ½A6-2S engines, it went about 15 feet up and then just plopped down. The fourth was the best flight. Present with the writer was Captain Forrest Mims, USAF, who took the accompanying photographs. The launch was spectacular! The saucer soared about 75 feet into the air and returned safely, except for one engine mount that was lost.

The *S. S. Orion,* although it flies well, is not essentially a very stable rocket, and for that reason it is recommended for the more experienced rocketeer. Perhaps, through experimentation and further design work, the model may be improved upon. Anyone with any ideas – please write to:

Bill Resnik
9017 La Barranca, N. E.
Albuquerque, New Mexico 87111

Q&A

I am planning to build a closed-breech launcher and I would like to know how to make a piston which catches the jet gases. I have not been able to find any information on this.

Dale Meyer,
Fonda, Iowa

A piston for a closed-breech launcher can probably be made without too much difficulty from an ordinary metal funnel, such as you can buy in most hardware stores. Simply cut off the spout part and enough of the cone-shaped portion so that the hole will barely admit the rocket engine. Then epoxy a piece of body tube, which will fit snugly around the rear of your rocket, to the funnel. You may also wish to add a piece of tubing (of the same diameter as the wide end of the funnel) to the wide end of the funnel. This will keep the funnel from trying to tip over and getting stuck in the launcher tube. As you can see, you will have to be careful in selecting a launcher tube inner diameter, to make sure you can buy a funnel to fit.

In the August 1969 issue of **Model Rocketry** I noticed that the Excalibur uses rearward ejection. What is rearward ejection?

Gregory McCarthy,
Harrisburg, Pennsylvania

Rearward ejection refers to the fact that the rocket engine is allowed to eject itself out the rear of the rocket body tube at flight apex, rather than blowing off the nose cone of the model. The shock cord of the parachute or streamer is attached to a fitting on the engine, such that the recovery system is pulled out the rear of the rocket when the engine is ejected. Engine, recovery device, and rocket are all tied together with the same line and are all brought slowly to earth by the recovery device.

The purpose of rearward ejection is to eliminate the joint between the nose cone and body tube. Since the nose cone can be glued to the body, filler material can be used and the body tube/nose cone joint can be eliminated. The drag on the rocket is reduced and its altitude performance can be increased by this method.

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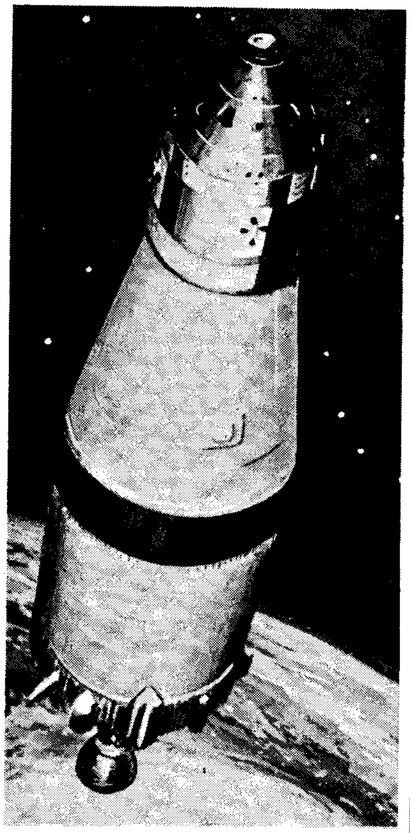

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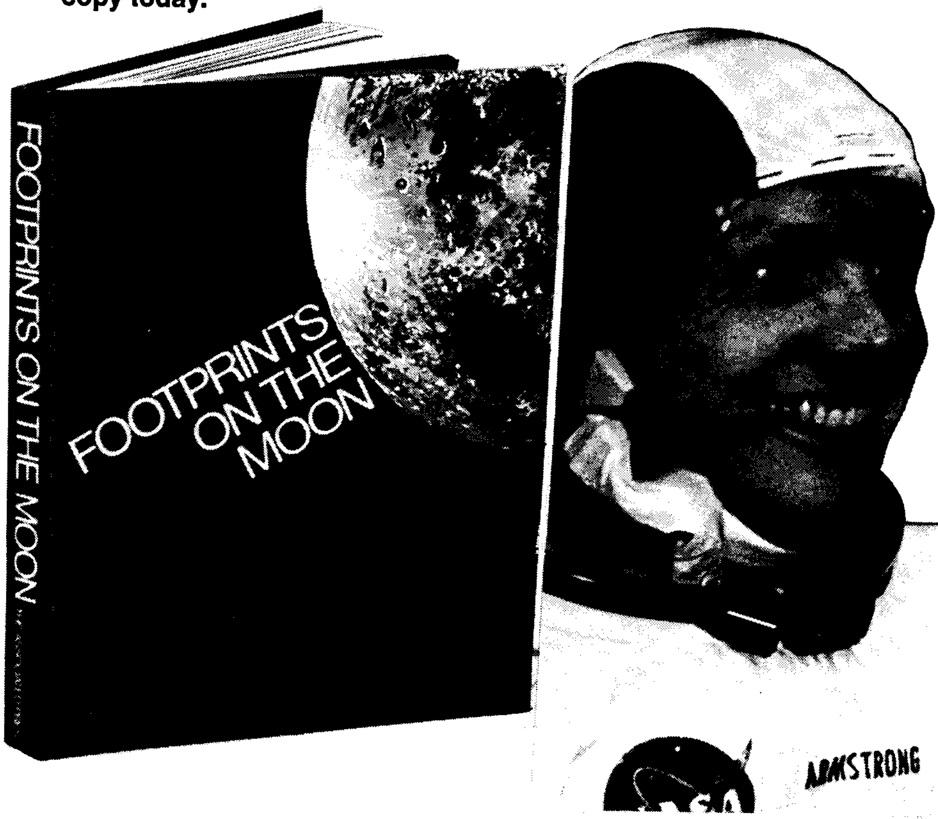

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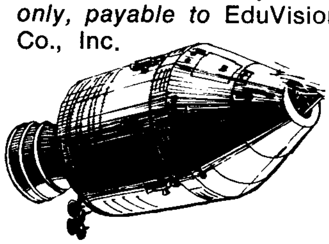

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Cox Rockets Presented to Marine Corps

Ben H. Garrett (center), director of marketing for the L. M. Cox Manufacturing Company, presents mounted sets of four Cox model rockets to Col. Kenneth E. Huntington (left), Station Commander of the Marine Corps Helicopter Air Station in Santa Ana, California, and Santa Ana Mayor Lorin Griset (right). A one-mile square area at the Helicopter Air Station has been provided for Cox research and development personnel as a model rocket launching site, where their new models can be fired and retrieved safely. Following the presentations, the Cox Little Joe II, Honest John, and Nike Zeus models were launched.

SEMROC Announces New Product Line

Semroc Astronautics Corporation has opened for business, offering seven new models and a number of model astronautics accessories. Their motto is "something for every modeler" in this inaugural line. Highlighting the selection is the Hydra VII, a large model capable of using up to seven engines. Hydra VII permits clusters of three, five and seven engines. The most versatile of all cluster assemblies on the market, Hydra VII is recommended only for the advanced modeler. It sells for $5.98.

For the beginner, Semroc offers the tiny Triton. This 89¢ model can be assembled and flown in a single afternoon. An easy-to-assemble two-stager is the Sigma II, available for $1.98. Other models include: Aphelion, a fine sport rocket for all modelers ($1.98); Goliath, a big three-engine model with two parachutes ($3.29); Swift, an easy-to-build high performance rocket ($1.29); and Lune R-1, an ideal demonstration model featuring a 5" payload section ($2.98).

For more information on models and a detailed listing of accessories, send for the colorful 17-page catalog produced by Semroc. The address is Semroc, Modelers' Division, Box 333, Ayden, North Carolina 28513.

NEWS NOTES

Canadian Regional

The Edmonton Rocketry Club has announced plans for the first large Canadian model rocket competition to be held in Edmonton, Alberta, Canada on July 11 and 12, 1970. All interested rocketeers are invited to participate in the Annual Alberta Regional Meet (AARM-1). Events to be flown are: Scale, Design Efficiency, Class I Altitude, Parachute Duration, Streamer Duration, and Swift Boost/Glide. Further information may be obtained from the Contest Director:

Denis Lufkin
Contest Director
AARM-1
13540 – 126th Street
Edmonton, Alberta, Canada

Skinner Receives HIAA Award

Photo by Robert Parks

Tim Skinner (left), Chairman of the HIAA Model Rocket Division, receives the "Man of the Year" award for doing the most to further the aims of model rocketry during 1969. His activities in promoting the liberalization of state and local model rocket legislation as well as efforts in organizing various model rocket demonstrations across the country were cited by Maurice Gherman (right), publisher of Craft, Model, and Hobby Industry, who presented the award. In his address to the division, Skinner cited the achievements in promoting public acceptance of the model rocket hobby. "Model rockets and rocketry were exposed to the American public in vast numbers in the closing months of 1969. We were involved in two television programs with national coverage plus a number of programs at the local level. In the recent past, it was estimated that only one person in twenty had even the slightest knowledge of model rocketry. Hopefully and presumably this ratio is steadily decreasing."

MODROC CALENDAR

HMRARM-1 – May 23, 1970, a competition open to rocketeers from Summers, Mercer, Greenbrier, Monroe, and Fayett counties West Virginia. Events: Open Spot Landing, Class 2 Altitude, Drag Race, Class 2 PD, Class 3 PD, and possibly Hornet B/G. Contact: HMRA, Route 1, Box 141, Hinton, West Virginia 15951.

SPQR-5 – June 21, 1970, Space Pioneers Quality Regional open to NAR members in the Northeast. Events: Scale, Super Scale, Swift B/G, Sparrow B/G, Class 1 PD, and Open Spot Landing. Site: Lapham Field, New Canaan, Conn. Contact YMCA Space Pioneers, 564 South Avenue, New Canaan, Conn. 06840.

MMRR-2 – June 27-28, 1970. Regional Meet sponsored by CSAR, open to NAR members in the Midwest. Events: Super Scale, Eggloft, Sparrow B/G, Swift B/G, Design Efficiency, Parachute Duration, Open Spot Landing, R & D. Site unannounced. Contact: Miss Vikki Lundberg, 1972 Beal Road, Mansfield, Ohio 44903.

TEXAREA-II – June 27-28, 1970, an area meet for Texas NAR members. No events or site yet announced. Contact: Apollo-NASA Section, c/o Mark Evans, 10203 Overcup, Houston, Texas 77024.

Canadian Convention – July 4-5, 1970. Conference open to all rocketeers. Discussion groups, and launch sponsored by Montreal's Atmospheric Rocket Research Society. Contact: Steven Kushneryk, 7800 Des-Erables Ave., Montreal 329, Quebec, Canada.

NARAM-12 – August 16-21, 1970, the 12th National Model Rocket Championships, open to all NAR members. Events: Class 1 Parachute Duration, Design Efficiency, Sparrow B/G, Scale, Swift B/G, Space Systems, Egg Lofting, Open Spot Landing, R&D. Site: Astroworld, Houston, Texas. Contact: by July 6, 1970, Contest Director, Richard Sipes, 5012 60th Avenue, Bladensburg, MD 20710.

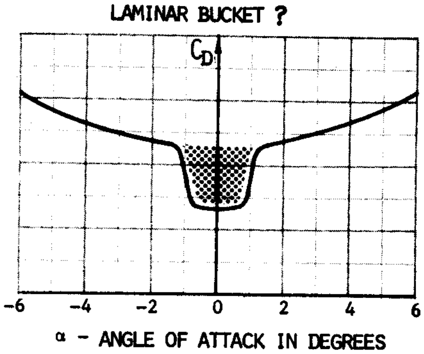
ATTENTION
CONTEST DIRECTORS
Mail notices of your contests at least 90 days in advance for listing in Model Rocketry's Modroc Calendar to:

Modroc Calendar
Box 214
Astor Station
Boston, Mass. 02123

ERRATTA

In the April 1970 issue of Model Rocketry the graph which should have appeared on page 35 was inadvertently replaced by another chart. The correct graph, showing the small bucket shaped drag minimums typical of laminar type airfoil sections, is reproduced below:

LAMINAR BUCKET ?



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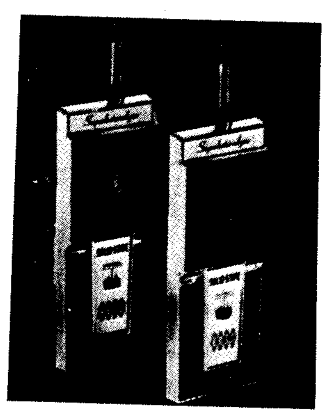

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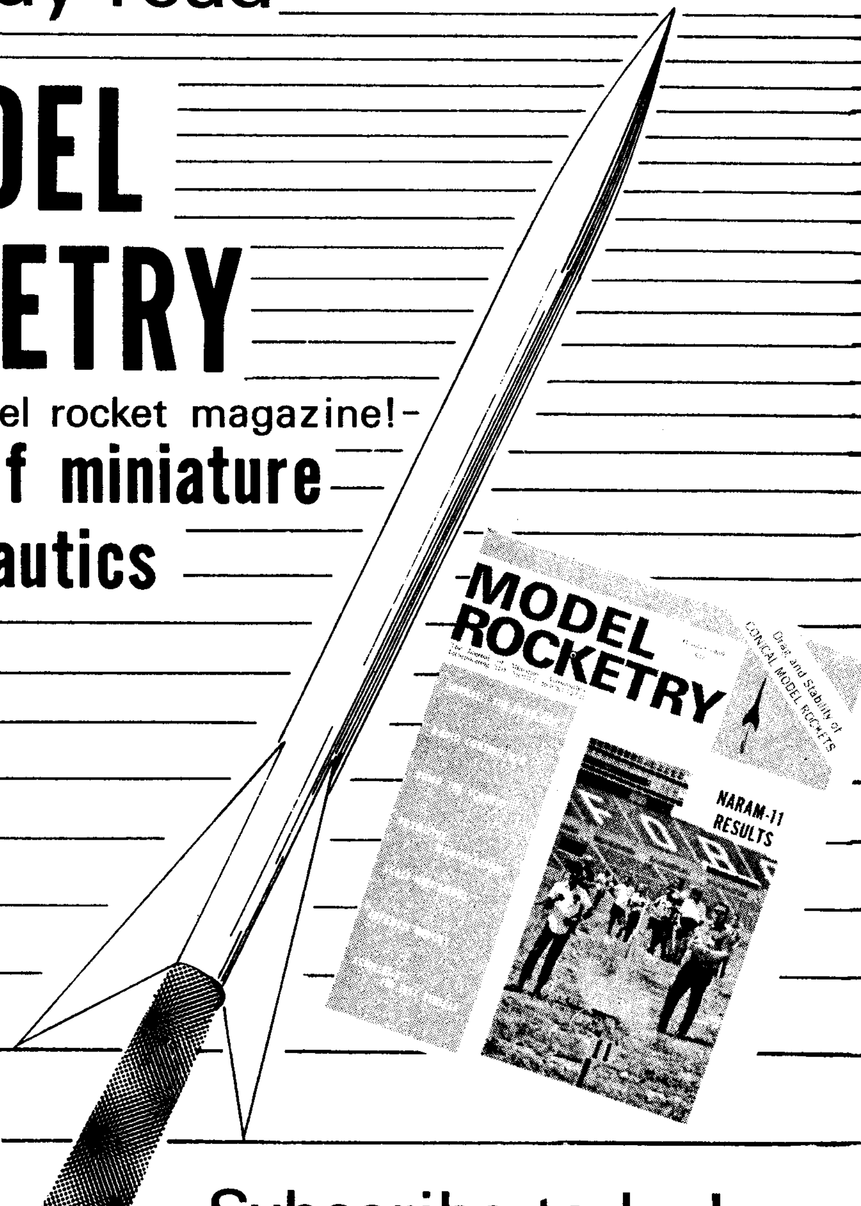

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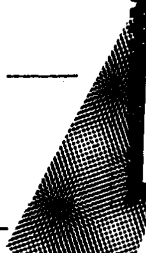

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Pittsburgh Spring Convention

MARCH 20-22, 1970

To organize a Convention which can both educate beginners and stimulate the thinking of advanced rocketeers is no easy task. In previous years the Pittsburgh Spring Convention, organized five years ago to raise the level of rocketeers in that area, had few attractions for more advanced modellers. This year however, Pittsburgh's Steel City Section, which sponsors the annual event, came up with a program of lectures and discussion groups which spanned the entire hobby. Neither the beginners nor the advanced modellers who attended could leave this year's Convention with the complaint that they had not benefitted from the program.

The Convention, held over the March 20 to 22 weekend, moved from its traditional home at Shadyside Academy to the Holiday Inn North to allow more rocketeers to be accommodated. Steel City's expectations of as many as 200 participants were exceeded by the turnout of 220 rocketeers from 18 states including Florida, Kansas, and Texas.

The atmosphere at the motel was considerably different from previous years at Shadyside. "Don't build any models or use any spray paint in your rooms," Convention Chairman Alan Stolzenberg warned the rocketeers, "the motel will make us pay for any damage!" But MPC came to the rescue of those last-minute-rocketeers who never seem to get around to designing a rocket until T minus five hours or less. The new MPC Pioneer rocket kit, employing plastic fin and nose sections and requiring little glueing and less painting, was distributed to all participants.

The theme of the Convention, set by the dual keynote addresses from G. Harry Stine and Gordon Mandell, was "Model Rocketry – Science and Sport." To start things off, Harry Stine, who has probably competed in more NAR contests than any other rocketeer, discussed the history of competition in the hobby. He presented a firsthand account of modroc competition from the first meet in Denver in 1958 to this year's First World Championship Meet scheduled for September in Yugoslavia.

"An emphasis on competition in all areas . . . breeds the improvement of model rocketry," Stine said. Competition among manufacturers results in the development of *more* and *better* engines, supplies, and kits. Furthermore, he emphasized, competition among individuals and clubs leads to the development of *better designs* as well as an increase in the individual's modelling skills.

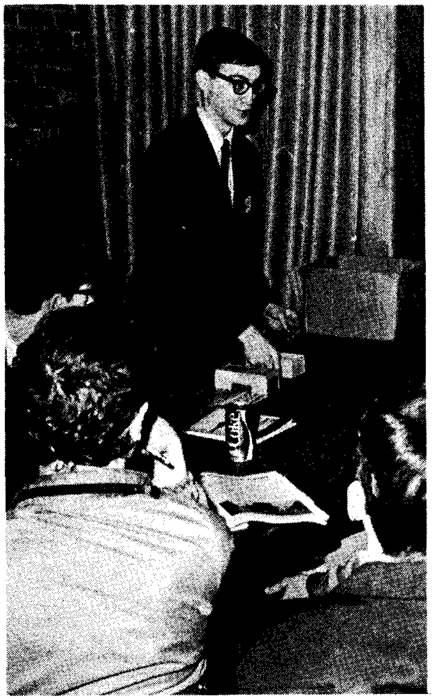
Rocketeers frequently cite the luck factor in winning a competition. Many say, "Why build a good model when it will go too high to get tracked! I'll get beaten by an inferior design, if the builder is *lucky* enough to get tracked." "*Luck* is the refuge of the inexperienced modeller," Stine contended. The successful competitor will examine the size of the field, the wind and weather conditions, etc. *before* selecting *which* model to fly in a particular contest.

Stine offered several tips on competition strategy to the conventionites. To increase the chances of getting tracked, he suggested bringing several rockets with different paint patterns to the flying field. If the sky is overcast perhaps an orange or black rocket should be flown. A white or silver rocket might be chosen on days with a clear dark blue sky. Watch how the tracking is going. If it's bad, and almost nothing over 200 meters is getting tracked, weight down the rocket to achieve its *best trackable performance.* It second flights are permitted and you've already qualified on the first flight, go for broke on the second flight.

In B/G and Parachute Duration, Stine suggested checking out the size of the field and the wind conditions before selecting your bird. On the first duration flight, weight the bird so that wind drift will carry it just to the edge of the field. Again, if the first flight qualifies, try for a better performance, thus increasing the *risk* of not recovering the rocket, on the second attempt. Stine's contention that *strategy* not *luck* dominates in winning a contest was well received by the participants.

Gordon Mandell followed with a discussion of the scientific aspects of model rocketry. He chided the manufacturers for not doing enough in the development of instrumentation and experimental apparatus while suggesting that model rocketry's biggest problem, an almost total failure to retain the interest of hobbyists past high school age, could be solved by providing scientific and technical challenges within the hobby. While he admitted that the challenge of craftsmanship necessary to construct a good scale model and the challenge provided by competition will help retain some rocketeers in the hobby, he asserts that "only scientific and technological challenges are interesting enough to keep all of today's dedicated rocketeers interested tomorrow." Mandell suggested that only by interesting the beginner in model rocket research on a level he can handle can we assure the future growth and development of the hobby. (The complete text of his speech will be found in this month's *Wayward Wind* column.)

At the end of the opening session a series of discussion groups aimed at introducing these technical challenges as well as basic modelling skills to the participants was announced. Each discussion group was presented three times, twice on Saturday and once Sunday morning, to allow the rocketeers to attend those which interested



(Left) Dick Fox describes the new "Foxmitter-2" at the Telemetry session.
(Right) Dr. Gerald Gregorek explains basic boost/glide construction principles. The insert shows a Gregorek BBG on its first flight at the Convention launch.

them.

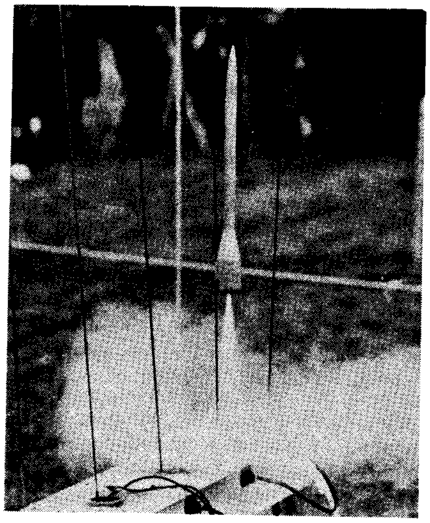
In a session on Model Rocket Instrumentation, Dick Fox discussed the use of transmitters and sensors in model rocket research. He played tapes of telemetered data from several model rocket flights, described the improved "Foxmitter-2" (see article elsewhere in this issue), and explained the functioning of a new humidity sensor (to be featured in next month's **Model Rocketry**) and a new accelerometer module. Only one group out of the 50 or so rocketeers in the room had ever launched a rocket-borne telemetry transmitter, but most seemed anxious to learn about the possible applications of these devices. Perhaps the most straightforward application is Dick's use of a homing beacon on his Camroc vehicles to assist in the location of the high-flying multistaged Camroc carriers he employs. The valuable Camroc payload can be easily located using a directional loop antenna. Other more sophisticated measurements such as atmospheric temperature profiles, model rocket acceleration data, and spin rate measurements were also discussed at the session.

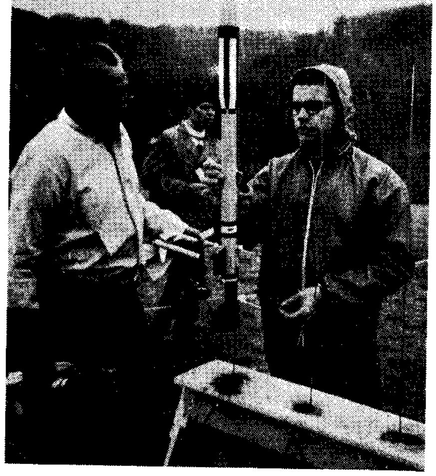
Next door, in the beginning R&D session, Bob Mullane and Karl Feldman described the types of research open to young rocketeers. The purpose of this session was to emphasize that research vital to the development of the hobby can be done by rocketeers without elaborate test equipment and a knowledge of calculus. Karl's work on the use of styrofoam as a model rocket construction material was cited as an example of *basic* modroc research. When he started flying B/G's cut from the bottom of old styrofoam meat containers, many rocketeers were quite sceptical that there would be any practical results. HIs work continued, and was presented as an R&D project at the last Pascack Valley Regional Meet. Recently a number of other rocketeers, seeing the advantages of styrofoam, have started employing it for their B/G's. In fact, anticipating the demand for this new modelling material, D-B Enterprises introduced pre-airfoiled wing sections at the Convention.

Several other examples of basic research open to rocketeers were cited. A typical example was that of launch lug drag. The lug, as with any protrusion from the surface, increases the drag (and thus decreases the altitude) of the rocket. A launch tower eliminates the lug (and its associated drag) but causes a friction force at three or four contact points over the entire length of the launch tower. (The launch lug, of course, also has a friction force associated with its contact with the rod.) Under certain assumptions, the magnitudes of all of these effects can be calculated theoretically. More important, however, they can be measured by a simple series of experiments conducted by any rocketeer with a good strong rocket and some tracking equipment. The following method was suggested: 1) launch the rocket, without the lug, ten or twenty times from a tower and record the altitudes; 2) add the lug, again launch ten or twenty times from the tower, and compare the altitude with 1 to get the decrease in altitude caused by addition of a launch of a launch lug; 3) launch the rocket with lug from a standard launch rod, and compare the results with 1 to determine whether tower or rod launching results in better performance.

G. Harry Stine exhibits the new MPC "Vostok" for interested rocketeers. Among the new MPC kits on display were the Lunar Patrol, far right with B/G's attached, and the Flat Cat B/G.

The Advanced R&D session, conducted by Gordon Mandell and Patrick Stakem, was designed to appeal to old-time rocketeers who already had some technical back-





A number of unusual rockets showed up at this year's Convention launch. The Arcturus (built from MRm November 1969 plans), left, flew well despite the dire predictions of the RSO. Estes Industries provided one of the more spectacular flights of the day with their two-stage D-powered vehicle (center). The last rocket (right) was flown from a radio controlled pad built by John Fleisher, preparing the rocket, and Chris Pearson. (Photo by Chris Pearson)

ground. Fundamentals such as static stability criteria were assumed, and Gordon proceeded to elaborate on the results of his dynamic stability experiments and theoretical analysis. Pat discussed his work on model rocket trajectory analysis which has led to a computer program which describes the ballistic flight path of a model rocket.

A seminar on scale modelling was led by Harry Stine and Robert Hagedorn. The younger modellers at this session were concerned with how to build a good scale model, and where to obtain the necessary substantiation data. Howard Kuhn, this year's Senior National Champion, introduced the topic of a unified set of scale judging rules. He proposed a set of rules which would clarify the point of allocation for substantiation and adherance to scale, and result in more uniform judging than under the present rules. His rules would, for example, require that the modeller substantiate perhaps ten dimensions on the prototype and then judge the model for percentage adherance on each of these dimensions. These criteria were used in judging the scale event at WAMARVA-1 last year, and it was found that they speeded the judging as well as resulting in a more uniform allocation of points. He has forwarded a copy of the proposals to the NAR Contest Board.

Harry Stine also presented a special discussion on the use of plastics in rocket modelling. He emphasized the need for modellers to develop new modelling skills in order to use plastics to their maximum advantage. With the expansion in participation in model rocketry to over the last three years, the mass production of quality plastic parts is now becoming economically feasible, and the appearance of many plastic parts to supplement the present balsa and cardboard construction materials can be expected.

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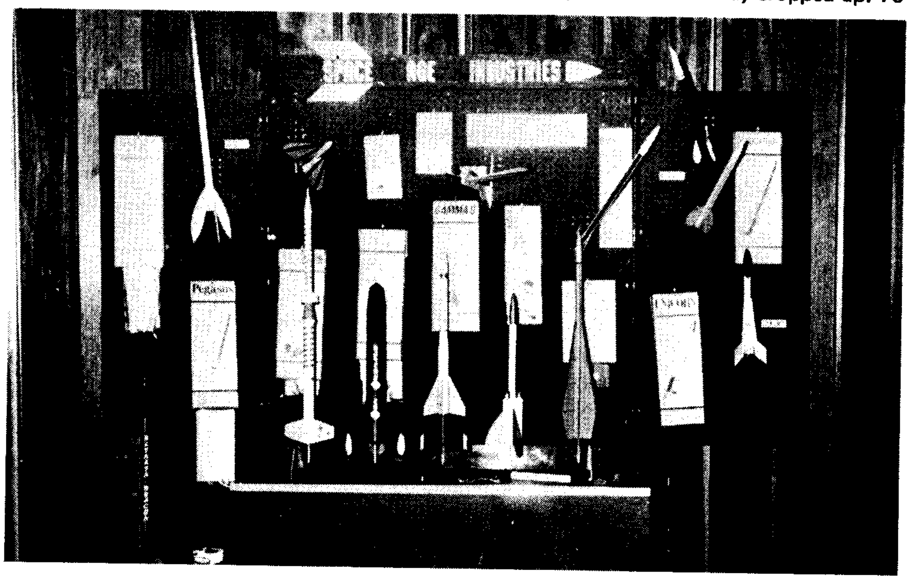
ment the present balsa and cardboard construction materials can be expected.

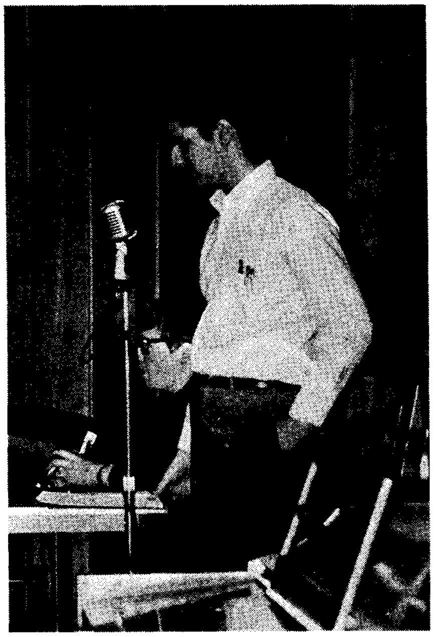
A group chaired by Elaine Sadowski, Jay Apt, and Joe Persio, discussed model rocket club organization. Group projects and other activities to maintain the interest of current members as well as demonstrations and public launches to attract new members were suggested. In those areas where local police or fire officials question the safety of the model rocket hobby, it was suggested that the local rocketeers obtain a copy of the National Fire Protection Association Model Rocket Code (41-L) to show to the officials. (Copies of the code are available from NFPA, 60 Batterymarch Street, Boston, Mass. 02110 for 50¢ each.)

A principle attraction of any Convention is the launch, and this one was no exception. As in previous years, the launch was plagued by bad winter weather. With it scheduled for Saturday afternoon, rain threatened all morning, and snow flurries fell before lunch. But, when the buses arrived, the precipitation stopped and only the cloudy sky and muddy ground hindered the launch.

As in previous years, the launch field was at Shadyside Academy, a 20 minute bus ride from the motel. However, because of the muddy conditions, participants could not be permitted on the athletic field, which would have been torn up by the over 200 rocketeers who attended. Thus the site selected for launching was a small dirt road adjoining the athletic field, and overlooking a steep hill. Just as the rocketeers arrived, the first problem of the day cropped up. To



The expanded SAI line including the 3-stage Omega (bottom, far right), Wombat B/G (upper left), and Hen Grenade egglofter (second rocket in bottom row) was introduced at Pittsburgh. Their new "Blinkin Beacon," now available in kit form, was one of the stars of the show.



Convention Chairman Alan Stolzenberg sums up the successful Convention – the first Pittsburgh Convention to provide a balance of beginners and advanced material satisfying all the participants.

speed the launchings, Steel City had borrowed the launching equipment of Pittsubrgh's Three Rivers Section to supplement their own launchers and panel. Both systems were hooked up, and the PA system broke down. After considerable investigation, Arnie Pittler determined that both the SCS and TR launch panels were grounded to their cases, and that each club had selected a different ground polarity, thus shorting out the systems through the metal table. The Three Rivers PA system, which was designed for small club launches and didn't have the power to be heard by the spectators, was pressed into service as a replacement for the SCS system which was damaged by the grounding problems.

First up was a rack of five Estes Cherokee D's powered by the new D-engines from Estes. It wasn't a fair test of the rockets' performance, since they broke through the clouds and went out of sight. Disk Fox launched a new "Foxmitter 2", which flew perfectly and telemetered data back to the ground throughout the flight, but landed in a tree and had to be left unrecovered. Bob Hagedorn, who has just introduced pre-airfoiled styrofoam B/G wing sections for sale, flew a scaled down Thermic 20 B/G with styrofoam wings. Over 100 rockets were launched before the buses returned to take the participants back to the motel for the evening sessions. The last rocket off the ground was launched from a radio controlled launch pad designed and built by John Fleisher and Chris Pearson. After requesting that all transmitters and walkie-talkies in the area be turned off, (how about that Foxmitter which was 100 yards away in a tree merrily transmitting away?), they activated the pad and launched the rocket by radio control. After the launch, everyone hurried back to the busses, to get out of the cold winds, and returned to the motel for the manufacturers' displays.

As at any Convention, the manufacturers were given an opportunity to display their new products. Those rocketeers who observed Harry Stine, representing MPC at the Convention, noticed that he carried a small black plastic bag wherever he went. He guarded it carefully, and never let it out of his sight. Finally it was time for the displays, and he removed the new MPC flying "Vostok" from its container. His flight version, painted in the green (almost U.S. Army olive) used for USSR military vehicles, and accurate down to the white frost pattern on the side of the vehicle, was accompanied by a display model "Vostok" with scale fins, and a display model "Sputnik". The MPC kit, soon to be available at local hobby shops, will contain all parts necessary to build the flying "Vostok" with the slightly oversize fins necessary for stability, or a display model "Vostok", or a flying or display model "Sputnik".

Space Age Industries announced the purchase of the entire Rocket Supply Company (AMROCS) product line, almost doubling the number of kits now offered by MPC. Among the AMROCS kits which SAI displayed at Pittsburgh were the three stage Omega III, the Wombat boost/glider, the Hawk boost/glider, and the Scorpion and Liberty Bell single staged models. Perhaps the most interesting of their new models is the Quasar, a high performance model employing a single core engine and three strap-on pods which are jettisoned at burnout. Also new from SAI is the "Hen Grenade" – a modification of the egglofter design which took first place in the Senior Division at last year's PVARM-1.

Competition Model Rockets displayed their new "maxi-Manta," an enlargement on Howard Kuhn's present Manta design. The "maxi-Manta" with a span of over 14 inches is designed for Hawk and Condor B/G competition. It will be offered with an optional fuselage pod making it capable of carrying radio-control equipment.

From Estes there's a new launch pad – the Port-A-Pad – molded out of plastic, which will replace the wooded Tilt-A-Pad. The Sprint, Estes' first competition model, features elliptical fins and a high performance design. Also on display was a prototype of the CINEROC-carrier, a D-powered bird to be offered with the CINEROC, as the Delta is presently regarded as the standard Camroc carrier.

Two new companies, D-B Industries and Astro-Communications exhibited their products. Bob Hagedorn of D-B Industries (Box 2835, Mansfield, Ohio 44906) displayed their new pre-airfoiled styrofoam wings, available in three sizes: 2" chord, 1/8" thick; 2½" chord, 3/16" thick; and 3" chord, 1/4" thick; all offered with 16 inch span and priced at 50¢ each. Astro-Communications (3 Coleridge Pl., Pittsburgh, PA 15201), which is being run by several Steel City members, will market in kit form the parts for the "Foxmitter-2" (described elsewhere in this issue) for under $15.00.

Late in the afternoon Dr. Gerald Gregorek, a professor of Aeronautical and Astronautical Engineering at Ohio State University, presented a discussion on basic boost glider design. He attempted to set down some simple design criteria which will assure a good flying B/G. Since the complete report is scheduled for publication in the July issue of **Model Rocketry**, just a brief outline of his discussion should suffice. First, pick a wing area. About 30 square inches is suggested for Sparrow B/G. The stabilizer should have an area of 1/3 to 1/4 that of the wing, and the leading edge of the tail should be located about one wing half-span behind the trailing edge of the wing. The tail should have an area about 1/10th that of the wing. The center of the pod should be located about 1½ times the wing chord in front of the wing leading edge. About 1/32 inch of decalage should be applied to the stabilizer. Follow the rules, trim it well, and it should fly as well as the demo flight Dr. Gregorek gave at the launching – about a minute with an A engine on a windy day. Pretty good for a rectangular glider quickly assembled before the Convention as a prop to be used during the speech. In fact, the flight at the Convention was this glider's first! On Saturday evening, Dr. Gregorek led a B/G discussion group, elaborating on the design rules presented at the general session. The attendance of over 75 rocketeers perhaps indicates that the upcoming contest season will see better B/G performance than last year.

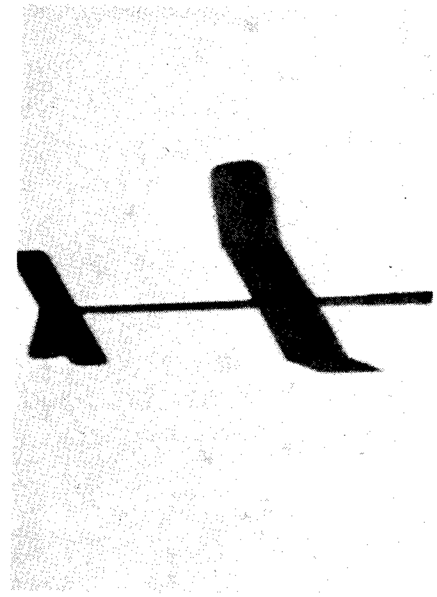
Over the last five years the Pittsburgh Spring Convention has been growing, and searching for a way to provide something for every rocketeer attending. The presentation of both beginner's and advanced material this year indicates that the Convention Committee has worked out a balance that can be appealing to everyone.

See next month's Model Rocketry

for on the scene coverage of

the MIT Model Rocketry Conference

Fly the Oberon XBG-118



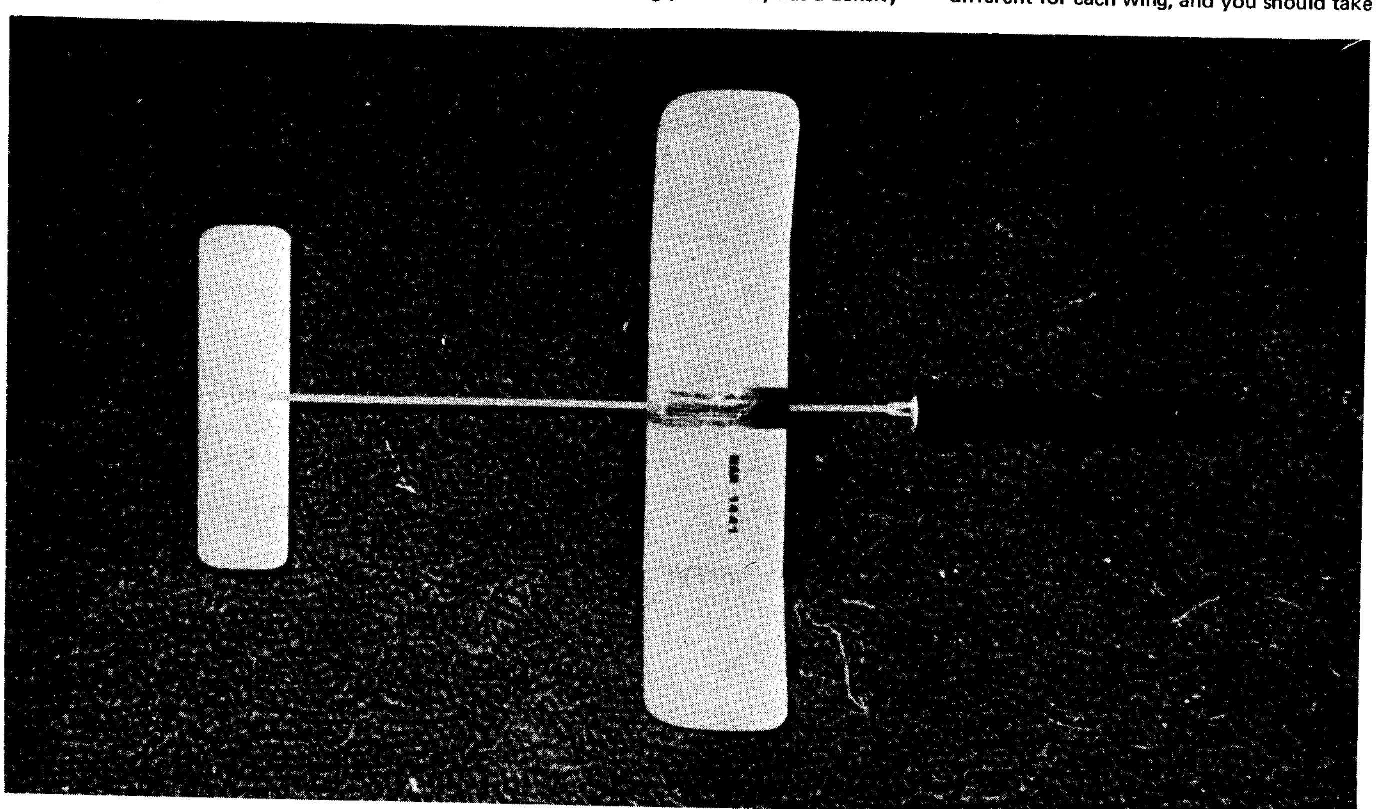
Designed by Gordon Mandell

The Oberon XBG-118 is a simple Sparrow B/G employing the new, pre-airfoiled wing sections recently put on the market. It uses high-quality, light-weight, styrofoam wings which offer several advantages over solid balsa construction.

The Oberon XBG-118 is a simple, strip-pod boost/glider designed to investigate the potentialities of a new specialty product for model rocketeers and hand-launch glider buffs that appeared on the market last month. The product, a pre-airfoiled styrofoam wing, is produced by DB Industries (Box 2835, Mansfield, Ohio 44906).

Foam plastic as a wing material is actually nothing new in aeromodelling; polyurethane foam wings have been available to model aviators for some years now, and Karl Feldman of the Pascack Valley (New Jersey) NAR Section has been investigating the application of styrofoam in boost/glide model rocketry for the last year or so. What is unique about the DB product is first, its pre-airfoiling (previously available only in large model aircraft wings), and second, its high-quality foam material. The only foam previously available to model rocketeers for building the relatively small wings of our boost/gliders was the kind that could be scavenged from such sources as supermarket meat trays and packing material. Such foam has a rather coarse bubble structure and a density of about one pound per cubic foot, and must be shaped completely by hand. The material DB uses to make their wings, however, has a density of three pounds per cubic foot. The increased density is due to a finer bubble structure which increases the strength and stiffness of the foam and also allows a smoother surface finish on the completed wing.

The DB wing material is offered in three sizes: 3-inch chord X 3/16-inch maximum thickness, 2½-inch chord X 1/8-inch thickness, and 2-inch chord X 3/32-inch thickness. To the aerodynamicist, this translates into thicknesses of 6.25% for the 3-inch chord, 5% for the 2½-inch chord, and 4.8% for the 2-inch chord. The airfoil type is thus different for each wing, and you should take



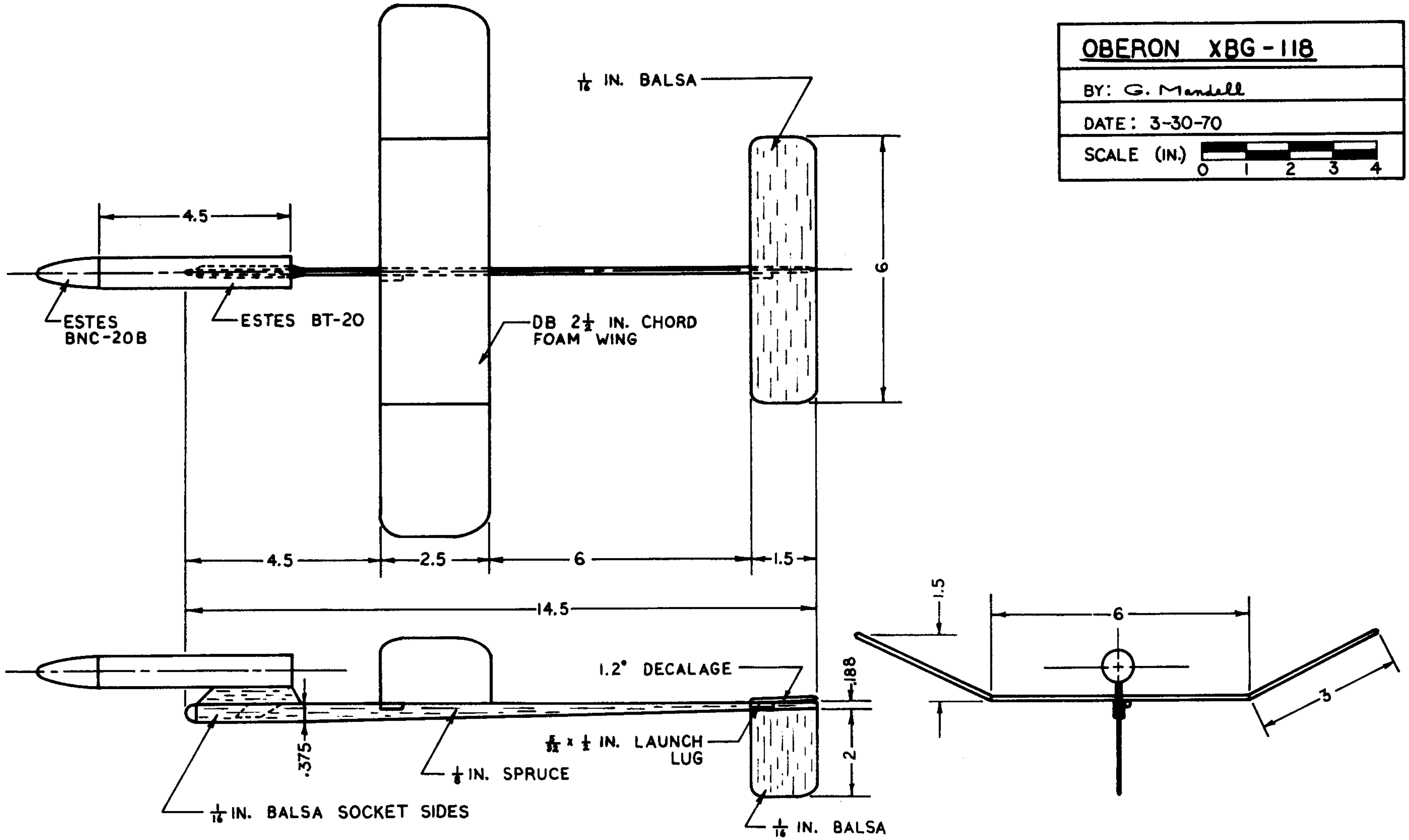
The Oberon XBG-118 pop-pod Sparrow B/G is shown above. The styrofoam wings are finely sanded but left unpainted to reduce overall weight. Note the aluminized tape at the wing chord to reduce heat damage to the styrofoam.

OBERON XBG-118

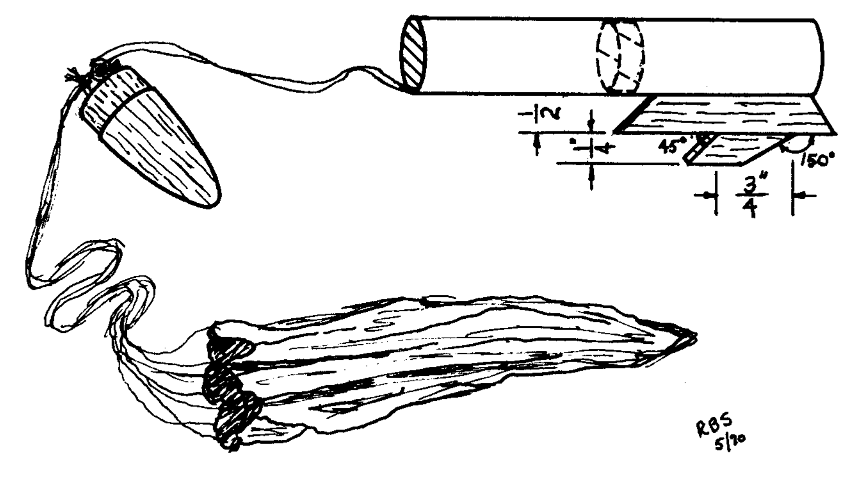
BY: G. Mandell

DATE: 3-30-70

SCALE (IN.) 0 1 2 3 4



POD DETAIL



this into account in deciding which wing to use for a particular glider. As you can see in the plan, I picked the 2½-inch wing for my test bird. I had no strong preference for it over the others; I just wanted a representative sample of the material. Having picked the wing chord, I designed the rest of the glider according to the rules for basic boost/glider design presented by Dr. Gerald M. Gregorek at the 1970 Pittsburgh Spring Convention. There isn't any strong disagreement between the proportions Dr. Gregorek recommends and those favored by most other advanced B/G fans, but I wanted a standardized design on which to base my comparison of the foam-winged glider with representative all-balsa birds. In case anybody wonders where the name came from, "Oberon" has been my code for B/G's since 1962, this is the 118th scheduled one I've made, and it's experimental.

It turns out that all DB wings are offered in 15-inch lengths, so there was no material shortage problem in making the 12-inch-span wing of my glider. The 118's aspect ratio turns out to be 4.8, which is about as high as I wanted to go with foam. Unless your bird is a biplane, in fact, I don't suggest you use the whole piece of foam for other than 3-inch chord wings. An aspect ratio of more than 5 could cause you some problems with foam, which doesn't have as much spanwise stiffness as balsa.

DB wings are produced from blocks of foam by cutting them with a heated wire bent to the shape of the desired airfoil. It is not possible to produce a foil with a perfectly rounded leading edge or a perfectly sharp trailing edge in this way, so you will have some final shaping to do before you can produce a finished glider wing from the raw stock. The pre-shaping certainly does save lots of work over scratch-building, though: I spent less than 1/4 the time on the 118's wing than I usually have to spend on a conventional balsa one. I also learned a few things about working with foam, which is subtly different from balsa in its properties and requires a bit of special handling.

First of all, you can't go at the stuff like it was hard fin stock. Medium Flexigrit takes it down *fast,* and if you aren't careful you'll sand off too much. Also, even though styrofoam's in-flight toughness is greater than that of balsa, it's bearing strength is less, so if you are too rough on it with sandpaper you will score the surface with abraded particles of foam. And the surface on which the foam rests while you work with it must be absolutely smooth; a typical rough-plywood worktable will dent it and reduce its aerodynamic efficiency. Another point that will become clear as you finish up the airfoiling is that the full work saving associated with the pre-shaping can only be realized if you use a constant-chord wing, as I did. The foil is designed for the chord-length in which the material is supplied, and must be modified at each spanwise station if a tapered wing is desired. Sorry, Virginia; there *isn't* any painless way to make Spitfire wings!

Although I finished up my foam wing with Flexigrit, there is another technique for doing this which may prove to be superior to the use of an abrasive. Karl Feldman uses an iron set on low heat to shape the airfoils on scratch-built styrofoam wings and reports that it is relatively easy to obtain a smooth, accurate foil section in this manner. An iron should work equally well on the foam of the DB wing; I would have tried the method out myself, had I one handy.

Styrofoam is dissolved by organic solvents such as acetone, so sanding sealer, dopes, and ordinary model aircraft cements like Ambroid, Testor's, Comet, and C-77 cannot be used on it. It isn't necessary to fill or paint DB foam in any way, though, since both as-received and fine-sanded surfaces have a rather good surface finish. Franklin Titebond aliphatic resin glue gave me very good results in making the tip-dihedral joints in the 118's wing, and also in joining the wing to the top of the spruce body stick – the same uniformly good results it gave me in assembling the rest of the model.

The wooden parts of the Oberon 118 should be sealed, however, to resist warping and smooth the surfaces. I gave all wooden parts on mine two coats of sanding sealer except on the small areas where they were subsequently Titebonded together – my standard compromise between smooth surfaces and light weight. In all other aspects, the 118 follows standard B/G construction. The strip-pod, shown in the detail drawing, is almost identical to the one on Bob Singer's Bumble Bee (December 1969 **MRm**), the only difference being that mine is a half-inch longer. The strip-pod, of course, must not be glued to the pod sheath; it should be free to be pulled off at ejection and in fact should fit so loosely that it almost (but not quite!) falls off when gantry-mounted firing clips are connected to the igniter. The 1.2-degree stabilizer decalage is obtained by placing a 1/32-inch shim under the stab's trailing edge. Watch that decalage! Too much and you'll get one big loop and . . . that's all, brother. The *wing* may survive, but the whole thing's not foam! I generally find that ordinary soda-straw launch lugs tend to suffer in B/G landings, so in the 118 I used the Competition Model Rockets parchment strip-lug material for the first time – and was quite favorably impressed. The tubing is strong, stiff, accurately round, and easy to cut and sand without shredding. To finish up the bird I added aluminized mylar tape to a one-inch expanse of the wing right over the wing-body joint in order to prevent the hot rocket exhaust from burning the foam. I painted the strip-pod black for appearance's sake, but avoided coloring the rest of the glider (except for required identification markings) so as not to add unnecessary weight.

So much for construction. How about flight characteristics? My completed Oberon 118 weighed in at 10.8 grams without the pod, including about 1.75 grams of lead nose weight glued under the forward end of the pod sheath. This represents a considerable weight saving over the typical American balsa-winged boost/glider and can probably be equalled only by the ultralight, soft-balsa-and-tissue construction used by the East Europeans. The bird has a slow, floating and stable glide of 10 to 15 feet per second and descends about 1 foot per second in still air. All-up weight at liftoff is 34.8 grams with the A5-2 engine for which the 118 was designed. With a wing area of just under 25 square inches, Oberon 118 is a Sparrow class glider. You might try it out in Hornet with a ½A6-2, but I don't recommend stuffing a B in the ship to try for Swift – you might run into wing deflection problems under flight loads. Scale the bird up for the 3-inch chord if you want to fly with B's or C's. Meanwhile, the present design should give you plenty of flying pleasure and maybe a contest place or two. We haven't any official times on the 118 yet, but it looks as if a properly trimmed flight article could turn in a 2- to 4-minute flight in Sparrow. In short, foam wings are definitely going to give balsa some strong competition in materials selection for B/G design.

FIG. 1

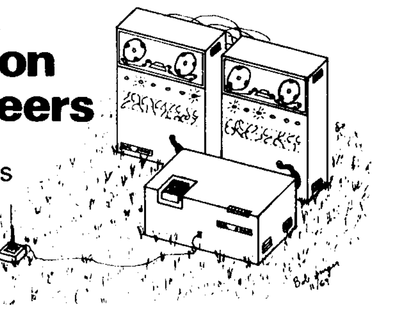
MULTI-STAGED PROGRAM FOR O/S USERS

(Use one card per line)

```
// JOB
// FOR
*LIST ALL
*IOCS(2501 READER)
*IOCS(1442 PUNCH)
*IOCS(TYPEWRITER)
*IOCS(KEYBOARD)
*IOCS(1403 PRINTER)
      REAL M,M2,M3,MB,MB2,MB3,K,K2,K3
      DIMENSION I123(8)
C     ALTITUDES FOR ONE, TWO, AND THREE STAGE
      ROCKETS
C     DIRECTORY
C
C     NUMBERS FOLLOWING VARIABLES IDENTIFY CORRE-
      SPONDING STAGE
C     WT = LIFTOFF WT OF STAGE + UNEXPENDED STAGES
C     BOWT = BURNOUT WT OF STAGE + UNEXPENDED
      STAGES
C     A = CROSS-SECTIONAL AREA OF ROCKET
C     CD = DRAG COEFFICIENT
C     D = DIAMETER OF ROCKET AT WIDEST PART OF
      STAGE
C     TB = BURN TIME OF STAGE
C     F = AVERAGE THRUST OF STAGE
C     MB = MASS OF STAGE AT BURNOUT
C     K = DRAG CONSTANT
C     M = MASS OF ROCKET
C     XB = BURNOUT ALTITUDE OF STAGE
C     VB = BURNOUT VELOCITY OF STAGE
C     X = PEAK ALTITUDE
C     TT = TOTAL TIME FROM LAUNCH TO APEX OF LAST
      STAGE
C
 38   READ(8,26)(I123(j),J=1,8),WT,BOWT,D,CD,TB,F,WT2,
     BOWT2,D2,CD2,TB2,F12,WT3,BOWT3,D3,CD3,TB3,F3
 26   FORMAT(8A4/6F11.5/6F11.5/6F11.5)
      M=WT/32.2
      M2=WT2/32.2
      M3=WT3/32.2
      MB=BOWT/32.2
      MB2=BOWT2/32.2
      MB3=BOWT3/32.2
      A=3.142*(.5*D)**2
      A2=3.142*(.5*D2)**2
      A3=3.142*(.5*D3)**2
      K=.000154*A*CD
      K2=.000154*A2*CD2
      K3=.000154*A3*CD3
      XB=(-MB+SQRT(MB**2+K*TB**2*(F-M*32.2)))/K
      VB=(TB*(F-(M*32.2)))/SQRT((MB**2)+(K*((TB**2)
     *(F-(M*32.2)))))
      HC=(MB/(2*K))*ALOG(((K*(VB**2))/(MB*32.2))+1)
      TC=SQRT(MB/(32.2*K))*ATAN((SQRT(K/MB*32.2))*VB)
      IF(K2) 95,98,97
 98   K2=0
      GO TO 96
 97   XB2=-(M2+K2*XB)+SQRT((M2+K2*XB)**2+2*K2*TB2
     *((M2*VB+K2*XB*VB)*(T1B2*(F2-M2*32.2))))/K2
      VB2=(M2*VB+K2*XB*VB+TB2*(F3-M2*32.2))/(M2+K2
     *XB+K2*XB2)
      HC2=(MB2/(2*K2))*ALOG((K2*(VB2**2))/(MB2*32.2))
     +1)
      TC2=SQRT(MB2/(32.2*K2))*ATAN((SQRT(K2/MB2*32.2))
     *VB2)
      IF(K3) 95,94,93
 94   K3=0
      GO TO 96
 93   XB3=-(M3+K3*XB2)+SQRT((M3+K3*XB2)**2+2*K3*
     TB3*((M3*VB2+K3*XB2*VB21)*(TB3*(F-M3*32.2))))/
     K3
      VB3=(M3*VB2+K3*XB2*VB2+TB3*(F2-M3*32.2))/(M3+K3*
     XB2+K3*XB3)
      HC3=(MB3/(2*K3))*ALOG(((K3*(VB**2))/(MB3*32.2))
     +1)
      TC3=SQRT(MB3/(32.2*K3))*ATAN((SQRT(K3/MB3*
     32.2))*VB3)
 96   TT=TB+TC
      TT2=TB+TB2+TC2
      TT3=TB+TB2+TB3+TC3
      X=HC+XB
      X2=HC2+XB2+XB
      X3=HC3+XB3+XB2+XB
      WRITE(5,36)(I123(J),J=1,8), XB,VB,HC,TC,TT,X,XB2,VB2,
     HC2,TC2,TT2,1X2,XB3,VB3,HC3,TC3,TT3,X3,CD
 36   FORMAT('NAME/',8A4/'ALTITUDE',5X,'B.O. ALT',3X,
     'B.O. VEL',3X,
     1'COAST HT',3X,'COAST TIME',3X,'TOTAL TIME',3X,
     'TOTAL ALT'/'FIRST
     2STAGE',5X,F7.1,3X,F7.1,3X,F7.1,6X,F5.2,6X,F5.2,
     5X,F7.1/'SECOND S
     3STAGE,'5X,F7.1,3X,F7.1,3X,F7.1,6X,F5.2,6X,F5.2,
     5X,F7.1/' THIRD ST
     4AGE', 5X,F7.1,3X,F7.1,3X,F7.1,6X,F5.2,6X,F5.2,5X,
     F7.1/' CD=',F5.53/)
      GO TO 38
 95   CALL EXIT
      END

// XEQ
PENETRATOR FSI F-100-0,F-100-8
      7.99        6.22        1.15        .75         .500        361.6
      4.89        3.15        1.15        .75         .500        361.6
```

Automatic Computation for Rocketeers



by Charles Andres

This month's program is one which follows February's as another for computing altitudes. However, it has been expanded to take into account rockets with up to three stages. The main difference is in the equations which determine second and third stage burnout velocities and altitudes. These were taken from the equations published by George Caporaso in the April 1969 column of *Technical Notes.*

As I mentioned in March, I have presented two versions of the program for clarity so that both RAX and O/S users can see the minor differences needed to be made in their programs. In order to do this, I have sacrificed the space used for a flowchart from this issue so that both programs could be shown. The flowchart, if printed, would closely resemble that printed in the December issue, with 'if' statements separating each stage's equations. In this program, the 'if' statements make sure that if there is no second or third stage, the computer will not divide by zero since there are no variables for stages not present.

To summarize the main differences in the programs in figures 1 and 2, I have listed them below:

(a) In the read and write statements, O/S readers should write READ (8,26) and WRITE (5,36), the first number being changed from 5 and 6 under RAX to 8 and 5 respectively.

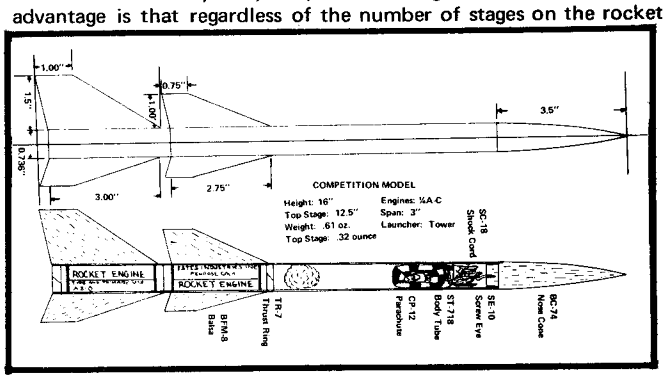
(b) Always leave column 1 empty on all O/S programs. Begin statement numbers in column 2 and end them by column 5. They cannot extend into column 6 which is reserved for the continuation code.

(c) O/S starts on line 7 and RAX now begins on line 10.

(d) Since Column 1 is empty, plan for this in the format statement which prints out data. Leave a space for every column 1. (Column 1 can only be used for direct computer commands.)

In the multi-stage program, all of the coast altitudes are figured to be relevant only for the last stage on the model being analyzed. Thus, if one is analysing a two stage rocket, the coast altitude for the first stage is equal to the peak altitude of both the booster and sustainer vehicle in the event that the second stage engine did not fire. If the second stage ignites instantly as assumed by these equations, then top altitude for the first stage will be equal to its burnout altitude. Due to the delay in staging which certainly can throw off all of the calculations, the program has a limited accuracy. However, this should be able to predict a rocket's maximum possible altitude if it is launched perfectly.

As explained before, this program can find approximate theoretical altitudes for any one, two, or three stage rocket. The only disadvantage is that regardless of the number of stages on the rocket



being analysed, the format statement will print out the entire list of variables being solved for. This takes a little more time when RAX users are analysing one and two stage rockets, but O/S users will find the extra microsecond required to type out two more lines of data will be negligible. For RAX users, it is easier to analyse single stage rockets under a separate program such as the one shown in February.

The test design illustrated here is a smaller version of a rocket I designed to fly with two F engines. The larger version has been tracked to over 6300 feet. The smaller should be a good competitor in most NAR contests. Data on both versions of this rocket is shown as it was computed for these programs.

I have found that two stage rockets carrying as much power as a single staged model of identical weight usually reach a much higher altitude. I had at least one staged model using ¼A engines reaching altitudes close to that normally reached by A engines. Even the **Handbook of Model Rocketry** seems to indicate that nearly all two staged models will outperform a similarly powered single staged model. Referring to Peter Wysgalla's conclusions in his article (MRm, May 1969) on *Staging vs. Cluster,* he found that a smaller diameter staged rocket would climb higher than a clustered rocket requiring a larger body diameter. Clusters win out when the rocket weight is over five ounces, but staged models fly farther when they are under this weight. Wysagalla's graph also shows that the more powerful engines reached a higher level of performance when staged rather than clustered.

Thus, if two and three staged models reach higher altitudes, why don't we see more staged models at NAR meets? The answer is probably due to the disadvantages of staged models. They are more complicated since they require two tail sections and a joint. They are more expensive to run since two ½A's cost more than one B. Second stage ignition is not guaranteed. The action of staging can be sufficiently violent enough to keep a rocket with poor dynamic stability from regaining a vertical flight path. A recovery system is required for the lower stage. However, a careful builder could eliminate nearly every one of these disadvantages. A little more work spent on the drawing board and in calculating stability would yield a rocket which could possess good dynamic and static stability in both stages. The expense is not as great as it may seem. If the engines are fastened one on top of the other, there is no reason why an airstart should not take place. I have never had a sustainer fail when the two engines were taped together before launch. A recovery system for the booster stage is no problem either. Glide and tumble recovery is allowed under the Pink Book Rules and Regulations, and since booster fins are fairly large anyway, it does not take a great deal of ingenuity to make sure it will tumble when ejected. Thus, with a little more time, staged models may become as popular again as they were at other times during the history of model rocketry. So give your new contest bird a booster stage and analyze it with this program to see if it doesn't outperform a similarly powered single staged model – at least theoretically.

One of the drawbacks of the programs presented in the last three installments on altitude is that all values are set at the beginning of flight and burnout, with only final values being computed. One of the great advantages of computer calculations is that 100 calculations can be made as easily as one, the time element being completely dependent on the time it takes to type in and print out the data. I am now working on programs which will be able to change all of the variables as much or as little as a rocketeer might desire so as to analyze rocket flight more closely, and to discover the result of changing one variable a known amount. This type of program would then give a flight history of the rocket, with computer data being available for every increment of flight down to perhaps 1/1000 of a second. We know that during burning, thrust is not constant but varies with the time thrust curve given by the manufacturers. Weight is not constant either, since the burning propellant is constantly being ejected from the rocket. The drag coefficient can vary as well, especially when very high velocities are approached. Thus, a program which gives a flight history with respect to a group of constantly changing variables, would be extremely useful to those rocketeers who want to seriously analyze rocket flight. This type of a program would perform operations similar to those in calculus, and would probably add to the accuracy of the altitude predictions now being made. This will be thoroughly discussed in some of the forthcoming articles.

FIG. 2

MULTI-STAGED PROGRAM FOR RAX USERS

(Comment statements appearing Fig. 2 can be typed into this program between /job go and Dimension)

```
/JOB GO
              DIMENSION I123(8)
              REAL M,M2,M3,MB,MB2,MB3,K,K2,K3
38            READ(5,26)(I123(J),J=1,8),WT,BOWT,D,CD,TB,F,
             WT2,BOWT2,D2,CD2
        1     TB2,F2,WT3,BOWT3,D3,CD3,TB3,F3
26            FORMAT(8A4/6F11.5/6F11.5/6F11.5)
              M=WT/32.2
              M2=WT2/32.2
              M3=WT3/32.2
              MB=BOWT/32.2
              MB2=BOWT2/32.2
              MB3=BOWT3/32.2
              A=3.142*(.5*D)**2
              A2=3.142*(.5*D2)**2
              A3=3.142*(.5*D3)**2
              K=.000154*A*CD
              K2=.000154*A2*CD2
              K3=.000154*A3*CD3
              XB=(-MB+SQRT(MB**2+K*TB**2*(F-M*32.2))))
             /K
              VB=(TB*(F-(M*32.2)))/SQRT((MB**2)+(K*((TB**
             2)*(F-(M*32.2)))))
              HC=(MB/2*K)*ALOG(((K*(VB**2))/(MB*32.2))+1)
              TC=SQRT(MB/(32.2*K))*ATAN((SQRT(K/MB*32.2))
             *VB)
              IF(K2) 95,98,97
98            K2=0
              GO TO 96
97            XB2A=(M2+K2(XB)
              XB2B=(M2*VB+K2*XB*VB)*(TB2*(F2-M2*
             32.2))
              XB2=-(XB2A)+SQRT((XB2A)**2+2*K2*TB2*
             (XB2B))/K2
              VB2=(M2*VB+K2*XB*VB+TB2*(F2-M2*32.2))/
             (M2+K2*XB+K2*XB2)
              HC2=(MB2/(2*K2))*ALOG(((K2*(VB2**2))/MB2*
             32.2))+1)
              TC2=SQRT(MB2/(32.2*K2))*ATAN((SQRT(K2/MB2
             *32.2))*VB2)
              IF(K3)95,94,93
94            K3=0
              GO TO 96
93            XB3A=(M3+K3*XB2)
              XB3B=(M3*VB2+K3*XB2*VB2)*(TB3*(F3-M3*
             32.2))
              XB3=-(XB3A)+SQRT((XB3A)**2+2*K3*TB3*
             (XB3B))/K3
              VB3=(M3*VB2+K3*XB2*VB2+TB3*(F3-M3*32.2))/
             (M3+K3*XB2+K3*XB3)
              TC3=SQRT(MB3)/(32.2*K3))*ATAN((SQRT(K3/
             MB3*32.2))*VB3)
              TT=TB+TC
              TT2=TB+TB2+TC2
              TT3=TB+TB2+TB3+TC3
              X=HC+XB
              X2=HC2+XB2+XB
              X3=HC3+XB3+XB2+Xb
              WRITE(6,36)(I123(J),J=1,8),XB,VB,HC,TC,TT,X,
             XB2,VB2,HC2,TC2,
        1     TT2,X2,XB3,VB3,HC3,TC3,TT3,X3,CD
36            FORMAT('NAME/',8A4/'ALTITUDE',5X,'B.O.
             ALT.',3X,'B.O. VEL.',3X
        1     ,'COAST HT',3X,'COAST TIME',3X,'TOTAL TIME',
              3X,'TOTAL ALT'/'FI
        2     RST STAGE',5X,F7.1,3X,F7.1,3X,F7.1,6X,F5.2,
              6X,F5.2,5X,F7.1/'SE
        3     COND STAGE',4X,F7.1,3X,F7.1,3X,F7.1,6X,
              F5.2,6X,F5.2,5X,F7.1/'T
        4     HIRD STAGE',4X,F7.1,3X,F7.1,3X,F7.1,6X,F5.2,
              6X,F5.2,5X,F7.1/'C
        5     D=',F5.3/)
              GO TO 38
95            STOP 7734
              END
/DATA
PENETRATOR FSI (2) F 100-0, F 100-8
      10.7      8.85      1.15      .75      .500      361.6
      7.99      6.22      1.15      .75      .500      361.6
(A row of zeros can be left blank.)
VITESSE I A 8-0, A 8-4
      1.690     1.544     .736      .75      .42       28.76
      .950      .803      .736      .75      .42       28.76

VITESSE I 1/2A 6-0, 1/2A 6-4
      1.517     1.462     .736      .75      .20       21.57
      .821      .765      .736      .75      .20       21.57

VITESSE I B 6-0, B 6-6
      1.977     1.658     .736      .75      1.20      14.38
      1.160     .941      .736      .75      1.20      14.38

/END RUN
```

SEE AUGUST 1970 MODEL ROCKETRY FOR DRAG COEFFICIENT AND CENTER OF GRAVITY PROGRAMS.

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

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

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NARAM-12

SITE CHANGED

The site of the Twelfth National Model Rocket Championships has been moved from the Astroworld in Houston to the NASA Manned Spacecraft Center. The change, announced by NAR Contest Board Chairman Richard Sipes, is due to financial and spacial limitations. The nationals will now be flown from a much larger launching field than had been available at the Astroworld complex. A special tour of MSC for NARAM-12 contestants will also be provided. NARAM-12 Contest Coordinator, Forrest McDowell, is presently making arrangements for housing of contestants, range support, and other details and will be reporting this information in next month's issue. The following events will be flown at NARAM-12:

Class 1 Parachute Duration
Design Efficiency
Sparrow Boost/Glide
Scale
Swift Boost/Glide
Space Systems
Egg Lofting
Open Spot Landing
Research and Development

The entry fee will be $1.00 per event and a minimum of six events must be entered by all contestants.

Anyone interested in attending NARAM-12 should send a postcard requesting an application to the Contest Board, c/o Richard Sipes, 5012 60th Ave., Bladensburg, Md. 20710 by June 1, 1970. Please include your name, address (with Zip code), and NAR number.

A NARAM-12 application package will be sent to you as soon as your card is received. The application must be returned with all fees by July 6th, 1970 at the latest.

You will be notified shortly thereafter if you are accepted. If, for any reason, you have not been accepted all fees will be returned to you with the notification.

FAI CERTIFIES FIRST WORLD RECORDS

The first international model rocket performance records were certified by the Federation Aeronautique Internationale. The announcement was made on February 25, 1970 by Charles E. Hennecart, Director General of the FAI. The three records listed below have been certified and registered in the official list of FAI records:

PARACHUTE DURATION, 209 seconds, Jess S. Medina at Colorado Springs, Colorado on 15 August 1969.

SWIFT CLASS BOOST/GLIDER DURATION, 230 seconds, Robert Bruce Dunbar at New Canaan, Connecticut on 22 June 1969.

SPARROW CLASS BOOST/GLIDER DURATION, 120 seconds, Eleanor Anne Stine at Colorado Springs, Colorado on 14 August 1969.

G. Harry Stine, Chairman of the NAR Records Subcommittee, termed the acceptance of these records "a historic milestone." He went on to say, "These are the very first World Class Records for Model Rockets homologated by the FAI and they were set in the good old USA! Let us hope that USA modellers can keep them here."

LAC NEWSLETTER AWARD

The announcement of the LAC Newsletter Award printed last month is open to incorrect interpretation. Each section wishing to enter the competition must send one copy of *each issue published after NARAM-11* to the LAC. Entries should be addressed to:

Elaine Sadowski
1824 Wharton Street
Pittsburgh, Pa. 15203

the award will be presented at NARAM-12.

MODEL ROCKET CODE IN OREGON

by William D. Boggs
NAR State Department Head, Oregon

Reference is made to the feature in the January 1970 issue of **The Model Rocketeer** in which it stated "few details are available about a model rocket code in Oregon."

The Oregon code requires that an adult have a state model rocket permit to purchase engines and to launch model rockets. This adult can add names of mindrs to his permit, but is responsible for model rocket safety for such minors and must be present when they launch. There is no charge involved, and permit applications are available from the Office of the State Fire Marshall, local fire marshalls, hobby dealers, and NAR senior members. In the case of model rocket clubs, the senior advisor can add club members to his permit for club launches and engine purchase. The permit is valid for six months, with a new application necessary at the end of that period.

The permit is under the jurisdiction of the State Fire Marshall, and is for model rocketry. It encompasses the **Code for Model Rocketry** published by the National Fire Protection Association.

A duplicate permit is given the applicant to file with his local hobby dealer. In the case of clubs, members added are also filed with the hobby dealer. The dealer sells engines only to those with valid permits.

We feel this is a very workable requirement, and is in the best interests of model rocketry. NAR members have been on TV and radio to make the hobby and state requirements known. We enjoy a close working relationship with the Office of the State Fire Marshall and local fire marshalls, and are tentatively slated to present a program at the 1971 state fire marshalls convention.

Model rocketry is thriving in Oregon and has the understanding of the civic officers mentioned.

NAR Financial Report-1969

The folowing NAR Financial Statement was prepared for *The Model Rocketeer* by NAR Treasurer, William Rich.

Balance, January 1, 1969		$ 8,650.66	
INCOME			
Memberships –			
Individual	$20,273.23		
Section	325.00	$20,598.23	
Received for NARTS (orders)		100.80	
Sales for supplies & membership lists		82.25	
Insurance certificates (sections)		69.50	
Overpayment – membership dues		499.00	
Postage paid by members	8.55	21,385.33	
			30,035.99
EXPENDITURES			
Administrative Services Contract:			
AMA	$ 5,625.00		
Mrs. Ward	1,250.00	$ 6,875.00	
Insurance Premium (member insurance)		1,800.00	
Magazine			
American Modeler	2,765.85		
Model Rocketry	3,024.64		
Mag. Postage –			
American Modeler	392.45		
Model Rocketry	240.31		
Editorial Expense	187.09	6,610.34	
Office Supplies & expense		1,529.44	
Printing		2,368.33	
Officer's expense		230.30	
Committee expense		173.60	
Ley funeral		53.65	
NARAM-11		913.89	
Refunds to members (overpayments)		286.90	
NARTS		104.45	20,945.90
Balance – December 31, 1969			$ 9,090.09

STANDARDS AND TESTING COMMITTEE

The Standards and Testing Committee has issued a Safety and Contest Certificate for the Flight Systems, Incorporated D6-0, D6-6, and D6-8. Please place these additions in the list of Contest Certified engines published in the February issue.

Editor's Nook

This issue of *The Model Rocketeer* is being completed while attending the MIT Model Rocketry Convention. At the convention I have had the chance to talk with many NAR members and have received several interesting comments on the magazine. Most are satisfied with the content but some have valid criticism about the format. We are still experimenting with different column width and stylistic variations to make the newsletter more attractive.

Richard Sipes, NAR Contest Board Chairman, reports that revision of the "pink book" has proved to be a more formidable task than was first expected. It is likely that a provisional pink book supplement will be issued for use during the 1970-1971 contest year to test the popularity and practicality of new events and rule changes. During that contest year, a complete revision will be written on the basis of reactions to the provisional rule book. New events being tested include streamer duration and some form of semi-scale competition.

The Leader Administrative Council held meetings at both the Pittsburgh and MIT Conventions. Minutes of these meetings will be published in the next issue. The July issue will also include a LAC Election Ballot and resumes of the LAC candidates. All NAR Leader and Senior members are urged to vote in this election. The LAC has discussed possible changes in the present NAR Technical Services. A report was generated from comments by selected NAR members and officers. In general, the majority of people questioned proposed that the present technical reports be expanded and updated, that the non-scale rocket plans be withdrawn from sale, that the scale plans be improved for use as substantiation in NAR competition, that engine data reports be issued, and that the "Operations and Procedures" materials be rewritten. Topics for several new reports were suggested and binders for reports were recommended.

Many NAR members and rocketeers are discontent with some of the services, programs, and policies of the NAR. Realistically speaking, the NAR has problems, makes mistakes, and exhibits other human symptoms. If you don't like something that the NAR does what should you do about it? Quit the NAR? Sulk? Write nasty editorials in your club newsletter? None of these actions remedy the problem, if there is one. If you wish to criticize the NAR or make constructive suggestions you can simple write to NAR HQ, one of the Trustees or Committee Chairmen, or the LAC and air or words. They will be read and discussed and perhaps acted upon by the appropriate people. The best way to improve the NAR is to become actively involved in activities such as LAC or committees and try to make changes in places where they are nee?ed. Your opinion does count.

Pascack Valley: Profile of a Districted Section

by Bob Mullane

I belong to a rocket club that has fewer than ten members and has all the advantages of a club that size: the members all know each other well, they are close to the meeting hall and the launch site, they can hold demonstrations, and do many other things best handled by a small, local club. I also am a member of a NAR section with more than sixty members and many advantages of a NAR section that size: it has NAR section insurance; it can hold rocketry classes, sanctioned meets, seminars, conventions; it can publish a good looking newsletter, and can do many more things that only a large section can handle. And . . . Oh, yes, they're both the same club. How is that possible? I belong to the Pascack Valley NAR Section, a club made up of six separate small clubs.

The concept of a district (the local, small club) which is part of a larger section was originated by former PVS president Lindsay Audin several years ago and was updated by Karl Feldmann and Bob Mullane a little more than a year ago. They contacted all the rocket clubs that they knew of in New Jersey at that time and the final result was the joining together of four clubs as a NAR section which would assume the name Pascack Valley from the section that originated the idea. Since then, two more clubs have joined the section as districts.

The section is set up to give each district as much freedom as possible to do as it pleases on a local level. Each district must have at least one senior member, but aside from that there is no restriction on the membership of a district. When joining the section, a member may join whichever district he desires; the decision is usually based on geographical considerations. The member may attend the activities of any district but he may vote only in his home district (where he must also pay his dues). The districts plan meetings and other activities for themselves and carry them out on their own. Each district has its own meeting and launch sites and its own range equipment.

The section is governed by an executive board which is made up of the president of each district (the members of each district annually elect a president and secretary of the district). The Executive Board elects from among themselves the section officers each year. This year's officers are: President, Bob Mullane; Vice President, Mark Wargo; and Secretary, Skip Conrad. The Executive Board sets section policy such as section dues and the appropriation of money to section projects and activities and arranges section activities such as meets and section meetings, which include films, slide shows, presentation of R&D papers, and many other activities. The section publishes a newsletter, *IMPULSE*, which includes news from the various districts, news about the section as a whole, NAR news, R&D reports, cartoons, and photographs. This reporter is editor of *IMPULSE* and gives a tip of the hat to Tina Feldmann for being the only member of the staff; she must type, draw, write, proofread, etc., etc. That's the secret of success for any editor: get a slave to do all the work, and your section will have a good newsletter. The section treasurer is a senior member (not a member of the Executive Board) who is elected by the Executive Board.

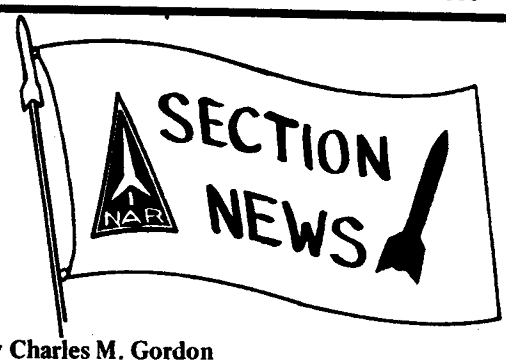
That is the basic operational outline of Pascack Valley. Now, what does it all mean? It basically means that a member of a club like PVS can belong to a small local club in which he knows all the members, is close to club activities, and has a great amount of influence in club affairs. At the same time, this member has the advantages, influence, and activities of a large NAR section available to him.

How do you go about forming such a section? If you are already part of a section or club and know of several other clubs in your area, the job is easy, draw up a proposed set of By-laws and call the heads of the clubs together to discuss the proposal. You will probably find, as we did, that all the clubs (if they are small) have similar problems; difficulty in keeping members, inability to get good meeting and launch sites, difficulty in becoming (or remaining) a NAR section, and many more. The clubs will probably be eager to join in such a venture. If you don't know of any other clubs in the area, write to the editor of *The Model Rocketeer* or the Club News section of **Model Rocketry** and they'll run an announcement for you asking any clubs in the area to contact you (you'll probably find, as we did, that there are more clubs in your area than you realize). Then the process is the same as if you already knew about the clubs. If you have any questions or problems, feel free to contact me or any other member of the Leader Administrative Council for advice or assistance in setting up such a section. Good luck, and let us know if you get such a club going.

TOP POINT STANDINGS

The following list of the top five point holders in each age category and top five NAR sections in the US was provided by the Contest Board. All totals are correct as of March 1, 1970.

Senior Division	NAR Section	Points	Meet Factors Used
1. Forest McDowell #12687,	Apollo-NASA	471	3
2. Maurice Stubblefield #PEND	Apollo-NASA	339	3
3. Shirley Lindgren #13685	Pascack Valley	291	3
4. Bernard Rusell #5765	Apollo-NASA	286	2
5. Kenneth Lyon #14005	MARS	237	4
Leader Division			
1. Mark Evans #9484	Apollo-NASA	516	3
2. Mark McGaffey #11413	Apollo-NASA	319	3
3. Chris Williams #13101	North Shore	306	3
4. Bob Deleon #15469	Apollo-NASA	289	3
5. George Pantalos #10620	CSAR	199	3
Junior Division			
1. John Albert #12068	Apollo-NASA	349	3
2. Carl Guernsey #9925	NARCAS	303	5
3. Gary Lindgren #10678	Pascack Valley	252	3
4. Craig Streete #11943	CSAR	230	3
5. Barry Friedrichs #12554	Apollo-NASA	220	3
Team Division			
1. Brewer Team #5335, 6268	SSB	198	3
2. Meerdter Team #6198, 11426	SSB	156	3
3. Sipes Team #11544, 11760	MARS	128	4
4. Barrowman Team #6383, 7489	NARHAMS	126	3
5. Ball-Hagedorn #9838, 11691	Mansfield	82	2
Section Standings			
1. Apollo-NASA		4005	3
2. Pascack Valley		1737	3
3. MARS	1626	1626	4
4. CSAR		1336	3
5. YMCA Space Pioneers		1006	2



By Charles M. Gordon

The National Association of Rocketry welcomes the following new sections to the organization. These sections were chartered since the last section roster was compiled.

MODEL ROCKETEERS OF LODI NEW JERSEY
James Sedita
59 Mitchell Street
Lodi, New Jersey 07644

MODEL ROCKETRY CLUB OF WHEELING
James Lovins
900 So. Elmhurst Road
Whelling, Illinois 60090

AEROSPACE RESEARCH NORTHWESTERN PENNSYLVANIA
P.O. Box 50
Meadville, Pennsylvania 16335

POLARIS SECTION
Scott Newton
2270 Tulsa Avenue
Clairmont, California 91711

* * * * * * *

The Wheaton (Maryland) Rocket Association Section has made provisions for a radio equipped recovery ground crew to be used at all launches to prevent loss of models in high folliage. At a launch in March, only two rockets out of the over one hundred models launched were lost, despite the 15 mph winds.

* * * * * * *

The Southland NAR Section (Los Angeles, California) plans to publish a small booklet intended for new rocketeers in the Section. Its purpose will be to provide rocketeers with helpful information which is not usually found in common sources such as the "Handbook of Model Rocketry", technical reports, and magazine articles. The information will come primarily from more experienced modelers in the section.

* * * * * * *

Congratulations to the TIROS Sections (Crystal Lake, Illinois) for coming out with the first edition of *Vector Forces*, the official section newsletter. Good luck with it and keep printing.

Reported in the first issue was a short report on an R&D project by two section members, G. Adler & G. Kensgaard. The report was titled "The Launching of an Astron Streak From Underwater" and that is just what they did.

It is wondered that, if the next time a Polaris missile is entered in space systems, and underwater launch facility will also have to be provided. Good swimming, judges.

* * * * * * *

In spite of 24° temperatures and falling snow, the Annapolis (Maryland) Association of Rocketry Section held one of its regular practice launches in February. Just another reminder that "Neither snow, nor. . . ." shall stop the relentless rocketeer.

* * * * * * *

During this past winter, members of the Three-Rivers Section (Pittsburgh, Pennsylvania) were busy setting up computer programs for calculating the center of pressure and predicted altitudes for model rockets. Members of the section now have the opportunity to send all relevant data on their model in and receive the computer's answer back, an extremely useful idea in testing new rocket designs.

* * * * * * *

On March 28, the Arevalos Rocket Association (Fountain Valley, California) held a demonstration launch before public officials and teachers of Huntington Beach in an effort to obtain a new launch site. The Arevalos section also held a two-week model rocket exhibit at the Huntington Beach Public Library to help gain new members and introduce the public to our hobby.

* * * * * * *

ATTENTION ALL SECTION NEWS CONTRIBUTORS

Between June 25 and August 15, the NAR Section News Editor will be a counselor at a summer camp in Pennsylvania. All Section News material submitted between these dates ONLY should be mailed to:

Charles Gordon
c/o Camp B'NAI B'RITH
Starlight, Pennsylvania 18461

Any news mailed to Charles' home address will be forwarded to him each week. Please be sure to recommence sending Section News to Charles' regular address after August 15.

Range Meet Symposium

The following outline was produced at the WAMARVA Range Meet Symposium held at Goddard Space Flight Center on February 21, 1970. The outline can be used as a guide in organizing section range meets and competitions. Any suggestions for additions to the outline are welcome.

I. Preliminary Planning
  A. Sanction
    1. Send to Contest Director with fee
    2. Information needed — sample Application
  B. Legal Considerations of site selection
    1. Permission from owners
    2. Size
    3. Checked by fire marshall (if not federal property)
  C. Public Relations
    1. Newspapers — Hometown and nearest big-city.
    2. Radio and TV
    3. Flyers
  D. Organization
    1. Applications
      a. Include full information
      b. Limit number that can be handled comfortably.
    2. Registration
      a. Early — in order to make data cards
      b. Forms completely filled in
        1). Name, section, division, date
        2). Applicant's signature and parent's approval
    3. Data Cards
      a. Must be filled in before meet
      b. Have supplementary cards — viz. quadrathon
    4. Awards
      a. Ribbons, trophies, kits?
      b. Number of events
      c. Number of divisions
    5. Judges
      a. Kinds needed — scale, timing events, etc.
      b. Number needed — not too much doubling up.
  E. Transportation
    1. To and from motel — from point of arrival.
    2. To and from motel and meet grounds.

II. Housing
  A. Motels.
    1. Contact motels in area.
      a. Get rates.
      b. Check capacity of motel or motels.
    2. Make up reservations forms.
      a. Number of nights.
      b. Rate per night.
      c. Per Number in room.
    3. Set date for final reservations to be in and amount of deposit and/or entire amount.
    4. Mail forms to contestants or prospective contestants.
    5. Collect data.
    6. Send to motel before motel's deadline date.
    7. Set rules of conduct — monitor behavior.
  B. Banquet
    1. Contact restaurants in area.
      a. Check prices.
      b. Check capacity.
    2. Make up reservation forms.
      a. Kinds of dinners.
      b. Prices of dinners.
    3. Set date for final reservation (including money).
    4. Mail to contestants or prospective contestants.
    5. Collect data
    6. Sent to restaurant before restaurant's deadline date.
  C. Special Events
    1. Plan program — Saturday night — no more than one hour.
      a. Speaker
      b. Movies
      c. Slides
    2. Find available space for program — also equipment.
    3. Tours — find what is available in your area.
    4. Think you letters to
      a. Motel people. (check that all is well)
      b. Restaurant people.
      c. Any other support people.

III. Records
  A. How.
  B. Where.
  C. When.

IV. Equipment.
  A. Range.
    1. Launchers.
    2. Rope, Stakes.
    3. Shelter — Tent, etc.
    4. Public-Address System.
  B. Range Support.
    1. Tables, chairs.
    2. Judges and judging areas.
    3. Tracking.
      a. Trackers.
      b. Computer print-outs.
    4. Event support
      a. Tape Measures.
      b. Rulers.
      c. Stop Watches.
      d. Shelter.
      e. Pink Book.
    5. Latrines and Handwashing.
    6. Food Provisions.
    7. Range Store.
    8. Flag, Flag Pole and/or poles.

V. Range.
  A. Site.
    1. Size.
    2. Terrain.
  B. Site Set-up.
    1. Data Center.
    2. Data Reduction Center.
    3. Work Tables.
    4. Launch Complex.
    5. Trackers.
  C. Crowd Control.
    1. Ropes.
    2. Monitors.
  D. Maintenance.
    1. Monitors.
    2. Self-discipline.

VI. Tracking.
  A. Optimum Set-up.
    1. Base Line.
      a. 300 meters.
      b. south of launcher.
    2. Direction — East-West.
    3. Trackers.
      a. Same height above sea level.
      b. In sight of each other.
      c. In sight of launch complex.
  B. Calibrating the scopes.
    1. Original calibration.
    2. Occasional checks during event.
  C. Care of Scopes.
    1. DO NOT LEAN ON SCOPES.
    2. DO NOT KICK SCOPES.
    3. Calibrate frequently.
  D. Communications.
    1. Hard lines.
    2. Disadvantages of walkie-talkies.
  E. Competent people.
    1. Trained people.
      a. Operating scopes.
      b. Recording data.
      c. Reducing data.
    2. Sturdy people. (Neither wind nor rain, sleet nor snow, etc.)
    3. Interested people.

VII. Data.
  A. Cards.
    1. Where to get.
    2. How to fill out.
  B. Data Reduction.
    1. Need for competent people.
    2. Use of computerized books.
    3. Check and double check all calculations including simple additions and subtractions.
  C. Data Recording.
    1. Need for accuracy — double check.
    2. Type of papers.
      a. Scale sheets, etc.
      b. Final data to be mailed to National Contest Director.

VIII. Check in.
  A. Safety Checking.
    1. What is it[1]
    2. Why is it done[1]
    3. Who may safety check a rocket[1]
    4. How may a rocket be disqualified for safety purposes[1]
  B. Rail Assigning
    1. What does run, rail, and rack mean[1]
    2. Why is rail assignment so important[1]
  C. Return.
    1. Why must the rocket be returned[1]
    2. To whom is the rocket returned[1]

IX. Launch.
  A. Firing Officer.
    1. Need for get up and go; keep things going, no dilly-dallying.
    2. Familiar with launch procedures.
  B. Range Safety Officer. (See pink book)
    1. In area at all times.
    2. Is final authority over all other officials at meet.
  C. Smooth Launching Procedures.
    1. Smooth check-in procedure.
      a. Number of check in points in ratio to number of entries.
      b. Run, rack, rail assignment.
    2. People.
      a. Competent.
      b. Sufficient number.
    3. Good overall directions.

Join the.............

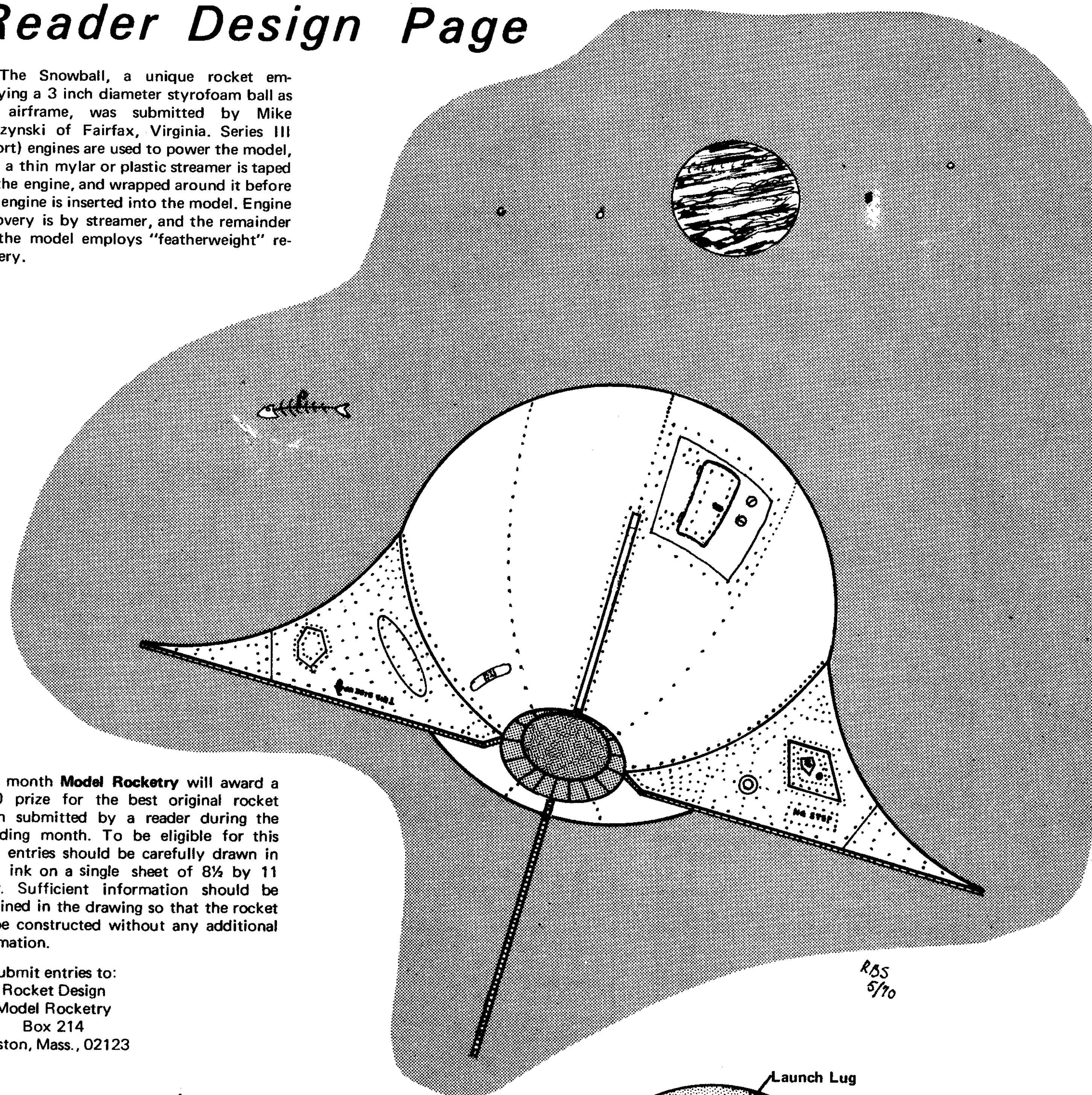
National Association of Rocketry

1239 VERMONT AVE. N.W.
WASHINGTON, D.C. 20005

NAR

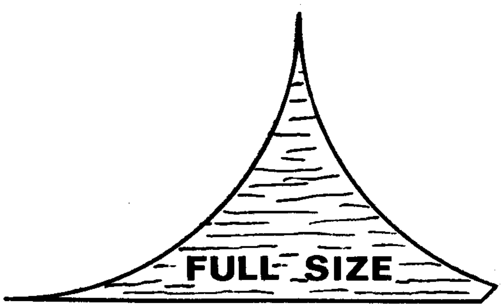
Reader Design Page

The Snowball, a unique rocket employing a 3 inch diameter styrofoam ball as an airframe, was submitted by Mike Burzynski of Fairfax, Virginia. Series III (short) engines are used to power the model, and a thin mylar or plastic streamer is taped to the engine, and wrapped around it before the engine is inserted into the model. Engine recovery is by streamer, and the remainder of the model employs "featherweight" recovery.

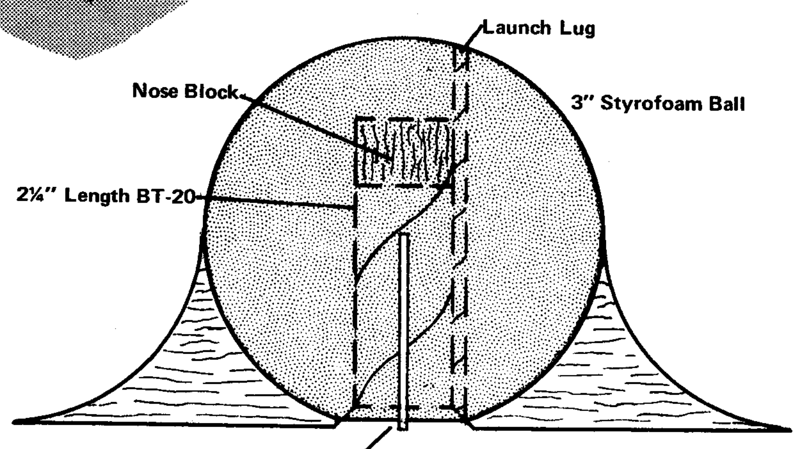


Each month **Model Rocketry** will award a $5.00 prize for the best original rocket design submitted by a reader during the preceding month. To be eligible for this prize, entries should be carefully drawn in black ink on a single sheet of 8½ by 11 paper. Sufficient information should be contained in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

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



Four Fins, 1/16" thick



DEALER DIRECTORY

Hobby shops desiring a listing in the **Model Rocketry** Dealer Directory should direct their inquiries to Dealer Directory, Model Rocketry magazine, Box 214, Boston, MA 02123. Space is available only on a six month contract for $18.00, or a twelve month contract for $35.00, payable in advance.

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

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

CONNECTICUT – Bridgeport
Model Rocketry & Radio Control
is are only business
FRED'S VARIETY
184 Success Avenue

ILLINOIS – Chicago
M&G HOBBY SHOP
3443 North Pulaski Road
Chicago, Illinois 60641
Phone 539-5310

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

NEW JERSEY – Highland Park
Complete Rocket Supplies
Estes, Centuri, MPC, BoMar, etc.
MINIWHEELS HOBBY CENTER
714 Raritan Avenue

NEW JERSEY – Princeton
Complete Rocket Supplies
Centuri – Estes – MRI – SA !
NASSAU HOBBY
142 Nassau Street Princeton

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

NEW YORK – Elmira
SCIENCENTER
147 West Water Street
Estes – Centuri – Flight Systems
Elmira 14901

NEW YORK – Uniondale
Biggest and Best with the Most
CARD AND CRAFT
1004 Front St.
Mon, Thurs, Sat – 9-6 Fri 9-9 Sun 10-3

OHIO – Upper Sandusky
Estes and Centuri Rockets
THE ROCKET SHOP
640 Skyline Drive
6-9 pm 294-1322

(Club Notes, continued)

fired rockets in the classroom. The demonstration attracted so much interest that the teachers decided to start a rocket club to meet every other week. Club officers were elected: David Drennan, President; Darrel Drennan, Vice-President; and Rocky Flick, Secretary-Treasurer. Presently the club has over 100 members, and holds a scheduled launch once a month.

A new model rocket club is being formed in the Elkins Park, Pennsylvania area. Rocketeers interested in joining the Elkins Park Spitfires Club are invited to contact Jon Rains, 409 Shoemaker Road, Elkins Park, PA 19117 or call ME 5-2348 after 6 PM.

Stan Stephenson and Jay Rosati of Largo, Florida are trying to form a model rocket club and NAR Section in that area. The group has access to a very large, nearby launch field. Contact Stan Stephenson, 203 Poinciana Lane, Harbor Bluffs, Largo, Florida or phone 584-1761.

The Rocket Flight Systems Specialists of Glendora, California presented a model rocket demonstration at the La Fetra School on Friday, February 27, 1970. Under the direction of Club Advisor James Militello, and President Jack Kobzeff, the group has been presenting regular demonstration launches at schools in the Glendora area.

The model rocket club in Monterey Park, California has received permission from the Recreation and Parks Commissioners to use the site of a new golf course as a model rocket launching site until the golf course is constructed. The recommendation will be sent to the City Council for final approval.

The Santa Clara Rocket Association in Palo Alto, California has published the first issue of their newsletter – *Hi Lights*. Their first sanctioned contest as an NAR Section was planned for April 18th. The events which they planned to fly were Parachute Spot Landing, Class 1 Parachute Duration, and Sparrow B/G.

The Princeton Association of Rocketry, organized in October 1969 at Princeton High School in Princeton, New Jersey, is pursuing an active program of model rocket experimentation. The club has already begun plans for telemetry payloads, aerial photography, wind tunnel testing, and altitude prediction. Construction of a club launch field communications system and tracking equipment has also begun. Membership in the PAR, which is already up to 17 members, is open to any rocketeers interested in model rocketry. For further information contact Josh Rafner, 108 Clover Lane, Princeton, New Jersey.

The Waynesburg Association of Rocketry held a competition launch on Saturday February 7th. A total of 48 launches, including single-stage, two-stage, cluster, odd-ball, and boost/glide models, were flown. The best tracked altitudes were 1900 feet for a rocket built by Chris Wunder, and 1,840 feet by Terry Arbogast.

The launching of an Estes Sprite followed by a two-stage Estes Shrike from the Ferry School playground climaxed a meeting of the Grosse Point Woods, Michigan, Cub Scout Pack 34 which was dedicated to "An Evening in Space." The program also included the showing of NASA's Apollo 11 moon landing film.

Though rocket launching is presently prohibited in the area, special permission was given by the school board for the program. The launchings were supervised by Russell Allard, a Woods public safety officer and fire inspector. Earlier in the evening, Allard gave the boys a short talk on the laws governing amateur rocketry, and warned of the hazards of unsupervised experimentation with home-built rockets. James Lafer, supervisor of photographic instrumentation for the Chrysler Corp., stressed the ruled for model rocket safety, and endorsed model rocketry as an excellent activity in which fathers and sons can work together. He expressed the hope that a rocket club could be formed in the area, where model rockets could be launched in accordance with the laws and under adult supervision.

Michael Low and Michael Bernhardt are attempting to organize a model rocket club in the Manhattan, New York area. Interested rocketeers should contact Michael Low, 426 West 27th Street, New York, NY 10001.

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

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

Maryland Rocketeers View Eclipse

On Saturday morning, March 7, 55 members and friends of the Star Spangled Banner Section of the National Association of Rocketry boarded a chartered bus for the trip to Assateague Island, Virginia to see and record on film a sight which we would never forget – a total eclipse of the sun. The bus left from the Howard Galloway home at 7:45 A.M. Mr. and Mrs. Galloway are the founders of the section and the meetings are held in their home. After traveling for approximately 3 hours, we arrived at the southern end of the island where we met the NARHAM Section of the N.A.R. The telescope and other equipment were set up and the direction for the sighting of the rocket launchings on Wallop's Island was marked. We watched a few rockets blast off and tracked them by their vapor trails and then had lunch. When the first contact of the eclipse could be seen reflected on a viewing screen of one of the larger telescopes everyone set up his own viewing arrangements. There were long enclosed boxes with pinholes and pieces of cardboard with pinholes that reflected the sun on white paper. Binoculars and small telescopes were upended and the sun's image reflected on white cardboard. About 5 minutes before totality the revolving light of the neighboring lighthouse turned on. Just before the total eclipse shadow bands could be seen racing across the sand, caused by corrugations in the light waves from the sun hitting irregularities in the earth's atmosphere. During totality the temperature dropped about 17 degrees and it was like deep dusk. The stars and Venus could be seen along with the flame from the many rockets from Wallop's Island, some going as high as 500 miles. The sun with its brilliant, irregular corona was spectacular. Everyone with cameras took pictures and some telescopes were focused on Venus, now visible. The shadow bands again raced across the sand and the sunlight burst from behind the moon. Minutes later a flock of hundreds of white birds arose from the trees some distance away and the lighthouse light went off. Around 3 P.M. the soccer game and shell collecting were interrupted when more rockets went off. We left Assateague Island around 4:30 P.M. and after having dinner in Salisbury we arrived home about 10 P.M. All of the members agreed that it was indeed a memorable experience that they would remember for the rest of their lives.

–Bill Hall II

Photos by SSB Photography Committee

Shiela Duck (NARHAMS) adjusts her telescope just prior to the beginning of the eclipse. The telescope was used to project the image of the eclipsed sun onto a sheet of cardboard held by Jim Turgeon (SSB).

DEALER DIRECTORY

NORTH CAROLINA – Chapel Hill
BILLY ARTHUR, INC.
North Carolina's Leading
Rocket and Hobby Center
Eastgate Shopping Center
9-9 Mon thru Fri 9-6 Sat

WASHINGTON – Seattle
Rocketry for the Northwest
Nationally Known Brands
CAMPUS HOBBY CENTER
4738 University Way N. E.
Open Thurs. Eve. LA5-2222

(**The Old Rocketeer**, continued)

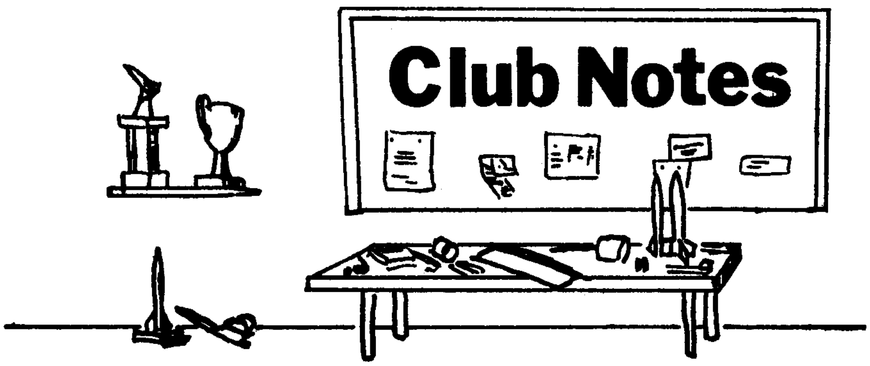
that it rather resembles the keel of a boat. This ventral location seems to make the Jiskra roll-out better at transition between boost and glide when the power pod leaves the party.

The secret of getting long-duration flights from Jiskra – or any other B/G, for that matter – is *trim.* Both boost and glide trim. In the USA, it is now very rare to see a B/G loop during boost phase, but it is still seen in Europe and was prevalent at Vrsac in 1969; good boost trim is achieved with a far-forward (ahead of the wing leading edge) boost CG point and a high wing loading (ounces per square inch), and this is usually achieved by using a heavy power pod. On the other hand, good glide trim and long duration flights depend on an aft CG point, low weight, and low wing loading; this is achieved by getting rid of all the weight possible such as the power pod while at the same time causing the CG point to shift aft. Getting the proper glide trim is a matter of lots of flight testing . . . many hand-launched flights in glide configuration and several powered test flights on the actual day of competition. The Europeans do a lot of B/G test flying, particularly of the Jiskra design. At Vrsac, there was a special launch area set aside for test flights. In the USA, B/G modelers do not do enough test flying prior to making their competition flights.

Jiskra will really "hang in there, man," if you get it trimmed.

Test flights should use a Type A engine of 2.5 Newton-seconds. Jiskra is capable of being flown with Type A and Type B engines. I don't know what would happen to it with a Type C engine, but it would most certainly be over-powered with its 20-gram weight and 36 square-inch wing area. It might loop and part your hair, or it might get so high that it would never come down . . . .

And, incidentally, just so our World Championship team would know what the competition is likely to be at Vrsac in September, I took the opportunity to send copies of these drawings to Kukowski, Gregorek and Pantalos early in March. Since the Europeans already have many of our B/G designs by virtue of the fact that **MRm** is widely read in Europe, it seemed to be only fair turnabout.

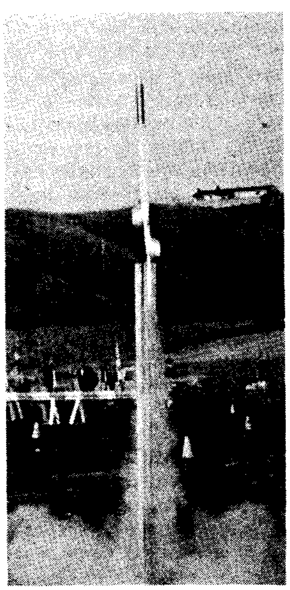


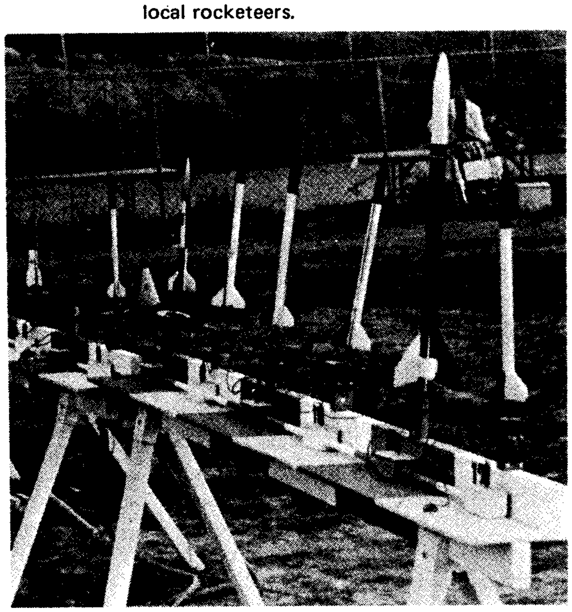
The First Annual Fur Rendezvous demonstration rocket launch was held on Saturday February 21, 1970 at the Wendler Junior High School athletic field in Anchorage, Alaska. Sponsored by the Anchorage Association of Model Rocketry, the demonstration was supervised by club president Bob Westmoreland. The Anchorage club's demonstration team consisted of Kevin Lindsay, Lee Wilkins, Darrel Gardener, Jeff Martin, Mickey McDermott, Ed Ezzell, Richard Hantz, Bob Westmoreland, and Jim Harpster.

The Glen Ellyn Rocket Society sponsored a display of model rockets in the Glen Ellyn Savings and Loan Association lobby during the month of February. The display included all types of model rockets, but the most popular rocket was a scale Saturn V. Members of the Glen Ellyn club were also on hand in the lobby to explain model rocketry to visitors.

In November 1969 several students at the Antonian High School in San Antonio, Texas, organized the Antonian Rocket Club. They quickly attracted the attention of the local newspaper, the San Antonio *Express and News,* which ran an article on the club's activities in early March. Club officers are: Gene Mireles, president and Toby Richter, vice-president. The A.R.C. would like to arrange competitions with other clubs in the area. Contact Tony Richter (TA4-8251).

Civil Air Patrol members in the Green Bay, Wisconsin area are attempting to assess interest in a possible rocket competition in that area. Presently the local rocketeers are involved in the CAP rocketry program which involves a study of model rocket and aerodynamic fundamentals as well as discussions on construction techniques and model rocket safety. They eventually hope to affiliate with the NAR and sponsor a contest for local rocketeers.





The first Pacific Area Regional Meet (PARM-1), sponsored by the City of West Covina, was held over the weekend of March 21, 22, 1970 at the launch site of the West Covina Model Rocket Society launch site in California. Eight events were flown including Parachute Duration, two Sparrow and Swift B/G, Scale, and Scale Altitude, Payload Altitude, Spot Landing, and Design Efficiency. (Above Left) The winning Lr./Sr. scale model, an Aerobee 350 lifts off (Photo by Paul Trainer). (Right) A rack of scale altitude models, dominated by Tomahawk models, prepped for launch (Photo by Desmond Welch). On Saturday evening, after the competition flying, representatives from the Aerospace industry, and model rocket manufacturers spoke to the rocketeers.

The *Tycho Times,* newsletter of the Birch Lane NAR Section in Davis, California, reports that the club has purchased two new Centuri Sky-Track trackers so that tracking can be improved at their launches. The club has also acquired a telephone switchboard and fieldwire to make operational the two field telephones already owned by the club. Also reported was the election of Jim Delwichie as President of the club.

The Model Rocketry Organization of Rubidoux (MROOR), recently organized in Riverside, California, has published the first issue of its newsletter – ***MODE 1.*** It reports the results of the club's first launching from the Prado Park launch site. On the morning of February 23 MROOR members met at the club headquarters and set out for the site even though there were wind gusts of up to 25 mph. Because of the wind, only small (A and B) engines and 12 inch chutes were employed. But after the first two birds, a Centuri "Javelin" and an Estes "Skyhook", drifted out of the park, the club switched to streamers. After that, there was no trouble in recovering the other rockets which were launched.

The Northwest Regional Championship Contest for the state of Washington was hosted by the Boeing Employees Model Rocket Society on Saturday May 16th, 1970 at the Boeing Kent Space Center. Five standard events were scheduled to be run in two age divisions (Junior, under age 17; and Open, 17 and older): Class O Altitude, PeeWee Payload, Class 2 Parachute Duration, Swift B/G, and Open Spot Landing. In addition, three events were scheduled to be run open to all contestants: Class 2 Altitude, Egg Lofting, and Payload B/G Duration.

Civil Air Patrol members from Middletown, Delaware, took part in the "Launch Day" of the local rocket club. CAP Cadets C/Capt. Gary P. Payne, C/I Lt. Nancy E. Hammond, and C/Maj. Frank W. Hammond, Jr. successfully launched their rockets after participating in the CAP model rocket instruction program, and will receive Rocket Badges.

Model rocketeers are growing in number throughout Douglas County, Oregon, because of a series of rocketry classes being held by the Oregon Museum of Science and Industry, Southwestern Oregon Division. Those youngsters attending the classes are responsible for building their own rockets, and, on designated days, the class gathers on a field for a rocket shoot.

The Irving School in Winfield, Kansas has inaugurated a model rocket program under the sponsorship of two teachers, Don Mull and Mrs. Kearns. Both teachers became interested in model rocketry at a science workshop in October 1969. They brought the idea back to their classroom, and through a team teaching approach correlating science and reading they built and

(Continued on page 46)

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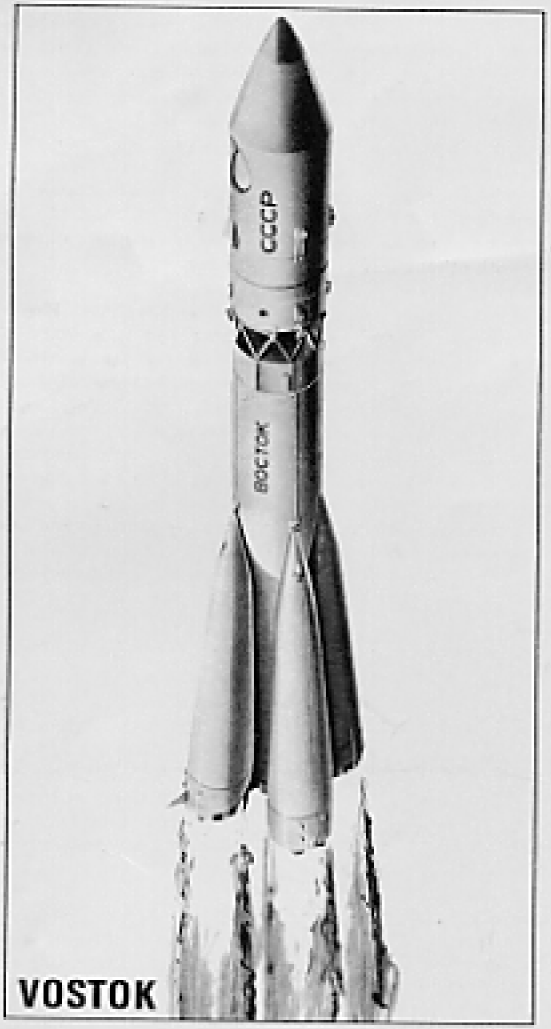

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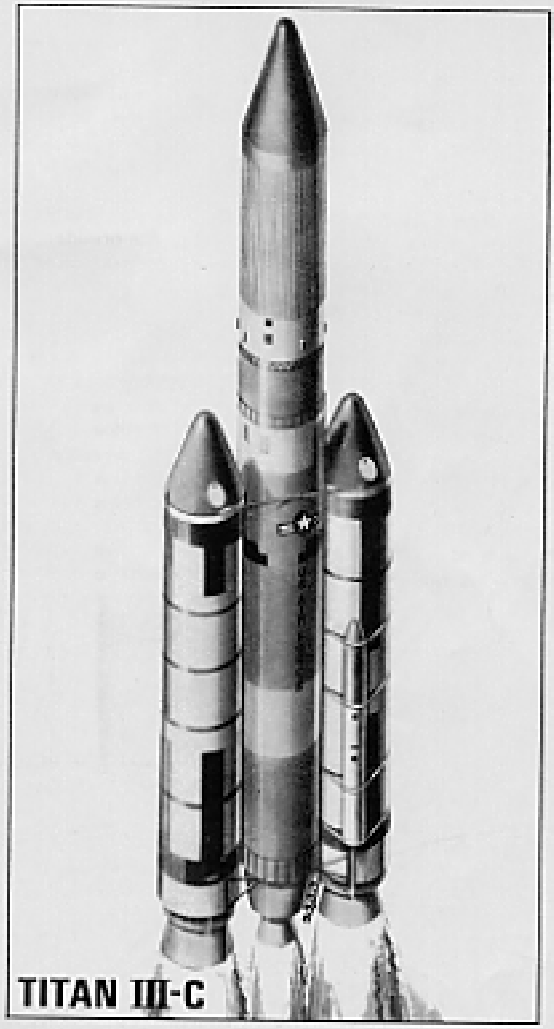

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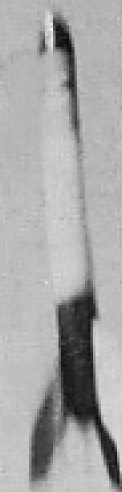

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