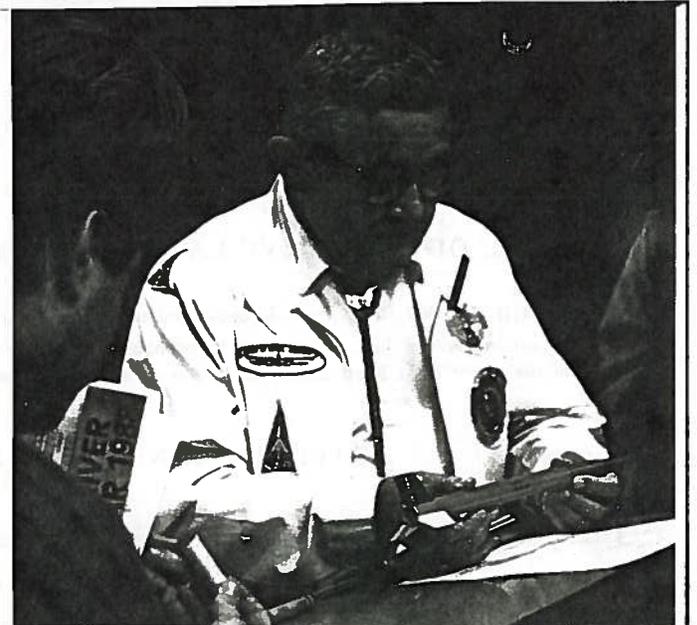


LAUNCH RACK



G. Harry Stine, NAR 2



The Launch Rack

The Official Publication of The
Garden State Spacemodeling Society

JANUARY/FEBRUARY 1998

ISSUE 122

The Launch Rack is the official publication of the *Garden State Spacemodeling Society* (Section 439 of the National Association of Rocketry) and is published for the enlightenment and entertainment of its membership.

Others interested in receiving this publication may do so for the annual subscription rate of \$7.50 for 6 issues. Overseas subscriptions are \$17.50. Please send this money payable in USD to **Arnold Klein, 2 Oneida Avenue, Rockaway, NJ 07866.**

The Editor invites and encourages all to submit articles, photographs, plans, letters to the editor, etc., for future publication. In addition to articles, the Editor welcomes and encourages constructive feedback on each an every issue. Please send all material to:

Jack Sarhage
875 River Road
Piscataway, NJ 08854-5549

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LAUNCH WINDOW:

Anyone wishing to attend any GSSS activity should call the GSSS hotline (908) 658-9417 the morning of, to verify the event is still on. If the event is cancelled, the recording will be updated at 9AM.

A NOTE ON NORTH BRANCH PARK. Please keep in mind that the park and weather conditions dictate what we allow to fly. Just because a rocket is under the one pound limit, do not assume it is an automatic launch. If the RSO does not feel the model can be safely flown or recovered within the park's boundaries, it will not be flown regardless of the weight or impulse. If some other activity shows up and starts using the adjoining fields, the RSO will reduce impulse for all flights. So, bring some small stuff just in case. **REMEMBER, WE SHARE THE PARK.** We do not pay a fee and most of us are not a resident of that county. Rocket flying fields in New Jersey are in short supply, and we are protective of the fields we have. If you're unhappy with this limitation, then we invite you to help us in gaining legal access to privately owned, large, open fields.

Sat., January 31, 1998

10:00 am - 3:00 pm

Sport Launch

Sat., February 28, 1998

10:00 am - 3:00 pm

Sport Launch

Sat., March 28, 1998

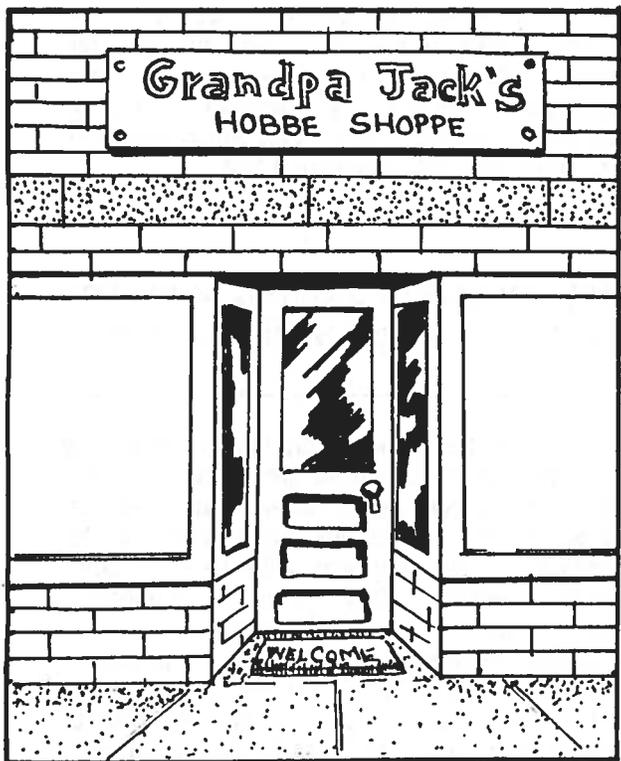
10:00 am - 3:00 pm

Sport Launch

ALL OF THE ABOVE LAUNCHES WILL BE HELD AT NORTH BRANCH PARK

ON OUR COVER: This issue is dedicated to Mr. G. Harry Stine, NAR #2. I took these photos during the Pearl Seminar in 1988 of him doing what he probably enjoyed best, sharing Model Rocketry. The NAR logo and number 2 in the upper right hand corner of the cover will appear on each issue during 1998. Thank you, Mr. Stine!!

NOTE: DEADLINE FOR NEXT ISSUE IS FEBRUARY 20!!!



"His list of accomplishments and the body of work he leaves behind are too long to mention. Harry was one of a kind, a man we cannot ever hope to replace."

There will be memorials a plenty set up in his name but, I think the greatest gift we can give, and one he himself would ask for, is that we take care of what he has given all of us that enjoy the hobby/sport of model rocketry.

May God rest his soul and bring peace to his family and friends.

New Jersey Adopts NFPA 1122: Ironically on the same day G: Harry Stine died the State of New Jersey adopted NFPA 1122. We have devoted the next three pages to a report by Dr. Bob Kreutz. Thank you Dr. Bob for this report and all you have done to bring this change about.

Commemorative T-Shirts: These are still in the works. My original source of transfers decided to increase the price. A new source has been found and I hope to have samples by the first launch in January.

Election Results: Your club officers for the next two years are President, Jack Sarhage; Vice Presidents, Ken Goddard and Kurt Koegel; and Secretary/Treasurer, Arnold Klein. **NOTE: THERE WILL BE A CLUB MEETING HELD IN CONJUNCTION WITH THE SPORT LAUNCH BETWEEN NOON AND 1:00 pm. THE RANGE WILL BE SHUT DOWN DURING THIS PERIOD.**

Order of the Golden Igniter: "Official NAR Sport Cards" will be available at the January launch for you to begin logging your flights toward this award. See Issue 121 for rules. There is a section on these cards reading, "Launch Crew Use Only" and it will be your responsibility to be sure they fill it in.

Wearing Two Hats: Since I'll be wearing two hats this column will be used for both the Editor and GSSS President to bring matters to your attention. As Editor, I am asking that you help filling up the space by sending your articles, plans, photos, etc for publication. As President, I am asking that you help bring about those things that are meaningful to you and to the Model Rocketry family. **THANK YOU!!!!**

Mr. G. Harry Stine is Gone: I am sure that all of you are aware that Mr. Stine, NAR #2, died Monday, November 3, 1997 apparently of a heart attack. This will not be obituary in the sense that I knew him well enough to write one. I will leave that to those that can do it in the manner he deserves.

I met him once at an NAR reunion held at the 17th Annual Pearl River Modroc Seminar in April 1988 and I treasure the photo of us comparing his Aerobee-Hi with my MRC Sidewinder missile. Later, as the after dinner speaker I remember him saying, "model rocketry is living on the edge of disaster....we must be careful not to lose what we have and we can do this only by policing ourselves and others....if model rocketry wasn't started when it was it could not be done today." I still feel that way. He saw universities and colleges using model rocketry more in the future. This prediction has come true and in the lower grades, too. He encouraged us with the changes coming by saying, "accept them, don't fight it, but incorporate it into the system." And, when the evening was done you had the feeling that the hobby was secure when he said that it is still the "safest hobby...except for stamp collecting."

The accolades you will see and hear are well earned. As Mark Bundick, NAR President, wrote

Jack

Legislative Update

New Jersey

Adopts :

NFPA 1122

**Statewide Safety Increased
With National Coherence**

By
Dr. Bob Kreutz

It's Official ! Published in the November 3rd, 1997, New Jersey Register, the State of New Jersey has officially repealed the old regulations for Model Rocketry and replaced them with NFPA 1122. From the Department of Labor, Division of Workplace Standards comes: Model Rocketry, Adopted Repeal and New Rules: N.J.A.C. 12:194. Long overdue because of manpower shortages mandated by Governor Whitman, the rewrite of New Jersey's model rocketry regulations have finally been revised. Adoption of NFPA 1122 brings New Jersey into accord with nationally recognized and accepted guidelines. Doing so greatly increases the scope of New Jersey's Regulation: NJAC 12:194, and allows Hobby Rocket activity to take place within well defined nationally recognized specifications in order to guide our science minded citizens and youth, safely.

... Adoption of NFPA 1122
brings New Jersey into
accord with nationally recognized
and accepted guidelines.

As early as April, 1995 I had recommended adoption by reference of NFPA 1122 to the Commissioner of Labor, Semour Rubenstein. Using the code as the State's own regulation(s) is termed "adoption." There are 2 different formats for adopting a nationally recognized code: "Adoption by Transcription," whereby the code is transcribed in its entirety, without change, to be used as the State

regulation, and; "Adoption by Reference," where the basic code is used but certain portions are changed to comply with State law or additions are made that may have been mandated by legislation. Adoption by Reference is the condition under which the State of New Jersey now utilizes NFPA 1122.

...many benefits of this new regulation
is actually for non-State residents...

One of the many benefits of this new regulation is actually for non-State residents. As a nationally recognized code, out-of-state, that is: visiting sport and competition fliers, will now be knowledgeable of and familiar with New Jersey's Regulations before they arrive, eliminating confusion and increasing safety awareness.

Additional recommendations were proposed to the present Commissioner of Labor, Mel Gelade, that along with adoption of NFPA 1122, the State of New Jersey also adopt NFPA 1127, "Code for High Power Rocketry." This was proposed in order to include motors, technologies and aspects of Hobby Rocketry that exceed the limits defined in NFPA 1122. Unfortunately, this part of the proposal was

...the Department of Labor cannot
adopt any other national standards
without the explicit statutory authority
to do so.

rejected, *not* because of unworthiness, but on the grounds that the Department of Labor cannot adopt any other national standards without the explicit statutory authority to do so. In other words: another "Act of Legislation." could be necessary. The expiration date for the current State Regulation, NJAC 12:194, is November 3, 2002. This would be the next time that the regulations could be changed by a "bill," the prevailing law making operation, if proposed and passed through the legislature. You should all recall, this "Act" was also the procedure used to eliminate the NJ State Permit in January, 1992. Culminating with a state wide legislative letter writing campaign, the lobbying effort on the part of Garden State Spacemodeling Society was the last of a series of multiple attempts that

successfully revised NJ State Laws. This "laborious effort," on the part of many individuals, took over 10 years to complete. Not a very optimistic outlook. However....

... there *is* another way...

...However, there *is* another way... In my communications with Mr. Howard Black, Director of the Office of Safety Compliance, New Jersey State Department of Labor, a more direct and time saving opportunity does exist to amend our current regulations. The sooner the better?

The original bill S-2424 was sponsored by Senator Gerald Stockman, who introduced it on April 25, 1988. It survived one administration in the legislature, then changed designation to S-490 while stalled in the Assembly Law and Public Safety Committee hearings. Mary Roberts (Estes) and I (for GSSS) testified before the committee to help its advancement. The bill was finally enacted when signed by Governor Florio, January 9th, 1992. Now, if former Senator Stockman proposes that his original bill (which became NJAC 12:194,) be amended to *also* include the adoption of NFPA 1127, the Department of Labor can revise the current regulations to include NFPA 1127 in the current law. This could be premised on the grounds of "advancing technology" since the time the bill was originally conceived and public accessibility to products that exceed NFPA 1122 after being adopted by NJ. However, Senator Stockman is no longer in Office, he now practices Malpractice Law in Trenton. Current efforts will concentrate on contacting Senator Stockman in an attempt to persuade him to recommend the change to his original bill.

The body of the new code follows, from the New Jersey Register, listing amendments and rationale for the adoption of NFPA 1122.

The conversion of the states to 1127 is going to be a slow, long-term project. It's taken 40 years to get all the states to adopt 1122 or something functionally equivalent to it...

- J. Pat Miller

DIVISION OF WORKPLACE STANDARDS

Model Rocketry

Adopted Repeal and New Rules: N.J.A.C. 12:194

Proposed: August 18, 1997 at 29 N.J.R. 3702(a).

Adopted: October 10, 1997 by Mel Gelade, Commissioner, Department of Labor.

Filed: October 10, 1997 as R.1997 d.468, without change.

Authority: N.J.S.A. 21:1C-1 et seq., specifically 21:1C-6.

Effective Date: November 3, 1997.

Expiration Date: November 3, 2002.

Summary of Hearing Officer's Report and Agency Responses:

A public hearing on the proposed repeal and new rules was held on September 3, 1997 at the Department of Labor, John Fitch Plaza, Trenton, New Jersey. Deirdre L. Webster, Regulatory Officer, was available to preside at the hearing and to receive testimony. While no one appeared to give testimony on the proposed repeal and new rules, Dr. Robert T. Krutz, DDS, provided written comments. The hearing officer recommended that the rules be adopted without change. The public hearing record may be reviewed by contacting Deirdre L. Webster, Regulatory Officer, Office of Regulatory Services, Office of the Commissioner, Department of Labor, PO Box 110, Trenton, New Jersey 08625-0110.

Summary of Public Comments and Agency Responses:

Written comments were received from Robert T. Krutz, DDS.

COMMENT: It is highly recommended that the Commissioner of Labor incorporate by reference the National Fire Protection Agency (NFPA) Standard 1127 (NFPA 1127, 1995 ed.) which, like NFPA 1122, proposed for adoption by reference, contains instructional guidelines and specific standards for the design, construction, limitation of power and reliability of rocket motors manufactured for sale to the public and for the design and construction of hobby rockets propelled by these motors which exceed those described in NFPA 1122.

RESPONSE: Through amendments to N.J.S.A. 21:1A-12B et seq., the Legislature mandated that the Department adopt by reference NFPA 1122, Code for Model Rocketry, 1994 edition and any subsequent amendments thereto as the rules for the manufacture and use of explosives in model and amateur rocketry in the State of New Jersey. In light of this, the Department cannot adopt any other national standards without the explicit statutory authority to do so.

Federal Standards Statement

There is no Federal law or regulations which govern the adopted repeal and new rules. As a result, the adopted repeal and new rules do not exceed standards or requirements imposed by Federal law. As a result, a Federal standard analysis is not required.

Full text of the adoption follows:

CHAPTER 194 MODEL ROCKETRY

SUBCHAPTER 1. GENERAL STANDARDS

12:194-1.1 Purpose

This chapter is promulgated to establish minimum safety requirements and standards for the manufacture and use of explosives in model and amateur rocketry.

12:194-1.2 Scope

This chapter is applicable to rocket experimentation by amateurs, including the mixing of rocket propellants, and the sale, storage, transportation and use of rocket propellants and preloaded, factory-made commercial model rocket engines that do not require mixing the propellant, as set forth in the National Fire Protection Association 1122 Code.

12:194-1.3 Adoption by reference

(a) The standards of the National Fire Protection Association (NFPA) 1122, "Code for Model Rocketry," 1994 edition and subsequent amendments thereto are hereby incorporated by reference as the rules for the manufacture and use of explosives in model and amateur rocketry. Copies of the NFPA 1122 may be obtained from the U.S. Government Publications, Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(b) In addition to the standards incorporated by reference, this chapter sets forth additional rules governing the use of model and amateur rocketry.

SUBCHAPTER 2. DEFINITIONS

12:194-2.1 Definitions

The following words and terms, when used in this chapter, shall have the following meanings unless the context clearly indicates otherwise.

"Act" means N.J.S.A. 21:1C-1 et seq.

"Approved" means approved by the New Jersey Commissioner of Labor.

"Authority having jurisdiction" means in the New Jersey Commissioner of Labor.

"Commissioner" means the New Jersey Commissioner of Labor or his or her authorized representative.

"Department" means the New Jersey Department of Labor.

"Model rocket" means a commercially made rocket that is propelled by a rocket motor:

1. That contains a device for returning it to the ground in a condition to fly again;
2. Whose structural parts are made of paper, wood, or breakable plastic and contain no substantial metal parts; and
3. Whose primary usage for the purposes of education, recreation, and sporting competition.

"NFPA 1122 Code" shall mean the National Fire Protection Association 1122 Code for model rocketry.

"Rocket motor" means a device that provides the necessary force or thrust to cause a rocket to move and the force or thrust is created by the discharge of gas generated by combustion, decomposition, change of state, or other operation of materials completely stored within the rocket motor during the commercial manufacturing process and requiring no mixing of propellants.

SUBCHAPTER 3. AGE RESTRICTIONS

12:194-3.1 Age restrictions

(a) A person at least 12 years of age, but less than 14 years of age, who is a participant in a bona fide model rocket education program may fire a model rocket bearing the standardized engine coding 1/4A, 1/2A, A, B and C only when under the direct supervision and control of a person who is at least 21 years of age and only during the course of the model rocket education program.

(b) A person at least 14 years of age, but less than 18 years of age, shall be eligible to purchase and use a model rocket bearing the standardized engine coding 1/4A, 1/2A, A, B and C provided that the person has a consent form signed by a parent or legal guardian.

(c) A person at least 18 years of age shall be permitted to purchase and use a model rocket of any type or size.

SUBCHAPTER 4. CERTIFICATIONS

12:194-4.1 Certification requirements

(a) A model rocket shall not be sold, offered for sale, made available to the public, or used in this State unless it has been certified by the Commissioner of Labor.

(b) Any model rockets certified by the National Association of Rocketry is deemed certified by the Commissioner of Labor for sale and use.

(c) The Department shall maintain a current and complete list of all model rockets which have been certified by the Commissioner of Labor for sale and use and shall make such list available to the public upon request.

SUBCHAPTER 5. PERMITS

12:194-5.1 Permit restrictions

A person shall be required to obtain a permit for the storage of more than 100 kilograms (220 pounds) of solid propellant model rockets. No other permit shall be required for the possession, use, purchase, transportation, or sale of model rockets.

12:194-5.2 Storage permits

(a) Applications for a storage permit shall be made to the Commissioner on forms provided by him or her and shall contain such information including the applicant's name, address and amount of model rockets being stored.

(b) Any permit is revocable by the Commissioner for any violation of the Act or any rules or codes adopted thereunder.

SUBCHAPTER 6. VIOLATIONS/PENALTIES AND HEARINGS

12:194-6.1 Violations/penalties

(a) A person who violates any of the provisions of the Act or any rules or codes adopted thereunder, shall be liable for an administrative penalty of \$100.00.

(b) Each incident in violation of the provisions of this Act, or any rules or code adopted thereunder shall constitute an additional separate and distinct offense.

(c) Unsatisfied penalties shall be recovered by the Commissioner in a civil action by a summary proceeding under the Penalty Enforcement Law, N.J.S.A. 2A:58-1 et seq. in the county or municipality where the violation occurred.

12:194-6.2 Hearings

(a) No administrative penalty shall be levied pursuant to this chapter unless the alleged violator is provided with:

1. Notification of the violation;
2. The amount of the penalty to be imposed;
3. An opportunity to request a formal hearing.

(b) A request for formal hearing must be made in writing and received within 10 calendar days following service of the Notice of Violation.

(c) All hearings shall be conducted pursuant to the Administrative Procedure Act, N.J.S.A. 52:14B-1 et seq. in the Uniform Administrative Procedure Rules, N.J.A.C. 1:1.

(d) If a hearing is not requested, the Notice of Violation shall become the final order upon expiration of the 10-day period following receipt thereof.

(e) The operator may request the initiation of a settlement conference at the time that the request for formal hearing is made. If a settlement conference is requested, or if the Department determines that a settlement conference would be useful, the settlement conference shall be scheduled and conducted by the Department within 30 days of the receipt of their request for a formal hearing.

(f) If a settlement is not agreed upon or no settlement conference is scheduled, the request for a formal hearing shall be transmitted to the Office of Administrative Law (OAL).

(g) Payment of the penalty shall be due when the final agency determination is issued or when notification becomes the final decision because no appeal has been filed.

(h) All payments shall be made payable to the Department of Labor in the form of a certified check or money order, or such other form that the Department deems suitable.

(i) Upon entry of the final order the penalty imposed may be recovered with the cost and the summary proceeding commenced by the Commissioner pursuant to the Penalty Enforcement Law, N.J.S.A. 2A:58-1 et seq.

Unfortunately and ironically, November 3rd is a day we will remember for a very somber and tragic reason, the passing of G. Harry Stine, NAR #2. Harry was a Co-founder of the NAR and Model Rocketry's long time friend and representative, as Chairman of the NFPA Technical Committee on Pyrotechnics. Mr. Stine, possibly above all others, was responsible for development and promulgation of NFPA 1122, the basis of our safety code. His efforts should be remembered by all, for the health and well being of each rocketry hobbyist and the countless number of injuries and accidents that have ultimately been avoided. That is the safety record we can so proudly boast.

*Fly High - Harry
and
Thank You !*

An Analysis of the New Apogee Micro Motors — What Makes Them so Much Fun?

By Tim Van Milligan
NAR 35872

In this article I thought it might be a good idea to review the characteristics of the Apogee 10.5mm diameter motors for people who are not familiar with them. Before I begin, I'll tell you my reasons for doing this article. First, there is that self-serving motivation to sell more rocket motors. I clearly admit this, but there is another reason too. Being a modeler myself, knowing the good and bad points of the motors would allow me to use them to their best advantage; as well as staying away from those situations where the motors are not useful or that could be unsafe. By letting other modelers know these opinions too, I believe that we'll keep the hobby much safer and more fun.

First I'd like to list all the general characteristics of the motors. Then I'll give my opinions and reasons for the advantages and disadvantages that each trait offers, compared to motors made by Estes or Quest. I'll try to keep the orientation of the comparison geared toward "sport" models, because that is where most modelers get their enjoyment.

Here are the characteristics that I'll go into depth about:

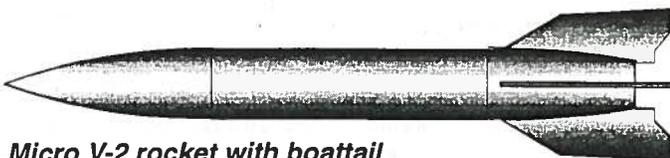
1. Small diameter
2. Longer lengths
3. Low thrust level
4. Longer burn duration
5. Low case mass
6. Price
7. Specific Impulse
8. Total Impuse

From these characteristics, you can make your own conclusions as to whether these motors would meet your own needs.

Small Diameter

The most obvious trait of the new motors is their skinny diameter — 10.5mm. From a competition modeler's point of view, the smaller the diameter of the model, the higher it can fly because it has lower drag. So this is a very large advantage in that situation.

And smaller models are typically less expensive to build compared to big rockets needing heavy-duty construction. Therefore the advantage of having a smaller motor can mean that the overall model cost can be cheaper too. For example, you don't need any expensive tools, equipment or supplies like epoxies to build small models. Typically all you need is a knife

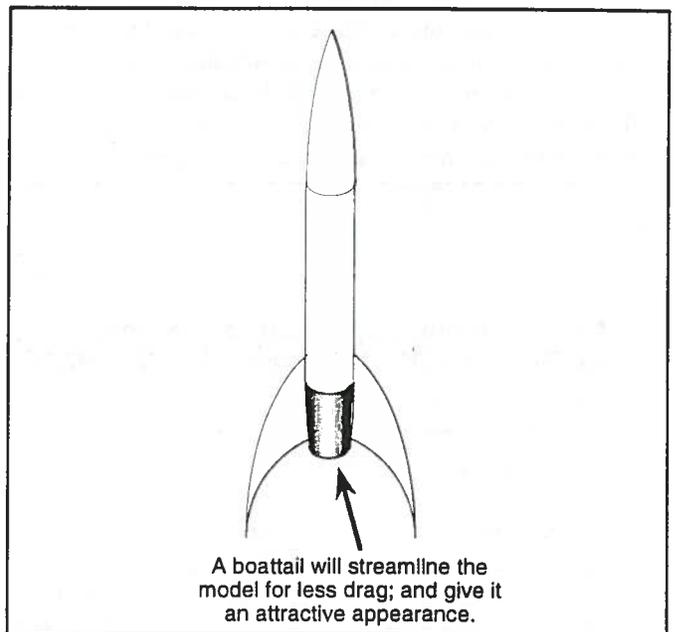


Micro V-2 rocket with boattail

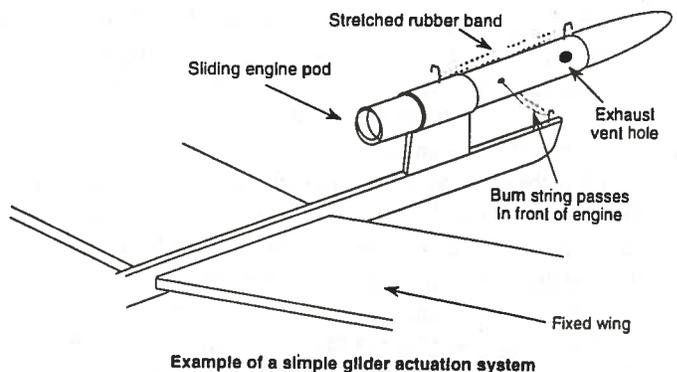
and some wood glue.

But the skinny diameter also allows the development of some unique sport models. A good example is the "peanut-size" models. Already many modelers are building scale rockets in tiny sizes that are cute and friendly. The new Micro V-2 kit from Apogee Components can only be made as small as it is because of the small diameter of the 10.5mm motors.

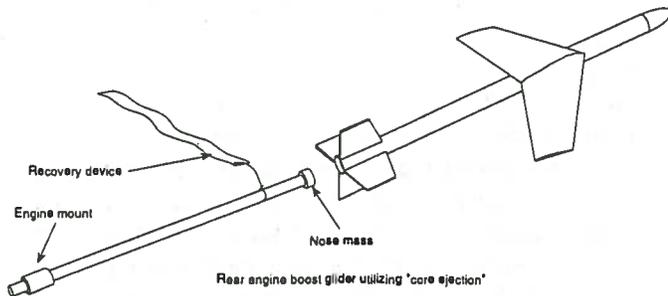
The aerodynamics of bigger models can be improved by using a smaller motor too. A simple modification that can be made to "non-minimum diameter" models is to put a boattail on it to make a streamlined shape. Then those 1950's style "Buck Roger" rockets can be made super slick to fly a lot higher.



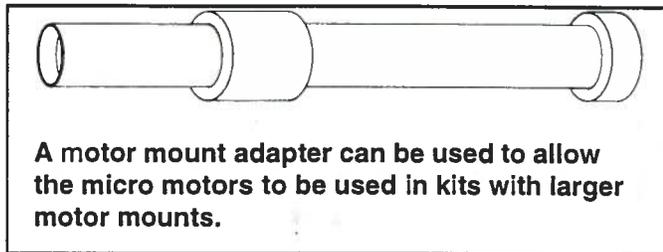
I like to think that one of the greatest advantages the smaller size gives for sport models is the ability to have sliding mechanisms carried internally. An example of this is the "sliding pod" type rocket glider. The motor's small size means that it can slide easily inside a larger tube, so repositioning the mass of the model after burnout is far easier. And it can be done while keeping the overall size of the model small to reduce the con-



struction costs. Another example of a sliding mass is the “rear-ejection” type models. Here the “slider” is the motor itself. And by careful positioning of the centering rings around the motor, you can create a pocket for the recovery device. This compartment will help protect the parachute from the heat of the exhaust gases, so recovery wadding won’t be needed.



The disadvantage of the “odd” size is that the motors do not simply slip into your existing rockets. But this drawback is easily overcome with a motor mount adapter to increase the diameter of the motor to make it fit larger models. Transitioning from “micro” to “mini” is easily accomplished with a few wraps of masking tape over the diameter of the motor.



Longer lengths

The next most obvious trait of the new motors is they are longer in length than modelers are familiar with. The reason for the longer length is a result of the skinny diameter. The extra length is needed to hold the proper amount of propellant inside the motor. To get a full power “B” motor, you need around 6 grams of black powder, and if the motor is skinnier, it must be made longer.

The advantage from the longer length is that it moves the Center-of-Gravity (CG) of the motor forward; and hence the model’s CG forward too. This helps make the model more stable when it is launched, hopefully increasing the safety of the flight. So for a hobby modeler, they might not have to add extra nose weight into a model to get it to fly straight; allowing a wide variety of rocket shapes that can be launched. And as the motor burns propellant, the CG continually moves forward and the stability factor of the rocket increases; hence the overall safety of the model is enhanced.

From the competitor’s standpoint, this is absolutely GREAT! With the stability of the model increased, he has the option of decreasing the area of the fins slightly without having the model go unstable. And by reducing the area of the fins, the drag of the model lowers, and it can fly even higher!

The big disadvantage of the longer length is similar to having an odd size diameter; the motors don’t readily fit in exist-

ing models. But again, this is a fairly easy modification to “un-built kits” — just move the position of the motor block forward to accommodate the longer motors. Another option is to let a portion of the motor hang out the rear of the model, and then compensate for it with extra nose mass (if necessary).

Low thrust level

The 2-Newton average thrust level of the motors is a big advantage for models that are fragile and can’t withstand high liftoff stresses. Models can be built using lighter-weight materials — which again improves the overall performance of the model by allowing them to fly higher. And again, light-weight materials are typically less expensive. You can use paper (heavy cardstock) fins instead of balsa, and balsa instead of basswood or plywood.

One example of a typically fragile model is the boost glider. I think that we have all seen models shred at liftoff, and the problem is that the model was over-powered. A lower thrust motor like the micro motors increases the success of the launch by lowering the forces trying to tear the model apart.

The other characteristic that low thrust motors offer is the model will lift off from pad slower. This could be either good or bad depending on the situation. If the model is “neutrally stable,” taking off slower would probably mean that it would go unstable after clearing the rod. But for models that are stable, the slower liftoffs are nice; it gives the model a “realistic” appearance, like real NASA style rockets that also lift off slow. And when they lift off slow, the roar of the motor seems to be around longer and sounds louder; enhancing the pleasure of the lift-off.

And slow lift-offs are great for spectators who might have a hard time following the flight of a very fast model. You’ve probably stood next to a person at a launch who asked: “Where did it go?” And since slow flights are easier to track, this lowers the chances that they might be lost in the haze of the sky. And it is always nice to return home without losing your favorite model.

The low flight speeds are fantastic for competition modelers. Because the drag on the model stays lower, the model can fly higher. You can read more about this in Apogee’s Technical Publication #1. Even for sport models, there will be a slight but noticeable altitude increase because the drag on the model is lower.

The main drawback of the low thrust from the motors is that it limits the size model that can be safely lifted. So typically, models using the new motors are limited to BT-55 size and smaller. But there is still more “grunt” force from the motors than you would expect, and some heavy or draggy models can still be flown. It is best to check the maximum liftoff masses listed on the instructions that come with the motors.

Longer burn duration

The increased length of the motors allow them to burn for a significantly longer period of time. This is really noticeable for most models, as the smoke column is really a nice crowd pleaser.

I think a lot of people love long burn motors because they remind them of high powered rockets which also produce sky-reaching smoke columns when they lift off. The longer 'motor roar' duration is an added plus too (more rumble for the ruble - or dollar).

The longer burn could be a disadvantage if the model goes into an erratic flight, as it could land in some dry grass while still under power. But hopefully modelers will take precautions to minimize this situation in any models they might fly by performing proper stability checks.

The other disadvantage is that the case is hotter after the propellant is burned. Most times this isn't a problem; by the time the model descends to the ground, it has cooled to where it isn't noticeable. But this heat can cause some types of glue to soften or to shrink. This is one reason Apogee doesn't recommend friction fitting the motors into engine mount tubes. The adhesive on the tape can turn to goo making it difficult to remove the motor after flight.

Low weight case

After the motor burns out, the case mass becomes dead weight and reduces the performance (altitude, speed, and duration aloft) of the model. So having a lightweight case like the micro motors offer will increase the performance of the model.

The low mass also allows many different science fair experiments to be performed. One such example would be "optimum weight" experiments. With the low weight case, now you have to add mass to the model to get it to an optimum mass for best altitude. So comparing different motors to each other is simple and fun to perform.

And when the motor weighs less, the overall model mass will be lighter too. Therefore it doesn't need to be built as strong to survive hard landings, since it will descend slower. For example, you don't too often see "G" powered helicopters, because the helicopter blades would be easily damaged when the model lands hard on the ground. But if lighter motors could be used, the blades are more likely to survive to fly again.

As a comparison, the typical Estes 18mm motor has a case that weighs about 10 grams, compared to less than 5 for the Apogee "B" motor. The Estes mini motor (13mm dia) has a case mass of 3 grams, which is still over the 2.5 gram mass of the Apogee "A" motor.

It is hard to think of a disadvantage to having a lightweight motor and model; so I can't list anything here. If you need more mass to make the model more stable, or to get up to optimum weight, it is better to add mass to the forward part of the rocket by using tracking powder.

Price

Even though the micro motors are much cheaper than composite motors, the obvious disadvantage to the new micro motors is their higher price compared to other black powder motors made by Estes and Quest. It would be great if you could have all the advantages already listed and a lower price too, but there are always tradeoffs.

But if you compare performance versus price, the new Apogee motors are reasonable.

Specific Impulse

The measure of how much thrust is produced per pound of fuel consumed is called "Specific Impulse." This number is used to compare motors to each other to see which is more efficient. The higher a motor's Specific Impulse number, the more efficient it uses the propellant. So at this time we'll compare different motors.

The composite propellant motors have all black powder motors beat "hands-down." They are almost twice as efficient as the black powder motors. Here is a quick comparison of the Apogee B7, the new B2, and the Estes B6.

Motor	Specific Impulse
Apogee B7	1760.56 m/s
Apogee B2	833.3 m/s
Estes B6	725.0 m/s

As you can see, even though the B2 and B6 use the same type of propellant, the B2 is slightly more efficient. How does the Apogee B2 get more efficiency out of the same type of propellant? The answer lies in the chamber pressure of the motor. The Apogee black powder motor uses a stronger paper case, so it can hold more internal pressure — which forces the burning gases out of the motor faster, which makes the motor efficient. You can learn more about this by reading Apogee's book called "*Model Rocket Propulsion*."

But operating at a higher chamber pressure does have its disadvantages. If the motor should fail, you'll hear a louder pop. But so far, the micro motors are operating as designed, so we'll all have to wait and see if the paper is capable of keeping the failure rate low in spite of the high pressures trying to blow it apart.

Total Impulse

The Total Impulse of the motor is found by multiplying thrust created by the motor (in Newtons) by its burn duration. So a motor that produces an average of 2.5 Newtons of thrust for two seconds has a Total Impulse of 5 Newton-seconds. This is equivalent to the total power level of the motor. If you remember how motors are classified, a "B" motor can have up to 5 Newton-seconds of Total Impulse. Since a "C" motor is twice as powerful as a "B" motor, its Total Impulse would extend up to 10 Newton-seconds.

So how does this number fit into our comparison? Isn't a "B" motor from one manufacturer the same power as a "B" motor from another? The answer is "not always." The Total Impulse can be adjusted by the manufacturer of the motor and it is affected by a variety of conditions. But mostly it is a quality control aspect.

The Apogee micro motors were designed for high performance, so the Total Impulse of each has been set to the maximum allowable for the motor. So a "B" motor from Apogee is

very close to 5 Newton-seconds. To prove this for yourself, you can get a copy of the NAR's motor certification tests. In these tests, you can see that the Apogee motors have higher total impulses than motors from other manufacturers within the same motor classification. Therefore, they are slightly more powerful.

How does this benefit you? For one thing, it will make your rocket fly higher! It also tells you that you are getting the most value for the money you paid for your motors. And since the micro motors cost slightly more, you can feel confident that you are getting everything you expected from the purchase, and not being ripped off.

Other Qualities of the Micro Motors — Good Tracking Smoke

Many people have commented that the little micro motors have better tracking smoke than motors from other manufacturers. This is great for making it easier to follow your rockets into the air — meaning you'll probably have a better chance of a successful recovery for another flight.

Healthy Ejection Charge

Another comment that has been made about the micro mo-

tors is that they seem to have a good ejection charge. This is characterised by a loud pop when the parachute is ejected from the rocket. While the ejection charge sounds "strong," it has been designed to pressurize a larger tube that has more internal volume than a skinny rocket. So if you use the motors in a larger diameter rocket, you can be assured that the motor will most likely kick the parachute out to ensure a successful and safe descent.

Conclusions

As you have read, the micro motors from Apogee have a lot of qualities that make them a lot of fun to use — even for "sport" rockets. And these same qualities make them the best for competitions flights too. If the opportunity presents itself, why not give them a try!

You can get more information about the Micro Motors from the Apogee Components web site. The address is: www.ApogeeRockets.com. You can also get a printed version of the Apogee catalog by sending \$1 to:

Apogee Components, Inc
1431 Territory Trail
Colorado Springs, CO 80919-3323

Micro V-2

Product No. 5021 \$6.25 (INTRODUCTORY PRICE)

The blitz is back with another vengeance! The micro-motor powered V-2 Rocket is ready to thunder into your fleet. At just under seven inches tall, this little dynamo will capture those nostalgic feelings for the glory days of rocketry.

Real balsa wood is used for both the nosecone and tailcone. The tailcone is pre-drilled, ready to accept the motor tube for the 10.5mm motors. Add the balsa fins, launch lug, and recovery system, and you're ready to launch!

This is one of the most sought after rockets of all time. Order today!

Specifications:

Skill Level: 2 - Previous Rocket Experience Suggested

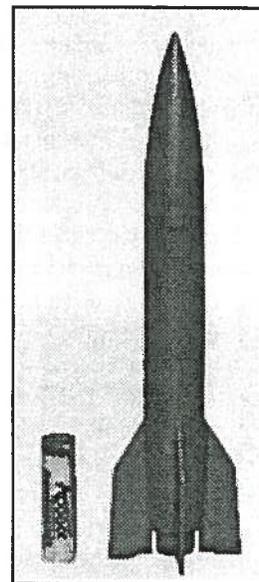
Length: 17.15 cm (6.75")

Diameter: 18 mm (0.736")

Weight: 10 grams (0.35 oz)

Recovery Type: Streamer

Recommended 10.5mm Rocket Motors: 1/4A2-2 (first flight), 1/4A2-4, 1/2A2-2 (breezy days), 1/2A2-4, A2-3 (breezy days), A2-5.



The new V2 kit shown with a 1/2A micro-motor for size comparison.

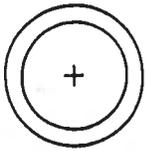
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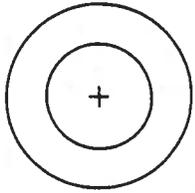
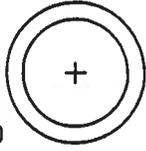


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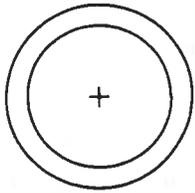
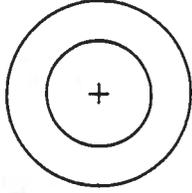
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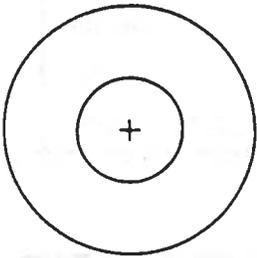
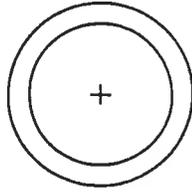
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(USE WITH PA-520)



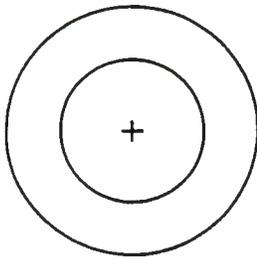
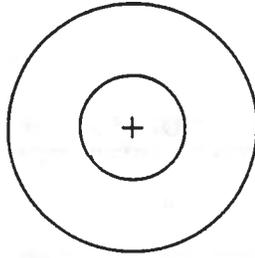
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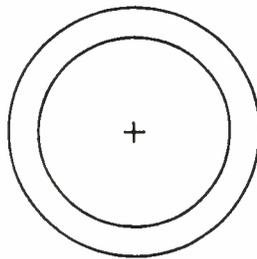
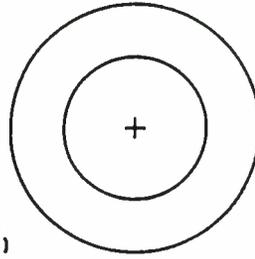
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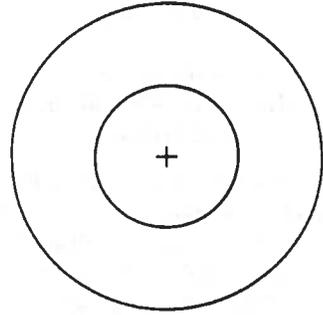
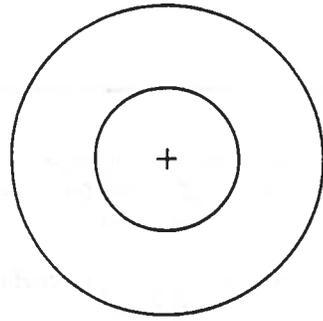
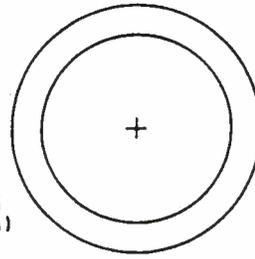
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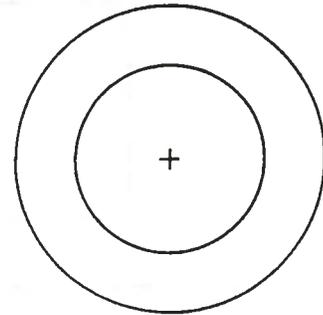
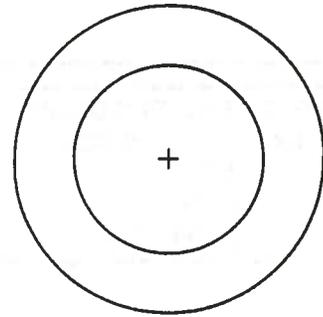
RA-2055
(PA-2055)



RA-5055
(PA-5055)



RA-2080
(PA-2080)



RA-5080
(PA-5080)

NOTE: GLUE DESIRED RINGS TO STIFF PAPER BOARD BEFORE CUTTING.
CUT RINGS ALONG CENTER OF PATTERN OUTLINE.

**DIRECTIONS TO NORTH BRANCH
PARK LAUNCH SITE**

North Branch Park is very near the traffic circle
junction of NJ Routes 22, 28, 202, and 206, near
Somerville. Follow 202 South from the circle for
2 miles, past Ortho Pharmaceutical and Harris Corp,
under railroad trestle marked "4H is Tops", to right
turn onto Milltown Road. Make first left after
firehouse and 4H Center on right; follow
path to open field. Monthly launches from 10-4.

FROM NORTH

NJ Turnpike South to Exit 10, 287 North to Exit 13,
202/206 South to Circle

FROM SOUTH

202 North to Milltown Rd.; or 206 North to Circle

FROM EAST

287 North to Exit 13, 202/206 South to Circle

FROM WEST

Rt. 78 or Rt. 80 East to 287 South to Exit 13,
202/206 South to Circle

GSSS MEMBERSHIP APPLICATION

Name _____

Address _____

City _____ State _____

Zip _____ Birthdate _____

Phone Number _____

NAR number _____ GSSS number _____

Membership Category (Check One)

- Junior (Under 16) \$5.00
- Leader (16 through 20) \$7.00
- Senior (21 or over) \$10.00
- Family Plan (Deduct \$2.00 for each additional family member, only one Launch Rack will be sent.)

I pledge to abide by the NAR/HIA Safety Code and GSSS Constitution and Bylaws in all my non-professional rocketry activities.

Signed _____ Date _____

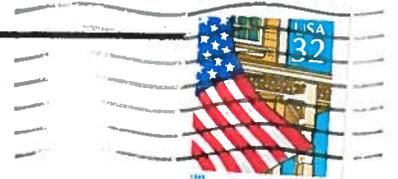
Send this application along with check for dues payable to: Arnold Klein, 2 Oneida ave Rockaway N.J. 07866

GARDEN STATE SPACEMODELING SOCIETY -- NAR SECTION #439

Robert Zabriskie
3 Peachtree Road
Basking Ridge, NJ 07920

TO:

Robert Nee
222 Willow Avenue - 2A
Hoboken NJ 07030



THE LAUNCH RACK

NEWSLETTER OF NEW JERSEY'S SPACEMODELING SOCIETY