



THE LEADING EDGE

Newsletter of the Northern Illinois Rocketry Association,
NAR Section #117

Volume 23, Number 3
May/June 2000

Club News

June Launches Rearranged – due to field scheduling problems with MRFF, the launches for June have been rearranged. MRFF has been moved to June 3&4 while the Youth Group launch has been moved to Sunday the 25th.

In addition to these previously scheduled launches, a regular club launch has been scheduled for Sunday the 18th (Father's Day).

Insurance is Back – As most members probably know by now, the NAR has found a new source for insurance. Because there was no actual lapse in insurance, NIRA will be able to hold all of the launches scheduled for the year.

Since this is an important topic for all NAR members (and potential members), the complete insurance announcement is being printed (at left).

BATF Lawsuit – The lawsuit filed against the BATF by the NAR & Tripoli is still progressing. The latest new released by the NAR is printed on page 11 – there is still no word on the NAR/Tripoli counter motion which was filed almost two weeks ago.

Logo Contest – The vote for the club logo has been postponed to the July meeting. This is because the June meeting is the day before MRFF and last minute preparations are expected to take much of the meeting.

If you need to refresh you memory of the entries, they were published in the last Leading Edge which is available online on the NIRA web site (<http://nira.chicago.il.us>).

Meeting Dates – There have been a couple of questions about the NIRA meeting schedule after August. The civic center schedules their rooms from September through August and the list of available dates is expected soon.

In prior years, because of civic center scheduling, we have had to change either the locations or the dates of the September and October meetings. This will be discussed as soon as the schedule is published, probably at the July meeting.

New NAR Insurance Coverage Announced

By Mark 'Bunny' Bundick
(on www.nar.org)

I'm pleased to announce the NAR Executive Committee has approved a new insurance policy for NAR members and Sections. My thanks to Bob Blomster, our agent at J. A. Price Agency, who put a tremendous amount of effort into finding and structuring a policy for NAR members in a very short period of time. Thanks also to NAR Treasurer Stew McNabb, NAR Trustee George Gassaway and NAR HQ manager Marie Stumpe, who all contributed key data and administrative support to the insurance application effort.

Policy Particulars

The policy was obtained through the J. A. Price Agency in Eden Prairie, MN and is underwritten by Lloyds; a company rated A- by Best. Coverage will apply to the NAR itself, all NAR members, Sections and site owners as registered and in good standing. The commercial liability coverage we obtained has the following limits, deductible and exclusions:

Limits of Liability

General Aggregate Limit (Other than Products and Completed Operations)	\$2,000,000
Products and Completed Operations	Included
Personal and Advertising Injury	1,000,000
Each Occurrence	1,000,000
Fire Damage – any one fire	100,000
Medical Expense – any one person	5,000

Deductibles

Per Bodily Injury & Property Damage Claim	\$250
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Exclusions

- Commercial Use
- Nuclear Accidents
- Year 2000
- Safety Codes
- Assault & Battery Exclusion
- Sexual Abuse Exclusion
- Liquor Liability Exclusion

The first four exclusions are the same as our

previous policy; the last three are new, but should not present an issue for NAR members and Sections.

Administrative Items

I ask for your patience as we set up this new administrative structure; it will take us 30-45 days to restructure NAR HQ operations to obtain all the forms and procedures necessary to support the new insurance program. However I can pass along the following information that should help you understand the basics of our new policy.

1. Our coverage will be effective Wednesday, April 5, 2000. This means there will be no gap in NAR insurance coverage for members or Sections.
2. We intend to publish a new "Proof of Insurance" coupon in the next issue of the *Model Rocketeer* (June 2000) to provide members needing to show such proof some physical evidence of your coverage.
3. We'll also publish that coupon as part of the NAR website's filing cabinet for members who cannot wait for the *Rocketeer*. We hope to have that coupon available sometime in the next two weeks.
4. Our second member packets in the future will obtain details of the coverage for member review.
5. Sometime in the next 30 days, a new version of the NAR Insurance Frequently Asked Questions (FAQ) will be available at the NAR website. That FAQ will outline key provisions of the coverage and we hope, will answer most of your questions about coverage as applies to particular circumstances.
6. We'll also provide claims form information, and contact information at J. A. Price for landowners who have questions about the policy particulars.

Key Information for NAR Sections and Members

1. NAR Sections who applied for their charters prior to April 5 are covered automatically under

(*New NAR Insurance continued on page 6*)



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THE LEADING EDGE is published bimonthly by and for members of the Northern Illinois Rocketry Association (NIRA), NAR Section #117, and is dedicated to the idea that Sport Rocketry is FUN!

Articles, plans, photos, other newsletters, and news items of interest should be sent to:

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Send membership applications (dues: \$6 per youth, \$8 per adult, \$12 per family, including a six issue subscription to the Leading Edge), non-member subscriptions (\$10 per six issues), and change of address notification to:

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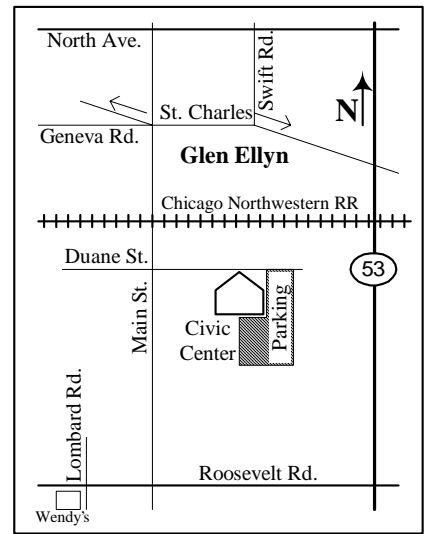
NIRA's web site is at: <http://nira.chicago.il.us/>



CLUB MEETING DATES

All meetings start at 7:30 pm. Bring a model for 'Model of the Month.' We always need volunteers for pre-meeting lectures, contact Rick Gaff if you want to schedule a date. The location is the Glen Ellyn Civic Center, 535 Duane Street (usually the 3rd floor, but check the board in the lobby).

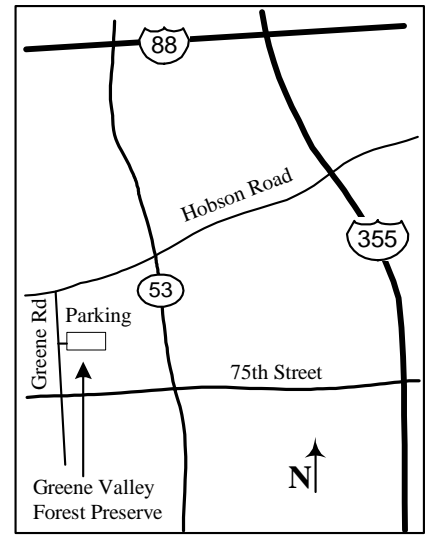
- April 7
- May 5
- June 2
- July 7
- August 4



CLUB LAUNCH DATES

Launches are BYOL (bring your own launcher). The location for our launches is the Greene Valley Forest Preserve (see map at right). Call the NIRA hotline for pre-launch information: 630-483-2468.

- June 3-4 – Midwest Regional Fun Fly (at Bong)
- July 18 – Regular club launch.
- June 25 – Youth Group Launch (at Greene Valley)
- July 16 – Regular club launch.
- August 20 – Regular club launch.
- August 27 – Youth Group Launch (at Greene Valley)
- September 17 – Greene Valley Forest Preserve
- October 15 – Greene Valley Forest Preserve
- November 19 – Greene Valley Forest Preserve



Model of the Month Winners! (photos by Rick Gaff)

April – Cal Jestic won the adult category with his Black-Glassed Bertha while Beth Pleimling won the youth category with the rocket she built at the hobby show.

May – Tim Cordes won the youth category with a Mach Buster while Mike Wisvader won the adult with a Python converted to a Nike-Smoke.

Modifying the Phantom 4000 for Standard HPR motors by Bob Kaplow (NAR 18L)

Copyright 2000 by Robert G Kaplow

This spring I picked up the NCR Phantom 4000 starter set being dumped by Hobby Lobby for \$20. Since NCR motors don't seem to be available any more, I had to modify the rocket for standard 29mm motors, and augmented the NCR motor clip with Kaplow Klips (September/October 1996 Sport Rocketry, page 29-30). I also added an ejection baffle. This is the third NCR kit I've modified in this manner.

I haven't used the launch controller from this set yet, but it seems to be a decent unit, but expensive to feed if you don't already have the two RC NiCad batteries and charger. The plastic pad and rod in this starter set are junk. The pad tilt adjustment isn't solid, and will slip apart at a glance. The aluminum rod is too flimsy to fly this rocket from. At a minimum replace it with a 4'x4" steel rod.

The only parts I added to the kit itself were a pair of 6-32 T-nuts and matching 6-32 x 1/2" stainless steel cap screws, some 1/4" x .025 brass strip for the Kaplow Klips, plus a scrap of 1/8" ply to plug the forward end of the MMT. I also used a Quick-Link on the nose cone to connect the chute and shock cord. The rocket was built using the System Three Epoxy trial kit <http://www.systemthree.com/> available for \$10 postpaid.

The first step is to modify the three centering rings. In the FORWARD centering ring, I drilled four 5/8" holes midway between the ID and OD, and evenly spaced around the ring, avoiding the webbing.

In the REAR centering ring, I drilled 2 holes for the T-nut shoulders, installing them as close to the center as possible, again avoiding the plastic webbing and retainer slots on the back side. Since the T-nuts have 3 tabs, I also made 3 small slots around each center hole for the tabs, with a rotary tool. Roughen the black ring where the T-nuts will be glued. Epoxy the T-nuts into the holes, taking care not to get any epoxy in the T-nut threads. I usually put a bit of reload grease into the threads to prevent any wayward epoxy from sticking. Liberally fillet thickened epoxy over the T-nut flanges.

I also filled the unused slots in the MIDDLE and REAR centering rings with a slurry of epoxy and filler, by creating a well with masking tape and dripping in some extra epoxy slurry.

Next, modify the MMT to fit standard motors, and to vent into the baffle. Using the sharp point of a modeling knife, loosen the start of the spiral on the inside of one end of the motor mount tube. Grab with a needle nose pliers,

hemostat, or tweezers, and slowly and carefully roll the paper back on itself, peeling up the tube about 6-7" (see photo at right). If it tears before you are deep enough, restart with the knife up inside the tube and continue. Check the fit. You may have to remove a second layer to fit standard AeroTech motors easily.

At the other end of the MMT, mark 4 lines evenly spaced around the tube, as if you were installing fins. Mark locations along this line 2", 3", 4", 5", and 6" from the unpeeled end of the tube. These 20 locations will be drilled with 1/4" holes. I recommend the use of a brad point bit for drilling holes in the tube, as it makes a cleaner cut than a normal twist drill. Carefully drill the 20 holes.

Once the tube is peeled and drilled, soak the inside of the tube ends and the edges of the 20 holes with thin CA. Allow to cure well, then sand the inside of both ends of the MMT with a 1" dowel with sandpaper wrapped around the end. Double check the AeroTech motor fit after sanding. Clean up the MMT baffle holes with a rat-tail file.

Finally, cut a plywood disk so that it fits snugly in the forward (vented) end of the MMT. Glue it in the forward end of the MMT, recessed about 1/8" and fillet both sides well.



Drilling holes for the baffle

You are now ready to build the Phantom, pretty much as per the directions EXCEPT do **NOT** install the REAR centering ring to the MMT until later (page 3 second column, skip the fourth box).

Also, when installing the FORWARD ring (page 3 second column, sixth box), be sure to align the rows of MMT holes so that they are **BETWEEN** the centering ring holes (see photo at left)



Align baffle holes between the centering ring holes



Using needle-nose pliers to modify the motor mount for standard motors.

as these offset holes form the baffle.

Obviously skip filleting the REAR centering ring (page 5 second column, first box).

I prefer to finish my rockets before installing the fins. I covered the tube with iron-on Econokote, and did likewise with the fins. I put a piece of 1/2" masking tape on the BT where fins and lugs will be glued, cover, and then with a sharp knife cut the coating and peel off the tape.

Now you are ready to install the fins as per box 2 on page 5. The REAR centering ring has been left off so we can fillet the fin insides as well as the outside. Fillet the centering ring - body joint, the centering ring-MMT joint, the fin-ring joints, and the fin MMT joints. These are done one pair at a time, at the same time as the external fin - body fillets (see photo below). All the fillets use epoxy thickened with your favorite filler. Allow each set of fillets to cure before continuing.



Attach fins before the rear centering ring so that internal fillets can be made.

Now you can install the REAR centering ring, with the T-nuts and webbing on the inside. Spread epoxy on the inside of the body tube, outside of the MMT, and on the fin tabs and shove it in place. With the rocket vertical, allow it to dry, so that the epoxy forms internal fillets. When dry, turn the rocket upside down and fillet the outside of the REAR ring.

I've kept the NCR retainer for use with the few remaining NCR motors. But to retain RMS motors or expendables, you'll need to add Kaplow Klips. To make the Klips, get some 1/4"x.025 or .032 brass strip. Drill a hole near each end for the cap screw that fits the T-nut you used. Install the reloadable or expendable motor you will be using (most expendable motors will need a tape ring shoulder). Now with a needle nose pliers, gently bend the brass so that it fits from the centering ring, down the side of the MMT (if any is still exposed) and aft closure, across the motor closure, and back up inside the closure. Cut with a wire cutter or cutoff tool. Do the same with the other end of the brass strip so the two hooks are identical. Avoid any sharp 90 degree bends, and give all corners a small radius to reduce stress. Sand or file off any sharp corners or edges.

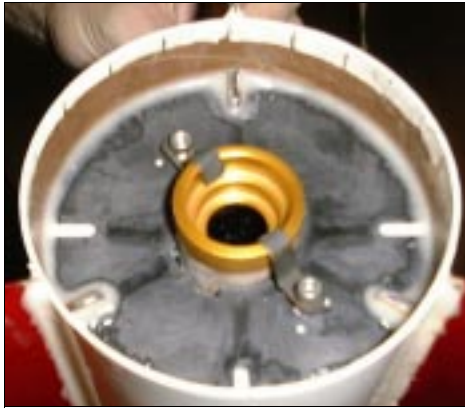
(Modifying the Phantom 4000 continued on page 4)

(Modifying the Phantom 4000 continued from page 3)

To fly, prep your reload or wrap tape around the end of the expendable motor, install the motor in the MMT, then using cap screws, secure the two hooks in place snugly. Install the parachute normally, but leave out the wadding. Remember, the hot gasses do NOT burn the chute! It's the still burning ejection charge particles that do the damage. The baffle traps the burning particles, allowing the gas to continue relatively unimpeded. Prep the rest of the rocket normally.

No real maintenance is needed. Unlike the tight mesh, the baffle trap is not dense and doesn't clog up with ejection crud. With reloads, do remove the red cap after flight, which will still be in the MMT unless your holes are too big. The rocket will develop a bit of "rattle" over time as small debris collects in the baffle. I've never tried, but a shop vacuum "enema" might remove some of this.

I've flown the Phantom 4K once so far, on an NCR F62 motor. But with the extra reinforcing of the fin can I think this rocket will hold up to



Completed engine mount with engine held in by Kaplow Klips

H motors with no problem, making it a bargain Level 1 certification rocket if you can find one on closeout. At least one NIRA member has certified with his P4K.

A couple notes about using this baffle system in other rockets.

My rule of thumb is to preserve the cross sectional area of the MMT in the gas ports. For the FORWARD centering ring, that usually means 4 holes each half the diameter of the MMT. For the MMT vents, 4 rows of 4 holes each 1/4 the diameter of the MMT. Since 1/4" is a bit small, I used 5 holes in each row. Keep the holes at least 3 diameters apart to prevent weakening the MMT too much.

The **Interceptor-G** has no motor retainer. I used miniature DuBro 6-32 T-nuts in this rocket, but they are over 2" from the end of the plastic shroud. I had to scrounge for some 6-32 x 2.5" screws. I built a single brass strap that goes across the aft end of the motor with a large hole for the nozzle to hold the motor (NCR or AT) in place. I also had to use 6 smaller holes in the FORWARD baffle ring, to preserve the area and thus more rows of smaller holes in the MMT tube. This rocket is still under construction.



Interceptor-G retainer and Kaplow Klips

Kosdon, Kosdon East and Aero-Tech, Inc. Agreement Announced

Las Vegas, NV (ROL Newswire) - Franklin "Frank" Kosdon of Kosdon Enterprises, Paul Robinson of Kosdon East and AeroTech, Inc. are pleased to announce an agreement whereby AeroTech will obtain an exclusive license to certify, manufacture and distribute Kosdon TRM™ (Truly Recyclable Motors) reload kits and hardware.

This means that Kosdon TRM™ products will continue to be available for Frank's loyal customers and more. As many people know, a number of the current Kosdon TRM™ Tripoli motor certifications are due to expire on June 1, 2000. The Kosdon team decided the best method to continue and increase production of Kosdon TRM™ products was to license the TRM™ technology to a fully legal and very capable manufacturer. After months of discussion, AeroTech has been chosen as the best supplier for Kosdon TRM™ products.

The existing line of Kosdon motors will be sold under the name "Kosdon TRM™ by AeroTech". This will effectively increase the certified availability of the excellent rocketry products that Frank has developed over the last 15 years.

While some minor details are still being negotiated, the following information can be released

at this time:

Frank has agreed to sell an exclusive license for the rights to manufacture the Kosdon TRM™ technology to AeroTech. This includes the Kosdon TRM™ hardware and the "FAST", "SLOW", and "DIRTY HARRY" propellant formulations. The primary reason is simple. Lately, Frank has been unable to devote the time he desires to research alternate propulsion technologies. The increasing popularity in Kosdon TRM™ has caused production to take too much time away from his R&D efforts. Frank wishes to be involved in all aspects of the hobby, just not selling Kosdon TRM™.

AeroTech will produce and sell Kosdon TRM™ products for the high power rocket community and the current expanding customer base.

Frank will become a West coast dealer for Kosdon TRM™ by AeroTech.

Kosdon East will become an East coast dealer for Kosdon TRM™ by AeroTech.

Paul Robinson will receive a license to produce and sell his own new products using the patented AeroTech reloadable motor technology (additional information on new products will be announced at a later time by Paul).

Frank is pleased that he will be able to continue to "personally serve the faithful" who have appreciated his rocket motors and related components, engineered since becoming a "born again

rocketeer" in 1985. Under this arrangement he will be able to devote full time and energies to product development and, according to Frank, "in no way curtails Kosdon TRM™ products or my creative efforts".

Gary Rosenfield, President of AeroTech, states that "every effort will be made to certify and expand the unique Kosdon TRM product line". Gary has also set the goal of submitting the Kosdon motor line to the California State Fire Marshal (CSFM) for CSFM classification, so that they will "enjoy the same widespread availability that AeroTech motors have had for some time in California." Frank will be given every encouragement to resume full-time creative efforts and AeroTech will strive to expand the certified availability of current (and new) Kosdon motors.

AeroTech is committed to expanding the variety of products offered to the sport rocketry community and to improving it's current line of product offerings.

As the certification of certain Kosdon TRM™ motors will end on June 1, 2000, recertification discussions with Tripoli and NAR in this regard have already been initiated. (Note: The Tripoli consumer protection policy gives purchasers 3 years after certification end date, to use any purchased motors or reloads manufactured during the certification period.) The renewed availability of Kosdon TRM™ products to sport rocketry

(Kosdon continued on page 11)

Rocket Math 4: Hemisphere Parachutes *(The Gore-ē Details)* by Norm Dziedzic (NAR 72426)

Introduction

In model rocket recovery, nearly everyone understands the simple, flat, plastic hexagon (6 sides) or octagon (8 sides) Estes style of parachute. These parachutes are cheap and simple to make and do the job for most model rockets. However, for performance, looks or both, the hemispherical or semi-hemispherical 'chute is employed.

We'll detail the math behind generating a hemispherical 'chute and how you can make your own plastic hemispherical parachutes with items you already have at home.

You Can Call me AI (Gore)

Since it's almost impossible to find material woven into a hemisphere, these parachutes are constructed by joining together flat pieces of material called *gores* to approximate the hemisphere. Figure 1 shows a hemisphere with gore lines overlaid on it to illustrate this concept.

Our job here is to determine the flat pattern of the gores so that when joined together on the edges, the result resembles a hemispheric shape.

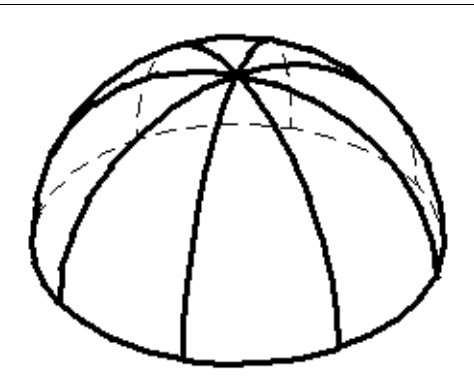


Figure 1. An 8 gore hemisphere

Pi are round?

The most basic relationship regarding circles is that of the diameter to the circumference (or distance around the circle). Thinking back to grade school geometry you may remember the infamous: $\pi \cdot r^2$. Well, that's the formula for the *area* of a circle and **not** what we need here. Our equation for the *circumference* (C), or distance around a circle is even simpler:

$$C = 2 \cdot \pi \cdot r \quad \text{or} \quad C = \pi \cdot d \quad [1]$$

Where C is the circumference of the circle, r is the radius of the circle, d is the diameter of the circle and π is that "magic" constant which is about 3.14.

Gore Generation

Since we know we can't make a perfect gore from a flat material, we need a plan of attack to approximate the shape as best as possible. The most common path to gore generation is to draw

a line down the center of the gore and make this match the true length along the outside of the sphere. If we call the radius of the sphere R , then the length of this line (L) equals $\frac{1}{4} C$ or a fourth of the way around the sphere.

The other value we need to know is the width at the base of the gore which lies along the diameter of the sphere. This is simply the circumference of the sphere divided by the number of gores. If we denote the number of gores as N , then this width (W) is:

$$W = \frac{C}{N} \quad [2]$$

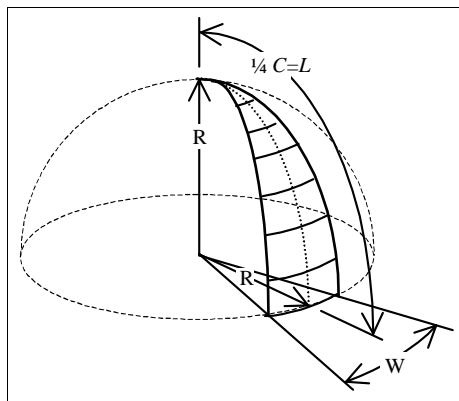


Figure 2. Gore Layout

At this point, we actually have enough information to create a rough gore pattern which will suffice for our purposes. We will proceed with an example for a 12" diameter, 8 gore parachute.

The radius of this hemisphere is half the diameter or 6" and equation [1] gives:

$$C = (2)\pi(R) = (2)(3.14)(6) = 37.68\text{in}$$

Then the center line length of the gore is $\frac{1}{4} C$ or 9.42 inches and the base width of the gore is C over the number of gores or $37.68 \div 8$ which is: 4.71 inches.

To create the gore pattern, draw a vertical line of about 9.42" and then center a 4.71" line at its base as shown in Figure 3. To create the curved sides of the gore, start at one end of the base line and draw *almost* straight up and toward the center.

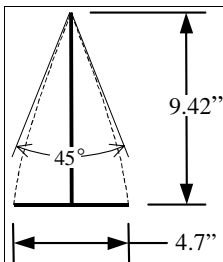


Figure 3. Full Hemisphere Gore

When you get to the tip of the gore, the angle between the two outside curves will depend upon the number of gores desired. Remember, each gore is an equal division of the circle so for our 8 gore example, this angle (which our curves should be contained within) will be $360^\circ \div 8$ or 45° .

Once you have one side of the gore drawn, fold the paper in half along the vertical line and trace the form for the other side onto the paper or if you are making a pattern, just cut both sides at once.

For you sticklers, there are exact equations for the curves on the sides and ways to generate more points for the side curves to be drawn through. But, for our purposes, this "by eye" method will be just fine.

OK, How Do I Make One?

The basic material for these hemispherical 'chutes is the same as the standard hex sheets: plastic bags (garbage bags, dry cleaning bags, grocery store bags). Use two or more colors to make more interesting looking parachutes.

Materials/Tools Required:

- Clothes Iron
- Wax Paper
- Thin Cardboard for Patterns
- Smooth wooden board to iron on (An ironing board will be too soft)
- Plastic for the gores
- Button/Carpet thread (shroud lines)
- Tape (shroud attachment re-enforcement)
- Hobby knife

Warnings:

- Children should be supervised when using hot appliances such as a clothes iron.
- Read and follow all of the safety instructions which came with your iron.
- When ironing on a board for extended periods of time, the board will retain heat and may become hot enough to burn. Do not iron over the same area of the board continuously, rather, for each seam, move to a different section of the board to distribute the heat and avoid creating a "hot spot".

Instruction Steps

1. On the cardboard, draw a gore pattern using the instructions in the previous section of this article and cut out. This is the ironing pattern. (patterns for a 12" 8 gore 'chute are included in this issue of *The Leading Edge*.)
2. Draw a second gore pattern on the cardboard adding $\frac{1}{4}$ " to each side of the outside curves and cut out. The extra $\frac{1}{4}$ " is for the seams joining the gores together. This is the cutting pattern
3. Using the cutting pattern, cut out the required number of gores from the plastic material. Cut off about 1" from the point of each gore to allow for a spill hole and to keep things from getting crowded when ironing the seams at the gore tops. Keep a few scrap pieces of plastic handy for ironing tests.
4. Preheat the iron to the "wool" setting. Create a test stack of the following layers (as seen in Fig. 4): wax paper, plastic scrap, cardboard scrap, plastic scrap and wax paper. Line up one set of edges of the plastic scraps and let them overhang the cardboard by about $\frac{1}{4}$ ".

Make sure the wax paper covers all areas where you will be ironing (top and bottom). Using the edge of the cardboard as a guide,

(Rocket Math continued on page 6)

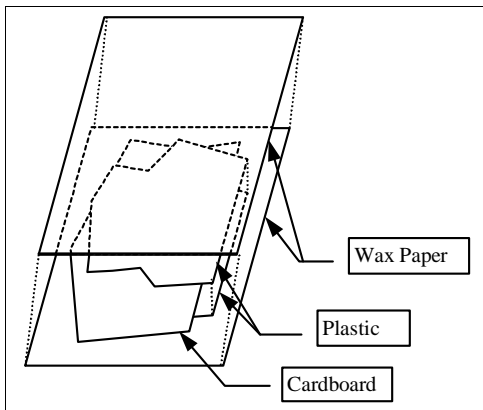


Figure 4. The test stack

run the iron over the top of the test seam a couple of times. Allow to cool for a minute or two and test the seam by pulling on the two pieces of plastic. If the iron is hot enough to fuse the plastic, it will tear near the seam; otherwise the seam will peel apart and you need to increase the heat setting slightly and try the test again.

5. Now make up a stack using the plastic gores and cardboard ironing pattern. If you made different color gores, remember to alternate. Iron the seam on **one side only**. Continue adding gores, working your way around the 'chute until you iron together the first and last gores completing the circle. When finished, turn the 'chute right side up to get the seams on the bottom of the chute.
6. Cut shroud lines from the button/carpet thread to the desired length and attach to the bottoms of the seams with the tape. A good rule of thumb is to make the lines at least 1.5 times the 'chute diameter.

(New NAR Insurance continued from page 1)

the terms of our policy with no additional paperwork required, *whether or not* the optional insurance was paid for. These NAR Sections may schedule and fly launches at any time, with no notice needed to our insurer. Your coverage remains in effect at all times with no advance notice required.

2. All NAR members are covered for all sport rocket activities (as defined in the NAR Model Rocket and High Power Safety Codes), *whether or not* they paid for insurance in this membership period. Those who paid for optional insurance under the old plan (prior to April 5) are eligible for a partial rebate as described below.

3. Non-NAR members continue to be welcome at NAR ranges without respect to any insurance coverage they may or may not have. NAR insurance coverage will remain in effect for members and Sections regardless of other parties' use of your field.

4. Section and site information is being forwarded to J. A. Price who will create and distribute new insurance coverage certificates for Sections and their site owners. Insurance certificates will be mailed out sometime in the next seven business days.

More Performance

While the full hemisphere provides the best looking parachute, a more efficient design (descent rate vs. weight) is to make a 'chute using just the top half of a hemisphere or a *semi-hemisphere* parachute.

Looking at the semi-hemisphere in Figure 5, we will call the radius of this truncated hemisphere R' with R again being the radius of the full sphere. Since all of our equations are based on R , we need to find a way to generate R from the radius of our semi-hemisphere radius, R' . Since space is growing short I'll just throw out the equation here:

$$R = \frac{2}{\sqrt{3}} \cdot R' \quad [3]$$

The length of W is the same as before (since the diameter of the 'chute is the same as before) but we need a new L which is:

$$L = \frac{\pi}{3} \cdot R \quad [4]$$

(note: use R not R')

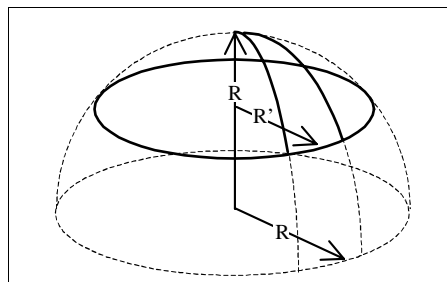


Figure 5. The Semi-Hemisphere (from the solid line up)

5. If a site owner's mailing address was not on file at NAR HQ, the site owner's certificate will be forwarded to the Section contact, either president or advisor, per the Section's records at NAR HQ.

Financial Arrangements

Unfortunately, since our new coverage could not remain optional, all NAR members will have to share the financial burdens of a new premium payment. Effective immediately, NAR dues will now be:

Juniors	\$25.00
Leaders	\$25.00
Seniors	\$47.00

Financial Arrangements For Members Who Previously Purchased Optional Insurance for 2000

NAR members who purchased our previously optional insurance coverage may redeem a coupon to be printed in the June 2000 issue of the Model Rocketeer. This coupon can be used to obtain either an extension to your membership or a check for the difference between the new and old cost of insurance. Given the new dues structure and the cost of the first three months of insurance for 2000, the value of this coupon is as follows:

So, again using our example of an 8 gore, 12" diameter parachute we first determine R for the full sphere:

$$R = \frac{2}{\sqrt{3}} \cdot 6" = 6.928"$$

Then we use this value in equation [4] to find the length, L , of the gore:

$$L = \frac{\pi}{3} \cdot 6.928" = 7.255"$$

The only difference in drawing the semi-hemisphere gore is when it comes to the curved sides. Instead of starting the line up from the base in a straight up fashion, you start the line angled in at approximately 60° from horizontal as shown in Figure 6.

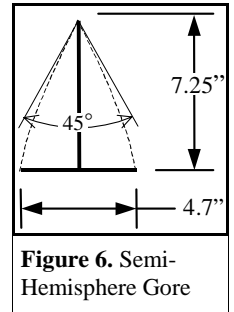


Figure 6. Semi-Hemisphere Gore

Conclusions

By now you should realize that the details of hemispherical parachutes are not that gory after all. A couple simple equations are all it takes to create the patterns for professional looking 'chutes that you can build from items you probably have on hand already. So next time you have that special model or just want to jazz up an old bird, try a hemisphere or semi-hemisphere plastic parachute.

Juniors/Leaders	extend membership 6 months or \$14.25 cash value
Seniors	extend membership 2 months or \$9.00 cash value

In either case, you must redeem your coupon not later than August 15, 2000. Coupons received with postmarks beyond that date cannot be accepted.

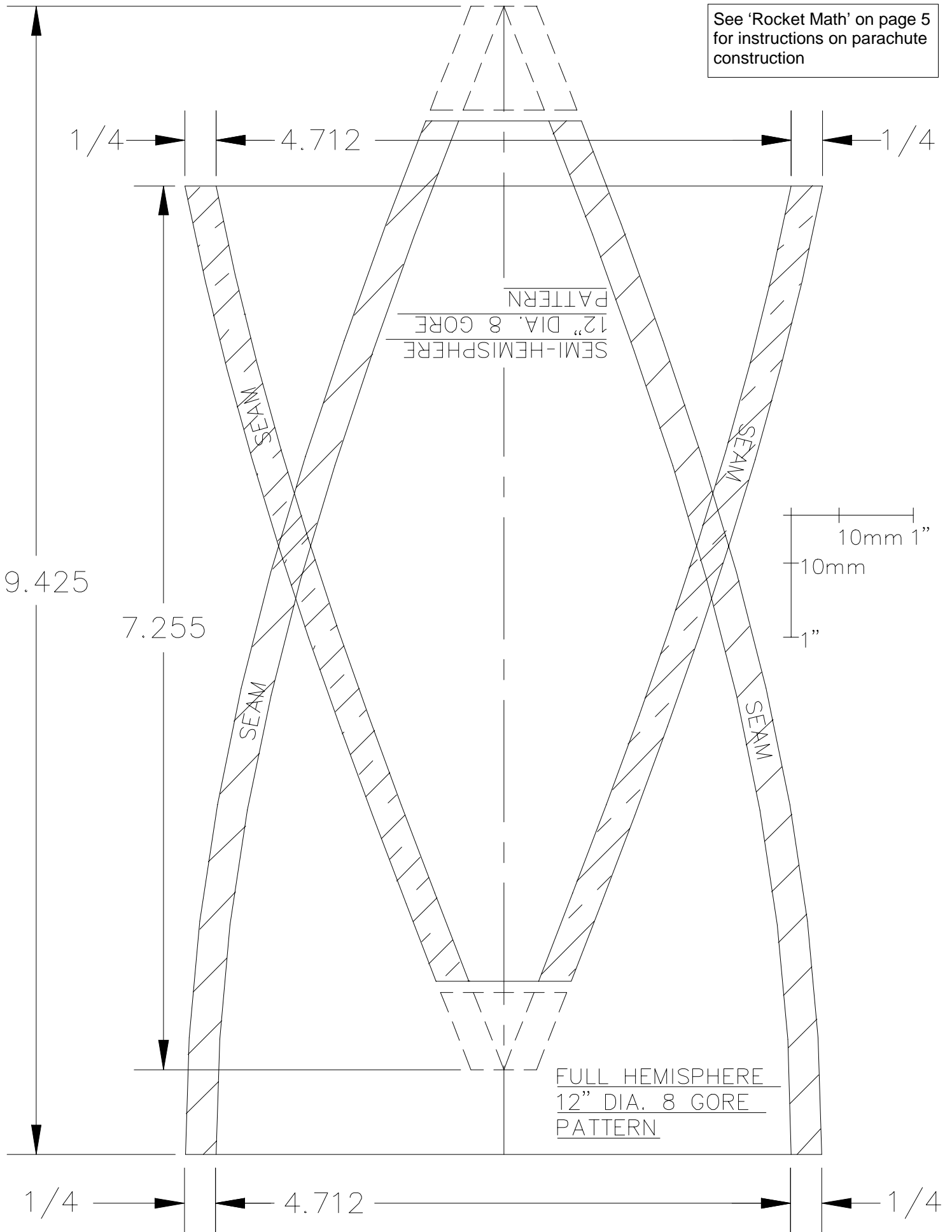
Closing Comments

I realize that the past month with the uncertainty regarding NAR insurance coverage have been difficult, particularly with Sections planning launches for the 2000 flying season. My apologies for the difficulties we've caused, and my thanks for your understanding and patience during this transition period. With a new solid insurance program in place, I believe the NAR is poised to have an excellent, safe and successful flying season.

Pay forward. Aim high.

Mark B. Bundick, President
National Association of Rocketry

See 'Rocket Math' on page 5
for instructions on parachute
construction



Space Launch Report for March-April 2000

by Tim Johnson

There were nine space launch successes and one failure during March-April 2000. Sea Launch suffered the failure. Russian launchers provided five successes from Baikonur, including three by Soyuz-U and two by Proton-K. Arianespace scored two successes. Delta and Taurus each flew once from Vandenberg. Range refurbishment silenced Cape Canaveral/KSC, where five rockets stood ready to fly at the end of April.

Sea Launch Zenit 3SL Failure

The third Sea Launch Zenit 3SL/DM-SL failed to orbit ICO Global Communication's \$100 million F-1 satellite on March 12. ICO F-1 would have been the first of a 10-satellite Medium Earth Orbit (MEO) comsat constellation.

Zenit builder KB Yuzhnoye blamed the first Sea Launch failure on a bad automatic launch sequencer step that left a second stage pneumatic control system valve open at liftoff. The system gradually lost pressure, shutting down two of the stage's four RD-8 steering engines after staging.

When the rocket flew out of control 461 seconds after liftoff, Zenit's flight control computer shut down the 93,000 kgf thrust LOX/kerosene Energomash RD-120 second stage main engine. Zenit fell into the Pacific about 4,300 km from the launch site.

Zenit's four-chamber RD-171 first stage engine fired for 154 seconds as planned, lofting the vehicle southeast from LP Odyssey's 0 deg North, 154 deg West launch position. If the second stage had not failed, the RSC Energia Block DM-SL third stage would have burned twice to put the 2,750 kg Hughes HS-601 comsat into a 10,390 km x 45 deg orbit.

Three Soyuz-U Launches

The second Soyuz-U/Fregat flew Starsem Flight ST-08, the European Space Agency Cluster 2 validation flight, on March 20. The 3.5-stage rocket lifted off from Baikonur LC31 with a 2,270 kg dummy payload simulating a stack of two Cluster 2 spacecraft. After Soyuz propelled Fregat to sub-orbital velocity, Fregat fired to put itself into a parking orbit. Following a 75 minute coast, Fregat burned again to put

itself into a 242 x 18,000 km x 64.86 deg deploy orbit where two payload separation events were simulated.

On April 4, a Soyuz-U launched Soyuz TM-30 and two cosmonauts on a Mir-revival mission. Commander Sergei Zolotarev and Flight Engineer Alexander Kaleri rode the 2.5 stage rocket from Baikonur's LC-1. Their 7,250 kg spacecraft gradually climbed to Mir's 329 x 333 km x 51.6 deg low earth orbit (LEO) before docking on April 6. MirCorp, a Netherlands based consortium partially owned by RSC Energia, funded the \$20 million Mir-28 mission.

Another Soyuz-U launched Progress M1-2 to Mir from Baikonur LC1 on April 25. The 7,250 kg spacecraft docked with Mir on April 27, replacing Progress M1-1, which undocked and deorbited on April 26. MirCorp also funded this resupply mission. The launch was the 39th consecutive Soyuz-U success since 1996.

Two Proton-K/DM Missions

Two Khrunichev Proton-K boosters with Block DM fourth stages orbited Russian-built comsats during March-April. A Proton-K/DM-2 orbited Intersputnik's Express-6A from Baikonur on March 12. A Proton-K/DM-2M orbited the Siberian-European Satellite (Sesat) for Europe's Eutelsat from Baikonur Area 200 Pad 39 on April 17. The latter mission was the year's third Proton-K/DM launch and the 272nd Proton since 1965.

Both flights were two-burn Block DM missions. In each, Proton-K put the upper stage/payload stack into a parking orbit. The LOX/kerosene stage then performed a 7-minute burn at the first equatorial ascending node, about 73 minutes after liftoff, to enter geosynchronous transfer orbit (GTO). About 6.5 hours after liftoff, as the vehicle reached a 35,600 km apogee, the stage fired again for 3 minutes, boosting itself into a circular geosynchronous earth orbit (GEO).

NPO-PM, of Zheleznogorsk in eastern Siberia, built both 2,600 kg Express-6A and 2,500 kg Sesat. Sesat was the first Russian-built Western comsat. Alcatel France supplied both communication payloads. The Russian Aviation and Space Agency conducted both launches.

Two Arianespace Missions

Ariane L505, flying Arianespace Mission V128, put Asiastar and Insat 1B into GTO from Kourou ELA 3 on March 21. The 2,777 kg Alcatel-built Asiastar deployed from atop the Sylda 5 dual payload carrier about

28 minutes after liftoff. Insat 1B, a 2,070 kg spacecraft built by Indian Space Research Organization, deployed from within Sylda 5 about 6 minutes later. It was the second commercial Ariane 5 mission and the first to orbit multiple comsats.

Ariane L496, on Arianespace Mission V129, orbited PanAmSat's Galaxy 4R comsat from Kourou on April 19. The three-stage Ariane 42L lifted off from ELA 2. Twenty one minutes later, after a standard direct single-burn third stage mission, the 3,668 kg Hughes HS-601HP satellite separated into GTO. V129 was the 54th consecutive Ariane 4 success and the 93rd Ariane 4 success in 96 flights.

Darpa Taurus

An Orbital Sciences Darpa Taurus (Taurus 1110) with a Peacekeeper ICBM first stage, successfully orbited the U.S. Dept. of Energy's Multispectral Thermal Imager satellite (MTI) on March 12. The four-stage rocket lifted off from Vandenberg SLC 576 East. From its 600 km polar orbit, 587 kg MTI will test "spy" satellite imaging technology.

The first stage, called "Stage-0" by Orbital, burned for 61 seconds. The Orion 50S Stage-1 and Orion 50 Stage-2 then burned for about 80 seconds each. Stage-2 remained attached to the Orion 38 Stage-3 (fourth stage) during its 300-second coast to a 572 km apogee, 2,433 km downrange. There, Stage-3 fired for 74 seconds to put itself and MTI into orbit. This was the third Darpa Taurus and the fifth Taurus success in five attempts.

Delta 277

Delta 277, a Boeing Delta 7326 model with three strap-on solid motors, a Thiokol Star 37 third stage, and a 2.9 meter diameter aluminum payload fairing, successfully orbited NASA's Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) from Vandenberg SLC 2W on March 25. Delta's third stage injected the 494 kg IMAGE spacecraft into a highly elliptical polar earth orbit about 56 minutes after lift off.

After first stage separation, the 4,451 kgf thrust Aerojet AJ10-118K-powered second stage burned for 424 seconds to enter an elliptical parking orbit. Delta coasted for 43 minutes to a 1,000 km apogee where the third stage spun up, separated, and burned for 65 seconds to boost itself and IMAGE into a 1,000 x 45,871 km x 90 deg deploy orbit.



Proton-K/DM-2M with Sesat being raised to launch position. (Eutelsat photo)



Taurus No. 5 at liftoff (Orbital Sciences photo)



Soyuz-U/Fregat lifts off on Starsem Flight ST-08 (Starsem photo)

A Visit to the Kansas Cosmosphere

by Bob Wiersbe

Over spring break I took my family on a seven day, 2700 mile excursion into the heart of the country. We visited the farmlands of Nebraska (where my folks live), the mountains of Colorado (where my wife wants to live), the area around Canon City, Colorado (where NARAM will be held this year), and made a final stop in Hutchinson, Kansas.



Russian engines on display

What's in Hutchinson, Kansas you say? Not much, except this one really cool museum - The Kansas Cosmosphere. Most people probably haven't heard of it, even though it is part of the Smithsonian Institute. If you're a rocket nut then you chances are you know about it. If you watched them raise the Liberty Bell 7 from the ocean floor last year, then you should know about it.

The Cosmosphere is a museum dedicated to spaceflight, and it has the largest collection of Russian space hardware in the United States (maybe even outside of Russia!). It is the resting place of the Odyssey, the Command Module for Apollo 13, and will be the home for the recently restored Liberty Bell 7.

A Mercury-Redstone and Gemini-Titan greet visitors outside the museum, and a bronze statue of Eugene Cernan as he takes his last steps from the moon is near the entrance doors. Inside an SR-71 hangs from the ceiling, and a mock-up of a space shuttle gives an idea of the sheer size of the orbiter.



Statue of Gene Cernan

On the first level is the Omnimax theater, Dr. Goddard's Lab, the Planetarium, cafeteria, and gift shop. One could spend hours (and lots of money) in the gift shop, so I recommend that you go there last (unless you need film). The offices and classrooms are upstairs, and the museum fills the entire downstairs.

The museum has a little bit of everything, including a solid history of rockets since World War II. On display are a V2, Buzz Bomb, as well as pictures and the history of the people involved. I have to admit that I was in a bit of a rush to get to the Liberty Bell 7, so I went

through the museum pretty fast. A few things did catch my eye, such as the remains of a destroyed Mercury capsule, and much of the Russian hardware.

It's amazing to me what the Russian's have accomplished in space, using what we would consider "inferior" technology. Their rocket engines were developed in 1956, and they still use them today! The robots that they landed on the moon are fascinating to look at, and they really worked.

As I mentioned, the Odyssey is on display in the museum. It sits alone in a room, about 15 feet behind the glass so you can get a good picture of it. It was sobering to look at that spacecraft and think of what those three men went through on their trip to the moon.

There is a fullsize mock-up of the Apollo-Soyuz mission, including both spacecraft and the docking collar. The size of the Service Module is unreal, and the engine in the rear is huge. As I was looking it over I got distracted by a crowd gathered in another corner of the room. Then I saw what they

were looking at - the room where the Liberty Bell 7 was being restored.

This is what I'd come to see! I had to wait until the tour group finished, then I walked up to the glass to get a closer look. The capsule was about 15 feet in the room. I took a picture in front of the glass, then realized that the flash had just ruined the picture. I turned off the flash, and took more pictures, not knowing how they were going to turn out. There were three people in the room at the time, but they moved off to the side so I could take my pictures.

I moved over to the door that led into the room and was about to take another picture when the door opened and a woman came out. I told her that they had done a great job restoring the capsule and that I had been following the story of the re-

covery and restoration. She thanked me and asked me if I'd like to come inside for a better picture! She didn't need to ask twice. I couldn't believe my luck, I was inside the room!

Then she asked me if I wanted her to take a picture with me and my sons next to the capsule! I couldn't get them in the room fast enough. I set the camera up for her and prayed that the photo would come out. After she took the picture I asked her if I could take some pictures of the inside. She told me to help myself, but that another tour group was coming soon and we'd have to leave then.

I got the chance to look inside, and actually touched the capsule! I got one last picture of my sons with the capsule before the tour group came, and we had to leave the room. None of us could believe our luck. We knew it would be cool to see the capsule, but to get right next to it - wow! This is something that none of us will ever forget.



Apollo 13 Command Module 'Odyssey'

After the museum we went to Dr. Goddard's Lab. I highly recommend that you go to see this when you are there. It's a fun look at rocketry from the view of a scientist, and it's mainly geared for school groups. Don't let that stop you! Have you ever seen an Estes rocket launched inside a clear

plastic tube that has a vacuum inside? Think it won't work? Did you know that the New York Times once published an article on how it was impossible to fire a rocket motor in space because there isn't any air? Have you ever seen what happens to a large ball of cotton when it is soaked in liquid oxygen and ignited?

All of these things were demonstrated in the Lab, quite impressively too! When the cotton ball was ignited it made a concussion wave so

(Kansas Cosmosphere continued on page 10)



The Wiersbe clan standing in front of the restored Liberty Bell 7

Confused Stages – Stage 13

by Jonathan Charbonneau

The moment of truth has come. Tom and Joe have their rockets on the pads, ready for an altitude event. Tom's rocket flies first and doesn't go very high. Joe's rocket flies next and goes extremely high. Joe shouts "Yes!" believing he has won. Later, at the awards ceremony, Joe learns that he has lost to Tom's mediocre flight and is baffled as to how that can be. When Joe asks why he lost when his rocket flew higher, the official tells him that he got a "track lost."

The above is an example of how a good flight could lose to a mediocre flight of a rival despite an honest to God effort to follow the rules. There is more to winning a rocket contest than having the best flight. If the officials cannot confirm a relevant factor, the flight cannot win. This stage of the series is about beating Murphy's Law. "Murphy's Law?" you ask. Here it is, plain and simple:

Murphy's Law: What can go wrong, will go wrong.

If you've been a victim of this, you're not alone. It has happened to many people. Even experts have fallen victim to this law. What follows are important points to bear in mind.

Altitude Events: Be sure that the trackers can easily see your rocket. If they can't see it, you'll get a "track lost." A "track lost" will not score

you any altitude points. Choose the delay that comes closest to the optimum. If the optimum delay is 5.5 seconds, use a 5 second delay, not a 7 second. The trackers lock their tracking devices at ejection, not at apogee. It is therefore best to use the delay that will put ejection closest to apogee. Remember to use tracking powder. If your rocket is a boosted dart, be sure to tell the trackers before you launch.

Duration Events: Be sure the timers can see your rocket during the whole flight. The timers stop their watches when they cannot see your rocket. Strive to get a good time on both flights because the times are summed.

Returns: In all of the following events – duration events, payload events, eggloft events and craftsmanship events – a contestant is required to get a returned flight. Without a return, the flight is disqualified. A return is when a contestant brings his/her rocket back to the judges for post flight inspection. This is also required on any flight for high power certification.

Sportsmanship! This is the most important thing of all. If you're a poor sport, you're liable to be expelled from a competition. It's not a matter of whether you win or lose. It's how you play the game. Nobody likes a sore loser or poor sport. Everybody likes a good sport including good losers.

Eat Cheese Or Fly 2000

W.O.O.S.H., NAR section #558, is sponsoring a public rocket launch on Saturday, July 8, at Bong State Recreation Area in southeastern Wisconsin. Launch facilities for small and high power rockets, with an FAA waiver of 10,000', will be provided by W.O.O.S.H. Details are at:

<http://www.gamerz.net/woosh/ecof2000.htm>

Rain date: Sunday, July 9.

Some lucky flyers will win genuine Wisconsin cheese!

Bong is a 4,500 acre state park used for many sports and hobbies including rockets, camping, hiking, bird watching, radio controlled aircraft, horse riding, ATV's, hunting and fishing.

General information about W.O.O.S.H. can be found at:

<http://www.gamerz.net/woosh>

(Kansas Cosmosphere continued from page 9)

powerful that the doors shook. The guy that did the presentation was great, he wanted to be a teacher but no one would hire him. I'm glad, because he's really good at doing the demos. His final words were to encourage the students to experiment and learn, to try new things. But, he said, be smart. All of the things he had shown us



Interior photo of Liberty Bell 7

could be dangerous, but he had learned how to do it safely.

It's only a 13 hour drive from West Chicago to Hutchinson (including pit stops), and it's sort of on the way to Canon City, Colorado. My guess is that it's less than 10 hours from Hutchinson to Canon City (about 440 miles). If you're planning to drive to NARAM this year, I recommend that you schedule some time either on the way out or back home to stop by the Cosmosphere.

Unfortunately, the Liberty Bell 7 is only scheduled to be on display at the museum until April 17th. After that it will be prepared for a three year tour (dates and locations to be determined). You can check them out on the web at <http://www.cosmo.org> for up to date information.



Models of spacecraft on display



Russian Vostok (with ejection seat)

Welcome to the Club!

Steven Bucksbaum, Tim Cordes, Ryan Lenahan, Algis Salys, and David Wallis have all joined NIRA in the past few months. Welcome to the club!

Heard on the Street

Congratulations to long-time NIRA member Greg Roman. He graduated magna cum laude from Elmhurst College on May 28 with a Computer Science major and math minor. This career changes comes after 13 years as a bridge construction carpenter. He'll also be one of the several NIRA members working at Lucent Technologies. There he'll be developing tools used to simulate and test their new voice-over-ip product. Now that life is settling down a bit, he hopes to be able to get back to NIRA events soon.

Park Forest Rocket Launch and R/C Model Air-Show

The Village of Park Forest, IL, is hosting its 3rd Annual Rocket Launch and R/C Model Air-Show from 11:00a.m. – 4:00p.m. on Saturday July 22. The site meets NAR requirements for rockets up to "G" power, and the FAA notification will be made for LMR launches.

For R/C planes, a 200'x30' grass runway will be prepared. The unobstructed flying area is well over 200 acres.

A rocket build and take for kids will also occur. Last year over 600 spectators attended, and 300 kids built rockets.

This is a great opportunity to present the hobby to a good size audience.

Park Forest is about 3 miles east of I57, in the south suburbs.

If anyone is interested in participating, please contact John Kallend (kallend@iit.edu) for details.

The event is sponsored by Suburban Aeroclub of Chicago, Don's Hobby World of Glenwood IL, Estes, and the Park Forest Parks and Recreation Dept.

(Kosdon continued from page 4)

enthusiasts will be dependent upon fulfilling the requirements for obtaining new DOT EX-numbers for shipping as well as completion of NAR and Tripoli certification. AeroTech will make every effort to supply these organizations with the information and assistance necessary to ensure timely completion of these benchmarks. AeroTech will release updated availability information as soon as certification is achieved and production schedules are finalized.

ATF Responds to NAR/Tripoli Civil Complaint

(from www.nar.org)

After a three week extension, the Bureau of Alcohol, Tobacco and Firearms (BATF) filed a motion to dismiss the four-count civil complaint filed against BATF on February 11, 2000 by the Tripoli Rocketry Association (TRA) and the National Association of Rocketry (NAR).

In this latest action, posted on Friday May 5, 2000, BATF has moved to dismiss the case on three grounds, all of which were anticipated by our legal counsel. Our lawsuit is by no means over -- this is just an predictable step in a much longer legal dance.

First, the BATF claims that we are not entitled to sue them over the explosives list because BATF is not required to issue the list in proposed form for public comment before it is issued in final form.

Second, they claim that the list was first published in 1971 and has not changed (at least in so far as ammonium perchlorate composite propellant) since then. Accordingly, they claim we are barred by the statute of limitations (six years) in bringing this lawsuit even though we are only challenging the 1999 list.

Third, BATF claims to still have our letter of September 7, 1999 under "reconsideration."

Our attorneys are preparing a counter motion which will be filed no later than Friday, May 19th. As soon as our counter motion has been filed, we will post the text of that at our associations' web sites.

The next step is likely to be a hearing before the Federal District Court, but the timeframe and scheduling of such hearings are highly variable. As we have more information to share with you, our members, we'll continue to pass it along.

We thank the many individuals in both organizations who have generously donated funds to see this through. We hope those offerings of support will continue. Your support makes the effort possible. If you haven't yet donated to our Legal Defense Fund, please consider doing so now. We'll need all of your valuable help in the months to come.

Mark B. Bundick, President
National Association of Rocketry

Bruce E. Kelly, President
Tripoli Rocketry Association

For Sale

Jonathan Charbonneau has the following items for sale. See him at a meeting or launch for further information:

- Estes Apollo XI (open but complete) \$40 or best offer
- Aerotech Mantis launch pad and Interloc clip (new) \$60 or best offer.

'In the Shadow of the V-2' Available from Saturn Press

I can't believe it's not a V-2! In the Shadow of the V-2, the latest offering from Saturn Press, provides scale data on 15 rockets that resemble the infamous V-2. There are historical essays and dimensioned drawings for all, as well as paint schemes and eight photographs.

In the shadow of the V-2 details rockets from three countries:

Germany: the A-5, the first test of the V-2 design; the A-4, the V-2 itself; the A-9/A-10, a proposed intercontinental 2-stage V-2; the A-4b, the winged V-2; the Wasserfall, a surface-to-air missile based on the V-2.

United States: The Blossom Project, a stretched V-2 with parachute recovery of the nose; Hermes II, a ramjet testbed; Bumper, a 2-stage V-2; NATIV, a research missile modeled on the Wasserfall; MX-774, a revolutionary missile in the guise of a V-2.

Soviet Union: R-1, a copy of the V-2; V-1-A, created to test a separable warhead; V-1-Ye, a geophysical research rocket; R-2, a new missile with the shell of a V-2 tail section; and the V-2-A, the research rocket that took bunnies into space and back.

This 36-page booklet sells for \$12.00 plus shipping. Shipping is 10% in the US, 16% surface mail outside the US.

My order form is on my Saturn Press website.

I can accept checks drawn on US banks, VISA, and MasterCard. You can order by phone, fax, mail, or e-mail.

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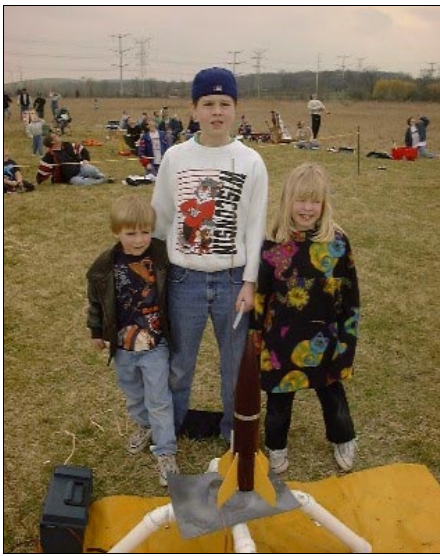
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Apogee Components Announces Free Email Newsletter

Apogee Components has started a FREE rocketry E-Zine Newsletter. Every-so-often (about once every couple of weeks), the opt-in newsletter is delivered right to your email account. It is primarily for those that want a refreshing diversion to their regular boring email messages. In this newsletter, many different rocketry topics will be discussed; including: rocket design philosophy, computer simulations, construction techniques, rocketry in education, happenings in the rocket industry, competition strategies, and new product announcements.

This is a FREE opt-in newsletter. To subscribe, visit the Apogee Components web site (www.ApogeeRockets.com), or send an email a message to:

apogeerockets-subscribe@listbot.com



Photos from the April 2nd Launch, the first launch of the year.

(clockwise from right) NIRA VP Pierre Miller shows off his Mercury Atlas; Adam Elliot shows off the remains of one of his flights; Tom Pastrick loads his new flop-wind RC rocket glider onto the launch rod; hooking up the clips on a rocket; three kids and their Big Daddy.



C/O Jeff Pleimling
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