THE LEADING EDGE

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

Volume 22, Number 4
July/August 1999

Club News

Change in Meeting Dates – Because the Glen Ellyn Civic Center is closed for cleaning and repairs, the September and October meeting dates have been moved to the third and second Fridays respectively.

This should work out much better then trying to arrange an alternate meeting location as we've done in past years. The meeting schedule with the revised dates is on the next page.

Youth Group Launch – There is a youth group launch the weekend after our normal August launch. The purpose of this launch is to help youth groups by providing a launch site with equipment and people to run it.

If you can help out at the launch, or know a youth group that would like to attend, please contact Mike Ugorek or Bill Thiel.

High Power Launch – Because our Greene Valley launch site doesn't allow for high power launches, NIRA decided to return to the sod farm on Labor Day weekend with 'Watch the Grass Grow 1999. See the article later on this page for more information.

Prang Film – A highlight of the June meeting was a showing of Rick Gaff's prang movies. Old enough to be shot on 8 mm film, they showed NIRA in an earlier, bell-bottom and tank-top clad time. Interestingly enough, the people who had lots of hair then seem to have the least now (but Bunny never seems to change).

Pre-Meeting Talks – Rick's movies ended the current run of pre-meeting talks. If there is a subject that you'd like to tell us about, let Rick know. Just about any rocket related topic is fair gam and would be much appreciated by the crowd.

Launch Equipment – Lately, a constant source of discussion at meetings has been about club owned launch equipment. If you have any opinion about the kind of equipment the club should have, and where we should store it, please come to a meeting and let everyone know.

'Watch the Grass Grow 1999' NIRA's High Power Launch

No ponds. No gravel parking lots. No swamps. No tall grass. No entry tolls. Just lots of really nice mowed grass.

NIRA will be holding a High Power launch at the Beaver Run Sod Farm north of Harvard, IL on September 4-5, 1999 from 9 am to 5 pm.

This will be run like a typical NIRA launch, i.e. misfire alley, with the exception of several LMR and HPR pads that we will bring. You will need to bring your own launch systems for small rockets. We have a 5000' waiver for the day, and plenty of open field to recover your rockets.

Normal NIRA field rules and flight cards will be used for non HPR rockets. All "complex" rockets must go thru the RSO safety check before going to the pad. Of course, with a 5000 foot waiver and lots of space, this is the time to bring out the big stuff that you can't fly at Greene Valley or MRFF. Otherwise, there's nothing to do but sit around and watch the grass grow.

The only other rule for the sod farm is DO NOT DRIVE ON THE GRASS. This includes freshly seeded areas that may just look like dirt. Please follow our signs and only drive where directed. We usually don't know where we'll be set up until we get there and survey the field. Please clean up any mess and use biodegradable wadding.

Saturday evening, many of us will head to dinner at the Heritage House, at the south end of Harvard where Routes 14 and 23 fork. It is right next to the Amerihost Inn (815-943-0700).

Directions to Beaver Run Sod Farm:
The sod farm is located north of Harvard, IL just off Route 14, and just south of the Wisconsin border. The best way to get there from the Chicago area is to get to take I90 west to the Marengo exit, and then follow Route 20 west to Route 23. Take 23 north into Harvard. 23 meets with 14 at the south end of Harvard.

Alternately, take Route 14 (Northwest Highway) all the way into Harvard, This will take you through Palatine, Barrington, Cary, Crystal Lake, and Woodstock.

Once you are heading north/west on 14 you need to go to and through Harvard which is only a few miles south of the Wisconsin border. As you continue on 14 beyond Harvard you will pass the large Motorola factory on your right. Once you pass the factory start looking for Yates Road on your left, about 2-3 miles past the factory. Turn left (west) on Yates and continue to its end, a tee intersection with Lilja road. Turn left (south) on Lilja, follow it around a 90 degree bend to the right and the Beaver Run Sod Farm will be on the right about a quarter mile past the bend. Look for our signs to see where we are flying that day. PLEASE do not drive on any grass or freshly seeded areas. Stay on the bare dirt road only.

HERITAGE HOUSE (815) 943-6153
21225 E Us Highway 14
Harvard, IL 60033

AMERIHOST INN (815) 943-0700
1701 S Division St
Harvard, IL 60033

Apollo 11 Factoids

- The heat leak from the Apollo cryogenic tanks, which contained hydrogen and oxygen, was so small that if one hydrogen tank containing ice were placed in a room heated to 70 degrees F, a total of 8-1/2 years would be required to melt the ice to water at just one degree above freezing. It would take approximately 4 years more for the water to reach room temperature
- The Apollo environmental control system performed 23 functions compared to 5 for the average home conditioner. The 23 functions included: air cooling, air heating, humidity control, ventilation to suits, ventilation to cabin, air filtration, CO2 removal, odor removal, waste management functions, etc.

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Photos will be returned, other material returned upon requested.

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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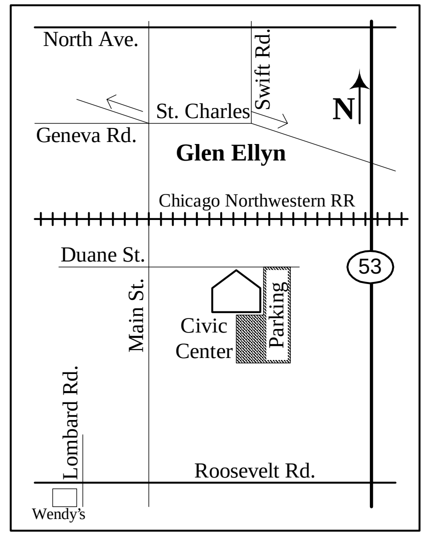
CLUB MEETING DATES



All meetings start at 7:30 PM, with the pre-meeting lecture starting at 7:00 PM. Bring a model for 'Model of the Month.' We always need volunteers for the pre-meeting lecture, 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).

August 6

September 17 **Third Friday!**

October 8 **Second Friday!**

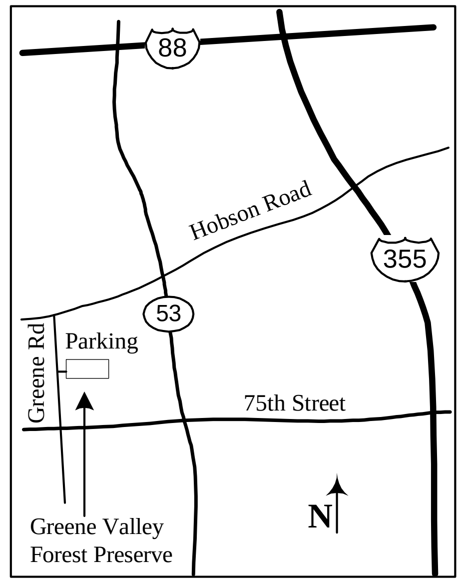
November 5

December 3

January 7

February 20

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.

August 15 – Regular club launch.

August 22 – **Youth Group** launch.

September 4-5 – **High Power** launch (see page 1)

September 19 – Regular club launch.

October 17 – Regular club launch.

November 7 – **Hobby Show** launch.

November 21 – Regular club launch.

December ?? – Holiday Party

January 16 – Building Session? (location TBD)

February 20 – Building Session? (location TBD)

Model of the Month Winners! (from left to right, photos by Ric Gaff)

June – Adam Goodwin took the youth category with his Estes Firebird. The adult category was won by John Barrett with an Estes Black Hole Space Probe. John found the model already built (for static display) in a store.

July – Martin Schrader displays his winning adult entry. Beverly Fitzpatrick won the youth category with her Sputnik (a newer version then what she flew at MRFF).

Swivel Device for Painting Model Rockets

by Bruce S. Levison (NAR 69055)

Did the finish on one of your models get ruined when the paint ran or dripped down along the air frame? Do you get worn out and dizzy performing a "circular dance" around your model rockets as you spray paint them? Have you ever found that your perfect paint job was ruined by a sag or run in the finish you didn't see on the other side of the model? Then give this simple painting apparatus a try. This article describes a simple, inexpensive, swivel assembly that can support a model rocket in a horizontal position and allow it be turned by hand during painting and finishing operations.

The author wishes to acknowledge, his wife Debbie, both of his sons, Ian and Ben, for their encouragement, support and help with this article.

Over the years I have come to realize that gravity is definitely working against me even when I spray paint model rockets. On many occasions the spray paints I used ran down the model's airframe and fins as it was painted on a vertical stand made from several used rocket engines glued end to end. The same problem occurred when I tried painting my models held vertically by a section of launch rod. Since I always seemed able to achieve a smooth coating of paint on plastic model cars with their almost horizontal flat surfaces, I then tried painting my model rockets supported horizontally on a launch rod or length of string. Each of these set ups still allowed the fresh spray paint to run or sag to the lowest point on the model making for some uneven finishes, not to mention how difficult it was to get the paint under the support rod or string. I also tried the recommended technique of using a rolled up newspaper pushed into the engine mount tube. This method worked out much better since I found I could rotate the model during the spray painting operation. However there were still some drawbacks, I always seemed to somehow get newsprint ink smudges on the fresh paint coat, and the rolled up newsprint got flimsy and sticky as I proceeded, making it difficult if not impossible to rotate the model during painting. To overcome these problems, and still maintain the desirable aspects of this recommended technique, I developed a method to attach the model rocket airframe through its engine mount to a swivel that could be both horizontally mounted and rotated by hand.

Figure 1: A model rocket being painted on a horizontal swivel stand.

My painting device for model rockets using 18 mm motors started out as a 12 to 18 inch long section of 5/8 inch outside diameter by ½ inch inside diameter PVC pipe. I built up the end of the pipe with wraps of masking tape until it fit securely into the model's motor mount tube. Another wrapping of tape was built up around the pipe where it exits the rocket motor mount, about 2 inches down the pipe from the first band, to prevent any paint from getting inside the motor mount tube. I also masked the pipe about 4 inches past this last band of tape to protect the pipe that extends out past the end of the rocket. I found that this hollow stick was also great for supporting my model rockets during various operations, such as gluing on fins and lugs. For support, I clamped the free end of the PVC pipe so the model rocket extended out over the edge of my work bench. The pipe or rocket air frame itself could be easily rotated as needed for gluing on additional fins or other parts.

Figure 2: Close up showing dowel fit into shimmed PVC pipe

I improved on this "Rocket on a Stick" design by incorporating a swivel effect to rotate the model rocket. A 7/16 inch diameter wooden dowel rod was inserted into the ½ inch diameter central bore of the pipe to create this effect. The dowel rod was held stationary in a horizontal position and the rocket attached to the hollow PVC pipe could then be rotated around it. I first plugged the shimmed end of the pipe with several layers of masking tape. The taped over end of the pipe prevents the dowel rod from being pushed too far into the model rocket where it could do some damage. I then placed the shimmed taped end of the pipe into the rocket's motor mount. Next, I securely clamped the one end of a 7/16 inch diameter by 36 inch long dowel rod horizontally to a sturdy support. I typically used C-clamps to fasten the free end of the dowel rod to a rung on a step ladder a few feet above the ground over a drop cloth (see figures). I then placed the hollow section of pipe protruding out of the model rocket over the free end of the dowel rod.

This swivel setup allowed me to rotate the model 360 degrees by turning the PVC pipe with one hand while spray painting the model with the other. This lathe-like design enabled me to spray paint on the model lengthwise along its' air frame, and then turn the rocket to expose another unfinished portion for painting. With this arrangement, the model could be rotated at any time so the paint coat could be inspected for imperfections that could then be corrected immediately. If runs or streaks developed during the painting process the model was rotated in the direction of the paint build up, to move the sag through 180 degrees to face in the opposite direction. This allowed the pull of gravity to help level out the paint coat again. Using this horizontal swivel, I have been able to achieve smooth finishes with the runniest paints. Over spray on the masking tape along the pipe can be touched and used as an indicator for the dryness of the rest of the paint coat. This small patch of paint also provides a nice area to pre-treat to determine the compatibility of different paint coats.

This apparatus can be scaled up to fit into models requiring larger diameter motors. For models with 24 mm diameter motor mount tubes, similarly wrap a 12 to 18 inch length of ¾ inch outside diameter PVC pipe with tape and use a 1/2 inch diameter dowel rod. Alternatively, you can tape or shim a spent 24 mm motor casing over the end of the swivel apparatus made for the models using 18 mm diameter motors. The cost of this device is minimal, only a few dollars for the PVC pipe and dowel rod. This swivel device is reusable; I transfer the shimmed PVC pipe to the next model after the paint on the first one is dry. The only maintenance required is to change the masking tape on the PVC pipe when the paint builds up excessively.

Apollo 11 Factoids

- Rocketdyne built 30 engines that were used on the Saturn V rocket. 5 F-1 engines for the first stage, 5 J-2 engines for the second stage, 1 J-2 engine for the third stage, 1 engine used in the LM for ascent, 12 reaction control engines, and 6 small "ullage" motors that were used in the second and third stages to settle propellants prior to ignition of the J-2 engines.
- The interior of each of the first stage propellant tanks is large enough to accommodate three large moving vans side by side.

Rocket Math 1: The Tangent Ogive Nose Cone

by Norm Dziedzic (NAR 72426)

Background

One of the most popular model rocket nose cone shapes is the Tangent Ogive. We've all seen this nose cone with its point at the top, then a gentle downward arc which mates perfectly with the top of the body tube. In this article, I'll take a look at the math behind the tangent ogive, how to fully define its shape and how to find the ogive's centroid which is its center of pressure when found using using the "cardboard cutout method".

Now the term ogive (pronounced \ OH - jiv \ according to Webster) comes from the name for pointed Roman arches that you might see in an old church doorway or window. As applied to our noses cones, ogive means a circular arc. Figure 1 shows a tangent ogive nose cone with the rest of the circle drawn in to give a better idea of what this means.

The term tangent means that there is a smooth transition where the circular arc meets the body tube. In mathematical jargon, this means that the slope of the arc and the slope of the body tube are identical where they meet.

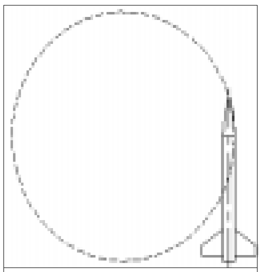


Figure 1:

With a little imagination, you should be able to see that this smooth transition only occurs when the center of the circle is at the same elevation as the top of the body tube. Picture the circle in Figure 1. moved up and down and you will see that with the center of the circle above or below the top of the body tube, there would be a sharp transition between the nose cone and body tube. Besides the aesthetic beauty of the smooth transition, by making the ogive tangent, we are reducing drag on the rocket and increasing its performance.

Once the curve of the ogive is defined, you take it and rotate it about the line which comes up the center of the body tube. This line is known as the rocket's axis and the resulting shape of the nose cone is called a surface of revolution.

Defining the Tangent Ogive

In order to keep all of our figures and equations in order, we have to designate some variables to represent the dimensions that go into defining the ogive. Referring to Fig. 2, the following items are defined:

d: Rocket Body Diameter
r: Rocket Body Radius
k: Aspect Ratio for Ogive (ratio of Body Diameter to Ogive Length)
L: Length of Ogive
R: Ogive Radius (what we are trying to find)
α: The included angle of the circular segment

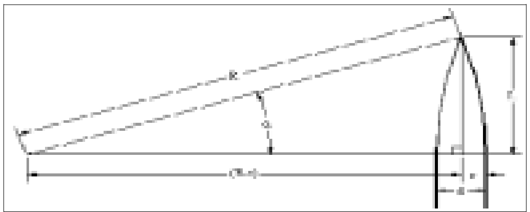


Figure 2:

Note that the aspect ratio is a common method of describing the length of the nose cone with respect to the diameter of the rocket. For instance, if a nose cone has an aspect ratio of 5, then the length from the top of the body tube to the tip of the nose cone is 5 times the diameter. Nose cones with different aspect ratios are shown in Figure 3. below.

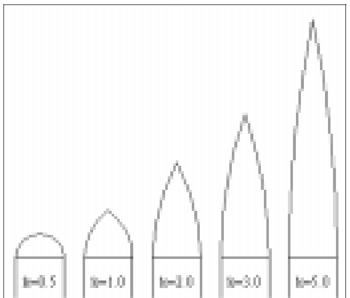


Figure 3: Ogive Shapes for different k values

With the radius of the ogive defined as R then the distance from the centerline of the body tube to the center of the ogive circle is given by (R-r). Now with the Pythagorean theorem we can get an equation where the only unknown is the Ogive radius R.

$$L^2 + (R - r)^2 = R^2$$

And solving for R gives:

$$R = \frac{1}{2} \cdot \frac{\left(L^2 + r^2\right)}{r} \qquad [1]$$

To put things into terms of the diameter, just substitute $\frac{d}{2}$ for r in the above equation to get:

$$R = \frac{L^2}{d} + \frac{d}{4} \qquad [2]$$

Or, putting things in terms of the aspect ratio k:

$$R = d \cdot \left(k^2 + \frac{1}{4}\right) \qquad [3]$$

So, with equations [1] through [3] you can solve for the radius of the ogive whether you're given the overall length of the nose cone or the aspect ratio and whether you like working with the body radius or diameter. And in any case, the distance from the centerline of the body to the center of the ogive arc is given by: (R-r)

As an example, take a BT-50 body tube with a tangent ogive nose cone that has an aspect ratio of 5. To find the Radius of the ogive proceed as follows:

Body diameter $d := 0.976 \cdot in$

Aspect Ratio: $k := 5$

Body Radius: $r := \frac{d}{2}$

$r = 0.488 \cdot in$

Ogive Radius $R := d \cdot \left(k^2 + \frac{1}{4}\right)$

$R = 24.644 \cdot in$

Distance from center of body to Ogive center: $(R - r) = 24.156 \cdot in$

Centroid / Center of Pressure Calculation

The centroid of an area is the point at which a cutout of the area will balance perfectly. This same procedure is sometimes used to approximate a rocket's center of pressure and is called the "cardboard cutout method".

Traditionally, the x and y values of the centroid coordinates are labeled $\overline{x}$ and $\overline{y}$ (pronounced "x-bar" and "y-bar").

Those familiar with statistics will notice that this is the same notation used for the average of a set of numbers and indeed, you can think of this as an "averaging" of the area.

The way the coordinate system is set up, the nose cone is symmetric about the y axis, so x-bar will always lie along the axis of the rocket. Thus only y-bar needs to be found to define the centroid (see Figure 4). Also due to symmetry, the y-bar for one half of the ogive shape is identical to y-bar for the entire ogive. So we will go about finding y-bar for the right half of the ogive shaped area.

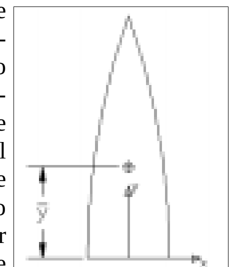


Figure 4:

To begin, we will first use an approximation method to determine y-bar and then extend the information from this method into the calculus behind the exact solution for the centroid.

To approximate the centroid, we first break up the ogive shape into a series of rectangular sections of the same width as shown in the example in Figure 5. Then we can combine the y-bar values from each rectangle to approximate the y-bar for the ogive.

Let the width of each rectangle be x_i and the height of each rectangle be y_i then the y-bar of each rectangle is $\frac{1}{2} \cdot y_i$ and the area of each rectangle can be given $A_i = x_i \cdot y_i$

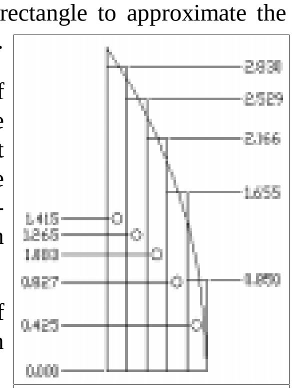


Figure 5:

Now the trick comes in how to combine all of this information to come up with the y-bar for the entire area. This is done by taking each y-bar and multiplying it by the area of its respective rectangle. Then we sum all of these values and divide the whole mess by the total area of all rectanges. This looks something like...

$$y_{bar} = \frac{\left[\left[\frac{1}{2}\cdot y_1\cdot(x_1\cdot y_1) + \frac{1}{2}\cdot y_2\cdot(x_2\cdot y_2)\right] .... + \left[\frac{1}{2}\cdot y_i\cdot(x_i\cdot y_i)\right]\right]}{(x_1\cdot y_1) + (x_2\cdot y_2) + ... + (x_i\cdot y_i)}$$

Which Simplified gives:

$$y_{bar} = \frac{\left[\frac{1}{2}\cdot x_1\cdot(y_1)^2\right] + \left[\frac{1}{2}\cdot x_2\cdot(y_2)^2\right] + ... + \frac{1}{2}\cdot x_i\cdot(y_i)^2}{(x_1\cdot y_1) + (x_2\cdot y_2) + ... + (x_i\cdot y_i)}$$

Notice that every term contains an x_i but by definition, when we divided the ogive area, we made all of these widths the same so all of the x_i terms cancel out of the equation. Changing to summation notation, the above equation simplifies to *(This summation notation is just a short hand way of signifying that the term following the Σ symbol is calculated for each slice of area and then all of them are summed or added together):*

$$y_{bar} = \frac{\sum_i \frac{1}{2}\cdot(y_i)^2}{\sum_i y_i}$$

And the $\frac{1}{2}$ can come out of the upper summation for:

$$y_{bar} = \frac{\frac{1}{2}\cdot\sum_i (y_i)^2}{\sum_i y_i} \qquad [4]$$

In our example of Figure 5. we would get:

$$y_{bar} := \frac{\frac{1}{2}\cdot\left(2.830^2 + 2.529^2 + 2.166^2 + 1.655^2 + 0.850^2\right)}{2.830 + 2.529 + 2.166 + 1.655 + 0.850}$$

or

$y_{bar} = 1.125$

For our approximate solution.

The actual value of y-bar for the example is 1.142 so we came within about 1.5% of the solution which is pretty good for our purposes (Note, this result is mainly due to luck in picking the x-slices. Normally, a much finer slicing is required to achieve this accuracy). This technique, where we take a complex problem and break it down into a series of simpler and perhaps approximated problems is called numerical methods. It is used for all sorts of engineering problems where an analytical solution cannot be found.

The pro's of this method are:

- It works for any area even if it cannot be easily defined by equations.
- The math operations are simple (only addition, multiplication, squaring and division are used).
- Results can be accurate if care is taken when defining slices.

...but there are also several cons:

- It cannot be generalized for a given shape (i.e. all of the steps must be repeated for each different diameter/aspect ratio combination).
- There is a large chance for error with several operations to be carried out.
- It is not an exact method.
- It is difficult to apply to small areas - scaling needs to be done which gives another opportunity for errors to be made.

If we can find an equation for y-bar based on the information we know about the area, then we will have one solution which can address all tangent ogive nose cones. This can be programmed into a calculator or spread sheet and once verified, can provide us with reliable results time after time.

What we need is a way to make our equation [4] depend on known values instead of measured values. As it turns out, way back in the 18th century two very smart men (Sir Isaac Newton & Gottfried Wilhelm Leibnitz) came up with a way to do just this. They dared to asked the question, "What happens when the thickness of your slices become infinitely small.?" And then went about answering it.

This type of operation is called *integration* and is one of the fundamental operations of calculus. Don't let the 'C' word scare you, just take a look at equation [4] and see how it relates to the equation below:

$$y_{bar} = \frac{\frac{1}{2}\cdot\int_a^b y^2\,dx}{\int_a^b y\,dx} \qquad [5]$$

Notice how the form of the equations is almost identical. The elongated 's' symbol is the integral symbol. You would read this equation as *"one-half the integral from a to b of y squared dx all-over the integral from a to b of y dx."* The dx business just means that we are slicing things in the x dimension The a and b are the places where we start and finish slicing. So if we refer back to Figure 2. and work on the right half of the ogive area, our a and b become (R-r) and R which gives us the equation:

$$y_{bar} = \frac{\frac{1}{2}\cdot\int_{(R-r)}^{R} y^2\,dx}{\int_{(R-r)}^{R} y\,dx}$$

We are almost there but we need to do something about y squared and y. Since we are integrating in the x direction, we need to have an equation based on x. This is achieved by realizing that the ogive is a circular arc so we can use the equation for a circle to get the y values in terms of x. We proceed as follows starting with the general equation for a circle.

$$x^2 + y^2 = R^2$$

solving for y yields:

$$y = \sqrt{R^2 - x^2}$$

and

$$y^2 = \left(R^2 - x^2\right)$$

So, our integral equation [5] for y-bar becomes:

$$y_{bar} = \frac{\frac{1}{2}\cdot\int_{(R-r)}^{R} \left(R^2 - x^2\right)dx}{\int_{(R-r)}^{R} \sqrt{R^2 - x^2}\,dx} \qquad [6]$$

Since this article is not meant to be a course in calculus, We'll just wave a magic want and tell you that equation [6] above becomes the equation shown below when you apply the rules of integration:

$$y_{bar} = \frac{\frac{1}{2}\cdot R\cdot r^2 - \frac{1}{6}\cdot r^3}{\frac{1}{2}\cdot\left(R^2\cdot \operatorname{asin}\left(\frac{L}{R}\right) - L\cdot R + L\cdot r\right)}$$

and doing a little rearranging:

$$y_{bar} = \frac{r^2\cdot\left(R - \frac{1}{3}\cdot r\right)}{R^2\cdot \operatorname{asin}\left(\frac{L}{R}\right) + L\cdot(r - R)} \qquad [7]$$

where asin(L/R) is given in radians

Now we could stop here and be done with it. After all, we have an expression for y-bar with no unknowns in it. But, since we know the relationships between L, R, and r, it would be nice to do a little more rearranging and come up with a y-bar expression that depends on only one or two variables. When you look at Figure 2. you see that L is in the same direction as y-bar so it makes the most sense to try to change R and r terms into expressions of L and then try to simplify the whole thing.

Substituting these expressions:

$$r = \frac{L}{2\cdot k} \quad \text{and} \quad R = \frac{L}{k}\cdot\left(k^2 + \frac{1}{4}\right)$$

Into equation [7] gives:

$$y_{bar}=\frac{\frac{L^3}{k}\cdot\left[\left(k^2+\frac{1}{4}\right)-\frac{1}{6}\right]}{4\cdot k\cdot L^2\cdot\left[\frac{1}{k}\cdot\left(k^2+\frac{1}{4}\right)^2\cdot \text{asin}\left[\frac{k}{\left(k^2+\frac{1}{4}\right)}\right]+\left[\frac{1}{2}-\left(k^2+\frac{1}{4}\right)\right]\right]}$$

OK, this looks much more complicated than equation [7] but fear not. We're on the path to a surprising and elegant solution for y-bar.

Canceling the L squared out of the bottom and rearranging some of the k factors leaves us with one L multiplied by a large conglomeration of k's shown in equation [8] below.

$$y_{bar}=\frac{\frac{1}{4\cdot k^2}\cdot\left[\left(k^2+\frac{1}{4}\right)-\frac{1}{6}\right]}{\frac{1}{k}\cdot\left(k^2+\frac{1}{4}\right)^2\cdot \text{asin}\left[\frac{k}{\left(k^2+\frac{1}{4}\right)}\right]+\frac{1}{2}-\left(k^2+\frac{1}{4}\right)}\cdot L \qquad [8]$$

To get a better understanding of the mess of k's multiplying L in equation [8], I've made a graph of this factor for different values of k. As it turns out, this function becomes almost a straight line when $k > 2$ with the approximate value of 0.375.

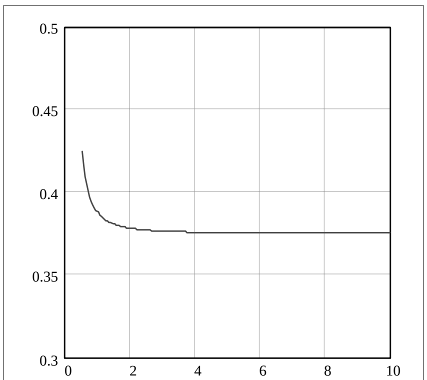


Figure 6: Centroid Length Factor vs. k

This somewhat unexpected result makes our life much easier because for most rocket nose cones, the aspect ratio of the nose cone will be greater than 2 (See Figure 3 above). Thus we can simplify equation [8] to the elegant solution:

$$y_{bar} \approx \left(\frac{3}{8}\cdot L\right) \text{ where the aspect ratio } k>2 \qquad [9]$$

Conclusion

In this inaugural Rocket Math column, we've inspected in great detail the math behind the tangent ogive nose cone. Hopefully, you've gained a little bit better understanding of how this shape is developed and how it's centroid is determined. Beyond this, it is hoped that the reader goes away with the fact that, as in our arrival at equation [9], it sometimes pays to wade through the more complicated steps of a problem to reach a simplistic answer.

If you have any comments regarding this column, you may e-mail the author at ndzied1@interaccess.com

Home on the Range

by Ken Hutchinson

Fairly early the first morning of the Midwest Regional Fun Fly (MRFF), well before most participants arrive, the launch site springs to life. Quite a bit of work goes into a normal monthly launch, work that many folks are unaware of. The MRFF range is more elaborate due to the larger crowd and the starting time is earlier. So the setup work starts early and is quite intense. A weedy gravel parking lot must be turned into a launch facility that can fly 600 rockets over two days without any strain at all.

Setting up a high capacity rocket range like NIRA's MRFF range is never really easy. It goes up the same way every year and there are a number of NIRA members who know the drill and who pitch in to help. But it's still a lot of work, a lot of little details to get correct. And this year we were flying at Bong. This meant we had to set up some equipment that gathered dust the previous two MRFF's -- the high power pads. It takes a lot of heavy-duty extension cords to reach out to four pads 100 and 200 feet beyond the low power circle. Troubleshooting the batteries, connections, and relay boxes at that distance has been tedious in the past. We had two way radios this year to make that easier.

The main range is 12 pads in a circle. Twelve steel stakes for the pads had to be driven into Bong's mil-spec gravel. The wiring must be strung, ropes for traffic control set out, the LCO station set up under a tent, the PA system, the prep area tent, blast deflectors, launch rods, micro clip cleaning, signs along the entrance road…the list is so long you have to wonder how it all gets done. But it does.

Sunday's setup was mostly just reconnecting everything that had been put under cover overnight. But at five o'clock it all has to come down again. There's a special place in heaven for those few saints who are willing to come early and stay late for range hand duty. As we were packing up the equipment one young volunteer looked around the deserted field and said, "Hey, where is everyone?"

Range operations duty rarely draws a line of volunteers waiting for their chance to help either. This is more of a mystery since it is a lot of fun to run the range. The check in officer gets to inspect every rocket at close range and trade barbs with the owners. The range safety officer keeps an eye on everything in the air and on the ground, watching for safety problems and aircraft that ignore the FAA's warning to avoid the airspace we have permission to use. Scanning the skies for trouble has the occasional unexpected reward. Saturday morning we spotted one stray cloud that exploded in a rainbow of color and delighted the crowd for several minutes. The launch control officer has the job that outsiders always assume is main attraction of the hobby: pushing the button that launches the rockets. Rocket after rocket goes up. You don't have to prep them, you don't have to chase them, and you don't have to find them in the weeds. Life should always be so good!

And things went pretty smoothly on the range this year. Rick Gaff had to check out a balky pad 4. Sunday morning we had to shuffle the batteries around so that those that still could were launching rockets and the rest were doing lesser jobs like running the PA. Aircraft were a constant concern, especially Sunday with a WWII era trainer doing aerobatics nearly all day and never very far away. Even so we had capacity to spare. The range was frequently empty and except for the high power pads never full. We could do a thousand flights in a weekend, probably 1500 without too much effort. Maybe next year!

So this has been a behind the scenes look at what it takes to put up the range that so many people enjoyed using at MRFF 99. I don't mean for it to sound like griping. I do want to make it a call to arms. We can use your help, and you will find the work rewarding. It is a great way to forge new and tighter bonds with your fellow club members. In fact, those of us who routinely pitch in for this volunteered to staff an entire range shift at the NSL in Muncie last year and had a grand time doing it. More help means better events for everyone. We started the MRFF 99 setup at 8:00 on Saturday, hoping for a 9:00 range opening. Instead it was nearly 10:00 before everything was ready. We can do better if we have more help. I helped with the setup, tear down, and pulled two shifts as RSO. And I flew more rockets this year than I have in a long while, with plenty of time left over for socializing. So give it a chance. Join us. Become one of the few, the proud, the Range Hands.

A view of the MRFF range (John Barrett Photo)

MRFF '99 Memories

Cheri Chaney works as LCO while Bob Wiersbe runs the checks in. (John Barrett Photo)

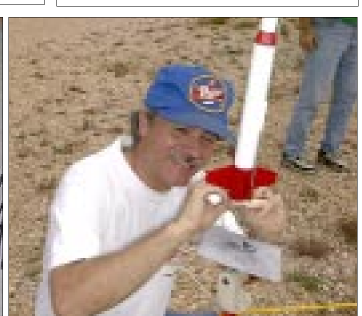
Bob Weirsbe watches the perfect launch of his Nike–Tomahawk (John Barrett Photo)

Kevin Wickart with his shrunken Orbital Transport. (Rick Gaff Photo)

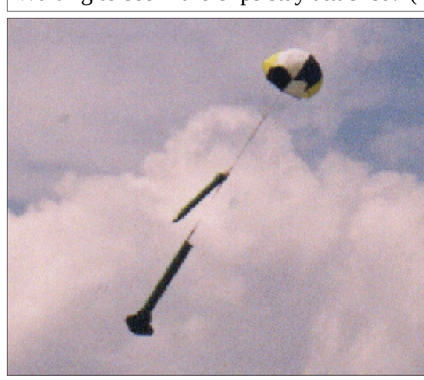
John Barrett's Interceptor G on an F62-6 Darkstar. (John Barrett Photo)

Waiting to see if the clips stay attached. (Rick Gaff Photo)

Even Babies liked MRFF '99 (Rick Gaff Photo)



Hooking up the igniters **can** be a fun task! (Rick Gaff Photo)



A Nordic Rocketry Ascender, decending... (John Barrett Photo)

Space Launch Report for May-June 1999
by Tim Johnson

There were twelve space launches during May and June. The highlight was Discovery's STS-96 May 27 launch, the first shuttle mission in six months. The low light was a second Delta 3 failure.

STS-96/Discovery

STS-96/ISS-2A.1 commenced May 27 when orbiter Discovery (OV-103) rose from Kennedy Space Center LC 39B. Aboard were Commander Kent Rominger, Pilot Rick Husband, and Mission Specialists Tamara Jernigan, Ellen Ochoa, Daniel Barry, Julie Payette (Canada), and Valeriy Tokarev (Russia). They traveled with 4,000 pounds of supplies for the International Space Station (ISS), including Russia's Strela crane, parts for a U.S. crane, and a Spacehab-DM module.

Discovery entered a 324 x 341 km x 51.6 deg. orbit, from which it chased down and docked with ISS at 04:24 UTC on May 29. The crew conducted several space walks before undocking on June 4. Discovery deployed microsat "Starshine" on June 5 and landed in darkness at KSC on June 6.

Space Shuttle Discovery at launch, clearing the fixed service structure. NASA Photo

Delta 3 Failure

Boeing's second Delta 3, an 8930 model flown as Delta 269, failed to put Loral's Orion 3 comsat into geosynchronous transfer orbit (GTO) after a May 5 launch from Cape Canaveral SLC 17B. Unlike the first Delta 3, which exploded 75 seconds after its August 27, 1998 liftoff, this one reached orbit, successfully firing its cryogenic Pratt & Whitney RL10B-2 second stage engine for 8 minutes 43 seconds. It was the first time the RL10B-2, an upgraded (some say "redlined") version of the RL-10 series, had fired in space.

Unfortunately, the 25,000 pound thrust single-chamber engine failed 3.5 seconds after restarting for its transfer orbit burn. A breach in the RL10B-2 combustion chamber caused an explosion that punctured one or both propellant tanks, putting the vehicle into a tumble. The failure stranded the payload in a 162 x 1,378 km x 29.5 deg. orbit. Delta 269 cost $85 million and the 4,300 kg HS-601HP satellite cost $145 million. It was the fourth failure in the last six U.S.-based launch attempts.

Delta 2 for Two

Two Delta 2 rockets flew during May-June. A third had to be de- stacked from Canaveral SLC 17A in late May after a leaky gantry roof water-damaged its GPS-2R payload. Delta 270, a 7420-10 model with four solid rocket boosters (SRBs), orbited four Globalstar comsats on June 10 from Cape Canaveral SLC 17B. The 448-kg spacecraft entered 1,400 km x 52 deg. circular orbits. Delta 271 orbited NASA's 1,335 kg Far Ultraviolet Spectroscopic Explorer (FUSE) on June 24 from Canaveral SLC 17A. The Delta 7320-10 (three SRBs) injected FUSE into a circular 768 km x 25 degree orbit. FUSE will perform a sky-search for hydrogen and deuterium, remnants of the Big Bang.

QuickSCAT being launched on a Titan 2. NASA/JPL photo

Two Long Marches

China Great Wall Industries launched two Long March (CZ) rockets from Taiyuan during May-June. One, the first CZ-4B, put China's 958-kg Fengyun 1C weather and 298 kg Shijian 5 "multipurpose scientific research" satellites in 850-km sun synchronous orbits (SSO) on May 10. The 44.1 meter-tall CZ-4B, built by Shanghai Academy of Spaceflight Technology, can loft 300 kg more than predecessor CZ-4. It uses two CZ-3 stages topped by a hypergolic third stage. The other Long March, a CZ-2C/SD, successfully launched two replacement Iridium cellular telephone comsats into 624 x 635 km x 86 deg. orbits on June 11.

Two Protons

Two ILS Proton-K/DM3 boosters flew during May-June. One launched Telesat Canada's Nimiq-1 direct TV satellite, a Lockheed Martin A2100 model, into a 7,050 x 35,790 km x 15.9 deg. GTO on May 20 from Baikonur Cosmodrome LC 81. Nimiq-1 will serve North America. The second, the 265th Proton launched since the vehicle's debut more than 30 years ago, boosted 3,728- kg Astra 1H, a Hughes HS-601HP, into a 7,400 x 35,850 km x 16.4 deg. GTO from Baikonur LC81 on June 18. Astra 1H, operated by SES, will serve Europe.

Two Titians

Lockheed Martin Titan 403B-12 successfully orbited a classified satellite from fog-enshrouded Vandenberg SLC 4 East on May 22. This Titan did not use an IUS or Centaur upper stage. It had a short 50-foot fairing, indicating the payload might have been an SDS data relay satellite or a trio of U.S. Navy satellites. Titan 403B-12 entered a preliminary 200 x 293 km x 63.4 deg. orbit, a match for the 12-hour Molniya inclination used by SDS. What happened next is anyone's guess.

Titan 23G-7, a refurbished Titan 2 ICBM, orbited NASA's 970 kg Quick Scatterometer (QuikSCAT) from Vandenberg SLC 4 West on June 20. QuickScat carries a 13.4 GHz, 110 watt pulse radar named SeaWinds to measure sea surface winds. Titan's second-stage verniers performed an apogee burn over Madagascar to put QuickScat into an 800 x 280 km x 98.7 deg. SSO. QuickScat thrusters will circularize the orbit at 800 km.

Other Launches

An Indian Space Research Organization (IRSO) Polar Satellite Launch Vehicle (PSLV-C2) placed IRSO's 1,050 kg IRS-P4 ocean monitoring satellite into an 820 km x 98.8 deg. SSO from Sriharikota on May 26. Two subsatellites included Korea's 110 kg Kitsat-3 and Germany's 45 kg DLR-Tubsat-C. PSLV uses solid fuel first, third, and SRB stages. An Ariane Viking 4 engine powers the N2O4/UDMH second stage. A two-engine N2O4/MMH fourth stage performs on-orbit burns.

A Pegasus XL with a Primex HAPS monopropellant fourth stage orbited NASA's 123 kg Tomographic Experiment using Radiative Recombinative Ionospheric Extreme UV & Radio Sources (TERRIERS) and the U.S. Army's 48 kg Multiple beam Beyond Line of sight Communications (MUBLCOM) satellite from Vandenberg on May 18. Both entered SSO with TERRIERS at 550 km and MUBLCOM at 775 km. TERRIERS failed to orient its solar panels on orbit, killing its battery. HAPS performed five burns during the relatively complex mission.

March-April Failure Updates

Titan 402B-27 faltered on April 9 when its Inertial Upper Stage (IUS-21) apogee burn failed. The two IUS SRM stages did not separate cleanly, if at all. Hung-up SRM-1 blocked or damaged the extendible SRM-2 motor nozzle. When the 17,200-pound thrust SRM-2 motor ignited, the vehicle gyrated wildly for 110 seconds, leaving the DSP-19 satellite tumbling in an elliptical orbit.

Titan 401B-32 stranded its Milstar 2 F-1 satellite in a low orbit on April 30 when faulty Centaur (TC-14) attitude control system software caused the stage to rapidly use up all of its hydrazine attitude control propellant.

An electromechanical "race" condition caused the April 27, 1999 Athena 2 failure. An electrical signal to fire the payload shroud separation ordnance failed to reach the upper set of pyros. The lower charges fired as planned, but when the fairing opened at its base it separated connectors, open-circuiting the upper pyro signal.

NASA's Wide-Field Infrared Explorer (WIRE) failed in March because designers did not provide sufficient power-up reset time for a field programmable gate array (FPGA) chip in the pyro box. The chip provided uncontrolled outputs when power was initially applied on-orbit, prematurely firing the telescope cover latch pyros. WIRE's hydrogen ice overheated without the cover and sublimated into space. NASA's Goddard Center built WIRE.

In depth Space Launch Report is on the Web monthly at:

http://www76.pair.com/tjohnson/slr.html.

The Rockit-Rack
by John Barrett

At MRFF '99 I used this system to display and store my rockets during the launch.

It consists of two collapsible wooden clothes dryers (Madison Princess Model No. 12) arranged side by side.

As can be seen, it affords a handy and easy way to arrange your collection, relatively inexpensively, easily available (I got mine at Menards), collapsible and portable.

P.S. How many of the rockets can you name?

New Competition Payload Model Available from ASP

Haven't built that payload model yet? Aerospace Speciality Products is coming to the rescue! Our new Versi - Loader 18 kit is ready for immediate shipment! Based around our TT - 20 Telescoping Tube, the kit features custom turned balsa parts as well as a complete payload kit.

Although designed primarily as a payload model, the Versi - Loader is also capable of being a competitive Parachute or Streamer Duration model in the higher impulse events (B & up) as well as in Altitude events, or even just for fun as a high - flying Sport Model!

The kit retails for $11.95, product code is KVL - 18. For more info on Aerospace Speciality Products, visit our web site at:

http://www.asp-rocketry.com

or write to:

Aerospace Speciality Products
P.O. Box 1408
Gibsonton, FL 33534

Remember that for your shopping convenience, Aerospace Speciality Products accepts VISA, Master Card and American Express!

Why Not Do A Demo?
by Bob Wiersbe

My son Kyle's 5th grade class was studying space in their science class and one of their projects was to build a rocket that would fly under balloon or tennis ball power. Kyle asked me for some help with his team's rocket, and I gladly gave it to him. I guess their finished project never got off the ground.

But, it left me with an opportunity to ask his teacher if I could come in to the classroom and talk about model rockets and do a demo launch. She was very excited about the idea, and even suggested we get all three 5th grade classes together for the event.

In the classroom I talked about the history of model rocketry, the Safety Code, motor types, rocket construction, and showed them rockets as small as a Mosquito to a 1/5 scale Nike-Tomahawk.

One of the first questions I asked them was how many of them had ever seen a model rocket fly. About 45 of had, so I had 6 of them stand up and told the class that back in 1958 these 6 kids would either be killed or seriously injured trying to build and fly their own rockets. I did this to give them an idea of why model rocketry was started, why we follow the Safety Code, and why we don't try to make our own motors.

After talking and answering questions for about 20 minutes we went outside for the launch. I wanted to keep the launch simple, so I used mostly 1/2A and A motors in the rockets. I only flew 10 rockets in all, but it was enough to introduce them to model rocketry.

The kids and teachers really seemed to enjoy the launch, and were surprised by how high a tiny Mosquito could go (and then disappear). They also got a kick out of a CATO rocket breaking apart (one teacher thought my rocket had just been destroyed and was horrified), and an X-Wing that lost a bunch of fins on a hard landing.

The next day Kyle brought home a large envelope filled with letters from the kids. Each one had taken the time to thank me for coming to their school and told me what they had learned from the demo. It really impressed me how much the kids remembered about what I had said in the classroom and not just how cool flying the rockets was. The teachers invited me back next year to do another demo during their space section, which was an offer I couldn't refuse.

It really doesn't take much to do a demo at a school, the most important thing is to be willing to do it. It's a great opportunity to teach kids about our hobby, and how to do it safely. You'll have as much fun as they do.

Explore More At Admiral Byrd School

by Ken Hutchinson

Early this year I received a message from Rick Heller whose daughter attends Admiral Byrd School in Elk Grove Village. Rick was serving on a parent's committee organizing a special program at the school called "Explore More" and was interested in having NIRA participate. It is a program that seeks to expose the children to a variety of disciplines and activities, many related to science. Since the theme this year involved space science, NIRA seemed like a natural resource to contact. I foolishly agreed to put something together for the school, knowing that it would be hard to find club members who could help out on a workday. Little did I know at the time that I would also be moving my place of residence twice in the thirty days prior to the event.

Rick and I decided that we would like to have some rocket building classes like those NIRA runs at the Chicago Hobby Show in the fall and a brief demonstration launch. After searching for alternate sources of kits, NIRA president Rick Gaff came through for us with some 'Windy City Special' kits left over from previous hobby shows. Retired NIRA member Tom Pastrick has no problem freeing up a weekday and he was willing to help so it seemed like the mission was 'go'.

June 9, Explore More day, didn't start off too well. I drove through a downpour on my way to pick up Tom but the rest of the day was as nice (and as hot!) as you could hope for. We saw Rick Heller out on the athletic field preparing to rope off the spectator area as we pulled into the parking lot. We marched right out to the field and jointly put together the final (wind determined) plan on how to lay out the range. Next we signed in at the front office, got a quick orientation tour of the school and 'our' classroom, and carried the building supplies into the classroom. That cleared the way for our first important activity of the day: lunch!

The Explore More committee had put together a nice lunch for volunteer presenters. The food was perfectly fine but the best part was that it gave us an opportunity to chat with some of the other presenters. At our table were a gentleman giving a golf class, another from a nature center in Schaumburg giving a talk on turtles, a third from the Museum of Science and Industry with a presentation on the international space station, a woman from the EPA with a demonstration of pollution effects and control, and another woman who was going to teach classes on sign language. She was concerned that the younger children might not have the fine motor skills necessary to make the signs correctly. We had to tell her we had the same concern over fine motor skills with respect to sharp hobby knives!

Finally it was time to start the classes. The day's schedule had been shortened a bit to make more time available for us to set up for the demo launch. That ended up putting us in a bind during the classes, though. Our students ranged from K through 5. One of the school's 5th grade teachers, Jim Ciosek, was there to act as a helper. We decided that I would take the younger children with Jim while Tom would take the older children alone. We only had 40 minutes for each of three sessions and it just wasn't enough. We did get most of the basic assembly done but our hopes of letting a few of the children fly their new rockets at the demo launch were dashed by our inability to get the kits done in the time allotted. This problem doesn't show up at the hobby show were there are no scheduled time slots and each group can take as much or as little time as it needs. The children were quite enthusiastic and seemed to enjoy the sessions. So the effort was basically a success in spite of the time problems.

Then it was time to do a quick clean up and dash out to the field for the demonstration. I was worried that without the student's rockets, our demo fleet was a little small, only five birds. We put the first two on the pads, a pair of HiJax's with A and B engines. The school principal, Dorisanne Weitermann, introduced us and we were off. Tom and I shared the announcing duties; three fifth grade volunteers did recovery duty for us. The cheering that followed the A powered HiJax into the sky told me that I didn't need to worry about the demonstration; it was an easy crowd. Grade school kids learn to count backwards from 5 real fast and with great gusto, let me tell you! The engine power demonstration was followed by my Quest tube fin rocket and Tom's modified Windy City Special. I'm not sure but it appeared to be set up to act as a power pod for a large glider. Tom wasn't able to fly his Big Bertha because he accidentally brought the D engine version and we didn't think the field was suited for a 'mighty D'.

Well that's not entirely true. I wanted something a little spectacular for a 'grand finale' and that suggests a composite motor. With the small field, no guarantee on the wind (which turned out very gentle), and the proximity to O'Hare Airport I was stumped for a while. The answer turned out to be something I saw Ed LaCroix doing repeatedly at NARAM last year much to Dane Boles' amusement. Fly a Quest Flying Saucer with the ever loud and satisfyingly smokey Aerotech D13 reload. It turned to be a pretty good ending to the day and yes, the copperhead igniter worked first time.

If I ever get the chance to do this again there are things I would do differently. Building on this time scale demands a simpler kit. If there isn't a suitable one (I haven't thought of one yet) I would suggest a rocket physics lecture and hands on demonstration. I think that there are several things that could be done to convey some simple rocket physics in a fun way to children. It's easier to stop a lecture in the middle than to stop building a rocket when it is half done.

If time does permit a building session, I would try to get sponsorship for the cost of the kits. Even in bulk packs the kits are fairly expensive and Estes (or Quest) can't stay in business if they give them to every school. Since it is a parent driven program the school didn't fund it and the parent's funds were limited. NIRA doesn't usually have many kits left over (almost none now). But it occurs to me that my employer might have been talked into donating the money for kits in return for a listing in the school and NIRA newsletters. Next time I would certainly check this out.

And with children this young, two adults per group of five or six is not too many. Tom could have used a helper with the older kids. Even though I usually had more and younger children in my groups I did as well as Tom at keeping to the schedule. This was due in no small part to Jim Ciosek's experience at working with grade school kids.

Was it worth a day of vacation? You bet! About 26 children got to have a good time building rockets and learning a little about them. All 400 students and most of the adult participants were able to watch the demonstration launch. Tom and I had a lot of fun doing it. Participation in events like this can give NIRA a higher profile in the community and shows us in a good light. In fact the whole Explore More concept seems like a winner to me. If you are the parent of grade schoolers and your school doesn't have a program like Explore More you should look into starting one. If you get the chance to do a demonstration like this, take it. Some of the tiny seeds we plant today will bear fruit for the hobby in 20 year's time. And they will all bear fruit for our society even though they won't all stay involved with the hobby. Because of the O'Hare airspace overhead we weren't able to aim very high, but I think we paid forward in a small way.

Apollo 11 Factoids

- When the Apollo spacecraft passed through the Van Allen belts on its way to the moon, the astronauts were exposed to radiation roughly equivalent to that of a dental X-ray.
- The command module offered 73 cubic feet per man as against 68 feet per man in a compact car. By comparison, the Mercury spacecraft offered 55 cubic feet for its one traveler and Gemini provided 40 cubic feet per man.
- There are approximately 2-1/2 million solder joints in the Saturn V launch vehicle. If just 1/32 of an inch too much wire were left on each of these joints and an extra drop of solder was used on each of these joints, the excess weight would be equivalent to the payload of the vehicle.

Heard on the Street

(with apologies to the Wall Street Journal)

Welcome to the Club!
Dean Hemmingson, Terry and Tori House, the Orris family and Richard Padula have all joined NIRA in recent months. Welcome to the club!

NASA Pulls Webpage – a web page that details the 'Procedure to Follow in the Event That Building 245 is Attacked by Vikings' has been pulled from a NASA web site. The page seemed to be a response to ISO 9000 implementation. The NASA Watch web site has reproduced the page at:

http://www.reston.com/nasa/arc/arc.viking.raid/Viking.Raids.html

Hickman pens new book – Homer Hickman Jr., who wrote *Rocket Boys* (that became the movie *October Sky*) has a new book on the shelves.

Back to the Moon has been described as a technological thriller of an ex-astronaut hijacking the Space Shuttle Columbia (but for a good reason).

New Edmonds Glider Available from Apogee

Just in time for NARAM, Apogee Components now has the new Edmonds Aerospace glider in stock. The new glider called "Edmonds RGX" is a "rocket glider" design built around the 10.5mm micro motors from Apogee Components.

Glider Specifications:
Mass: 23.1 grams (without motor)
Length: 18.25 inch (46.4 cm)
Wing Span: 13 inch (33.0 cm)
Recommended motors: Apogee A2-3 or B2-3

Glider Description: At this time, I do not have a photo of the glider, but I'll try to get one posted to the Apogee Components web site as quickly as possible. The design is a bit more competition oriented than the other Edmonds Aerospace design called the "Ecee." Unlike the canard style Ecee, the new RGX is a conventional configuration, with the wing in front of the tail. It features a floating wing, which is free to pivot along the leading edge during boost, and is then forced to a fixed position at a positive AOA for glide by a sliding piston arrangement. The kit features laser cut balsa wood, and can be assembled in about an hour using wood glue.

Price: Special Pre-NARAM price: $14.95 Orders can be placed using the Apogee Components Online ordering system of the Apogee web site.

Tim Van Milligan
Apogee Components, Inc.
630 Elkton Dr.
Colorado Springs, CO 80907-3514 USA

Tel: 719-535-9335
fax: 719-534-9050

web site: http://www.ApogeeRockets.com
reply email: tvm@ApogeeRockets.com

FAQ available for the Optional NAR Insurance

The official NAR web site now included a Frequently Asked Questions (FAQ) list about the NAR's optional insurance.

Readers of the rec.models.rockets newsgroup asking questions about the insurance proposed that the NAR provide such a list.

The page header states: "This document outlines some frequently asked questions about NAR insurance. It is not an exhaustive review of NAR insurance, and is not a legal document in any contractual sense. Its sole purpose is to provide NAR members with a plain-English explanation of the coverage available to them and to NAR Sections as an optional membership benefit."

The page can be accessed at:
http://www.nar.org/insurancefaq.html

Apollo 11 Factoids

- Jeff Ashby, a U.S. Navy captain who will make his first shuttle flight with the July 1999 STS-93 mission of the Space Shuttle Columbia, was a 15-year-old dishwasher when Apollo 11 landed on the moon.
- The fully loaded Saturn V launch vehicle with the Apollo Spacecraft stood 60 feet higher than the Statue of Liberty on its pedestal and weighed 13 times as much as the statue.
- The boost protective cover protected the command module from temperatures that reached 1200 degrees during launch.
- The command module used only about 2000 watts of electricity, similar to the amount required by an oven in an electric range.

Astronaut Charles P. ''Pete'' Conrad dies in accident at 69

OJAI, Calif. (AP) - Just last spring, Charles P. "Pete" Conrad said he was Apollo 12 astronauts, looking forward to the day he would turn 77. "I fully expect that NASA will send me back to the moon as they treated Sen. (John) Glenn, and if they don't do otherwise, why, then I'll have to do it myself," he declared.

Conrad, one of NASA's pioneering astronauts and just the third man to walk on the moon, died Thursday after a motorcycle accident near Ojai. He was 69.

Conrad was on a trip to Monterey with his wife, Nancy, and friends when he crashed on a turn, Ventura County Deputy Coroner James Baroni said. Conrad, who lived in Huntington Beach near Los Angeles, died later at an Ojai hospital.

"He was going back to space as an entrepreneur, trying to create ways for rockets to launch inexpensively and manage satellites," Mrs. Conrad said Thursday evening. NASA selected Conrad, an aeronautical engineer and Navy test pilot, as an astronaut in 1962. He piloted the eight-day Gemini 5 mission in 1965, which set an endurance record in orbiting the Earth. A year later, Conrad commanded Gemini 11, which docked with another craft during orbit and set a space altitude record of 850 miles.

As commander of the Apollo 12 mission in 1969, Conrad earned the distinction of being the third man to walk on the moon after bringing the lunar module down in the moon's Ocean of Storms. He and astronaut Alan Bean spent seven hours and 45 minutes on the lunar surface. When the 5-foot-6 Conrad stepped onto the surface, he exclaimed with his trademark sense of humor: "Whoopie! That may have been a small one for Neil, but that's a long one for me."

Conrad, who graduated from Princeton University in 1953, also flew in the first manned Skylab mission. During the 28-day flight in 1973, he established a personal endurance record for time in space by bringing his total flight time to 1,179 hours and 38 minutes. He has called his last mission in space the most satisfying, working to repair the damage Skylab suffered during its liftoff.

After retiring from NASA and the Navy in 1973, he worked as chief operating officer of American Television and Communications Corp. in Denver and later for McDonnell Douglas Corporation, the aviation manufacturer. Among his numerous awards are the Congressional Space Medal of Honor, two NASA Distinguished Service Medals, two NASA Exceptional Service Medals, two Navy Distinguished Service Medals and two Distinguished Flying Crosses. He was enshrined in the Aviation Hall of Fame in 1980.

The Philadelphia native is the third of the 12 original moon walkers to die. James Irwin of Apollo 15 died in 1991 and Alan Shepard of Apollo 14 died a year ago. In reflecting on the upcoming 30th anniversary of Apollo 11, Conrad recently said, "Time flies when you're having fun, and I've been having fun for the last 30 years." Conrad, who divorced his first wife, is survived by his second wife, three sons and seven grandchildren. A son preceded him in death.

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