THE LEADING EDGE

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

Volume 23, Number 5
September/October 2000

Club News

Safety at Club Launches – The September club launch was fantastic, but there are more people attending the monthly launches and increasingly largeer (i.e. F and G) motors being used. Because of this the NIRA email list was overflowing with comments and suggestions on how to make our launches safer and more fun.

Some of the suggestions included:

- Having 2 people on range duty: an LCO and an RSO. The RSO would check in 'complex' rockets (see a flight card or the range rules for the definition) and be watching the range looking for problems to develop. The LCO would give countdowns, scan the sky for aircraft and observe launched rockets.
- Increase the buffer zone between spectators and the launch pads. Although spectators are currently a safe distance away, the area just behind the pads has been getting crowded.
- Rockets need to launch from vertical or near vertical. It was gusty last launch and people were overcompensating for the wind, causing some rockets to go horizontal.
- Adding a partial 3rd row of pads for Large Model Rockets behind the current rows.

Let Bob Kaplow, club RSO know of any suggestion you might have. Safety and club operations will also be discussed at club meetings and launches.

HPR Motors at Greene Valley – Although it shouldn't come as a surprise, HPR motors are not allowed at launches at Greene Valley (the field size doesn't permit it). Usually this isn't an issue since most HPR motors are easy to spot (H or greater), but there are some F and G motors that are classified as High Power motors. These include the F101, G104, G125 and the G33.

The first three are High Power because they are over 80N average thrust, the last one (G33) because it contains more then 62.5g of propellant.

Also, rockets that weigh more then 1500g at launch are consider High Power no matter the engine (and can not be flown at Greene Valley).

Chicago Hobby Show Update!

We have received a few kits; they have been assembled, and even flown at the last club launch.

The supplies such as tape, extra pencils, paper towels and the cardboard cutting boards are being supplied by RCHTA.

What we still are in great need of are volunteers.

This is how it stands today. We have 10 people for tables, and 3 set-ups for the am shift on Saturday, the pm shift only has 6 people for tables, and one set-up.

Sunday has 10 people for tables in the am shift, and 7 people for the pm shift. There are no set-up people for that day at all.

What I need are people to fill the following positions:

1. Someone who can be out front by 9:00 in the am to pass out the admittance badges, and then again around 12:30. I need this for both days.
2. Additional people at the tables. I need at least 13-16 people per shift to have this work smoothly.
3. Additional people to help in the set-up of the tables. This means filling tables with kits and supplies as people go through.
4. Line Greeters. These people assist the public in getting to the tables,
5. Photographer. This can be someone for the entire day or different shifts. Possibly this person could also assist in the am or pm badge handout.

So if you have not already emailed or spoken to me directly and you can help please contact me as soon as possible.

Thank you
Jane Piette
Jane@simon.chi.il.us

National Sports Launch 2001

by Dave Urbanek on rec.models.rockets

Where's the NSL gonna be in 2001? Where, oh where?

Well, I'll tell you where.

The NAR National Sport Launch will be May 26, 27 and 28th, 2001 at UROC's Pony Express Test Range, in Tooele County, Utah. The site is about 30 miles west of Lehi, Utah, and about 30 miles south of Tooele, Utah. Yep, it's the middle of no-where, and we love it.

Expect a 10,000' waiver, mild temperatures and lots of wide open spaces. There isn't a tree within 10 miles, nor a building nor power line. Just wide, flat, desert scrub.

For more information on the launch site, see the UROC web site at:

http://www.uroc.org

Thanks to the NAR for accepting our bid and I hope to see you all there in May.

NARAM 43 Information

by Chris Kidwell on rec.models.rockets

As others have mentioned, NARAM-43 will be held in Genesco, NY, Aug 4-10.

Events are:

1/2 A Boost Glider
1/2 A Flex-Wing
A Altitude
B Super-roc Altitude
C Streamer
C Eggloft Altitude
D Helicopter
Sport Scale
Research & Development

CD is John Viggiano, jsvrc@rc.rit.edu

Make your reservations at the Ramada Inn, 800-888-8210

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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!

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Ken Hutchinson
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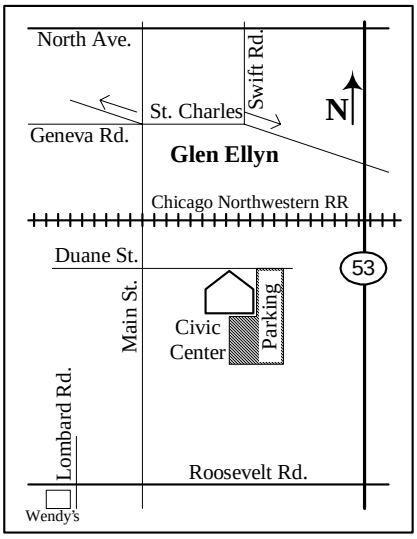
Crystal Lake, IL 60014-4541

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).

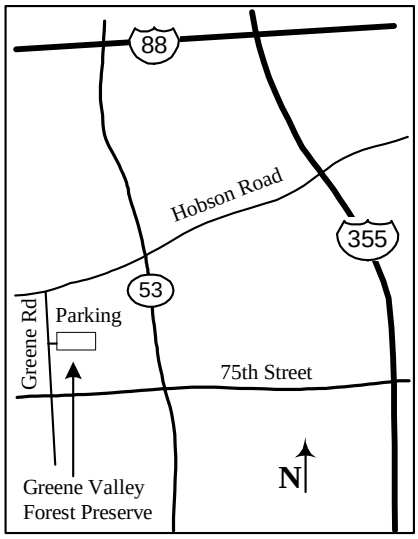
October 6
November 3
December 1
January 5
February 2
March 2
April 6



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 infoline for pre-launch information: 630-483-2468.

October 15 – Greene Valley Forest Preserve
October 29 – Hobby Show Launch at Greene Valley
November 19 – Greene Valley Forest Preserve
December ? – Holiday Party (details TBA)
January 21, 2001 – Building Session at Bob Kaplow's
February 18 – Building Session (details TBA)
March 18 – Building Session (details TBA)
April 15 – Greene Valley Forest Preserve
May 13 – Youth Group Launch at Greene Valley



Model of the Month Winners! (August photo by Jeff Pleimling, September by Rick Gaff)

August – Greg Cisko shows off his winning Estes Mercury Redstone. There wasn't a youth entry this month.

September – Adam Goodwin shows off the 'Flying Pharmacy,' winner of the youth division. Bob Kaplow's winning entry was an upscaled Cloud Hopper (with a different Bunny's face).

3rd Annual Park Forest Demo
by Bob Wiersbe

On July 22nd the 3rd Annual Park Forest Parks Department Rocket Launch and R/C Demo was held at Central Park in Park Forest. The event was sponsored by the Suburban Aeroclub of Chicago, the Village of Park Forest, Don's Hobby World of Glenwood, IL, and Estes Industries.

This event draws hundreds of spectators from the surrounding area, and is heavily supported by the Parks Department of Park Forest. They even provide traffic control and crossing guards.

It was a real picnic atmosphere, with a cotton candy, hot dog and hamburger vendor on hand. People were sitting in the stands that were set up in several locations around the field, in chairs, on blankets on the ground, or just hung out near the planes and rockets.

Don's Hobby World was running Make It - Take It rocket building sessions all day long with kits donated by Estes. The kits were just like the ones we did at RCHTA last year. Several of the folks who built the kits came down and flew them too. Don also provided motors for us to use for the demo, which was very generous of him. Thanks Don!

NIRA members Randy Dust, Ken Goodwin, John Kallend, and Bob Wiersbe along with SAC member (and former NIRA member) John Boren participated in the Rocketry side of the event. John Kallend also flew his Phoenix and Ladyhawk radio controlled rocket gliders and R/C helicopter. The field wasn't bad, but the wind was carrying the rockets into tall scrub and weeds (and bees) which would make it tough on our recovery crew.

The show opened with a demonstration of R/C airplanes, with up to four planes in the air at a time. We were busy getting rockets ready to launch and trying to debug some problems with the launch system so we didn't get to see much of the airshow. After about a half hour of flying it was time to do some launching.

We started off small, with a Micro-Maxx (I adapted a Micro-Maxx pad to work with the rack system). It flew just fine but the energetic ejection charge blew the removable fin unit off and it was lost in the tall grass. The rest of the first rack was a mix of A-D rockets, including an X-wing, CATO, Big Birdie (one of my favorite oddrocs), and ending with a Phoenix missile.

"Look! Up in the sky! It's a plane! It's a rocket! Oh nuts, I don't know which it is." (Bob Wiersbe photo)

The X-wing went unstable when the motor mount failed and the motor moved forward. Luke somehow managed to eject the chute before impact for a safe landing. The CATO was a huge hit with the kids (as usual), but unfortunately some pieces were lost. The Phoenix on a D12 got lots of oohs and ahhs.

When we finished with our rack Randy and John flew theirs. They had much better luck than we did with no misfires or unstable rockets, and together we put on a pretty good show. They also had a nice collection of Tasmanian Devils that the crowd really liked. Randy flew his Phoenix on an Aerotech E15, which really got the crowds attention. You could tell they really wanted more of the big and loud stuff. After they finished their rack the R/C guys took over again and we got ready for another rack of rockets.

The R/C guys flew some really sharp stuff too, and know what they're doing. They even held a "Combat", where they tie a streamer to the back of the plane and try to avoid having theirs cut off while attacking the other planes. It was a real dogfight, and requires an awful lot of piloting skill.

One other highlight of the show was the flying "Lawnmower", a real scale flying lawnmower. I don't know how the guy designed and built this thing, much less learned how to fly it. It was really, really cool. He could do loops, rolls, all sorts of stunts with it.

John Boren had something bolted down to a picnic table between the rockets and the planes, it turned out to be a $3000 jet engine. He cranked that thing up a couple of times during the show, and man, was it loud! Just like the real thing in miniature! He's planning to build a plane to go around it, something capable of 200mph flights. Yikes!

A view of the RC crew. John Kallend is in the front at left prepping his Aerotech Phoenix RCRG. (Bob Wiersbe photo)

Randy and John were flying bigger rockets (C-F) while Ken and I were flying smaller ones (A-C). It worked out very well, and we tended to have a very balanced show each time (even though we really weren't planning anything). John Kallend flew his Bomarc on a G64 reload, which was the heaviest rocket and most powerful motor flown that day. It was also a very nice flight.

My one "big" flight of the day was an Arreaux on an F20-7 motor. The rocket headed the wrong way at liftoff and was drifting away from the recovery area, and drifting fast. Several kids took off after it, and so did I. After a long walk around a drainage ditch I realized that the building that I saw it land behind was actually a pool. I was very relieved to hear that the lifeguards saw the rocket land, not in the pool but on the roof of the library next door.

I went to the library to let them know that my rocket was on their roof (they already knew, the kids beat me to it) and that it wasn't a fire threat or anything. They were grateful and said that if one of the guys from the Parks Department was at the launch they might be able to get it down. Sure enough, someone from the Parks Department was at the launch, he heard about the rocket, and he went and got it for me. What a great bunch of people!

In all I think we did four launches that day. My log book says I launched 22 rockets and Ken told me he launched 17, so that sounds right. Randy and John probably launched 6-9 rockets per demo too, so we launched around 75 rockets give or take a few.

I'd like to say a word of thanks to our recovery crew, who braved the tall grass, thickets of weeds, nests of bees, thorns, cut legs, and other nasty stuff to get our rockets back. They were: Mark Boeckman (attending his first launch), Adam Goodwin, Mark Anderson, Chris and Kyle Wiersbe. I know there were others that helped, but I don't know their names.

This is a yearly event, and I know that they want to do the rocket part again next year. It's a really fun show, not hard to do at all. If you're looking for something to do on a Saturday, or just looking to fly a few rockets, please think about doing this next year. All you have to do is show up with a few rockets prepped and ready to fly.

Launch Report: WTGG '00
by David Wallis

NIRA hosted its annual high-power launch, Watch The Grass Grow, on Saturday and Sunday, September 2 and 3. This event took place at the Beaver Run Sod Farm in Harvard, Illinois.

During the drive to Harvard, it looked like the weather was going from bad to worse. When we left home, the sky was partly cloudy. The farther north we went, the lower and darker the cloud cover got. I even had to turn on the windshield wipers a time or two. This was not looking good; I had planned for this launch for months, and was planning to do my NAR Level 1 certification flight this weekend. I might not get another chance until next year!

When we (my 10 year old son, Alex, and I) arrived at the sod farm, the sky was overcast, but not as threatening looking. But there was a haze that hung down all the way to the ground, and the wind was probably 15 miles per hour, with gusts much greater than that. Even though we'd arrived at the scheduled start time, the range was just beginning to be set up. Erecting sunshades and canopies was taking teams of 4 or more people because of the wind.

Alex and I unloaded all our gear, and set up our launch rack and controller. We pitched in with most of the other people present, and the range was set up and ready to go by shortly after 10:00 a.m. However, there was still nobody brave enough to launch a rocket in the haze and wind!

Around 10:30, the wind had started to die down a little (although it would stay with us all day), the haze finally burned off, and a few brave souls tested their luck by launching a couple model rockets. The wind was not too bad, and WTGG '00 was off and running (er… flying), finally!

At about 10:45, I finally decided that meekness was not the name of the game for the day, and Alex helped me prep and launch my Aerotech Initiator on an F23-4FJ Econojet. This is my favorite motor in this rocket – dense black smoke, and the Black Max propellant really gets the Initiator off the pad in a hurry! On this motor, the Initiator topped out at about 800 feet, the parachute deployed right on time, and brought the rocket to a gentle landing just shy of the cornfield on the north edge of the field.

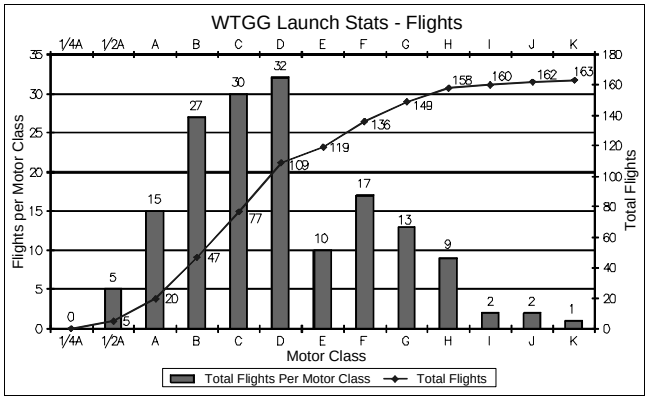
Did I say cornfield? Yee gads, either that corn didn't get fed all summer, or the Rocket Gods were hiding in it! The corn was about 7 feet tall, and very dense. There were way too many rockets sacrificed to the corn. First up was Dave Johnson's Aerotech Mirage flown on a G35. This rocket was set up to recover the nose/body and fin can on separate parachutes. Both 'chutes deployed perfectly, but both sections drifted into to corn on our trusty wind. The nose/body section was eventually found, but the fin can was lost.

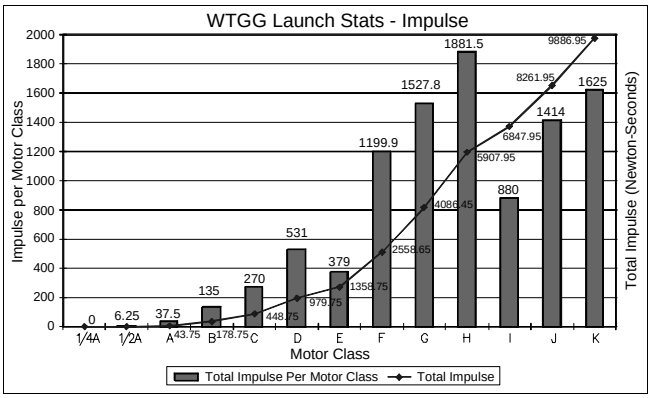
Chuck Nozika, who bravely lofted his "Gimme Shelter" on an Aerotech K1100, tragically lost his rocket to the corn as well. Rumor has it that Chuck has founded a "WTGG Lost Rocket Support Group" called "Children of the Corn." Chuck, thanks for a spectacular flight, the only K motor of the launch, and accept our condolences for your loss.

Rocketeer's Row... with Al's Hobby at the far end (David Wallis photo)

Finally, around 1:00, I couldn't stand the suspense any longer! The winds, while still present, were down below 10 mph, and at times, the air was still. Time to go for my Level 1 certification flight!

Bob Kaplow took a few minutes away from his LCO duty to perform a safety inspection of my rocket. I was certifying with a LOC IV, modified with to-the-mount fins, an ejection baffle, 2 extra centering rings (1 for the baffle, 1 at the top of the fin tabs), and 20 feet of 9/16" tubular nylon recovery bridle and harness. Add in a 120 Db screamer I got from Radio Shack for $5, and the weight rose from the 29 ounces of the stock LOC IV to 45 oz. (without motor) that I measured after the rocket was complete. With the RSO inspection out of the way, Dean Roth volunteered to witness my preparation, flight and recovery. I assembled the AT H128-W reload that was brought to the launch by Tim Lehr of Al's Hobby Shop, installed the motor and inspected and prepped the recovery system (the stock LOC 36" 'chute, harness and screamer). Dean refused to let me certify with a copperhead igniter, and graciously gave me one of his hand-dipped igniters.





The walk to the high-power pad seemed like the longest of my life! My son, Alex, and Dean both came with, offering support and advice. Dean even took a picture of Alex and me with the rocket! Setting up the rocket was a breeze… after reading certification attempt reports from other people who told of, "being so nervous, I didn't know which end was up!" I had named my certification rocket "This End Up!" and the paint scheme included a big, white, arrow, so there was no confusion as to how the rocket went on the pad!

After turning in the flight card and waiting for a few minutes, I heard my certification flight announced. Dean had headed towards the corn to serve as my recovery and tracking team, and I watched with great excitement as the countdown started.

The H128 lifted the 3-pound rocket quickly into the air… despite the wind, the LOC IV boosted nearly straight up. Waiting for the recovery charge to fire seemed to go on forever… but the 'chute appeared soon after the rocket started to arc over, just like the simulation said! The screamer was clearly audible, even from 900 feet in the air. The rocket drifted somewhat on the wind, but landed well short of the dreaded cornfield. Dean was the first one to reach the rocket… and wasted no time putting the pin back into the screamer… at close range, that thing is deafening!

A quick inspection showed no damage greater than some spot putty that had cracked off a fin fillet…. A quick handshake from Dean, and I was officially a High Power Rocketeer! My paperwork was quickly completed while I floated a few feet off the ground nearby.

There were 5 other certification flights on Saturday, one level 2 attempt, and 4 level 1 flights. Unfortunately, only 3 of those were successful. Steve Piette lost his level 2 rocket (a PML Endeavour) in the corn, which just about broke my heart, as this was his second attempt at level 2. Bob Wiersbe had a successful level 2 flight with his PML Endeavour, on an AT J350 reload.

*(**WTGG** continued on page 9)*

Rocket Math 6:
Altitude Tracking
Part I – Single Station Tracking

Introduction

In model rocketry sooner or later, although usually sooner, you will come across the question, "How high did it go?" There are several ways to deal with this question such as:

1. Use the mfg.'s listed altitude.
2. Perform a computer simulation.
3. Include an altimeter within the model.
4. Track the model with a radar type system.
5. Visually track the model and use the observations to calculate the altitude.

Methods 1 and 2 give an approximate idea of altitude but cannot account for the actual conditions at the launch

Methods 3 and 4 can give accurate altitudes but are costly and the electronics required will not fit into smaller rocket bodies and add weight to the model. Also, using advanced radio methods may require special licenses.

Method 5 gives accurate results without adding any weight to the model and without requiring expensive components or radio operator licenses. In this Rocket Math, we will investigate the visual tracking methods.

Get on the Right Track

Visual tracking methods consist of measuring the line of sight from a fixed point or points on the ground to the model's apogee. The actual measurements taken are the angles from the horizontal (elevation) and in two point tracking, the angle in the plane of the ground (azimuth).

The angles are manipulated along with the known distances on the ground to determine the altitude the model reached. This process is sometimes called *data reduction*. Of course, to derive these procedures requires the use of some trigonometry but fear not! You won't have to go through 11th grade math again. We'll just cover what's required for the altitude tracking and try to make it plain as pi.

One is the Loneliest Number

The simpler but less accurate method of determining altitude is called Single Station Tracking (SST). As the name suggests, only one tracker is required. He or she stands a know distance from the launch pad and sights the flight of the model through a tracking device (we'll cover these instruments later). At apogee, the tracker fixes the position of the instrument and can then read off the angle of elevation (above horizontal) at which the apogee was observed as depicted in Figure 1.

For SST to work, we have to assume that the model rocket will travel straight up. Since this is rarely the case, there can be quite a margin of error but SST is still better than "eye-balling" an altitude. Also, analyzing SST will give us a good footing to move on to Two Station Tracking (TST).

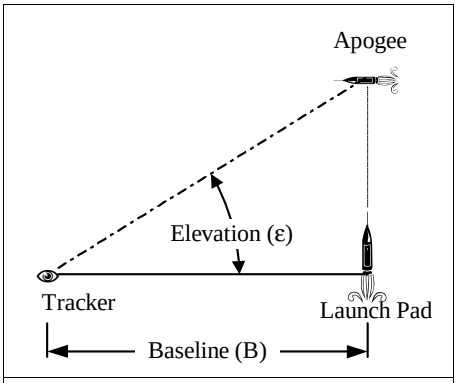


Figure 1: Single Station Tracking

***Right* as Rain**

-Or-

History Repeats Itself

This straight up motion assumption leads to the generation of a 90° angle at the launch pad (see Figure 1) between the rocket's flight path and the baseline. The triangle formed by those two lines and the tracker's line of sight is then called a *right triangle* and lets us make use of some powerful trigonometry to quickly and easily determine the altitude attained.

We will call the measured angle of elevation epsilon (ε). Angles are often labeled with Greek symbols to differentiate them from lengths which are usually labeled with regular letters but don't let that ε scare you. It's just a name we give the angle until we make an actual measurement and can fill it in with a real value.

We have seen these right triangles before in Rocket Math 2 (Cones and Transitions) and the next figure is culled directly from Rocket Math 2 (symbols have been changed to match those used here).

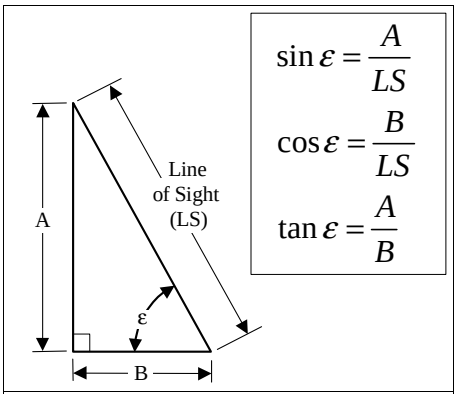


Fig 2: The Right Triangle & Basic Trigonometric Relationships For Right Triangles

In our case, we know the length of B or the baseline because we had the tracker stand a known distance from the launch pad. What we want to find is A or the altitude so looking at Figure 2, we find that the third relationship using the tangent function has only one unknown quantity which is A. If we multiply both sides of the equation by the baseline length we come up with the equation to calculate the altitude from the measured angle and known baseline:

$$A = B \cdot \tan\varepsilon \qquad [1]$$

The tangent of the angle can be found using a simple hand held calculator. So, taking the example of a 150 ft baseline and a measured angle of elevation of 55° the altitude is given by 150 tan 55° and the answer will have the units of ft. To perform this on your basic $12 calculator just type in the following keys[1]:

1 5 0 × 5 5 tan =

to find that the answer is about 214.2 ft.

You may have noticed that the units used for the baseline are carried through to the calculated altitude. Thus, if your baseline is measured in meters, your calculated altitude will be in meters.

There are two other small parts to the altitude calculation. The tracker's eye is going to be some distance above ground level so this height can be added to the altitude. Similarly, the rocket as sitting on the launch pad is slightly above ground level, so this reading should be subtracted from the altitude. For your own personal flight records, these matters are trivial but for competition flights, this may make a difference in the outcome of the event (note: as stated previously, single station tracking can have a large margin of error and thus is not allowed for official NAR sanctioned competitions).

No Runs, No Hits, Some Errors

We have already mentioned that single station tracking is prone to errors but that's a very general statement. There are two major types of errors in SST. The first is tracker error in which the angle observed is not the true flight angle and the other is caused by a non vertical flight. Looking at how much each of these cases effects the calculated altitude may help us position the tracker to minimize the error for a given flying situation.

Let's look at the cases where a tracker measures an angle of 5° more and 5° less than the true angle. We will call these erroneous altitudes A^+ and A^- and they can be calculated as:

$$A^+ = B \cdot \tan(\varepsilon + 5°)$$
$$A^- = B \cdot \tan(\varepsilon - 5°) \qquad [2]$$

If we plot the two parts of equation [2] as a percent error from the true altitude (the one calculated from using just ε) we get Figure 3 (page 6).

There are two points of interest here. First is that the percentage of error is minimized right around a 45° elevation for both a plus and minus deviation from the real elevation. This shows us that it is best to set up the baseline for a flight to try to get an elevation reading of around 45°. Rearranging equation [1] gives:

$$B = \frac{A}{\tan(\varepsilon)} \qquad [3]$$

(***Rocket Math*** *continued on page 6)*

[1] Hewlett Packard *RPN* type calculators and some other advanced calculators use a different order for pressing the keys. Consult your calculator manual if the given order doesn't work.

*(**Rocket Math** continued from page 5)*

but for ε=45°, tan(ε) is 1 so equation [3] reduces to B=A. In other words, to minimize the effects of tracker errors, set up your baseline to match your expected altitude. If this becomes difficult due to the expected altitude, you can use equation [3] to set up a baseline to try to keep your expected elevation between 30° and 55°.

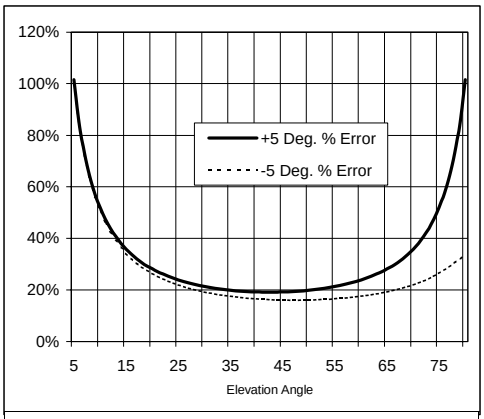


Figure 3: Tracker Error Percent (+/- 5° error)

The second point Figure 3 shows is that the error in reading too large of an angle is always greater than that of reading too small of an angle. Therefore, trackers should pay special attention to avoiding overshoot in tracking.

Back to Basics

To move on, we have to cover a couple additional triangle/trigonometry basics. The first item is that for any triangle, the angles at the three corners will always add up to 180°. This means that whenever we know two of the angles of a triangle (say α and β), we can always calculate the third angle (γ)by subtracting the other two from 180° (γ = 180 – α – β).

The other item is called the *Law of Sines* (LOS) and defines a relationship between the lengths of the sides of a triangle and the sines of the corner angles as shown in Figure 4. A, B, and C are the lengths of the sides of the triangle and α, β, and γ are the angles **opposite** those sides. The LOS applies to any triangle, not just right triangles.

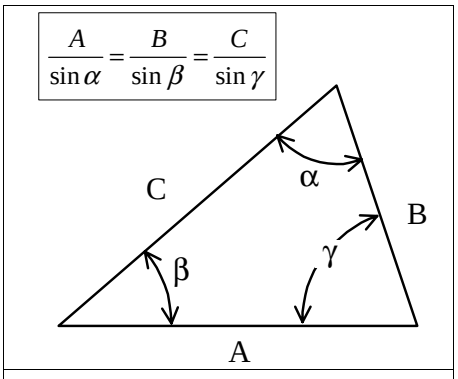


Figure 4: Law of Sines (LOS)

The Not So Straight and Narrow

We all know that no model rocket travels perfectly straight up. Using SST, any variation from this unattainable straight up path leads to errors in the calculated altitude. Lets look first at what happens when the model angles straight away from the tracker as shown in Figure 5. We'll call the deviations from vertical by the angle delta plus (δ^+).

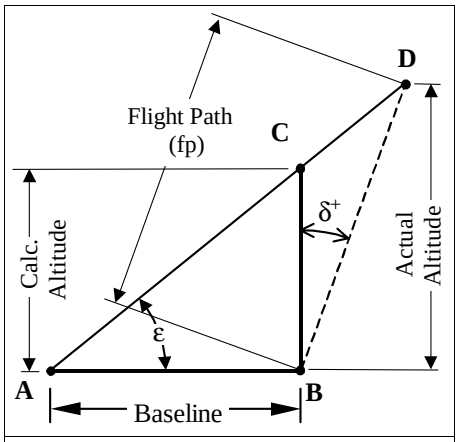


Fig 5: Flight Deviation Away from Tracker

In this case, the altitude calculated from equation [1] will be less than the actual altitude attained. To find this real altitude, we'll first calculate the length of the flight path (fp). Looking at the triangle formed by the points ADB, the angle at point D is 180-ε-(90+δ^+) or 90-ε-δ^+.

Then using the LOS, we can calculate fp from:

$$\frac{fp}{\sin\varepsilon}=\frac{B}{\sin(90-\varepsilon-\delta^+)}$$

Or re-arranging:

$$fp=\frac{B\cdot\sin\varepsilon}{\sin(90-\varepsilon-\delta^+)} \qquad [4]$$

Then we can use the second right triangle relationship (Fig. 2) to get he actual altitude from fp:

$$Altitude^+ = fp\cdot\cos\delta^+ \qquad [5]$$

Then combining equations [4] and [5] gives:

$$Altitude^+ = fp\cdot\frac{B\cdot\sin\varepsilon\cdot\cos\delta^+}{\sin(90-\varepsilon-\delta^+)} \qquad [6]$$

The condition when the model deviates toward the tracker is similar. In this case, the deviation angle is called δ^- and the actual altitude is given by:

$$Altitude^- = fp\cdot\frac{B\cdot\sin\varepsilon\cdot\cos\delta^-}{\sin(90-\varepsilon+\delta^-)} \qquad [7]$$

The last case we'll look at is when the model deviates to the left or right of the tracker. This situation is shown in Figure 6.

The math behind determining the true altitude for this case gets a little more complex and space is short so I'll just throw up the equation for the altitude

$$Alt=B\cdot\frac{\sqrt{1-(\tan\varepsilon\cdot\tan\delta)^2}}{1-(\tan\varepsilon\cdot\tan\delta)^2}\cdot\tan\varepsilon \qquad [8]$$

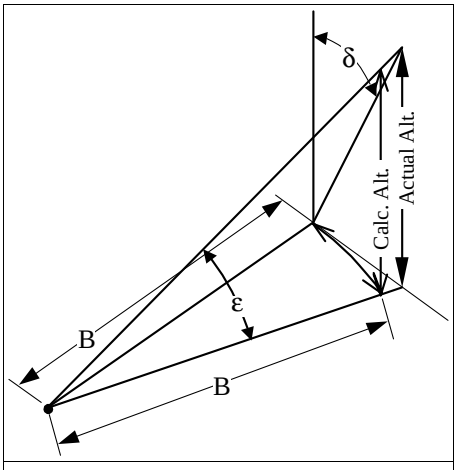


Figure 6: Flight Deviation Left/Right

As we did before with the tracker error, Figure 7 shows Equations 6, 7 and 8 plotted as a percentage error for the case where the deviation from vertical (δ) is 10° in the described direction.

Again, there are interesting things to be observed here. As with tracker errors, the greatest vertical deviation error is found when the model moves away from the tracker. Unlike tracker error, there is no minimum error point to these curves. The higher the elevation angle, the greater the effect of the error. But the real interesting point here is how much less a left/right deviation effects the error vs. the toward or away cases.

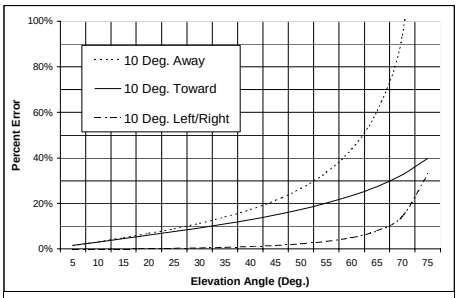


Figure 7: Non-Vertical Path Errors

Conclusions

Single Station Tracking can be a simple and effective way to determine model rocket altitudes. The basic calculation used in SST and shown in equation [1] was easily derived with a simple trigonometric relationship.

Looking further into equation [1] we found that tracker errors are minimized when the baseline is chosen to get an elevation between 30° and 55°. Then digging deeper into the trig. and with a little hand waving to get equation [8] we saw that the direction a model deviates from vertical can make a large difference in the error of the altitude calculated.

We can summarizing the findings in this article to give the following rules for Single Station Tracking:

1. Estimate your altitude and set up your baseline using equation [3] with an angle ε of between 30° and 55°.
2. Although trackers are always attempting to be

*(**Rocket Math** continued on page 9)*

Launch Report: August 2000
by David Wallis

NIRA hosted its regular club launch on Sunday, August 20, 2000 at the Green Valley North Picnic Area launch site. The day was nearly perfect for flying rockets, with a high temp of about 75 degrees under a nearly cloudless blue sky. Winds were variable, gusting from about 5 miles per hour to a maximum of 12 – 15 mph.

The day began with Scouts of Cub Scout Pack 534 of Naperville flying rockets they'd built, under the guidance of Mike Ugorek. This launch was rescheduled at the last minute, and these boys lived up to the Boy Scout motto, "Be Prepared!" Prepared they were, with rockets of every shape and color. Nineteen Scouts participated, helped along by 26 parents and leaders, and 15 brothers and sisters. The boys started their launch at about 1:00 pm, an hour before the club launch officially started.

More people started arriving as the Cub Scouts were winding down, although I noticed a handful of the Cubs stayed around for most of the rest of the launch. I think they're hooked! Who knows, perhaps someday one or more of these kids will set foot on Mars or pilot the next generation space shuttle.

As the afternoon heated up, so did the pace of the rocketeers. There were many Estes kits, new and old, a number of unique scratch built models, and a fair number of large model rockets flying on composite motors, both reloadable and single-use. For most of the afternoon, all 24 launch pads were in use, even though there was never a line at the Launch Control Officer's table.

Norm Dziedzic's Warthog takes to the air (photo by David Wallis)

Here are some of the flights that were memorable to me:

- My youngest son, Nick (age 5) pushing the button to launch his first model rocket – the look on his face was priceless!
- Ken Goodwin flew his Estes Maters Series Mercury Atlas on a D12-3 motor – the first flight for this beautifully built and finished model. The motor lit instantly, and the rocket screamed off the pad into a series of loops and wild turns. Ken was heard yelling, "Oh no! I forgot the fins!" (The Mercury Atlas uses clear fins for flight that can be taken off for static display of the model). Although the Atlas landed before the chute deployed, it didn't appear to suffer any significant damage.
- Joe Provenzano's Launch Pad AMRAAM Missile flew on a pair of Estes D12-5s. Well, it was supposed to! One engine failed to light, but was lit in reverse by the ejection charge of the other engine. The motor burned so hot inside the rocket that the body tube was badly burned and crumpled. A sad end to a rocket, but an unusual situation that I had never seen before.
- Norm Dziedzic's FAO Schwartzkopf flew on an Aerotech G-64 reload for a perfect (as usual!) flight and recovery.
- Jonathan Charbonneau's Nike Smoke. This rocket flew so many times that I left surprised that the paint had not worn off! It even survived an unstable flight that resulted in at least three loops before burn out.
- Bob Kaplow flew his normal assortment of Oddrocks, including: American Pie (made from 2 disposable plastic plates and a bowl); AOL.con (made from an AOL CDROM and a soft drink dome lid); a Rock Sim CDROM handed out at MRFF (Bob, did you install the software first?); a Quest flying saucer and I don't even know what all else!

As for myself… I had a very successful day. My 5-year-old son Nick launched his new Estes Mini Mars Lander twice. On the first flight, the 'chute failed to deploy, but on a 1/2A engine, the darned thing only went about 30 feet high! The second flight on a full "A" motor was perfect. He also flew his Estes Athena 3 times, each with a great flight and perfect recovery, no farther that 30 feet from the launch pad. My 10-year-old son Alex flew his Estes Skywinder for a perfect flight on a C6-5, lost his Gnome on an A4-3T, and flew an Estes "Spare Parts Special" a couple flights on a B6-4 and B4-4, successfully recovered.

My main objective for the day was to make a successful flight on a reload… my first attempt, and part of my preparation for a Level 1 Certification attempt to take place in 2 weeks at NIRA's "Watch the Grass Grow" high power launch in Harvard, IL.

I loaded up an E23-4W reload in my Aerotech 29/40-120 reloadable motor, with some advice from Bob Kaplow. The motor was installed in my Aerotech Initiator, and loaded on the pad. With fingers crossed, I pushed the button and was rewarded with an instantaneous roar as the motor lit and the Initiator leaped off the pad. The 'chute deployed precisely at apogee, and the rocket floated gently back to Terra Firma a few feet from the launch pad. My first reload was a total success! I also flew the Initiator twice more on Aerotech F23-4FJ Econojet motors. Both motors lit immediately, and popped the parachute right at apogee. The only mar on 2 more perfect flights occurred on the last flight, when the Kevlar shock cord parted and the body fell without benefit of a recovery device. It tumbled slowly down though, and landed without damage. The nose cone and parachute were recovered a few minutes later with Alex's help, and the Initiator will live to fly another day.

Rick Kramer gets ready to fly one of his tube fin models (photo by David Wallis)

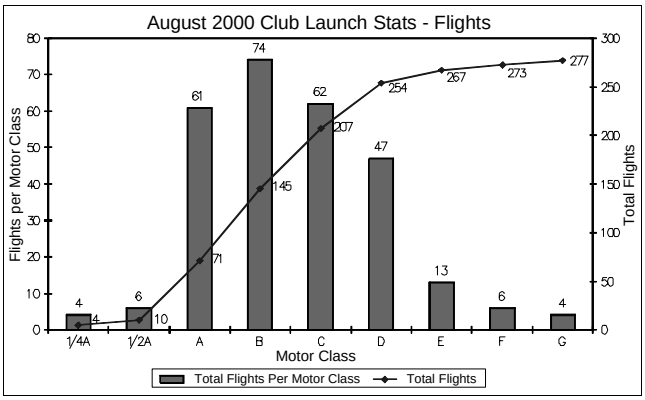
As the 5:00 hour approached, rocketeers began packing up and leaving, and there were a few lulls in the action while the remaining fliers prepped and loaded their final efforts of the day. The final flight of the launch was that tireless Nike Smoke, on yet another flawless flight.

Here are the statistics for this extremely successful club launch:

Total Flights:	277
Cluster Flights:	4
Multi-stage Flights:	3
1/4A Flights:	4
1/2A Flights:	6
A Flights:	61
B Flights:	72
C Flights:	62
D Flights:	47
E Flights:	13
F Flights:	6
G Flights:	4

Total impulse flown this day: 3,223.15 Newton seconds, or the equivalent of a 63% L motor!

Thanks to RSO Bob Kaplow, LCOs Adam Elliot and Ken Goodwin, Mike Ugorek for helping the Scouts, and all the other NIRA members who helped to make this such a fun time!



Space Launch Report for July-August 2000
by Tim Johnson

There were 14 unmanned space launches during July-August. Russia's long awaited launch of Zvezda to the International Space Station (ISS) was the biggest story. Also notable were the first Boeing Delta 3 success, the return of Sea Launch Zenit 3SL, and a $1.3 billion Titan 4B mission.

Three Proton Launches – One Orbits Zvezda

A three-stage Proton-K orbited the Zvezda (Star) ISS Service Module from Baikonur Area 81 Pad 23 (LC81L) on July 12. For the ISS-1R flight, 698,413 kg Proton had a stubby stepped payload fairing. The 13.1 x 4.3 meter, 21,000 kg Zvezda entered a 185 x 354 km x 51.6 deg orbit. Zvezda, built by Moscow's RSC Energia, circularized its orbit before docking with the ISS Zarya (Sunrise) Functional Cargo Block, opposite NASA's Unity Node 1 module, on July 26, creating a 35 meter long, 68,934 kg station.

Proton-K liftoff carrying Zvezda (NASA photo)

Two four-stage Proton-K/DM-2 rockets also flew from Baikonur. The first put Kosmos-2371, a 2,400 kg Geyser military comsat, into geosynchronous earth orbit (GEO) from LC200L on July 4. The second launched Kosmos-2372, a 2,400 kg Globus-1 military comsat, into GEO from LC81P (Pad 24) on August 28.

Deltas 2 and 3

On August 23, nearly two years after the first Delta 3 exploded above the Atlantic, Boeing's $85 million rocket finally succeeded. Delta 280, the third Delta 3-8930, injected a 4,348 kg DM-F3 (Delta Mission-Flight 3) simulated payload into a subsynchronous transfer orbit about 36 minutes after liftoff from Cape Canaveral SLC 17B.

DM-F3 entered a 179 x 20,672 km x 27.62 deg orbit, well short of the 185 x 25,380 km x 27.5 deg target listed in Boeing's press kit but still in an acceptable range. Atmospheric conditions and the second stage's use of propellant depletion shutdown (PDS) on its second burn were responsible. Delta 280 used PDS because DM-F3 exceeded Delta 3's 3,810 kg geosynchronous transfer orbit (GTO) capacity. PDS is less accurate than the more common command shutdown method.

Delta 280 (Delta 3 No. 3) (Boeing photo)

Delta 3 uses Delta 2's first stage 110,658 kgf thrust Rocketdyne RS-27A engine and 2.44 meter diameter liquid oxygen (LOX) tank, along with Delta 2 RIFCA avionics. New for Delta 3 are nine enlarged 62,691 kgf thrust GEM-46 solid rocket motors (SRMs), including three with thrust vector control. Also new are the "hammerhead" 4 meter diameter components. These includes an aluminum first stage RP-1 fuel tank, an intertank, a LOX/LH2 second stage powered by a single 11,224 kgf thrust Pratt & Whitney RL10B-2 engine, and a composite payload fairing. The second stage, with a Japanese Mitsubishi LH2 tank and French SEP carbon/carbon extendible nozzle, is rocketry's most efficient upper stage. The 300,771 kg Delta 3 lifts off on 486,804 kgf thrust.

Meanwhile, Delta 2 is still active. Delta 279, a $50 million 3.5 stage Delta 2-7925 with nine SRMs, a Thiokol Star 48B third stage, and a 2.9 meter diameter fairing, orbited 1,078 kg GPS 2R-5 from SLC 17A on July 16.

Sea Launch Zenit 3SL Returns to Flight

The fourth Sea Launch Zenit 3SL orbited PanAmSat's 3,660 kg PAS 9 comsat on July 28 – a comeback for the three-stage Ukrainian/Russian rocket after a March 12, 2000 failure. The 458,960 kg Zenit flew from LP Odyssey in the Pacific at 0 deg North, 154 deg West. The Energia Blok DM-SL third stage performed two 5.5 minute burns. The first put PAS 9 into a parking orbit. The second, 54 minutes after liftoff, injected PAS-9 into low inclination GTO.

Titan 404B-28

Lockheed Martin launched Titan 404B-29 "Julia Ann" on a $1.3 billion mission for the National Reconnaissance Office from Vandenberg AFB SLC 4E on August 17. The 2.5 stage rocket used a 20 meter long payload fairing. Its classified payload may have been the fourth 14,500 kg Lacrosse/Onyx radar reconnaissance satellite. The payload entered a 68 deg low earth orbit (LEO) 9.5 minutes after liftoff. It was the 10th Titan 4 launched from Vandenberg and the 30th Titan 4 overall. Only 10 Titan 4s remain, and one is unassigned.

AC-161/Echostar 6

AC-161, an International Launch Services (ILS) Atlas 2AS, launched Echostar 6 from Cape Canaveral SLC 36B on July 14. The 237,459 kg vehicle, fitted with a 4.3 meter diameter payload fairing, used two ground-lit and two air-lit Castor 4A solid motors. Centaur performed two burns to propel the 3,700 kg Loral FS-1300 spacecraft into a 26.46 deg supersynchronous transfer orbit. It was the 52nd consecutive Atlas success.

Three Soyuz-U Launches

A 2.5 stage Soyuz-U launched the Progress M1-3 cargo ship to ISS on August 6 from Baikonur LC1. Progress M1-3, with 2,200 kg of fuel and supplies, docked with the rear Zvezda port on August 8. It was the first ISS Progress mission.

The third and fourth Starsem Soyuz-U/Fregat rockets launched four European Space Agency (ESA) Cluster 2 solar wind monitoring spacecraft. Starsem mission ST-09 orbited "Samba" and "Salsa" on July 16. Flight ST-10 orbited "Rumba" and "Tango" on August 9. Both 3.5-stage rockets lifted off from Baikonur Area 31 (Pad 6) with 2,270 kg dual spacecraft payloads. On both flights, Fregat burned twice to reach a 250 x 18,072 km x 64.7 deg deployment orbit. The ST-10 Soyuz-U second stage underperformed, but Fregat burned longer to save the mission.

Kosmos 3M/CHAMP/MITA/BIRD (RUBIN)

A two-stage NPO Polyot Kosmos-3M (11K65M) rocket orbited Germany's 550 kg CHAMP gravity research spacecraft and two smaller satellites from Plesetsk Cosmodrome's LC 132 on July 15. The Kosmos-3M second stage fired its Khimmach 11D49, 15,964 kgf thrust engine twice to put CHAMP into an 87.3 deg LEO.

Sea Launch Zenit 3SL (Sea Launch photo)

OSPSLV Minotaur/ MightySat 2.1

The second U.S. Air Force/ Orbital Sciences "Minotaur" orbited MightySat 2.1 from the SSI Commercial Launch Facility at Vandenberg AFB on July 19. MightySat 2.1 entered a 97.6 deg sun synchronous LEO.

Ariane 44LP/V131

Arianespace launched a 3.5 stage Ariane 44LP booster on dual-payload commercial mission V131 from Kourou ELA 2 on August 17. The rocket carried 1,748kg Hughes-built (HS- 376W) Brasilsat B4 and 1,800 kg Astrium-built Nilesat 102 into GTO. Brasilsat separated from atop the rocket's Spelda system. Nilesat was deployed from within Spelda. V131 was the 55th consecutive Ariane 4 success.

*(**Rocket Math** continued from page 6)*

exact, be especially careful to avoid overshooting the model as these errors are greater than undershooting.

3. Trackers should stand so that any prevailing winds will carry the model left or right as opposed to toward or away from them to minimize non-vertical flight path errors.

In Part II of this Rocket Math, we'll take a look at Two Station Tracking (the method used in NAR Contests) and the physical devices used in tracking.

Questions, Comments or ideas for future articles can be e-mailed to the author at ndzied1@interaccess.com or by regular mail to the Leading Edge Editor.

*(**WTGG** continued from page 4)*

Teddy Farmer flew his Eclipse on an I300, but suffered a broken centering ring on the booster section. Finally, Cole Arntzen flew his "Big Blue" on an AT H123W, and suffered a drag separation at the end of boost. Cole was able to regroup, and flew the Big Blue on another H123W, this time successfully. Congratulations, Bob and Cole! Steve and Teddy, your flights were also exciting, and I wish you luck and success next time out.

I flew my LOC IV once more on an AT G75J reload. The boost was fine, but a parachute riser got tangled in the rigging, and the 'chute failed to open completely. It came down a little fast, and cracked a fin when it hit the ground. The damage is minor, and "This End Up" will fly again!

After recovering my rocket, I took a turn as LCO, from about 4:00 until the range shut down at 5:30. I had a great time checking in all the varied rockets, announcing the flights, and launching them. Now that I'm certified, I look forward to taking my turn at the LCO table regularly! After the last flight of the day, a group of very tired rocketeers broke down the range, loaded up and headed out for dinner in record time! Many folks met for dinner at a local Harvard restaurant. My son had his heart set on Arbys, so we ate there and then headed for home, and a shower to wash some of that fertile sod farm soil off – we were both pretty filthy!

I was not able to attend the launch on Sunday, but learned that it was cancelled due to rain. That was unfortunate, because I knew at least 2 other people planned to make certification flights that day.

Here are some of the flights that were memorable to me:

Chuck Nozika's K1100 flight. Anyone who saw this rocket go would understand where the term, "whoosh generator" came from!

Steve Piette's level 2 attempt. Man, I thought that thing was **never** going to come down. If I had 1 genie wish left, I would have used it to find that rocket.

My level 1 flight… what a rush! Thanks to Bob Kaplow and Dean Roth for the help and guidance.

Teddy Farmer's level 1 attempt… on an I300! That was a pretty ambitious project, and I hope he gets it repaired and his next flight is successful.

My son's winning flight in the "Closest to the PA Speakers" contest. Thanks to Al's Hobby Shop for donating the prize – that really made Alex's day!

Here are the statistics for this extremely successful club launch:

Total Flights:	163
Cluster Flights:	0
Multi-stage Flights:	4

1/2A Flights:	5
A Flights:	15
B Flights:	27
C Flights:	34
D Flights:	32
E Flights:	10
F Flights:	17
G Flights:	13
H Flights:	9
I Flights:	2
J Flights:	2
K Flights:	1

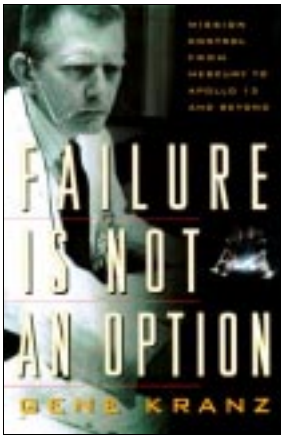
Total impulse flown this day: 9887 Newton seconds, or the equivalent of a 93% M motor!

Thanks to RSO Bob Kaplow, LCOs Rick Gaff, Bob Kaplow and David Wallis, and all the other NIRA members who helped to make this event a reality!

Bunny's Book Beat: "Failure is Not an Option" by Gene Kranz

Review by Mark 'Bunny' Bundick

If you've ever listened to an audio tape of the Apollo 11 landing, you'll hear a strong, clipped voice polling various controllers about their status and upon finishing the roll call almost shout out, "Capcom, you're go for landing". That voice belongs to Gene Kranz, head of the Flight Operations Directorate (FOD) at the Johnson Space Center. Kranz and his controllers were at the center of the ground-based action all during the Mercury, Gemini, Apollo and Shuttle eras.



"Failure is Not An Option" is a detailed and riveting account of that time in manned space exploration, with Kranz at the key position of "Flight", the lead flight controller for a mission.

A pilot in the Korean War, Gene Kranz shifted from his aircraft testing job to join Chris Kraft and the Space Task Group. He and others had to create the Mercury mission rules and procedure from the ground up. As he says, "Since there were no books written on the actual methodology of space flight, we had to write them as we went along." Bet you thought it was a lot more systematic than that, but it wasn't.

This kind of "reporting" from behind the scenes simply wasn't available from any source. It took someone on the inside to write a book like this. Kranz was on shift in the Manned Operations Control Center (MOCR, pronounced "mo-kar") for both the first lunar landing, and the start of the Apollo 13 crisis. He produces spellbinding accounts of all both these events. Besides Apollo 11 and 13, the high points of Kranz's narrative include John Glenn's orbital flight, and the moon-orbiting Apollo 8 --experiences as profound for the mission control professionals as they were for TV audiences. As I read his stories, I reflected on my one visit to the MOCR and wondered what it must have been like to have been there while the flights were going on.

Unfortunately, his account of these adventures is simultaneously fascinating and plodding. Details of key events abound, and are told with incredible richness. But other events get a "glossed over" treatment, and leave you hungering for the kinds of details more historic events receive. The pacing, occasionally fast and brief versus the gorgeous detail of historic or memorable events, gets confusing for the reader. Portions of the book could have used more editing to smooth things out, or maybe Kranz, known for his no nonsense style and somewhat rigid management style, simply said "my way or the highway" to his editors.

For those of us still wrapped up in the mystery of manned space exploration, this book, faults and all, falls into the "must read" category. Your gut will be wrenched, your pride will fill to bursting, your heart will break at the tragedies of our effort to reach out into space as recounted by one of the most colorful, interesting and capable people involved in the effort.

Bunny's Rating: 3 out of 4 rockets. Not quite up to Chakin, but worth the price at Amazon.com, and certainly worth a trip to the local library.

Failure Is Not an Option: Mission Control from Mercury to Apollo 13 and Beyond
by Gene Kranz
List Price: $26.00
Hardcover, 415 pages (04/2000)
Publisher: Simon & Schuster;
ISBN: 0743200799

Confused Stages – Stage 15
by Jonathan Charbonneau

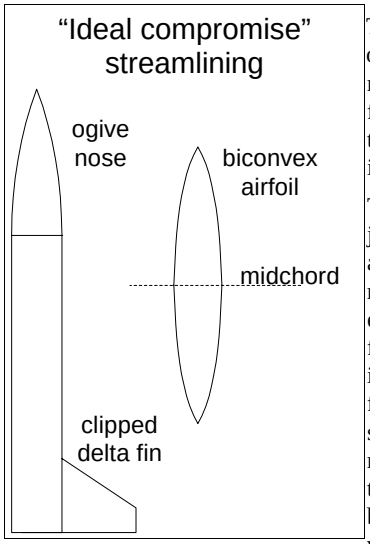
"My Black Brant II is more streamlined then your rocket," Bill quips. Syed does not comment but is positive that his rocket is better streamlined, having a parabolic nose and clipped delta fins.

The above is just one example of conflicting beliefs on the best aerodynamic shape for a rocket. In this stage, I will clear up at least a majority if not all of the questions you may have on streamlining and aerodynamics of rocketry.

It's been said that a parabolic nose and elliptical fins are best for model rockets. Many rocketeers find that hard to believe as most real rockets have pointed noses, straight fins, and sharp airfoils. I, myself, was in the same shuttle.

To understand why requires knowing the three realms of aerodynamics: subsonic, supersonic and hypersonic

Subsonic aerodynamics involves airspeeds that are slower then sound (741 mph). In this realm, the best streamlining is a parabolic nose, elliptical fins, and an aerofoil that's parabolic from leading edge to midchord and ogive from midchord to trailing edge. Nearly all model rockets fly entirely in this realm.



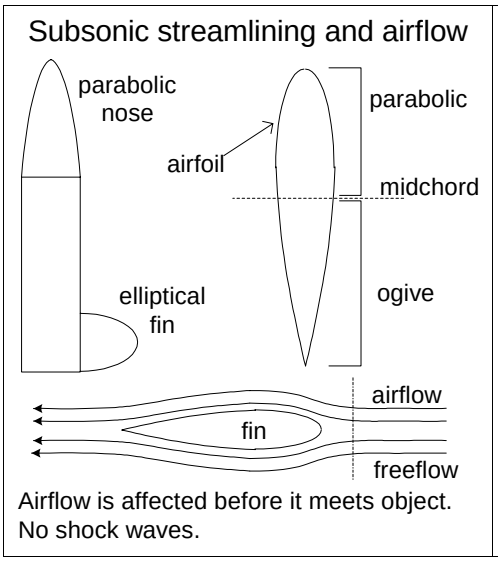
Supersonic aerodynamics involves airspeeds that are faster then sound. The big ones usually fly in this realm. It is here that a conical nose and swept fins with diamond airfoils are optimal. Hence, the popularity of these shapes.

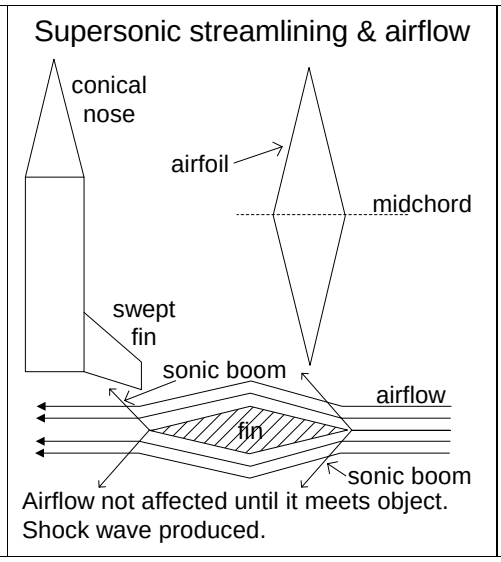
Hypersonic aerodynamics involves airspeeds of more then 5 times the speed of sound. IRMB's, ICMB's, SLBM's and rockets designed to carry payloads into orbit or beyond fly in this realm. Many sounding rockets reach speeds approaching this realm if not into it. The best nose shape is the blunt conical. The best fins are deep swept or slim delta. The best airfoil is diamond with a blunt leading edge.

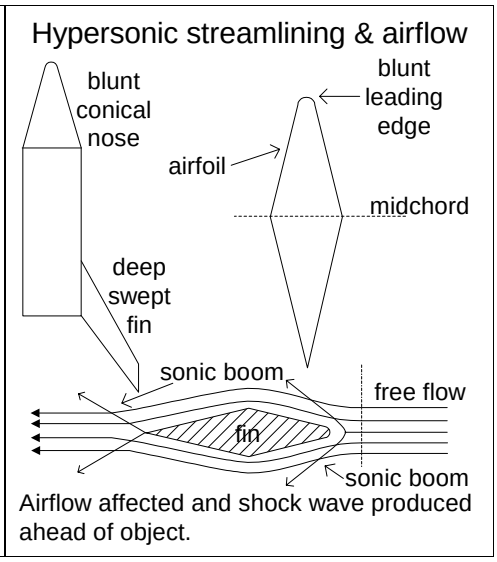
The reason for the difference in optimum streamlining in each realm is because of how the air flows past the rocket at each of these realms (see the airflow illustrations).

The Ogive (pronounced "O"-jive) is a popular nose shape among sport and professional rocketeers. For the sports rocketeer, it's an excellent compromise for good looks and low drag. It is second only to the parabola for low drag at subsonic airspeeds. For the professional rocketeer, it can better withstand the aerodynamic pressure loads better then the conical and provides more payload space.

The ideal compromise for low drag and good looks for fins is the clipped delta with bi-convex airfoils.







Apogee Educational Web Site Changes (press release)

This past week, I made major changes to the Apogee Model Rocket Educational Guide. Besides adding a ton of new links, I've changed the format to make it easier to navigate.

The URL is:
http://www.apogeerockets.com/education/

The educational guide isn't just for teachers. It is for anyone that wants to learn more about all aspects of rocketry. Some of the topics covered are:

- Construction and finishing techniques
- Electronic payloads for rockets
- Stability equations
- Software
- Recovery Systems
- Propulsion
- Glossaries
- Rocket Aerodynamics

The educational guide is a directory of links to other sites that contain this information. I've scoured the internet looking for this information, so that you don't have to. Each link is reviewed and categorized by topic, so that you can find the information you need as quickly as possible. It's better than a search engine; "I guarantee it." There is enough information here to keep you busy reading for years!

Note: If you don't see a link to your web site, why not forward the url to me at: tvm@apogeerockets.com. I'll be happy to review your site for inclusion into the educational guide web site.

Vinyl Graphics for Rocketry (press release)

I would like to announce the availability of custom computer cut vinyl graphics and lettering for the rocketry community. For those who are not familiar with this technique, adhesive backed 2 mil thick vinyl sheet is cut to the desired pattern and laminated to a transparent transfer paper which is used to apply the graphic to the model. The resulting graphic looks like it has been painted on. All vinyl used is premium grade and is available in hundreds of colors including metallics and fluorescents. For more information, please see our new website at:
http://members.aol.com/rocketgrafx

Randy Brust
NAR68770 L2

Welcome to the Club!

Cole Arntzen, Daniel, James, Lynne, Daniel and Logan Dubriwny, Mary Alice, Beverly and Andrea Fitzpatrick, Eric Grata, Felisa Marchosky Mike, Joe and Pamela Provenzano have all joined NIRA in the past few months.

Welcome to the club!.

Blackhawk R&D's Mini-Missile Line of Kits (press release)

Our brand new line of scale kits that are based on the Estes BT-50 sized body tube. The Mini-Missile line of kits are the beginning of a whole new line of rockets that we hope will bring back some of the old days of model rocketry. Using new materials not seen in most of the rocketry world we hope to be able to bring back the days where not every single rocket used a nose cone that was the only one available out of a very limited selection on the market. If the scale of a kit calls for a 5:1 ogive nose, it will have a 5:1 ogive nose, if it calls for a 2:1 conical, you can be assured it will be a 2:1 conical not some close cousin just because we could buy it cheap in bulk. This may sound expensive, well if you take a look at our line I believe we are very competitively priced with any company offering the size rockets that we offer. Other materials used in our kits are basswood fins, mylar streamers, nylon film chutes, and kevlar shroud line. And of course if we can obtain the data for the markings of each kit, full color decals are included.

For more information visit our website at
http://blackhawk-rd.com

We still have to enter some of the data on the rockets like suggested motors but all kits will work with practically any 18mm motor.

Andrew Bronfein
President
Blackhawk R&D

NAR Standards and Testing News

R64: NAR S&T MOTOR CERTIFICATION DESIGNATION CORRECTION

The following is in correction to NAR S&T News Releases R56 and R59. There has been some miscommunication while recertifying Quest motors due to a change in production facilities. Quest now appears to be shipping the old motors originally manufactured in North America.

The following Quest model rocket motors are in production and are certified for general and NAR contest use indefinitely:

Micro Maxx-1
A6-4
B6-4
C6-0,3,5

The following Quest model rocket motors have ceased production and lost their contest certification effective July 1, 2000. They remain certified for general use for three years.

B6-0,2,6
C6-7

Quest model rocket motors have never been released with the following designations. They will be removed from motor certification lists.

A8-3
B4-4

Jim Cook, Secretary for
NAR Standards & Testing
<JimCook@AOL.COM>

Jack Kane, Chairman

R65: NAR S&T MOTOR DECERTIFICATIONS

This announcement contains two types of model rocket motor decertifications.

NAR Contest Decertifications

The following motors will lose their certification for NAR contest use effective July 1, 2001 but are certified for use at NARAM 43. They remain certified for general sport flying for a period of three years, until July 1, 2004.

Estes
B6-0
D12-7

North Coast Rocketry
F62-4,6,9

NAR General Use Decertifications

The following motors, having been out of production for more than three years, will lose their NAR certification for general use effective July 1, 2001.

Centuri Engineering Company (all)
1/2A6-2
A8-3,5
B4-2,4,6
B6-0,4,6
B8-5
C5-3S
C6-0,3,5,7
D12-0,3,5,7

Estes
A8-5
B4-6
B8-5

Flight Systems, Inc. (all)
A6-3,5
B6-0,3,5
C6-0,3,5
D18-0,4,6
D20-0,3,5,7
E5-0,4,6
E60-0,4,6,8
F7-4,6
F80-0,4,6,8,10
F100-0,4,6,8,10

Jim Cook, Secretary for
NAR Standards & Testing
<JimCook@AOL.COM>

Jack Kane, Chairman

Joint Statement on BATF Litigation

(from www.nar.org, August 22, 2000)

Over the past six weeks, we have had extended discussions with our counsel and the Bureau of Alcohol, Tobacco and Firearms (BATF), seeking an out of court settlement to the litigation we filed back in February. Those discussions included one face-to-face meeting in Washington DC, and two lengthy joint conference calls.

We regret to report that we are unable to reach any settlement agreement at this time.

BATF was unwilling to agree to any settlement terms which left any portion of the high power rocket hobby unregulated by the agency, and appears willing to take its chances in court.

We have instructed counsel to let the current stay of litigation expire as scheduled on September 1, 2000, and asked them to seek the earliest possible court date to proceed with the litigation. When we have a firm court date scheduled, we'll notify members of that hearing date.

We continue to believe that our legal case is solid, both on procedural and substantive grounds. And we appreciate the extraordinary efforts our counsel undertook to attempt settlement, only to be thwarted by unreasonable demands from the defendant's staff and in-house attorneys.

We realize that committing to this step means a potentially long, uncertain and expensive journey. But we have exhausted all other avenues to provide sport rocket flyers with an elimination of the illegal and unnecessary regulation sought by BATF.

We will continue to seek all avenues of relief, judicial and legislative, to secure that unregulated environment for all sport rocket flyers. Our safe, legal and educational hobby deserves nothing short of our utmost effort in this battle, and we jointly pledge our maximum effort on your behalf.

If you can help out at all by donating to our Legal Defense Fund, please visit our online donation form and help us roll back this illegal and overreaching regulation. Any amount will be greatly appreciated.

Mark B. Bundick, President
National Association of Rocketry

Bruce E. Kelly, President
Tripoli Rocketry Association

Bob Wiersbe's Little Joe II about to lift-off at WTGG (David Wallis photo)

David Wallis' Level 1 rocket, "This End Up!" at WTGG (David Wallis photo)

Chuck Nozicka's "Gimme Shelter" (K1100) (David Wallis photo)

Someone's rocket lifting off at WTGG (David Wallis photo)

The Range Head being laid out WTGG (David Wallis photo)

THE LEADING EDGE

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This may be your last newsletter! Check your label for the expiration date.
If it says Membership Expired or Membership Expiring, this will be your last newsletter!