THE LEADING EDGE

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

Volume 23, Number 1 January/February 2000

Club News

Elections – One of the most important parts of the January meeting (next to 'model of the month') is the election of club officers for the new year. Elected by unanimous acclamation, the 2000 officers are:

President – Ric Gaff
Vice President – Pierre Miller
Secretary/Treasurer – Ken Hutchinson
RSO – Bob Kaplow

Reelected to their positions, Ric Gaff, Ken Hutchinson, and Bob Kaplow deserve a lot of thanks to the effort they put into running the club for many years. Pierre Miller, one of NIRA's enthusiastic youth members, is the new Vice President. This position was vacant for several months due to John Guzik's move to San Diego.

NAR's BATF Legal Fund – At the December meeting NIRA voted to send $500 as a club contribution to support the NAR/Tripoli litigation with the BATF (see the Nov/Dec Leading Edge or the NAR's web site for more information). It was also decided that the Ric Gaff and Ken Hutchinson would give a report at the January meeting about the state of NIRA's treasury and if another $500 donation would be possible.

At the January meeting, they reported that the finances would support another $500 donation. However, before this was put to a vote, NAR President (and NIRA member) Mark Bundick said that there would probably be a second round of donation requests and we could delay our contribution for the moment without impacting the litigation. He also talked about a possible NAR youth program that NIRA might want to channel some of this $500 into. Because of his information, NIRA decided to wait to see how the situations develop.

NAR Youth Membership – Mark is going to propose a program to the NAR Board at its next meeting to try to counteract the declining number of junior members in the NAR. His idea is to discount the price of a junior membership (age 15 and under) in half for those juniors who belong to a NAR section since junior members who belong to sections are more likely to be active and will either continue to be a NAR member or become a 'Born Again Rocketeer' later in life. After listened to all of the suggestions made at the meeting, he is planning on incorporating some of them into his presentation for the board meeting.

If the NAR adopts his idea, he suggested that NIRA might want to take some of the $500 and channel it toward increasing the number of junior members in NIRA. As he pointed out, resolving the BATF situation is critical to the future of High Power Rocketry while resolving the junior member problem is critical to the future of the NAR – and both are important.

MRFF 2000 – Mike Ugorek is again taking on the formidable task of organizing MRFF this year. Scheduled for June 17th and 18th, the theme of MRFF 2000 is 'Y2K Bug.' Mike is looking for fun events that have the 'Y2K Bug' theme, and there will be a special judging of theme rockets on Saturday. Contact him if you have an idea or want to help out in some other way.

As of the January meeting, however, the field is still undecided. Originally, MRFF was to be at Bong State Park in Wisconsin again, but another (unknown) group has the park reserved for a rocket launch on one or both of the planned dates. As soon as more information is known it will be put on the NIRA web site and in the Leading Edge.

COSMOS-5 – Adam Elliot has planned the next club contest for May. More information, including the events, is listed on page May 10.

Micro Max Parachute Duration – in response to the outstanding turnout for the Micro Max Streamer Duration fun contest ran last year, there will be a Micro Max Parachute Duration contest at the April launch. You just need to build a rocket that takes a Quest Micro Max engine and deploys a parachute to enter.

This isn't a NAR contest event but does give you club bragging rights.

Winter Building Sessions

These are informal session to build rockets, talk rocket, look at rockets, or just hang out. Bring your favorite snacks and a rocket to build.

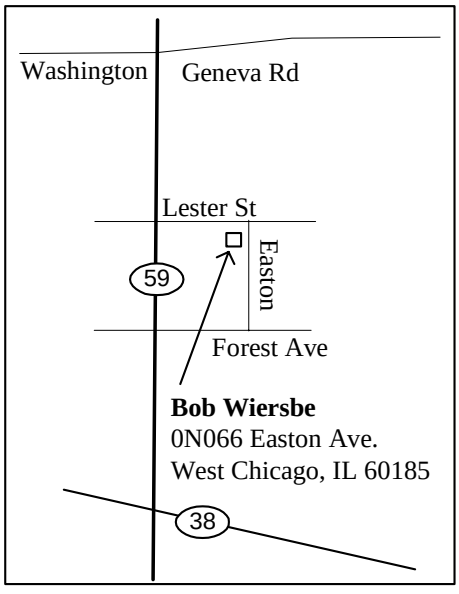
Both building session will start at 1:00 pm.

February Building Session
Bob Wiersbe
0N066 Easton Ave.
West Chicago, IL 60185

Bob Wiersbe has volunteered to host a building session at his new home in West Chicago on the southwest corner of Lester and Easton. Please only park along the **west** side of Easton, or along the **south** side of Lester.

March Building Session
Steve Smith
217 Waxwing Ave
Naperville, IL 60565

Steve hosted a building session last year and has opened his house again this year. A map to Steve's house is on page 11.



Map to February's building session at Bob Wiersbe's house.

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Send membership applications (dues: $6 per youth, $8 per adult, $12 per family, including a six issue subscription to the Leading Edge), non-member subscriptions ($10 per six issues), and change of address notification to:
Ken Hutchinson
82 Talcott Avenue
Crystal Lake, IL 60014-4541

NIRA 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).

February 6

March 3

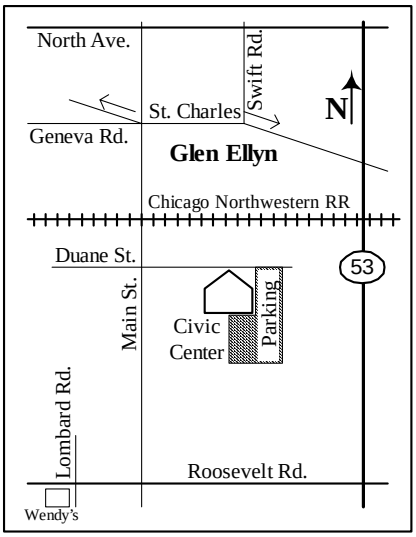
April 7

May 5

June 2

July 7

August 4



CLUB LAUNCH DATES

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

February 20 – Building Session at Bob Weirsbe's house (map on page 1).

March 19 – Building Session at Steve Smith's house (map on page 11).

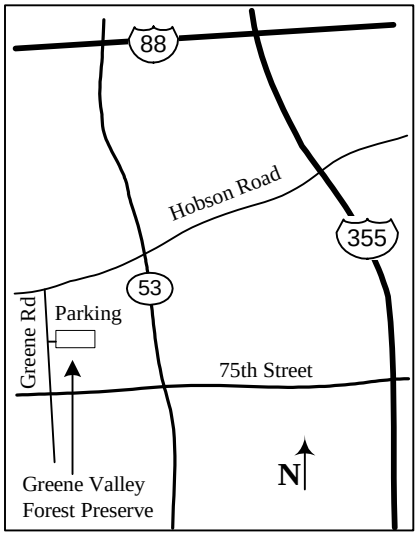
April 16 – Regular club launch.

May 21 – Regular club launch.

June 4 – Youth Group Launch (at Greene Valley)

June 17-18 – Midwest Regional Fun Fly (location TBD)

July 16 – Greene Valley Forest Preserve



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

December – Youth winner Mark Soppet displays the Quest kit he kitbashed into an X-15 Glider while Norm Dziedzic shows off the FAO Schwarzkopf

January – They said it wasn't planned, but both Mark Bundick and Pierre Miller won with kit-bashed Bumper-WACs. Mark started with an Apogee Micro V-2, Pierre with an Estes kit.

How to Succeed at Competition - The Insider's Secrets

by Tim Van Milligan

If you're reading this, you probably haven't crashed enough rockets yet.

In reality, that is the difference between "experts" and novice competitors. The experts have crashed more rockets than you have. This isn't because they wanted to crash more, but because they've tried more flights. From this, they have more experience and have learned the subtle techniques that lead to success.

This article will give you the secrets that I have learned. I can't claim any of these secrets are mine, because I've learned them from others. And I don't really claim that they are secrets. They are just things I've observed. Sooner or later -- if you stay in competition for a long time -- you'll learn them too. And I hope that you pass these down to the next generation of modelers. Somehow, I hope that we can speed up the learning process.

Secret #1: Never stop learning

There is always something new to learn. The experts are constantly asking questions so that they can learn more. They want to know about everything that is going on at a launch range. For example, who is flying a specific motor? What size parachutes are being used? What new materials are being tried out on that day? What techniques are being used to prep a rocket for flight? And on and on. And while they know that to become an expert, you need "experience;" this experience can be gained by watching someone else's flight.

They also know that every modeler to whom they ask the questions has an ego, and they enjoy being asked. So you aren't stealing any super-secret information. These modelers want to share it, especially if the person asking the question has a reputation of being a "expert." They can then brag later about how they personally trained experts!

There is a corollary to this secret: Learn from your own mistakes. If you make the same mistake two times, you only have yourself to blame. If something goes wrong on a flight, you have to ask yourself what were the possible causes, and how each of these might be minimized. As a personal example, I've made it my goal to never have a spit engine ever again. Why would I do this? Because it happened to me in a contest a couple of years ago, and it meant the difference between a great flight and a disqualification.

Secret #2: Demand 100% reliability from all your flights.

Sounds simple huh? But we all know that Murphy's Law has particular application to rocketry. There is a lot of things that can go wrong, even in very simple events.

Take for example the simple event of parachute duration. I can tell you from experience that it is very challenging to deploy a big parachute out of a little tube. I'm still learning this the hard way. In a competition in November, I could get the parachute out of the rocket (which is a big improvement over previous flights), but it just wouldn't open fully. This happened on two consecutive flights; so somewhere I just haven't learned enough to be competitive in this event. I need more experience.

Secret #3: Come prepared

I've stopped counting the number of times I've heard the phrase "I just don't have time to build anything new." To me, this is a safety issue. The person that scrambles around on launch day to get something in the air is more likely to make mistakes. These mistakes could get someone hurt.

From a competitors perspective, you need to get all your flights in during the contest day to get maximum amount of points. So if you're building parachutes on the field, you're wasting valuable time. While you may take some type of pride in building your contest models on the field, your odds of winning are pretty slim.

Also remember that each contest is also a learning opportunity, so the more times you can get a rocket into the air, the quicker you'll learn new techniques. And being prepared also means having a back-up plan for when things go wrong.

Secret #4: Build quality models

The expert doesn't show up on the field flying junky looking models. The models he builds are top notch; meaning sealed and airfoiled fins. He only uses clunker models as a back-up for when conditions dictate a dramatic change in strategy.

Experts go to very great lengths to build quality models. You might think an expert can put a fin on straight with just a calibrated eyeball. But they know different. I've seen guys spend $300 on special jigs to make sure their fins are on straight. They know that the odds of exceptional performance is greatly increased by starting with models of exceptional quality.

Secret #5: Don't try out new stuff at a competition

I guess that one thing that turns people off about competition is that all the models in a particular event look alike. There seems to be some type of a lack in creativity. So new competitors often like to try out new types of models that they think are innovative. Or the newbie thinks he's at a disadvantage with experts around and needs a "edge." So he tries something new.

Unfortunately, I have yet to see a case where radical innovation has resulted in a dramatic improvement over standard looking models. In fact, the typical result is that the model fails in a pretty dramatic way.

I mention this, because the "expert" doesn't perform radical experimentation at a competition. They look at a competition as a "final exam." And like a final exam, you're being tested on your current knowledge. You're not being tested on your ability to innovate. There is room to innovate in rocketry, but a competition isn't the place to do it for the first time.

Secret # 6: Practice

The expert has learned that practice pays off. When the novice finally learns this, he too will become an expert.

Let me give you an example from a NARAM a few years ago. The event was a 6-C motor cluster altitude. It was readily apparent in the final standings who practiced, and who didn't. Those that took the time to fly it prior to NARAM took home the trophies.

Unfortunately, I see this same situation repeating itself for NARAM-2000. People have already been asking me what is the "secret" to getting a cluster of 4 Micro "A2" motors to ignite simultaneously. I tell them "practice." Then they come back and say; "ok, so what is the 'REAL' answer?" It just frustrates them (as it does me to tell them yet again) that "practice" is still the answer, and it will always be the answer until the day of the competition. Then it will change to "prayer."

Secret #7: Don't give up the quest

I've seen it again and again; particularly at NARAMs. People travel hundreds of miles to attend, and when they have a bad first flight in any event, they throw in the towel and don't put up the second flight. Until it sinks into your mind, I have to keep reminding you that competitions are a great learning tool to help you develop your rocketry skills. Fly all the flights you're allowed, because you need the experience. Like I mentioned at the beginning, the true experts have all crashed more rockets than you have. From their bad flights, they have learned how to do it correctly.

And as you gain that experience, you'll often discover that your second flight may get you back into the hunt for the top positions.

The same goes true for lost models. Too many times, I've seen people give up trying to look for them. In most contest events, you have to return at least one model. If you don't, that great "flight time" you had will mean a big zero for your contest points. Don't give up. The "experts" are also experts at finding their lost models. This takes practice too.

Secret #8: Learn flying strategy

There is a lot of strategy involved in competition, which is one reason I find it a lot of fun to participate. On the surface, it looks like the thing to do for every event it to "go for broke" – all the time. This means using your finest models, and the best motors. But this is a very rare situation. A lot of times, you have a very good first flight and the model is lost. So on the second flight, you have the choice of flying a clunker model and getting it back, or flying a high performance 'back-up' model. The high performance model could fly away like the first flight, and since they typically have more types of failure modes than a clunker model, you could get a

*(**How to Succeed at Competition** continued on page 4)*

NIRA Logo Contest!

We're having a contest, but you don't need a rocket for this one! You just need to design a new logo for NIRA.

Several club members have suggested that we might want to consider adopting a new club logo. John Barrett has put some thought into this, he writes:

> "I wonder if anybody has taken a close look at our Club Logo recently. As you know it consists of an outline of the state of Illinois and a rocket taking off. Although I am sure that the logo has a long and interesting history, I would suggest that with the coming of the new millennium we should take this opportunity to consider whether this is a suitable time to redesign the Logo.
>
> I would propose therefore that we have a competition, open to all readers of The Leading Edge, to redesign the Logo. The top four or five entries, as judged by the editor, could then be published in the newsletter, and the members could then vote for their favorite. The old Logo would be automatically entered into the final voting so that those members who wish to retain it could have an opportunity to do so.
>
> With the new Logo (or the old one if it wins) we could then consider having it placed on patches, caps, T shirts etc."

This is the second notice for entries, and at this point the only entry we have is our existing logo. You have until the deadline for the March/April Leading Edge (March 3rd, at the club meeting) to get your entries to me. All of the entries will be published in the next newsletter so that people have time to peruse them before the vote

Entries should be submitted to the editor of the Leading Edge and can be either in a standard graphics format, or on paper. Entries should be suitable for use on patches, T-shirts, etc.

The winner will receive a one-year extension on their NIRA membership and, hopefully, lots of thanks from NIRA members.

Thanks to Kurt Schachner for supplying an Adobe Illustrator version of the current logo

New Rocketry Magazine

NEW EXTREME ROCKETRY MAGAZINE
Extreme Rocketry is a new, independent magazine dedicated to hobbyists at all levels of rocketry: beginners, mid-power, and high-power. We are nearing the completion of our first issue and expect to have a sample issue ready in a few weeks. At that time we will begin taking subscriptions for the magazine.

If you would like to be notified when we are taking subscriptions and other Extreme Rocketry news, please visit http://www.extremerocketry.com and add you name to our the Extreme Rocketry email list.

CALL FOR ARTICLES
Do you have an article you'd like to see published in extreme rocketry? We already have much of the first issue completed, but we are looking for interesting articles to add to upcoming issues.

***(How to Succeed at Competition** continued from page 3)*
DQ on the flight. This decision is part of contest strategy.

If you are new to competition, I'll always tell you to take a conservative strategy. Fly the clunker model and get a qualified flight. Even if your "little victory" is getting to take home a model, you need them to keep your interest in competition going.

Here is my own personal contest strategy: fly the high performance model first, and more importantly, fly it very early in the day. If you don't retrieve it, switch to the next event. At large contests, there is a better than average chance that someone else will find your model and return it to you. The earlier in the day you make your first flights, the better the odds. But this gets back to Secret #3 of being prepared before you get to the field. You can't fly early in the day if you aren't prepared before you arrive.

If the first flight turns out to be lost or was some other type of disaster, now your strategy should take a conservative mode. Fly the clunker model using a conservative rocket motor. Your entire strategy should be to get a qualified flight and to return the model. And if luck finally returns to you, the clunker model might get a decent flight.

Know this: in duration events, two mediocre flights typically beats a combination of a great flight plus a DQ'ed flight. It is very rare that someone will get two really awesome flights. So play the odds that are in your favor.

Secret #9: Fly against the best modelers
This goes back to the fact that competition is a great method for learning new techniques. Fly with those people that have paid their dues and have something to teach you. It will force you to hone your skills, which in the end will make you an "expert" too. Don't be shy about asking questions. But also remember that while the experts will give you answers willingly, there is a fine line when your conversations could prevent the other modeler from doing his own work. If you are in their prep area, about a 10 minute stretch of time is about as long as you should go before you start turning into a pest. However, if they are in your prep area, you can continue to ask questions as long as they are wiling to stick around.

Secret #10: Learn how to select motors
This secret could be included as part of learning contest strategy. But this is something that also takes experience. Fortunately, there is a quick way to gain this experience, and it is cheap. It is "computer simulations." On a computer, you can experiment with different motors and varying weather conditions and predict how the model will fly. If you're not doing this, you'll have to learn in the school of hard knocks.

Since I own Apogee Components, I personally get a lot of people that ask me what the "experts" are buying in the way of rocket motors. But the motors that they choose will most likely be completely different from what will work in your rocket.

Without seeing your model, knowing the weather conditions, your experience level, and your competition strategy, no expert is capable of helping you to select a rocket motor. But with a computer simulation, you can better be prepared for most situations and do some last minute tweaking depending on the conditions during the contest.

Conclusion
Rocket competition is challenging on a personal level. It is a lot like golf, where in the end, you only compete against yourself. But like golfers, we're all looking for the magic item that will dramatically improve our chances of success. But the only real tools are "education" and "experience." You need to fly more often to gain both. And you need to know your personal bests; so keep a logbook of how you did in each competition. Only then will you know if you are getting better.

The skills you learn while competing are incredibly valuable, and can be transposed to any other area of rocketry, be it high power, or sport flying. You'll have more fun because your rockets will perform better, have less damage, and will be around to fly again at another day. So go out and start competing today.

Tim Van Milligan is the owner of Apogee Components (www.apogeerockets.com) and has written several books on rocketry.

Rocket Math 3: Simulations – Part II

by Norm Dziedzic (NAR 72426)

Introduction

In our last Rocket Math, we took a look at the basic concepts used in simulating a rocket's flight. We discussed time, time steps, and the fundamental kinematic parameters of position, velocity and acceleration. Then we stated how Newton's 2nd Law is the key to the simulation and hinted at how the simulation begins with famous 2nd Law equation: $F = m \bullet a$ which re-arranged, becomes:

$$a = \frac{F}{m} \qquad [1]$$

where a is the acceleration of the model, F is the sum of all forces acting on the model and m is the mass of the model.

Free Your Body

When investigating multiple forces acting on a body, we usually draw a diagram of the object and place arrows on it to represent each force and the direction in which it is applied. This is called a *free body diagram* (See Figure 1).

Trust Your Motor Thrust

Starting from the bottom up, we first have the motor thrust pushing up on the model. This force changes with time as the thrust of the motor changes. The values for this force are obtained from the thrust curve plots provided by manufacturers or motor testing information. After motor burnout, this force is zero. For our simulation, we discretize the thrust curve based on our time step (0.1 sec) as shown in Figure 2.

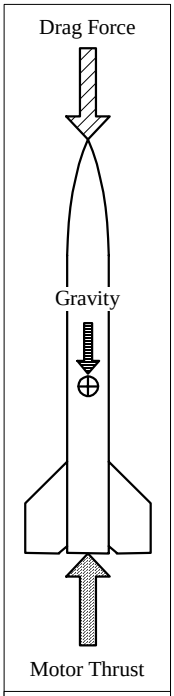


Fig 1. Rocket Free Body Diagram.

Gravity, It's the Law

Next is the force of gravity pushing down on the model. This force also changes with time as the motor's propellant is consumed and sent out the motor nozzle. After ejection, this force becomes a constant equaling the weight of the model plus a spent motor casing. Interestingly enough, objects experience gravity as a constant acceleration toward the center of the earth so we use the 2nd Law equation to determine the force of gravity acting on an object: $F = m \bullet a$ where a is the acceleration of gravity (g = 9.80665 m/sec^2) so:

$$F_{Gravity} = mass \cdot g \qquad [2]$$

In RASP-93, it was assumed that the propellant was used up in equal amounts for each time step. For our example Quest A6 motor, the propellant mass is 3.4*g* and the burn time is 0.4*s*. So, at each time step, we need to subtract 3.4 / 4 grams = 0.85 grams from the model mass. This is called the *mass decrement* (M_d) amount.

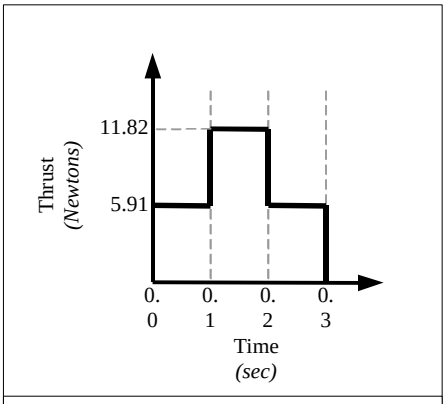


Figure 2. Quest A6, Rocket motor discretized Thrust Curve (from RASP-93)

What a Drag

Finally, there is the drag force which is the force of the air pushing against the model as it cuts through the atmosphere. This force always acts in the opposite direction of the model motion and depends on the frontal area of the model, the density of the air, the square of the speed of the model and a factor called the *Drag Coefficient* (C_D). The equation is:

$$F_{Drag} = \frac{1}{2} \cdot A \cdot \rho \cdot C_D \cdot V^2 \qquad [3]$$

Where the variables are defined as:

A	Frontal area of the model (m^2)
ρ	Density of air (1.2062 kg/m^3)
C_D	Drag Coefficient *(no units)*
V^2	Velocity Squared (m^2/sec^2)

When the units are multiplied out, we're left with $kg \bullet m / sec^2$ which are Newtons and are the force unit we are working in.

The Drag coefficient (C_D) is a *catch-all* term which tries to take into account things such as surface smoothness and model geometry to modify the drag force. For model rockets, this number usually varies from 0.3 for competition models to 0.9 or 1.0 for rough finished or geometrically complex models. Many programs default to a C_D of 0.6 or 0.7. The only way to determine the real C_D of a model is to track it's altitude or time to apogee and then using a simulation program, play with the C_D until the simulated results match those measured during the actual launch.

Looking at equation [3], the only thing that will be changing during the simulation is the velocity (we are assuming the air density and C_D remain constant). So in practice, the other terms are combined into a single term I call the drag multiplier (D_m). This value can be calculated once and then for each step, the drag multiplier is multiplied by the velocity squared to get the drag force.

$$D_m = \frac{1}{2} \cdot A \cdot \rho \cdot C_D \qquad [4]$$

$$F_{Drag} = D_m \cdot V^2 \qquad [5]$$

Sum of the Forces

Now we can re-write equation [1] in terms of the separate forces acting on the model. Notice how the thrust force is positive since it is acting up while the drag and gravity forces are negative since they are acting down:

$$a = \frac{F_{Thrust} - F_{Drag} - F_{Gravity}}{mass}$$

Next we substitute equation [2] for the gravity force; then canceling out the m in the gravity term with the one in the denominator we get the actual equation used in the simulation:

$$a = \frac{F_{Thrust} - F_{Drag}}{mass} - g \qquad [6]$$

Unit Unity

In all terms we use, we have to be consistent in the units (i.e. ft. vs. meters etc.) or, like the recent Mars Orbiter spacecraft, results will not be as we expect. We'll follow the units used in RASP-93 which are:

Length:	meters (*m*)
Velocity:	*m/sec*
Acceleration:	*m/sec*^{2}
Force:	Newton (*N*)
Mass:	kilogram (1 kg=1000 grams)
Time:	seconds (*s*)
Density of Air:	*kg/m*^{3}

To continue our explanation, we will use a BT-50 sized example similar to an Estes Alpha with the following parameters:

Body Dia. (D):	24.99 *mm*	=.02499 *m*
Empty Mass (M_E):	24.0 *g*	=.0240 *kg*
Motor:	Quest A6	
Motor Mass (M_M):	15.3 *g*	=.0153 *kg*
Propell. Mass (M_P):	3.4 *g*	=.0034 *kg*
Mass Decr. (M_d):	0.85*g*	=.00085*kg*
C_D:	0.75	
Liftoff Mass (M_L):	39.3 *g*	=.0393 *kg*

And our Drag multiplier from equation [4] is then:

$$D_m = \tfrac{1}{2} \cdot \frac{\pi(.02499m)^2}{4} \cdot 1.2062 \tfrac{kg}{m^3} \cdot 0.75$$

$$D_m = .000222 \tfrac{kg}{m}$$

I Need a Jump Start

OK, our simulated rocket is sitting on it's simulated pad. Our altitude is 0 (*m*) our velocity is 0 (*m/sec*) and our acceleration is 0 (*m/sec*^{2}). Not very exciting. So how exactly do we jump start this process?

Looking at Table 1 (on page 6), our initial conditions are shown in the top row. Then we look to the thrust curve in Fig. 2 to see how much the

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

Intruder Plus
by Jeff Pleimling (NAR 63951)

I became a BAR (Born Again Rocketeer) several years ago and, like many BARs, I immediately ran to my parents to recover all my old rocket stuff. And, like many BARs before me, I found that my parents had thrown out all of my rockets and supplies. I did find my old range box, it's a tackle box and that's probably what saved it.

Inside the range box I found some used engines, Centuri decals, a Centuri design book, and a copy of Estes' *Model Rocket News*. I remember reading this *MRN* at least a hundred times (it was my only one). There was a neat plan for the 'Intruder' inside, but I never built it.. As a BAR, I decided that finally building it would be a good salute to my previous efforts.

Only one problem, the original 'Intruder' was based around a BT-20 body with a 13mm engine mount. I **hate** trying to pack parachutes into BT-20 tubes, so I decided that this would also be my first upscale. Adding to my decision was a trip to American Science & Surplus where I found some sci-fi cockpit nosecones that fit BT-50 tubes (Bob Weirsbe told me a couple months ago that these are 'Manta Bomber' nose cones).

The Intruder Plus with a Mantra Bomber nosecone.
Rick Gaff Photo

Construction Notes

Construction is relatively simple, but make sure to join the halves together *before* attaching them to the body tube, making sure that the root edge is completely flat. Round all of the edges except where the drawing says 'sand flat.'

To build the Canopy, cut it out of a piece of cardstock and scribe along the fold marks to make folding easier. Sttach the canopy by applying glue around the rim of the cockpit and then carefully positioning it on the nosecone. Prefitting the cockpit and tracing a line around it with a pencil will make this job easier.

I let the rear of the engine mount stick out by 1/8". This makes it easy to wrap a piece of tape around it and the engine so the engine doesn't eject when the ejection charge fires. I soaked the end of the tube in thin CA to make it strong.

The position shown for the launch lug is great if you're using a standard nosecone. This won't work for the 'Mantra Bomber' or similar nosecones, however, since this position interferes with the launch rod. I mounted my launch lug under one of the wing, just far enough out for the launch rod to clear the nose cone.

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

motor is pushing on the model (5.91 *N* for the first step).

Next the drag force needs to be calculated from equation [5] using the velocity from **the previous step**.

Now here is where we put Newton's 2nd Law to work for us. The acceleration is calculated via equation [6] using the Thrust and Drag from this step **and the mass from the previous step**.

Remember from the last article, knowing the acceleration and time step, we can find the *change* in velocity for the current step by multiplying the acceleration by the time step. Then this is added to the previous Velocity for the current value.

Similarly, the *change* in altitude for the current step is found by multiplying the Velocity by the time step. Then this is added to the previous Altitude for the current value.

In the table, explicit calculations are shown for the first couple steps and then a few more rows are given with just he results. This continues in a mind boggling tedious fashion until you reach apogee or the highest point in the flight. For our example, this happens at 4.1 sec. With a simulated maximum altitude of 97.5 meters (320 ft).

A critical point in the simulation happens at 0.4 sec. The motor has burned out so from here on out, the thrust value is zero. This is also where we see the highest drag value which is derived from the maximum velocity in the previous step. The negative acceleration means that we are slowing down (which also makes sense as we have passed the maximum velocity point in the flight). Lastly, the mass now remains constant as there is no more propellant to burn.

So, as you see, there aren't any difficult mathematics behind the simulation, just the four basics of addition, subtraction, multiplication and division. However, the shear number of repetitions makes this a job well suited to the computer.

Next time, we will finish up the simulation topic with a description of what techniques commercially available software packages take to improve upon the RASP-93 model and where you can buy/download them.

We will also have an interview with Paul Fossey the programmer of RockSim 4.0 from Apogee Components.

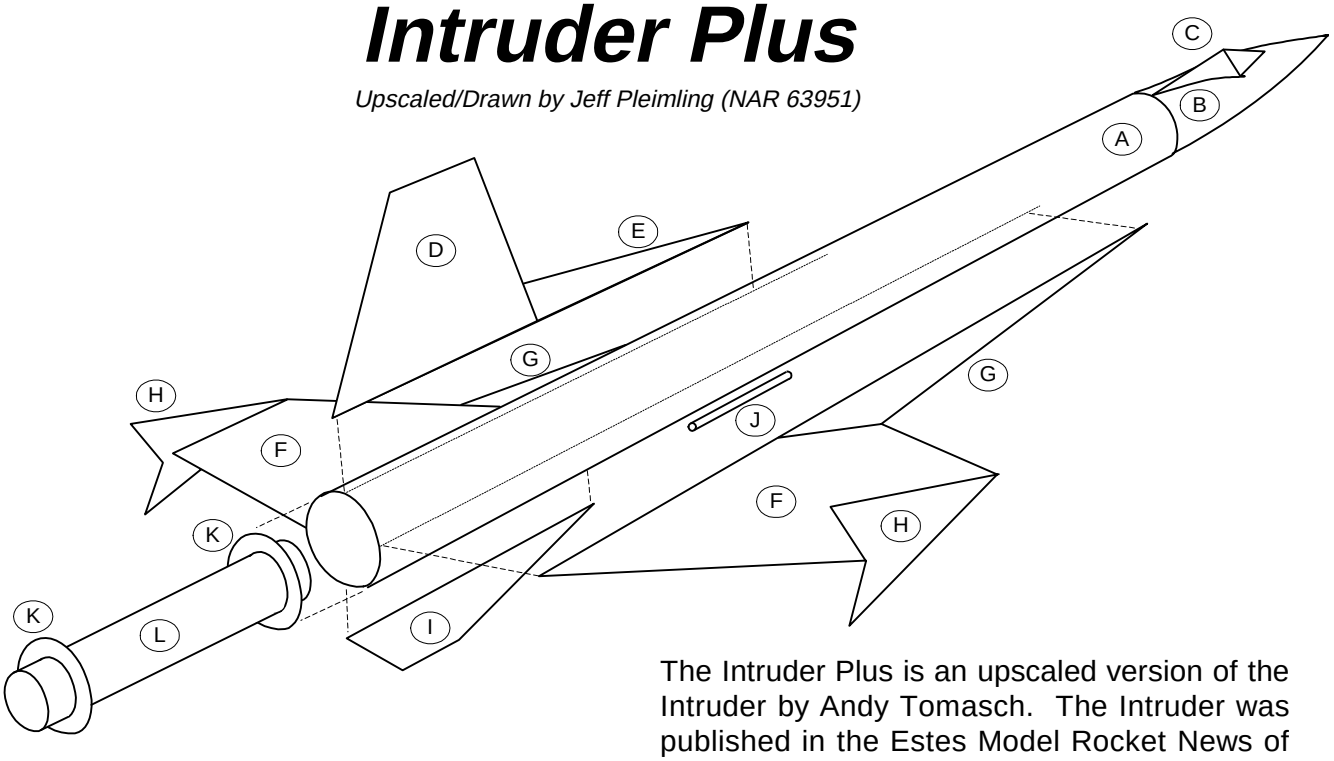
An Excel spreadsheet version of RASP-93 and the full simulation listing for this example can be found on the web at: http://homepage.interaccess.com/~ndzied1/rm3/index.htm If you have any questions, comments or suggestions for future Rocket Math article topics, you can write the author at ndzied1@interaccess.com

Table 1. The Simulation

Time *(sec)*	Thrust *(N)*	Drag *(N)*	Acc. *(m/sec^2)*	Vel. *(m/sec)*	Alt. *(m)*	Mass *(kg)*
0.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.03930
⇩	*Lookup In Thrust* `Curve`	*From Equ. [5]* $=D_M * V^2$ $=0.000222*0.0^2$	*From Equ. [6]* $=\frac{5.91-0.0}{0.0393}-9.81$	*Multiply. Acc. by* Δt `=140.5717*0.1` `Add to above`	*Multiply Vel. by* Δt `=14.0572*0.1` `Add to Above`	*Subtract the Mass decrement* -0.000850
0.1	5.910	0.0000	140.5717	14.0572	1.4057	0.03845
⇩	*Lookup In Thrust* `Curve`	*From Equ. [5]* $=0.000222*14.0572^2$	*From Equ. [6]* $=\frac{5.91-0.0}{0.0393}-9.81$	*Multiply. Acc. by* Δt `=296.4613*0.1` `Add to above`	*Multiply Vel. by* Δt `=43.7033*0.1` `Add to Above`	*Subtract the Mass decrement* -0.000850
0.2	11.820	0.0439	296.4613	43.7033	5.7760	0.03760
0.3	5.910	0.4240	136.0938	57.3127	11.5073	0.03675
0.4	0.000	0.7292	-29.6525	54.3474	16.9421	0.03590
0.5	0.000	0.6557	-28.0749	51.5399	22.0961	0.03590
↯	↯	↯	↯	↯	↯	↯
4.1	0.000	0.0005	-9.8246	0.5522	97.5436	0.03590

Intruder Plus

Upscaled/Drawn by Jeff Pleimling (NAR 63951)



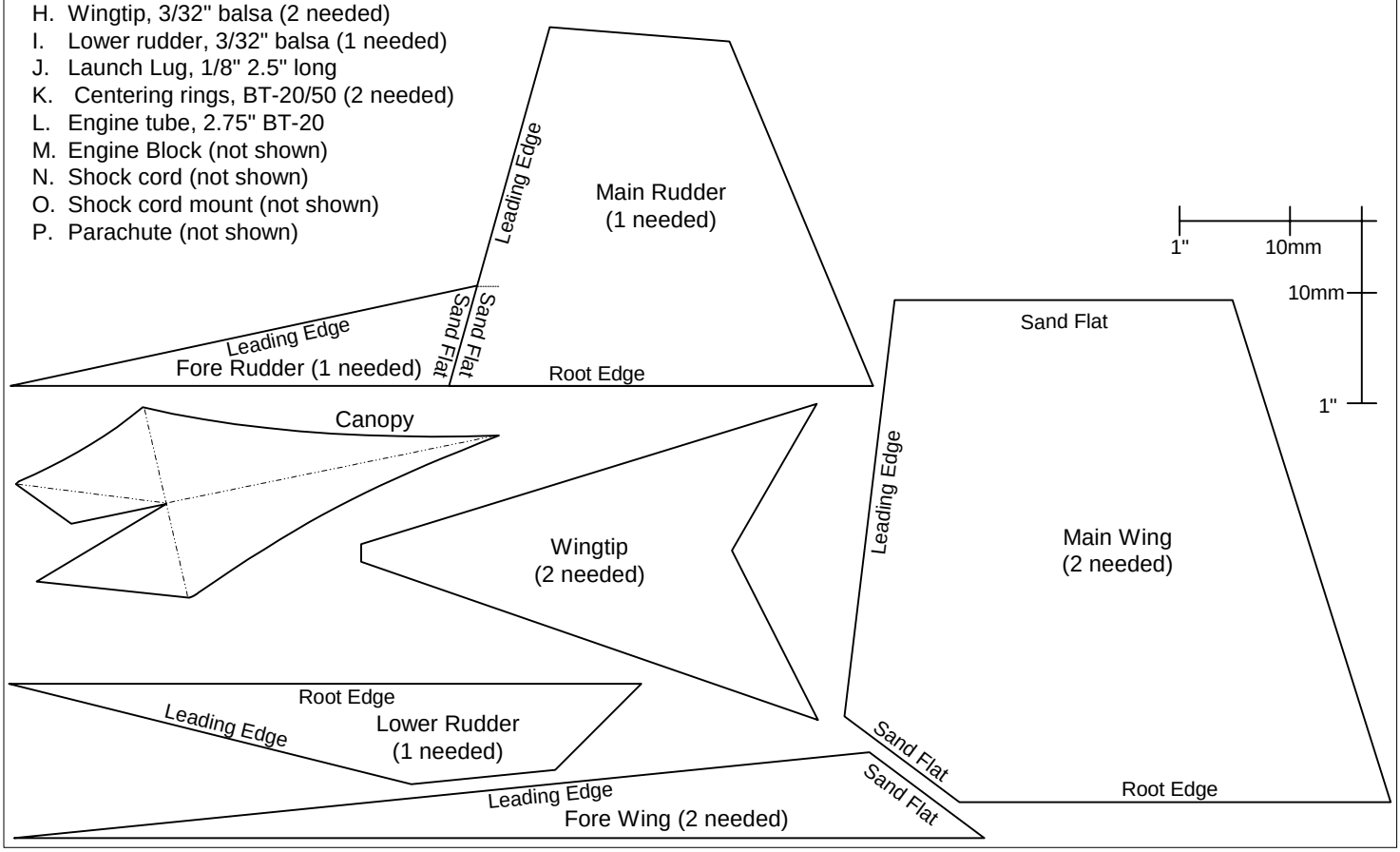
The Intruder Plus is an upscaled version of the Intruder by Andy Tomasch. The Intruder was published in the Estes Model Rocket News of April/May 1974 (V14N1). It was a Design of the Month Honorable Mention winner (Plan No. 82).

Parts List:

A. Body tube 10.25" BT-50
B. Nose cone PNC-50Y (4" length)
C. Canopy, heavy paper/light cardstock
D. Main rudder, 3/32" balsa
E. Fore rudder, 3/32" balsa
F. Main wing, 3/32" balsa (2 needed)
G. Fore wing, 3/32" balsa (2 needed)
H. Wingtip, 3/32" balsa (2 needed)
I. Lower rudder, 3/32" balsa (1 needed)
J. Launch Lug, 1/8" 2.5" long
K. Centering rings, BT-20/50 (2 needed)
L. Engine tube, 2.75" BT-20
M. Engine Block (not shown)
N. Shock cord (not shown)
O. Shock cord mount (not shown)
P. Parachute (not shown)

Notes:

- The center of gravity on my model is 5.5" from the rear.
- I used basswood, but balsa would work just as well.
- The launch lug should be 4" from the rear.
- Mine has flown on A8-3, B6-4 and C6-5 engines.



Space Launch Report for November-December 1999
by Tim Johnson

LAUNCH REPORTS:
There were 16 space launch attempts in November and December with two failures. China tested its Shenzhou spacecraft, Japan suffered its second consecutive H-2 failure, NASA shuttle Discovery visited Hubble, and Arianespace finished the year in a rush with four missions.

1999 ended with only 70 space launch successes in 78 attempts worldwide. Not since 1963 had there been fewer successes. The TsSKB- Progress Soyuz U led the way with a dozen successful flights, six for Starsem/Globalstar. Boeing's Delta II logged 10 successful missions. Ariane 4 flew nine times without fail. Krunichev's Proton K also lifted off nine times, but failed twice. Lockheed Martin's Atlas IIA flew five times. Twenty-one other launch vehicles flew, but most, including NASA's shuttle, only flew once or twice.


China's Shenzhou at liftoff

China Tests Shenzhou
China tested its new Shenzhou (Divine Ship) on November 19-20 on an unpiloted mission. Shenzhou completed 14 earth orbits before landing in Inner Mongolia. The first Long March 2F (CZ-2F) rocket orbited the 8.4-ton craft from Jiuquan. CZ-2F, derived from CZ-2E, has two core stages and four liquid strap-on boosters. All stages burn N2O4/ UDMH. At liftoff, the 462-ton, 55 meter-tall rocket produces 2,962 kN of thrust. Shenzhou had a Soyuz-like reentry module, an aft service module with two solar panels, and a forward cylindrical crew cabin equipped with a docking port. The three-part spacecraft was 8.8 meters long and 2.8 meters in diameter.

NASDA H-2S No. 8
Japan's H-2 rocket suffered its second consecutive failure on November 15. H-2S 8F and its $95 million, 2,900 kg Multifunctional Transport Satellite (MTSAT) payload were destroyed about eight minutes after lifting off from Tanegashima's Osaki Range, Youshinobu Launch Complex. Four minutes into the flight the LE-7 LOX/LH2 first stage engine shut down. The 85,714 kgf thrust engine should have run for six minutes. An LH2 fuel leak appeared to be responsible. The second stage separated and its new 14,000 kgf thrust LE-5B LOX/LH2 engine started. The vehicle began to track low, however, forcing a command-destruct. After the failure, NASDA cancelled the eighth and final H-2 mission in order to focus development on the new H-2A vehicle.

STS-103/Discovery/Hubble SM-3A
NASA launched Space Shuttle Discovery (OV-103) on Hubble servicing mission SM-3A on December 20. Discovery lifted off from Kennedy Space Center LC 39B with Commander Curt Brown, Pilot Scott Kelly, Payload Commander Steven Smith, and Mission Specialists John Grunsfeld, Michael Foale, Claude Nicollier, and Jean-Francois Clervoy. Discovery captured Hubble on December 22. The astronauts performed three space walks to replace gyroscopes and other equipment. Discovery landed at KSC on December 28.

Four Arianespace Missions
Arianespace launched four missions during November-December. The end-of-year launch surge allowed the company to complete nine Ariane 4 and one Ariane 5 missions in 1999.

Vehicle L491, an Ariane 44LP model performed Mission V123 on November 13. The rocket carried carried the 3,903 kg GE-4 comsat into geosynchronous transfer orbit (GTO) from Kourou ELA 2.

On December 3, Mission V124 put 2,555 kg Helios 1B and subsatellite Clementine into sun synchronous polar orbit (SSO) for the French Ministry of Defense. Vehicle L492, an Ariane 40 model without strap-on boosters, performed the mission from ELA 2.

Ariane 504 successfully completed the first commercial Ariane 5 mission on December 10 when it put the European Space Agency's X-Ray Multi- Mirror (XMM) into a highly elliptical Earth orbit on Mission V119 from Kourou ELA 3.

Ariane 44L Vehicle L493 performed Mission V125 on December 22 from ELA 2. The rocket boosted PanAmSat's Galaxy 11 into GTO. Galaxy 11 is the first Hughes HS-702, a 4,490 kg spacecraft with 62 transponders and 10kW solar arrays. V125 was the 51st consecutive Ariane 4 success, and the 125th flight of an Ariane-series launcher.


Ariane 504 clearing its pad
ESA Photo

Two Atlas Launches
International Launch Services/ Lockheed Martin Atlas IIA flew twice during November-December.

AC-136, an Atlas IIA, orbited the US Navy's UHF F/O F10 communication satellite on November 23 from Cape Canaveral LC 36B. Centaur performed a standard two-burn mission to inject the 3,205 kg HS-601 satellite into subsynchronous transfer orbit. The satellite later propelled itself to geosynchronous orbit.


AC-141 carrying NASA's Terra. NASA TV photo

AC-141, an Atlas IIAS with four Castor IVA solid rocket boosters, put NASA's $1.3 billion 4,645 kg EOS Terra spacecraft into SSO on December 18. The rocket, Vandenberg's first Atlas Centaur, lifted off from refurbished Space Launch Complex 3 East (SLC-3E). AC-141 flew a single-burn Centaur mission with Atlas's heaviest-ever payload. AC-141 was the fifth Atlas of 1999, the 123rd Atlas Centaur, and the 46th consecutive success.

Pegasus XL/Orbcomm
An Orbital Sciences Pegasus XL/HAPS put seven Orbcomm data relay satellites into low earth orbit (LEO) on December 4. The four-stage rocket was drop-launched from L-1011 "Stargazer" off the U.S. Virginia coast after staging from Wallops Island. It was the 28th Pegasus mission, the 14th consecutive success, and the third mission of 1999.

VLS-1/SACI-2
Brazil's second VLS-1 rocket failed on December 11 three minutes after liftoff from Alcantara. Range safety commanded the vehicle to self-destruct after its second stage failed to ignite. VLS-1 V02 carried the 80 kg SACI-2 research satellite. The first VLS-1 rocket also failed in 1997 when one of its four first stage motors did not ignite at liftoff. VLS-1 is a 19.4 meter tall four-stage rocket that weighs 49,700 kg at liftoff. All stages burn composite solid propellant. The first stage uses four 1.0 meter diameter motors, mounted "strap-on" style to the identical core second stage. VLS-1 is designed to orbit 350 kg.

Titan 23G-8/DMSP 5D-3 F-15
Titan 23G-8 orbited the USAF Defense Meteorological Satellite Program (DMSP) weather satellite DMSP 5D-3 F-15 from Vandenberg SLC 4W on December 12. The two-stage Titan 23G accelerated its payload to near-orbital velocity. A Star 37S kick motor provided the final orbital insertion punch 13 minutes after liftoff. DMSP-5D-3 F-15 entered SSO. This was the second

Titan 23G launch of 1999. Only six Titan 2 ICBMs remain of 14 refurbished as space launchers during the 1980s.

Taurus/Kompsat/Acrimsat
The fourth Orbital Sciences Taurus rocket boosted South Korea's KOMPSAT (Korea Multi-purpose Satellite) and NASA's ACRIMSAT (Active Cavity Radiometer Irradiance Monitor) into SSO on December 21. The four stage solid fuel rocket lifted off from Vandenberg SLC 576-E. KOMPSAT will perform earth imaging. ACRIMSAT will measure solar radiation for climate research. Taurus-120 uses a Thiokol Castor 120 first stage (called Stage 0) topped by three Pegasus stages. This was the first and only Taurus launch of 1999.

Starsem Soyuz-U/Ikar Globalstar ST-06
The sixth Starsem Soyuz-U/Ikar successfully orbited four more Globalstar cellular telephone satellites on November 22. The rocket lifted off from LC 1. The launch increased Globalstar's constellation to 48 of a planned 52. The launch was the 12th Soyuz-U launch of 1999 and the 34th consecutive success for the Semyorka-based booster.

Tsyklon 2/Kosmos 2367
A Ukrainian-built two-stage Tsyklon 2 put Kosmos 2367, a Russian electronic reconsat, into LEO from Baikonur LC90 on December 26. It was the first Tsyklon 2 launch since 1997. Assembled by Yuzhnoye, the rocket's two stages, fueled by UDMH/N2O4, are derived from the R-36 (SS-9 Sapwood) ICBM. The rocket can put 2,800 kg into LEO. The launch was the 89th consecutive Tsyklon 2 success, best in the world today.

Molniya M/Kosmos 2368
A 3.5 stage 8K78M Molniya M rocket successfully orbited Kosmos 2368, an Oko class early warning satellite, from Plestesk on December 28.

Liftoff occurred at 19:12 UTC. The 2.5 stage, Semyorka-based booster put the third stage and payload into a parking orbit. The Blok-2BL third stage fired to inject Kosmos 2368 into a 12-hour elliptical "Molniya" orbit. This was the second Molniya M launch of the year.

SPACE NEWS:
NASA's Mars Polar Lander (MPL) and two Deep Space 2 subsurface probes all failed to transmit after their planned December 3 landing time.

NASA's X-33 tech demonstrator right-hand liquid hydrogen tank failed during a test at Marshall Space Flight Center on November 3. NASA test fired the X33 Rocketdyne XRS-2200 Linear Aerospike Engine at full thrust for the first time on December 18 at Stennis Space Center, Mississippi.

Boeing holds as many as 50 mostly unannounced launch contracts for its yet-to-fly Delta IV booster.

Custom Rockets Elite and SAM-X
Review by Bob Wiersbe (NAR 44588)

While browsing through the rocketry section at a local hobby shop, I came across some really neat looking kits with eye catching covers. It turned out that they were Custom Rocket kits, the ones that had been displayed at the RCHTA show some 2 years ago but had never been distributed. I never had any complaints with the way the Custom kits were packaged, but the new way is definitely an improvement.

I picked up two of the kits, the Elite and the SAM-X. The Elite is a competition egglofter, featuring a BT-20 tube, semi-elliptical balsa fins, plywood standoffs for the launch lugs, and a Nova Egg Cone from Apogee Components.

The Elite is designed to get as much altitude from a given motor as possible, while getting the egg back in one piece. It was easy to assemble, and the fin roots even have a tiny notch in them to help novices know which end to glue to the body tube.

The only modification I made to my Elite was to mount the shock cord to one of the plywood standoffs using a length of Kevlar. I did this so that there wouldn't be anything in the body tube for the parachute to get hung up on. The Elite comes with an 18" mylar parachute (with really cute tape disks), and there isn't much room in the BT-20 tube for the chute, shroud lines and shock cord.

The Elite looks like a great first egglofter for anyone, especially if they are new to eggloft competition. The recommended motors are B6-2, B6-4, C5-3, C6-3, and C6-5. The Elite lists for $7.95, which is a real bargain considering that the Nova Egg Cone is $5.95 from Apogee, but you can get it for $6.75 at Timeless Hobbies through their web site (www.a2zhobbies.com).

Custom Rockets 'Elite' Specifications:
Skill Level: 2
Length: 15.37"
Diameter: .736"
Weight: .8oz
Recovery: 18" Parachute
Motor Mount: 18 mm
Recommended engine: B6-2, B6-4, C5-3, C6-5
Retail List Price: $7.95

The SAM-X is a model of an imaginary Russian surface to air missile. The unique thing about it is that it is a two stage model with a BT-55 booster and a BT-50 sustainer, with no transition between the stages. The booster and sustainer both use 18mm motors.

I liked the looks of the SAM-X the first time I saw it at the RCHTA show, and had been waiting for it to be released. It has 16 die-cut balsa fins, all of which had to be cut out, sanded, and glued into place. The fins have a notch in the root (seems to be a feature of the new Custom kits) to help you get it right, but I still managed to put one on backwards. I caught the mistake in time and paid more attention to what I was doing after that. For those of you who enjoy working with balsa (as I do), then you'll enjoy the SAM-X. Even with all those fins it was quick and easy to assemble.

The motor mounts are the usual Custom quality, and there are no motor hooks to contend with. Staging is done in the time honored manner of taping the motors together. Simple, but reliable. The plastic nose cone has a feature that I haven't seen before, two eyelets! One is for the shock cord, the other for the parachute. Nifty idea. The parachute is a throw-back to the Estes chutes of the late 60's and early 70's, a checkerboard pattern! A nice touch, in my opinion.

The face card states that the SAM-X can be flown as a single or multi stage model, but there wasn't anything in the instructions on how to do this, and an extra launch lug wasn't included in the kit for the sustainer. I solved this little problem by adding two 1/2" long launch lugs to the sustainer.

My only problem is going to be finding motors to fly the model with. The recommended motors for the booster are the B6-0 and C6-0, and Estes has just announced that they are discontinuing the B6-0. This narrows the choices to C6-0/B6-6 or C6-0/C6-7 flight, both of which are going to be out of sight. I would love to use this model at demo launches, but without the right motors I can't. Guess I'll just have to stock up on B6-0 motors.

The SAM-X is 14.38" long, .976" (sustainer), 1.325 (booster), and has a list price of $9.95. Timeless Hobbies has it for $8.45 from their website. I think all the Custom kits offer great value for the price, check them out!

Custom Rockets 'SAM-X' Specifications:
Skill Level: 2
Length: 14.38"
Diameter: .976" / 1.325"
Weight: 1.6oz
Recovery: 12" Parachute
Motor Mounts: 18 mm
Recommended single stage engine:
1/2A6-2, B4-4, B6-4, C6-5, C6-7
Recommended two stage engine:
Booster Stage: B6-0, C6-0
Upper Stage: B6-6, C6-7
Retail List Price: $9.95

COSMOS-3
by Adam Elliot

Okay, folks-

COSMOS-3 is coming our way! This year's events and points will be as follows:

Event	Weighting Factor
1/2A Helicopter Duration	19
Random Duration	10
1/2A Streamer Duration	8

We will be hosting COSMOS-3 in May (probably during the normal launch, but we might have a seperate contest launch) at the usual Greene Valley launch site. This will be a Local meet with a contest factor of 1. Many of you may not know what that means. But don't worry, its not important.
This is an ordinary NAR sanctioned contest. Anybody over the age of 6 can enter, even teams. Those of you who are NAR members will need your NAR number handy if you want proper credit.

As with any contest all models flown must be made by the contestant. No "family" models will be allowed. For some strange reason, this rule does not apply to RTF models. You can just thank the Chinese laborers, I guess. Also, it would be a good idea to have your NAR number or your name written on the rocket. Only NAR contest certified motors will be allowed.

Random Duration is the simplest event. But only in theory. A random time between 30 and 65 seconds will be drawn at the beginning of the day. It is the modeler's goal to fly a model to match that duration. Any single staged model will work that does not separate into multiple pieces. Models cannot be caught or otherwise intentionally interrupted from free flight. Each contestant is allowed only one official flight. This must be your first flight of the contest. Any contestant flying any other event prior shall forfeit his/her Random Duration eligibility.

1/2A Helicopter Duration is probably the most complex event featured at this meet. It requires a model that uses auto gyration around its long axis as the sole recovery means. All models must remain in one connected piece to receive a qualified flight. They also cannot flip-flop end over end more than once. Up to two models may be flown for up to two official flights. All your flights will be totaled for your score. The purpose is to remain in the air the longest amount of time with 1/2A class total impulse. No flexible aero-surfaces may be used.

1/2A Streamer Duration is exactly what it implies. Any model that flies on 1/2A impulse, stays in one connected piece, and descends with a streamer as its only recovery method is allowed. The streamer must be a uniform, rectangular shape. It also must have a length to width ration of at least 5:1. That is, for every unit it is wide, it must be five times that in length. It must also have a minimum area of 100 square centimeters. It must be attached at one end and nowhere else. Again you are allowed two official flights with up to two models which will be summed and scored.

For greater detail about provisions, consult the Pink Book. It is available from NARTS.

That is all there is to it. Bring your stopwatches and models. And come join the fun. The entry fee is $2.

As this is a NAR sanctioned competition, any modeler may attempt to set national or club records provided we have the time and resources to accommodate such an event.

See you at the range!

Confused Stages – Stage 11
by Jonathan Charbonneau

Optimum weight is one of the elements to getting best performance, but it isn't the only one. Another way to reduce drag is by minimizing frontal area. To do this involves using the smallest diameter airframe possible. When the engine mount tube and main airframe are the same diameter, the rocket is at minimum diameter for the intended engine size.

Minimum diameter rockets usually look easy to build but be warned. Minimum diameter rocketry, like other designs, has its challenges. For starters, minimum diameter rockets often have long airframes (e.g. over 15 calibers long). Longer airframes are more prone to structural failure, especially in the area just in front of the engine where the stress loads are greatest. Another challenge is the fin joints. This is because the fins cannot be mounted through the wall.

With careful design, however, these challenges can be dealt with successfully. The structural integrity of the airframe can be improved by installing one or more couplers into the airframe or by fiberglassing the airframe. It is most critical to do this on the first 3 to 5 calibers immediately forward of the engine. The stress load is greatest on this area of the airframe because the weight of the nosecone, payload (if any), and forward portions of the airframe, along with the drag forces acting on the forward airframe are carrying on a shove-of-war[1] against the thrust of the engine. When an airframe suffers structural failure, it buckles at the point of greatest stress, usually within a few calibers of the engine mount.

The fin joints can be strengthened by cutting dado slots in the airframe where the fins go. Caution: cut slots only half way. Do not cut all the way through. Sand the area around slots for a stronger bond. Use thick cyanoacrylate (CA) glue to attach fins to airframe in the dado slots. Use slow cure (30 minute) epoxy for the reinforcement fillets for strength. Another way to make the fin joints strong is by applying fiberglass cloth over the fins and airframe tail and coating with a finishing epoxy.

Superman's words of the wise

1 By using all of these suggestions together, you'll have a rocket that has a good chance of not rekitting[2] itself during powered flight.

2 These tips apply to all rockets. They are great for any rocket, minimum diameter or not. This includes sports flyers, monster models, and boosted darts.

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1 A shove-of-war is a tug-of-war in reverse. The rivals are pushing against each other instead of pulling.

2 Rekitting is when a rocket breaks into pieces during flight.

Blackshaft Tubing Available

To all competitors and modelers,

Ring Rocketry is happy to announce once again the availability of the Blackshaft thin wall phenolic tubing. This is the same stuff offered by the previous Apogee components years ago. It's primary intention is for competition, but can also be used for sport models if one so desires. It is probably the best choice for super-rocs, including D SRA at NARAM-42! I have ALL 4 sizes available, including 6mm, 13mm 18mm and 24mm. Yup, 18mm is once again available! Quantities of this size are limited....

Blackshaft can be sanding and polished to a glass smooth finish with minimal effort and thereby significantly reducing surface friction. This will allow a model to fly significantly higher. Tubing is black in color.

For more info, contact:
Ring Rocketry
206 E. Mary St.
Holland, IN 47541
812-536-5000
chadring@cs.com

Welcome to the Club!

Mary Jane and Jim Becks, Virg Black, Sean Feeley, Edward and Marcia Frankowiak, Kathleen Hulina, Brian and Sally Jestice, Kevin Keehn, John, Ann, Jonas and Katrice Krumplys, Allen and Mary Lukritz, Anne Marrero, Will Marrero, Grayson Mattila, Ed Neuzil, Will Newgard, and Drew Potenza have all joined NIRA since the last newsletter.

Welcome to the club!

Editor's Notes

This issue begins my second year of editing the Leading Edge – and what a year its been! As most of you know, the Leading Edge won the LAC trophy as the best section newsletter in the NAR. I can't take full credit for this since Bob Weirsbe was editor for half of the contest year and most of the credit has to go to those members that submit articles for me to publish.

Articles Needed
In order to maintain the high quality of the Leading Edge, I need members to submit articles. I always need feature articles (how-to's, contest strategy, fun stuff), launch reports, kit reviews, plans, cartoons, news clips, you name it. If you have any questions, please ask. My contact information is on page 2.

My goal is to have a rocket plan in every issue, which hasn't been the case for the last few months. If you don't have access to a drawing program, I am more then willing to redraw a hand drawn plan. Don't think the plan needs to be complicated or fancy – just interesting enough to build or inspire creativity.

Also, since this is a club newsletter, if you have something rocket related to sell or give away I'd be more then happy to put an ad in for you. Nothing commercial, however. Ad rates for commercial ads could be negotiated, however.

Mailing List
NIRA has an email list. If you have access to internet email, send an empty message to nira-subscribe@makelist.com and an email to confirm your subscription will be sent in reply. To prevent unwanted email (spam) from getting into the list, only members can send messages to the list.

The purpose of the list is to keep NIRA members informed about club events, discuss rocketry, and anything else that interest the majority of NIRA's members.

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

Estes Apollo XI (open but complete) $40 or best offer, Aerotech Mantis launch pad and Interloc clip (new) $60 or best offer, X-Wing control line airplane, with supplies, $10 or best offer.

NAR Standards and Testing News

R62: NEW MOTOR CERTIFICATIONS
The following motors have been certified by NAR Standards & Testing for general use as model rocket motors effective February 22, 1999. All are certified for contest use effective December 31, 1999.

Aerotech:
29mm x 73mm:
F23FJ-4,7 (56.0 Newton-seconds total impulse, 32.0 grams propellant mass)
29mm x 98mm:
G38FJ-4,7 (94.0 Newton-seconds total impulse, 55.0 grams propellant mass)

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

Jack Kane, Chairman

NYPOWER 2000/ The National Sport Launch

Here is some info on NYPOWER 2000/The National Sport Launch. This years launch will be held in May instead of July so please plan accordingly. The reason for this change is that we did not want to conflict with LDRS being held in July and because we are we incorporating the NSL with NYPOWER 2000 we can still keep a NYPOWER launch for the year 2000 that does not conflict with any other launches. The NYPOWER 2000 / NSL launch will be the same great launch as usual, hopefully this time with much cooler weather. If you plan on attending book you rooms early. Rooms will be limited come March & April.

Date: May 27-29, 2000
Location: Geneseo, NY
Event: NYPOWER 2000 / The National Sport Launch
Sponsors: MARS, NAR 136, and Buffalo Rocket Society Inc., NAR 590/TRA 85
Contact: Lloyd Wood 716-334-5429
email at Actionxprs@aol.com
Waiver: 8000 ft AGL
Host Motel: Rochester Marriott Thruway 5257
West Henrietta Rd
Rochester, NY 14602-0561
716-359-1800
Notes: More info and a brand new website will be coming soon.
-Ray Halm

Ray Halm
Buffalo Rocket Society (BRS)
Prefect / Tripoli Western NewYork #85

PML News: Volume 23
Fri, 31 Dec 1999

PML is announcing that we have discontinued the following kits, effective immediately:

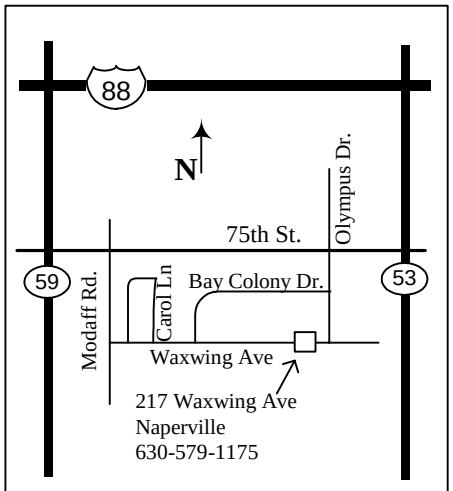
- Stratus
- Bulldog
- Lunar Express (6" size; the 4" Little Lunar Express is still in production)

We are discontinuing the Stratus due to low sales volume.

The Bulldog and Lunar Express are being discontinued because of relatively low volume, but also due to the exceptional amount of labor required to produce them. Each of these kits use two 6" diameter fiberglass nosecones. As you may know, we make all of our fiberglass nosecones by hand, which takes quite a bit of time and material to produce for the quality we require. Basically it's just not cost effective to continue the Bulldog and 6" Lunar Express at the current pricing, and to price them so they are profitable for us would make them too expensive, so they are discontinued effective immediately.

We do not have any of these kits in stock, and will not be producing "one last run" of them. If you are interested in one of these kits, check with your favorite dealer to see if they still have one available. (Please do not call PML to ask if a certain dealer has a kit you're interested in...we do not know their stock situation. You'll have to contact the dealer; see the Dealers list on our website for current PML dealers).

Andrew D. Waddell
PML Online Support Rep
Email: ADWaddell@home.com
PML: www.publicmissiles.com



Map to Steve Smith's

Map to March's building session at Steve Smith's house.







THE LEADING EDGE

C/O Jeff Pleimling
245 Superior Circle
Bartlett, IL 60103-2029

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!