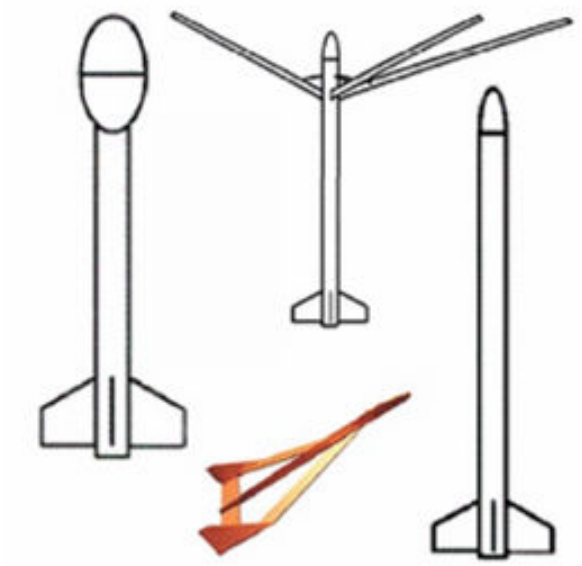
# The COS-Rocketeer

**The Official Journal of the Colorado Springs Rocket Society (COSROCS)**

**NAR Section #515**

Volume 12, Issue 7 Special Competition Issue, Winter 2001



A variety of competition rockets—egglofter, helicopter, duration, and Deltie boost glider.

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## Special Competition Issue

**Happy Holidays from the Nagging Editor!**

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Volume 12, Number 7
Competition Issue, Winter 2001

***The COS-Rocketeer*** is the official journal of the Colorado Springs Rocket Society (COSROCS), NAR section #515. This journal, published bi-monthly by members of COSROCS, serves to provide information on all aspects of rocketry. Articles, rocket plans, and photos are always welcome. Items for publication should be submitted to the editor:

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6121 Cranberry Ln.
Colorado Springs, CO 80918

e-mail: gelder@pcisys.net



COSROCS' membership dues are $20.00 per year per family. Junior memberships (under age 18) cost $5.00 per year. Checks should be made payable to COSROCS. Applications and payment should be mailed to the following address:

COSROCS
P.O. Box 15896
Colorado Springs, CO 80935-5896

The COSROCS phone number is (719)575-0060

If you have access to the Internet, COSROCS has a web site and a listserv. The COSROCS web site is:
http://www.cosrocs.org.

The e-mail address for the listserv is cosrocs@yahoogroups.com. To subscribe to the listserv, go to http://www.yahoogroups.com to register and select COSROCS.

COSROCS is a family-oriented club. Everyone is always welcome at our launches and meetings. Please join us. You'll have a blast!

COSROCS received the NAR's LAC Award (Rockwell Trophy) in 2000 for having produced the best newsletter.

## COSROCS Officers

| | |
|---|---|
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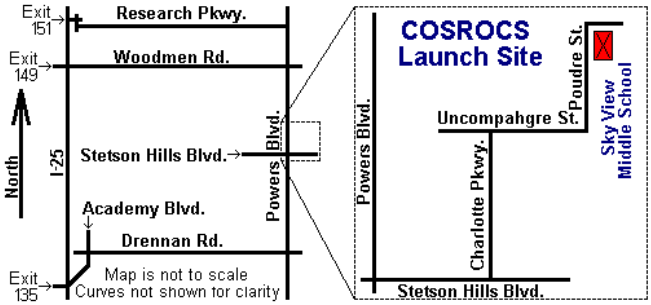
## Launches and Meetings

COSROCS holds a business meeting on the second Wednesday of every month from 7:00PM until 9:00PM. The meeting location is the Gold Hills Police Station at 705 South Nevada Ave., Colorado Springs.

COSROCS holds a sport launch on the first Saturday of each month, weather permitting. The launch is held at the Sky View Middle School, located at 6350 Window Peak Blvd. in Colorado Springs. The launches begin at 9:00AM and last until approximately 12:00 noon. Our launches are free and open to the public. A one pound weight limit is imposed for rockets launched at Sky View.




COSROCS holds a sport launch on the third Saturday of each month at Cape Preble in Peyton, Colorado. The launches begin at 9:00AM. This launch site has a 3.3 pound weight limit for rockets. To get to this launch site, head east on Hwy 24 towards Peyton. Turn left right after the grocery store. After the curve, bear right onto Peyton Hwy. Drive to Sweet Road, 4th turn on the right. Go approx 1.5 miles on Sweet road. On the left, near the bottom of the hill, is a gate to the launch site (21410 Sweet Road). Look for the green ranch gate (Star Gate).

## The Nagging Editor

By Greg Elder

Happy Holidays everyone! You're probably wondering why you are getting another issue of The COS-Rocketeer, when one was just published about 2 weeks ago. This is my holiday gift to COSROCS members. This is a special issue devoted to competition rocketry.

The NAR is a small organization, compared to other hobbies. Within the NAR is a smaller group of people, around 300 total, that participate in competition. Within our own section, only a handful of people attend and participate in the contests we sponsor. Since we have had a number of new people join our section during the past two years, I wanted to promote competition rocketry and encourage more people to give it a try. Hence, this special issue of The COS-Rocketeer.

This issue contains information about various aspects of NAR competition that should help you to understand this aspect of model rocketry and provide some tips for participating. This issue contains new articles, as well as reprints of older articles about competition. I've even included some competition rocket plans.

As mentioned in the Nov-Dec COS-Rocketeer, our Winterfest contest will be held January 5 at Sky View Middle School. This is a good contest to get "your feet wet", if you've never participated in a contest before. The degree of difficulty of the events range from easy to medium. Suggestions and tips for each of these events are presented in this issue. Refer to the Nov-Dec issue for specific details about each event. I'd like to thank Wolfram von Kiparski for supplying me with plans for the 1/4A boost glider printed in this newsletter. I posted a request on the Internet and he responded to me with the plans. Thank you very much!

## What is NAR Competition?

Compiled by Greg Elder
(Information adapted from the NAR web site and the Pink Book)

The National Association of Rocketry (NAR) was founded in 1957. In 1959, the first national rocketry contest, the NAR Annual Meet (NARAM) was held. Since then, for over 40 years, thousands of rocketeers have participated in competition rocketry.

All of the official rules and guidelines for model rocket competition in the United States is codified in the NAR's U.S. Model Rocket Sporting Code, also known as the Pink Book. (The first published U.S. Model Rocket Sporting Code was printed on pink paper, hence, its nick name.) The Pink Book discusses and provides rules for over 25 different competition events. When you join the NAR, you will receive a copy of the Pink Book. In addition, you may access the Pink Book from the NAR web site at the following URL:

http://www.nar.org/pinkbook

***Types of Events***

There are four main categories of NAR competition events: altitude (whose rocket flew the highest?), duration (whose rocket stayed in the air the longest?), craftsmanship (whose rocket is built the best and most closely resembles a real rocket?), and miscellaneous (any event that does not fit the first three categories). In addition, most of the events are further divided by motor impulse class. For example, B Altitude involves flying a rocket to the highest altitude possible using any NAR contest certified B impulse motor. Here is an overview of the different events by category:

***Altitude Events***

- *Altitude* — Achieve the highest altitude.
- *Super-Roc Altitude* — Fly the longest possible rocket to the highest altitude without structural failure. Points are awarded by a formula that takes into account both the length of the rocket and the altitude achieved.
- *Predicted Altitude* — Fly your rocket as closely as possible to an altitude you predict.
- *Set Altitude* — Fly your rocket as closely as possible to an altitude chosen by the Contest Director. The altitude is announced in advance of the meet and is the same for everyone.
- *Random Altitude* — Fly your rocket as closely as possible to an altitude chosen by chance on the day of the meet. The altitude is the same for everyone.
- *Cluster Altitude* — Achieve the highest altitude possible with a single-stage model using multiple motors.
- *Payload* — Carry a one-ounce cylinder of sand to the highest possible altitude.
- *Egg Lofting Altitude* — Carry a fresh hen's egg to the highest possible altitude. Return the egg unbroken.
- *Dual Egg Lofting Altitude* — Carry two fresh hen's eggs to the highest possible altitude. Return both eggs unbroken.

***Duration Events***

In general, duration models are not allowed to separate (recover in two or more pieces). This also limits most duration models to being single staged.

- *Parachute Duration* — Stay aloft the longest with one or more parachutes.
- *Streamer Duration* — Stay aloft the longest with a single streamer.
- *Helicopter Duration* — Stay aloft the longest with a model that uses autorotation as the sole recovery device.
- *Super-Roc Duration* — Stay aloft the longest with the longest possible model. Points are awarded by a formula that takes into account both the length of the rocket and the time aloft.
- *Egg Lofting Duration* — Stay aloft the longest while carrying a fresh hen's egg. Return the egg unbroken.
- *Dual Egg Lofting Duration* — Stay aloft the longest while carrying two fresh hen's eggs. Return both eggs unbroken.
- *Boost/Glider Duration* — Stay aloft the longest with a rocket-boosted glider. The model is allowed to separate and may be multi-staged, since only the glider portion is timed.
- *Rocket/Glider Duration* — Stay aloft the longest with a rocket-boosted glider. Nothing is allowed to separate; the entire model must boost vertically, but must return in a stable glide. This challenging event usually requires a model with clever moving parts.
- *Flex-Wing Boost/Glider Duration* — Same as Boost/Glider, except the glider must use flexible wings.
- *Predicted Duration* — Stay aloft as closely as possible to a time you predict.
- *Set Duration* — Stay aloft as closely as possible to a time chosen by the Contest Director. The time is announced in advance of the meet and is the same for everyone.
- *Random Duration* — Stay aloft as closely as possible to a time chosen by chance on the day of the meet. The time is the same for everyone.

***Craftsmanship Events***

Except for Scale Altitude, any motor power is allowed in craftsmanship events.

- *Scale* — Build and fly an accurate scale model. Supporting data is required. Judges measure and rank the model. The model must make a safe and stable flight.
- *Scale Altitude* — Fly an accurate scale model to the highest possible altitude. Models are judged as for scale, and an additional factor is awarded for the altitude achieved.
- *Super Scale* — Same as Scale, but includes a scale launching complex as well.
- *Sport Scale* — Same as Scale, but the model is not measured. It is judged for conformation and craftsmanship by a team of judges standing at a distance.
- *Giant Scale* — Same as Sport Scale, except that models cannot be smaller than a given minimum size.
- *Peanut Scale* — Same as Sport Scale, except that models cannot be larger than a given maximum size.
- *Plastic Model Conversion* — Construct a common plastic model of a rocket that was not originally manufactured as a flying kit, and convert it to fly in a safe and stable manner. Points are awarded for both craftsmanship and flight qualities.
- *Space Systems* — A Sport Scale rocket, along with an optional Sport Scale launch complex, must successfully simulate the flight performance and mission of the original prototype.

***Miscellaneous Events***

- *Spot Landing* — Land your model closest to the spot chosen by the Contest Director. The spot is the same for everyone. Any motor is allowed. This event can be held in three sub-classes: Parachute; Streamer; or Open (any recovery system allowed).
- *Drag Race* — Two rockets are launched simultaneously through a single switch. The judges award points for the model that achieves first motion, achieves the lowest altitude, and lands last. The winner of each "heat" goes on to fly subsequent heats until an overall winner is determined.
- *Radio-Controlled Glider* — A combination of Boost/Glider Duration, Set Duration, and Spot Landing. The object is to fly a Radio-Controlled Boost/Glider as close as possible to a time duration set by the Contest Director, while landing it as close as possible to a spot determined by the Contest Director. Radio-controlled gliders have their own additional Safety Code.
- *Research and Development* — Contestants prepare and present a written research or engineering project. Oral presentations are required of competitors being considered for the top four places.

***Types of NAR Meets***

The NAR sanctions five types of competition meets. These are as follows:

- Section Meet — Limited to the members of a single NAR Section.
- Local Meet — Open to specific neighboring Sections or to any NAR member within a specific geographical area.
- *Open Meet* — Similar to Local meets, but must draw a minimum number of competitors, and no more than 75% from the same Section.
- *Regional Meet* — Open to all members in two or more states.
- *National Meet* — Open to all NAR members. Held annually, in a different area of the country each year.

You can also sanction Record Trials, a popular form of competition at which members compete against the record book instead of each other. Each type of meet has a contest factor associated with it. The contest factor is applied to the points accumulated by each individual contestant.

***Competition Divisions***

Competitors are divided into divisions based upon age, as follows:

- *Division A* — 7 through 13 years of age.
- *Division B* — 14 through 18 years of age.
- *Division C* — 19 years of age and older.
- *Division T* — A special division for teams of two or more registered NAR members.

***Scoring***

NAR competition events are scored as follows:

- *First Place* — 10 points.
- *Second Place* — 6 points.
- *Third Place* — 4 points.
- *Fourth Place* — 2 points.
- *Fifth Place and Beyond* — 1 point for having at least one qualified flight.

Each event also had a weighting factor. The more difficult the event, the higher the weighting factor. For example, B Streamer Duration has a weighting factor of 9, while B Eggloft Duration has a weight factor of 17. The appropriate weighting factor is multiplied with the placement points. Finally, each type of meet has a contest factor that is also multiplied with the points. For example, a Local Meet has a contest factor of 1, while an Open Meet has a contest factor of 2. So, first place in B Streamer Duration in an Open Meet is worth 180 points (10 X 9 X 2). The points won by each individual in each event are then totaled together to determine the overall winner for a contest.

The NAR contest year runs from July 1 through June 31 of the next year. As a NAR contestant, you are limited to the number of contests you participate in each year. The maximum number of accumulated contest factors is 12. The points that you and your Section earn through competitions throughout the year are added up to determine which of the competitors and Sections at that year's NARAM will go home with one of the National Championship trophies!

This has been a brief overview of NAR competition. Please read the Pink Book to become familiar with the rules for the specific events for which you plan to participate. Competition rocketry is a fun experience, and it helps to improve your skills with building and flying rockets. If you have not tried competition yet, do so. You won't regret it.

## Model Rocket Competition—Why to Compete

By David J. Nauer
(Adapter from the Jan-Feb 2001 COS-Rocketeer)

Some of you may have noticed that we host two National Association of Rocketry (NAR) contests each year and may be wondering what it is all about? Why does COSROCS host contests, and what can it mean for our sport only member? Today we host a winter contest (Winterfest) the first Saturday of the year, and we host a second Regional contest in June or July called Pikes Peak or BLAST.

First, why compete? For some it is pure competition, the challenge of pitting your skills against others and to achieve placements and contest points towards national standings. This "pure competitor" does exist, and is usually experienced and difficult to beat. Others may take the challenge to better them selves, pitting their building skills against very difficult requirements at the highest levels of competition. Others may enjoy the friendships and interactions that occur at a local, regional, and national level.

For me it is a little of all of this—I love to fly my rockets against others and see how they can do. I also like the idea of learning new techniques, using new materials, and pushing designs to achieve better and more consistent performances. And finally, there is a group of people I know across the nation that I usually only see at National Meets (called NARAMs) or in the context of Model Rocket Competition.

OK—you are a beginner. You have never competed and are wondering how to "get into it". The first step is to go to the NAR web site at www.nar.org and download the "Pink Book"—the rulebook for model rocket competition. That book contains all of the necessary rules for each event and overall rules for each competition. Next, contact a member who is interested in competition and ask questions! You can call me at home at 719-487-8737 if you are interested in starting, but we have other members interested in this aspect, including our editor, Greg Elder, and in Denver, a former National Champion, Bruce Markielewski, who is also a long-time COSROCS member.

We have an upcoming contest on 1/5/02, with a bad weather date on 1/19/02—Winterfest XI. There are five separate events that could be of interest to you. Specifically, this consists of Open Spot Landing, 1/4A Boost Glider Duration, 1/4A Streamer Duration, 1/4A Super Roc Duration, and B Eggloft Duration. If you are remotely interest, stop by and watch, or bring a rocket and enter it!

What can you gain from competition? Perhaps the most important thing is better building skills, new friendships, and better knowledge of materials and construction options. For example, if you want to learn more about gliders, competition is an excellent path to go down—you must learn how a glider works, what options you have in a boost situation, and you learn the differences between "flexi", "boost", and "rocket" gliders and how to build them. Believe me, if you want to learn, there is a lot of material out there, and we are VERY VERY fortunate to have top-level competitors and the BEST rocket competition company out there in our own back yard. Apogee Components, owned by Tim Van Milligan, has a web site at: http://www.apogeerockets.com/ and sells a wealth of information on competition. Tim's company also has kits for most events that will be competitive at most contests, and has high performance model rocket engines which most competitors rely upon for many events.

SO—if you think this all sounds interesting, you may take a pause and investigate. Please give me a call if you are interested!

## NAR Competition Resources

By Greg Elder

There are a number of resources available to assist you with competition rocketry—everything from books, to people, to companies that sell rocket kits designed specifically for competition. Here is a brief review of currently available resources.

***Books/Printed Resources***

The first book to always start with is the NAR Pink Book. This book describes in detail the rules for each event. Even if you think you fully understand the rules for the events you will participate in, you should review the appropriate events in the Pink Book. You don't want to overlook anything related to the event. You should also review the current list of NAR contest certified motors. This information is available on the NAR web site (http://www.nar.org/SandT/NARenglist.shtml). You don't want to show up at a contest with motors that are not certified. (You won't be allowed to use them. I saw this happen to two contestants during NARAM-2000.)

If you plan to scratch build the rockets you will use for competition, there are some books available that describe designing rockets. One is *The Handbook of Model Rocketry* written by G. Harry Stine, the father of model rocketry. This is an excellent resource covering all aspects of our hobby. Every rocketeer should own a copy of this book. Tim Van Milligan of Apogee Components has a book entitled *Model Rocket Design and Construction*. This is another great resource that explains how to design and build all types of rockets—parachute and streamer duration models, boost gliders, rocket gliders, helicopter rockets, and others.

Another wonderful resource for material is the NAR Technical Service (NARTS). NARTS has a number of technical reports that can be of assistance to competition rocketry—glider construction, optimal streamer folding, parachute performance, and many other topics. NARTS also has a large collection of rocket plans, many dealing specifically with contest rockets. Furthermore, NARTS provides some scale technical data that can be used for some of the craftsmanship events. You can access the NARTS catalog at the following URL on the Internet: http://www.nar.org/NARTS/cat.html.

If you will be entering a scale-type event, you should look at the books offered by Saturn Press. Another book every rocketeer should own is *Rockets of the World*. This book contains photos and scale data for numerous rockets produced by different countries. Saturn Press has also put out supplements to this book containing new information.

***People***

People are a great resource to use concerning competition flying. Most sections have a few people that are experienced with NAR contests. Talk to those people. Ask them questions about strategies to use, what has worked best for them in the past, the pros and cons of different types of rockets, etc. I have found most experienced competitors to be willing to provide information. If you have access to the Internet, you may even try posting questions to the rec.models.rockets Usenet group. I have done this a couple of times and have received helpful information from people that I have never met in person. (The plans for the 1/4A boost glider were sent to me via the Internet.)

***Model Rocket Companies***

We all are aware of the major model rocket companies like Estes, Quest, and Custom. Some of the kits sold by these companies can be used for contests. However, most of these rockets may not be

light enough or aerodynamic enough to win a contest. (They make great backup rockets—something to get qualified flights with.) You can always modify an Estes or Quest rocket to improve its overall performance. And in some cases, the Quest or Estes rocket will win an event because other competitors' rockets were lost or were disqualified.

There are a number of smaller model rocket companies that cater to competition rocketry or provide parts for scratch building such rockets. I'll mention those I have done business with in the past and provide their addresses and Internet URLs.

If you wish to purchase parts for scratch building your rockets, a number of companies sell various parts. For balsa nose cones, look at Balsa Machining Service (BMS). This company has a vast selection of balsa nose cones. They even have reproductions of many of the old Estes and Centuri nose cones. In addition, BMS sells a launch tower designed especially for competition rocketry. (A launch tower allows you to launch a rocket without the need for a launch lug, thus, reducing the amount of drag on the rocket.) For body tubes and centering rings, check out Totally Tubular. They offer the widest selection in tubes and centering rings. Apogee Components also sells some parts—body tubes, centering rings, kevlar shock cords, and competition grade plastic and balsa nose cones. Furthermore, Apogee sells unique composite motors especially designed for some of the NAR events. One other company, Pratt Hobbies, sells some very light-weight nose cones and egg capsules made from vacuum formed plastic. Pratt also carries kevlar.

If you prefer building kits for competition, then three companies come to mind. The first is Qualified Competition Rockets (QCR). This company sells kits for almost every NAR event—parachute/streamer duration, egglofting, Super-Roc, boost glider, rocket glider, plastic model conversion, helicopter duration, and others. A second company with competition kits is Aerospace Specialty Products (ASP). ASP sells parachute and streamer duration kits. They also have a great line of egglofting kits that use an aerodynamic shroud on the body tube. In addition, ASP offers competition mylar parachutes. Finally, for boost gliders you should look at the kits produced by Edmonds Aerospace. His easy to build Deltie and competition grade Ivee kits have won many boost glide events. You can't buy the kits directly from Edmonds, but his web site lists various dealers that carry his kits.

Apogee Components, Inc
630 Elkton Drive.
Colorado Springs, CO
80907-3514 USA
http://www.apogeerockets.com/

Aerospace Speciality Products
P.O. Box 1408,
Gibsonton, FL 33534
http://www.asp-rocketry.com/

Balsa Machining Service
11995 Hillcrest Dr.
Lemont, IL 60439
http://user.mc.net/~bms/

Edmonds Aerospace
http://Members.aol.com/RobEdmonds/Edmonds.html

Pratt Hobbies
2513 Iron Forge Road,
Herndon, VA 20171
http://www.pratthobbies.com/

Qualified Competition Rockets
7021 Forestview Drive
Springfield, VA 22150
http://www.cybertravelog.com/qcr/

Saturn Press
P.O. Box 3709
Ann Arbor, MI 48106-3709
http://members.aol.com/Satrnpress/order.htm

Totally Tubular
Jim Fackert
Box 430,
Hamburg MI 48139-0430
http://www.buyrockets.com/buyrockets/tt.html

## COSROCS' NAR Competition History

By David J. Nauer

The early days of the club revolved around model rocket sport flying and the growing interest in the high power segment of the hobby. Our sport flying focused on school coordination and youth, and expanded into discovering what NAR Competition was all about. During this time, we saw the introduction of numerous new technologies such as RMS motors from ISP/AeroTech, the return of 1/4A engines, the development of a pure competition oriented company (Apogee, founded by Ed LaCroix), and several other companies which focused on competition kits (QCR in particular comes to mind). Meanwhile, high power remained an area focus as the Hartsel LDRS' were held that many in the early club attended (LDRS VI – IX). The NAR didn't embrace RMS technology quickly but in the early 90's included RMS motors in contest certification.

Our sole NAR sister club in Colorado (CRASH) was itself just starting NAR competition, and struggled with dates and formats, but put together great contests! CARCIS became the higher power version of NAR competition, often including events that flew D-F motors (at the time there were very few "G" motors generally available until AeroTech introduced the G40 and G80 single use engines, and the FSI F7 and F100 were popular black powder motors).

COSROCS got the competition "bug" after watching CRASH's early contests. After some planning our first contest was held on 7 July 1990 when Pikes Peak or BLAST I reintroduced NAR competition to Southern Colorado. This open event went off without a hitch. Our young club grew in part due to the increasing interest in contests and in part due to the new accessibility of high power rocketry. COSROCS coordinated with our CRASH friends to the north and agreed to host two contests each year. COSROCS took the summer and winter "slots", and later in 1990 decided to hold a contest the first Saturday of each year that we would call Winterfest.

Several members of CRASH and COSROCS decided to attend NARAM 32, held in Dallas, TX to learn more about competition. None of the Colorado contingent was wildly successful, although CRASH members took a few trophies home to Colorado.

While Pikes Peak or BLAST was targeted to provide a wide range of contest events, Winterfest was driven by the realities of cold

winter flying. We decided to host a judged event (e.g. sports scale, etc) and to hold some type of altitude event during Pikes Peak or BLAST. Winterfest would feature events that were compatible with winter flying, and target unusual events that could still fit in the winter format (Winterfest III featured F Streamer Duration which was won by Bruce Markielewski and Winterfest VIII featured F Helicopter Duration won by David Nauer as two examples).

To foster the knowledge in the region, CRASH and COSROCS joined together and hosted the National NAR Convention (NARCON-92) in the summer of 1992. We asked for competition to be one of the focus subjects of the convention, and were overwhelmed with the response from across the country. NARCON-92 featured visitors from the east and west coasts, and included some of the top competitors of the day describing construction techniques and contest philosophies. It was held for three days in Colorado Springs, and included a continuous COMPUSERVE chat room where anyone across the nation could host chats and follow the events of the convention.

The results of NARCON-92 was reinforced later in the year when CRASH and COSROCS members attended NARAM 34, held in Las Vegas, NV and hosted by AeroTech. At that event David Nauer took the Reserve National Champion prize for C Division for the contest year and actually won the NARAM itself (although this was not an award presented at this particular NARAM). Todd Schneider from COSROCS took Fourth Place in the nation in B Division, and Bruce Markielewski from CRASH finished fourth in the nation in C division.

The first regional competition hosted by COSROCS was attempted during Pikes Peak or BLAST IV. To prepare the club for the event, an open contest was held the first Saturday in June 1993 at Stetson Hills. We did not publicize this event, so only COSROCS and CRASH members attended. We did notify our region about our intent to fly a regional, and coordinated with Tripoli-Colorado to host one day of the contest at Hartsel in conjunction with a Tripoli-Colorado sport launch. We flew Pikes Peak or BLAST IV Regional on 26-27 June 1993. The interest was great, and we flew several fun contests suited to the site. Our first regional represented the first joint event between NAR and Tripoli where a sanctioned NAR contest was held together with an official Tripoli launch, and was featured in both Tripoli and NAR magazines of that era.

Pikes Peak or BLAST IV Regional fun events may not be repeated in the future, but they demonstrated a mix of low and high power and included "H" Water loft Altitude (a fun event) and F Payload Altitude (a NAR event). The C Division winners of both of these events were Tripoli-Colorado members (D. Larry Clark for H Water loft and Don Perko for F Payload Altitude), while some traditional events were won by NAR members (E Dual Egglofting duration was won by Mark Hamilton, eventual NAR National Champion in that contest year, and 1/2A Helicopter was won by three time national champion Kevin Kuczek). What was interesting was the wide scale of attendance—including folks from New Mexico, Utah, Kansas, and Colorado—and members from seven clubs or organizations—still a record for any Colorado contest we have record of other than the NARAMs hosted in Colorado!

COSROCS' contest interest remained steady, and many of the Colorado based national level competitors you know today developed their skills at COSROCS events. We have never missed a Pikes Peak or BLAST since the first one in 1990, holding the current Colorado record for consecutive repeats of a contest, through Pikes Peak or BLAST XII held this summer. Since Pikes Peak or BLAST IV's regional, every Pikes Peak or BLAST has been attended at a regional level.

Winterfest was interrupted one time with a winter contest renamed to honor one of our active club members who was killed in a light plane accident that fall. In February 1997 Winterfest VII was replaced by the event we named the "James J. Pattee III Memorial Launch", in effect a Winterfest event renamed for Jim. We resumed the Winterfest name in 1998, holding the delayed Winterfest VII launch. We are currently planning Winterfest XI to be held on 5 January 2002.

The author has been the Contest Director for most of our COSROCS events. Winterfest II was directed by our "B" division competitors Todd Schneider, who finished 4th in the country in B division two years later, and by Brian Schmidt (who designed our original club logo at the age of 12). Greg Elder will direct Winterfest XI, learning the ropes on contest operations and documentation.

Over the years the NAR had placed a great deal of pressure on Bruce Markielewski (CRASH's most active Contest Director) and myself to host a NARAM, the NAR's National Contest. The lack of a site and our concern about the scope and size of such an event led us to delay taking such a commitment. In early 1999 Bruce and I decided to explore a possible NARAM in Colorado (the first since 1969!) and put out a call for any interested in such an event. The two clubs endorsed hosting a NARAM and in the summer of 1999 Ken Mizoi accepted the position of Contest Director and the core of the NARAM-2000 planning committee was formed.

One of the most ambitious rocketry events to be held in Colorado since NARCON-92, there was a great deal of support and work performed by a large number of people for over a year. Both clubs (CRASH and COSROCS) as well as Tripoli-Colorado members pulled together to make NARAM-2000 happen, and represents the true pinnacle of contest focus in Colorado. Hopefully you were able to attend or participate in NARAM-2000 as a competitor or sport flier, as another event of that type in Colorado is undoubtedly many years off.

If you are interested in learning more about contest flying, or want to become a part of COSROCS' long legacy in NAR competition, come on out to Winterfest XI in January and check it out! If you have specific questions you can give me a call (David Nauer) at 719-487-8737.

## How to Succeed at Competition—The Insider's Secrets

By Tim Van Milligan

(Originally printed in the Jan-Feb 2000 COS-Rocketeer)

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 they¹ve 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 are 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 competitor's 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 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 willing 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***

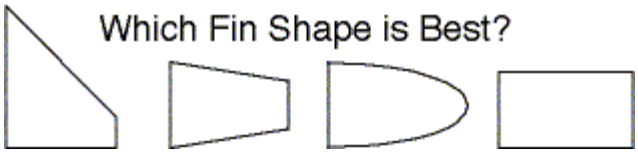
Rocket competition is challenging on a personal level. It is a lot like golf, where in the end, you compete only against yourself. But like golfers, we're all looking for the magic item that will dramatically improve our chances of success. But the only real tools are education and experience. You need 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 another day. So go out and start competing today.

## What Type of Fin Shape is Best?

By Tim Van Milligan

I'm often asked the question of which fin shape is best for small competition rockets. What I'm about to tell you about this may shock you. Many people have been told that the elliptical fin shape has the lowest induced drag. While that may be true for full size airplanes, it may not be necessarily true for small model rockets. The reason is buried in the very technical subject about something called the fin's "Reynolds Number." I'll try to describe this without getting too technical, because I want even young modelers to understand this (I've seen too many science fair projects with the subject being 'optimum fin shapes'—which you won't find in my book*: 69 Simple Science Fair Projects with Model Rockets: Aeronautics*).




There are two types of drag on a rocket; induced drag and profile drag. Induced drag only occurs when the fin creates lift. So if the rocket is flying along nice-and-stable, the fins don't have to create any lift forces to straighten out the flight path of the rocket. Hence, the induced drag on the rocket may be near zero. Therefore, it is highly likely that your rocket will have the same induced drag forces no matter what shape fin you use because, typically, a model flies straight and true and the induced drag in the rocket is very, very small.

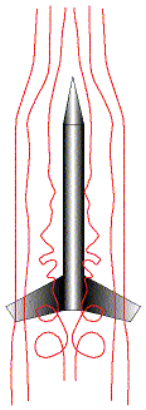
Profile drag on the other hand, is always present. It is a combination of friction drag and pressure drag. The profile drag force is determined by a number of factors, including the surface finish on the fin, airfoil used, area of the fin, the length of the fin chord, and the speed at which the rocket travels. The last two factors are also used with other parameters to determine the Reynolds Number for the rocket.

The Reynolds Number is often used to determine the Coefficient of Lift of the fin at various angle of attacks (AOA). You can see from the figure below, that the higher the Reynolds Number, the higher the fins Coefficient of Lift. Therefore, it will be more efficient at creating a restoring force to correct the path of a rocket.


So if your rocket is flying slow, and has very small fins, the Reynolds number might be so low that the fin will be very ineffective (because the Coefficient of Lift will be smaller). And if your rocket starts to stray from a vertical path, the model will cant much further

over before the AOA is high enough to force a larger Coefficient of Lift. This will then start to bring the rocket back to vertical, but now the induced drag really starts to increase as does profile drag; because the side of the rocket is exposed to the airflow. This makes it highly desirable to have a fin that has a high Coefficient of Lift, so the model quickly restores to the correct flight path when the AOA is still small.

If you look around for data, you will find that the Coefficient of Lift is determined by the airfoil of the fin, not its shape. We will now see that the wrong shape can make the situation even worse.

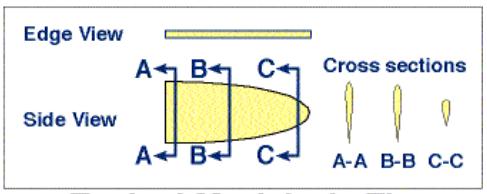


The tips are the most effective portion of the fin, because they are in the least turbulent airflow.

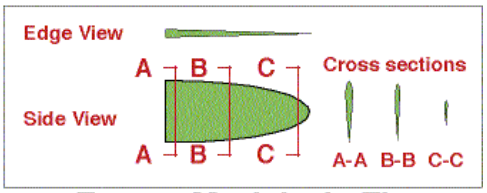
The most efficient part of the fin is at the tips; where the airflow is nice and smooth because it is outside the turbulence caused by air flowing over the nose of the rocket. On elliptical fins, and on other shapes where the tip is reduced because of tapering, the Reynolds Number is even further reduced—remember that Reynolds Number is a function of the chord length of the fin. So, because the Reynolds Number at the tip is lower, the tip is less effective at creating lift to restore the rocket to vertical if it should be disturbed. To compensate for this, you'll have to increase the size of the fin, which defeats the purpose of trying to make the model as small as possible to help reduce both weight and profile drag.

Another problem associated with tapered fin shapes is that the airfoil shape typically changes too. Why is this? Because the thickness as a percent of the chord length increases, unless the fin thickness get progressively thinner toward the tip of the fin. Even people that sand an airfoil into the fin rarely make the tips thin compared to the root to keep a constant airfoil. This is because they are already starting with a thin fin, and it would be difficult and time consuming to sand the fin so thin that you could see through it. Well, this fatter airfoil makes the problem associated with low Reynolds Numbers worse! The tip of the fin is even less effective at creating a restoring force if it should become disturbed.

So we now see that the elliptical fin or the highly tapered fin may not be the optimum for lowest drag. These fins will require the model be further deflected before the forces acting on the fins are large enough to cause them to be effective in straightening out the flight of the rocket. And while the rocket is deflected, the nose and body tube are presenting a lot of side area to the on-rushing airflow; so the drag can be huge.



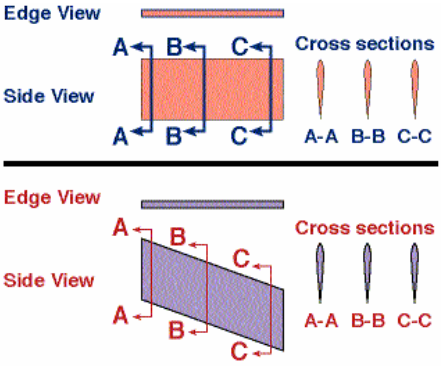

**Typical Modeler's Fin**



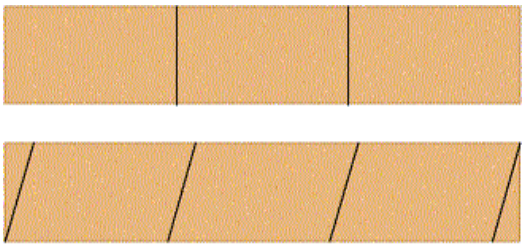

**Expert Modeler's Fin**

It would be better to use a shape that is more effective at low Reynolds Numbers, and that is easy to make without the hassle of thinning the thickness of the fin toward the tip. The better solution would seem to indicate that a rectangular or parallelogram would yield lower overall drag.

And there is a huge advantage to the rectangular shaped fin; you can cut and sand one long strip of balsa wood. Then you can just section it into the individual fins. All the fins now have the identical airfoil shape! This helps reduce the drag forces on a fin that might otherwise be non-identical with the others on the model.

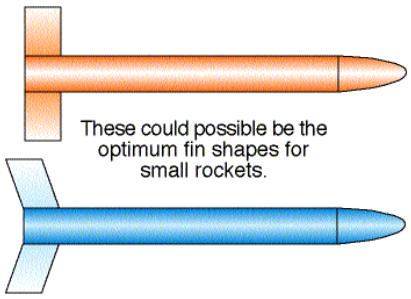



**Two Fin Shapes for Competition Rockets**



**Creating identical fins is easy because you can sand the airfoil into all the fins at the same time before cutting them apart.**

There you have it. The best shape for a small competition model is a rectangle or the parallelogram. And it just happens to be the easiest fin to make!




References:

"Problems Reduce Benefits of Elliptical Fins" By Bob Parks. Journal of the International Spacemodeling Society. September 1993 (Volume 1, Number 5). pg 4.

## Suggestions for Winterfest

By Greg Elder

If Winterfest will be your first NAR contest, you may be wondering what rockets would be suitable to fly in each event. I will present some options here to get you thinking about these events. This is not an all inclusive list. By talking to other competitors and researching other available resources, you should be able to generate other ideas for rockets for these events. Please refer to the Nov-Dec COS-Rocketeer for details about each event.

***Open Spot Landing***

This is probably the easiest event but also offers the most where luck can be a major factor. The idea is to land a rocket closest to a spot (target) designated by the contest director. The rocket landing closest to the spot wins. The distance is measured from the spot to the tip of the rocket's nose cone. Any rocket and any certified motor may be used. In addition, any recovery system may be used (parachute or streamer). You'll need to take into consideration the direction and speed of the wind and angle the launch rod appropriately. I've seen people use Estes Alphas and Big Berthas, Quest Falcons, and various other kits. It's good to have a general idea how far the rocket you plan to use will fly on different motors. You will not know how far the spot will be from the launch pads until the day of the contest.

***1/4A Streamer Duration***

This is the second easiest event. Everyone will have to use Estes 1/4A3-3T motors for this streamer duration. Your best bet is to use a minimum diameter rocket—BT-5 (13mm) body tube. Estes does offer some kits that could be used to get qualified flights. The Mighty Mites line of rockets will work; however, the timers could have a hard time seeing these little rockets. (If they can't be seen, they can't be timed.) The Gnome may be another candidate but it probably weights too much. Your best choice would be to use a streamer duration kit from Qualified Competition Rockets (QCR) or Aerospace Specialty Products (ASP), or to scratch build your own (which is quite easy for this event).

If scratch building a streamer duration rocket, use about a 10" length of BT-5 body tube. Use a lightweight nose cone, such as a balsa cone from Apogee Components or a plastic vacuum formed nose cone from Pratt Hobbies. Make the fins from 1/16" balsa—3 fins in a trapezoidal shape. Use kevlar for the shock cord. Attach the shock cord on the outside of the rocket—glued with a small amount of epoxy between a fin and the body tube joint. In this manner, the rocket will descend hanging horizontally from the streamer, thus, having more drag (and hopefully, a longer duration time). Use a small 1/8" diameter launch lug, unless you plan to launch from a tower. For the streamer, use a 4" X 40" piece of crepe paper, mylar, or mica film (best choice, in my opinion).

***1/4A SuperRoc Duration***

This is the third easiest event. Again, Estes 1/4A3-3T motors will have to be used by everyone. The only company I know of that produces a SuperRoc kit is QCR. However, as with the 1/4A Streamer Duration event, you can very easily scratch build a SuperRoc. The basic design is the same as the 1/4A Streamer Duration model—BT-5 body tube, lightweight nose cone, etc. The two exceptions here are the length and the use of a parachute. The overall length of the rocket must be from a minimum of 25cm to a maximum of 50cm. I suggest that you take into account the length of the nose cone, plus how far the motor will extend from the back of the rocket, and use a length of BT-5 body tube to achieve an overall length of 50cm. Make a 15" parachute from either a plastic dry cleaner bag (it's very thin) or thin mylar. If the parachute material you use is too thick, you may not be able to pack a 15" 'chute into the rocket. In this case, you may need to reduce the parachute size to 12".

***B Eggloft Duration***

For this event, your motor choices are Estes B6 and Apogee B7 motors. Both QC, ASP, and Custom sell eggloft kits. I prefer the ASP kit myself, as it uses an aerodynamic shroud for the body. Custom's Elite has an egg capsule and can be used for egglofting. A big parachute will be a tight fit in the Elite but you can always modify it. If you want to scratch build an egglofter, you can purchase egg capsules from Pratt Hobbies or Apogee Components. In addition, you could use a plastic Easter egg for the capsule. Just glue a tube coupler to the bottom of the Easter egg so you can put it into the body tube. Use either a BT-20 body tube (not much room for a parachute) or a BT-50 body tube (you would be able to put a larger parachute in here). Due to the size of the egg capsule, you'll need to have your launch lugs glued to a stand-off. Make as large of a parachute as you think you can pack in the body tube—24" at least. Some people have been known to pack 40" mylar 'chutes into a BT-50. You want your rocket to stay aloft as long as possible and also ensure the egg returns unbroken. When packing the egg, place it in a plastic baggie. In case the egg breaks, the baggie should contain all the egg "goo". You can also add some foam rubber around the egg for additional protection.

***1/4A Boost Glider Duration***

This may be the hardest of the events. (It's close with the eggloft duration.) QCR sells a 1/4A boost glider kit. Also, Edmond's Aerospace Deltie is a good boost glider that is easy to build. Unfortunately, it is probably too heavy for a 1/4A motor. You could scale down the Deltie, however—perhaps build one that is 2/3 the size of the original. In addition, you can build a 1/4A boost glider using the plans in this newsletter. If you build the Eiger 25, you will need to add a pop-pod. Here are some boost glider rules that Wolf sent me along with the plans:

Rules:

1. Build with light-weight components! Light C-grain balsa for the wings! The Estes 1/4A3-3 motor demands it.
2. Glue joints must be a perfect fit before gluing! Use aliphatic resin glue (ala Titebond) and be sparing with it. As long as the parts fit together precisely, with no gaps, you won't need much glue. Double-glue joints and fillet for supreme strength.
3. I don't recommend tissuing the flying surfaces. At these low Reynold's Numbers, a rough finish (fine sanded balsa) is better than a smooth finish (from Jap tissue) because a rougher finish encourages turbulent flow across the wing surface. This is good for these tiny gliders!
4. Trim, trim, and trim some more! If you can give your 1/4A glider a toss, and it floats away from you 50 -100 feet, you've done well. The 20-25 foot figure you might read in the literature is for larger models. Tip - rather than adding nose weight to get a decent glide, build your glider with an extra long fuselage ahead of the wing's leading edge. Simply cut off excess until the glide is right.

That's it, off the top of my head. Good luck....

Wolf

Don't forget Winterfest—January 5, 2002 at the Sky View launch site. Give competition rocketry a try. The events are:

Open Spot Landing
1/4A Streamer Duration
1/4A Super-Roc Duration
1/4A Boost Glider Duration
B Eggloft Duration

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