

# Competition Rocketry: The Art of

# DUAL EGGLOFTING

by Dan Wolf

The dual egglofting event: Anyone who has been to a contest where it was flown will have a story or two to tell (I have more than a few). It's one of the events that keeps competition rocketry interesting. The object of the dual egglofting events is to carry two grade A large eggs in a model rocket without breaking them. There are both altitude and duration versions of dual egglofting and engine classes from C to G.

Dual egglofting is also an event with a colorful history. It was originally introduced back in the early 70s as an altitude-only event. Most competitors used the techniques and methods that they used in other competition events (the typical model rocket construction methods common at the time). These methods did not work well with the weight of two eggs and their container, however. All too often, the recovery system in the rocket was not strong enough to handle the weight of the eggs and the egg capsule. There were many broken shock cords and stripped chutes. The parachutes and shock cords in modified or "kitbashed" Estes Scramblers could not handle the stress at ejection with two eggs in the payload compartment (especially if ejection occurred too early or too late).

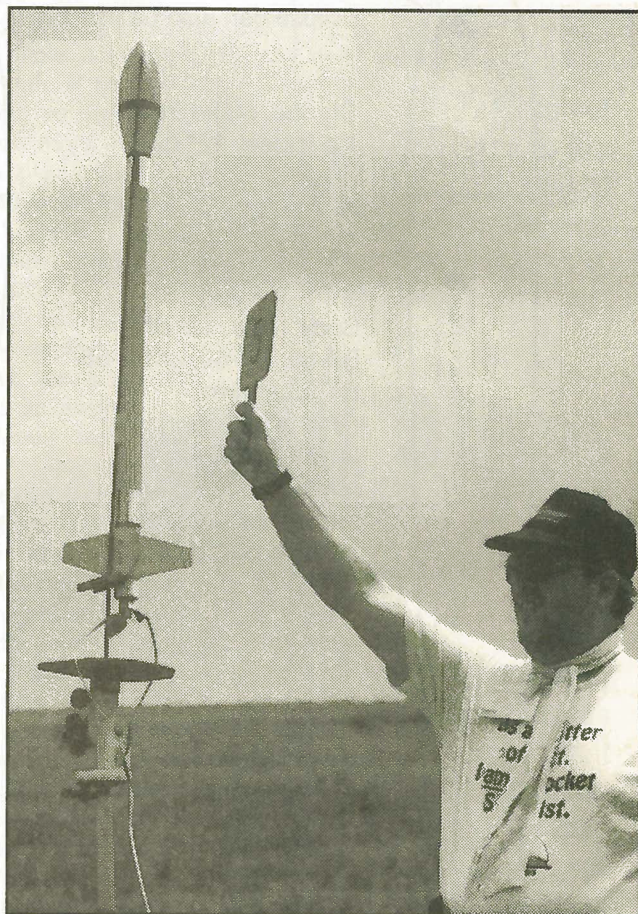
Attempts to use higher performance models based on the CMR egg capsules were not significantly better, as again, stripped chutes and broken shock cords were all too common. Due to many unsuccessful flights and the danger presented by egg capsules ballistically

streamlining in from above, the event was dropped from the Pink Book in 1980.

Those of you who flew the event "back then" will recall these types of failures. Here's a couple of incidents that come to mind from my brief experience of flying the event from 1977 until 1980. One afternoon at NARAM-21 (the last NARAM where DEL was flown before being dropped) my brother and I were standing about 30 yards from the rangehead. We were watching the flights (having "DQ-ed" our flights earlier in the day). All of a sudden we heard a WIZZ-THUNK

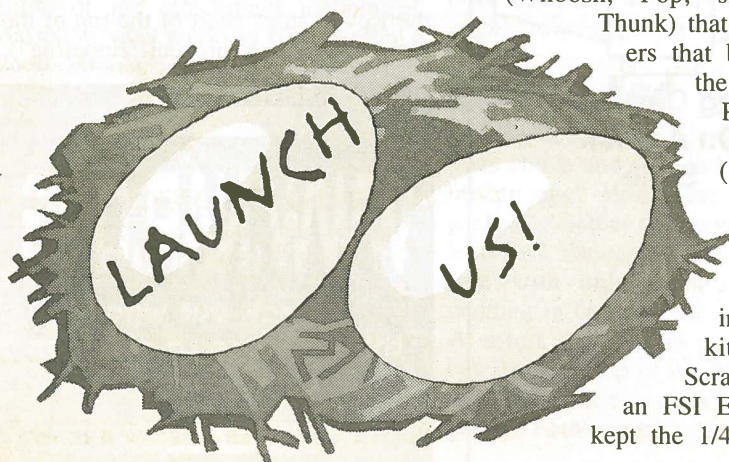
behind us. We turned around and there, about 20 feet behind us, a CMR dual egg capsule, with nothing else attached, had planted itself into the ground. Apparently, the attachment string had broken loose or pulled away from the CMR capsule. The capsule had come down ballistically. We both shuddered to think what might have happened if we had been standing on the spot where it had hit! It was this kind of flight (Whoosh, Pop, silence, Wizz, Thunk) that led the "powers that be" to remove the event from the Pink Book.

I also (regrettably) recall my first attempt at DEL at a meet in Ft. Wayne in 1977. I had kitbashed a Scrambler to take an FSI E60, but I had kept the 1/4 rubber shock

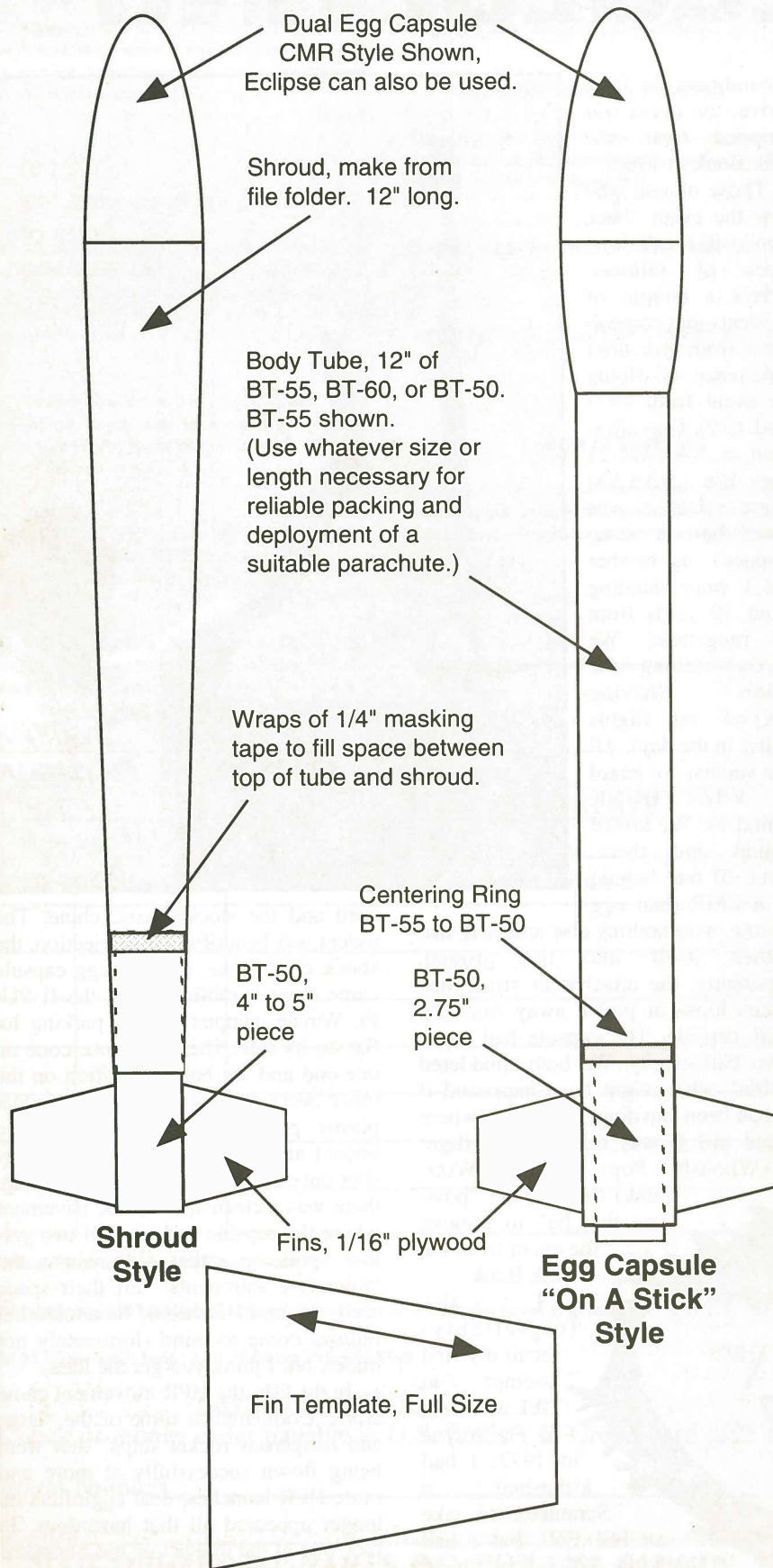


cord and the stock plastic chute. The ascent was beautiful, but at ejection, the shock cord broke, and the egg capsule came down tumbling. It hit the IUPU-Ft. Wayne campus asphalt parking lot flat on its side. The balsa nose cone on one end and the balsa transition on the other were both blown off the clear plastic payload compartment by the impact and the scrambled yellow eggs shot out each end. When I picked it up, there was a clean spot on the pavement where the capsule had hit, and two yellow spots on either side where the "miniature astronauts" left their space craft (in rapid fashion). Several other failures come to mind (fortunately not mine), but I think you get the idea.

In the 80s, the HPR movement came along. Compared to some of the "large and dangerous rocket ships" that were being flown successfully at more and more HPR launches, dual egglofters no longer appeared all that hazardous. In fact, one of the things that has benefited dual egglofting is the general knowl-



# E Dual Eggloft "Plan-ettes"



edge of, and exposure to, techniques and materials that create stronger and more reliable recovery systems that were brought about by HPR. The 1990 Pink Book brought the return of Dual Egglofting Altitude. A few years later, Dual Eggloft Duration was added for your enjoyment.

In spite of these changes, dual egglofting remains a difficult event to master. Even with our current technology, I still consider this event to be an art rather than a science. As such, don't get discouraged if you do everything "right" and still DQ. It's the nature of the event and it is part of what makes it fun.

While watching F Dual Eggloft Duration being flown at NARAM-38, I saw many competitors make the same mistakes. It occurred to me that what was needed was an article to bring up some of the common mistakes and failure modes that occur in dual egglofting, and how to avoid them. So here they are:

## Shock Cord Failure

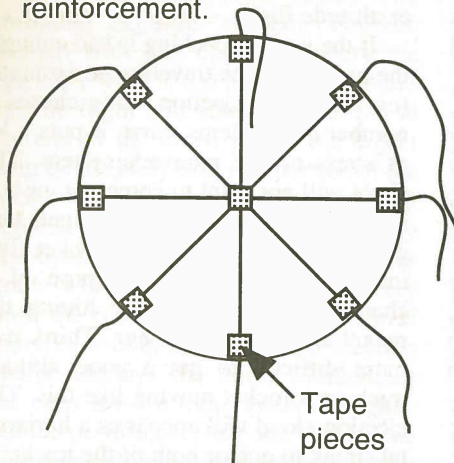
Even Estes finally quit shipping kits with 1/8" and 1/4" rubber shock cords. Dual egglofters need a strong cord. I've seen competitors use 1/4" flat sewing elastic and it is a good strong choice. You often see it in HPR kits (included in many LOC kits, like the Graduator, LOC IV, etc.) that weigh more than twice what a dual egglofter weighs, so you know they can handle the stress. But they are rather bulky and require a larger model.

I've had good luck with the heavy round sewing elastic (1/8"), but I usually double it up for dual egglofting. On many egglofters I will use a double section of round sewing elastic along with 100-pound Kevlar. The Kevlar attaches to the inside wall of the body tube or to the motor mount, with the elastic section attached to the capsule. For length, the Kevlar stops short of the top of the body tube (to help prevent "zippering"),

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and the elastic I usually make 2 to 4 feet long, depending upon the size of the rocket and how paranoid I am. (An example of the event being an art, not rocket science?) For altitude, the egg capsule can also be recovered separately with a separate chute.

## Shock Cord Attachment Failure

It's easy on a CMR-style capsule for the shock cord attachment to give way. Drill small holes in the bottom of the capsule and bring the elastic shock cord through them for a more reliable mounting technique.

The same goes for the new Estes Scrambler II egg capsule as well. The part of the shock cord that mounts to the body tube should be secure as well. I have used Kevlar attached to the motor mount, but I have also had this fail (burn through on a D21 after only two flights). Stainless steel leader attached to the motor mount is another good alternative.

If you've built some HPR models, you can probably begin to recognize some of the attachment techniques. Basically, what works in HPR is often a good choice for dual egglofters if weight and bulk are not a problem.

## Chute Failure

This is still seen way too often at meets. I recall a recent meet where a contestant used the stock Estes chute in an Estes Scrambler II and after a beautiful flight, the chute stripped clean away at ejection.

Nylon chutes are reliable and offer the advantage of opening up, even in cold weather. But nylon chutes tend to

be bulky and hard to fit in small body tubes.

A good alternative is "over-the-top" shroud lines on plastic chutes. With this technique, each shroud line is 3 to 4 times the diameter of the chute in length. The shroud lines are then attached so that the shroud lines go up and over the chute. A chute made this way, with 8 to 16 shroud lines, is very strong and takes up only slightly more space than a conventional plastic chute.

Another alternative are parachutes sold by Sentell. They make a line of chutes called "thin mill" chutes that are a thin nylon, with thin shroud lines. They can be packed into smaller body tubes and are fairly strong, but weigh quite a bit more than the over-the-top shroud line plastic or mylar chutes.

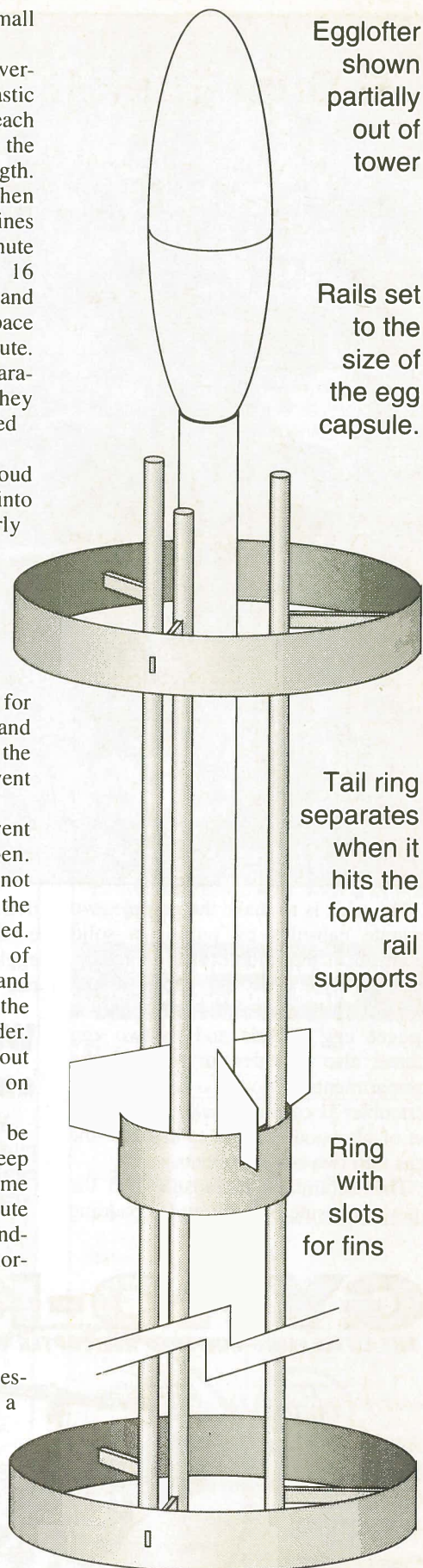
At some contests, the check-in person may ask to inspect your recovery system. This is done to help prevent this type of failure. It is for both the safety of the contestants and observers as well as for the good of the contestant if this is done. It can prevent chute and shock cord failures.

Another chute problem in this event is when they refuse to open. Occasionally, a plastic chute may not open, in spite of the speed at which the egglofter is falling with it closed. Shrouded egglofters require lots of wadding as it's easy for the gasses and ejection particles to get around the wadding as the shroud gets wider. Consider making a chute protector out of a piece of wadding. Don't skimp on wadding either.

Plastic or mylar chutes can also be coated with talcum powder to keep them from sticking. I like to put some powder in a plastic bag, throw the chute in and shake it around (ala "shake-and-bake chicken") to get the chute thoroughly impregnated with powder.

## Broken Egg

So you followed all of the suggestions above and still ended up with a broken egg? How were the eggs packed? Another common mistake is to pack the eggs in the egg capsule with only foam or other padding in between the two eggs. At liftoff, the g forces push the top egg down on top of the bottom egg and one of the two eggs loses (usually the bottom egg).



Egglofter shown partially out of tower

Rails set to the size of the egg capsule.

Tail ring separates when it hits the forward rail supports

Ring with slots for fins

Method for centering rear end of egglofter in launch tower.



The trick is to make the capsule two separate capsules by putting a solid bulkhead in the middle of the capsule. The new style CMR egg capsules sold by Pratt Hobbies do this for you. The Apogee egg capsule and its two egg adapter also provides for separate egg compartments. If you're using the Estes Scrambler II capsule, make a bulkhead out of plywood or balsa to separate the eggs into two compartments.

The Scrambler II capsule and the Apogee capsule both allow for padding

to be placed all the way around the egg. My current favorite material for this is polyester fill material for pillows.

The CMR capsule, being smaller in diameter, is usually a better performer. The drawback is that there is no room for any padding around the egg, just on the ends. This is not a problem if the capsule lands on its end, which is usually the case. Sometimes however, at ejection, the capsule may swing around and hit the body tube on the side, breaking an egg. The chance of this happening can be minimized by using a long shock cord and attaching the chute to it at a point so that when the model hangs below the chute, the capsule hangs above the body tube. Another alterna-

tive is to use separate chutes and shock cords for altitude models. Note that in eggloft duration the model cannot separate into pieces.

## Weathercocking and Tip-off

With 4 ounces of eggs in the nose, plus the weight of the capsule, dual egglofters are heavy and prone to weathercocking. If it is a windy launch,

consider angling the launcher away from the wind (downwind). The result will be a more vertical boost and a higher altitude flight.

If the weathercocking is bad enough, the model may be traveling horizontally (or worse) at ejection. This causes a number of problems. First, it puts a lot of stress on the recovery system. The chute will not want to come out, or if it does come out, it immediately gets tangled with the rocket as the rocket flies into it. Second, there is more of a chance of the egg capsule hitting the rocket and breaking an egg. Third, it is more difficult to get a good altitude track on a rocket moving like this. The ejection cloud will appear as a horizontal streak to one or both of the trackers.

A related problem is tower tip-off. It is not uncommon to see a dual egglofter flown out of a tower leave the tower at an angle far from vertical. This often occurs on shrouded egglofters. The tail end of the egglofter has some degree of freedom to move around because it is a smaller diameter than the egg capsule.

Tip-off can also occur because the tower may simply be too short. Once the egg capsule clears the tower rails, the rocket is not constrained. The effective length of the tower is the distance from where the egg capsule is at ignition to the top of the tower. If a 3 foot tower is used, this distance may only be a foot or less. Thus the rocket isn't going quite fast enough yet and the wind that hits the rocket as it leaves the tower is more likely to affect the flight path.

One solution to this problem is to use fixed launch lugs, one mounted on the capsule another mounted on a fin, or one on the fin and another on a standoff. If 1/4" lugs are used, the rocket could be flown off of a 4-foot rod. The lug(s) on the fin (and body) will provide guidance for the first four feet of the flight versus one or two feet. This can make a big difference in the flight path.

Another option, while still using a tower, is to use a tail cone ring that slips over the fins. The ring is designed to pop off of the rocket as the fins clear the tower, by either tying a string to it and fastening it to the tower or by some other means.

A longer tower will help as well. If the winds are strong (15 to 20 mph) consider a higher thrust motor. For example, a popular motor for E Dual is the E15, but an E30 might be a better choice on a windy day.

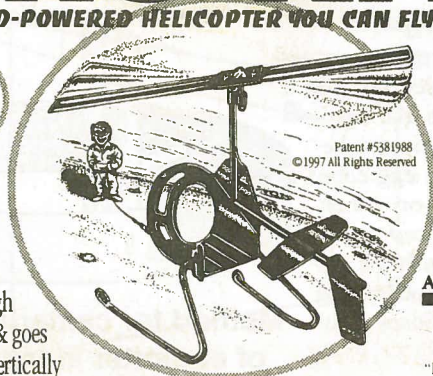
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## Drag Separation

Drag Separation often occurs with shrouded egglofter designs, but can happen with any egglofter where the egg capsule fit is too loose on the rocket. The flight will start out fine, but at the end of the thrust phase, the higher drag on the body-and-fins portion of the rocket will cause it to pull away (drag separate) from the heavier and more aerodynamic egg capsule. You never know what happens next. At the very best, the rocket will continue to travel more or less upward until the ejection charge deploys the chute. Sometimes the eggs survive these kinds of flights, but the performance is poor. Worst case is a stripped chute, broken eggs, and a DQ.

To prevent drag separation make sure the egg capsule is snug on the body tube, but not too tight. Another example of this event being more art than science. Sometimes it's hard to get those egg capsules to fit snug on shrouded egglofters. In this case, a couple of pieces of Scotch Magic tape can be used to hold the egg capsule on. Put a couple of pieces running vertically along the capsule/shroud joint, 180 degrees apart. Scotch Magic tape is used because it will hold the two together at thrust burn out, but break away at ejection.

## Dual Egglofter Designs

Designs for dual egglofting vary depending upon whether the event is duration or altitude, and depending on the engine size. Shrouded designs like the popular Apogee/Eclipse Streamliner kits are good, particularly for the lower impulse classes (C, D, E).

For C, the model must be built as light as possible. For larger engine class duration, "kitbashes" of some HPR kits is popular. For example, for NARAM-38 I flew an Apogee dual egg capsule on the bottom portion of an AeroTech Arreaux kit and managed to take 4th place.

A "stock" Arreaux kit can be used for G Dual Eggloft with the eggs placed in the upper payload compartment. But the kit weighs too much to do this for F Dual Eggloft and still meet the maximum recommended liftoff weight of most F motors.

Another popular kitbash target for F & G DEL is the Mustang. Some of the top performers at NARAM-38 in F Dual Eggloft duration were no nonsense 3-fins-and-body-tube, with a CMR egg

capsule on top. Jon Rains took top honors in C division flying this type of model.

In general, lightweight, nicely finished, shrouded or straight body tube designs are needed to do well in the dual eggloft altitude events. Do the high disqualification rate however, it's always a good idea to have a more draggy, but also more reliable, design as a back up (more room for a chute, stronger chute, stronger but bulkier shock cord, etc.). If the high performer doesn't work out, there is still a chance for a high place at most meets with your "qualifier" rocket.

For duration, the usual "it's not what you fly, but when you fly" often applies. I've seen Estes Scrambler II kits thermal away in D Dual Egglofting. In the higher impulse classes, a heavier but more reliable model, perhaps with a bigger chute, seems to work just fine.

### Manufacturers mentioned in this article:

Apogee Components  
1431 Territory Trail  
Colorado Springs, CO 80919-3323  
(719) 548-5075

Eclipse Components  
570 Buckeye Dr.  
Colorado Springs, CO 80919-1212  
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