

# APOGEE

## PEAK OF FLIGHT

### NEWSLETTER

## Altitude Flying Strategies

By Tim Van Milligan

Last weekend, our local rocket club had a tune-up contest for NARAM. Besides getting logistics worked out, we wanted our local club members to get the feel for flying some of the events that are coming up at NARAM later in July.

I volunteered for tracking duty, so I got my chance to see what types of models and strategies were working best for people. While this article covers the events at NARAM-2000, I'll try to make it generic enough to have crossover to flying any altitude competition (or record attempt).

In NAR altitude events, the height of your rocket is determined by angular measurements made by people assigned as trackers. They use two-axis theodolites to take elevation and azimuth angles. Knowing these angles, and the distance between tracking stations, the altitude of the model can be determined with good accuracy.

Basically, this whole article can be summed up in a simple phrase: "Please be kind to the trackers."

The key to getting your model tracked is to make sure it can be seen clearly and easily by the people doing the altitude tracking. Unfortunately, most modelers don't realize this, and seem to do everything possible to make it hard for the trackers to see the model in the sky.

Here is what the novice modeler does: First, he builds his model as tiny as possible, and then leaves it unfinished, and bare in color (so that it is as light as possible). Also, to save weight, he doesn't put any tracking powder in the the rocket. What happens is that the model does fly to great heights, but since the trackers can't see it, the result of his efforts is a "Track Lost." This means, the trackers couldn't find the model in the sky.

The expert modeler is different. He knows that getting tracked is 90% of the contest. He's going to do everything he can to increase the odds of that happening.

### Here are my suggestions:

1. Prepare and Practice. You must show up at the launch with models that you know the flying characteristics of. For example, does your super-roc wobble around in the sky? You can't know this unless you fly it before the contest. Will your cluster-motor model fly straight if all the motors don't ignite?

2. Build back-up models to compensate if the flying conditions are poor. Most modelers will show up with a single high-performance model, and use a high performance rocket motor. But if conditions are poor, the modeler will never get tracked. But a big clunky model will be easily seen.

3. Use tracking powder. This is a powdery substance like ground chalk or tempra paint, that is inserted into the model. When the ejection charge of the motor deploys, it pushes the powder out, and makes a big target in the sky for the trackers to see. Have two colors in your range box: red and black. Red will be your primary color, but sometimes the sky conditions will make it easier to see black.

Don't just pour the tracking powder into the tube. This will clog the tube, and you'll have a recovery device failure. The model will streamline into the ground. To do it right, make a pouch out of stiff tissue paper (like the Quest recovery wadding). Roll the tissue around a dowel that fits loosely into the tube. Slide the roll partly off the dowel, and fold the sides in, so that you seal off one end of the roll. Then pull the roll off the rest of the dowel, and fill it with tracking powder. Don't seal off the top end; leave it open so that the powder will spill out easily at ejection. Then slide this pouch into the tube. It must slide easily, or it may not eject from the rocket.

Also, use a big streamer. If by chance your tracking powder isn't seen by the trackers, a lot of times, the streamer will be.

4. Make sure you use a launcher with sufficient length. Typically, your 3 foot launch rod or tower is about 3 feet too short. You'll want to read Ed LaBudde's R&D report "A Design Procedure for Maximizing Altitude Performance" on the



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Apogee web site at: <http://www.apogeerockets.com/software/Naram99.pdf>. In this report, he makes a good case for getting the rocket up to a high velocity so that the model won't stray from verticle. You don't want the model to go flying over the heads of the tracking people, because this makes getting a good track harder, and you loose altitude.

5. Test, Test, Test your igniters. This year is going to be particularly frustrating for modelers that just show up and expect everything to work. The D3 motor (which will be a good choice for D-Super-roc altitude), is difficult to ignite due to the small nozzle size. Most modelers are going to go through five or six igniters before finally achieving success. It may take well over an hour of trying before you get a single flight off. But this can be eliminated by testing your launch techniques, and making back-up plans for this type of situation. If all the competitors are having lots of misfires, they will be using up a lot of the spare time to get off flights later in the day. You may not get a second flight off because of igniter problems. Be prepared.

6. Fly your clunky model first. Get a successful track early in the day. If the launch rate bogs down, you may not get a chance for a second flight. Your one good flight might be enough to get you lots of contest points.

7. Paint or color your model. Even though Colorado has some of the best tracking conditions in the country (clear skys, low humidity, and low pollution), it is still going to be difficult to track these models at NARAM. At around noon time, puffy cumulus clouds begin to form, and this changes the track-

ing conditions. The nice column of tracking smoke that makes it easy to track early in the day is going to blend in with the clouds. The only way to see the rocket is if it has contrast against the clouds. Use a couple of different colors on the rocket, like red and black. These show up a lot better against the clouds than unpainted white tubes.

Also, the D3 motor has almost zero smoke. Trackers are only going to see the model, not any smoke.

The cluster-motor event is also going to be a challenge for trackers. Since motors may not ignite, they will probably stray from verticle. It is always much harder to spot and track a model that doesn't go straight up. So build the fins a bit bigger to try to compensate.

Again, 90% of the the effort in altitude events should be aimed at getting a good track. If you do get the first model tracked, then, and only then, should you go all out and use your high performance model.

#### **About the Author:**

Tim Van Milligan is the owner of Apogee Components (<http://www.apogeerockets.com>) and the curator of the rocketry education web site: <http://www.apogeerockets.com/education>. He is also the author of the books: "*Model Rocket Design and Construction*," "*69 Simple Science Fair Projects with Model Rockets: Aeronautics*" and publisher of the FREE e-zine newsletter about model rockets. You can subscribe to the e-zine at the Apogee Components web site, or sending an email to: [ezine@apogeerockets.com](mailto:ezine@apogeerockets.com) with "SUBSCRIBE" as the subject line of the message.

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