

# PEAK OF FLIGHT

NEWSLETTER

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# PEAK OF FLIGHT

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## NARTREK Achievement

By Tim Van Milligan

How do you prove to others that you're a rocketry expert? When I worked at Cape Canaveral in the early 1990's we had a term for such a person: a steely-eyed missile man. If you're under 18, how do you earn the respect of people that have been in rocketry for years and years? The answer to these questions is a program from the National Association of Rocketry called "NARTREK."

NARTREK is an acronym that stands for 'National Association of Rocketry Training Rocketeers for Experience and Knowledge.' It consists of a series of achievement levels in rocketry, much like a model rocket competition. You are given a few simple missions, and your objective is to complete them. The cool thing is that there is no time limit, so you get to progress on your own schedule.

There are actually two different versions of NARTREK. There is the standard version called the "Skills program", and then the "Cadet program." The difference is that the Cadet program is geared toward younger modelers - under the age of 18. The other difference is that you don't even have to be a NAR member to participate in the Cadet program, although there is an entry fee.

Both the NARTREK Skills program and the Cadet program have multiple difficulty levels, and you start at the basic level and work your way up.

In the standard NARTREK Skills program, the three different levels are called: Bronze, Silver and Gold. The Cadet program names its achievement levels as: Mercury, Gemini, Apollo and Skylab.

I thought I'd give you my suggestions on the NARTREK Cadet program for younger modelers, so that if you want to achieve them, you'll have the right materials to get you through it quickly.

### **NARTREK Mercury Achievement Level**

In the Mercury level, you have to achieve two missions. For the first mission you get a choice. You have to pick either:

- Fly and successfully recover an RTF (ready-to-fly) rocket two times, and assemble a rocket with single or multi-piece plastic fins and fly it successfully two times.
- Assemble a rocket with balsa (or stiff card stock) fins and fly it successfully two times.

The gist of this first mission is to build up your experience in flying rockets. The harder choice in this first mission is the latter one, which requires you to put together a rocket where you have to glue on the fins one at a time, and those fins have to be either paper or balsa. This is a skill that most of your rockets will have in the future. Wooden fins are lighter in weight than plastic, and allow for greater variability in size and shape.



Figure 1: Apogee Apprentice

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If you're looking for a kit to use in this first mission, we at Apogee Components do not have a ready-to-fly rocket. But you can borrow a model that one of your friends built, and fly it twice. That is perfectly acceptable. Remember, this first level is to get you "flying" experience, not so much "construction" experience. The second part of option A can be flown with a simple to assemble kit with plastic fins, like the Apogee Apprentice (**Figure 1, Page 2** <https://www.apogeerockets.com/Rocket-Kits/Skill-Level-1-Model-Rocket-Kits/Apprentice>).

If you choose the second option (B), and use a rocket with balsa or paper fins, I recommend you start out with what we call a Skill Level 1 rocket. These are simple to build and usually have balsa fins. If you've never built a balsa fin rocket before, or are guiding someone that hasn't, then I'd really recommend a rocket with through-the-wall fin tabs, like the Apogee Research Express (**Figure 2** [https://www.apogeerockets.com/Rocket\\_Kits/Skill\\_Level\\_1\\_Kits/Research\\_Express](https://www.apogeerockets.com/Rocket_Kits/Skill_Level_1_Kits/Research_Express)). The through-the-wall fins are used to make sure that the fins are aligned perfectly straight along the tube, and assures a straight flight.

The second mission you'd have to complete in order to fulfill the requirements of the



Figure 2: Apogee Research Express

Mercury level is to assemble a rocket that is at least 24" long, and fly it successfully two times. This second mission isn't any harder than the first one. The only difference is that the rocket is longer, which actually makes the rocket more stable. You will find it more visually impressive when you launch it, particularly if other people are with you at the launch. Everyone wants to see the bigger ones go.

Because the rocket is bigger, you'll have to pay more attention to your glue joints when you assemble the rocket. You don't want to bust off a fin on landing, because I'm sure that you're harder on your definition of success than spectators. You're the ultimate judge of success though, since NARTREK is a self-guided program. You'll find that there are fewer long rockets with through-the-wall fins, so you'll probably be using surface mounted fins on this rocket. A good choice, if you're looking for a kit, is the Apogee Diamondback rocket (**Figure 3** [https://www.apogeerockets.com/Rocket\\_Kits/Skill\\_Level\\_2\\_Kits/Diamondback\\_Rocket\\_Kit](https://www.apogeerockets.com/Rocket_Kits/Skill_Level_2_Kits/Diamondback_Rocket_Kit)). It is over 30 inches long, and still flies nicely on a C6-3 rocket motor.



Figure 3: Apogee Diamondback

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### NARTREK Gemini Achievement Level

Once you complete the Mercury level in the Cadet program, you can start the Gemini challenges. In this level you have to complete three tasks, but you can choose from four challenges. They are:

- Parachute duration: achieve a timed flight of at least 40 seconds with a "B" motor or smaller.
- Streamer duration: achieve a time flight of at least 20 seconds with a "B" motor or less.
- Assemble a model with glider, or helicopter recovery and fly successfully two times.
- Assemble and fly a "D" engine model successfully.

These challenges start to resemble some of the competition events that other modelers like to participate in. Don't be frightened by them, as they are actually attainable on your first launch. The parachute duration challenge can be done with a rocket like the Apogee Avion (**Figure 4** [https://www.apogeerockets.com/Rocket\\_Kits/Skill\\_Level\\_1\\_Kits/Avion](https://www.apogeerockets.com/Rocket_Kits/Skill_Level_1_Kits/Avion)). It has surface mounted fins and flies to about 525 feet (160 meters) on a B6-4 rocket motor. I can tell you from experience that it can hang in the air for well over a minute on that motor, which easily surpasses the minimum duration.

The challenge of streamer duration is also easily attainable. You can use a small kit like the Apogee Blue Streak (**Figure 5** [https://www.apogeerockets.com/Rocket\\_Kits/Skill\\_Level\\_1\\_Kits/Blue\\_Streak](https://www.apogeerockets.com/Rocket_Kits/Skill_Level_1_Kits/Blue_Streak)), that zooms really high on a "B" size rocket engine. Your rocket will be easily flying to an altitude close to 1000 feet. You want a lot of

altitude on a streamer duration rocket, because they come down a lot faster than those using a parachute.



Figure 4: Apogee Avion



Figure 5: Apogee Blue Streak

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Figure 6: Condor Boost Glider

The third option is probably the hardest of the four in this Gemini level.

While there is no time duration that you have to achieve, you have to build and fly a more complex type of rocket. Both gliders and helicopters are harder to build and fly successfully. If I had to make a recommendation to a young modeler, I'd

suggest that they build a glider first before attempting a helicopter duration rocket. The reason is that helicopters are more complex to build. There are lots of moving parts on a helicopter recovery model.

For an easy to build glider, my first choice would be the Sky "Condor Boost Glider" (Figure 6 [https://www.apogeerockets.com/Rocket\\_Kits/Glider\\_Rockets/Condor\\_Boost\\_Glider](https://www.apogeerockets.com/Rocket_Kits/Glider_Rockets/Condor_Boost_Glider)). It is a model classified as a "Boost Glider." The NAR uses the definition that a Boost type of glider can come down in multiple pieces.

I've seen beginners put together the Condor Boost Glider and set endurance records with it. It is a champion flyer, and I'm sure you'll be impressed with how easy it is to get it to soar like a real glider.

The final option is to build and fly a "D" engine model. This is probably the most popular of the choices, because you've been itching to fly more powerful rocket motors. The choices here for kits are immense. I like to recommend the rockets in the DynaStar brand (<https://www.apogeerockets.com/Dynastar>). I personally like the Sky Torpedo because it is big and easy to build (Figure 7 [https://www.apogeerockets.com/Rocket\\_Kits/Skill\\_Level\\_2\\_Kits/Sky-Torpedo\\_Rocket\\_Kit](https://www.apogeerockets.com/Rocket_Kits/Skill_Level_2_Kits/Sky-Torpedo_Rocket_Kit)).



Figure 7: Sky Torpedo

### NARTREK Apollo Achievement Level

Up next is the Apollo Level in the NARTREK Cadet program. This level is a bit more involved, and like the others levels previously accomplished, it has two parts. The first part is more involved, as it pushes you to be a participant in a rocketry activity besides just building and flying rockets. But you're given a whole bunch of choices. From this list you have to do any two:

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- Prepare a science fair project using model rockets to gather data
- Assist with running a club launch range
- Organize (or assist) in starting a club or serve in some capacity in an existing club
- Organize (or assist in) a demonstration launch or have a story published in a newspaper or newsletter about a launch
- Give a talk on rocketry to a school, civic club or youth group
- Write a 200-word report on any rocketry subject that interests you and submit to the NARTREK base
- Prepare a simple database of your previous rocket flights, (Mercury and Gemini) and document your experiences; submit the report to NARTREK base

As you look over the list, you'll realize that all of these have a heavier time commitment. The Apollo level is where you'll really earn status. It is a big deal from my point of view, and I really admire people that complete the Apollo level in the NARTREK Cadet program. While this program is geared towards younger modelers, in this level the kids are doing adult-level effort. My hat is off to you.

The second part of the Apollo level is a lot of fun too, and is a bit more hands-on with building rockets. Again, you get a choice of what type of rockets you can select and build. From this list, choose to do any two:

- Build a model with individual fins that also requires painting and/or decals. This is sometimes defined as Skill Level 2. Concentrate

- on craftsmanship. Fly and recover successfully, without damage to the model.
- Build and fly a multi-stage model successfully.
- Build and fly a clustered model successfully.

The first option is the easiest of the three choices. By this point, you may have already accomplished decorating a rocket by painting and applying decals. So if you choose this option you should try for a greater level of craftsmanship. For example, you might make it your goal to seal the balsa wood fins so that you can't see any wood grain on the fins. This not only makes a better-looking rocket, but it reduces the drag and allows the model to fly higher. You'll find helpful videos on building a rocket at: [https://www.apogeerockets.com/How-To/Getting\\_Started\\_How\\_to\\_Build\\_a\\_Rocket](https://www.apogeerockets.com/How-To/Getting_Started_How_to_Build_a_Rocket)

Multi-stage rockets are a lot of fun too. They go a lot higher into the sky, and watching a rocket drop a stage in flight is always a thrill. If you're looking for a kit, we're releasing a new easy-to-build kit (that has through-the-wall fin tabs) called the SkyMetra. There are other multi-stage rocket choices too, and you'll find them at:

The final optional task in this level of the NARTREK program is to build and fly a cluster engine rocket. This can be challenging, because it takes more diligence in hooking the rocket up for flight. I recommend using a rocket with just two side-by-side rocket engines. We have a lot of kits on the Apogee web site that are clusters ([https://www.apogeerockets.com/Rocket\\_Kits/Cluster\\_Rockets](https://www.apogeerockets.com/Rocket_Kits/Cluster_Rockets)), and many

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of them are three or more rocket engines. The more engines there are in the cluster, the more difficult the challenge. So staying with just two will be the easiest way to complete this task.

Congratulations if you've completed the tasks in the Apollo level. It is quite an accomplishment, and I'm sure you'll have learned a lot.

### **NARTREK Skylab Achievement Level**

The final level in the NARTREK Cadet program is the Skylab level. The options on this level are to pick two challenges from this list:

- Assemble any skill level scale model, have an adult judge it for quality and accuracy (include information about the full scale 'real' version) and fly successfully.
- Design and build a model rocket using materials specifically designed for use in model rockets. Properly test the design using simulator software or by Swing Test on a String to prove stability, and fly the model successfully two times. (This requirement is limited to D motors or less).
- Build a kit of a mid-power rocket (E or F motor) and fly successfully. (Limited to Cadets 14 and older).
- Build a competition model for any National Association of Rocketry (NAR) event and enter a sanctioned meet, or build one competition model and achieve 40% of the NAR record for that event in your contest class.

The first choice is a scale model, which is a small replica of a real rocket that was launched by professional organizations, such as NASA. You'll find a ton of choices at: [https://www.apogeerockets.com/Rocket\\_Kits/Scale\\_Rockets](https://www.apogeerockets.com/Rocket_Kits/Scale_Rockets). If

you want to make it easy on yourself, pick one that has a lower skill level rating. Scale rockets get harder when they have more detail, and even seasoned modelers are wise to pick something that matches their ability and construction skills. The second choice is to make your own rocket. This is what we all get into rocketry for, which is to make our own dreams and visions come to life in a rocket we created ourselves. I can still remember my first design that I made of my own. It wasn't anything special, but it was special to me. I'm sure you'll have the same sense of accomplishment once you complete this challenge. If you want some help, I'd recommend the book: "Model Rocket Design and Construction" ([https://www.apogeerockets.com/Rocket\\_Books\\_Videos/Books/Model\\_Rocket\\_Design\\_And\\_Construction](https://www.apogeerockets.com/Rocket_Books_Videos/Books/Model_Rocket_Design_And_Construction)). It has a lot of tips to help you make a cool looking rocket that flies well.

If you're at least 14 years old, you can select the third challenge here in the Skylab level. That is to build a rocket that uses an E or F motor. Again, the DynaStar rockets (<https://www.apogeerockets.com/Dynastar>) are a good choice, and something I'd personally recommend.

The last challenge option is to build a rocket designed for a competition. There are many events to choose from, which is the hardest part of this challenge. There are literally hundreds of events. I'd suggest that you go to your local club and ask them if there is an upcoming competition within the club. If there is, then you should participate. And you'll find a lot of help and guidance in your local NAR section. They'll try to get you to enter all of the events in the competition.

If you're not in a club, then you'll look at the NAR records and try to achieve at least 40% of the score that previous modelers have

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reached. Start by going to the records list on the NAR's web site (<http://www.nar.org/contest-flying/records/>) to help you select an event. If you're between 14 and 18 years old, you're in the "B" division of modelers, and those are the records you'd have to beat. So if the B-division record for "A HD" (which means 'A' size rocket motor in Helicopter Duration) is 153 seconds, you'd have to reach 40% of that score. In other words, you'd have to hit 61 seconds with a helicopter duration model that uses an A-size motor.

That completes the Skylab level. By this point, you're in the top echelon of modelers if you complete this level. There are many people that are high-power rocketry certified that haven't accomplished this much in rocketry. While the NARTREK Cadet program is not well known, if you complete it, you are well on your way to being an expert. Be sure to write us here at Apogee and let us know you've completed it. You're the kind of person that we respect!



Figure 8: NARTREK Logo

If you'd like to learn more about the NARTREK Cadet program, please visit: <http://www.nar.org/model-rocket-info/nartek-skills-program/the-nartrek-Cadet-program/>. If you wish to join the NAR, please tell them that I referred you. It is my goal to personally get over 100 people to join a rocketry organization like the NAR or Tripoli.

### About The Author:

*Tim Van Milligan (a.k.a. "Mr. Rocket") is a real rocket scientist who likes helping out other rocketeers. He is an avid rocketry competitor, and is Level 3 high power certified. He is often asked what is the biggest rocket he's ever launched. His answer is that before he started writing articles and books about rocketry, he worked on the Delta II rocket that launched satellites into orbit. He has a B.S. in Aeronautical Engineering from*

*Embry-Riddle Aeronautical University in Daytona Beach, Florida, and has worked toward a M.S. in Space Technology from the Florida Institute of Technology in Melbourne, Florida. Currently, he is the owner of Apogee Components (<http://www.apogeerockets.com>) and also the author of the books: "Model Rocket Design and Construction," "69 Simple Science Fair Projects with Model Rockets: Aeronautics" and publisher of the "Peak-of-Flight" newsletter, a FREE e-zine newsletter about model rockets. You can email him by using the contact form at: <https://www.apogeerockets.com/Contact>.*

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