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NEWSLETTER

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Cover Photo: Sunward Aerospace Screamer rocket kit.
http://www.apogeerockets.com/Rocket_Kits/Skill_Level_3_Kits/Screamer

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Starting a Rocketry Program in Your Civil Air Patrol Squadron

By Nicholas Timpe

Aerospace Education is one-third of the education requirements for the Civil Air Patrol (CAP), and model rocketry is a great way to teach cadets about science and math. It provides a base that you can branch off of to learn about the history of rockets, the space race, and post-cold war advancements in the fields of space travel. I will give you a step-by-step process to start a rocketry program in your home squadron, and a few examples of how to go further than the National Headquarters' prescribed curriculum. Let's get started:

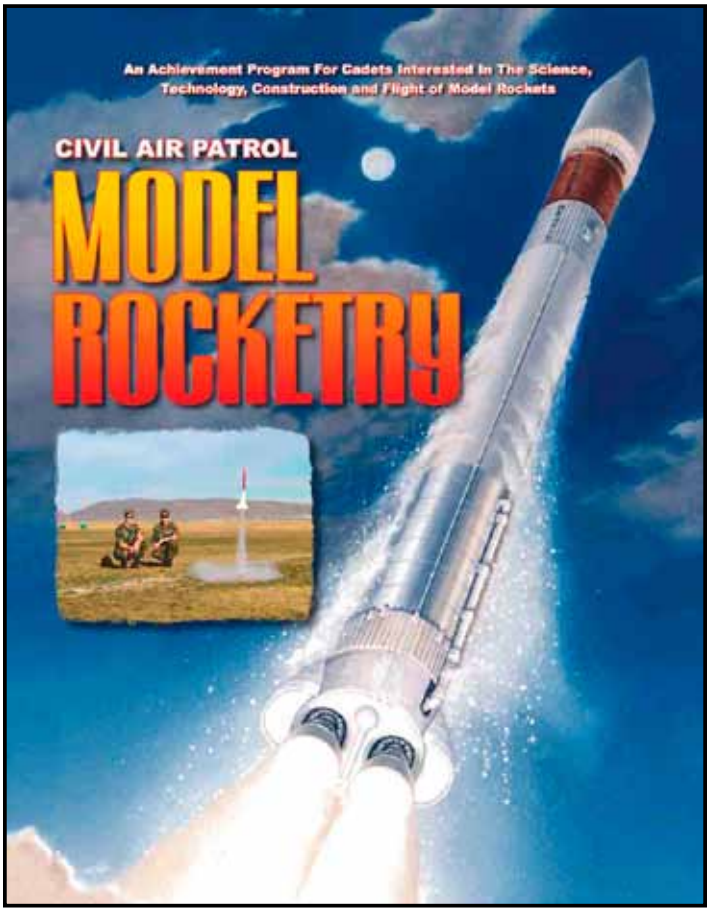
Step 1: Gauge Your Cadets' Interest

The first step to starting a rocketry program in your CAP Squadron is to gauge your cadets' interest. If they are not interested in rocketry at all, then starting a rocketry program will not keep them interested. However, if there is a lot of interest in your home squadron, then starting a rocketry program could boost morale and help to keep cadets engaged.

Sometimes, cadets might not know exactly what a model rocketry program would entail. Some cadets from my squadron thought that we would just be making paper rockets for show, and some thought we would be working with NASA on a future moon rocket. Watching videos of model rocket launches or bringing in examples of rockets can be very helpful for curious cadets. Once their interest is gauged, and you know that they are interested in model rocketry, then you can start implementing your rocketry program.

Step 2: Get Familiar with the CAP Curriculum

Step two is where you actually start making your program. You need to gather supplies and to communicate with cadet staff to find a time to have a class. National Headquarters published a model rocketry textbook, which can be found at www.capmembers.com/aerospace_education/internal_specific/model-rocketry/. There, you can download the whole curriculum or each chapter separately. Each of the three sections of the prescribed curriculum should be completed in order, as each module uses concepts discussed in the previous chapters. Not only has National Headquarters provided hands-on activities for cadets, but also, they have provided written tests to go along with the three sections of the textbook.



The Model Rocketry textbook used by the Civil Air Patrol.

If cadets complete all three chapters of the textbook, then they are authorized to wear the model rocketry badge on their Dress Blue Uniforms.

The written tests range from discussing the fathers of model rocketry, to the science that goes into the black pow-

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der rocket motors. The model rocketry textbook provides study material for these tests, as well as the instructions for hands-on rocketry activities.

You will also have to get materials for the hands-on activities. The materials can be found in the textbook and are fairly inexpensive. For the first phase, or "Redstone," the cadets build a Goddard rocket made of foam tubing, rubber bands, zip ties, and foam board.

For phase two, or "Titan," the cadets need to build two commercial, single stage, solid-fueled model rockets. The first can be any model they choose, and is usually a simple and inexpensive Skill Level 1 rocket kit. The second rocket they build needs to be a scale model of a real rocket. If you need some choices, you can find a large assortment of scale kits on the Apogee web site at: http://www.apogeerockets.com/Rocket_Kits/Scale_Rockets.

For phase three, or "Saturn," the cadets need to build a rocket that is either a two-stager, or a payloader that can take three ounces to at least 300 feet. The Estes Mongoose is a very inexpensive two-stager that can also be picked up at Hobby Lobby, and has plastic fins, so there is no problems with gluing them. Payload-capable rockets, such as the Quest Payloader One, can be found online at Apogee Components (http://www.apogeerockets.com/Rocket_Kits/Skill_Level_1_Kits/Payloader_One_Rocket_Kit). The Quest Payloader One is a simple kit with pre-slotted tubes for easy fin assembly.

You do not necessarily need to get all of the supplies for all phases at the same time, though. If the first phase goes well, than you can invest in some rockets for your cadets, and the squadron or wing can buy them for you. Once you have all of your materials together, then you can continue to step three.

The Goddard rubber band rocket built during the Redstone phase.

Step 3: Teach The Education

Step three is where you start teaching your cadets about model rockets. One night per month can be allotted as aerospace night, so each month your cadets complete one of the phases.

The Redstone phase can easily be completed in one night. It consists of the construction and flight of a Goddard rubber band rocket, and 10-question written test. The textbook says that the Goddard rocket is the best bet for cadets, as it is simple and reliable, and every rocket costs about a penny. The only adhesive that you need is hot glue, which melts the styrofoam body tube's surface and bonds it very well to the fins.

Titan and Saturn are a little harder to complete in a two hour meeting, but you can send your cadets home with their rocket kit so they can finish it there. This way, they

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The pre-launch safety brief is very important. Here, Major Bratton, (far left), pointed out the safety hazards and how to avoid or eliminate them.

will not have to rush their kit construction, and you can use the meeting time to teach cadets about how solid-fueled rockets work, and have them take their written test for Titan and Saturn.

Also, before they launch a solid-fueled rocket, the cadets need to take a safety test. This is a short written test on the NAR safety code, and it is pretty straight forward. After a short Power-Point on the main concepts of the safety code, the cadets should easily complete the test. If you build both of your solid-fueled rockets at the same time, you can get the entire program done in one or two months.

Step 4: Launch Your Rockets!

The fourth step of your rocketry program is to set up a launch time and location. With permission, you can choose anywhere from an empty farm field to a club launch site. Either way, be sure to coordinate times with all of the cadet staff and any necessary senior staff.

Make sure that you follow the NAR Safety code regarding where and when you can launch.

If you are launching on your own, make sure that you have all of the launch materials, such as engines, igniters, a launch pad, and a launch controller. If you are going to attend a pre-set club launch, talk with the people who run the club and make sure that you may bring a group. The NAR's section clubs are very willing to support youth rocketry education, so don't be afraid of contacting them (see: www.nar.org/NARseclist.php). Even if you have just one or two cadets, you still should contact the club. This will ensure CAP keeps a good relationship with the club.

If you are launching on your own, before you let your cadets launch their rockets, give them a quick safety briefing, and do a thorough safety inspection of their rockets. Check the center of gravity, and do your best to estimate the center of pressure. If these are close, then you can do a string test to make sure that they are in fact stable.

Also, check the rockets' motor mount, motor retention

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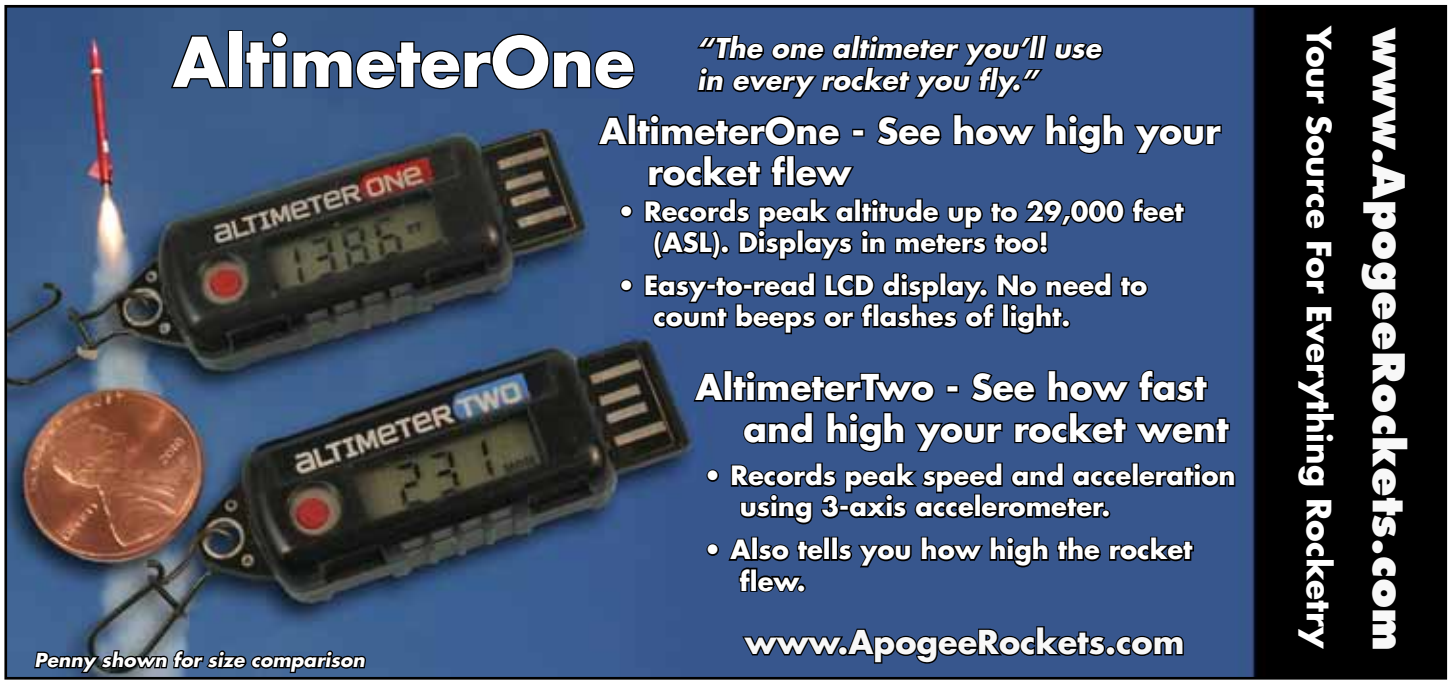

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The launch setup at the squadron's recent launch.

system, parachute, recovery wadding, and shock cord. If something is not done right, then it is much better to have the cadets make the necessary repairs and launch at a later time than to risk them losing their entire rocket and having to build a new one.

If they are launching a payloader for their Saturn launch, make sure that the payload bay is sealed properly. Also make sure that the engine the cadet is planning to use will have enough thrust and an adequate time delay for the weight being launched. For a two stager, check to see if the motors are fastened into their respective stages, and that the stages will not separate prematurely. All of these steps will help to ensure that the launch will be safe, and that the cadets will have the highest chance of recovering their rockets. Once the launch is complete, you can debrief your cadets on what went well, what didn't, and what they learned.

Keep Going!

It is important to know that you do not have to stop at the end of National Headquarters' prescribed rocketry curriculum. If you wish, you can take your cadets into higher stages of amateur rocketry. There are many fundamentals of Mid-Powered Rocketry that can be used to teach cadets about science and aerospace. Here are some examples of classes that you can teach to help advance your cadets in the field of rocketry:

Exploring Aerodynamics

By the time you get to teaching about mid-powered rockets, your cadets should already know about the Center-of-Gravity and the Center-of-Pressure, and how to make a rocket stable. However, they may be interested in what part of the fin is actually working the most to keep the rocket stable, and how to design a rocket with the most effective fin design. Check out http://www.apogeerockets.com/technical_publication_16 for info on this topic.

Add More Pop With Clustering and Staging.

This one is pretty simple. You can allow your cadets to look at the thrust curves of a clustered rocket and a staged rocket, and they can try to figure out which rocket will go the highest. Check out http://www.apogeerockets.com/

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Tech/How_2-Stage_Rockets_Work for staging. Clustering and staging info can be found at www.estesrockets.com/pdf/2845_Classic_Collection_TR-TN.pdf

Designing Their Own Rockets

If you have computers at your squadron, you can use RockSim to allow your students to design their own rocket. (http://www.apogeerockets.com/Rocksim/Rocksim_information) If you want, you can have a competition to see who can make their rocket fly the highest or fastest, or see which one takes the longest to get to apogee. (Coupled with ideas 1 and 2, they can use their new knowledge and put it into a practical application). After you find the winning rocket, you can grab some parts, and have your cadets build it. Building the winning rocket is a great way for your students to gain hands-on experience with rocketry, and turns the class from theoretical to applied rocketry.

Also, having your cadets work together to build a rocket will help build teamwork and leadership skills, such as delegation and time management. Check out the videos at http://www.apogeerockets.com/RockSim/RockSim_Video_Tutorials for help with RockSim.

Advanced Construction Techniques

Advanced construction techniques such as fin tabs, fin fillets, and the use of different adhesives can lead to some very interesting topics. Doing tests as to which adhesive bonds wood, paper tube, different plastics, and fiberglass the best is a great idea for a science-filled meeting.

Taking a simple one-stage rocket and measuring altitude with and without fin tabs can also be a great project. Cadets can work on their building skills by making fin fillets out of glue or epoxy clay. A discussion as to why fin fillets are helpful will increase their understanding of aerodynamics and rocketry, and if they decide to build mid-powered or high-powered rockets on their own, then they will have a greater base understanding of what makes rockets fly the fastest or highest, or what makes rockets the strongest. Check out http://www.apogeerockets.com/Advanced_Construction_Videos for more ideas and information about advanced construction techniques.

Through the four steps above, you can start your own

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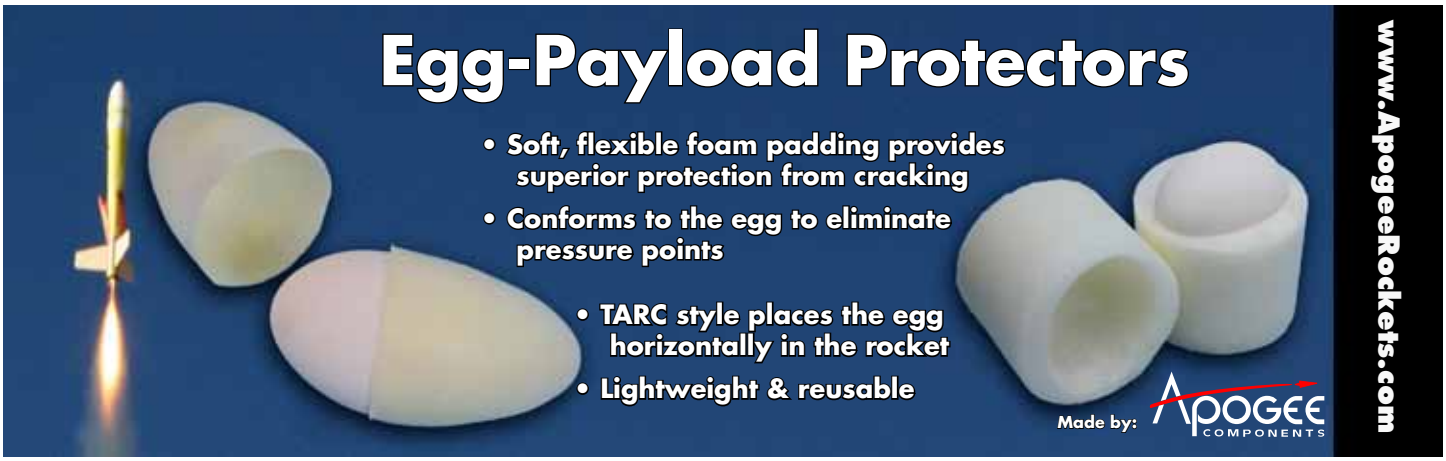

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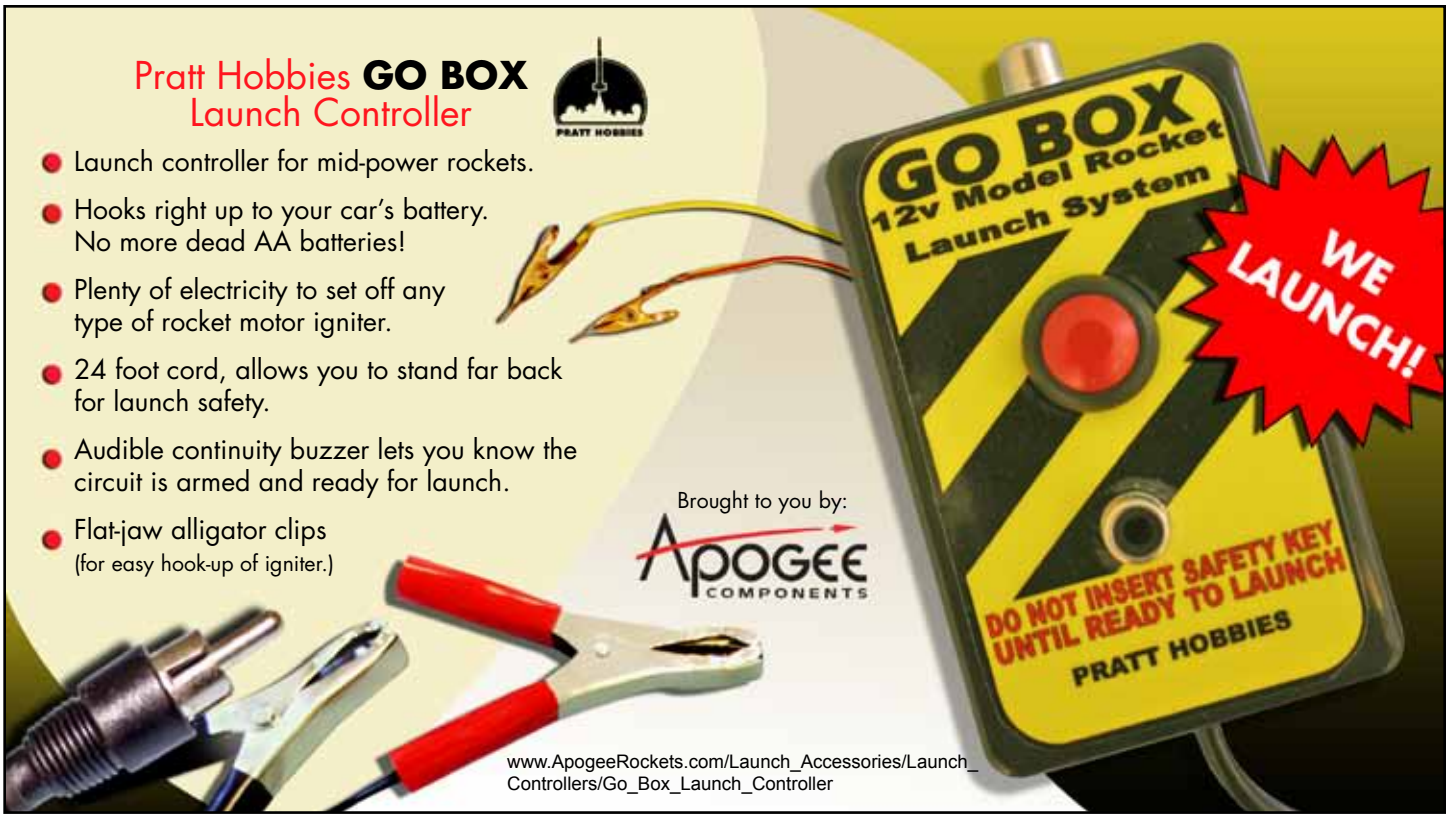
The author, Nicholas Timpe, gives a countdown to the launch of his rocket at the Squadron's recent launch.

model rocketry program in your CAP home squadron. Also, you can use the examples I gave you to go further than the National Headquarters prescribed curriculum. You can also come up with your own ideas for advanced classes. If you have any questions about this process or any topics for advanced classes, feel free to email me at nicholastimpe@gmail.com.

About the author

Nicholas Timpe is a 14-year-old rocket enthusiast from Lafayette, Colorado. He has built and launched rockets since he was eight years old. When he was twelve, he joined the Colorado Wing of the Civil Air Patrol, and currently holds the rank of Cadet Second Lieutenant. His squadron has had a very successful model rocketry program over the past year.

The Civil Air Patrol is the official Non-Profit auxiliary of the United States Air Force. CAP has three main branches: Emergency Services, Aerospace Education, and the Cadet Program. CAP does search-and-rescue missions all over the country, and saves, on average, 100 lives every year. CAP also teaches its cadets (12-20 years old), and other kids about flight, space travel, and the Air Force. The Cadet Program provides training about leadership, followership, and life in the military. For more information, visit http://www.gocivilairpatrol.com/.