Apogee Components

PEAK OF FLIGHT

NEWSLETTER

Running Batch Simulations in RockSim Using Your Favorite Motors

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How do you determine the force of an ejection charge?

Kit of The Month
The Apogee Avion

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PEAK OF FLIGHT

Batch Engine Files for SMARTSim: Efficiently Launch RockSim Simulations For All Your Favorite Motors

By Kenneth J. Karbon

Introduction

Peak-Of-Flight Newsletter issues #168 and #169, which can be downloaded at: http://www.ApogeeRockets.com/education/newsletter_archive.asp, describe the batch processing feature of SMARTSim version 2. Included in this article are csv (comma separated values) files to be used with any RockSim design file to quickly and accurately run simulations for many motor combinations in batch mode. This saves time and prevents errors when you want to add dozens of simulations to a new design or to a rkt file received from another modeler (through the EMRR database, for example).

The files represent all the motors in the following groups, and are in the proper format for SMARTSim batch processing:

1. All motors offered by Estes, Quest and Apogee, ranging from 6mm MicroMax to 29mm F10 (estes.quest.apogee.smartsimbatch.csv)

2. All single-use and RMS hobby line motors from Aerotech, ranging from 18 to 29mm (aerotech.hobbymotors.smartsimbatch.csv)

Step-By-Step Instructions

To use the engine files, perform the following steps to create a SMARTSim batch file, edit the batch file, and finally execute the batch file. Prior knowledge of spreadsheets and the RockSim XML file convention is helpful.

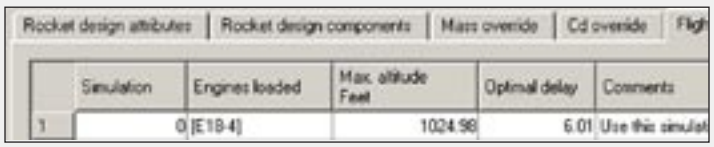

Figure 1. RockSim simulation

1. In RockSim, prepare and launch a single-stage simulation to replicate with all the motor combinations. Also include a comment (Figure 1). Save the design file.

2. Open the Rocksim file in SMARTSim and go to Tools > Create Batch File.

3. In the tree, navigate to SimulationResults>Stage3Engines>EngineSet. Highlight the following elements and "Add" them as Control Factors: EngineMfg, EngineCode, and EjectionDelay (Figure 2). Go a little higher in the tree and add SimulationName and Comments (Figure 3). The final list of control factors should look like Figure 4 and be in exactly the same order. When complete, "Write" the batch file. Since each RockSim design file is unique, this step must be repeated for every rkt file requiring batch processing.

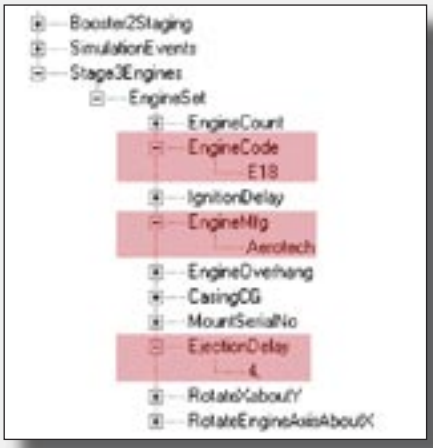

Figure 2. Selecting the engine parameters

4. Open the batch file in a spreadsheet. It should look similar to Figure 5 on page 4. Rows 1-7 contain data unique to your design file and RockSim units preferences. Row 8 contains names of the file elements selected in the previous step. Do not alter rows 1-8.

Continued on page 3

About this Newsletter

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Batch Engine Files for SMARTSim

Figure 3. Selecting the display parameters

5. Starting in row 9, paste any or all of the contents of the engine csv files to your batch file as in Figure 6. Each row represents a new simulation with the corresponding motor. Names for the manufacturer and engine code follow the RockSim database format and must exist in your RockSim Data directory of eng or rse files. An EjectionDelay of –1 indicates to RockSim to calculate "all" delays, but you can use any appropriate value. SimulationName is how RockSim displays the "engine loaded" in its flight simulations tab. Comments can be any descriptive text. Save the batch file as csv. (Note that this batch method accepts any size motor without changing the motor tube diameter in the design file.)

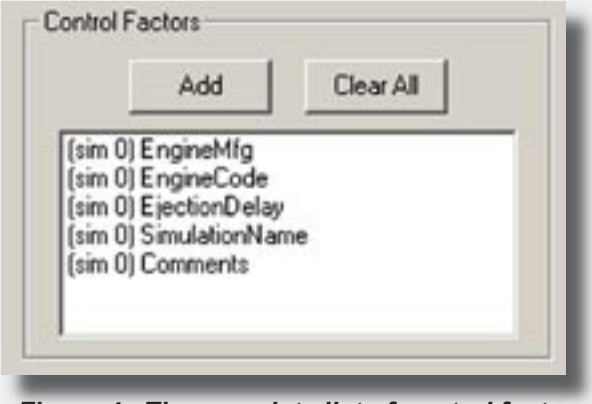

Figure 4. The complete list of control factors for batch engine processing

6. Go to the SMARTSim menu Tools > Run Batch Simulations. Browse for the batch file edited in the last step. Select "Append simulations to RockSim file" as the output

Continued on page 4

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Batch Engine Files for SMARTSim

	A	B	C	D	E
1	Semroc-SLS Explorer-DD.21dec07.rkt				
2	0				
3	-1	-1	-1	-1	-1
4	1437	1435	1441	1330	1333
5	-1	-1	-1	-1	-1
6	control	control	control	control	control
7			s		
8	EngineMfg	EngineCode	EjectionDelay	SimulationName	Comments

Figure 5. The SMARTSim batch file in a spreadsheet

option and give a file name. (I use a new, "append" file name rather than overwriting the original RockSim file.) Be careful when appending many simulations as this creates very big rkt files. Press Run. SMARTSim automatically

	A	B	C	D	E
1	Semroc-SLS Explorer-DD.21dec07.rkt				
2	0				
3	-1	-1	-1	-1	-1
4	1437	1435	1441	1330	1333
5	-1	-1	-1	-1	-1
6	control	control	control	control	control
7			s		
8	EngineMfg	EngineCode	EjectionDelay	SimulationName	Comments
9	Aerotech	D13	-1	Aerotech-D13-*	RMS-18/20
10	Aerotech	D24	-1	Aerotech-D24-*	RMS-18/20
11	Aerotech	D9	-1	Aerotech-D9-*	RMS-24/40
12	Aerotech	D15	-1	Aerotech-D15-*	RMS-24/40
13	Aerotech	E11J	-1	Aerotech-E11J-*	RMS-24/40

Figure 6. Completed batch file with rows of engine data.

substitutes the new motors and launches the simulations. When complete, read the appended rkt file into RockSim and see the new simulations!

Summary

With the provided files, you can quickly add over 60 different motor simulations to your RockSim files without searching and scrolling through the launch preparation screen. If you are savvy with spreadsheets, you can easily modify these engine files to include other manufacturers, engines, delays, and comments.

Resources:

Order the SMARTSim software at: http://www.ApogeeRockets.com/smartsim.asp

The RockSim software can be found at: http://www.ApogeeRockets.com/rocksim.asp

About the Author

Ken Karbon is a rocketeer from Michigan and the developer of SMARTSim. He holds a Masters Degree in Mechanical Engineering and works as an aerodynamicist in the auto industry, specializing in CFD simulation. For more information email smartsim@comcast.net

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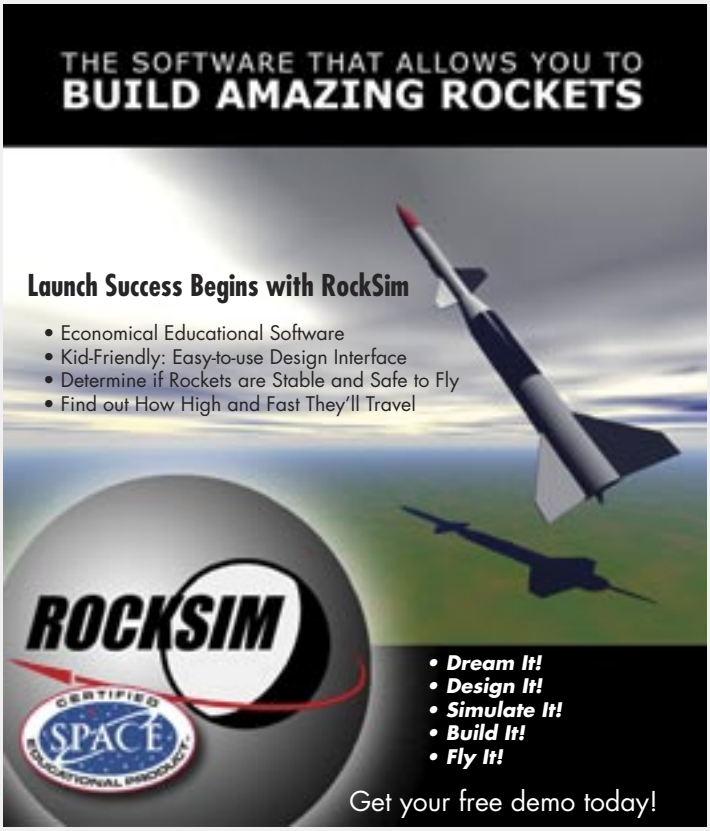


Rocket Plan

Build the Apogee Egglofter-1

By Tim Van Milligan

The Apogee Egglofter-1 is a competition style egg-lofting rocket for the NAR's egglofting duration events. This particular design can use regular size motors, and is suitable for B, C, and 18mm-diameter D size engines. The Apogee D10-5 (http://www.ApogeeRockets.com/composite_motors.asp) works great!

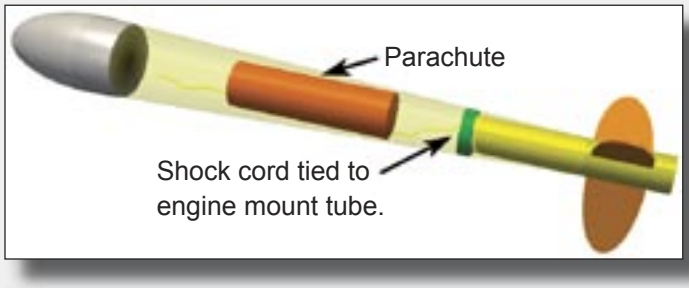
What makes this a nice design is the huge internal volume where you can stuff a really big parachute. In egglofting duration events, you'd want to start with at least a 32-to-36 inch diameter chute. Of course, if it is a breezy day, then you'd want to cut that back to a 24 inch chute so the model doesn't drift too far away.

To make this design, you'll first need the Apogee vacuum-formed egg capsule (p/n 20102), which can be found on the Apogee Components web site at: http://www.ApogeeRockets.com/nose_cones.asp. While you're ordering parts, you'll also need:

(1) Airframe Tube: AT-18/18 (P/N 10086) - cut to 4 inches long
(1) Centering Ring CR/18-24 (P/N 13032)
(1) Centering Ring CR/13-18 (P/N 13028)
(1) 32" Diameter Plastic Parachute (P/N 29118)
48" - 100-lb shock cord (P/N 30325)

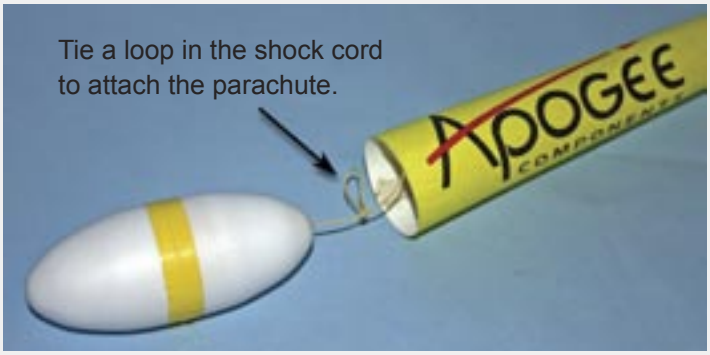
The other parts, like the sheet balsa for the fins, and the cardstock sheet for the paper shroud you'll need to find locally, since we don't typically carry those items.

Making the paper shroud is the hardest step on this design. You'll find generic instructions in Peak-of-Flight newsletter #136, which can be downloaded at: http://www.ApogeeRockets.com/education/newsletter_archive.asp. You can print out the template from the RockSim design file. But it does require a big sheet of paper (11" X 17"



sheet size). If you want to throw three or four bucks our way, we can print out the pattern sheet for you and include it with your order of the other supplies.

The vacuum-formed egg capsule just sits on top of the transition shroud, which is a bit unusual. The cylindrical shoulder is not needed at all. If you don't like the floppy fit of the nose on the transition, you can take a little bit of rubber cement and put it in the inside perimeter of the transition. This will make it sticky so the nose cone doesn't flop around as much. Don't worry though, it will stay on during flight without any problems.



Because of the large front end and the tapered shroud, this rocket does not contain a launch lug. To launch it, you will have to use a tower launcher. This rocket is also suitable for egglofting "altitude" competition, but you'll have to watch the overall weight and use a smaller chute.

The RockSim design file for this rocket plan can be downloaded at: http://www.ApogeeRockets.com/education/downloads/Egglofter-cone.zip

Apogee News

When Will I Stop Giving Away So Much Free Stuff?

By Tim Van Milligan

Last November, we videotaped a rocket building workshop that I held here at our shop. The reason I wanted it taped was so that we could put it up on the Apogee web site so that people new to model rocketry could see the procedures and techniques of building and painting a simple rocket.

With all the other things that were going on around here in the last few months, we didn't have time until this past week to complete the editing of the videotape and convert it to web format. It is now done!

I'm pleased with the way it turned out. I think that you'll find it useful too. Because of the file size, I split it up into eight segments. They run between 6 and 10 minutes long. You can view them at: http://www.ApogeeRockets.com/getting_started.asp

I also decided that we would make a high-quality DVD version of the workshop video. We do have it for sale at $30.95, BUT I will give it away FREE if you place an order for at least $100. See the web site for details. *Note to self: I really have to stop giving so much stuff away for free.*

The reason I'm giving it away for no charge is that I think that this DVD would work really well in classrooms, to train students how to build rockets correctly. I feel that once a new modeler builds a really nice rocket, they'll stick with the hobby for a long time and come back and buy some other items from me. I look at it as an investment in you and other modelers. You'll buy from us soon, won't you?

The new *Apogee Avion* rocket kit is finally out (http://www.ApogeeRockets.com/Avion.asp). We were waiting for weeks and weeks on the die-cut decals, and they finally arrived. I think you'll like this simple kit. We developed it for the school market and teachers that want something different from the Estes Alpha kit. Check out the kit of the month on page 8 for more details.

Unfortunately, I had to let Dave Curtis go because of the recession slow-down. If your company needs a graphic artist, contact him. His web site is: www.dcurtisdesign.com.

QUESTION & ANSWER CORNER

How to Find The Force Of The Ejection Charge?

Ed Schwerkolt writes:

My TARC students need to know the force of an ejection charge from Estes C, D, and E motors. We have searched the web for this info to no avail. Most articles talk about the ejection charge but none give the forces involved.

Do you have any idea where they can find the info?

I want them to find a way to test their recovery systems on the ground before launch, some are quite elaborate. We can build a small air system to attach in place of a motor if we knew what pressure to use.

This is a great question, and you're smart to want to ground test everything before you spend the money launching it. That is exactly what NASA would do. It will save you a lot of frustration when it comes time for the real launch of your rocket. You can't win the event if things don't happen the way you expect them to.

The ejection charge in the rocket motor consists of black-powder. It is pretty loose in the engine, and when it burns it creates the internal pressure inside the tube that pushes off the nose cone. It is really this pressure that you want to find, because once you find pressure, finding the force is pretty easy.

Recall that pressure times area is equal to the net force. The area you use is the base of the nose cone. So if the internal pressure is 10 psi, and the area of the base of the nose cone is 1 square inch, then the force is 10 pounds trying to push the nose cone off.

Your question then can be answered by finding the amount of pressure that is created by the burning black-powder ejection charge. The pressure is obviously going to be related to the internal volume of the rocket. The smaller the volume, the higher the pressure.

The first thing you have to do is calculate the internal volume of the rocket between the base of the nose cone and the top of the rocket motor.

From there, you need to find out the weight of the black powder that is inside the various motors you mentioned. The Estes D12 and E9 motors have 0.85 grams of powder*. I don't know what the C6 motor contains, but I'd guess that you could use 0.6 grams as a starting point.

Once you know the internal volume and the weight of the ejection charge, you can use the equations on some of the web sites to calculate the amount of pressure you can expect the ejection charge will create as it burns. You can find those equations at:

http://www.info-central.org/recovery_powder.shtml

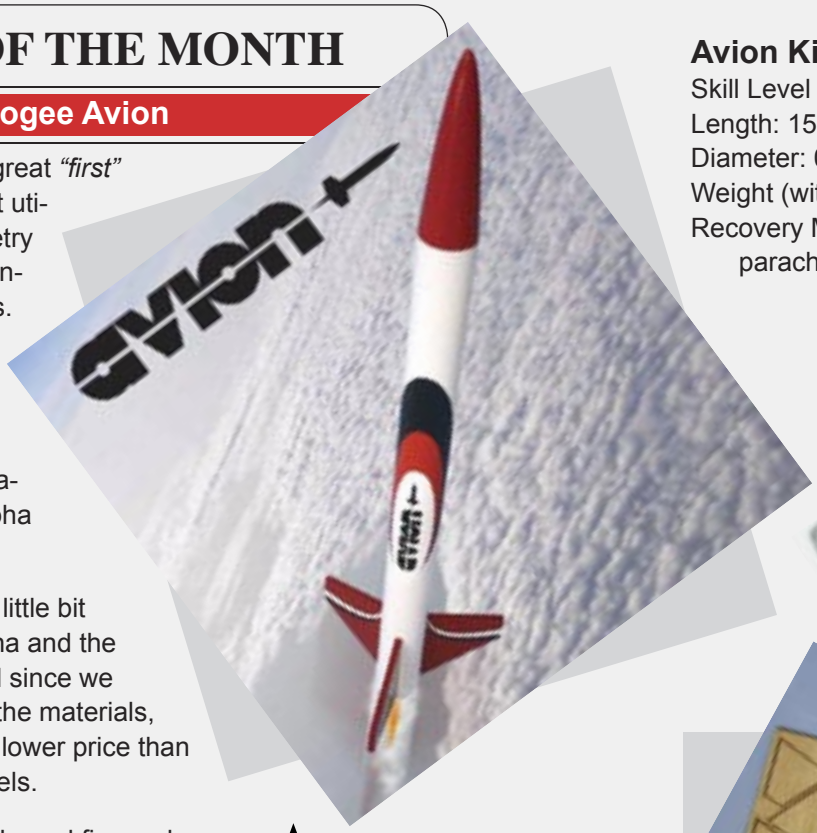
I think this is a great exercise for students because they get to use all sorts of math in the quest to find out the answer. First, they have to calculate internal volume, and then they have to calculate the pressure and finally the force pushing the nose cone off.

The critical item in your project is making sure the parachute doesn't bind and get stuck inside the tube. Pay particular attention to how you fold the chute, and fold it the same way every single time. See Peak-of-Flight Newsletter 199 for folding techniques. You'll find it at: http://www.ApogeeRockets.com/education/newsletter_archive.asp

*Source: http://www.info-central.org/recovery_powder.shtml

KIT OF THE MONTH

Apogee Avion



The Avion is a great *"first"* rocket kit because it utilizes common rocketry parts and simple construction techniques. It is perfect for schools and youth groups that are looking for a good-looking alternative to the Estes Alpha kit.

This rocket is a little bit bigger than the Alpha and the Quest Astra kit. And since we control the price of the materials, we can offer it for a lower price than either of those models.

The trapezoid shaped fins make this a great performing rocket. It can easily go over 1000 feet in the air on a C6-5 rocket motor.

The Apogee Avion is a great first rocket for beginners because it has so many features that make it easy-to-build. This includes laser-cut tubes and die-cut decals to give it a great finish.

You'll love this kit if you have a young modeler in your family, or if you are a teacher. It has all the classic parts of a traditional model rocket, like the balsa wood fins add, but is easier to assemble. And it actually teaches assembly techniques, so your child will have to follow directions like the classic rocket kits that you grew up with.

Don't worry though, assembly is very easy! Check the Apogee web site for video instructions on building this rocket kit.

Avion Kit Specifications:

Skill Level 1: Easy to Construct and Fly
Length: 15.0" (38.1 cm)
Diameter: 0.976" (24 mm)
Weight (without motor): 1.25 oz (35.5 gm)
Recovery Method: 10" (25.4 cm) plastic parachute

Kit Features

- Plastic Nose cone
- Laser-cut Balsa Fins
- Colorful decals (die cut)
- Metal Engine Clip
- Kevlar® Shock Cord
- 10" Diameter Plastic Parachute
- Premium Quality Body Tubes
- Flies over 1000 feet on Estes C6-5 motors

For more detailed information, go to:
http://www.ApogeeRockets.com/Avion.asp