ISSUE 16, AUG 20, 2000

APOGEE

PEAK OF FLIGHT

NEWSLETTER

Exporting Data from RockSim

By Tim Van Milligan

In this article, I'm going to try to explain one lesser-known procedure of exporting data from RockSim. There are a couple of ways to export, but I like the method described here best. The reason is, I can control what is being exported; so when it is time to manipulate data, I have a better handle on how it is formatted. My particular method is probably the hard way. You can play around with RockSim, and probably do the same thing easier.

Why would you want to export data?

Reason: to manipulate it further in a spreadsheet program. One might want to take certain data and perform more mathematics on it. For example, you could export the mass depletion curves, and the velocity curves. By multiplying these together, you could get a momentum curve (momentum = mass times velocity), or a kinetic energy curve (kinetic energy = mass times the square of velocity).

Another reason to export may be to combine the results of several simulations together. The plotting program of RockSim can only display the results from one simulation at a time. So if you wanted to run several different motors in the same rocket and see the velocity curves on one chart, you'd have to export the data out and recombine it in a spreadsheet program.

For this article, I decided I wanted to find the optimum trajectory of a rocket to yield the greatest distance (the military calls these "ballistic tables"). In the classical physics problem, the effects of drag and thrust duration are always ignored. But what happens if you don't ignore them. Can you predict what the results would be?

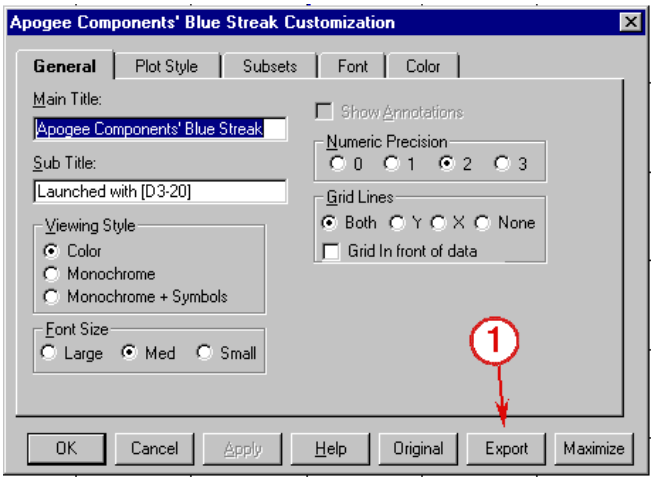
Well, with RockSim, you can. And the results are very interesting. If you want to follow along with your own copy of RockSim, for the simulations listed here, I used the Blue Streak file that is in the Design folder of RockSim. I then used the Apogee D3 motor, and also the Aerotech D21 for the simulations.

To Export the Data:

Before you run the simulation, check all your launch site parameters. Set the launch rod angle (as measured from vertical), and also reset the simulation sample rate to a low number (around 150 samples/sec), so that you don't overload the amount of data points generated by the simulation. The 150 samples/sec is a really low number, and for normal simulations, it should be set at a much higher number. Personally, I don't like to set the number below 300 samples/sec for any simulation that isn't launched vertically.

When you load the motor, you can type in the delay you want. I use a pretty high number, say around 20 seconds for a small rocket motor. The reason is that I want the rocket to impact the ground before the ejection charge goes off. Otherwise, once the ejection charge fires, the simulation stops.

At this point, you can run the simulation. Then select the plot button, and set the axes of the graphs to "Distance" for the x-axis, and " Altitude" for the y-axis. After the graph is



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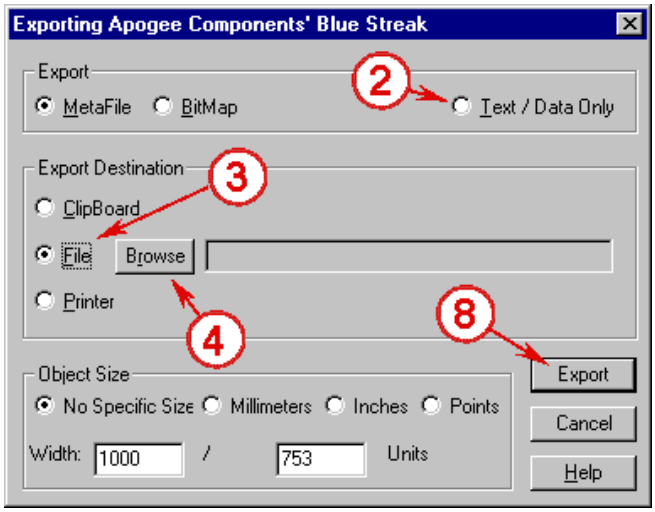


plotted out; double click on it in any location. The graph customization menu pops up. It is shown below:

1. Click the export button. This brings up another export box, which is shown below.

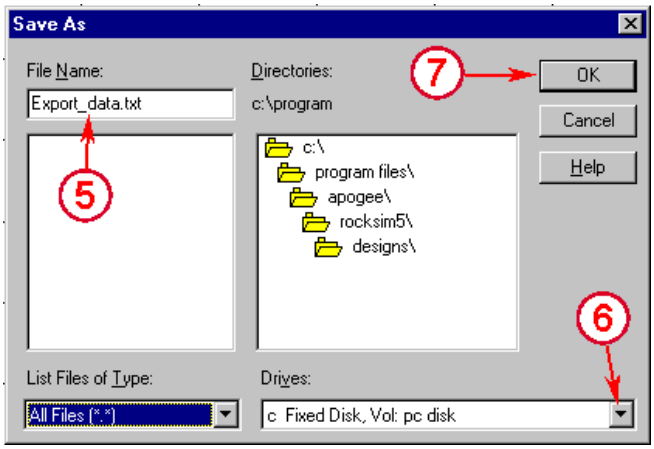
2. Click the "Text/Data Only" button.

3. Click the "File" button.

4. Click the "Browse" button. This will allow you to select the location where the data file will be stored. The "Save As" screen will now pop up. This is shown above.

5. Type in a name for the data file.

6. You can select which drive and folder the data will be stored.



7. Click the OK button. This brings you back to the "export box" shown two illustrations above.

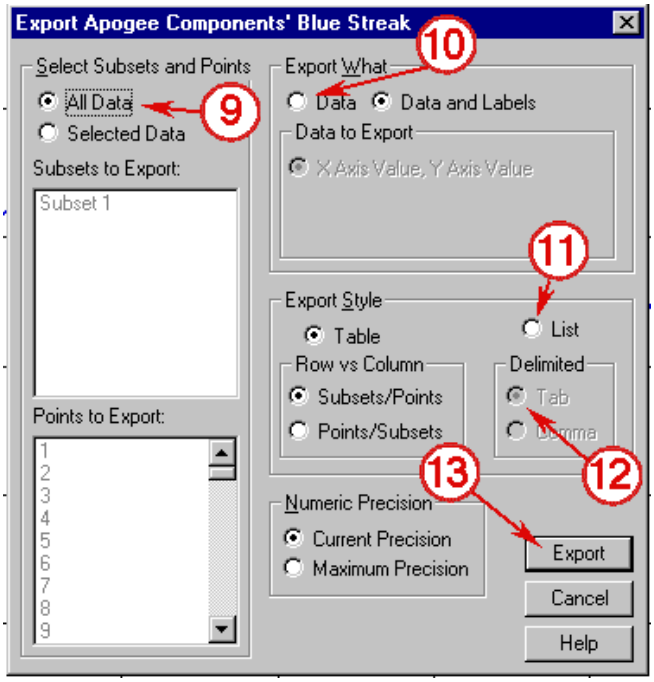
8. Click the "Export" button. You'll now be given a choice how to format the data being stored. The following box appears:

9. Choose "All Data" from the left side.

10. Choose the"Data" button from the right side top.

11. For "Export Style," choose "List.:

12. In the "Delimited" box, choose the "Tab" button.



13. Finally, choose the "Export" button. The data is now stored.

This may seem like a lot of work, but it gives you a lot of options of how the data is stored.

The whole reason to export the data, is so that you can manipulate it further in a spread sheet program. In this instance, I wanted to combine the data from several different launch simulations. RockSim only allows data for one simulation to be displayed at once. In a spreadsheet program, like

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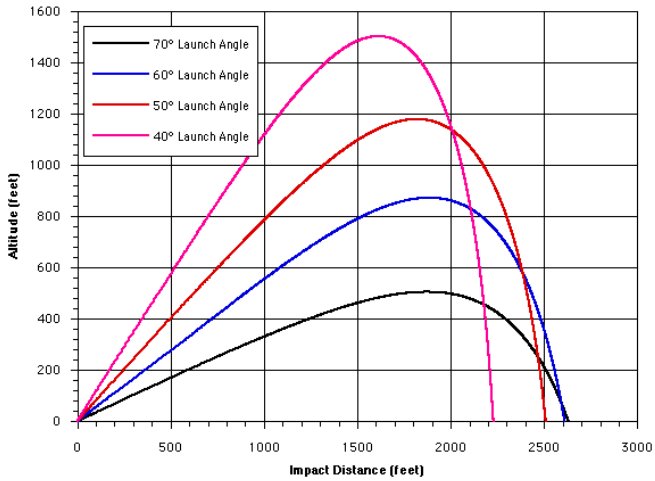
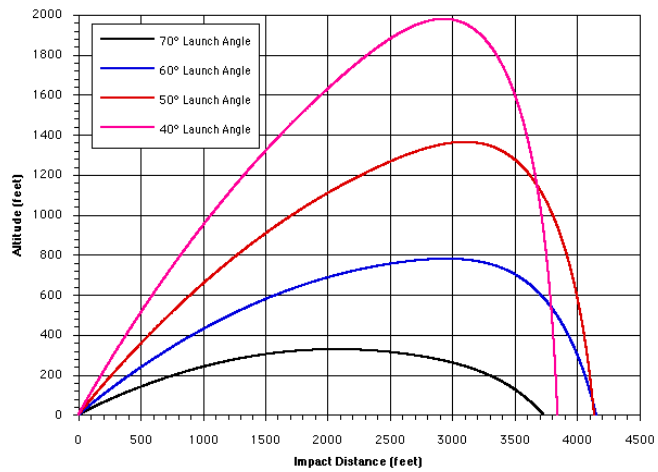


Launch of the Blue Streak model on an Aerotech D21 motor. The optimum launch angle is about 50°.



Launch of the Blue Streak model on an Apogee D3 motor. The optimum launch angle is about 60°.

Microsoft Excel, you can plot the trajectory curves of several simulations. I'll leave it up to you to read the help file in your spreadsheet program for combining data sets on a single graph. It is easy, but it does take a little extra labor. Then you can add colors and text to make your graph pretty, like the ones shown below.

In the first graph, I launched the "Apogee Blue Streak" model (which is in the sample designs, included with the RockSim software) on a Aerotech D21 motor. After exporting 4 different simulations and combining them in Excel, I got this graph showing that a launch angle of 60° or 70° to be best for achieving maximum distance.

For the next set of simulations, I switched motors to the Apogee Components D3 (long duration burn) motor. This time, the situation changed dramatically. Now the optimum launch angle was less around 60 degrees. Also note that the distance covered is significantly further.

Note: every rocket behaves differently. That is why you have to use a program like RockSim.

The classical physics problem is to find the optimum angle for a cannon firing a cannon-ball. In this problem, they always assume a instantaneous explosive force, and no drag. In that case, the optimum angle is 45 degrees. But, as we can see, things are a lot different when the thrust force has a given duration, and drag is also included.

Extra Credit: For additional variety, try varying the wind speed in the experiment. You can choose to launch with the wind, or into the wind by changing making the launch angle in the application settings to a negative number.

It is a lot of fun to run these types of simulations, and you can see why having a great program like RockSim makes simple work of a complex situation.

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 with "SUBSCRIBE" as the subject line of the message.