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APOGEE

PEAK OF FLIGHT

NEWSLETTER

High Acceleration Numbers In RockSim?

By Tim Van Milligan

Whenever I get a lot of people that have the exact same RockSim question; I figure it is time to write a e-zine article about it. That is how most of the articles in this newsletter were born. This week is no exception.

The basic question from customers always starts out like this:

"RockSim has a bug..."

That may be true. But it is very rare that we find "NEW" bugs after the program has been out for more than six months. There are so many people that use the program and the free demo version that we find most all the bugs within the first two weeks of the program's release.

Anyway, this particular question is about the "simulation summary" area on the top of the main RockSim screen. One item that can be displayed is the "acceleration" of the rocket. Most people display this number in "Gees." A typical rocket can lift off with a typical acceleration of anywhere between 4 and 60 Gees.

What a lot of people are seeing is a number that is a couple of magnitudes higher than this. For example, it may be displaying 10,000 gees.

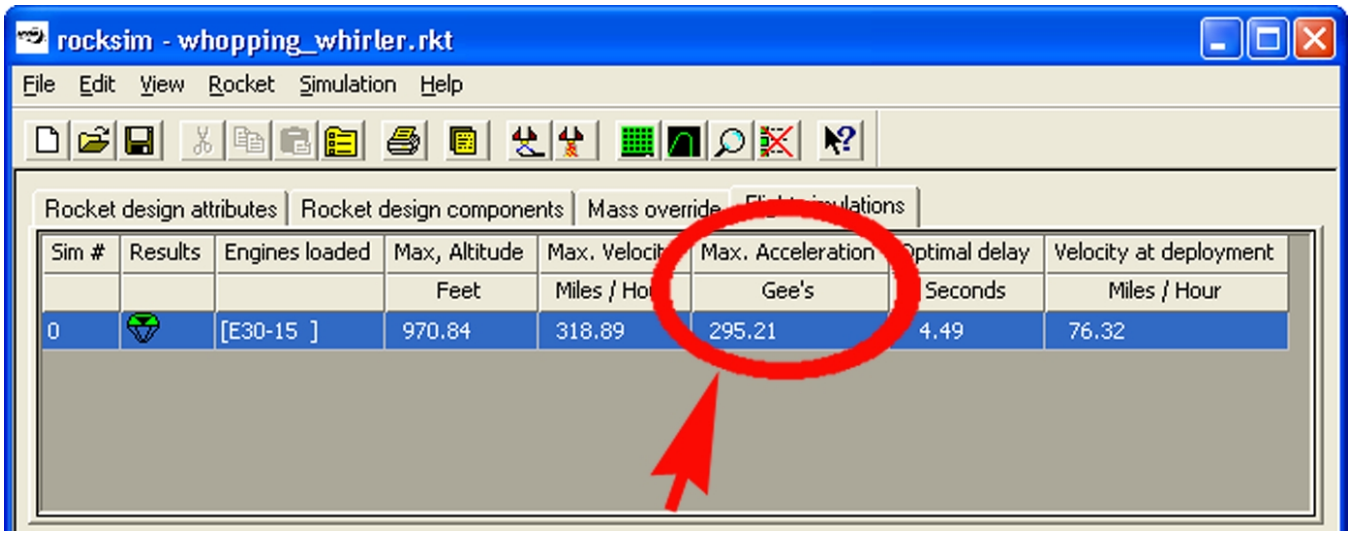
That is where their question comes from. "Why is RockSim displaying such a high acceleration value?"

This is not a bug...

RockSim is displaying the "maximum" acceleration. The number is not necessarily the maximum "LIFT-OFF" acceleration. It is an "Absolute Value" number. That means that if the number is negative, it will still display it as a positive number. For example, if you have an acceleration of -11, the simulation summary will display it as "11."

The negative acceleration (called deceleration) can hit very very high values at parachute deployment. Especially if the rocket ejects while still traveling upward at a high rate of speed.

Have you seen rockets that had stripped parachutes? These are usually caused by the high opening forces that happen right when the chute is ejected. It wouldn't be unusual for the de-



Why is the acceleration so high in this simulation?

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celeration to high -1000 Gees for a brief second.

So if RockSim is displaying a high acceleration value, what should you do?

1. You should then plot out the graph of acceleration versus time. The graph will show the entire range of acceleration values.

More importantly, it will tell you when they occur during the flight. What you'll see is a very high spike right at parachute ejection.

From the same graph, you can also easily find the maximum lift-off acceleration -- which is what you're probably most interested in.

As valuable as it is, I suspect that many people are not using the graph feature of RockSim. Otherwise they would have seen the high deceleration values. I use the graphs all the time to figure out what is going on in a simulation. Here is another example.

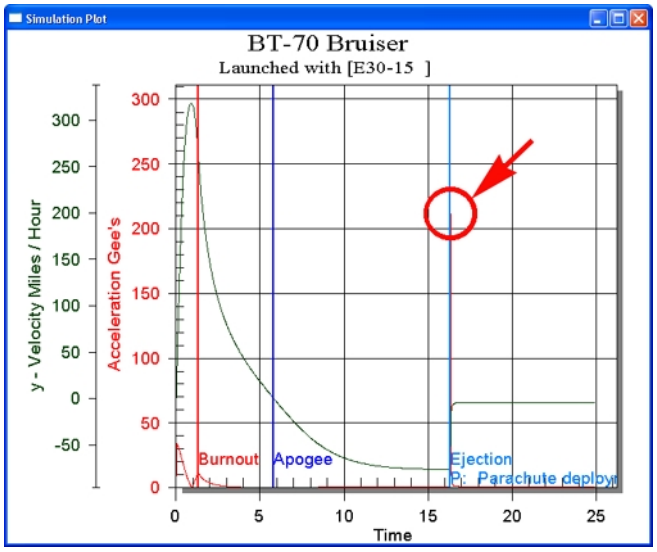
Two times in the last few months, customers have sent me .rkt files of rockets that were behaving badly. The rockets were straight forward looking, and therefore they should have flown on a standard trajectory. But in these two cases, the rockets were ejecting only a couple of hundred feet into the air -- instead of the expected altitudes. They were both high power flights, so the user was expecting to see altitudes much greater than 2000 feet.

When they sent the designs to me, I'd run the simulations, and the results would look correct -- with the rocket ejecting at much higher altitudes than they were seeing when they ran the same simulation. So I have to look at the graphs. I'd have to ask myself -- what factors would affect the altitude of the rocket? My first inclination would be either: 1: a bad motor data file, 2: a bad component mass, 3: the Cd value being set at a number too high, 4: somehow their RockSim file got corrupted, or 5: something else.

It is when I get to #5 that I start to get worried. Maybe it could be a bug in RockSim. But since the file ran fine on my computer and not the customer's I'll double check the graphs.

The drag shown on the graph looked a bit too high. But the Cd value was reasonable - around 0.5. So what else affects the drag? Then it hit me. The air density.

Sure enough, the modelers had accidentally set the atmospheric pressure too high. When it is anything over 33 inches of Mercury, that is probably too high. It is like launching the



If you look at the acceleration graph, you'll see the maximum acceleration (deceleration) occurs at parachute deployment.

rocket in thick soup. It will only go a couple of hundred feet even with large high power motors.

Usually, that is what I find. It is just one simple launch parameter that is set incorrectly.

In conclusion, I like to recommend to everyone to brush up on their "graph interpretation" skills. I think you'll find it a lot of fun. A while back, I published some sample RockSim graphs for people to decipher. If you'd like to try a good brain teaser, you're welcome to take a look at them. It will give you some good practice at interpreting the RockSim graphs. The "RockSim Challenge" graphs are in Newsletter 23.

About the Author:

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