ISSUE 23

APOGEE

PEAK OF FLIGHT

NEWSLETTER

The RockSim Challenge

By Tim Van Milligan

Shall we play a game? How about Global Thermonuclear War?

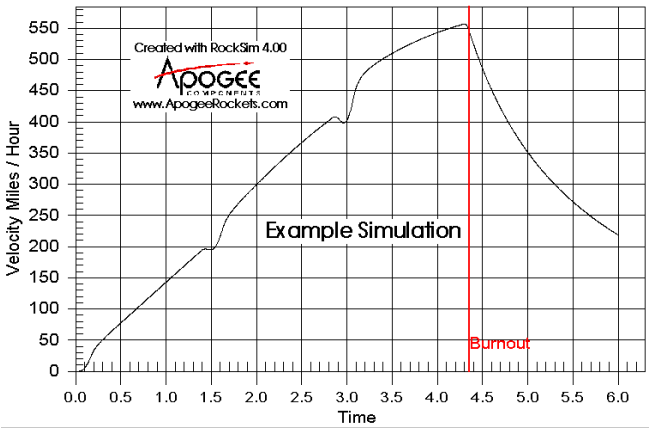
Naaa. This is a game that is much simpler to play, and much more fun.

RockSim is a tool that you can use to learn more about model rocketry. One fun way to use it is to learn is by taking a test. We call this particular test the "RockSim Challenge."

In the RockSim Challenge you'll be given a series of 10 graphs (all created by running RockSim v4.0 simulaitons); and you'll be asked to match the graph with the simulation description that made the graph. Its a lot of fun, and you'll learn a bunch about rocketry.

There is no prize in this game. The only thing you'll get out of it is a greater understanding of model rocketry. I guarantee that it will tax your knowledge of rocketry. Some simulations are easy, and some are hard. But I've given you some hints to make the challenge a bit easier.

When you're done, why not make your own RockSim Challenge? I found that I learned more by making up this test than anything else. Give it a try, and let me know.



In this test of skill, you will be given a series of ten graphs, which you need to match them to the correct rocket that was used to generate the data. Match all of them correctly, and you're a genius!

If you're a school teacher, this would be a great test of knowledge for students. Why not try making your own simulations for them to solve too?

Here is a Example Simulation:

From the illustration on this page, which of the rocket simulations listed on the next page was used to generate the graph?

Answer: C -- If you look at the Example Simulation graph, you can see the velocity increase in three phases. This indicates that the most likely rocket that could have made it was a three stage model. The only three stage rocket in the list is letter "C."

Here are some hints that may help you in this challenge:

First, look at the stats for the motors listed. The duration of the burn time is a big hint. If the rocket is staged, the burn time will be the sum of of the individual stages, including any delays between staging.

Second, look at the shape of the curve.

Third, know the characteristic of the rocket named. For example, the Apogee Centrix kit is a small rocket that is designed to fly high on very small motors. The Estes Fat Boy is a squat rocket that doesn't fly very high on small motors. The Estes Phoenix rocket has forward fins that reduces its stability. All the kits listed are included in the sample files that come with RockSim.

Finally, each answer is only used once. You can use the process of elimination to narrow down your choices if you get stuck.

Now, you match the rest of these rockets with their correct simulation graphs.

Apogee Components

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A. Apogee Components' Hydra kit: three motor cluster. Engines used: 1/2A2-6, A2-5, B2-3. Launched straight up, with no wind.

B. Apogee Centrix with Super Centrix Staging Unit. Engines used: A2-0 in booster, and A2-5 in upper stage. Launched at a +10 degree angle from vertical, into a +15 mph wind.

C. An 18mm diameter; three stage model. Engines used: Estes C6-0, C6-0, and C6-7. Model Launched Straight up, with no wind. (hint: don't pick this one; it was the answer to the Example simulation.)

D. Nike Hercules model: Engines used: four A10-0 in the booster stage, and a B7-8 in the sustainer. Launched straight up, with no wind.

E. Estes Fat Boy rocket kit (with extra nose weight). Engine used: Estes B6-6. Launched at a 10 degree angle (from vertical), into a -15mph wind (from the right to the left).

F.Estes Bull Pup 12D kit. Launched on an Apogee Components D3-5 engine; straight up with no wind.

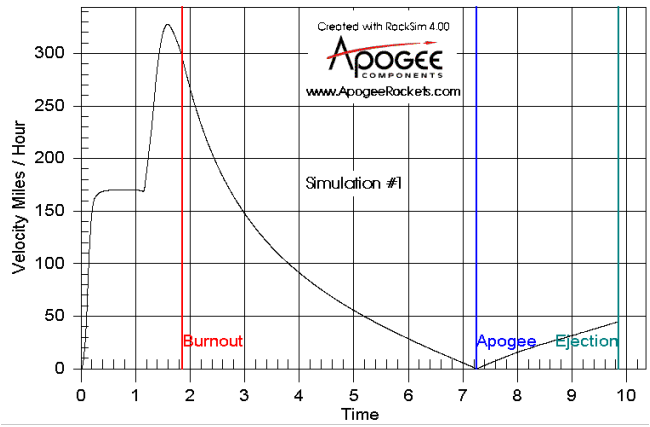
G. Apogee Components Blue Streak kit. Engine used: Aerotech D21-4. Launched at a -20 degree angle (measured from vertical).

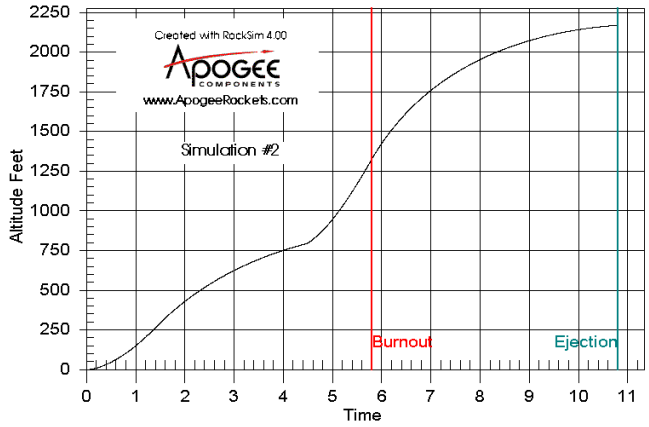
H. Custom model: An 18mm diameter competition style model, that has a boosted dart (10.5mm in diameter) on top (note: a "boosted dart" is an unpowered upper stage). Engine used: D3-0, and a fictitional dart motor that produces no thrust in the upper stage. Launched straight up, with no wind.

I. Estes Phoenix kit. Engine used: D12-3. Luanched at +30 degree angle from verticle, and into a 20 mph wind that begins 50 feet above the ground.

J. Apogee Components Hydra kit - three motor cluster. Engines used: A2-5, B2-3, and a A2-3 (this last motor is air-started two seconds after the other motors ignite). Launched straight up, with no wind.

K. Apogee Centrix with Super Centrix Staging Unit. Engines used: A2-3 in booster, and A2-5 in upper stage. Launched straight up, with no wind.





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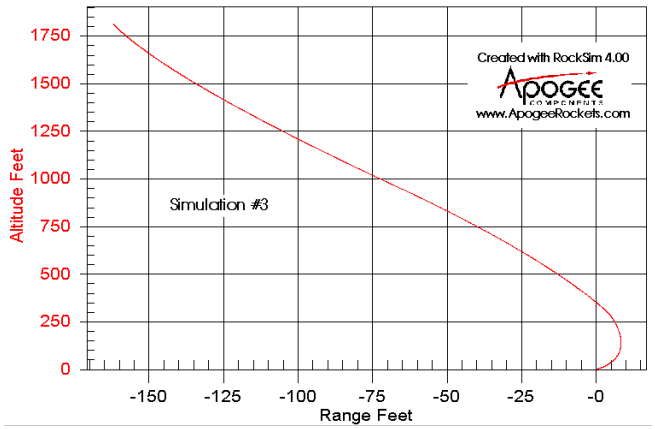
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Range Feet
Simulation #3
Created with RockSim 4.00
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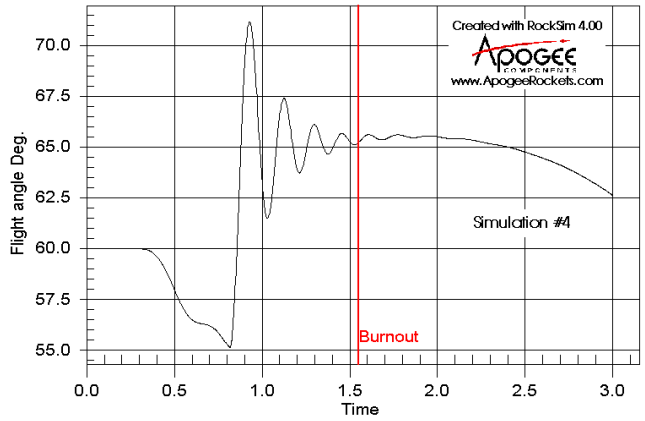
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Simulation #4
Created with RockSim 4.00
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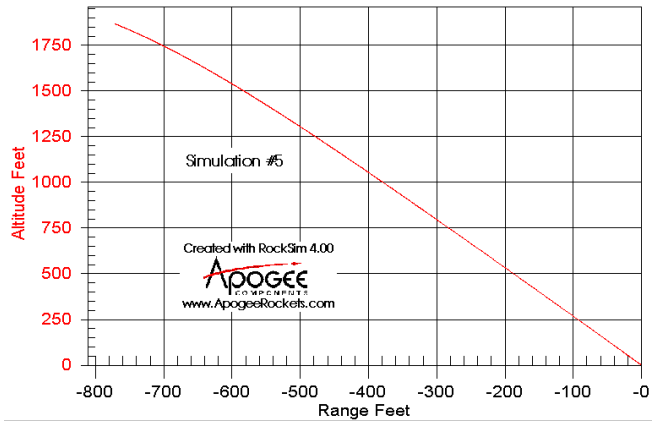
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Created with RockSim 4.00
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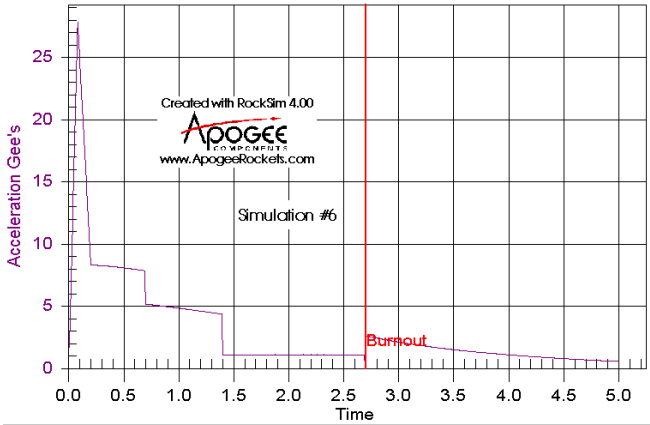
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Time
Burnout
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Created with RockSim 4.00
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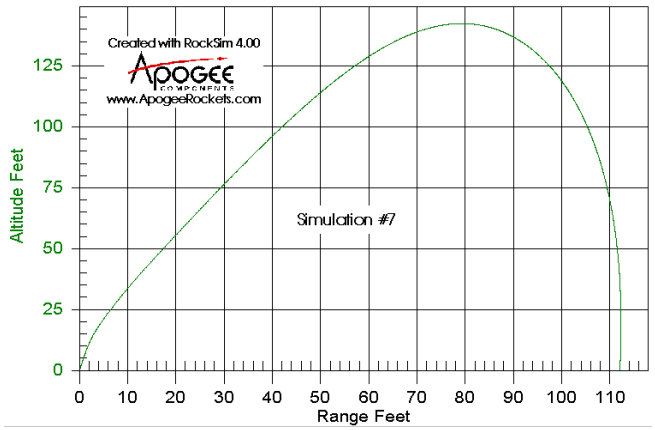
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Range Feet
Simulation #7
Created with RockSim 4.00
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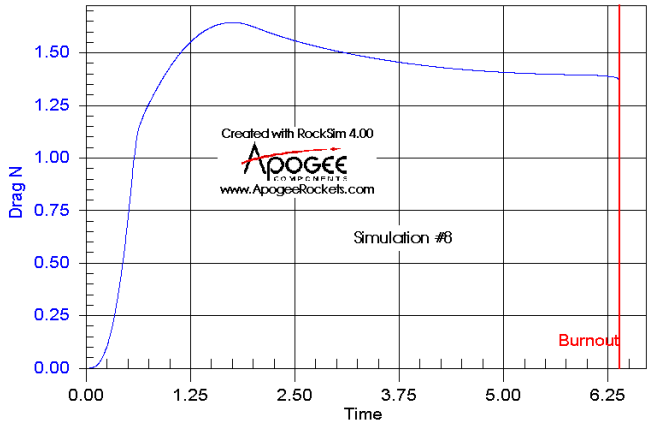
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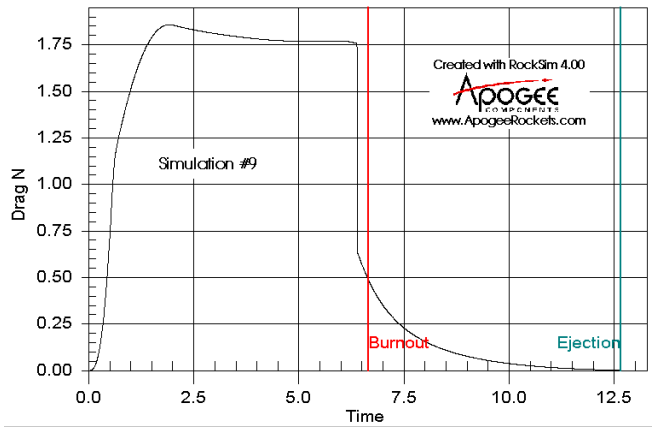
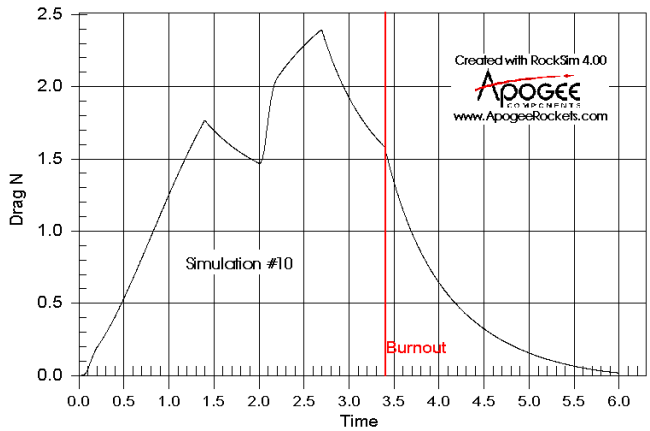
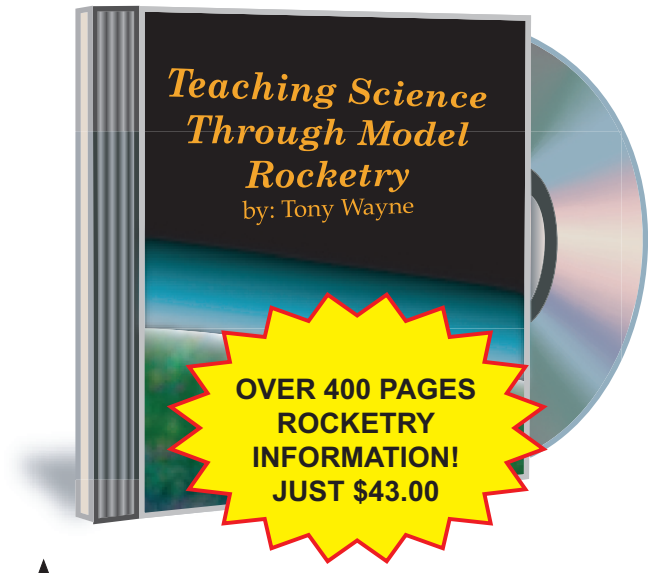




See the next page for the answers.

"Teaching Science Through Model Rocketry"

By Tony Wayne



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Media: This book comes on a CD-ROM that works on both Windows and Macintosh computers. Contains a collection of files that can be read with Adobe Acrobat Reader. The videos can be viewed with an internet browser like Netscape and Internet Explorer, or with a stand alone program like QuickTime viewer.

This massive (400 pages) collection of information and experiments gives teachers the ideas you need to teach science with the excitement of rocket power.

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Answers

Simulation #1

D. Nike Hercules model: Engines used: four A10-0 in the booster stage, and a B7-8 in the sustainer. Launched straight up, with no wind.

What gave it away was:The quick burn time, plus the sudden change in velocity is the clue for this simulation.

Simulation #2

K. Apogee Centrix with Super Centrix Staging Unit. Engines used: A2-3 in booster, and A2-5 in upper stage. Launched straight up, with no wind.

What gave it away was:The shape of the curve is the first clue. It indicates a two-stage rocket. The total burn time is the second clue. The A2 motor burns a little under 1.5 seconds. So two of them, plus a 3 second delay would be almost 6 seconds. The third clue is the final delay time of exactly 5 seconds, which is what the final A2-5 motor would produce.

Simulation #3

B. Apogee Centrix with Super Centrix Staging Unit. Engines used: A2-0 in booster, and A2-5 in upper stage. Launched at a +10 degree angle from vertical, into a +15 mph wind.

What gave it away was: Apositive wind in RockSim blows to the right. Plus, the model is angled to the right (a positive launch angle). This graph shows the rocket starts out going in a positive direction, but then weathercocks into the wind. Finally, it reaches a very high altitide, which is what a Apogee Centrix model is designed to do.

Simulation #4

I. Estes Phoenix kit. Engine used: D12-3. Luanched at +30 degree angle from verticle, and into a 20 mph wind that begins 50 feet above the ground.

What gave it away was:The initial launch angle is 60°, and it takes a moment for the oscillations to start, indicating that the disturbance started later in the flight.

Simulation #5

G. Apogee Components Blue Streak kit. Engine used: Aerotech D21-4. Launched at a -20 degree angle (measured from vertical). What gave it away was:The negative launch angle (toward the left) is the first clue. Plus, the model doesn't oscillate because of the high thrust motor.

Simulation #6

A. Apogee Components' Hydra kit: three motor cluster. Engines used: 1/2A2-6, A2-5, B2-3. Launched straight up, with no wind. What gave it away was:The fact that the peak is near the beginning indicates a black powder motor. Then it steps down, because the smaller motors burn out in succession.

Simulation #7

E. Estes Fat Boy rocket kit (with extra nose weight). Engine used: Estes B6-6. Launched at a 10 degree angle (from vertical), into a -15mph wind (from the right to the left).

What gave it away was:A Fat Boy rocket isn't going to go very high, and the extra weight complicates the problem. So this rocket impacts the ground. The launch direction is also a clue for this simulation.

Simulation #8

F. Estes Bull Pup 12D kit. Launched on an Apogee Components D3-5 engine; straight up with no wind.

What gives it away was: The long burn time of over 6 seconds. The model also reaches a terminal velocity, and actually starts slowing down (reduced drag) as the model rises.

Simulation #9

H. Custom model: An 18mm diameter competition style model, that has a boosted dart (10.5mm in diameter) on top (note: a "boosted dart" is an unpowered upper stage). Engine used: D3-0, and a fictitional dart motor that produces no thrust in the upper stage. Launched straight up, with no wind.

What gave it away was:The sudden drop in drag prior to burnout is the big clue. The model separates at that point, which is why the drag drops so quickly.

Simulation #10

J. Apogee Components Hydra kit - three motor cluster. Engines used: A2-5, B2-3, and a A2-3 (this last motor is air-started two seconds after the other motors ignite). Launched straight up, with no wind.

What gave it away was:The second spike begins exactly 2 seconds into the burn, indicating that a new motor started to thrust.

Example C.

An 18mm diameter; three stage model. Engines used: Estes C6-0, C6-0, and C6-7. Model Launched Straight up, with no wind.

What gave it away was: The velocity increases in three phases. This indicates that the most likely rocket that could have made it was a three stage model.