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APOGEE PEAK OF FLIGHT NEWSLETTER

Educational Uses of RockSim

By Tim Van Milligan

Teachers: *Why should you use RockSim in your classroom?*

RockSim offers the educator a wonderful tool to teach about rocketry. Here are some of the many benefits:

1. Allows the student to simulate hundreds of rocket flights very quickly -- this saves lots of money! Just think of the time saved too. You don't have to spend hundreds of dollar buying motors and hours-and-hours of time building different configurations, launching, recovering, and repacking rockets.

2. Safety. When you go out to fly rockets, knowing how they'll behave is an important aspect of safety. Precautions can be made. By running the simulations, the students learn what aspects contribute to safety.

3. The scientific value is awesome. RockSim is packed with useful features and generates mountains of data. Analyzing this data is a fantastic way to teach the scientific method.

4. Using RockSim is fun! It has features like a video game, so the students may not realize how much they are learning at the same time.

5. RockSim is the same tool that is used by real rocketry professionals - like NASA, military contractors, and universities. So you can feel confident in the results you get back from the program.

6. The software allows students to explore their creativity. They can design vastly different looking models, while learning engineering skills, assembly steps, and physics.

Here are just some of the many topics you can explore with RockSim:

1. Aerodynamics and drag reduction
2. Forces of flight: Lift, Drag, Thrust, and Gravity
3. Projectile motion
4. Rocket propulsion as used for space travel
5. Atmospheric studies: how does temperature and pressure affect performance?
6. Planetary differences: how does the same rocket perform on different planets in our solar system.
7. Dynamics and harmonic motion with damping
8. Engineering - how parts fit together
9. Newton's Laws of motion
10. Artistic expression
11. Explaining distance, velocity, and acceleration.
12. Material properties, like density and volume
13. The importance of weight and balance (CG position) when designing rockets
14. Explaining that Work = force X Distance
15. Explaining the concepts of Kinetic and Potential Energy
16. Showing free-fall, and terminal velocity
17. The importance of units and unit conversion
18. Following directions
19. Exporting data and using spreadsheet programs to perform data reduction and manipulation
20. To show why multi-stage and cluster motor rockets are used
21. Concept of stored chemical energy (in the rocket propellant) and how it is converted to mechanical energy
22. Concept of efficiency - getting the most performance from the least exertion of energy. Can be explained by the different types of propellant formulations
23. Showing the concept of momentum and how it affects the optimum mass of the rocket
24. Finding the optimal launch angle for breezy conditions
25. Optimal launch angle for distance (ballistic curves), and how it varies with the thrust curve of the motor
26. Show how the distribution of mass affects the dynamic stability of the rocket
27. Demonstrating the concept of "Numeric Precision" -- the more iterations performed, the better the accuracy.
28. Show how different shaped components affects the

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static stability of the rocket

29. Compare the thrust curves of different motors. This can show how different geometries (hole size, location, dimensions) affect the thrust produced by the rocket.

30. Concept of "Impulse:" which is a thrust force multiplied by the time duration that thrust is created. The higher the impulse, the more power the motor has.

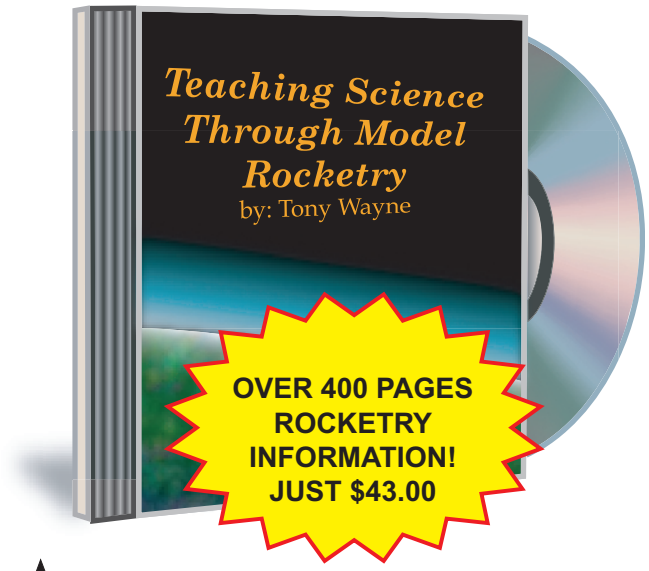
As you can see, RockSim is a versatile tool. You'll save hundreds of dollars because it can do so much.

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.

"Teaching Science Through Model Rocketry"

By Tony Wayne



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

You'll discover high-intensity demonstrations, activities, and research projects that are easy to perform:

- Detailed lesson plans using a "how-to" approach.
- 24 simple "magic trick-like" demonstrations.
- QuickTime™ videos and FLASH™ animations.
- Building Tips to help make better rockets.
- How to measure a rocket's altitude and liftoff velocity.
- 21 Rocketry labs you can perform.
- Overhead transparencies for your classroom.
- A list of 34 basic rocketry supplies.
- Five different launch controller plans
- How to use Apogees' RockSim design software in your rocketry unit. See a **FREE** sample of one of the Lesson Plans at: http://www.apogerockets.com/sample_lesson.asp
- Information that can be used in grades 6 and up.

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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.

For more information, and to order your own copy, please visit:

http://www.ApogeeRockets.com/teaching_science.asp

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