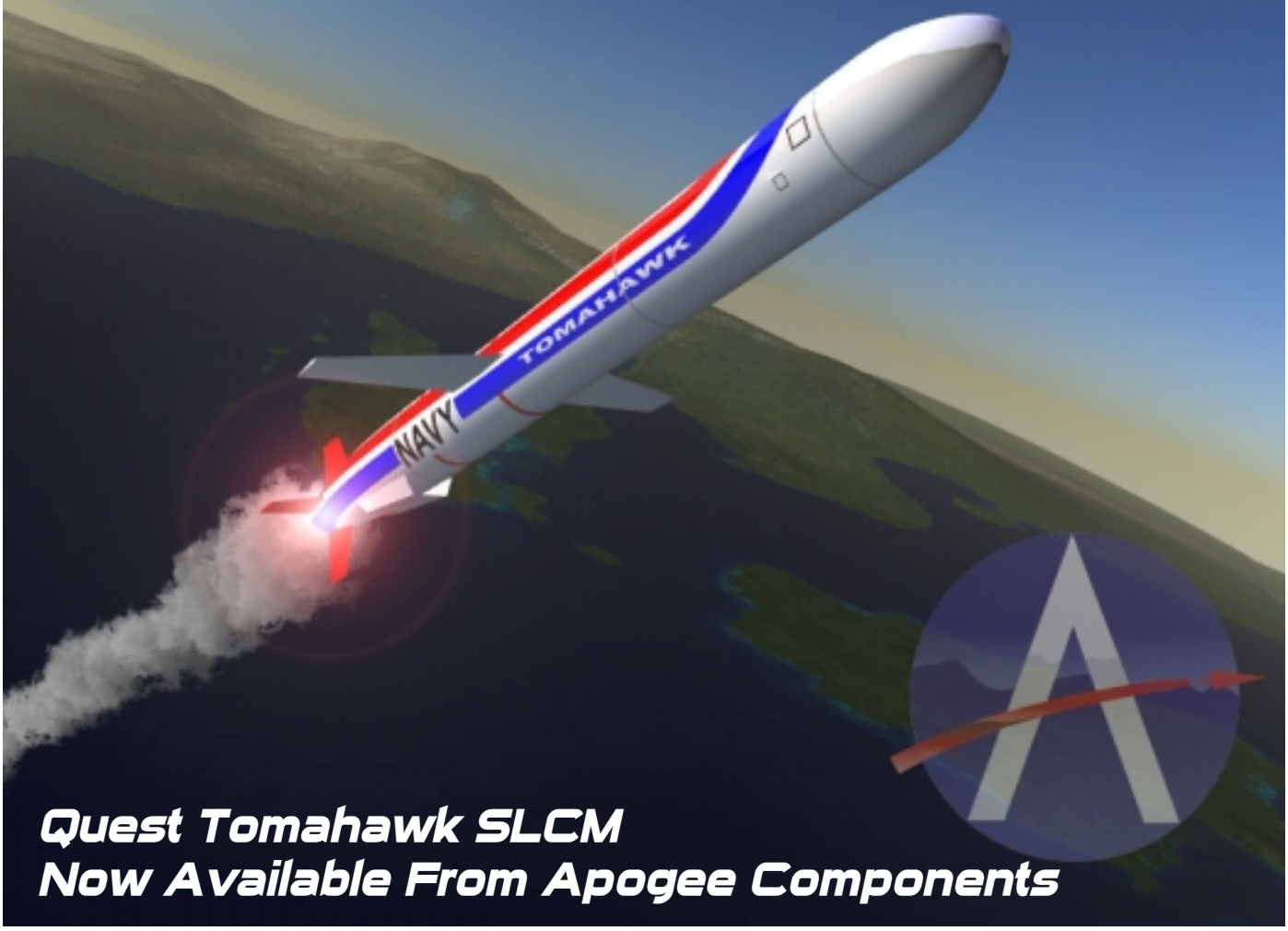
ISSUE 102 - APR. 18, 2003

APOGEE PEAK OF FLIGHT NEWSLETTER

Understanding RockSim Simulations:

How To Run Quick-and-Dirty Simulations



Quest Tomahawk SLCM Now Available From Apogee Components

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PEAK OF FLIGHT

Quick-and-Dirty Launch Simulations

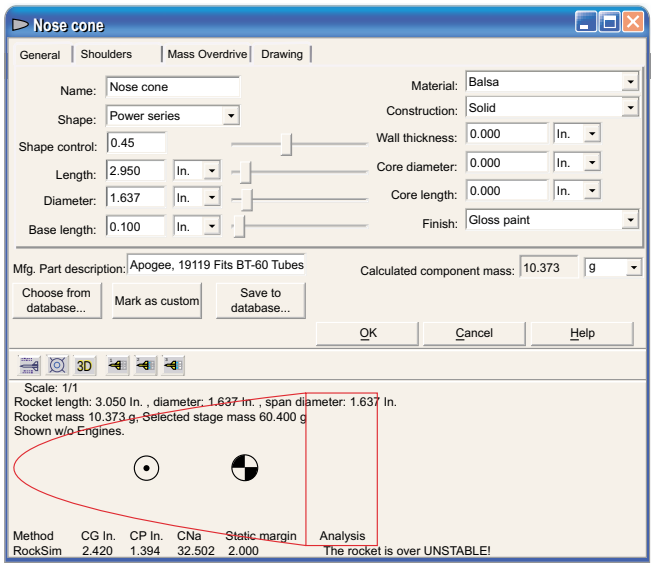
By Tim Van Milligan

Bob Kaplow writes on r.m.r.: *"Having never used RockSim, and seeing folks frequently ask "Do you have a Rocksim file for the Mumblefrazz?" I've got a simple question. For a relatively simple rocket (LOC IV), starting from scratch, how long does it take to give RockSim enough data that you can get an altitude prediction out of the program for a standard (already known data) motor?*

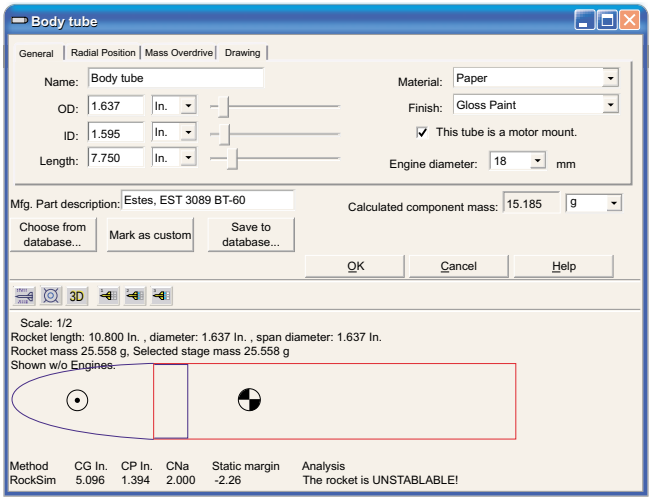
I'm getting the general feeling that it takes far too much futzing around to do this. Perhaps there's some advantage to the old fashioned software where you just input rocket mass, diameter, CD, and the motor and can get results in 5 seconds if you type like me."

The quick answer is that RockSim can run simple simulations very quickly, and get back basic results just like you'd get from programs like WRASP. All you need to do is enter just a few parameters into the program.

Here's how you'd do it:



step 1: select a nose cone. The shape is unimportant, but the diameter is.



step 2: Add a body tube. Make sure to check the little box that says "This tube is a motor mount." And from the drop-down menu, select the diameter of the rocket engine.

1. Select the nose cone from the database of parts; this tells RockSim the diameter of the rocket.

This diameter is used to calculate the reference area in the drag equation. That way, it can calculate the overall drag of the model to determine how high the rocket will fly.

2. Add a body tube to the nose cone. Make sure to select the little box that say "This is a motor mount tube." Then select the size motor you plan on using in the rocket. By doing this step, you'll be telling RockSim where to place the motor.

3. Next, we're going to add simple fins to the rocket. Without fins, the rocket will go unstable, and the simulation results will be useless. Just choose simple trapazoid fins. Use the defaults that RockSim generates. This is good enough for our purpose.

4. Input the Cd you want to use. This is located on the "Rocket Design Attributes" tab.

5. Input the weight of the rocket (without the motor installed). This is done from the mass-override tab in the design screen. RockSim will automatically account for the weight of the motor later in the simulation.

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Archives of this Newsletter

All the articles that have appeared in this newsletter are archived at http://www.apogeerockets.com/education/newsletter_archive.asp

Quick-n-dirty sims

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6. From the Simulation Preparation screen, select the engine you want in your design. Under the simulation controls, tell RockSim to end the simulation at “apogee.” Now, click the launch button.

The results from this type of simulation would be identical to programs such as WRASP. The only additional steps that aredifferent than WRASP is #2 and #3; where you select a engine tube and add simple fins.

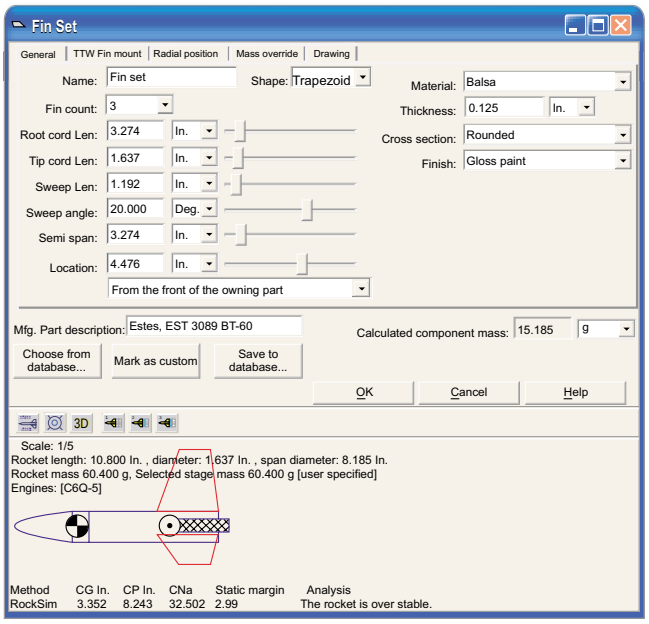
The reason for the additional step #2 is that RockSim needs to know where to place the rocket engine. Why?

This gets back to the original question and the underlying reason why a person might be looking for a specific rocket design file.

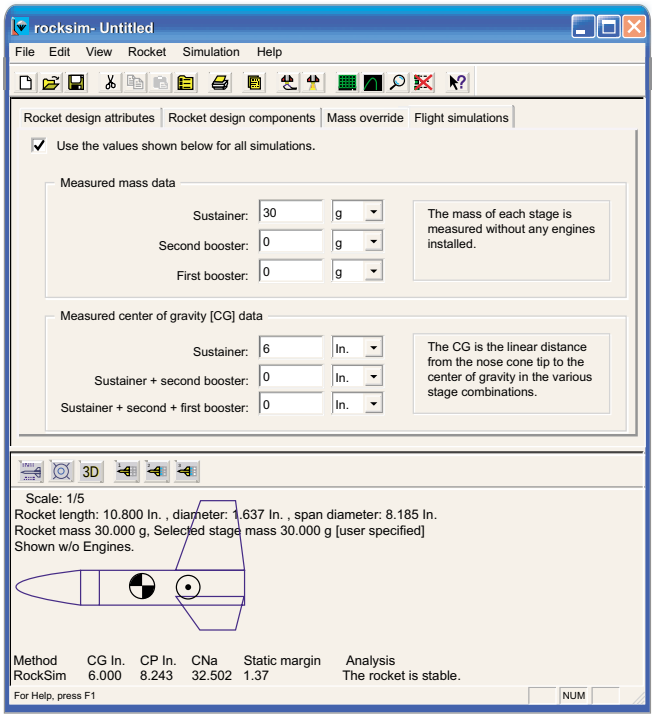
There are many different reasons that people prefer RockSim over other, so-called "quick-and-easy," programs. For one, WRASP doesn't tell you the CP location of the rocket. Without that, you don't know if the rocket will be stable when launched.

RockSim also allows you to print out all sorts of templates and pattern sheets. If you are cloning a rocket kit, all these templates will help you duplicate the rocket quickly and easily.

Additionally, RockSim is a "design program" as well as being capable of running simulations. Most quick-and-dirty simulation programs don't have this important feature. With it, you can eliminate the trial-and-error process that occomapnies the seat-of-the-pants design method. This not only saves time you time by getting it right the first time, but you end up saving money too. Many RockSim users have told me over and over how much money they've saved by having the software help them to find mistakes before they've started construction. And you also save money by eliminating launch mishaps; such as selecting the wrong rocket motor delay time.



step 3: add simple fins. Just use the default fin shape that rocksim generates.



step 5: under the mass override tab, enter the weight of the rocket and the cg position.

Another reason people prefer RockSim over other programs is that the software is the only one that allows you to simulate complex "flight events." This can be anything such as delayed staging, to electronic dual-deployment parachute recovery. It is also allows you to find the optimum launch angle (based on wind conditions) to get close proximity recovery. The cheapy, quick-and-dirty programs don't offer this feature.

But most of all, people choose to use RockSim for one simple, but important reason. It has to do with "accuracy."

Modelers want to be assured that their rockets are going to fly as they intended. You don't want to launch a rocket and watch as the parachute is ripped away from the rocket. People have heard that RockSim is the best program (the most accurate) for finding out how the rocket will behaive when it is

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Quick-n-dirty sims

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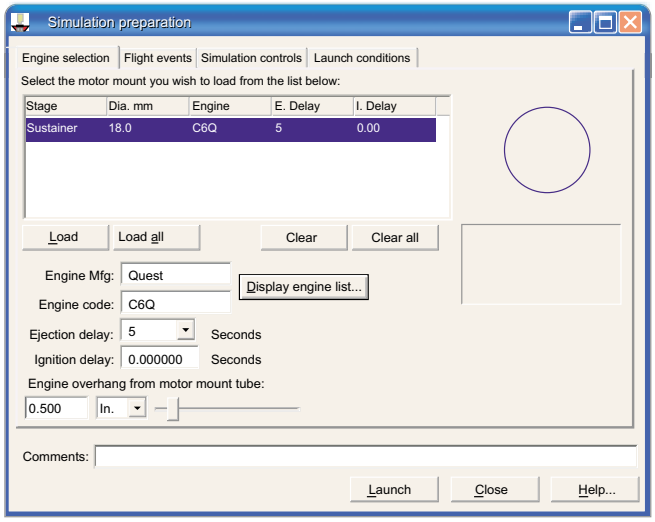


step 6: select the rocket motor.

launched. Not only the simple stuff like how high the rocket will fly, but complex stuff like what the actual trajectory will look like due to the rocket interacting with the wind. This interaction with the wind is what we associate with the term "dynamic stability." RockSim is the only program that will give you this information!

What the trajectory will look like when wind is taken into account is emmensely important. You can't accurately know what motor to use, nor even what direction to launch the rocket if you don't know how the rocket will behaive when the wind is blowing.

How the rocket interacts with the wind is dependant on the shape of the rocket, and the position of the internal parts. These affect the moment of inertia of the rocket. Since quick-and-dirty programs don't really care when the parts are positioned, they'll never be able to predict the actual trajectory of the rocket.

You can find more about this topic in Apogee e-zine newsletter #78, which can be downloaded at: http://www.ApogeeRockets.com/education/downloads/newsletter78.pdf

As you can see, there are a variety of reasons to use RockSim. It comes down to that the results of the flight strongly depend on the shape of the rocket, and the location of the parts inside the model. Since this is so important to the accuracy of the simulations, then it becomes apparent that a good design file for the "Mumblefrazz" rocket is needed.

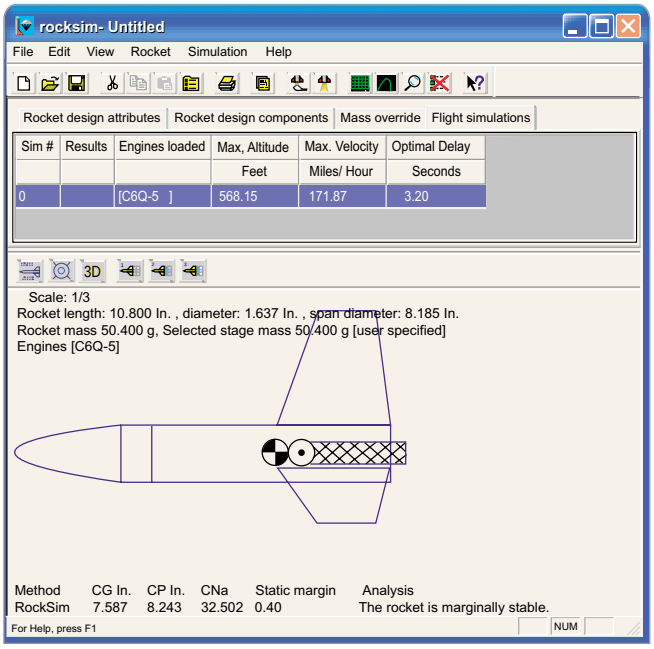
But rocketeers are pretty smart. They heard that RockSim is widely used, with over 3000 copiese used by people all over the world. That said, there should be a better-than-average likelihood that someone has already input a particular rocket kit into the program and created a design file. So why re-invent the wheel? Why not find out for sure if the design file already exists? It sure would save some time time when it comes time to get an "accurate" simulation.

Yep... you can get a quick and dirty simulation result from RockSim, just like you can get from WRASP. But it doesn't tell you much information about the flight. And it doesn't tell you if the rocket is stable or not.

The person that uses RockSim wants more information that just how high and how fast the rocket will fly. And, he wants to be assured that the accuracy of the simulation is the best. That is why you will continue to see people looking for RockSim design files.

reprint information:

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. This article may be reprinted as long as this paragraph is included with the text.



use these basic results to refine the model.

Quest Tomahawk Sea Lauched Cruise Missile (SLCM) Now Shipping From Apogee Components!

The Tomahawk Cruise Missile (BGM-109 or Boosted Guided Missile model 109) is a very accurate, unmanned, expendable subsonic aircraft for delivering muitions at more than 700 miles per hour to a target more than 900 miles (1,458 kilometers) from its launching point. The newest version can loiter near the target for about two hours, waiting for the target to show itself. It may be launched from either surface ships or submarines.

During Operation Desert Storm in 1991, 288 of the $600,000 Tomahawks were launched against targets in Iraq. In Operation Iraqi Freedom, more than 750 of the missiles have been launched.

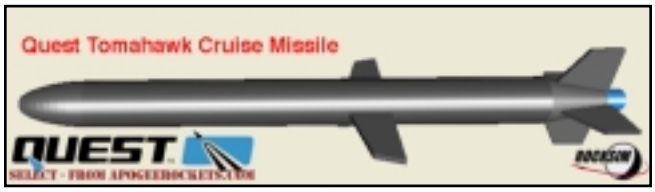
Here are just a few features of the Quest Tomahawk™ :

Plastic Nose Cone - The smooth plastic nose requires no finishing, other than a coat of paint. It's rounded nose shape is very efficient for low speed flights.

Color Coded Parts - You don't need to know the technical names of each of the items in the kit; like thrust ring, motor mount tube, and airframe tube. Just follow the instructions when it says to glue the red ring onto the yellow tubes, etc. Makes assembly of this level 3 rocket kit relatively error-proof.

Colorful Water-Slide Decals - Since this is a scale-like model, you'll love the thin water-transfer decals. They give you a lot of detail to cover the missile in its prototype color scheme.

The large 14" diameter *plastic parachute* that comes with the kit, brings the rocket down slowly for a nice soft touchdown. The canopy on the parachute is a colorful yellow and red pattern, which is easy to see in the sky, and when it lands on the grass.



What makes this a skill level three rocket is that it introduces you to some more challenging building and painting techniques. You'll get to create a paper tail cone, adding a cosmetic belly intake-scoops, and inserting clay weight into the nose cone to enhance the stability of the rocket. You'll also be challenged to complete a three-color paint scheme.

When you're done, this colorful rocket will be a perfect addition to your rocket fleet, and will also show off your patriotism. It is big, bold, and yields a thunderous sound when launched!

Kit Specifications:

Apogee's Part Number: 07020
Price: $14.50
Skill Level 3: Average Skills Required
Length: 19.4" (49.3cm)
Diameter: 1.57" (40 mm)
Empty Weight: 2.79 oz. (79 g)
Recommended Rocket Motors: B6-4 (First Flight), C6-3, C6-5. Rocket motors are not included with this kit.

Quest Tomahawk Altitude and Landing Distance Predictions

Motor Used	Altidude - feet (meters)	Drift Distance* in a 10mph wind
Quest B6-4	261 feet (80 m)	400 feet
Quest C6-5	590 feet (180 m)	880 feet

*The drift distance is how far away the rocket will land in a 10mph wind if it is launched straight up. This distance can be decreased by launching in calmer winds, or by tilting the launch pad slightly to point into the wind. Results created with RockSim software. Try the free demo version at: www.ApogeeRockets.com/rocksim.asp