

RockSim: Fly Your Rockets On Your Computer Before Spending Money.

By Tim Van Milligan

Overview of Presentation: In this seminar, you will see how you can improve your rocket designs with the aid of computer simulations. I'll show you how to create a design in RockSim, and then how to tweak it to make it better. This presentation will also show you the new features of Version 7.0 which Apogee hopes to release in the next few months.

What is RockSim?

Did you know you can test launch your rocket designs before you even start to build them? As you can imagine, if you can perform a rigorous shake-down to your rockets before the glue is dry, you can still modify it to make it safer, or to make it fly higher! This has a lot of advantages in time and money:

1. You'll save money by making sure they fly straight. An unstable rocket that crashes is a waste of money because you can't fly it again and again.

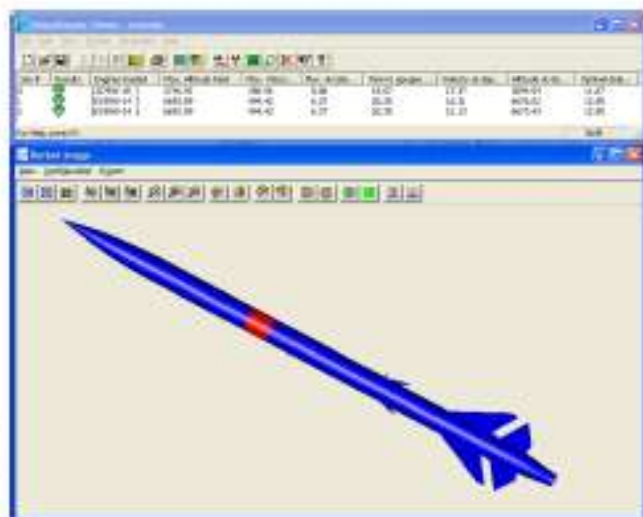
2. Prevent a rocket drifting out-of-sight and losing an expensive motor casing. This waste of money can be avoided by some pre flight simulations and selecting the right rocket engine to use.

3. If you know all of the parts you need to build your rocket, you won't order unnecessary items -- saving you money!

4. Save time by preventing building errors. You'll know exactly where each part is positioned when it is time to put the rocket together. You won't have any more rockets where parts have to be chiseled out and replaced after the glue has dried. Think of all the frustration you'll be saving yourself from.

5. By testing your design beforehand, you know what rocket motor to buy. You won't end up spending money on rocket motors that have the wrong ejection delays.

6. You can actually design high performance rockets to fly from small launch sites. You'll know how high the rocket will fly, and how far away from the pad it will land.



7. You'll know the rockets projected weight, which is important if you are trying to build big rockets that don't require a waiver to launch them. This will also help you to select the right size parachute you'll need so you won't buy the wrong size.

8. If you are going to attempt a Level 2 or Level 3 high-power certification, you'll need proof of CP location. You'll get this from RockSim.

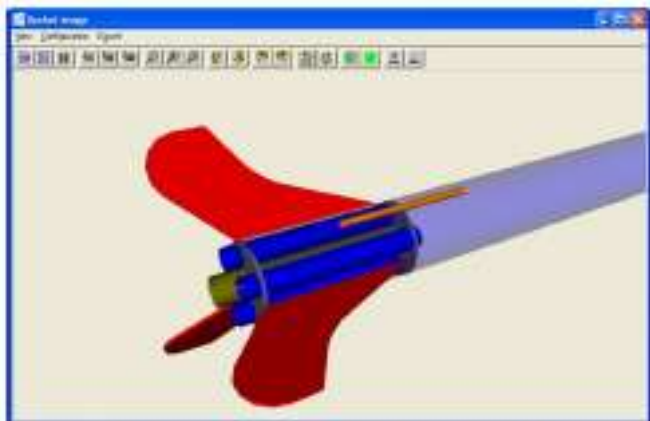
9. You'll know what the rocket looks like in 3-D, so you can find what color choice looks best before you buy any paint.

10. And if you fly a lot of rockets, you'll find that by designing your own rockets, you will save hundreds, if not thousands of dollars compared to buying kits. At the same time, you'll learn more about rocket science than expert modelers that have been flying rockets for years and years.

As you can see, using an advanced software like RockSim can save you a lot of money and time. But why RockSim? Can't you get the same features from a cheaper program?

First, before I answer that question, let me tell you a little bit about RockSim.

RockSim is a rocket design and simulation program for the Windows operating systems. It can be used to design models from tiny sizes to ultra-huge



RockSim lets you see if the parts will fit in your rocket before you cut your first tube.

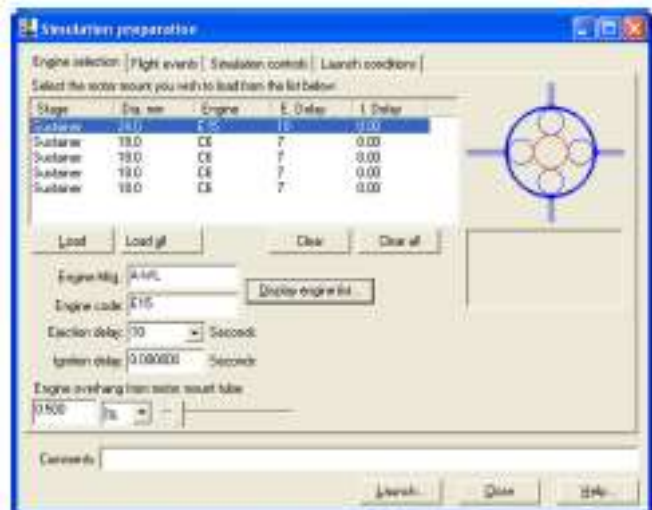
monster rockets!

When you create a rocket design, RockSim calculates the mass of the model, plus it finds the CP and CG locations so the static stability can be determined. Then, when you perform a simulation, it will tell you how high and fast it will go, plus where the rocket will land.

But deep down, RockSim is actually a collection of many unique computer programs that are seamlessly integrated into one package. The important part to you is that it is all "seamless" -- you can't tell where one part stops, and the next starts. This is what makes it so powerful and so easy to use!

RockSim has these mini-programs already built in:

1. A "CAD-like Drafting Program" to aid in lay-

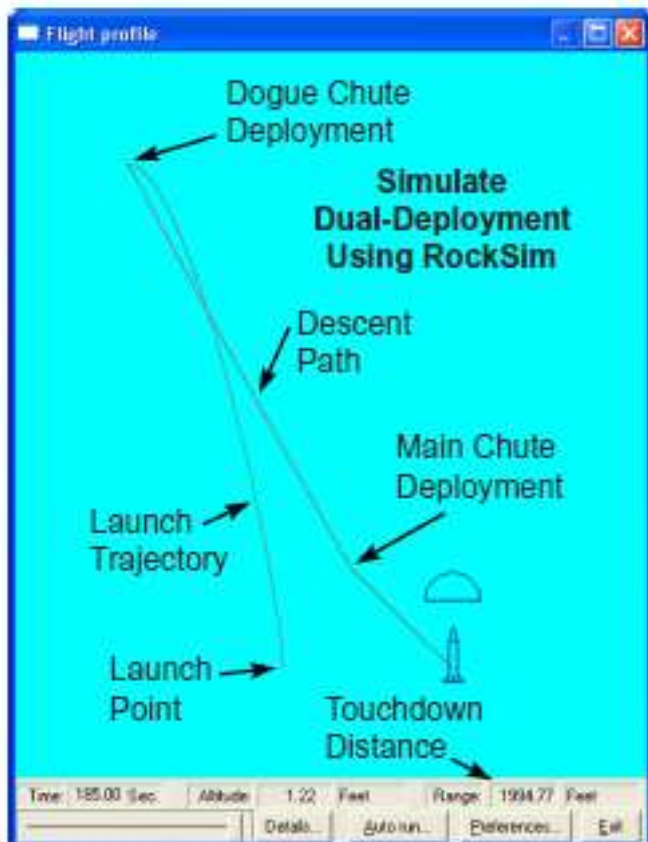


You can mix different motors in the rocket to see how high it will fly.

ing out the arrangement of the component parts; and to draw 3D images of the rocket. While it is CAD-like, it is much simpler to use - even 10 year old kids use RockSim without any problems.

2. A "Coefficient-of-Drag Prediction Program" to find out the efficiency of the rocket's shape. You can't even begin to tweak the performance of the rocket until you know its Coefficient-of-Drag. RockSim calculates this as you are still designing the rocket, so you can tweak the shape for optimum performance.

3. An "Optimum Mass Prediction Program" to

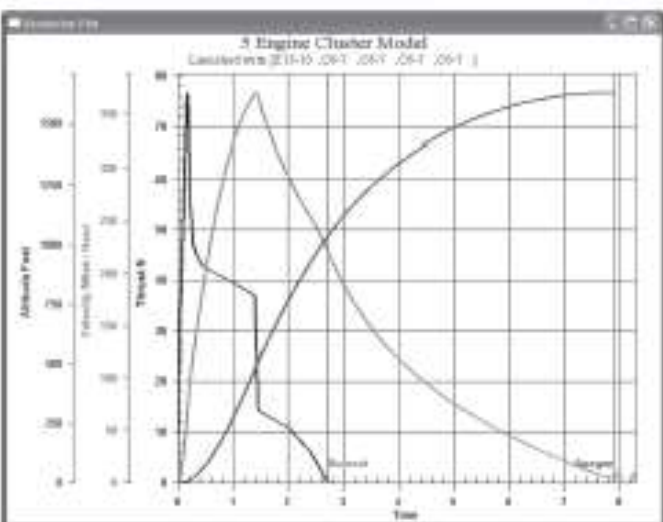


find the best weight of the rocket that gives the highest altitude. Did you know that sometimes you have to add weight to the rocket to make it go higher? RockSim will tell you what the best weight should be for the highest flights.

4. A "Center-of-Pressure Prediction Program" to find the static stability of the rocket.

5. A "Center-of-Gravity Prediction Program" to find out the overall weight of the rocket and its stability during flight.

6. A "Dynamic Stability Program" to find out the trajectory of the rocket including what happens



RockSim creates detailed graphs to show you the characteristics of your rocket s flight.

when wind acts on the model. No other software has this capability — they all assume there is no wind. "No wind?" – How ridiculous is that?

7. A "Flight Simulation Program" to find out how high and fast the rocket flies and help you in selecting rocket engines to achieve this performance.

8. A "Component Selection Program" prints out a list of materials to make it easier to gather parts when constructing the rocket.

9. A "Pattern Sheet Program" used to print fin and centering ring patterns, to aid you in building your rocket design.

10. A "Component Design Program" which helps you create new and unique nose cones, curved transition sections and odd shaped fins. RockSim is still the only program that will allow you to make any fin shape you want!

11. A "Special Events Editor" used to select when, where, and how to use electronic initiation devices during the flight. If you're a high-power flier, and you use electronics on your rocket, you need this feature to help you set the recovery sequences correctly.

12. A "Graphing Package" to create order and meaning from complex information generated by each launch scenario.

13. A "Recovery Device Selection Program" to determine what size parachute or streamer is needed to safely bring the rocket to the ground.

14. A "Landing Zone Prediction program" to

find out where the rocket will touch down, and to see if the field is large enough. Or you can use this to find out the angle the rocket needs to be tilted into the wind for a close proximity recovery.

15. A "Mass Prediction Program" to find out what the rocket will weigh before you start building it. This is needed to help you select the initial motor required to launch the rocket.

16. A "Teaching Aid" to help explain concepts to others using a visual tool of the 2D flight profile and to generate raw data that can be analyzed in a classroom environment.

17. A "Cluster Engine Design Program" to help you lay out an arrangement of motors that will fit into your rocket's body tube.

As you can see from the above list, RockSim is simply a huge collection of programs designed to make rocketry safer and more fun for you!

How Do You Start?

Designing rockets with RockSim is a snap. Typically, you'll select from the extensive database of parts from your favorite manufacturers like Apogee Components, L.O.C., Aerotech, or Public Missiles! By arranging your parts, you create a rocket design with which you can perform a simulated launch.

But in case we've forgotten some part you need, or if you have a custom part of your own, you can easily add it to your RockSim database. Once the part has been added to the database, you can call it up for any other rocket design!

Many people that use RockSim never enter a design themselves. Why? Because they fly "kit" rockets. There is usually someone amongst the 2,500 users of RockSim that has already entered the kit into the software. So you can simply download a rocket design you want from the internet. There are hundreds of websites that have RockSim rocket files, including kit manufacturers like PML and L.O.C.! As you can tell, RockSim has become the "Industry Standard" for storing information about rocket kits.

The cool thing is that when you load someone else's design, you can merge their parts database in with yours -- so it is a quick way to build up your own massive library of parts!

When you are finished with the design aspect, you can select a rocket motor for it, and RockSim

will perform a launch simulation that will tell you how high the rocket will fly, plus other parameters like acceleration, velocity and downrange drift. The simulations of RockSim are the most accurate of any software!

When it comes to predicting a rocket's stability, RockSim is the only software that includes the "Fossey/RockSim" stability technique. This method allows the user to create designs that weren't possible using the standard Barrowman stability equations. That is why it can allow you to design rockets with any fin shape you want!

And when you are ready to build the model you've designed, RockSim will print out templates you can use to make the construction phase much faster and easier.

RockSim also comes bundled with a separate Motor Editor program at no extra charge. This allows you to modify or create rocket motor rasp.eng files by dragging points around on a thrust curve. This is then compiled (the compiler is also included - again, no extra charge), and the data is ready to use by the RockSim program. With this feature, you can design rockets around your own hypothetical rocket motors, or update the motor data file as newly certified motors become available. There is no set limit on the size of the motor, so you can input the largest of HPR motors!

The current database of motors includes manufacturers such as: Apogee Components, Aerotech, Hypertech, Kosdon, Cessoroni, Estes, Quest, and Ellis Mountain Rocket Works.

What is coming in version 7.0?

In the past, RockSim was the first to bring you advanced features like "on-the-fly" prediction of CP, CG and Cd measurements. Other programs only pre-



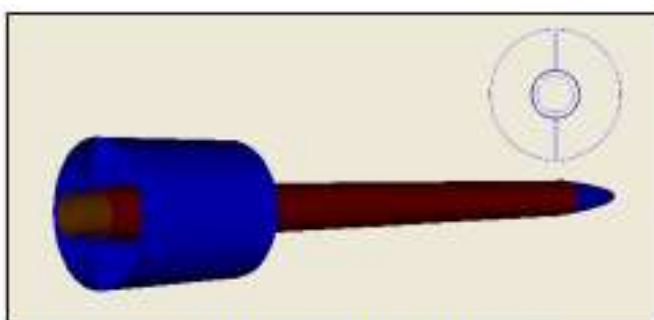
Version 7 will give you more choices for different fin types.

dicted CP, or only Cd. But RockSim was the first to do those, plus CG. This makes it easy to tweak your fin size to make sure the rocket will be stable.

Then, RockSim was the first to bring you "custom fin shapes." This broke the mold in software programs, because the other available programs only allowed trapezoid or elliptical shape fins. With RockSim, all of a sudden, you could make any curved shape you wanted!

As mentioned earlier, RockSim also predicts the dynamic flight characteristics of your rocket. This is known as dynamic stability. RockSim introduced this feature about 4 years ago, and it is still the only program that allows you to see how your rocket will interact with the wind. It would be silly to assume that your rocket would fly in perfect conditions on every launch. So it is important to make sure you





Ring Tail fin unit created in the new RockSim v7.0

know how it will behave in real-life situations. Safety is paramount.

That is a short synopsis of why RockSim is the leader in model rocketry simulation software. But where do we go from here?

There are three "blow-your-socks-off" new features in version 7.0. These have been requested by hundreds of users, and as you can see from our history, we're pioneering new ground once again.

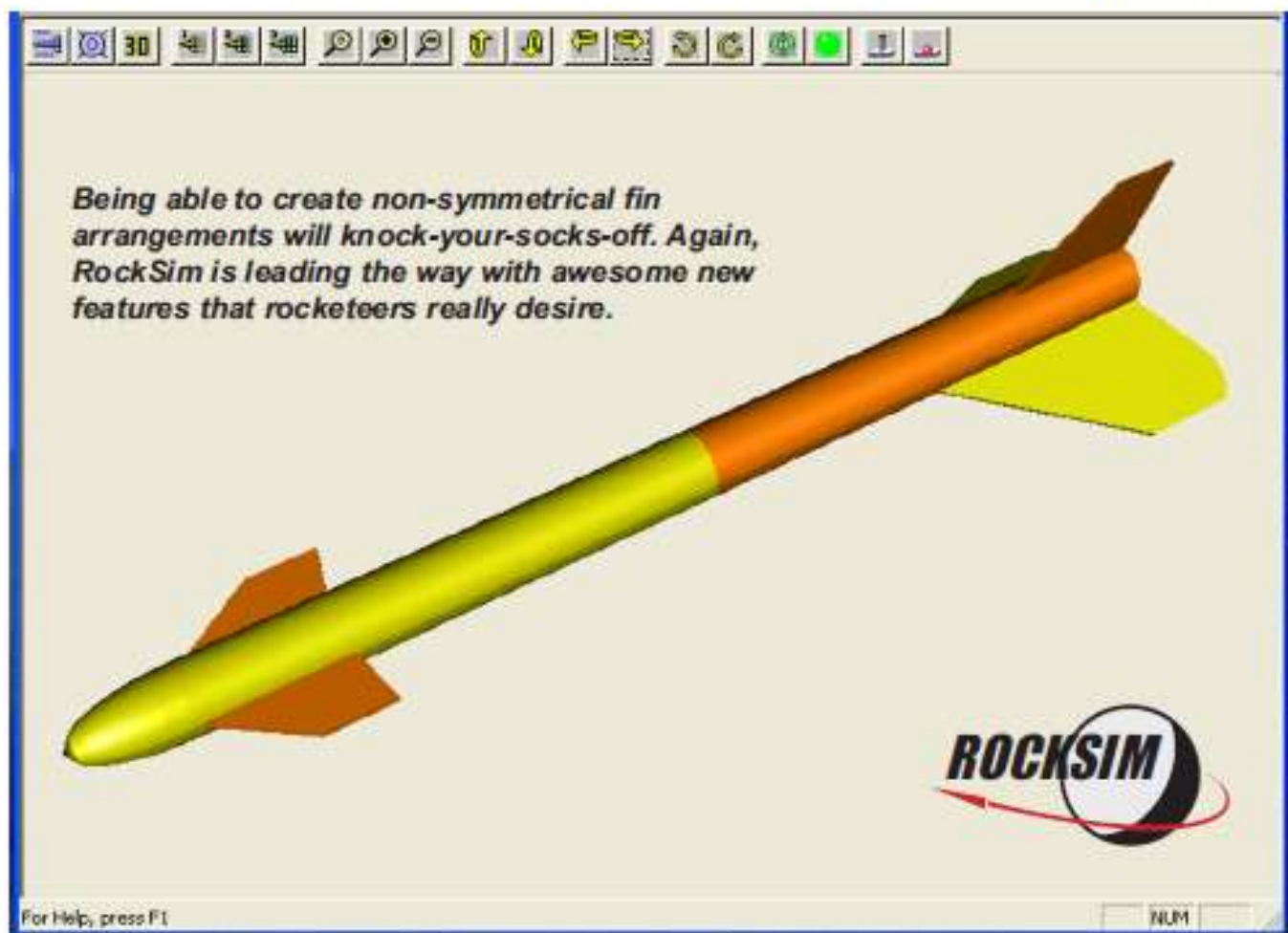
1. **Tube Fins** - Tube fins are short lengths of body tube that are glued to the aft end of the rocket

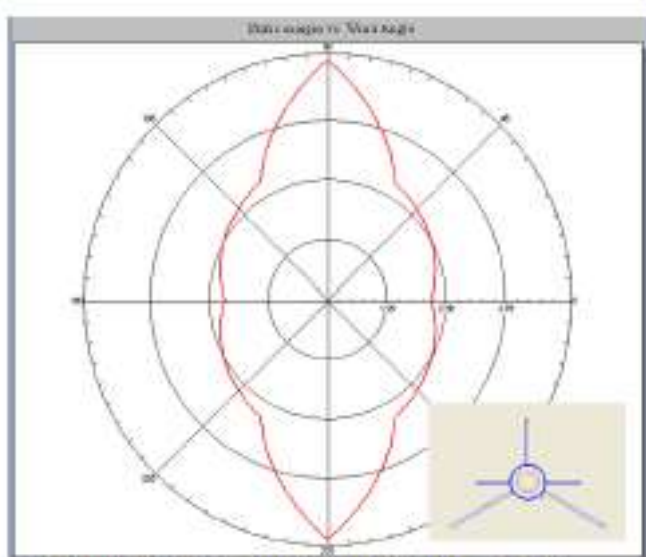
to replace the flat fins. In previous versions of RockSim users tried to simulate tube fins by cheating: moving "inside" tubes onto the outside of the rocket. But RockSim didn't know they were actually fins. They had zero effect on the CP or Cd of the rocket. In this version, you don't have to cheat. RockSim will let you start by putting tubes on the outside of the rocket.

2. **Ring Tail Fins** - Ring tail rockets have a single large tube that acts like fins. It is also concentric with the body of the rocket. Again, in the past, it was possible to make the rocket look right; but the simulations were just garbage. The software didn't know the tube was supposed to be a fin.

Both ring tails and tube fins were made possible because Apogee Components spent the time and money to perform real wind tunnel testing. We had to do this to find the governing equations that would predict the CP and the Cd of such configurations. This is similar to the Barrowman Equations that are used on rockets with flat fins.

3. **Asymmetrical Fin** - Each fin placed on the





Stability Polar - shows the axis of the rocket that is less stable. Inset shows the configuration of this rocket design.

rocket is independent of all others. This means it can be shaped differently from the others, and arranged on the tube with a different angle. With this new feature, it is now possible to make your rocket designs look like "aircraft" that have two wings.

This does open up some problems though. The direction of the wind and the orientation of the rocket to the wind becomes critical. Why? Because the rocket may be "stable" if the wind is blowing from

one direction, but it might be unstable if blowing from another.

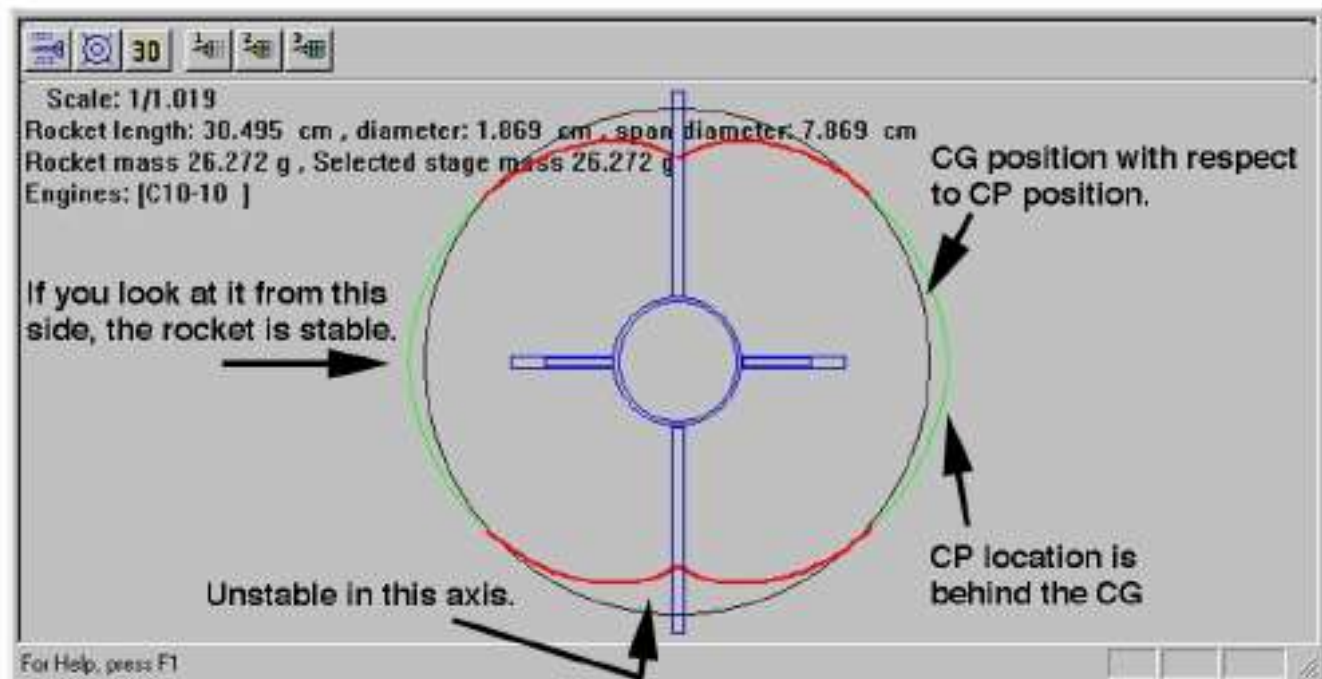
To solve this problem, and to let the designer know which way to orient the rocket for launch, RockSim 7 incorporates a new "stability polar" image. This tells you the stability margin of the rocket with respect to the direction of the wind.

Conclusions

Model rocket design has been greatly improved with the simulation software. Not only can you design rockets faster, you'll have new confidence that your creations will be stable and safe to fly.

Obviously, I recommend the RockSim software above all others. It has been a leader in bringing about advanced design features, and the new v7 will continue this trend. No other software has the features and the horsepower to do the things that only RockSim can.

Note: No release date has been determined yet for version 7.0. To receive an email announcement, please subscribe to the FREE Apogee e-zine newsletter. Visit the Apogee web site at: www.ApogeeRockets.com



Because Asymmetrical fin arrangements can be unstable along any given axis, RockSim 7 will tell you which directions it will be stable, and where it will be unstable.