PEAK OF FLIGHT NEWSLETTER

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TROUBLESHOOTING YOUR ROCKSIM DESIGNS

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PEAK OF FLIGHT

Troubleshooting RockSim Designs

By Tim Van Milligan

Customers often send us their RockSim designs to figure out what is wrong with them. This article will cover some of the most common issues that people have, as well as how to troubleshoot a design so that you become the rocketry expert that other people look up to.

What Problems? Isn't RockSim Perfect?

The first thing that should go through your mind, as you read the title of this article is: "Wait a minute… isn't RockSim the perfect software? Why should there be any issues with using it?

There are several types of issues that people could have with RockSim. Here is a list that I thought of:

1. ***Simulation problems*** - The rocket is not behaving like I think it should.
2. ***Design Problems*** - I can't figure out how to make it do the crazy configurations that I want it to.
3. ***Wishes*** - It can do what I want, but there has to be a simpler way of getting there.
4. ***Physics*** - Why can't it give me the results I want?
5. ***Bugs*** - It is definitely broken and not working properly.

Simulation problems

A simulation problem is loosely defined as a problem that occurs when you push the launch button to start running a simulation, but you don't get the results that you expected. A common problem is that the rocket doesn't leave the launch pad - which is indicated by the icon in the simulation summary of the rocket sitting on the pad, and all the numbers are zeros. For example, the maximum altitude is zero. That would indicate a simulation problem.

FIGURE 1: THE ICON YOU'LL SEE IN THE FLIGHT SUMMARY SCREEN, WHICH INDICATES THE ROCKET NEVER LEFT THE LAUNCH PAD

In about 90 percent of all the cases, when people come to us for help, they think RockSim is broken. However, most of them are not bugs, but would fall into one of the other categories of problems that the user is having with the software.

But when it comes to troubleshooting a simulation problem, verifying that RockSim is NOT broken is the first thing you will probably check. And it is a simple thing to check.

If you suspect a bug in RockSim, the first thing you should check is the version you have of RockSim, is it the latest version?

To find your version number, go to the Help menu (on Windows) and choose "About", or on the Mac it would be "About RockSim" from the "Rocksim" menu.

Finding the latest version of RockSim can be done on the RockSim Version History webpage. That is located on the Apogee website at: https://www.apogeerockets.com/RockSim/Version_History.

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About this Newsletter

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Newsletter Staff

Writer: Tim Van Milligan
Layout & Cover Artist: Derek Villar
Proofreader: Michelle Mason

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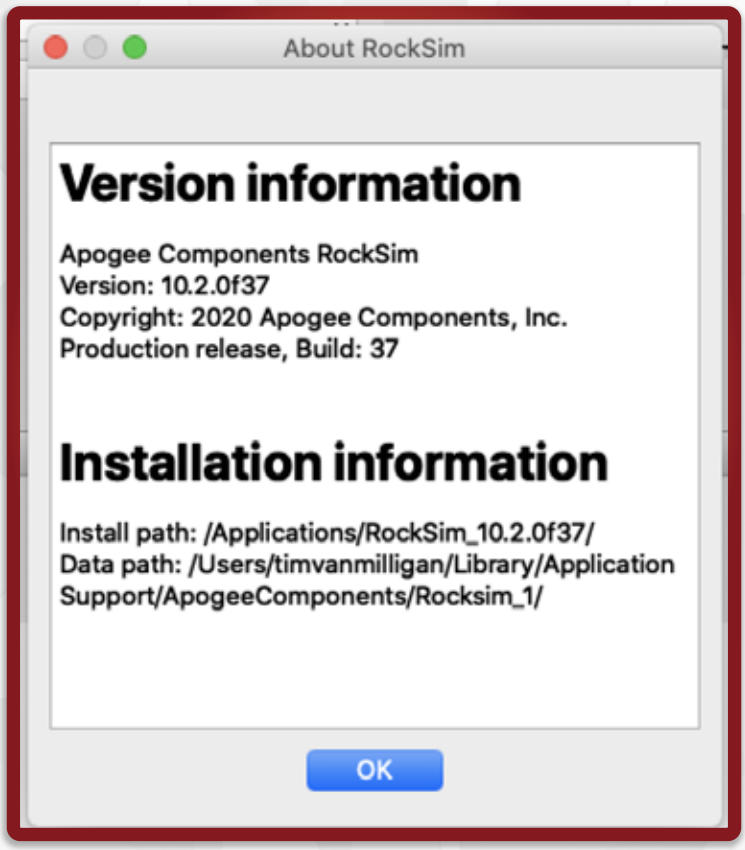

FIGURE 2: THE ABOUT ROCKSIM BOX SHOWS THE VERSION NUMBER YOU ARE RUNNING

The number you are looking for will have this basic format: v10.2.0f37. The first number (the "10") stands for the major edition of the software, and defines the major features of the software. The second number tells how many feature updates have been done to the software since the last major edition has been released. In the case of v10.2, that means there were two new feature updates to the software since v10 was first released. A "feature" is a new capability to the software that it didn't have before. It isn't a fix -- it is something brand new.

But you should be aware that at the same time we release features, we also release bug fixes to the software. In fact, my personal philosophy is that if there is a fix that needs to be done to the software (a bug fix), that we also add some new features to the program to entice people to go through the process of updating. I know it is a hassle to do an update, so I want users to see an extra advantage by doing the process.

The third number in the version sequence is the number of updates in the current minor version that are specifically for bug fixes. As I just mentioned, I don't like to release a bug fix by itself without also giving a new feature in the update. So this number is almost always a zero. So in version 10.2.0, there are no new bug fixes. If we did a bug fix after that, without releasing a new feature, it would be called version 10.2.1. But in all likelihood, you'd see a v10.3.0 instead (which would have at least one new feature).

To be honest, I don't know what the "f" stands for. But that last number after the "f", is used internally here at Apogee by our programmer. It is just the number of changes they have made internally in the code since the last update. These changes are often minor, such as adding internal comments or cleaning up code to make it more efficient. They aren't things that a user would notice. We just need to keep track of them for our own work. So you don't need to pay particular attention to them, unless you were a beta tester that is given a sneak peek at a future

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version. During beta testing, we may send out multiple updates to the people doing the beta testing.

At the time of the writing of this article, we do know of some bugs that need to be fixed. But instead of having a 10.2.1, we will be making it a version 10.3.0 because it will also contain at least one new feature. When it is released, we'll update the RockSim Version History page on our website to let you know what bugs were fixed, and what new features were added.

Once you have verified that you are running the latest version of RockSim, what you should then do is open up a DIFFERENT rocket design file. This is particularly important if you're having a simulation problem. Most people have tunnel vision, and only care about the particular design that they are working on. They just don't want to invest in the time to open up a different rocket design and see if that one has a similar issue. If the different RockSim design doesn't display the same problem you saw with your original design, you have eliminated the possibility that the software is broken.

The next step is that when you do open up a different design to run a simulation, also use a different rocket engine than the last time you tried to run a simulation. Pick a rocket motor from the current RockSim database. We see "tunnel vision" also extend to a particular rocket engine. Because one issue that can crop up is a bad motor (thrust curve) in the database. We at Apogee don't make many thrust curves, so we can't verify that the motor file in your database is OK. By running your simulation with a different rocket motor, you reduce the chances that your particular issue is caused by the motor.

So say the other simulation works just fine. Now you can open up your particular rocket that you are interested in. We recommend that you immediately save the design with a different file name as soon as you open it. This is so you protect the original version from any changes you're about to make during the next series of troubleshooting steps. Just knowing that your original design is protected and safe from changes really gives a lot of people emotional relief - and a burst of confidence to experiment a bit more. You can really screw up, and the original design won't be changed because it is not being worked on.

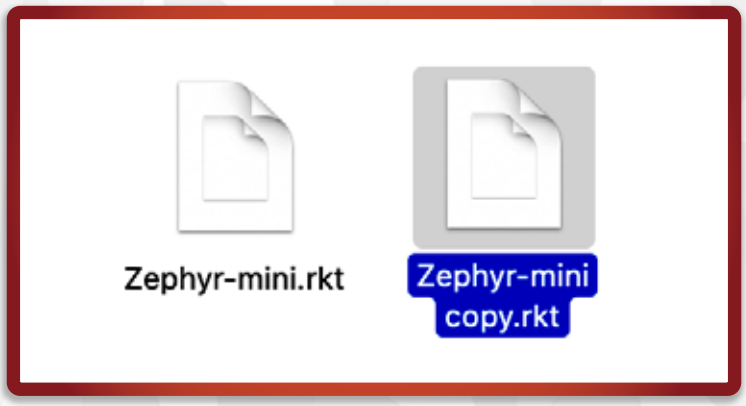

FIGURE 3: MAKE A COPY OF YOUR DESIGN SO YOU AVOID OVERWRITING IT WHEN TROUBLESHOOTING

Say your original rocket never left the launch pad, and now you've got your duplicate copy of the rocket opened in RockSim. Start by loading a motor from the database and try to run a simulation to confirm that it still doesn't leave the launch pad. It is actually a good thing that you're able to duplicate the issue.

Our next step is to start to look at the actual parts that make up the rocket and figure out which one is causing

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RockSim not to launch it in a simulation. What we're going to do is actually start deleting parts. That's right, we're going to delete parts one at a time, and try to run a simulation between deletions.

The process is to delete a part, hit the launch button and look at the summary screen. It will only take you a second to tell if the simulation worked or not. If the rocket still doesn't leave the pad, then the part you deleted didn't have any problems with it.

Before you start deleting parts, let's talk about what you can't delete. There is really only one part you can't delete, and that is the tube that is specified as the motor mount (also called the engine mount). You can't delete that part because RockSim needs to know where to place the rocket engine into the design. But everything else can be deleted.

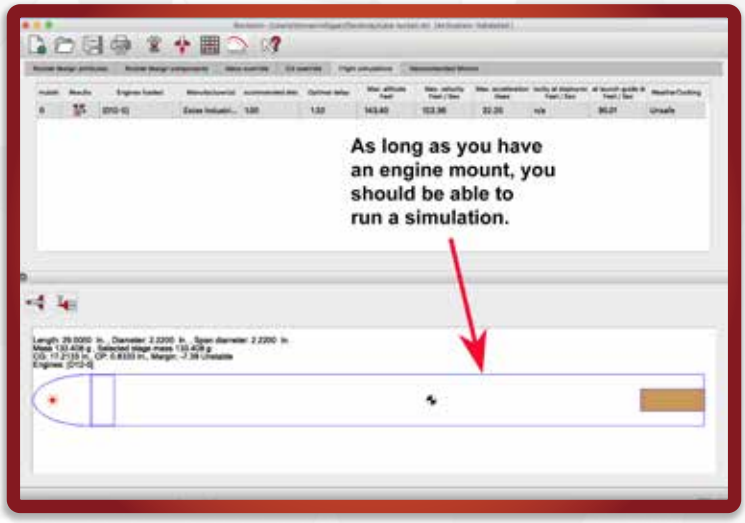

FIGURE 4: IN ORDER TO RUN A SIMULATION, YOU WILL NEED AN ENGINE MOUNT TUBE

At this point, we don't care if the rocket is stable or not. We just want the simulations to run until completion.

Eventually, you will find the part that is causing the problem. Once you delete it, the simulations will start running again! That is what we want to isolate.

Here is a tip: based on our experience, the part that we see corrupted most often is a fin set. So start by deleting the fin set!

Once you've got the part that is causing the problem isolated, you can now open up your original design. Again, before you start editing it, make another duplicate copy by choosing "Save As" from the file menu and giving the duplicate a new file name.

Now you scroll down through the parts tree and find that one part that is causing the problems. Say it was the fin set. When you open it up, you want to look at all the parameters on the general tab and make sure that they are "legitimate." By that, I mean do the parameters make sense. To be honest, this is the hardest part of troubleshooting, because it takes some previous rocketry experience and a bit of wisdom.

The most common culprit we see making problems are fins made out of a material called "Custom" as shown in Figure 5. But what is "custom?" A newbie might think that is a legitimate material. But experienced modelers would know that custom is not defined, unlike a material called "balsawood."

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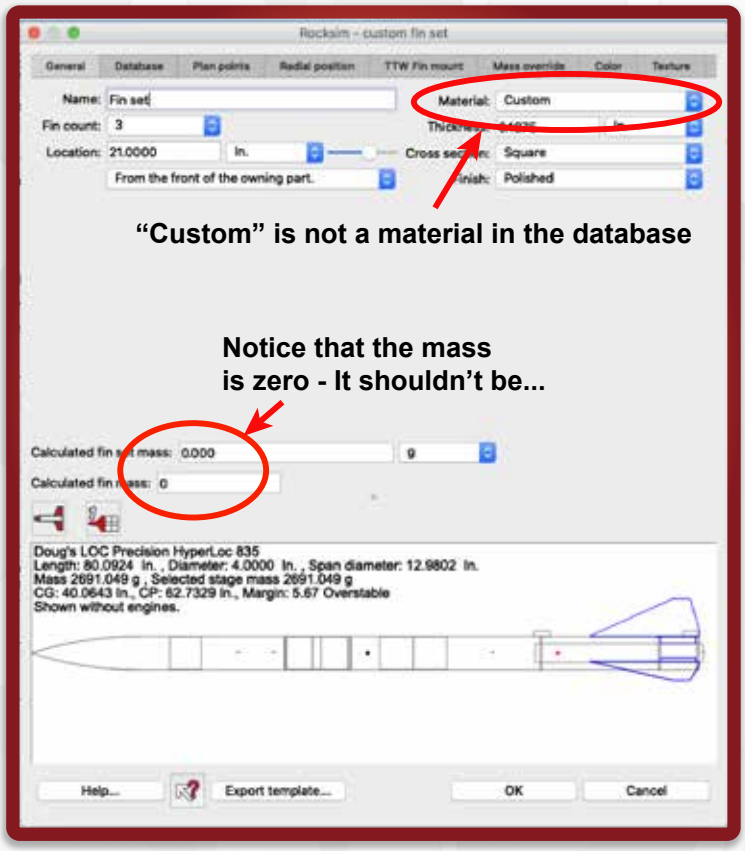

FIGURE 5: "CUSTOM" IS NOT A REAL MATERIAL, AND CAUSES SIMULATIONS TO HANG IN ROCKSIM

The first time we ran into this, we had a lightbulb turn on in our head too. To this day, we still don't know how "custom" is creeping into the designs, because it isn't in the list of available materials. But is it causing all sorts of havoc with the simulations not running properly.

I was doing a RockSim live training on April 30, 2021, when I ran into a problem of a design that I opened up, not allowing me to turn it from a single motor mount into a cluster motor mount. I went through these exact steps, and had to start deleting parts in order to find the one bad one that was causing the problems. (You can watch at: https://youtu.be/Unb2ZIAbFPU?t=551). I did find the part, and after I deleted it, and created a new part to replace it, the simulation worked just fine.

Design Problems - I can't figure out how to make it do the crazy configurations that I want it to.

The most type of design problems that we see happening stems from a lack of experience designing and building rockets in RockSim. For example, recently a user sent us a frantic question because he couldn't get his fin shape to match what he actually made in real life. This was a relatively simple trapezoid design.

For design problems like this one, our troubleshooting step is to just "play" with the slider bars that control the shape until you figure out what each slider bar does.

For example, moving the slider bar for the sweep length will also change the sweep angle of the leading edge of the fin. The two parameters are tied together. We designed it to be this way in RockSim, because some people measure the angle of the leading edge of the fin, while other people use an x-y coordinate system when they design their rockets. By just playing with the sliders, you can see both values are changing at the same time. But again, this comes down to a fear of messing something up in the design. This fear can be eliminated by simply following the

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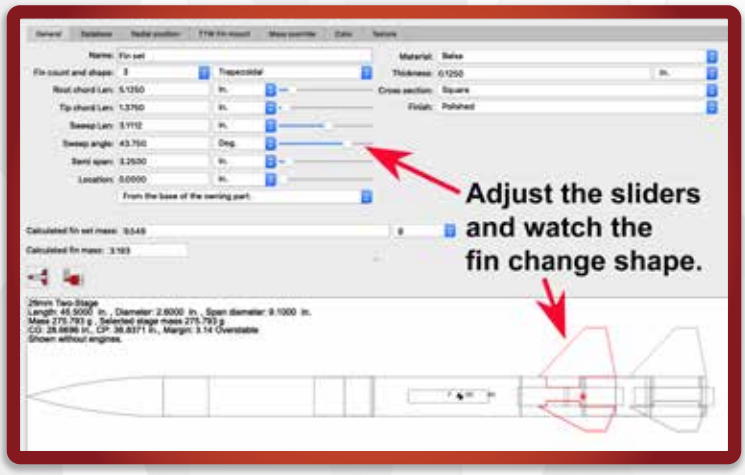

FIGURE 6: THE SLIDER BARS ALLOW YOU TO CHANGE VARIABLES AND SEE THE RESULTS INSTANTANEOUSLY IN THE 2D VIEW

same steps we did above - make a duplicate file on your computer by saving the design with a different name just before you start messing with the slider bars. We at Apogee encourage people to play! It is a lot of fun.

The other design problems that we see people having stems from a lack of knowledge in the design rules we had to build into Rocksim. For example, when you add parts into the design, some of the component buttons are not selectable. A simple illustration of this is that you just can't click to add a part like a parachute and attach it to a fin. That is a design rule. Parachutes must go inside a tube.

But if you don't know the design rules, it can be frustrating, because you might want to attach a streamer to a tip of a fin. In real life, this is possible. But in RockSim, the design rules prohibit that configuration.

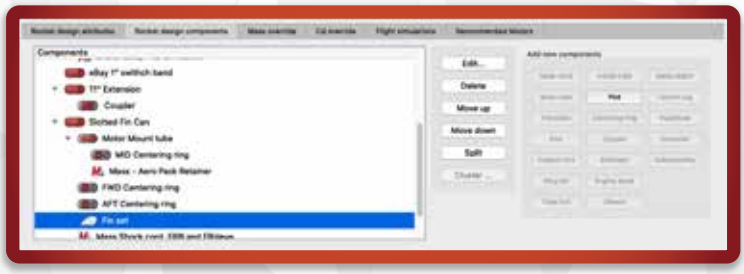

FIGURE 7: WHEN YOU SELECT A FIN, THE DESIGN RULES IN ROCKSIM PREVENT YOU FROM ADDING ANY PARTS TO IT, EXCEPT FOR A POD

I wish I had a simple and easy way to help people learn the design rules. This just takes a lot more experience using the software. It just comes down to playing a little bit more. And "playing" with RockSim is not a chore, it is fun.

There is a shortcut here - and that is to learn from someone that has more experience with the software than you currently have. And at Apogee, we've got your back. We not only have tutorial videos that cover the basics of the software (https://www.apogeerockets.com/RockSim/RockSim_Video_Tutorials), but in January 2021 we started a weekly live training session where you can ask your questions about using the software and get instant

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answers. You'll find that training session at: https://www.apogeerockets.com/RS-Live-Training

Troubleshooting Your Wish List

Many of the questions we get here at Apogee have to do with those features that customers wished RockSim had. In Episode #16 of our live training, one of the participants asked a really good question - Why can't RockSim calculate the optimum launch angle that you'd need to launch your rocket so that it was safe and would result in the shortest walk to retrieve the rocket?

FIGURE 8: A COMMON WISH - WHAT IS THE OPTIMUM LAUNCH ANGLE FOR CLOSE TO PAD RECOVERY?

As I was reading that question, I was wondering what it would take. I suppose it is possible in RockSim. But it isn't currently. That is a new "wish."

I encourage people to make new wishes in RockSim. It really helps us to improve the software so that it gets better in the future. What I'm saying is that I don't have any troubleshooting steps to fix this issue. I think it is a good problem to have, and I encourage users to bring those to our attention.

But a lot of times, the feature wishes that people have are actually already in the software. It is just they are hidden in places that are not well used. We all have our set routines on accomplishing things, and that can inhibit our exploration of the other parts of the software.

I had two different participants in a recent RockSim Live training do a face-palm emoji when I showed them that RockSim comes with hundreds of sample design files (from dozens of different rocketry manufacturers). They were surprised and overjoyed to find out that there were so many new rockets that they could explore, and they didn't need to download them from the internet. They just needed to navigate to the correct folder on their computer where the sample designs are stored.

Honestly… we're not trying to hide these golden nuggets. There are just so many features in RockSim, that we don't have the time to trumpet them all. Again, I encourage users to come to a few of our training sessions, or watch the replays on YouTube to discover where the features are accessed.

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Physics

The one observation that I've made over the years is that users of RockSim are impressed at what it can do. And comparing that to what they had available in the past, it is a huge leap in capability. It's almost like it is magic in some cases. Therefore, users make the next big assumption: "If you could do that stuff (which looks like magic), why can't you do this other magical thing?" They assume we have the capability to make continuous magic.

But as engineer Scottie on the Star Trek show was fond of saying -- "ya just cannot change the laws of physics Captain." There are certain things that we can't do yet in RockSim. Physics is hard, and it takes a lot of computer code to pull off the magic we're currently capable of. And to go further in capability, we need to put in a lot more computer code and bring in expertise that we don't have yet.

One case in point is that users have the desire to import real CAD objects into RockSim. Many users are hoping that we can take a nose cone they designed in SolidWorks, and use it as a component in RockSim. How I wish we could do that too. But for as advanced as RockSim is, I can tell you that it doesn't have any CAD capability.

RockSim needs simple shapes like cones and parabolas in the algorithms that calculate the trajectory of a rocket. But when you design in a CAD program, you have unlimited capabilities to add things like cockpits onto those nose shapes. Unfortunately, RockSim wouldn't be able to handle those things, since they break the rules of simple shapes. Until we are able to have better coding in RockSim, it will always be limited to simple shapes.

So unfortunately, there is no troubleshooting we can do in situations where we don't have capabilities yet.

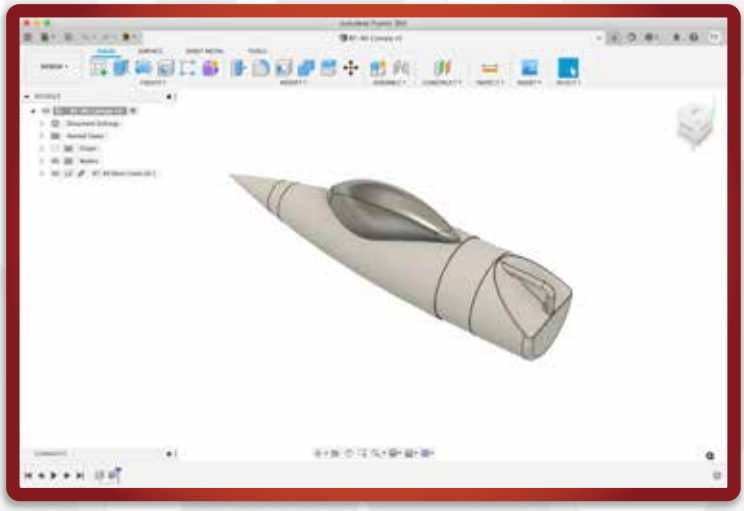

FIGURE 9: UNFORTUNATELY CAD PROGRAMS CAN CREATE SHAPES THAT ROCKSIM CAN'T SIMULATE

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Bugs

There are no known bugs in RockSim that cause issues with running simulations. But unfortunately, because I said that phrase that there is a possibility of an "unknown bug," you are going to fixate on that and believe that the issue you are encountering is a newly found bug. Once that thought occurs, you will then immediately disregard everything else in this article on how to troubleshoot the design. Why troubleshoot if there is a bug?

So what will happen – and I guarantee this 100% of the time – is that when someone comes to us and says to us that RockSim has a bug, we will go through the process of trying to educate the person on setting up simulations correctly. It will be an embarrassing situation for that person, because they will have tried to prove a bug exists where one doesn't. Our wish is that people would come right out and say: "I don't know how to set up a simulation properly." At that point, we will point them to our tutorials on the website and ask them to invest a few minutes of research time watching how to do it properly. But people don't want to invest their time. That is the real problem… and unfortunately, I don't think we'll ever have a troubleshooting step for that.

Conclusion

This article started out as a series of steps you could use to troubleshoot your RockSim designs. Basically, the steps to getting the software to do what you want involve a little investment of time. Don't get discouraged. Don't cry for help. We believe that you can do it when you just play around a little bit.

About The Author:

Tim Van Milligan (a.k.a. "Mr. Rocket") is a real rocket scientist who likes helping out other rocketeers. He is an avid rocketry competitor and is Level 3 high power certified. He is often asked what is the biggest rocket he's ever launched. His answer is that before he started writing articles and books about rocketry, he worked on the Delta II rocket that launched satellites into orbit. He has a B.S. in Aeronautical Engineering from Embry-Riddle Aeronautical University in Daytona Beach, Florida, and has worked toward an M.S. in Space Technology from the Florida Institute of Technology in Melbourne, Florida. Currently, he is the owner of Apogee Components (http://www.apogeerockets.com) and also the author of the books: Model Rocket Design and Construction, 69 Simple Science Fair Projects with Model Rockets: Aeronautics and publisher of the "Peak-of-Flight" newsletter, a FREE e-zine newsletter about model rockets. You can email him by using the contact form at https://www.apogeerockets.com/Contact.