Issue 652 / May 20th, 2025

# PEAK OF FLIGHT NEWSLETTER

Apogee Components, Inc. / ApogeeRockets.com / Colorado Springs, CO

# Why is There a Fake Motor In RockSim?



PEAK OF FLIGHT NEWSLETTER

Issue 652/ May 20th, 2025

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## FEATURED ARTICLES



### Why is there a Fake Motor in RockSim?

**by Tim Van Milligan**

Learn about the Fake Motor in our RockSim rocketry software, and why you may need it.

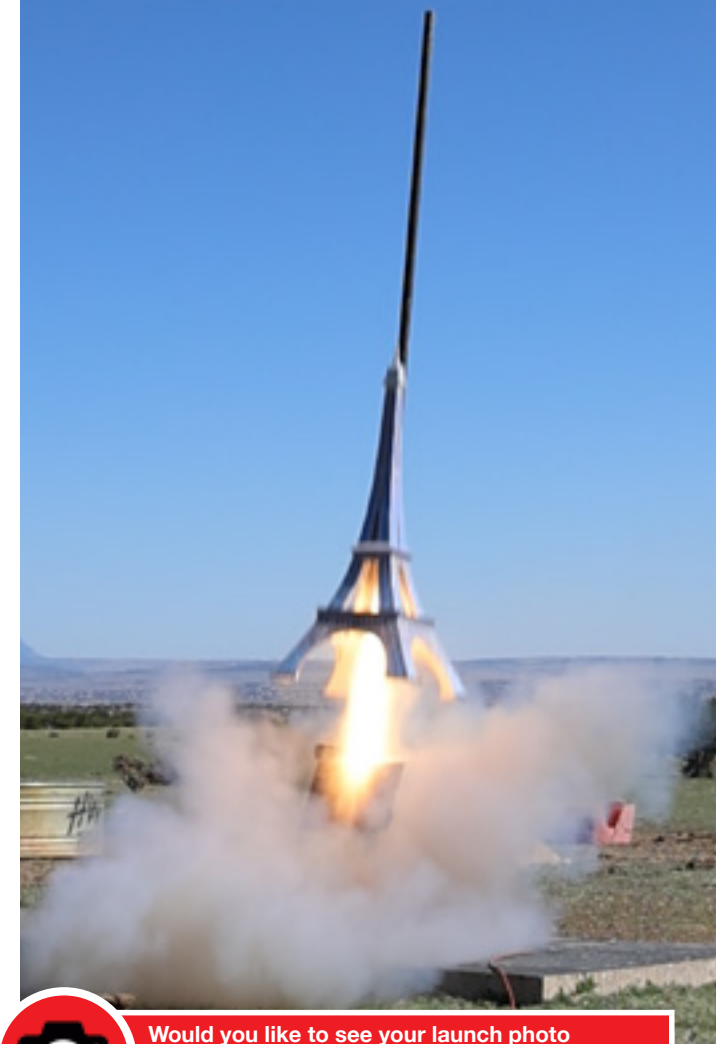
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# Why is There a Fake Motor In RockSim?

by Tim Van Milligan

You might be curious as to why there is a small motor in the RockSim engine database that is called “Fake-motor”. It isn’t there by accident, and It has a very special purpose.

Model rocket simulation software, like RockSim, aims to accurately replicate real-world rocket flights. However, complexities arise when dealing with non-standard configurations, such as boosted darts or staged rockets with non-motorized upper stages. This article addresses the common confusion surrounding the "Fake Motor" within RockSim's engine database and clarifies its crucial role in simulating specific flight events, particularly those triggered by time rather than altitude.

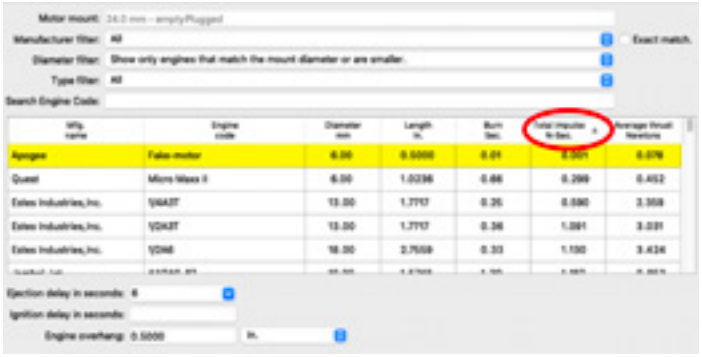


**Figure 1: The “Fake-motor” in the engine database of RockSim. To find it, set the diameter filter to show all, and sort the columns by Total Impulse.**

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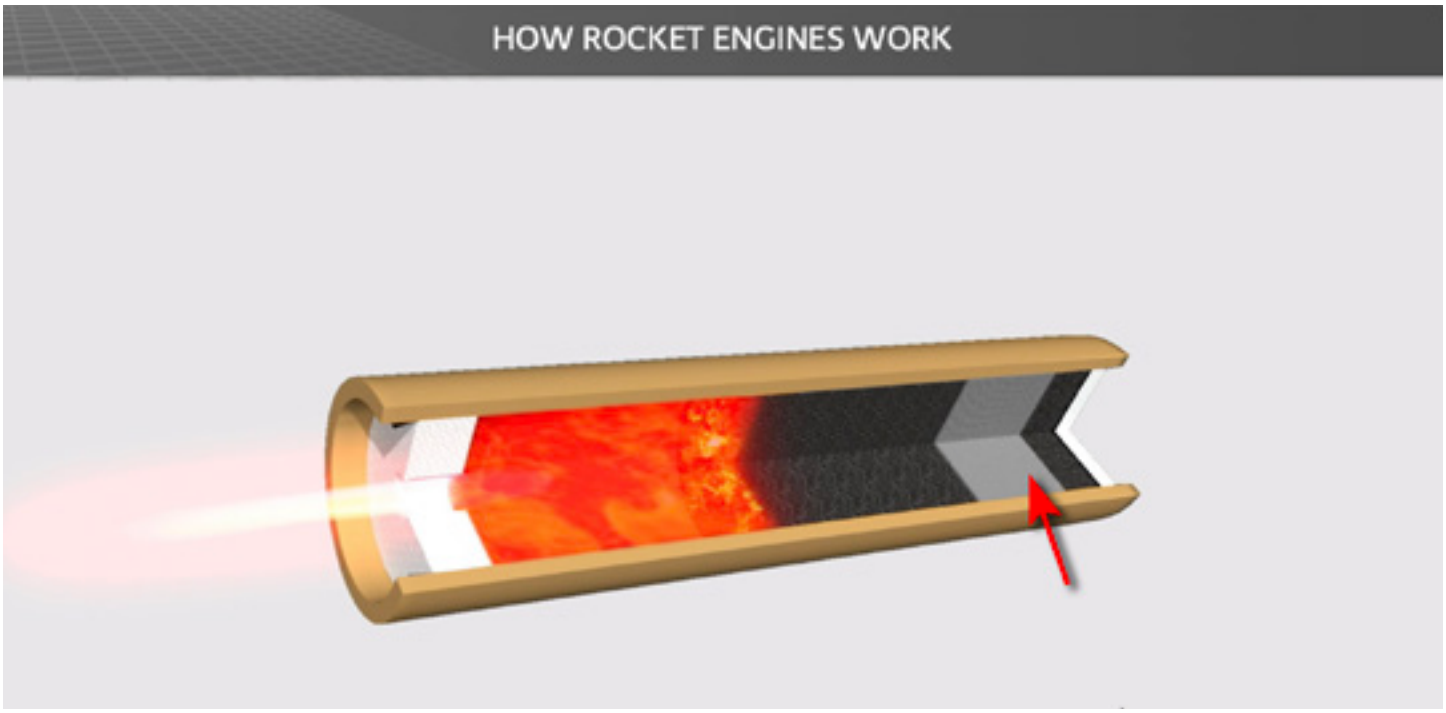



**Figure 2 - In the past, flight events were triggered by the ejection charge of the motor, not with electronic payloads.**

## History of RockSim's Flight Events

When we first started developing RockSim in the 1990's, we didn't need many events. The two main events we had were deploying a parachute, and staging a rocket. These were common types of things, and most modelers were familiar with how they occurred, because they were used to Estes black powder motors.

In a rocket launched with a black powder motor, the parachute is automatically ejected by the rocket engine. When does it occur? That depends on the delay charge built into the rocket engine.

For example, if you launch an Apogee Avion on a C6-5, the parachute will be ejected from the rocket 5-seconds after the propellant in the motor is burnt up. That's what the '5' on the end of the motor name means. If you want it to come out at 7 seconds, then you would need to select a C6-7 motor for the flight.

Staging is another event that is also controlled by the ejection charge of the rocket motor. As those of you familiar with Estes motors know, you need a booster motor with a 0-second delay in order to successfully ignite the upper stage, such as a C6-0 or a D12-0. See **https://www.apogeerockets.com/Tech/How_2-Stage_Rockets_Work** for an animation of how direct staging works.

In RockSim, we've always used the delay time of the booster engine as the trigger to start the upper stage motor burning. This is important to understand how to set up complex flight simulations.

Things in the real world get more complex because of the way composite propellant rocket motors work. They cannot be directly staged like black-powder motors. Composite motors require an onboard electrical system to manually ignite the upper stage motor. This is called "indirect staging," because the motors do not directly control each other.

There must be some type of electronic device that will use some other criteria to control when the upper stage is ignited. This electronic device is completely independent of the motor used. Normally, it will either be a timer of some sort, or possibly a special altimeter that detects how high the rocket is above the ground to set off the igniter that starts the upper stage. These devices are very sophisticated and have all sorts of safety features built into them to prevent ignition of the upper stage if things go wrong **(see Peak-of-Flight Newsletter #405 - https://www.apogeerockets.com/education/downloads/Newsletter-405.pdf).**

For example, most staging devices now have a feature that prevents staging if the rocket veers more than 30 degrees from vertical—in other words, if the rocket goes unstable and is pointed sideways, or it was pointed downward (hopefully not!), the electronics won't fire off the upper stage motor.

## How does this relate to RockSim?

In the real world, the electronics handle the triggering of the event (staging the rocket or parachute ejection). But how do we tell RockSim that our rocket has electronics in it?

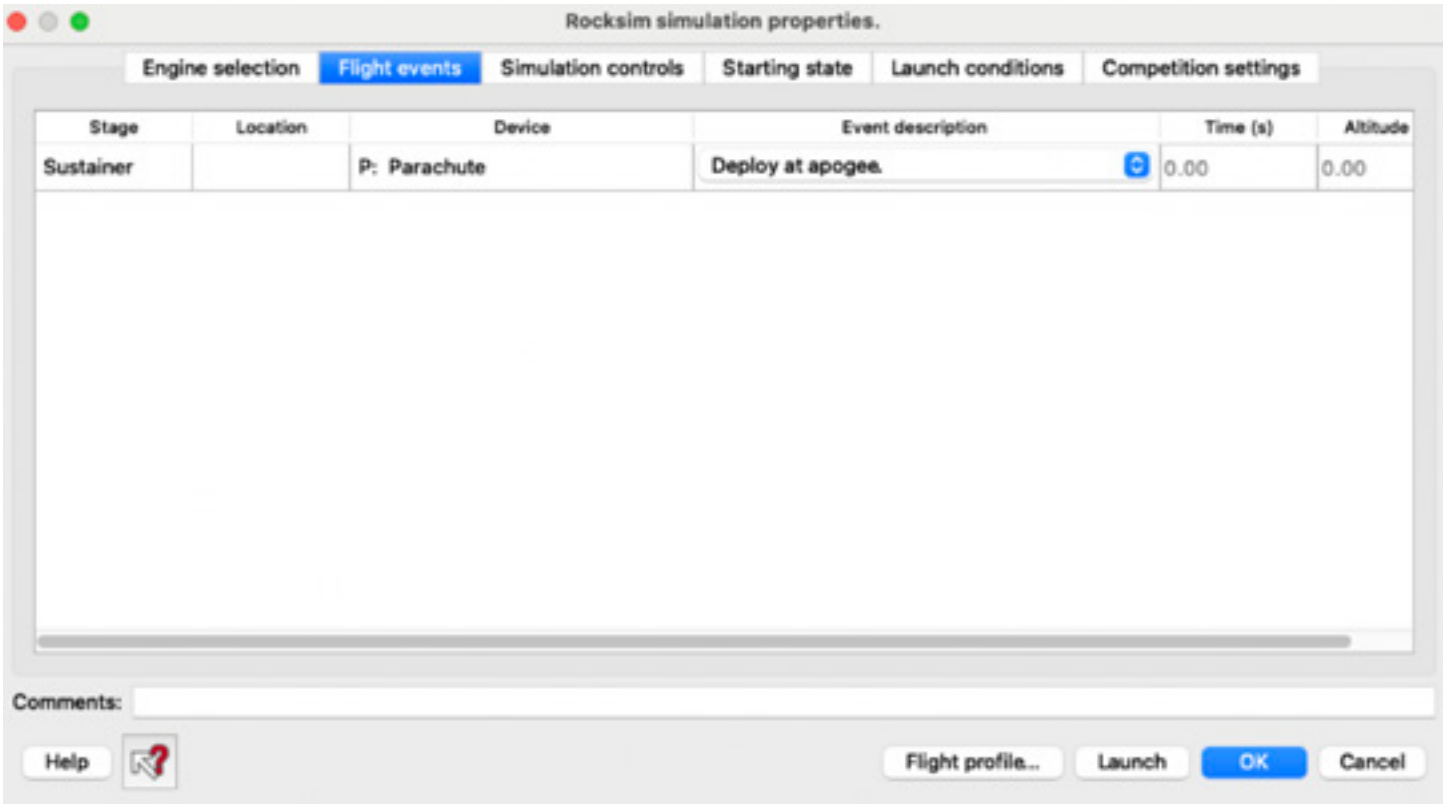
The short answer is that we have to manually trigger the flight events that are normally controlled by the electronics. This is what the "Flight Events" tab in the launch preparation dialog box does. We're going to manually tell RockSim when to push out a parachute. And I think this doesn't cause much confusion with users of RockSim. I think they want something called "altimeter set-up," but essentially, flight events are where you set up the altimeter functions in RockSim.

The other event, "Staging" is what can cause confusion. Remember when I previously said that staging is controlled by the ejection delay time of the booster motor? That is what causes confusion. Because in real life, the electronics control when staging occurs (is triggered) for composite motors, and now we have to remember that RockSim requires that we use the ejection delay time of the booster motor as the triggering event.

If it were a regular Estes black powder motor, I don't think users would have any issues with setting the staging in RockSim.




**Figure 3 - The "Flight events" screen in RockSim controls parachute deployment, but not the event of "staging."**



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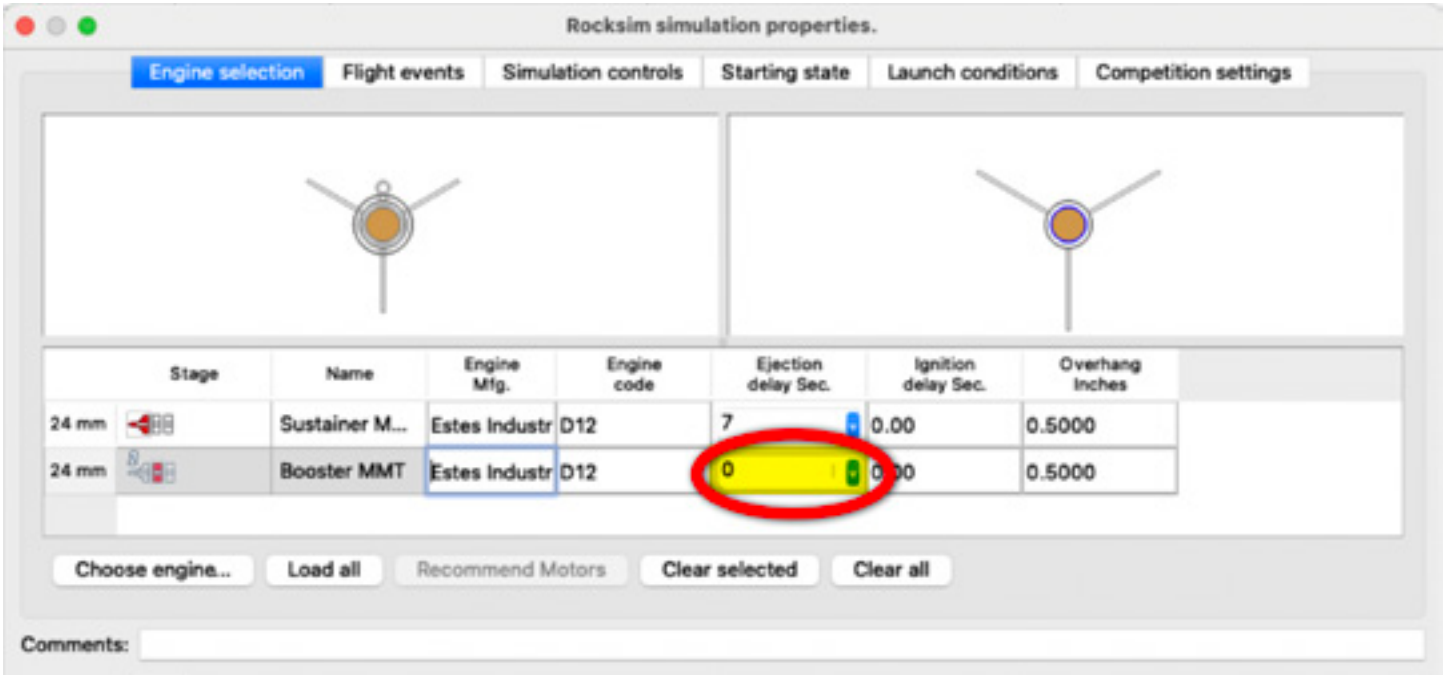



**Figure 4 - The Ejection delay of the booster motor controls when the two stages separate and the upper stage ignites. Here the upper stage will ignite zero seconds after the booster motor's propellant burns out.**

## What happens at Staging?

Two distinct things happen when a rocket "stages." First, the two stages of the rocket separate. And second, the upper stage ignites its engine and takes off.

Normally, those two things happen simultaneously. But there are occasions where you do want to have them happen at different times. For example, you might want your rocket to "drag separate" so that the upper stage coasts away from the booster stage before the upper stage motor ignites. Besides looking cool in flight, it has two other advantages. First, you don't scorch the top end of the booster stage with the hot exhaust of the upper stage. No one likes a sooty rocket that has to be cleaned up after a launch.

Second, if the upper stage separates and coasts a little bit, you actually get a higher altitude from the rocket. The reason has to do with drag. Now drag, as you know, is a function of the square of the velocity. High-speed rockets have significantly more drag than low-speed rockets. If we can get the upper stage to slow down a little bit, the drag will be lowered, and more of the energy will fight gravity rather than air resistance.



**Figure 5 - At staging, two events happen: separation and ignition of the upper stage**

In RockSim, we have multiple ways to make both of those events happen at different times. The separation portion is handled by the ejection time of the booster motor. If you have a 1 second delay, the two pieces of the rocket will stay together during that 1 second coasting period, then the upper stage will separate. Ideally, you want them to separate immediately after booster engine burnout, so the "ideal" delay time for the booster motor is always zero (-0).

The issue is that there are no composite motors with a zero second delay. So how do you select a -0 motor in RockSim? You use the "Custom" delay option, and physically set the delay to 0.

In a real launch, the electronic altimeter or timer device will handle this for you, as it will sense burnout. In Rocksim, we still have to use the "delay time" to separate the 2 stages of the rocket.

The second part of the staging sequence is the ignition of the upper stage. By default, if nothing is changed, the ignition of the upper stage is instantaneous with the separation of the pieces. Remember, it was designed originally around Estes black powder motors, and that is the way they work.

**Figure 6 - The Booster Ejection delay causes the stages to separate, and the Sustainer Ignition delay then controls with the sustainer motor ignites. Compare this with Figure 4.**

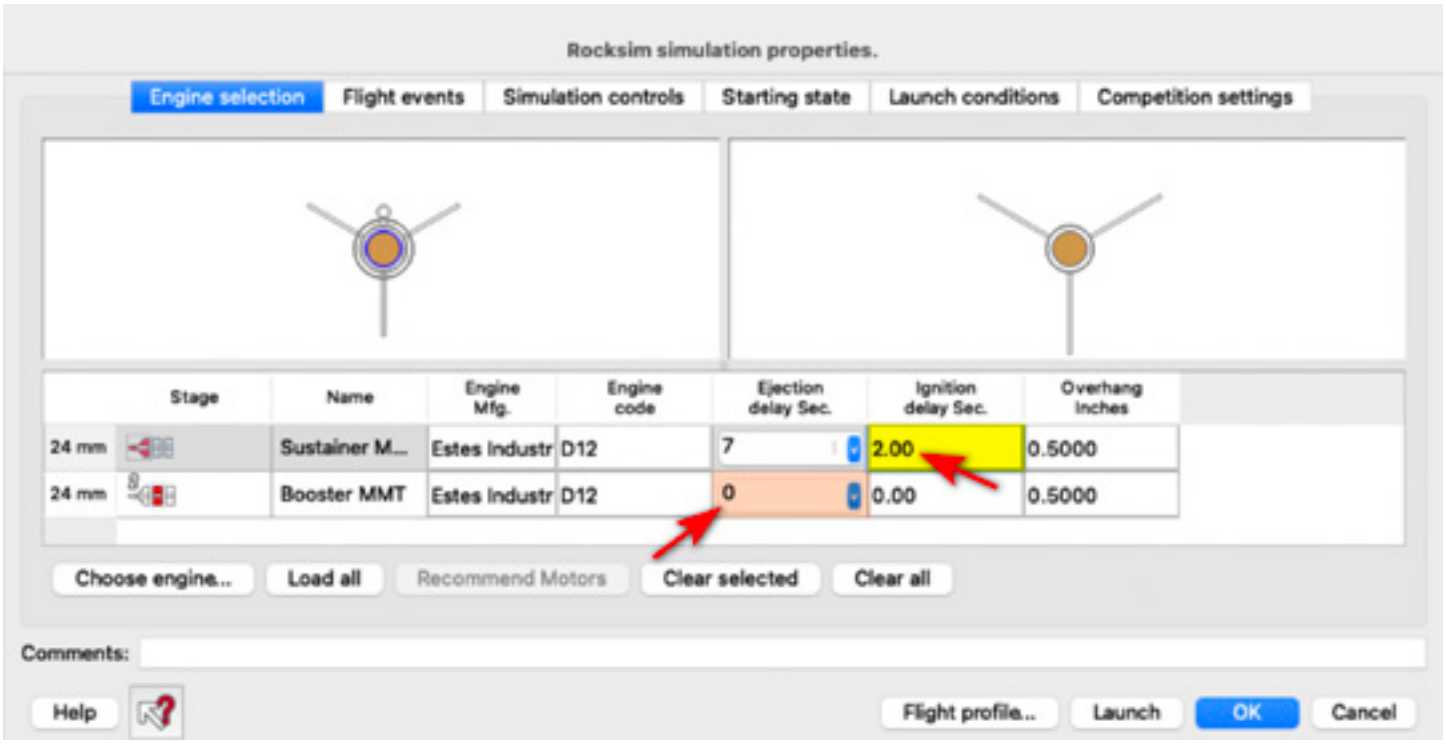
If you don't want the rocket motor in the upper stage to ignite instantaneously when the parts of the rocket separate, then you want to use what is called the "ignition delay." This is found on the "Engine Selection" dialog screen when you load the rocket motors.

Ignition delay is when the motor is delayed from igniting by the number of seconds typed into the column. For example, if you have 1.1 seconds typed in, then the upper stage motor will not burn for 1.1 seconds after the parts separate (this is based on the delay time of the booster stage motor).

It is also worth mentioning that if you are typing in a value for the ignition delay, ALWAYS hit the TAB key on the keyboard. This causes RockSim to jump to the next field and forces it to accept the value you typed in. Sometimes, if the TAB key is not pressed, it may not accept the value that is typed in.

**To Summarize:**

- The separation of the stages is controlled by the delay time of the booster stage
- The ignition time of the upper stage is controlled by the "ignition delay" of the motor in the upper stage.
- With these two values, you can do some amazing things in RockSim, like drag separation, and air starting the upper stage as it coasts away from the booster stage.



## The Fake Motor in RockSim

Back to the original topic: Why does RockSim have the fake motor in the engine database (see Figure 1)?

The reason is that sometimes the upper stage doesn't have any motor in it at all. The most common situation is a special two-piece rocket called a "Boosted Dart." These were used by NASA all the time to get rockets to extreme altitudes.

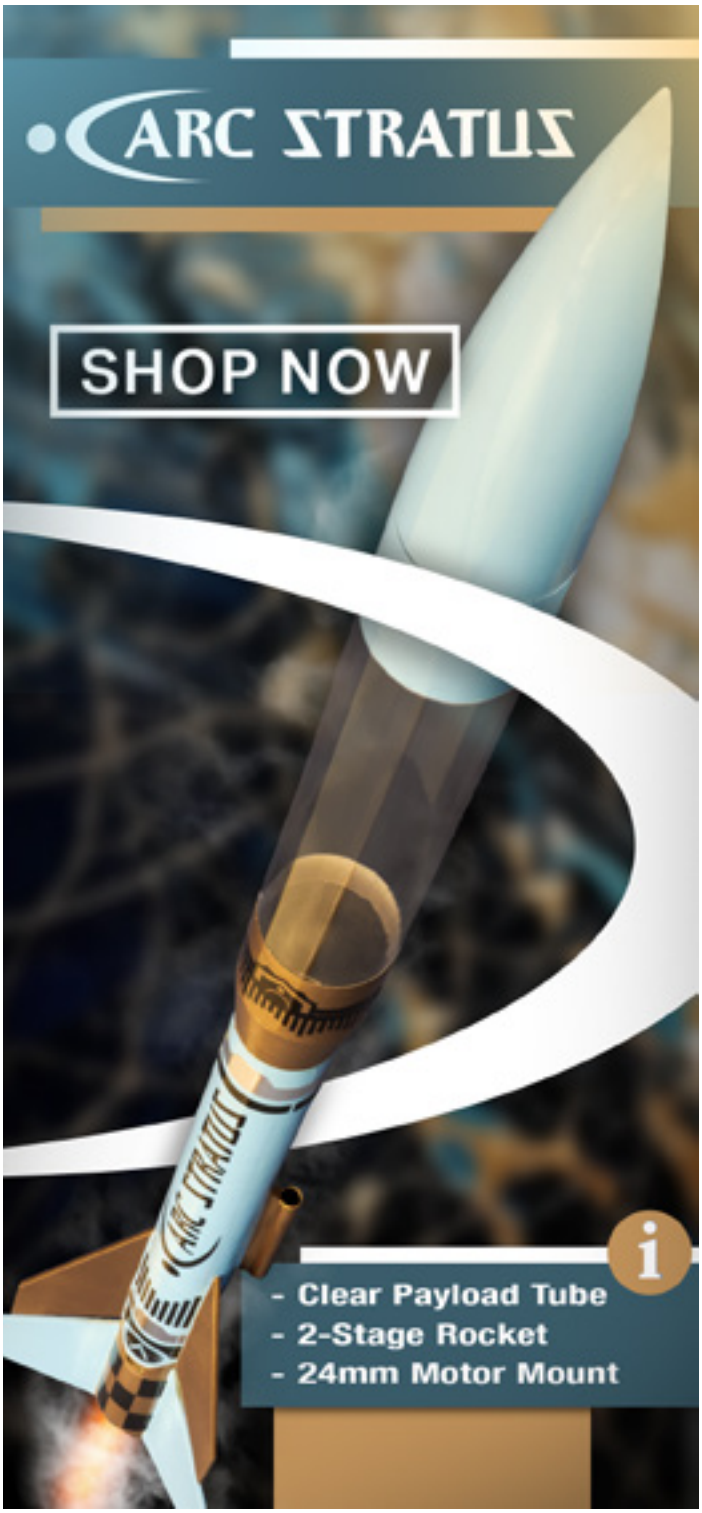
Essentially, it's a two-stage rocket with no motor in the upper stage (see Figure 7). The stages drag-separate, and the upper stage (called the "dart") coasts up to its maximum apogee point.

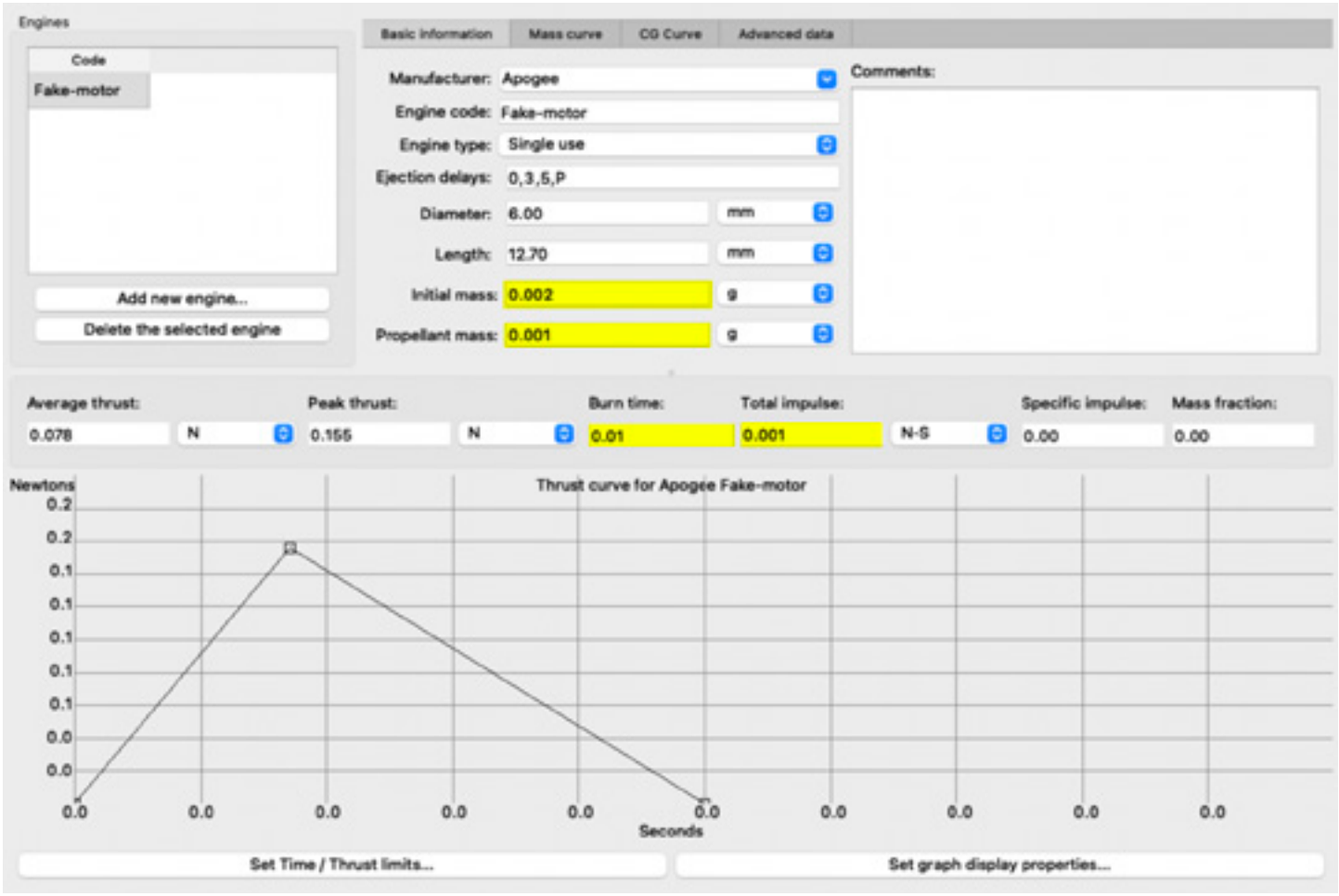
When we originally created RockSim, the parachute was controlled by the ejection charge of the motor. It was required to have a motor that had a number after the dash in the motor name (such as C6-3 or C6-5). So we originally created the fake motor for use in the boosted dart configuration.

Looking at the fake motor within the EngineEdit application (which comes bundled with RockSim) will show what we tried to accomplish—a motor without any of the traits of a rocket motor.



**Figure 7 - NASA's Super Loki had an unpowered upper stage. It didn't have a motor in it and just coasted after separation.**






The goal was to have a motor with near zero mass, propellant, and thrust. It couldn't be made exactly 0, but it could get close enough. This motor wouldn't budge even the smallest of rockets!

However, it did have one advantage: it had a delay and ejection charge that could be used to push the rocket stages apart and be able to deploy a parachute.

**Figure 8 - The Fake-motor was created in EngEdit, and everything was minimized to make an engine with near-zero mass, near-zero thrust, and near-zero weight. It is like it doesn't exist to do anything. But it does have delays and will eject a parachute in RockSim.**



## RockSim Evolves

Later in the development of RockSim, we changed how parachute deployments were triggered. People wanted something closer to how dual deployment works, based on altitude, not on time.

That is how the flight events tab came about—it makes it easier to eject them based on an altitude. At that point, the fake motor wasn't needed to eject a parachute out of a boosted dart. Instead, just specify what altitude it will trigger at in the flight events.

That being said, the separation of the dart from the booster stage is still triggered by the ejection charge time of the booster motor. If you use RockSim for a boosted dart, that's how you'd set it up to create a simulation. You don't need a motor in the upper stage, but you still need a delay time set in the booster stage.

## Where the Fake Motor is Still Needed

The fake motor is still needed if you have a situation where the parachute is deployed based on Time, not altitude.

For example, consider something like a rocket used in the A.R.C. competition. In many contest years, there is a requirement that the egg capsule separate from the bottom portion of the rocket and come down independently with its own parachute.

This seems simple because in real life, you just attach a parachute to the capsule portion of the rocket, and when the ejection charge of the engine blows, it pushes out two parachutes. One on the capsule, and one on the fin-can portion of the rocket.

But in RockSim, this is actually a lot more complex. We can't automatically separate the two parts of a single-stage rocket, and have each part come down independently.

The only way we could have two parts come down separately is if the rocket is set up as a two-stage rocket. So that is how we'll set this rocket up in RockSim.

For a two-stage rocket, RockSim is looking for a motor in the upper stage. We don't want a motor in the upper stage because that would push it higher and add weight—we only want it to separate and deploy a parachute. This is where we still need the fake motor, because it can independently deploy the parachute on the upper stage, which is our egg capsule with the parachute.

But in this case, we're not deploying the parachute based on the altitude of the rocket, but instead on the ejection charge time of the booster stage.

As a simple example, let's say we were launching a rocket like the Apogee Eggtosser—or an A.R.C. rocket—and we wanted it to come down in two pieces. We'd first break up the rocket to make it a two-stage design. The top stage is all the components of the capsule, plus one parachute (see Figure 10). We will also need one tube in the capsule, which is required for the placement of the fake rocket motor.

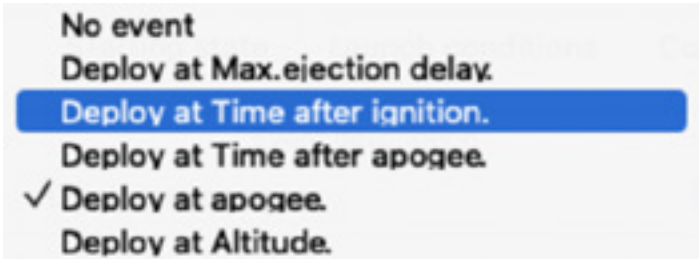



**Figure 9 - In the Flight Events, these are the various parameters you can use to trigger the parachute deployment.**

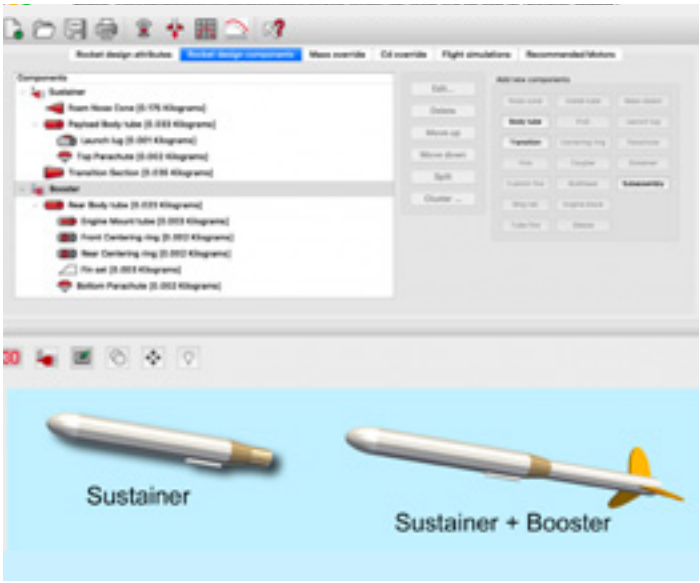



**Figure 10 - To make a rocket come down in two parts, we have to set it up as a 2-stage rocket. We don't want a motor in the Sustainer, so how do we deploy its parachute?**



The lower stage is the fin can of the rocket—everything else, plus a parachute for its descent.

We'll put a D12-5 motor in the bottom stage, which is exactly what you'd expect to fly in this lightweight rocket with an egg as a payload. In the upper stage, let's load in the Fake Motor. For the delay, which will deploy its parachute, let's use the custom delay and make it a zero (-0) second delay. Why zero? Because we want it to deploy the parachute as quickly as possible after separation from the bottom section of the rocket.

When we launch it, the booster burns, and then the rocket coasts for 5 additional seconds. Then the fake motor fires in the upper stage. Since this fake motor burns out nearly instantly, it doesn't gain any additional altitude. Then, it fires off the ejection charge after zero seconds to deploy the parachute. In essence, everything happens instantaneously. The capsule chute deploys at the same time as the fin can parachute.







## Addressing the Confusion

There is still one other reason why users might be confused—under the flight event for the sustainer parachute, there still is an option for "deploy at time after ignition" **(see figure 9)**.

Couldn't you use that for the egg capsule portion of the rocket and not have to use the fake motor?

For example, couldn't you specify to deploy the parachute five seconds after ignition of the rocket?

The answer is no, because the "time" doesn't start on the ignition of the rocket off the launch pad. You may be thinking of the rocket leaving the launch pad, but in this case, the parachute event is based on the ignition of the motor located in the **sustainer stage**. Since the upper stage doesn't have a motor, there is nothing there that would start the timer.

The only way around it is to use the fake motor in the upper stage. Once you have a motor, you can base the deployment on the ignition time.

## What to do When Things Don't Work

Being fully transparent, we "cheated" twice. First to turn the rocket into a 2-stage vehicle so we could track the capsule coming down on its own chute, and then we created the fake motor just to get the parachute out of the upper stage based on time, not altitude.

This is what engineers do. We recognize that we have a problem, and then find a "cheat" to make it work. It may not be perfect, but it is close enough that it solves the problem.



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# Why is There a Fake Motor In RockSim?

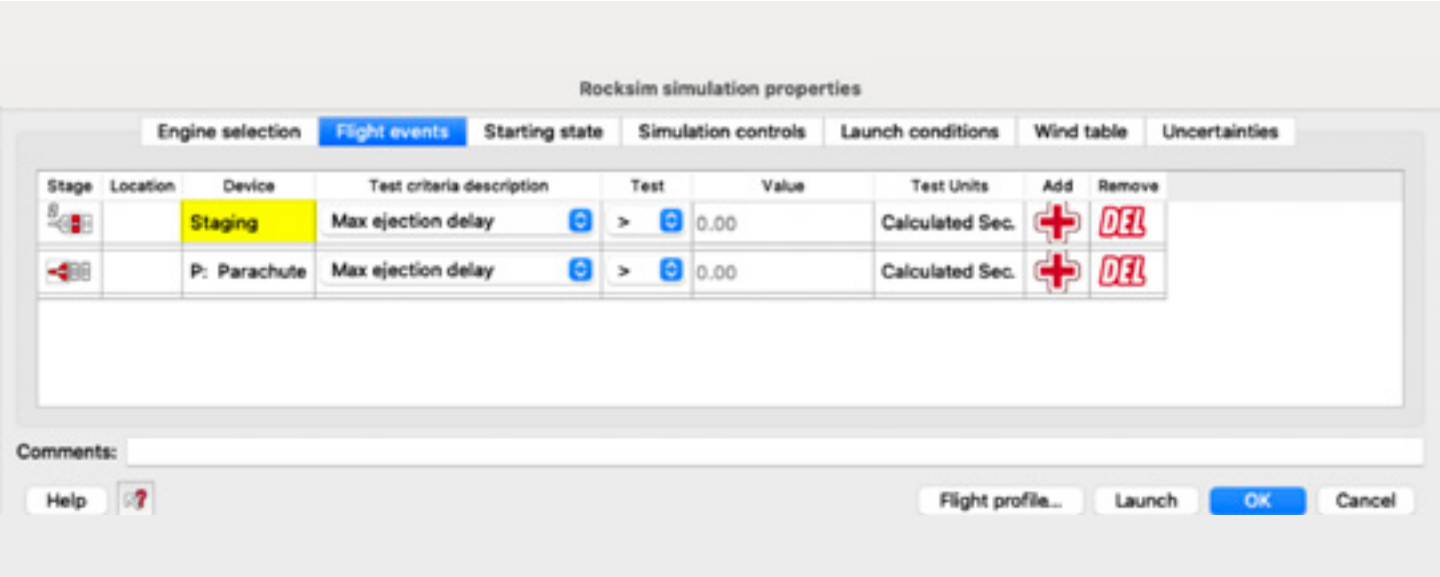



**Figure 11 - RS-PRO has a separate event for controlling when staging occurs. It is more similar to using electronics in your rocket. This is not available when "simplified flight events" are turned on in the preferences.**

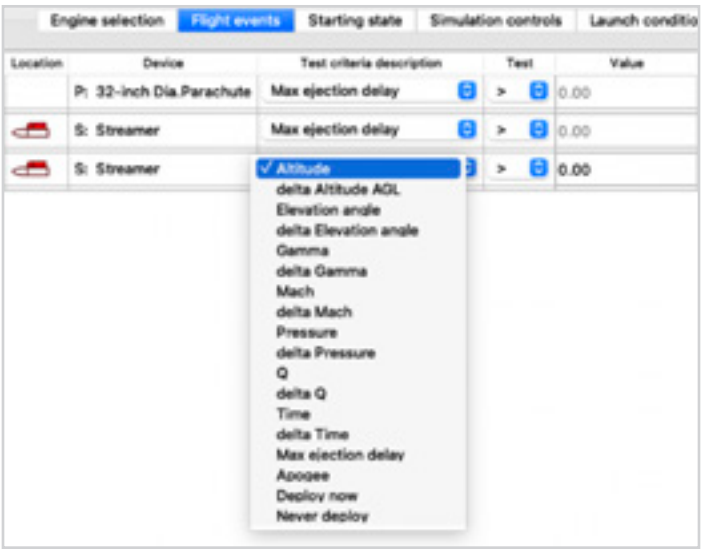



**Figure 12 - There are many more parameters that can be used to trigger deployment events in RS-Pro. But nobody really uses them.**

## How Does RockSim Compare to RS-PRO?

The current version of RS-PRO does have one additional flight event that RockSim doesn't have: "Staging."

This was made to give more control over when separation/staging occurs, rather than relying on using the delay time of the booster stage as the controlling factor. So in a sense, this is more like the real-world, where you use the electronics in the rocket to trigger the events that are independent of the rocket engines.

Additionally, RS-PRO does give you a lot more control over when events take place during the flight. Instead of just using time or altitude as the control inputs, you can also use the rocket's speed and its orientation as triggering events too.

For example, let's set up a flight to say, "Stage the flight if the rocket reaches 500 mph." If the rocket never reaches that speed, it wouldn't ignite the upper stage. There may only be a small number of people who need that much control, but it is there if you do.

There is also the option to set up sequences of preliminary events that must happen before other things are allowed to occur.

For example, ejecting the main parachute during a dual deployment event is actually a series of preliminary events that must occur for chute deployment. For example:

- The rocket must lift off from the pad
- The rocket must reach apogee
- The rocket must descend to a specific altitude

In RockSim, these are "assumed" to happen. So, if setting deployment at an altitude of 400 feet, RockSim assumes that the rocket reached apogee first. So just know that it does take away a little control of the setup to offer a simpler simulation process.

RS-PRO was originally set up to give maximum control of the setup to the user. The downside to this is that it does take a little more thought to set up simulations. Users were required to break up the flight into a series of events as numbered above. If, for example, users didn't specify that the rocket must reach apogee and had the parachute set to deploy the chute when the rocket was below 400 feet altitude, what would happen? Well, it would deploy the parachute as soon as the launch button was pushed.

This is Because while sitting on the pad, the rocket is below 400 feet of altitude, so the setup is absolutely true.

This was a point of confusion for new users. They thought something was wrong with RS-PRO. But in reality, they just didn't specify the entire series of events that had to take place first before the parachute was ejected.

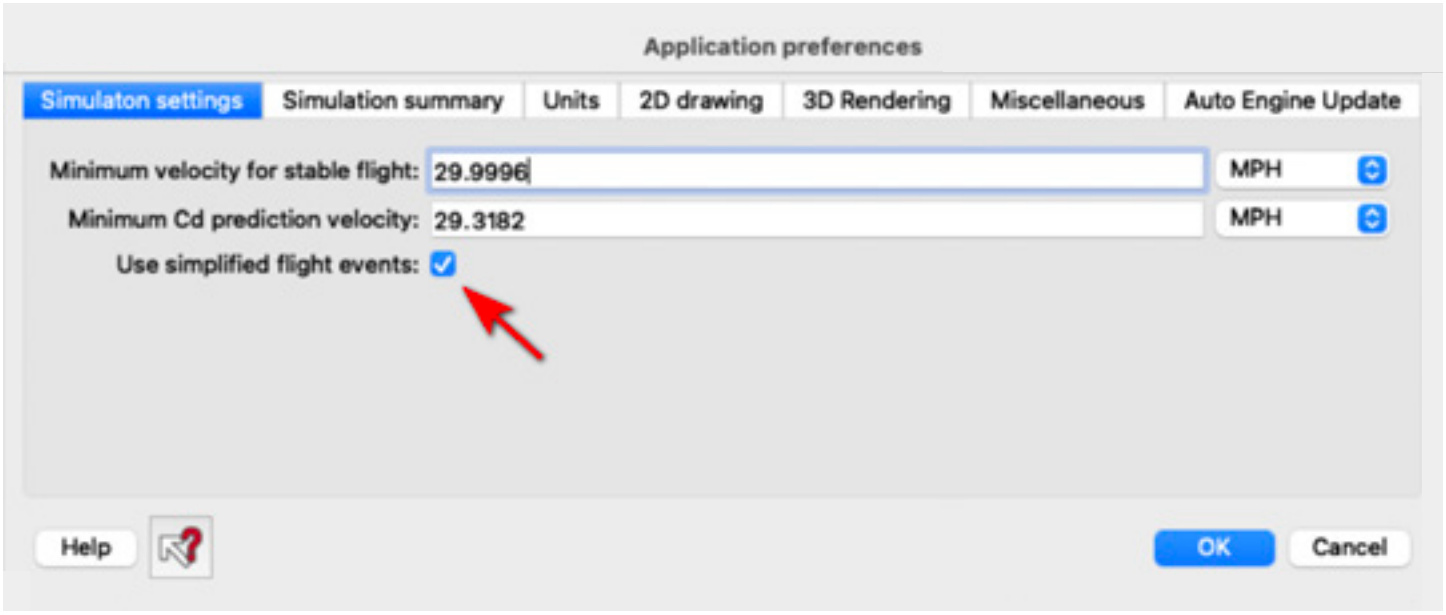
## Simplification of RockSim Pro

Because of the thought required to set up sequences of preliminary triggers, it was decided last year to provide an option in RS-PRO that would use "Simplified Flight Events," that would mimic the way regular RockSim did things. So you could just set the parachute to deploy at 400 feet, and it would assume you meant that the rocket had to be coming down first.

This "Simplified Flight Events" is turned ON by default in RS-PRO when you install it. So it should act just like you are used to in RockSim. It can be turned off in the program's preferences screen to allow for greater control over when events take place.




**Figure 13 - Simplified Flight Events are turned on in RS-PRO by default, making it operate just like RockSim. If you want more control over what can be done, uncheck the box in the RS-PRO application preferences.**



## Do You Still Need the Fake Motor in RS-PRO?

Yes. And it's exactly for that same situation where you want to separate a rocket into two parts, like with the A.R.C. simulations that we discussed previously. In that case, you still need to use the Fake motor to trigger the parachute deployment.

Lastly, whenever a user does these highly complex setups that involve the Fake-motor, it's good practice to always verify that it works by watching either the 2D flight profile in Rocksim, or the 3D Launch Visualizer in RS-PRO. Being able to actually see the events take place in the animation is really the only way to confirm that everything is happening correctly compared to what is expected to happen in the real flight.

Thinking ahead to your desired outcome is key to a successful flight. Define what success will look like, and make that the expectation. Then, use RockSim to verify how things are set up in order to properly achieve that expectation.

## Conclusion

The "Fake Motor" in RockSim serves as a unique workaround to simulate specific flight events that aren't tied to typical motor characteristics. While once originally designed for boosted dart configurations, its primary function now lies in scenarios where parachute deployment is time-based rather than altitude-based, particularly in complex setups like A.R.C. competition simulations. While RS-PRO offers a more sophisticated event control, including the "Simplified Flight Events" option that will mirror RockSim's simplicity, the Fake Motor still remains essential for triggering parachute deployment in staged rockets where the upper stage lacks a traditional motor.

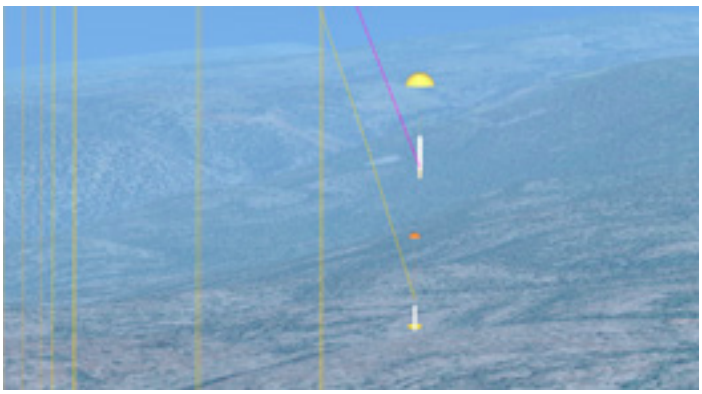


**Figure 14 - Use the Launch Visualizer in RS-PRO to verify that your flight events are set up correctly to track both parts of our two-stage rocket.**

Finally, verifying the simulation through the 2D flight profile or 3D Launch Visualizer is essential to ensure that all events occur as expected. Ultimately, understanding how to use the Fake Motor, and carefully planning flight events are key to achieving desirable outcomes in both RockSim and RS-PRO simulations.

## 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 ezine newsletter about model rockets. You can email him at https://www.apogeerockets.com/Contact.



PEAK OF FLIGHT NEWSLETTER

Article Submission Guidelines

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## SUBMITTING ARTICLES TO APOGEE

We are always looking for quality articles to publish in the *Peak-of-Flight* newsletter. Please submit the "idea" first before you write your article. It will need to be approved first.

When you have an idea for an article you'd like to submit, please use our contact form at **https://www.apogeerockets.com/Contact**. After review, we will be able to tell you if your article idea will be appropriate for our publication.

Always include your name, address, and contact information with all submissions. Including best contact information allows us to conduct correspondence faster. If you have questions about the current disposition of a submission, contact the editor via email or phone.

## CONTENT WE ARE LOOKING FOR

We prefer articles that have at least one photo or diagram for every 500 words of text. Total article length should be between 2000-4000 words and no shorter than 1750 words. Articles of a "how-to" nature are preferred (though other types of articles will be considered) and can be on any rocketry topic: design, construction, manufacture, decoration, contest organization, etc. Both model rocket and high-power rocket articles are accepted.

## CONTENT WE ARE NOT LOOKING FOR

We don't publish articles like "launch reports." They are nice to read, but if you don't learn anything new from them, then they can get boring pretty quick... Example: "Bob flew a blue rocket on a H120 motor for his certification flight." As mentioned above, we're looking for articles that have an educational component to them, which is why we like "how-to" articles.

You can see what articles and topics we've published before at: **https://www.apogeerockets.com/Peak-of-Flight?pof_list=archives&m=education**. You might use this list to give you an idea or two for your topic.

**Here are some of the common articles that we reject all the time, because we've published on these topics before:**

- How to get a L1, L2, or L3 Cert
- Building cheap rockets and equipment (pads & controllers)
- How to 3D print parts, or a Rocket Kit
- How to Build a cheap Rocket Kit
- Getting Back Into Rocketry After a Long Hiatus

## ARTICLE & IMAGES SUBMISSION

Articles may be submitted by emailing them to the editor. Article text can be provided in any standard word processor format, or as plain-text. Graphics should be sent in either a vector format (Adobe Illustrator, SVG, etc.) or a raster format (such as jpg or png) with a width of at least 600 pixels for single column images or 1200 pixels for two-column images. It is preferable for images to be simple enough to be readable in a two-column layout, but special layouts can be used.

Send the images separately via email as well as show where they go by placing them in the word processor document.

## ACCEPTANCE

Submitted articles will be evaluated against a rubric (available here on our website). All articles will be evaluated and the results will be sent to the author. In the evaluation process, our goal is to ensure the quality of the content in *Peak-of-Flight*, but we want to publish your article! Resubmission of articles that do not meet the required standard are heavily encouraged.

## ORIGINALITY

All articles submitted to Peak-of-Flight must not run in another publication before inclusion in the *POF* newsletter, but it may be based on another work such as a prior article, R&D report, etc. After we have published and paid for an article, you are free to submit them to other publications.

## RATES

Apogee Components offers **$300** for a quality-written article over 2,000 words in length. Payment is pro-rated for shorter articles.

## WHERE WILL IT APPEAR?

These articles will mainly be published in our free newsletter, *Peak-of-Flight*. Occasionally some of the higher-quality articles could potentially appear in one of Tim Van Milligan's books that he publishes from time to time.

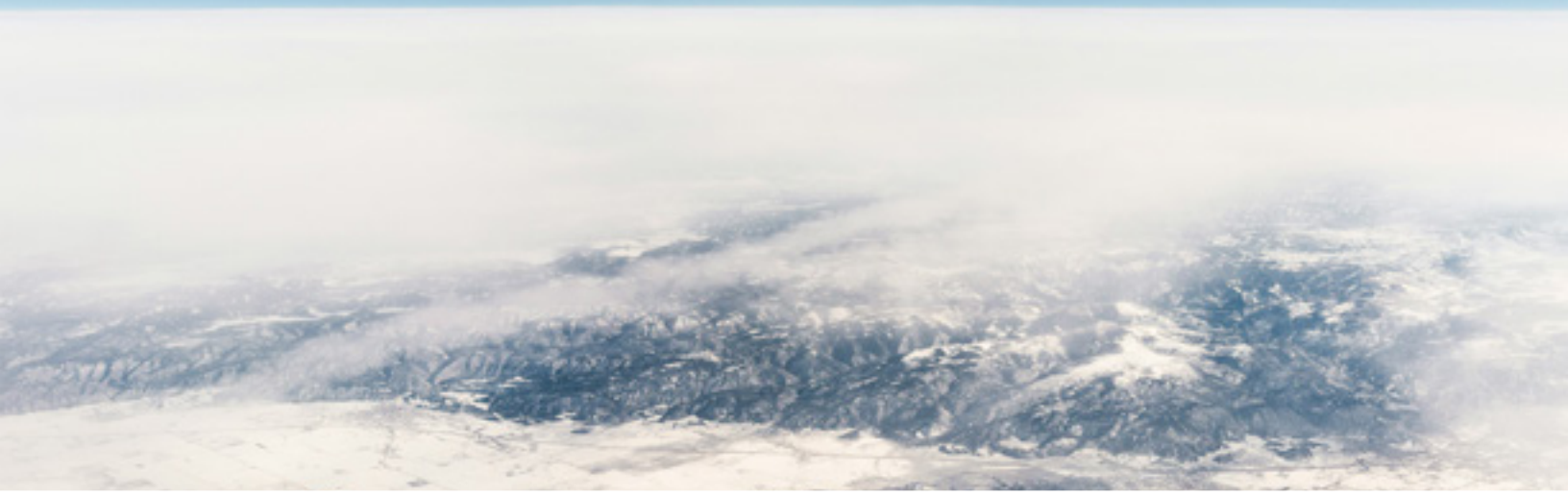



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