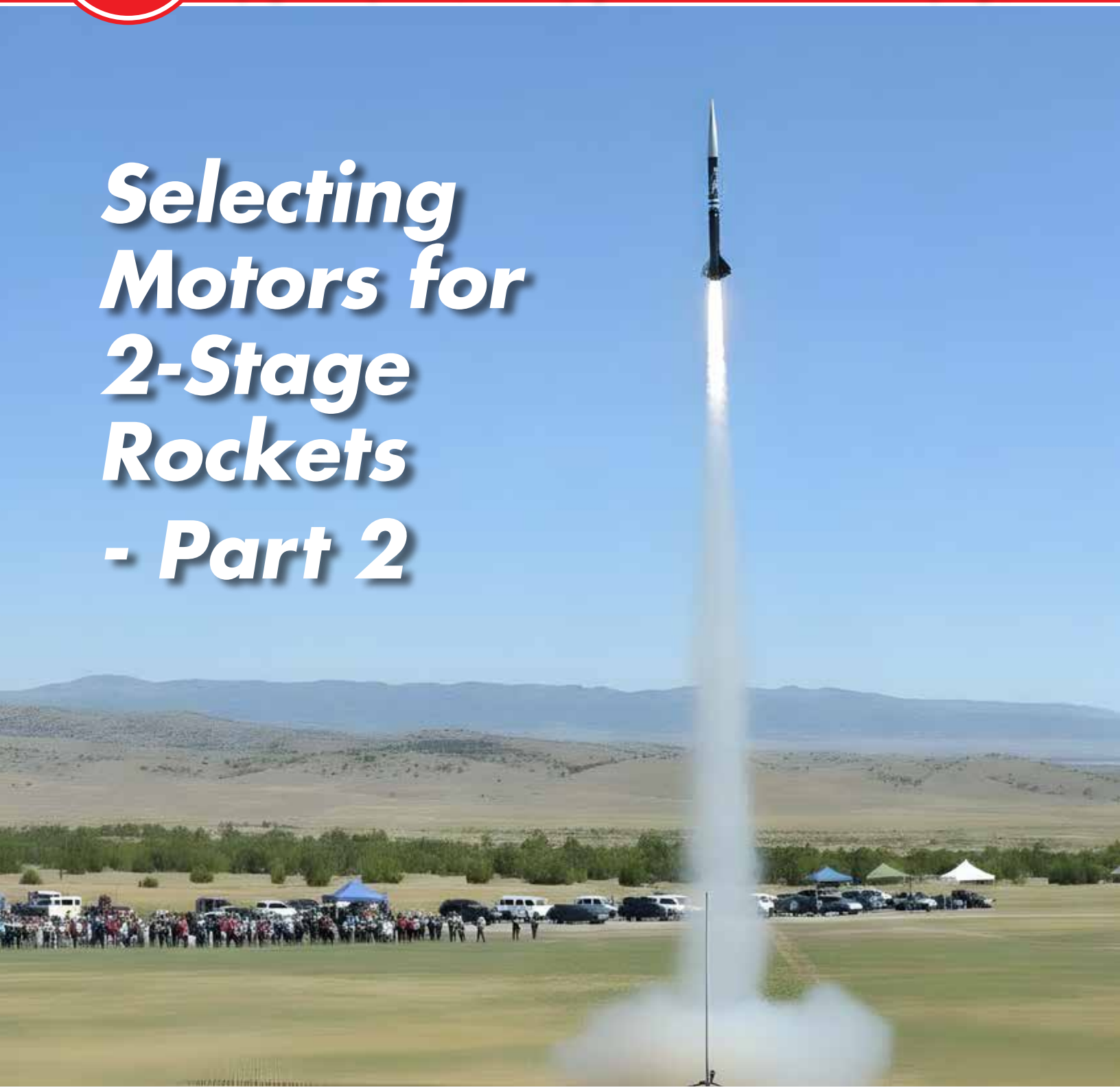
Issue 663 / October 21st, 2025

PEAK OF FLIGHT NEWSLETTER

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

Selecting Motors for 2-Stage Rockets - Part 2



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COVER PHOTO

Mega Mako

A rendering of the Mega Mako. This 4-inch diameter beast with its 54mm motor mount is built for spectacular high power flights

FEATURED ARTICLES

Selecting Motors for 2-Stage Rockets - Part 2

by Tim Van Milligan

How do you go about testing parachutes to measure their coefficient of drag? This article give you the steps needed.

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The Apogee Saturn 1B kit readied for launch by Tim Van Milligan

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Selecting Motors for 2-Stage Rockets - Part 2

By Tim Van Milligan

This issue is a continuation of the information in Peak-of-Flight #657 (https://www.apogeerockets.com/education/downloads/Newsletter657.pdf) and it will go deeper into the process of picking motors for a 2- stage rocket. I decided to write this because I had a customer ask the question again in a recent RockSim Live session (https://www.apogeerockets.com/RS-Live-Training) we did on YouTube. In particular, they didn't understand what to do when you had a situation where you had to keep the rocket below a set altitude - such as a waiver limit.

First of all, I would like to direct you back to *Peak-of-Flight #657* , because it explains the criteria we use for a safe flight. That is the background information that you need for all rockets.

But in general, when a person says to me that they want to know how to pick motors for a two-stage rocket, my immediate assumption is they know that the number of motor options is almost unlimited, and they are just overwhelmed by the choices.

Let me simplify things for a two stage rocket…The *Too-Long-Didn't-Read* (TLDR) of it is this…

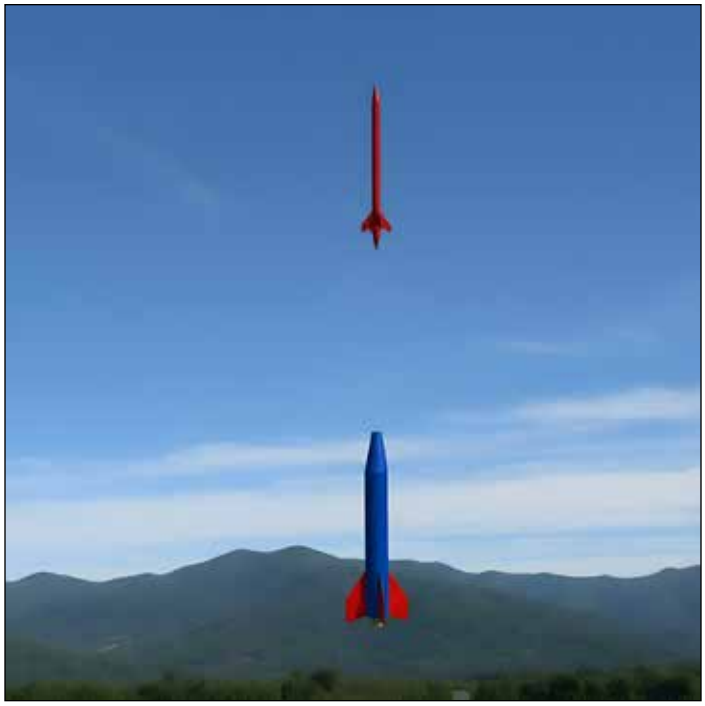

Figure 1: A "Boosted Dart" is a special 2-stage rocket that doesn't have a motor in the upper stage. The lower stage falls away due to drag-separation.

It's "ALL" about the Booster Motor!

What this means is that if you think about it long enough, you can use any rocket motor in the upper stage that you want. Whatever you have in your range box will work!

As long as the booster motor can lift the rocket safely (as described by the criteria talked about in *Peak-of-Flight #657*), any motor in the upper stage will be fine. By "fine," I mean it can be a "safe" flight. How do we know any motor will work?

The reality is, you DON'T even need a motor in the upper stage to have a safe flight. A rocket without a motor in the upper stage has a specific name: it is a "boosted dart" (see Figure 1). And these work fine if the rocket is designed correctly. Using onboard electronics, an ejection charge can be set off to push out the parachute at the appropriate point during the flight for a safe recovery.

So if a 2-stage rocket without a motor in the upper stage can be successful, then ANY rocket motor you put in the upper stage will be fine.

For example, you can have a high-thrust K-motor in the booster stage, and a 1/4A motor in the upper stage. That combination works just fine. So does a K-motor staged to another K-motor.

The safety aspect of the flight is always satisfied by what motor you have in the booster stage.

That is why in *Peak-of-Flight Newsletter #657*, I suggested that

you convert the two-stage RockSim design to a single-stage configuration. When you hypothetically glue the two stages together in Rocksim to make a single stage rocket, it makes picking the choices for the booster motor trivial. And that is the recommended procedure for making the selection of the booster motor (see figure 2).

Once you have a single stage rocket in RockSim, the option to use the automated feature of "Recommend motors" is turned on. This feature isn't available for two-stage rockets only for single-motor rockets.

The whole point of the "Recommend motors" feature is to give you a list of rocket motors that will result in a safe launch with the minimum amount of effort on your part. It is just three clicks of your mouse! And that is what we need for the booster stage.

Once you generate the list of motors using RockSim, you'll print it out, and then go to your motor dealer (hopefully that is us at Apogee Components), and buy a motor.

You'll always want a list of options - because of the "availability problem." What is the availability problem? It is that not every motor on the list will be available from the motor dealer due to the stock limits they have on hand. The reason a single dealer might not have a specific motor is that it is almost impossible to carry every variety of motor that the various manufacturers make. The cost of carrying that much inventory would probably put the dealer out of business - so they usually only have a fraction of what the manufacturers make.

Figure 2 - To convert a two stage rocket, copy all the parts from the booster stage, and paste them to the bottom of the sustainer parts.

When you have a list of options, you will get something that

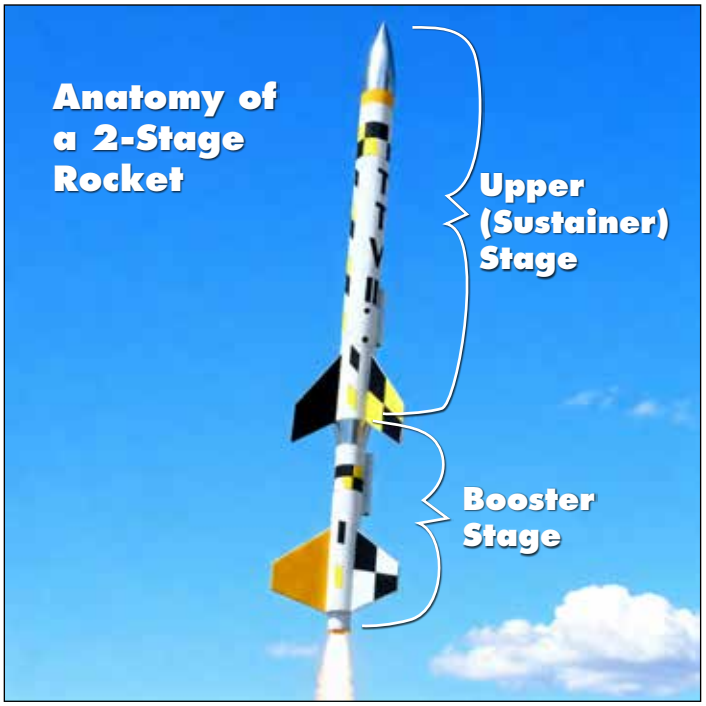

Figure 3 - Anatomy of a 2-stage rocket.

will work. So print out the list of booster motors that come out of the recommended motor list. I guarantee to you, it will be a big list.

Picking the Upper Stage Motor

Now for the upper stage, as I said before, ANY motor can be made to work. As strange as that sounds, it is true. You can have some pretty wild combinations, and it will give you a successful flight, particularly if you use electronics to control parachute deployment.

Because any motor can work in the upper stage, how do you pick one? I think this is where the confusion comes in.

The process you go through to pick motors for the upper stage will depend on the mission that you are trying to achieve. By "mission," I mean what objective you're after. To keep things as simple as possible, I'll give you three typical missions for a two stage rocket.

- **Just have a safe flight - usually just for fun.** You don't need it to go out of sight, and you want to keep it within visual range to make recovery easy.
- **Achieving maximum altitude** - an unlimited altitude waiver is available, so you want to go as high as your wallet allows.
- **Limiting the maximum altitude** - where there is a waiver in place, and you can't exceed it - but you want to get really close… the term we use in hobby is *"tickling the waiver."*

Just Have a Safe Flight

When selecting motors for the first mission of just having a fun 2-stage flight is done by examining the properties of the rocket motors. Let me give you some examples.

First of all, you'll probably look at the choices based on the cost of the motors. Everyone has a budget, so you'll want to sort the list based on the motor's cost. You might as well sort the list by availability too. That's just common sense -- can you get the motor easily from your dealer?

Second, you can limit the number of options based on motor diameter. It is likely that you'll want to pick a motor that fits easily into the upper stage. Although, you can use a motor adapter to allow the use of a smaller diameter motor in the upper stage. It makes the flight slightly more complicated, but is possible to select from a larger list. However, we're trying to narrow down our list to make selecting a motor easier. But smaller motors are usually cheaper, and that may be a more important criteria for your situation.

Something you do have to keep in mind is the available ejection charge times of the rocket motors. This comes into play if you

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Figure 4- The wide variety of rocket engines to choose from.

want to use direct staging of black powder motors. If you're using electronic staging, this won't be an issue, because the staging timer will automatically have a set-up to eject the upper stage parachute at apogee.

Next, we have the choice of black-powder motors versus composite propellant motors. This is likely the biggest choice you'll have to make.

If your booster stage uses black powder motors, then your "easiest" option for the upper stage ignition is to also have a black powder propellant motor. You can use direct staging in this case, which greatly simplifies the preparation for the flight. See *Peak-of-Flight Newsletter #98* (https://www.apogeerockets.com/education/downloads/Newsletter98.pdf)

If your booster stage has a composite propellant motor, you still have a choice between black powder or composite propellant in the upper stage, but you're going to need to perform electronic staging. But black powder is still easier to ignite than composite propellant, so that may be important to you when selecting a motor to use.

For information on electronic staging, we have a lot of information available in previous newsletters and how-to videos. It is getting much easier to do with modern electronics, and we're happy to guide you through the process. We also highly recommend starting with the TTV kit, which will guide you how to stage successfully by using smaller and cheaper motors. You can find the TTV kit here (https://www.apogeerockets.com/Model-Rocket-Kits/Skill-Level-4-Model-Rocket-Kits/TTV). There is also some additional advice on staging the Aerotech smaller motors here (https://www.apogeerockets.com/Advanced_Construction_Videos/Rocketry_Video_297).

With composite propellant motors, you get a wider choice of

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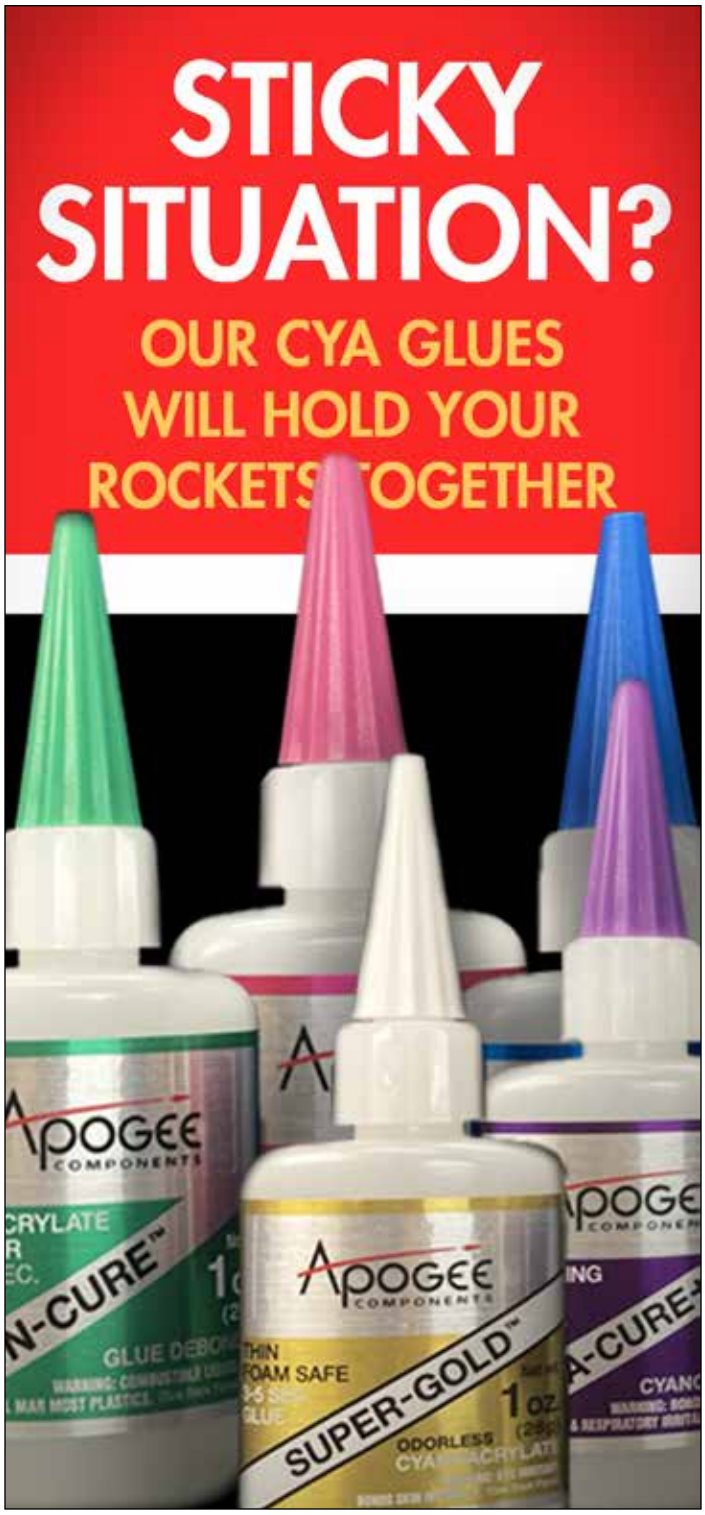

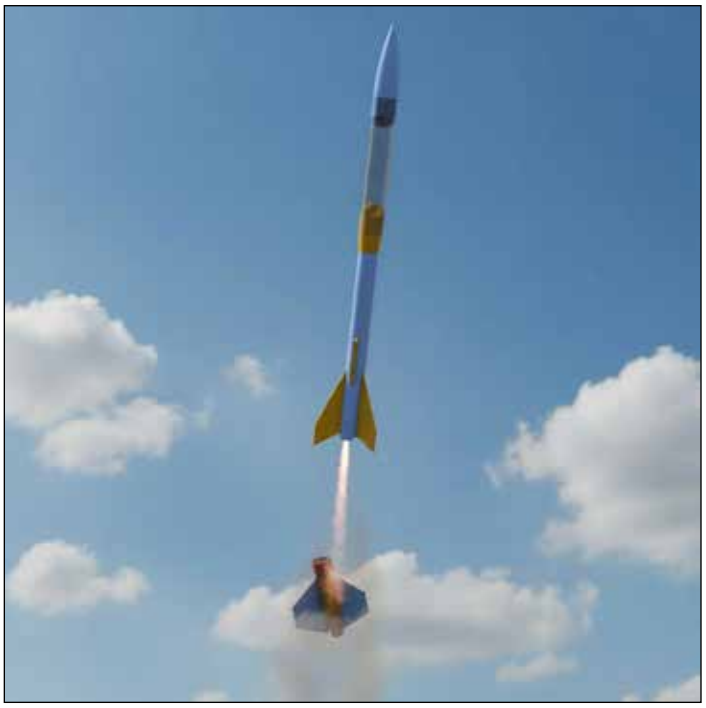

Figure 5 - Black-powder motors are easiest to stage and are quite common in rocketry.

flame and smoke color to select from. This may be important to you, as you might specifically want a motor in the upper stage that has a distinct color, such as red, green, or white.

What most people think of when selecting a motor is based on "size." So I'll add it here to the list of variables you have to consider when making a motor choice. If you're not certified for high power, you can scratch from the list all the motors that are H-size or larger. Throw out the "sparky" type motors too, since they require high-power certification to use.

When selecting motors for the upper stage and you're thinking about size, just remember this general rule-of-thumb: When you go from one letter designation to the next, the altitude of the rocket will approximately double. So a D-motor is going to fly approximately twice the altitude of a C-motor.

That is probably meaningless if you don't have a lot of experience with rocketry, because you don't know how high your C-size motor rocket will fly. Newbies have nothing to compare against, which makes motor selection based on size more difficult.

Ideally, we'd love for the newbies to run a RockSim simulation. But when they are just starting out, we know that isn't going to happen. I do everything I can to encourage people to run simulations, including building the Launch Visualizer simulator right into

the Apogee website as a widget. There is no software to load, they can run simulations right in the open browser window on the kit page of our website. Still, people rarely run simulations.

Therefore, our general advice to newbies is to use the smallest size motor in the rocket on the first flight. So for example, if the rocket has a 24mm motor mount diameter, we're going to suggest that they use the smallest 24mm motor available - an Estes C11. They can fly that, and see how it goes and if it lands within their available recovery area. Now they have some perspective, and we tell them that the next size, a D-motor will fly approximately twice as high. Then we ask them to think about where the previous rocket landed, and would a D-motor rocket also come down in their launch area if it went twice as high? They almost always buy both the C and the D motor on the same day, but they know that they don't have to fly the second flight with the D motor if the C-motor flight was hard to get back.

And that same advice for selecting motors-based-on-size, goes to two-stage rockets too. *If you're not going to take the time to run a RockSim simulation, choose the smallest motor for the upper stage that will fit into the motor mount.*

How do we Pick Motors Here At Apogee?

As you know, we fly a lot of rockets. And we also know that almost any motor is going to work in the upper stage. So our method of picking motors for the upper stage of our own two stage rockets

Figure 5 - The higher your rocket flies, the longer you may have to run to retreive it.

is simple: see what is sitting available in the range box. Instead of opening up a brand new pack of motors, we grab what is left-over from previous flights. "Yeah.. this one will work." For a simple flight, as long as the booster stage motor is sufficient for a safe flight, whatever motor we have collecting dust in the bottom of the range box is a GREAT candidate for the upper stage.

Mission # 2 - Going for Maximum Altitude

Assuming the altitude waiver is nearly unlimited, going for maximum altitude in a 2-stage rocket is a little more complicated.

Assuming you're high power certified, the *maximum altitude is only limited by the thickness of your wallet*. So "budget" is the biggest driver when selecting that upper stage motor (and the lower stage too). But in general, now you're basing your motor selection mainly on the total impulse of the rocket motor. You want the biggest one that you can afford.

But I'll be honest with you, if you're going for maximum altitude, why are you considering a 2-stage rocket? It is simpler and easier to use a single stage rocket to get to maximum altitude. Think about it, instead of using two K-motors in a two stage rocket, why not use a L-motor in a single-stage rocket? Your odds of going higher are much greater because the rocket probably isn't going to weathercock as much.

So unless you're topped out and can't get a motor larger than the biggest size available (I think it is currently an O-size motor), then going single stage will always get you a higher flight.

The reality is, in this hobby we do two-stage rockets for "fun," not to fly higher. Because we can always find a motor that has twice the amount of power as the booster stage motor.

Flying for "fun" is a totally worthy motivation for making a two stage rocket. In most cases, they are more spectacular from a visual perspective than a single stage rocket. They add a sense of apprehensiveness to the launch, because you don't know if every-

Figure 6 - Spectators watching your rocket scream skyward.

thing is going to work out correctly. And then when it does, there is an extra feeling of elation and exhilaration. Really, it is twice the fun!

Another reason to perform staging is that it gives you a new technical challenge to overcome, and that helps increase your rocketry skills. You have two vehicles to build and prep, and then you get more exercise recovering them too.

Finally, there is an element of showmanship in the process too. We all like to create a visual and auditory spectacle for the viewers of our launches. That's why we like the "big ones" at launches. And when we perform a successful two-stage flight, we do get a share of the bragging rights for the day.

Mission #3 - Tickle the Waiver

This is probably the most complex scenario, and is probably another worthy reason for doing a two-stage flight. When you have to reach, but not exceed a predetermined altitude, you have to do a lot more planning.

This is where you definitely have to run your simulations to see how high the rocket will fly.

The trick, of course, is to limit the amount of time and number of simulations it takes in order to pick the proper set of motors. You could run hundreds of manual simulations and come up with a lot of choices. But you have to ask yourself, "how much did I learn?" And "would doing it that way allow me to teach others the proper system of doing it? Because if you had to teach it to others, you'd want to come up with a repeatable system that minimizes time and effort.

For this case, I have to use RockSim-Pro, not Rocksim. Why, because RockSim-Pro allows us to have an initial velocity for the

Figure 6 - Staying under the waiver limit requires more planning and yes... running simulations.

flight, where RockSim assumes that the initial velocity is zero (launched from a static launch pad). This will be important because we have to break up the flight into two different phases to pick the upper stage motor.

So here's my system:

1. Start by listing the objective - let's say to get to 8,000 feet AGL without going over.

2. Pick the rocket you want to use. You might want to start with a kit, because you like a particular scale model. Or you might say that you want to create your own scratch-built design. That's cool too. But you have to start with a design file to run your simulations.

3. Define any visual criteria you want to include in the flight. This is where you're adding "fun" and "spectacle" to the launch. So you might put something down like the class of motors in both stages has to be the same (such as a G-motor staged to another G-motor). Or you might want a sparky motor in the upper stage, or something that produces a different color smoke in the upper stage. These criteria are totally made up, and are what is important to YOU. It adds a little challenge, and makes the flight memorable.

4. Pick a booster motor using the steps in Newsletter #657. Essentially, for the first simulations, you temporarily glue the booster stage to the upper stage in order to make sure the flight is on a safe trajectory from lift-off (see Figure 2). This is going to give you a list of booster motors that are possible to choose from. RockSim does hundreds of simulations, but the amount of work on your part is pretty minimal. After you have the rocket design converted to a single-stage configuration, you only have three-clicks of your mouse to generate a list of possibly hundreds of acceptable motors (see Figure 7).

Figure 7 - Click the "Recommend Motors" button to get an extensive list of motors that will work in your rocket.

5. From your list of possible booster stage motors, you need to pick one. Start by comparing to, and picking from a list of "available motors" from your dealer of choice (hopefully Apogee…). There are going to be a lot of options. So maybe you also want to have a particular flame effect you want to see on the launch. That will also help you narrow down the list. But unless you want to do a huge number of simulations, you need to focus on one motor for the booster stage.

6. We also need to pick the staging point of the flight. This is when the booster stage drops away and also when the upper stage ignites. This is another "user specified" choice when it comes to running simulations, because we can make up for any deficiencies by the choice of the upper stage motor. Again, "when" the rocket stages is mostly going to impact the visual spectacle of the flight. For example, a longer time before staging is more spectacular and typically creates a more anticipatory flight that generates a lot of exhilaration when it happens. While a shorter time typically means a straighter flight with less weathercocking. If you would like to learn more about how to set this up in RockSim, see *Peak-of-Flight Newsletter #572* (https://www.apogeerockets.com/education/downloads/Newsletter572.pdf).

7. Run the simulation, and note down the specifics about the staging point. During this simulation, the rocket is still "glued" together as a single stage rocket. So it will take a little digging to find out the speed of the rocket when the booster drops away, and how high it is in the sky. We should technically know the orientation of the rocket (which direction it is pointed) too if we want more accurate motor selection of the upper stage.

Recall that the strategy we're using here, is to get a new starting point for the upper stage of the rocket. We want to use the recommend motor feature, and to use it, we can only have a single stage (see Figure 7). But if we know how the rocket is moving prior to motor start-up, we can still run the recommend motor feature.

Load into your rocket the booster motor you have selected, and then run a simulation.

From the 3D flight profile shown in the launch visualizer of RockSim-Pro, display the flight data. Using the time slider on the bottom, go to the point in the flight where the booster stage would separate in the trajectory. The picture in Figure 8 shows the upper stage detached (call-out "A"), but in your simulation the stages will still be together. I fudged the simulation image to demonstrate that

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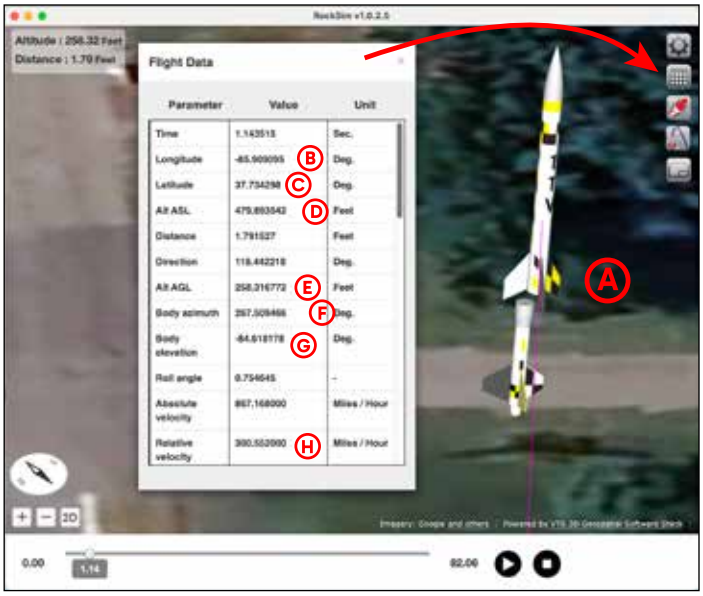

Figure 8 - From the Launch Visualizer in RS-Pro, get the position of the rocket at the staging point in the flight.

you want the point in the flight where they would be detached if they were not glued together in the components tree.

From the Flight Data pop-up screen (see figure 8), note down the values as listed:

- B,C - The longitude and latitude of the rocket. It has launch off the ground pad, so these are the new launch coordinates for the next simulation.
- D - Altitude ASL - Since the rocket took off, this will be the future pad location in the next simulations. Note that we could also jot down "E", which is the altitude above ground level, but then we'd have to do more calculations when setting up the next simulation.
- F - Body Azimuth - this is the compass direction that the rocket is aimed at the staging point in the flight.
- G - Body Elevation - This is the vertical orientation of the rocket. Note that the number is negative. This is because RockSim-Pro uses 0° as the rocket pointed to the center of the earth, not up into the sky. So we will add 90° to this to get the direction (from vertical) the rocket is pointed. This is like the elevation angle the launch rod is pointed.
- H - Relative velocity - This is the speed of the rocket at the instant of staging. The Absolute velocity, which is in the line above it, is the speed of the rocket with the extra speed of the rotation of the earth. We'll use the Relative velocity for our next simulations.

8. Now we'll create a new design file for the rocket, and this time it will be the upper stage alone. Because it is a single stage, we CAN run the recommend motor feature.

Now we need to input the new launch conditions. This will be new to most people, because the rocket has an initial speed, and it is already above the ground in the air.

From the Simulation Properties screen, click on the "Starting State" tab (see figure 9).

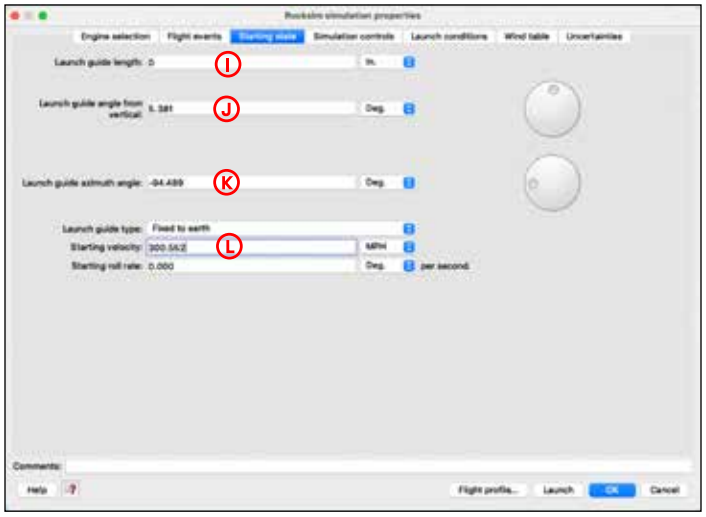

Figure 9 - The "starting state" for the upper stage will be the position of the 2-stage rocket at the moment of staging.

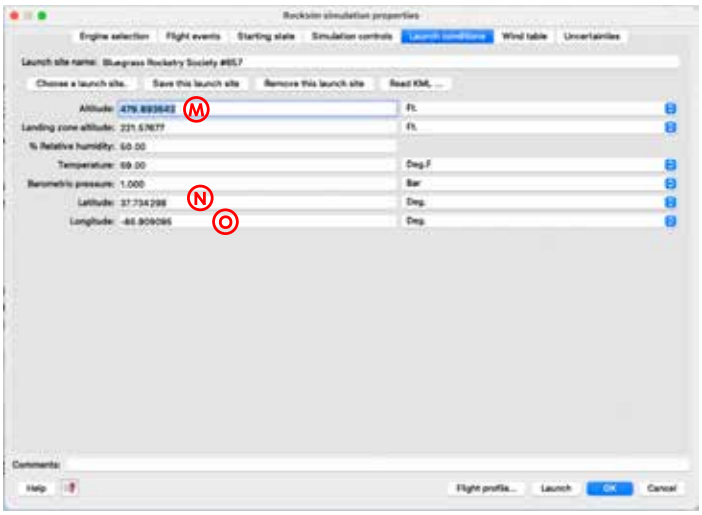

Figure 10 - Also adjust the launch position of the rocket in the "Launch Conditions" tab, since it has moved up and off the launch pad.

- I - The launch guide length is now 0, because we're not going to constrain it to a specific direction.
- J - The Launch Guide Angle from Vertical, is found by taking the value of G, and adding 90° to it.
- K - is the compass direction that the rocket is pointed. It is found from F. Note that RockSim-Pro may change this value automatically. In our images (figure 8), 267.505994° is the same compass direction as -94.489°. It is a little bit south of due west (due west could be entered either as -90° or 270°).
- L - is the the relative velocity of the rocket, which is the same as letter H in Figure 8.

At this point, click over to the Launch Conditions Tab and enter the last three points of information.

- M - The Altitude ASL (This was the same as point D)
- N,O - The new latitude and longitude of the rocket (the same values from B,C).

With the new launch conditions set, you can get a list of possible motors for the upper stage.

9. Run the recommend motors for the upper stage by itself from the "Engine Selection" tab (figure 7). When running the list, select "Use My Values" (see figure 11) instead of the default launch conditions. When you're done, you'll get a big list of motors, which you can output (Figure 12).

10. From the list, I'll sort the simulations by maximum altitude (figure 12). I want to see which motor in the upper stage will get

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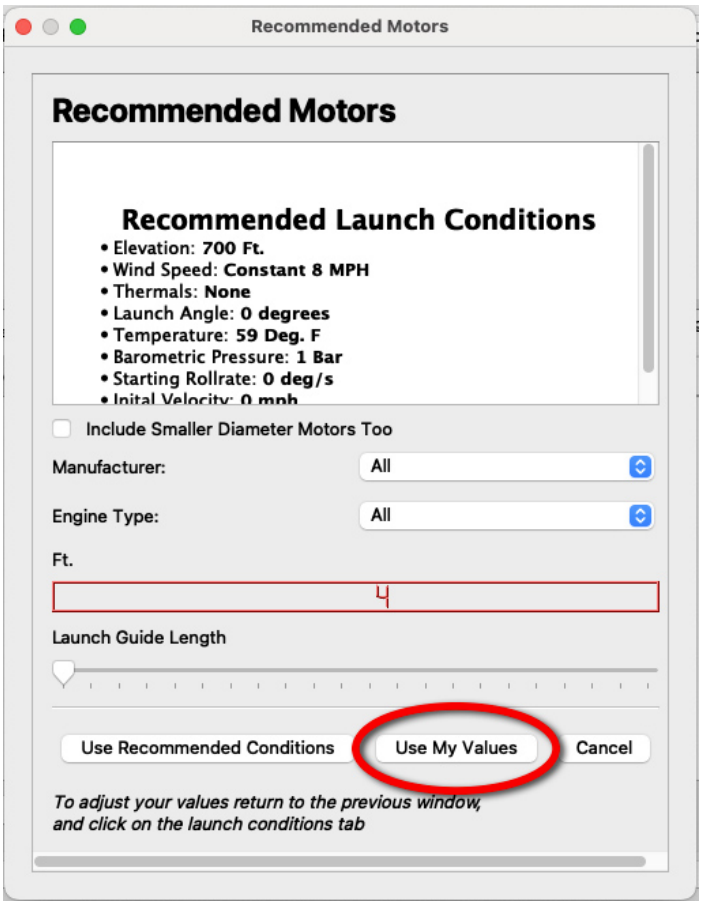

Figure 11 - When running the Recommend Motors feature, be sure to select "Use My Values" so it picks the new position of the rocket that starts above the ground.

me the closest to the target waiver altitude, but without breaking it.

Whatever is closest to the waiver altitude is my first choice for the motor. But again, there will probably be many motors that are "close-enough" to the target altitude. So as before, I may look at the propellant formulations to see which one will have the visual effects that are most desirable to me and the flight.

Now I want to do a confirmation simulation of the actual 2-stage rocket, with the two motors that were my primary motors.

In this case, the rocket is in its full-up condition, and I just want to use this to verify that I had done everything correctly and the rocket reaches about the same altitude that the single stage got to in the last simulation.

There were a lot of variables that happened during staging, and if I didn't account for them all, the altitude will be different. For review, we needed to know the rockets:

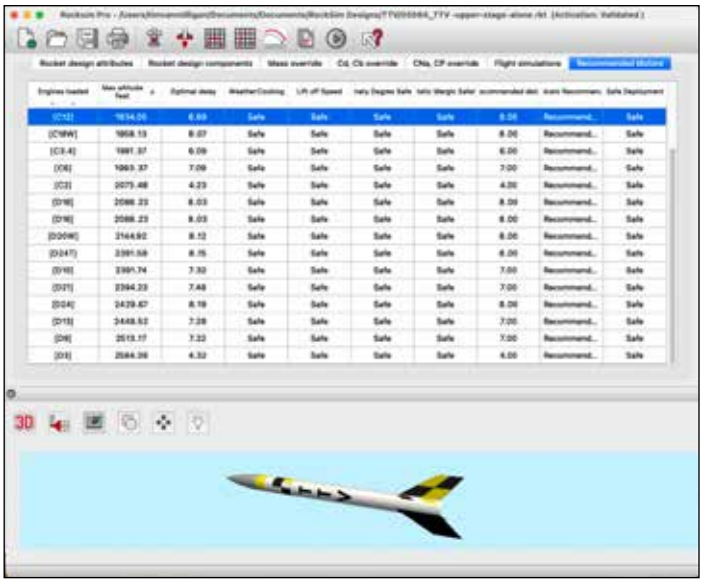

Figure 12 - The final list of motors to choose from for the upper stage. Sort the list by "Max. Altitude"

- Speed
- Altitude
- Orientation (the direction it was pointed)
- The GPS position of the rocket exactly at the moment of staging.
- Wind speed and direction at the exact moment of staging

These were the input conditions for when the recommend motors were run in step 9. If any of them are off, the final altitude of the rocket will be a little different if we compare the actual 2-stage version compared to the flight where the sustainer stage starte in the air. As an engineer, I just want to make sure that they are somewhat close (within say 5 percent).

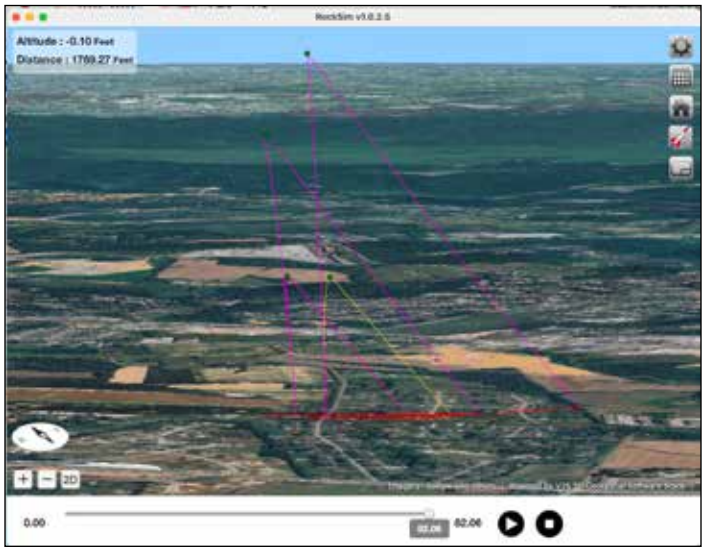

Figure 13 - RockSim Pro will allow you to compare the trajectories of two simulations so you can pick the one that looks best to you.

But even if they aren't close, I now have a new reference point as a result of completing the simulation of the two stage rocket. Is the altitude under the waiver? Great! If it is a little off your target altitude, you can evaluate the difference and gauge whether the extra effort required to get it a little closer is worth the effort. In other words, how many more simulations would I have to run to tweak things to get the perfection that you desire.

This was the process to run as few simulations as possible. But you can always run more if you want to dial things in.

To get to this point, I've had to make three different RockSim design files:

- The entire rocket, modeled as a single stage rocket - to get the choice of the booster stage motor, and to find the speed, altitude, and orientation of the rocket at the staging point.
- The upper stage alone - used to generate a list of motors for the upper stage
- The actual 2-stage - used to verify the file was set up correctly and to do final tweaks.

In reality, while it requires three different RockSim design files, you're just really modifying a single file and saving it in a different

configuration. So that is too bad.

Conclusion

Selecting motors for a two-stage rocket doesn't have to be as overwhelming as it initially appears. By breaking down the process into clear steps and understanding the fundamental principle that "it's ALL about the booster motor," you can systematically narrow down your choices from what seems like unlimited options to a manageable selection.

The key takeaways from this article are:

For the Booster Stage: Always prioritize safety by using the single-stage conversion method in RockSim to generate a list of appropriate motors. The booster motor determines whether your flight will be safe, making this the most critical selection in your two-stage rocket.

For the Upper Stage: Remember that almost any motor can work, giving you tremendous flexibility. Your choice should be driven by your mission objectives—whether that's simply having fun, achieving maximum altitude, or precisely hitting a target altitude within waiver limits.

Choose Your Mission First: Understanding what you want to accomplish with your flight will naturally guide your motor selection process. A casual fun flight requires far less analysis than attempting to tickle a waiver limit, and your approach should match your goals.

Author Tim Van Milligan with the Mega-Mako rocket and the original Mako kit.

Leverage Available Tools: RockSim and RockSim-Pro are invaluable for running simulations and using features like the "Recommend Motors" function. While it may seem like extra work upfront, proper simulation will save you money on motors and increase your chances of a successful flight.

Start Simple: If you're new to staging, begin with black powder motors and direct staging before moving on to the complexity of electronic staging with composite motors. The TTV kit mentioned in this article is an excellent, economical platform for learning these techniques with smaller, less expensive motors.

Don't Overthink It: For many recreational flights, the motor sitting in your range box from a previous launch may be perfectly adequate for the upper stage. Not every flight needs to be optimized to perfection.

Whether you're staging for the spectacle, the technical challenge, or to achieve a specific altitude goal, the systematic approach outlined in this article will help you make informed decisions. Remember that two-stage rocketry is ultimately about having fun and pushing your skills to the next level. Each successful staging brings that extra sense of accomplishment that makes all the preparation worthwhile.

Now get out there, run your simulations, select your motors with confidence, and enjoy the thrill of a successful two-stage flight!

Additional References:

- *Staging Electronics - Peak-of-Flight Newsletter #640* - https://www.apogeerockets.com/education/downloads/Newsletter640.pdf
- *Fabricating a Composite Transition for Boosted Darts - Peak-of-Flight Newsletter #435.* https://www.apogeerockets.com/education/downloads/Newsletter435.pdf
- *Multi-Staging Cluster Motor Rockets - Peak-of-Flight Newsletter #382* - https://www.apogeerockets.com/education/downloads/Newsletter382.pdf

About the Author

Tim Van Milligan (a.k.a. “Mr. Rocket”) is a real rocket scientist who enjoys helping fellow rocketeers. He is Level 3 high-power certified, an experienced educator, and the founder of Apogee Components. Formerly involved in the Delta II rocket program, Tim holds a B.S. in Aeronautical Engineering from Embry-Riddle Aeronautical University and has worked toward an M.S. in Space Technology. He is also the author of Model Rocket Design and Construction and 69 Simple Science Fair Projects with Model Rockets: Aeronautics, and publisher of the Peak-of-Flight newsletter.

PEAK OF FLIGHT NEWSLETTER

Article Submission Guidelines

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www.ApogeeRockets.com

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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