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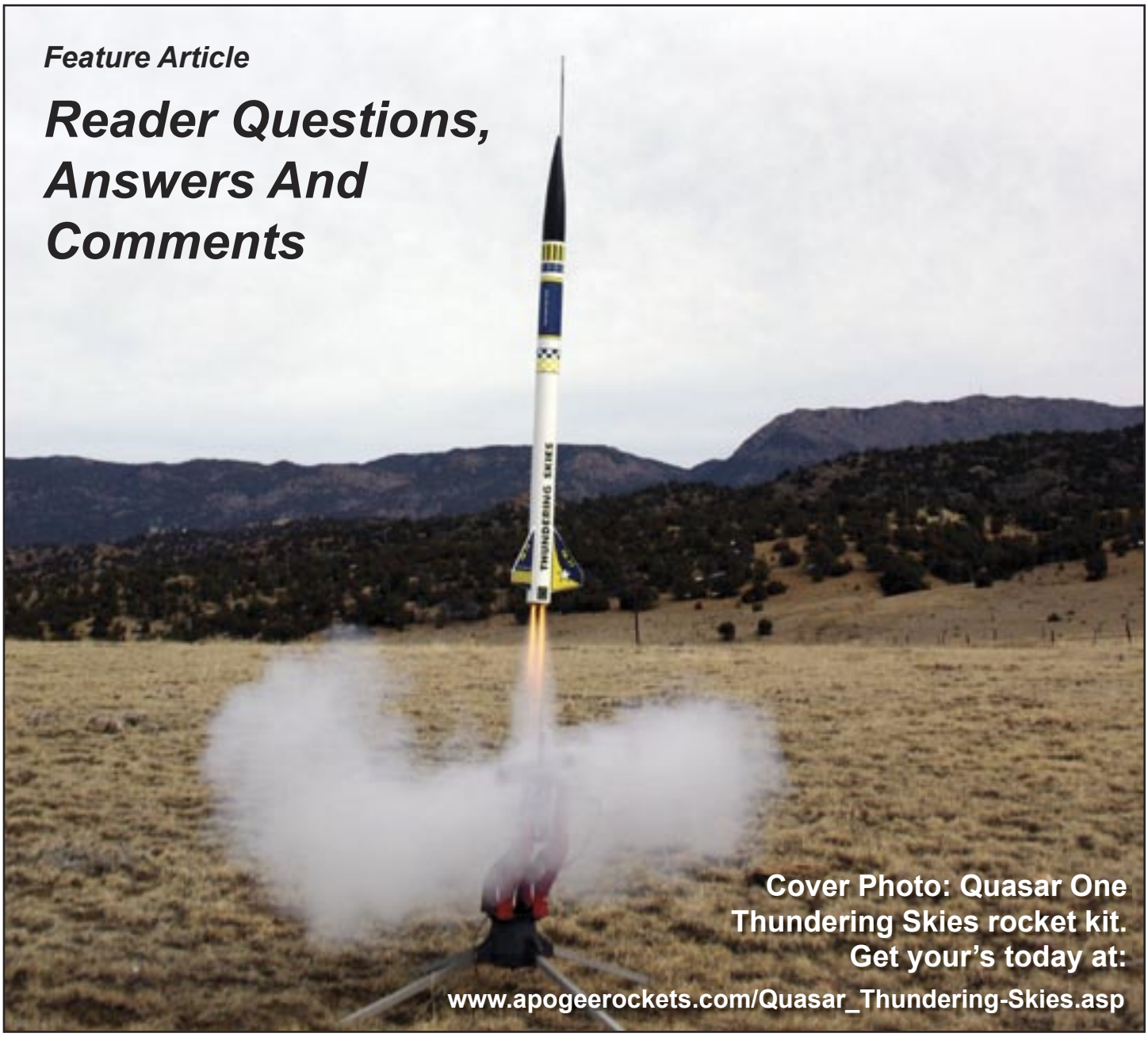
PEAK OF FLIGHT

NEWSLETTER

Feature Article

Reader Questions, Answers And Comments



Cover Photo: Quasar One Thundering Skies rocket kit. Get your's today at:

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ISSUE 255 FEBRUARY 23, 2010

Reader Questions, Answers and Comments

By Tim Van Milligan

In Newsletter 245 (www.ApogeeRockets.com/Education/Downloads/Newsletter245.pdf), I presented a plan for the "Kink" rocket, which is a NAR superroc style model. At the time I created the plans, I had only one launch attempt, and unfortunately, it kinked on the way up, about 20 feet off the launch rod. I felt bad about this, because it is embarrassing to release a plan that didn't work right.

Because of that, I built the model and flew it again at a rocket contest in January. The result was much better this time. It still kinked however, but this time it was about 700 feet in the air.

I consider this a successful flight, because it didn't kink while the F10-8 rocket motor was under thrust. It only kinked after the engine burned out and the rocket hit a weird wind shear.

The big test of this launch was to see if we could get a good lift-off of the long rocket in some high wind conditions using the Fly-A-Way Launch Rails Guides (see Newsletter 247 and 243 at: www.ApogeeRockets.com/apogeerockets.com/education/newsletter_archive.asp). From that perspective, the launch was a resounding success. The winds were in the 10 mph range and it was just a challenge to get the 13 foot long rocket even to the rangehead to load it on the rail, let alone to get it into the air.

I initially put two fly-away rail guides on the rocket; one set near the top, and one near the bottom (see Figure 1). But the wind was blowing strong enough that the rocket was bowing in the middle. I certainly didn't expect that to happen! It looked like an archer's bow, getting ready to draw back and fire an arrow.

The solution was to put a third fly-away rail guide in the middle of the rocket. I had one made, just in case I wanted to fly the rocket as a shortened "minimum-length" superroc (which in NAR competition for F-class engines is 2.0 meters long). Once I did that, everything was fine and dandy. In fact, we probably didn't launch the rocket for another 20 minutes after it was loaded on the pad, and it just sat there; the whole rail swaying in the wind, with the rocket firmly attached to the side and swaying along with the rail. We even stopped and shot some pictures because I knew we now didn't have to worry about the wind at all.

Figure 1: The 13-foot tall "maximum-length" F-engine superroc model on the launch rail. It used three sets of the fly-away rail guides for support (indicated by the arrows).

The launch was very cool. It slid up the rail seemingly effortlessly and the fly-away rail guides popped off nicely, just like I had seen them do in the past. For someone that has never seen a fly-away rail guide come off the rocket, it can be surprising. In fact, on the first flight of the superroc launch, the contest director though the fins had shredded

Continued on page 3

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You can subscribe to receive this e-zine FREE at the Apogee Components web site (www.ApogeeRockets.com), or by sending an e-mail to: ezine@apogeeRockets.com with "SUBSCRIBE" as the subject line of the message.

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Continued from page 2

Reader Questions, Answers and Comments

off the rocket, since that is what it looks like to spectators. The give-away that everything is OK is that the rocket continues to go straight up.

Once the rocket cleared the fourteen foot-long launch rail (which was made from an 8-foot section of rail that had another 6-foot long piece spliced onto it), it did do a bit of wobbling. It looked like a spaghetti noodle being pushed into the sky. But it just kept going and going and going on that 8-second burn of the Apogee F10-8 motor. It was almost out of sight when the rocket finally hit the wind shear layer at 700 feet in the sky. At that point, it folded in half, right in the middle of the rocket. Fortunately, the fold point was in front of the separation point, so the parachute was still ejected normally and the rocket came down just fine.

From a usage point of view, loading the long rocket onto the rail was a two-person task. It is so long that it is a bit unwieldy. I needed someone to hold the rocket while I slid the fly-away rail guides into position and rubber-banded them to the rocket. The other thing about the fly-away rail guides is that you have to do a little bit of adjusting to make sure that they slide freely along the rail. I think this is because they were hand-made and had a little bit of slop to them. But once the adjustment to put them into the proper place on the rocket was made, they worked just fine.

I was worried that they would get hung up in the splice where the two rail sections butted together. But that wasn't a problem. The butt joint was very tight and accurately aligned. My thanks goes to the COSROCS club for providing the 14 foot long launch rail, and to Richard Fonzi for putting it together.

Figure 2: This video frame taken from the launch of the superroc shows that the tube had quite a bit of bend to it. It did wobble a lot, but climbed nice and straight.

Continued on page 4

Continued from page 3

Reader Questions, Answers and Comments

Figure 3: The fourteen foot tall launch rails that will be available at NARAM this summer.

If you're coming out to Colorado for NARAM this summer (see www.PeakCity.org), you'll be happy to know that there will be several of these 14-foot long launch rails available for the F-Superroc Altitude competition. The only thing that you'll need to bring with you (besides the rocket, of course), is the Fly-A-way rail guides. You'll want to be prepared and have several sets with you, in case you lose a section on a flight. As I said, I personally made a whole bunch with several duplicates of the various sizes so that I'd be ready in case I needed an extra one. I also recommend painting them fluorescent orange or red and writing your name on them. That way they are easier to find after the launch, and if someone picks one up, they can give it to you later.

Modifications to the rocket

The only modification to the rocket that I made from the plans presented in Newsletter 245 is that I put a layer of fiberglass cloth over the tubes. That seemed to work just fine and give the rocket a bit more stiffness, and I'd probably recommend that to other people that build from the plans. Everything else was as described in that previous article.

Build Your Rail Guides Early

Figure 4: A box of fly-away rail guides for various size tubes.

I wouldn't recommend that you show up at NARAM without having pre-built the fly-away rail guides at home. Building your very first set of rail guides takes about an hour, so you should plan ahead. I've modified them from the first set that I came up with (that were shown in Newsletter 243). The newest version is shown in Newsletter 247. You can download these newsletters for free from the Apogee Components web site.

Contest Flight Strategy

For the superroc contest at NARAM, which is the winning strategy: fly high with a short model (minimum length is 2.0 meters), or go for maximum points with a maximum length (4 meter long) model?

That is the question that I had going into the contest. I have more information now than I did then, so here is what I came away with.

Based on the results of the January contest here in Colorado Springs, the edge goes to using a maximum length rocket.

For the minimum length rocket of 2 meters, the alti-

Continued on page 5

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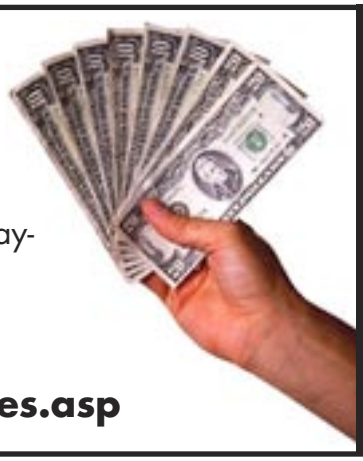

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Continued from page 4

Reader Questions, Answers and Comments

tudes were in the range of 1000 meters. The only maximum length rocket that got tracked was 574 meters. Even though the shorter rockets were going a lot higher, they didn't go exactly "twice as high" as the rockets that were twice as long. That gives a slight advantage to rockets that are longer but don't fly as high.

The cool feature of the "Kink" superroc plan from Newsletter 245 is that it can be flown as a shorter rocket by simply removing the upper two sections and placing a nose cone on the mid-section (24mm) tube. So it allows a bit of versatility.

In Superroc altitude competition, you get two flight attempts (actually you get more if you get a track-lost by the people measuring the altitude), so here is a flying strategy that I used and seems to work OK. On the first flight, I would fly it as a short 2-meter long rocket. If you get a good score, then you add the longer sections to the top, and refly it as a maximum length rocket.

I'd suggest doing this rather than going for broke on the first attempt. Why? Because if the long rocket crimps on the first flight, there is a good chance (according to Murphy's Law) that the crimp is going to occur near the bottom of the rocket where repair is difficult. You want it to crimp near the top, but that never seems to happen in competition. There is a much higher probability that the short 2m long rocket is going to boost straighter and therefore will remain intact through the duration of the flight. Go with the high probablility on the first flight, and then go for the maximum points on the second flight.

Reader Questions And Comments

Steve Stein of Medina, Ohio asks: *"I have a Rocksim question that I've not been able to find the answer to in the manual, newsletters or videos. When running a simulated flight in the viewer there is an "icon"--a colored arc that flips back and forth on either side of the velocity vector. What is this telling me?*

I absolutely LOVE all the educational materials you provide. I read each newsletter and watch each video. I put a lot of it to good use. Thanks!"

Thank you for the nice comments about our little company. And thanks for the good question. I get this one a lot and I keep forgetting to answer it here in the newsletter. The colored arc is the "Torque Vector" that acts on the rocket when it takes off.

What happens is that as the rocket leaves the launch pad, it sees the wind blowing from one side. The fins see

Continued on page 6

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Continued from page 5

Reader Questions, Answers and Comments

this wind as an angle of attack, and they produce a lift force because of it. This force causes the rocket to rotate in an attempt to zero out the lift-force. But because the rocket has an angular momentum, when it rotates to zero out the lift-force, it actually overshoots and rotates too far. Now the rocket sees a lift-force in the opposite direction, so it wants to rotate back. It continues this back-and-forth rotation as it goes up until the oscillations dampen out and the rocket flys at zero-angle-of-attack.

Figure 5: The Torque vector is the arc coming off thE side of the rocket in the 2D flight profile of RockSim.

You've probably seen this wiggle of the rocket in real life as the rocket takes off. This is actually a good sign that things are going as planned.

The torque vectors seen in the 2D flight profile are just telling you that it is oscillating back-and-forth as the rocket takes off. It all happens so fast that in many cases it is hard to pick up.

The arrows are just force vectors. They have a magnitude, and a direction. It is just like the lift and drag vectors that you see in the 2D flight profile. The only difference is that the torque vectors flip side to side as the rocket oscillates.

If they are too distracting, you can turn them off in the preferences of the 2D flight profile. I know a lot of people that do turn them off.

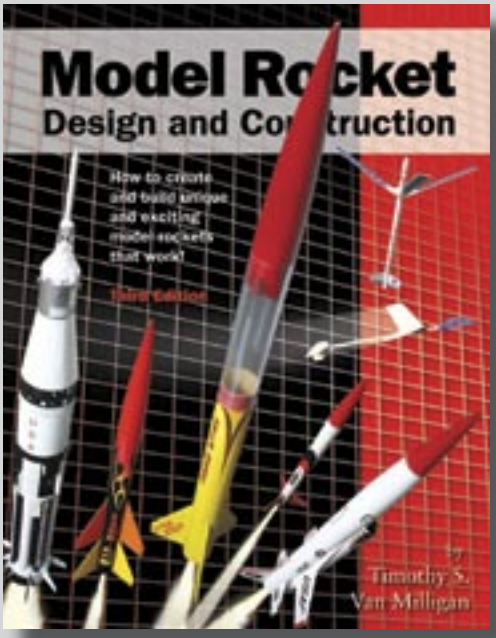
Deceleration and Shear Pins

Mike Momenee writes: *"Does Rocksim give the deceleration G force on the rocket at the moment of drogue chute deployment? As my rockets are getting heavier, I've found that the drogue, which is attached through the top of the nosecone, tends to separate the payload section from the rocket body section, prematurely deploying the main chute (even with an ultra-tight friction fit).*

The solution is to use nylon shear pins, but I'm trying to understand the G force on the rocket at the moment of deceleration caused by the drogue's opening. That, along with the weight of the rocket, will help me to calculate how many/what diameter nylon shear pins I should use to hold the rocket together through the force of the drogue event.

I've clicked on the "Details" button on the 2D Flight Profile screen, but I don't see G's listed. It's probably an easy calculation from some other data in "Details", but I can't fig-

Continued on page 7



Model Rocket Design and Construction

By Timothy S. Van Milligan

New 3rd Edition Now Shipping!

This new 328 page guidebook for serious rocket designers contains the most up-to-date information on creating unique and exciting models that really work. With 566 illustrations and 175 photos, it is the ultimate resource if you want to make rockets that will push the edge of the performance envelope. Because of the number of pictures, it is also a great gift to give to beginners to start them on their rocketry future.

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Continued from page 6

Reader Questions, Answers and Comments

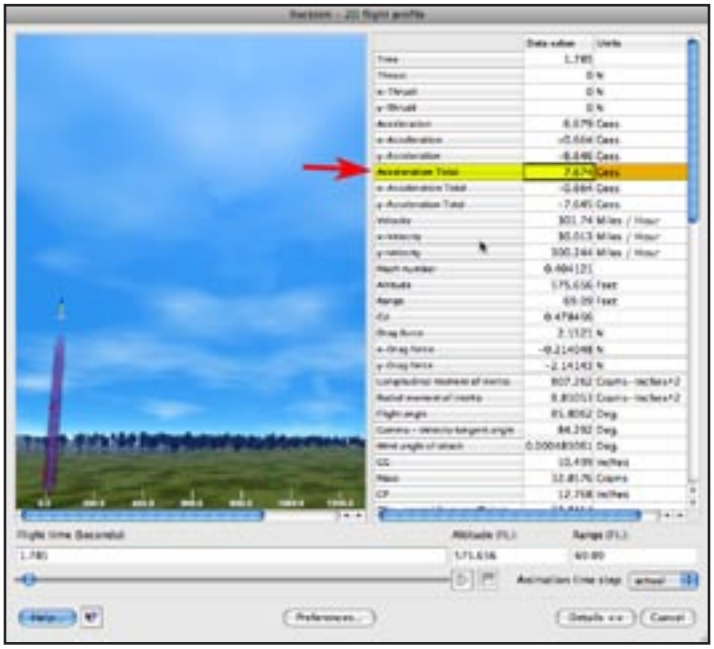

Figure 6: You can find the deceleration force in the details of the 2D Flight Profile.

ure it out. Any and all guidance will be greatly appreciated."

This a great question. You can get the deceleration force from the details in the 2D flight profile. It would be listed under Acceleration Total, with the units being Gees as shown in Figure 6.

However, I would recommend that you look at the graph of acceleration. The reason is that the details in the 2D flight profile have a larger step size between iterations, so it may be possible to miss the peak deceleration point when you're stepping through the animation. The reason it uses a larger step size has to do with the amount of processing time needed to generate the 2D animation. We

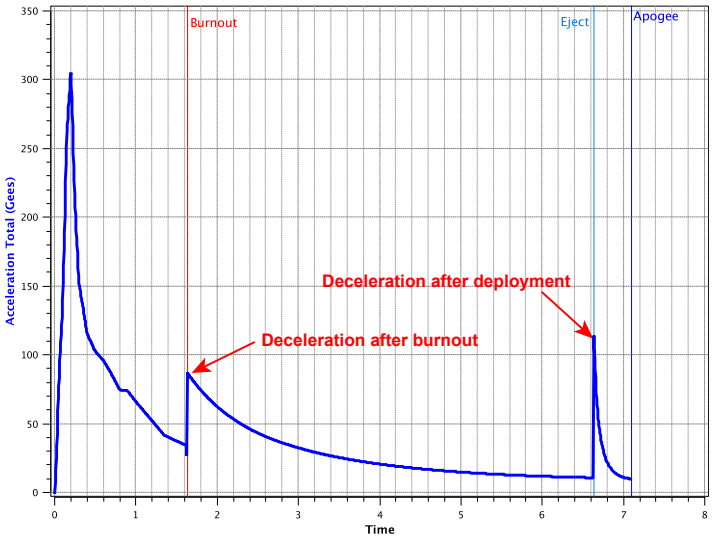

Figure 7: The acceleration graph will also show you the spikes in the acceleration of the rocket.

try to keep it low in order to make the animation pop up quicker on your computer screen.

When you are looking at the graphs, all the data that RockSim generates is available. You can zoom in on the graph to find the exact point where the deceleration point is the greatest.

For high thrust rockets that are big and draggy, the maximum deceleration can be quite high, and will occur immediately following engine burnout. You'll see the second spike when the parachute is ejected out of the rocket. The peak of that spike is going to be dependant on your weather conditions though, and how the rocket trajectory looks. If you get a perfect launch and the chute is ejected right at apogee (the slowest point in the flight), the deceleration at that point could be zero. If you size your shear pins based on this, they would be too small.

Continued on page 8

Continued from page 7

Reader Questions, Answers and Comments

I would suggest that you set up the simulation to try to mimic the worst flying conditions that you would expect the rocket to tolerate. For example, you might have high winds of 12 miles per hour, and the rocket angled into the wind at 30 degrees from vertical. That way when the rocket arcs over at apogee, it will be flying at a high rate of speed and the deceleration forces will be the largest. When you do this, you'll be able to figure out the largest size shear pins that would be needed to hold the rocket together.

Streamer Recovery Rockets

Mike Valletti writes: *"I am looking for a streamer recovery rocket for smaller fields. Can Apogee provide me a list of those utilizing streamers so I don't have to open each individually?"*

There are so many rockets that come with a streamer, that I can't remember them all. This brings up an issue that confronts us all the time here at Apogee Components. The question we struggle with is how do people search our web site looking for particular types of rockets, such as streamer versus parachute, versus price, versus weight. There are a million variables that people use to select rockets. It does make it quite a challenge to refine our web site. Since I don't have a perfect solution to this problem, I think you did the right thing by emailing us your question. We'll be happy to send you a list of rockets that come with a streamer.

On the flip side, it is possible to add a streamer to a lot of small rockets that come with a parachute. We typically recommend a streamer for rockets that weigh under 30 grams (1.05 oz.). But if you use them in larger rockets, just be aware that they are going to land harder, and broken or crunched fins are a bit more common.

In the book *"Model Rocket Design and Construction"* (www.ApogeeRockets.com/Design_book.asp), I recommend the streamer to be sized so that there is 8.5 cm^2 of streamer material per gram of returned model. So a 16 gram model should have a streamer with a surface area of at least 171 cm^2.

Using this criteria, you easily find out how big of a streamer you would need for almost any rocket. That will open up the number of rocket kit choices you might want to look at.

Personally, I tell people to look through the rocket kits and find the one that sets off their excitement meter. And then at that point, we can figure out how to make the rocket do what we want it to (how high it will go, how fast, and where it will land). I'd much rather you be excited about the rocket you've built, than having it be critical that it do a specific mission. If you're excited about the rocket, you're going have a more enjoyable rocketry experience, even it the rocket doesn't perform to perfection.