PEAK OF FLIGHT NEWSLETTER

ISSUE 451 | September 5th, 2017

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https://www.ApogeeRockets.com/Rocket-Kits/Skill-Level-3-Model-Rocket-Kits/Graduator-2-6in

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What is a Guide Chute?

By Tim Van Milligan

A question that you may have is "What is a Guide Chute?" I had the same question when I first heard of it, too. Is it a real thing, or just something made up by a manufacturer to sell something unique? In this article, I'll give you the information that I found out about the device so that you can make your own conclusion.

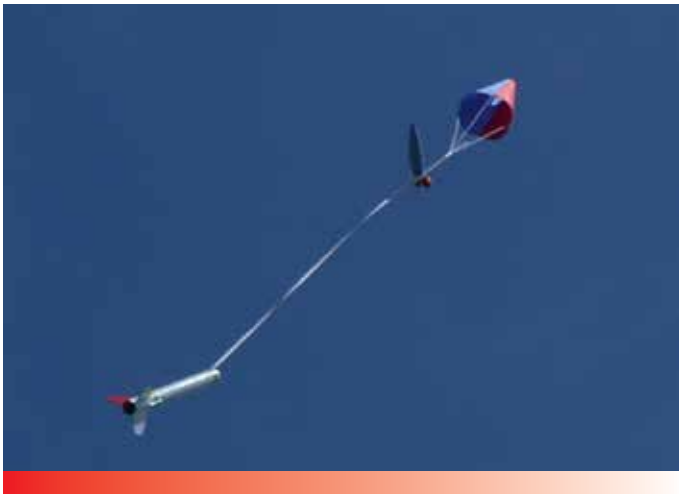

Figure 1: The conical shaped Guide Chute deployed, while the main chute is still reefed at the base of the nose cone by the chute release.

I was skeptical of the Guide Chute from Dino Chutes because I had never heard of one before, and it's very strange appearance seemed to come out of nowhere. It looks like a conical dunce hat, with the tip cut off.

Since I'm an engineer by trade, I wanted to know more about it. But initially, I had no information, other than what Pat Butler at Dino Chutes told me. When he approached me about selling his product at Apogee (and we're always looking for new items to sell, so if you manufacture something, please feel free to give us a call) he told me that he created it for his daughter's TARC project. He said they were looking for a chute that could be used with the Jolly Logic Chute Release (https://www.apogeerockets.com/Electronics-Payloads/Dual-Deployment/Chute-Release) in order to stabilize the rocket so that when the main chute opened, it would unfold in an orderly and predictable manner. The "Guide Chute," as he called it, would guide the opening of the main chute so it was in the right orientation with respect to the rest of the rocket. My initial thought was "Why not just try a streamer?"

Streamers, unfortunately, have hardly any drag. Rockets using streamers fall like stones, especially heavy rockets like those that TARC students build. Streamers are great for adding visibility, though, so if you want to be able to see your rocket after ejection a brightly colored streamer will help.

After I got the Guide Chutes here at Apogee, I really wanted to try it out for myself, so I did do a test launch last month using the LOC Graduator kit (https://www.apogeerockets.com/Rocket-Kits/Skill-Level-3-Model-Rocket-Kits/Graduator-2-6in) with a 24" Guide Chute (https://www.apogeerockets.com/Building-Supplies/Parachutes/Up-to-24in/Dino-Chutes-24in-Guide-Chute) for initial deployment, and the standard 18" hexagon parachute that comes with the rocket as the main recovery device. The rocket contained the chute release to limit the drift, and a Jolly Logic AltimeterThree (https://www.apogeerockets.com/Electronics-Payloads/Altimeters/Jolly-Logic-AltimeterThree) to record the flight data.

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Figure 2: The orange colored main chute is deployed along with the conical Guide Chute.

The flight was nominal and reached an altitude of 656 feet. In retrospect, I should have used a bigger motor to get the rocket up higher. But the Guide Chute deployed at ejection as expected, and when it got down to 300 feet, the Jolly Logic Chute Release let go of the hexagon chute, opening in plenty of time for the rocket to make a nice, gentle landing.

The graph generated by the AltimeterThree showed the initial descent rate at 36 feet per second. When the 18-inch hexagon chute opened fully, the descent rate dropped to 25 feet per second. This verifies that the Guide Chute, even though it's bigger, did have a lower drag coefficient than the 18-inch hexagon chute.

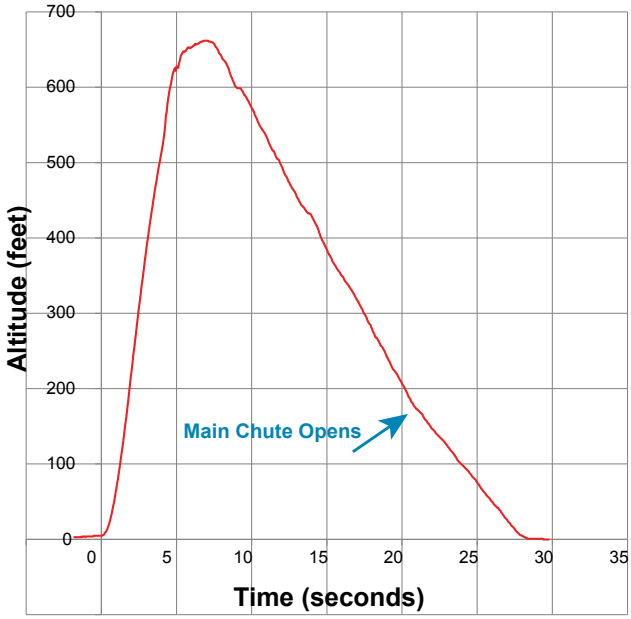

Figure 3: Where the slope of the graph changes is the indication that the main chute was deployed. In this case, the extra chute only slightly slowed down the rocket's descent.

After the flight, I talked to Pat Butler from Dino Chutes to tell him that I liked the Guide Chute. It was during that exchange that he casually mentioned that the data did correlate to the research paper he had used when he created the Guide Chute. "What? There is other research into this type of parachute?" I asked myself. Of course, I immediately asked to see the report.

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The information comes from Parks College Parachute Research Group (https://www.pcprg.com/tcdcprog.htm). The technical name of the parachute is a "Truncated Cone Decelerator." Essentially, it is a very long cone where the tip has been cut off. If you think of a windsock at an airport, that is what the Guide Chute is.

The mission the researchers envisioned for the Truncated Cone Decelerator chute was "for use in wind-sensing applications where GPS-instrumented payloads are to be drifting freely with the wind, in a stable manner, and without gliding." In other words, the researchers wanted a chute that would drop fast but would be pushed along by the wind.

For atmospheric researchers, to get an accurate reading of how fast the wind is blowing, the instrumentation has to be pushed along by the wind. They don't want the chute to create any lift that would cause the chute to go sideways or to penetrate into the wind. They want to know with accuracy how fast the wind is blowing where they drop the data sonde.

For rocketry, we can tolerate a little lift in a chute. In most situations, we want it because it increases the efficiency of the parachute and makes it fall slower. In effect, we're stealing some of the wind's energy, which makes the chute fall slower.

Another benefit for rocketeers is that a chute that has lift will penetrate the wind, which means that the rocket won't drift as far. If you think about it, if you want to a chute that is steerable it has to be able to penetrate the wind. The parawing chute (https://www.apogeerockets.com/education/downloads/Newsletter206.pdf) is a great example of this. Plus, it has a very slow descent speed.

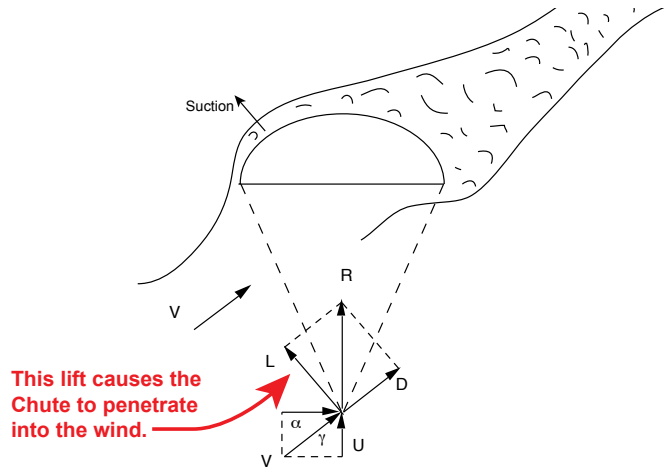

Figure 4: Lift occurs when the air flows up and over the canopy.

But the Truncated Cone Decelerator doesn't produce lift since the air doesn't flow over the top: it goes around. Because of that, you'll notice that it will drift a bit more.

However, it has a very low axial drag coefficient, about 1/3 that of a hemispherical parachute (Cd = .25 versus 0.75). Because of this, it falls very fast and gets down to the ground very quickly. It is a trade-off: it falls fast, but it will drift with the wind.

The other advantage of the Truncated Cone Decelerator is that the drag

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is much more predictable than a streamer. A streamer will whip around, and its drag fluctuates wildly. This, of course, will change the descent time each time you fly the rocket. The Guide Chute doesn't whip around like the streamer because it is inflated. The inflation stiffens up the device like a balloon so it doesn't loft around. So if you want a predictable and quick descent, then the Guide Chute is something you might consider. This has the potential to be a great chute for TARC contestants.

One thing that I noticed when I test flew the chute is that it was very visible in the sky. Like the streamer, it makes the rocket easy to see. Remember, though, the drag is higher than that of a streamer, so it will fall just a bit slower.

As noted on our web page, because of its low drag, the Guide Chute should not be used as a "pilot chute." A pilot chute is different from a drogue chute, in that it is designed to pull the main chute out of a deployment bag. You need a parachute with high drag so it creates a good tugging force to pull the chute out, like one from Fruity Chutes (https://www.apogeerockets.com/Building_Supplies/Parachutes_Recovery_Equipment/Parachutes/High_Power/18in_Classic_Elliptical_Parachute). The Guide Chute won't produce that much force because it has such a low coefficient of drag. It can be used for dual deployment as long as the Guide Chute doesn't have to provide a tug to pull the other chute out of the rocket.

My recommendation is to use the Guide Chute when the most important mission of the rocket is to have a very predictable and quick descent rate. If you're using it for dual deployment, the rocket is going to drift a bit more, which kind of defeats the purpose of dual deployment (which is to limit the amount of drift the rocket has), or use a smaller Guide Chute so that it doesn't drift as much.

Personally, if I was doing dual deployment in my own rocket, I'd either use a streamer for extra visibility for those high flying flights where the rocket disappears, or drogue-less recovery if the rocket will be easily visible because of its low altitude. Drogue-less recovery is a form of dual-deployment but doesn't have any recovery device that is deployed at apogee. The rocket pops off the parachute and tumbles to the altitude where the altimeter releases the main parachute. I like the Guide Chute, and if we get a smaller version of it (currently the smallest we have is 24 inches), maybe around 12 inches, then I think it would be good as a drogue chute.

Different chutes for different missions

This discussion of the Guide Chute prompted me to do a lot of research into different types of parachutes. The conclusion is that each parachute has both positive and negative aspects to it. What you'll find out is that each chute type is designed for a different mission. Just keep this in the back of your mind as you're planning your next launch.

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

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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.