PEAK OF FLIGHT NEWSLETTER

ISSUE 575 / JUNE 7TH 2022

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www.ApogeeRockets.com
4960 Northpark Dr, Colorado Springs CO 80918
Ph# 719-535-9335

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PEAK OF FLIGHT

Chute Release or Dual Deployment?

By Tim Van Milligan

Chute Release or Dual Deployment? Which should you choose?

A common question we get is about the difference between traditional Dual Deployment and the Jolly Logic Chute Release. Which should you use?

I totally understand this, as the Jolly Logic Chute Release seems to cut down on the complexity of dual deployment. It seems like a perfect solution to your problem of minimizing the distance that a rocket travels as it descends to the ground under parachute. Simple and elegant, right?

But why is it that "traditional dual deployment" and all the complexity that comes with using it still exists? It seems to be just as popular now as when it was first tried out decades ago. In other words, what information might you be missing to make your choice between a Chute Release and a dual-deployment altimeter? That is what we'll try to answer in this article.

The Basics - Why All the Fuss?

The whole purpose of either technique is about bringing the rocket down closer to the launch pad. The closer it is to the pad, the less walking we have to do to retrieve the rocket. Not only that, but there is a significantly higher probability that you'll find the rocket too. How many rockets have you lost because they drifted away so far that you don't know where they came down?

FIGURE 1: A TRADITIONAL FLIGHT WHERE THE MAIN PARACHUTE OPENS UP AT APOGEE. IT IS A LONG WALK TO RETRIEVE THIS ROCKET.

FIGURE 2 - TRAJECTORY OF A ROCKET WITH THE MAIN CHUTE BEING OPENED CLOSE TO THE GROUND. NOTE HOW CLOSE TO THE PAD IT IS COMPARED TO FIGURE 1.

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Newsletter Staff

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

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The way either technique of dual-deployment or Chute Release works is that you want to delay the opening of the large parachute until the rocket is closer to the ground.

You do need a large parachute to slow the rocket down, so that it touches down on the ground with a slow enough speed that nothing breaks on it. But that slow descent speed at touchdown means the rocket will drift a long way horizontally as it is pushed by the wind. The higher up in the air that the chute comes out, the further it will drift.

I'm not saying anything new. You know this already.

To get the rocket to land closer to the pad, you want it to come down quickly for most of the descent, and then only when it is close to the ground do you want the parachute to open and slow it down for a soft landing.

The Simplicity of the Chute Release

The Jolly Logic Chute Release is popular because of how simple it is.

First of all, it contains an electronic altimeter. But instead of firing off a pyrotechnic (explosive) ejection charge like a dual-deployment altimeter, it actuates a mechanical servo at a user-defined altitude. So not having to use explosive Black Powder is its first advantage. It is safe for kids to use.

How it works is to restrain the parachute by wrapping a rubber band around the canopy until the servo moves and releases a pin holding the rubber band. Once the rubber band is released, the parachute canopy is free to blossom open and slow the rocket down.

On paper, it is very simple and elegant.

Then why isn't everyone using it all the time?

There are some problems that it doesn't solve.

First, the successful release of the parachute does involve some careful preparation when packing the parachute. You can't simply bundle up the parachute and wrap the rubber band around it. I've seen a lot of cases where the Chute Release did eject the pin, but the chute didn't open because it got tangled in the device and its lanyard.

The Chute Release does come with a small lanyard that has to be secured to the rocket as well. If you don't tether it to the rocket, it will fall back to the ground separately and you'll lose it (been there, done that). The Chute Release itself is small enough that it is positioned on the outside of the parachute. Think of it as being strapped to the outside of the chute, holding the chute closed. When you release it, it simply falls away from the canopy. If you want it back, it has to be tethered somehow to the rocket.

This little tether cord, as simple as it sounds, can find its way into tangling up the parachute itself. With the parachute tangled up, the rocket lands hard to the ground, probably breaking one or more fins.

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If you get the rocket back, and it isn't flyable without repairing it, what good was using the Chute Release device? That is why careful parachute preparation before launch is critical to its successful operation.

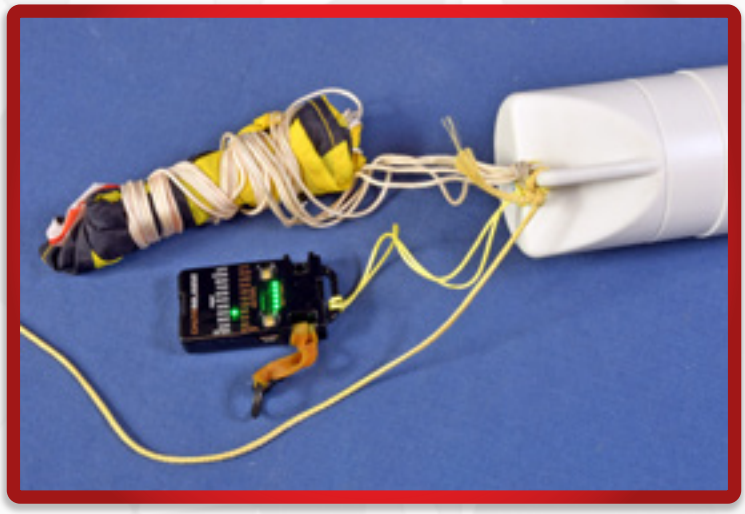

FIGURE 3: THE JOLLY LOGIC CHUTE RELEASE WILL BE WRAPPED AROUND THE PARACHUTE TO PREVENT IT FROM UNFURLING TOO EARLY.

The other way it can get tangled is during the descent of the rocket.

We tend to all think that when the ejection charge (built into the rocket motor) fires the nose cone out of the rocket, that everything slides out nice and smooth. The nose cone is off the rocket, the shock cord is extended, and the bundled parachute is nice and tidy too.

But it doesn't stay that way for very long. The whole system is twisting, spinning, jostling and gyrating and tumbling. The shock cord can also just as easily wrap itself around the bundled-up parachute during the tumbling descent toward the ground.

Again, with the parachute wrapped up (even if the chute release is working reliably), the rocket is going to land hard and probably bust a fin.

The Complexity of Dual Deployment

Dual deployment, using a traditional ejection altimeter and pyrotechnic explosive charges, is significantly more challenging. It alone pushes any rocket kit into a "high skill Level-5" project on the complexity scale (https://www.apogeerockets.com/PeakOfFlight/Newsletter31) that we use to rate how difficult the rocket is to build and fly successfully. This is the highest difficulty level we rate kits.

We've tried to simplify it as much as possible, but unfortunately, it is complex. You'll find we've written extensively on how to perform dual deployment successfully. In the reference section at the end of this article, we've linked to dozens of articles and videos that cover many aspects of successful dual deployment.

The downside of complexity is that reliability is reduced because errors can creep into the process of setting things up. If the level of detail when using the Chute Release is high, you can imagine how much more diligently you have to pay attention to the small things when setting up a dual deployment rocket. I won't even begin to try to list all the

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things that can go wrong with pyrotechnic dual-deployment, because the list is infinitely long.

But dual deployment does have some advantages over the Chute Release. That is why it is still quite popular in rocketry, and in particular high-power rocketry.

First, it is less likely that the main parachute is going to tangle up in the shock cord during the high-speed descent portion of the flight. The restraint that holds the large main parachute from opening is a tube. You can wrap a shock cord around the tube a bunch of times, and it still won't prevent the chute from opening. The ejection charge blows the chute out cleanly away from the tube, so it can get into open air where it can open successfully.

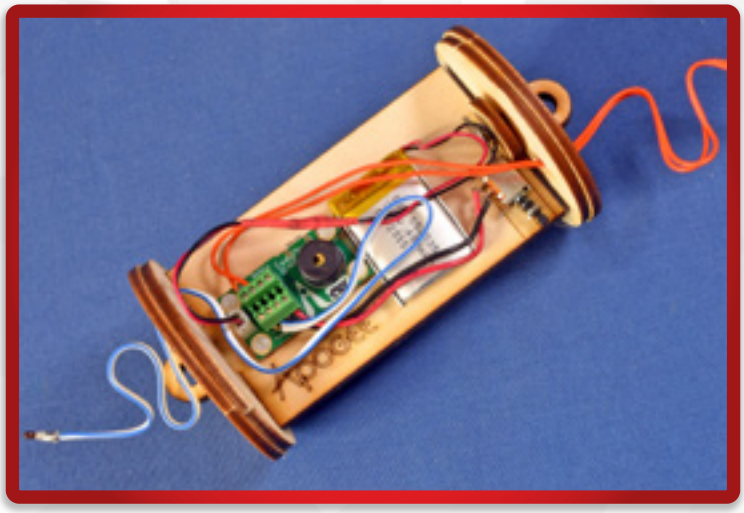

FIGURE 4: A TYPICAL SET UP FOR A DUAL DEPLOYMENT ROCKET. IT HAS MANY MORE COMPONENTS, WHICH MAKES IT MORE COMPLEX TO SET-UP PROPERLY.

The second advantage is redundancy. This gets more important when you are flying larger rockets (which is actually required in a Level-3 vehicle) or something expensive that you personally just don't want to get broken in a hard landing.

In a dual deployment rocket, because of the inherent complexity, I like to think that more people are cognizant of the number of possible things that can go wrong. And to their credit, they take extra precautions to make sure there is also redundancy in the set-up.

Of course, you can have redundancy in the Chute Release by daisy-chaining them together; it doesn't solve the last issue of redundancy.

That last issue is making sure the nose blows off the rocket to drag the parachute out into the air.

When using the Chute Release, you're absolutely depending on the ejection charge of the rocket motor firing and kicking the nose cone off the rocket. If the nose stays on and the chute isn't out in the air, it doesn't matter if the Chute Release device pulls the pin and lets go of the canopy at the correct altitude. If the chute is stuck inside the tube, it will never deploy and the rocket will have a hard landing.

With traditional dual-deployment, you use the rocket motor's ejection charge as a "back-up." In other words, you have two chances of at least getting the drogue chute out of the rocket. You typically set it up so the altimeter fires off the "apogee" ejection charge as the primary way to get the drogue chute out, and then you have the motor's built-in

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ejection charge as the back-up to provide redundancy. Read about setting up dual-deployment altimeters and selecting motors in the reference articles provided.

A similar situation, where only a traditional dual-deployment set-up can save the day, is when the rocket motor catos (violently malfunctions) or the rocket itself goes unstable in an unplanned direction. In both cases, the ejection charge built into the rocket motor will never fire and push out the drogue parachute. But the altimeter inside the payload bay still has the opportunity to fire off the separate ejection charge(s) to get a parachute out into the air. I've seen my share of those flights too. Everyone seems to congratulate the rocketeer for having the foresight to put in a dual-deployment altimeter into the rocket, which saved it from the unplanned disaster.

Furthermore, some high-power rocket motors don't even have ejection charges in the first place, so your only option is to use the traditional dual-deployment system. Any rocket motor that has a "P" after the dash in the motor's name, such as the H13ST-P https://www.apogeerockets.com/Rocket-Motors/AeroTech-Motors/29mm-Motors-Single-Use/Aerotech-29mm-HP-SU-DMS-Motor-H13ST-P), is a plugged motor and does not have any ejection charge to push out a chute. When you get into the range of M-size motors, you're almost always using dual-deployment because the motors typically don't have a built-in ejection charge.

Which Method Should You Choose?

So between using a Chute Release or using a dual-deployment altimeter, which one should you choose? This is a common question.

Regardless of which you choose, I always recommend starting "small." In other words, gain some experience first by only committing to use small rockets where the cost is cheaper, and the safety risks are also lower.

The tendency that we see a lot from customers is that they only think about this topic when they are about to fly a high power, H-size rocket motor. That situation, unfortunately, is starting "big."

You can test both dual-deployment and the chute release using smaller rockets, like a mid-power model. The Chute Release will fit in a rocket as small as a BT-60. That means it will fit into an Estes Big Bertha rocket (https://www.apogeerockets.com/Model-Rocket-Kits/Skill-Level-1-Model-Rocket-Kits/Big-Bertha). That's a really cheap way to get to know how to pack everything correctly to assure success.

You can set up dual-deployment in a rocket that is even smaller, all the way down to a 29mm rocket, like the Apogee Aspire (https://www.apogeerockets.com/Rocket-Kits/Skill-Level-2-Model-Rocket-Kits/Aspire). But it's a little harder in smaller diameter rockets, so maybe a good choice would be something like a modified Rising Star (https://www.apogeerockets.com/Rocket-Kits/Skill-Level-2-Model-Rocket-Kits/Rising-Star) with a BT-70 size Ebay (https://www.apogeerockets.com/Electronics-Payloads/Electronic-Bays/BT-70-Ebay-Kit) to house the electronics.

If you are just starting out, I'd suggest starting out with the Chute Release in the Big Bertha. It is the low cost option compared to the traditional dual-deployment altimeter and Ebay. The traditional dual-deployment also

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requires a lot of extra mounting hardware, switches, and ejection charges. While each item is relatively cheap, the pennies you spend do start to add up and will cost more than a Chute Release.

Conclusion

The purpose of this article was to explain the benefits and limitations of both the Chute Release system and a dual-deployment set-up. We don't think one is better than the other, and here at Apogee Components, we'll continue to recommend both systems. And I don't foresee that either of them will go away any time soon, so if you plan on being in rocketry for a while, you'll probably get to try each one.

Again, our advice is to start small. Each system has a learning curve. Try them out in small rockets first so you can get the feel of their use on rockets that are lower-risk. Don't jump into them when you have a high-dollar or high-power rocket that has to work 'the first time.'

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 by using the contact form at https://www.apogeerockets.com/Contact.

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Getting Started in Dual Deployment

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How-To Videos

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Is Your Dual Deployment Altimeter Firing At The Correct Altitude? https://www.ApogeeRockets.com/Advanced_Construction_videos/Rocketry_Video_94

Shock Cords for Dual-Deployment Rockets - https://www.apogeerockets.com/Advanced_Construction_Videos/Rocketry_Video_250

Building a Dual Deployment Ebay for a Small Rocket - https://www.apogeerockets.com/Electronics_Payloads/Electronic_Bays/29mm_Ebay_Kit

Construction and Flying of Dual Deployment Rockets

Turn a Payload Bay Into an E-bay for Dual Deployment - https://www.apogeerockets.com/education/downloads/Newsletter389.pdf

Building Your First E-Bay: Part 1 - https://www.apogeerockets.com/education/downloads/Newsletter464.pdf

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Building A Hatch-Accessible Ebay - https://www.apogeerockets.com/education/downloads/Newsletter423.pdf

Installing An E-Bay Inside A Nose Cone - https://www.apogeerockets.com/education/downloads/Newsletter329.pdf

Alternative to a Traditional E-Bay Install - https://www.apogeerockets.com/education/downloads/Newsletter564.pdf

Construction Ideas for Electronics Bays - https://www.apogeerockets.com/education/downloads/Newsletter288.pdf

Build a Vaccum Chamber To Test Your Dual-Deployment Altimeter - https://www.Apo- geeRockets.com/Education/Downloads/Newsletter256.pdf

Advanced Dual Deployment Techniques

Making A Non-Pyro Dual Deployment Rocket - https://www.apogeerockets.com/education/downloads/Newsletter401.pdf

Redundancy in Deployment Systems - https://www.apogeerockets.com/education/downloads/Newsletter322.pdf

How to Achieve Extreme Altitude Deployment - https://www.apogeerockets.com/education/downloads/Newsletter286.pdf

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Make Your Own Pyrotechnic Bolt - https://www.ApogeeRockets.com/Education/ Downloads/Newsletter266.pdf

Systems Similar to the Chute Release

How to Build Your Own Parachute Release Mechanism - https://www.apogeerockets.com/education/downloads/Newsletter277.pdf

Make A Simple Dual Deployment Rocket - https://www.apogeerockets.com/education/downloads/Newsletter258.pdf

Other Slow-Release Techniques that Mimic Dual-Deployment

The Spool Chute: Low Cost Deployment? - https://www.apogeerockets.com/education/downloads/Newsletter531.pdf

Reefed Parachute - https://www.apogeerockets.com/education/downloads/Newsletter183.pdf

Gradual Parachute Deployment - https://www.apogeerockets.com/education/downloads/Newsletter143.pdf

Simulating Dual Deployment In the RockSim software

Simulating Dual Deployment In RockSim - Part 1 - https://www.apogeerockets.com/education/downloads/Newsletter64.pdf

Simulating Dual Deployment In RockSim - Part 2 - https://www.apogeerockets.com/education/downloads/Newsletter65.pdf

Simulating Drogueless Dual Deployment Rockets - https://www.apogeerockets.com/education/downloads/Newsletter460.pdf

About Other Types of Rocketry Electronics

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