PEAK OF FLIGHT NEWSLETTER

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PEAK OF FLIGHT

The Chute Spool: Low Cost Deployment?

By Michael Moran

Back in the summer of 2014, I was very excited about attending our monthly club meeting. I had been working for months on developing an all-mechanical “dual deployment-like” device that I was going to present to our members. We have several esteemed rocketry members in our club, so I was anxious to hear their expert opinions on my invention. I remember that evening particularly well because the location of our meeting was quite unique. Due to a scheduling conflict, we couldn’t meet at our usual gathering place. Instead, we met in the dining room of a local hot dog and ice cream shop. So it was rockets, french fries, and ice cream. Not too bad, actually.

Our members listened patiently as I explained to them my growing frustration with the low-power practice of parachutes only deploying at ejection. Too many long walks and too many lost rockets had motivated me to try something different. I figured there had to be a low cost way for model rockets to use dual deployment. So I showed them my little contraption that I had nicknamed the “Moran Can”: its small enough to fit in a BT-60 tube, it used no pyros, no electronics, and no big bucks. Just simple mechanics.

FIGURE 1: 3/16” WOOD DOWEL. + 1/4” ALUMINUM TUBE VERSION

The Moran Can is basically a long streamer wound around a parachute that is attached to a shaft, like thread on a spool. The shaft rotates on an axle that is book-ended by two bulkheads with screw eyelets. One end is attached to the shock cord and the other to the nose cone. My idea was that when the “can” was ejected, the rocket would fall rapidly, while drag would gently pull and tug on the streamer. Once the streamer was completely unwound, it would release its hold on the chute, allowing it to deploy. The rocket would then finish its descent under parachute control. And all for under $4.

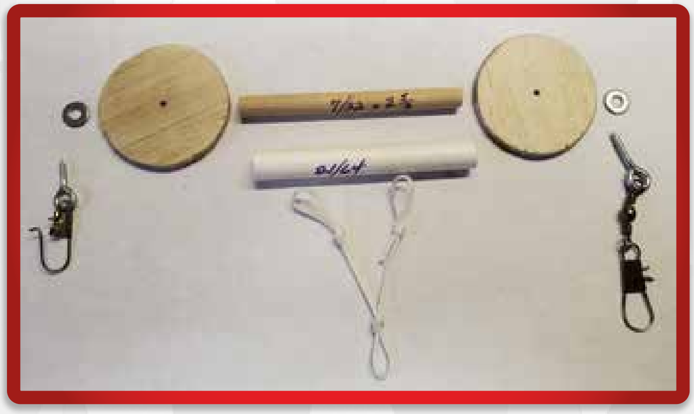

FIGURE 2: 7/32 WOOD DOWEL + 21/64” PAPER STRAW VERSION

Once my prototype had been passed around to everyone at the meeting, I finished my presentation and waited for their reaction. And to my pleasant surprise, several were very excited and offered plenty of positive feedback. One member said I should apply for a patent. Another said I should write an article about it for publication. But all said they were looking forward to seeing a demonstration at our next club launch.

What they didn’t know was that I had already test launched the device three times earlier in the week. And it worked! Well, it worked for two and a half flights, actually. Using an old Estes Big Bertha rocket for my test vehicle, the first two flights with the Moran Can were spot on, with

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the parachute fully deploying after the streamer unfurled. On the third test flight, however, the rocket didn't achieve enough altitude to give the device enough time to let the chute fully inflate. But my invention did get the parachute out, albeit only about 20 feet up.

So before the demonstration launch, I decided to incorporate some of the suggestions from our members and make some improvements of my own. Some components were replaced with stronger ones, and the length of the forward tube on the Big Bertha was increased by 4 inches. Unfortunately, these changes had consequences that I should have foreseen. The increased weight and length made the rocket very overstable and resulted in a loss of

FIGURE 3: TWO DOWEL SIZES

altitude.

It was windy on launch day, and the rocket weathercocked, never achieving much altitude. So the three demonstration flights were unsuccessful. Technically, they were all safe flights with each falling under streamer control with no damage. But the chute never came out because the streamer was still unfurling. The quick and easy solution that day was to just shorten the streamer. But do you really need dual deployment on a rocket that barely flies 250ft? I suspected the real issues were stability and altitude, so it

FIGURE 4: ALUMINUM TUBE

was back to the drawing board.

Right about this time we started hearing ramblings about some guy on the West Coast who was busy developing a small lightweight dual deployment device. Rumor had it that it weighed about half an ounce, used no pyros, and would fit in a BT-60 tube. And sure enough, several months later, the Jolly Logic Chute Release (https://www.apogeerockets.com/Electronics-Payloads/Dual-Deployment/Chute-Release) came along. And the rest, as they say, is history. While this little gadget is the greatest model rocketry innovation in decades, I couldn't help but think my little invention was already obsolete. So I shelved the idea...for the time being.

Six years and more than 30 scratch-builds later, I resurrected the Moran Can with new enthusiasm, and a new name: the "Chute Spool". Ironically, it was my regular use of the Chute Release that prompted me to take a different approach. Since I've designed all my new rockets around the capability to use the Chute Release, I applied the same parameters to the Chute Spool. As long as it weighed less

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than 20 grams and was less than 4 inches long, it would be suitable for all these rockets and many others. The original design weighed more than 31 grams and was over 4 inches long. But the new version is under 15 grams and only 3.25 inches long. So now it was just a matter of streamer length,

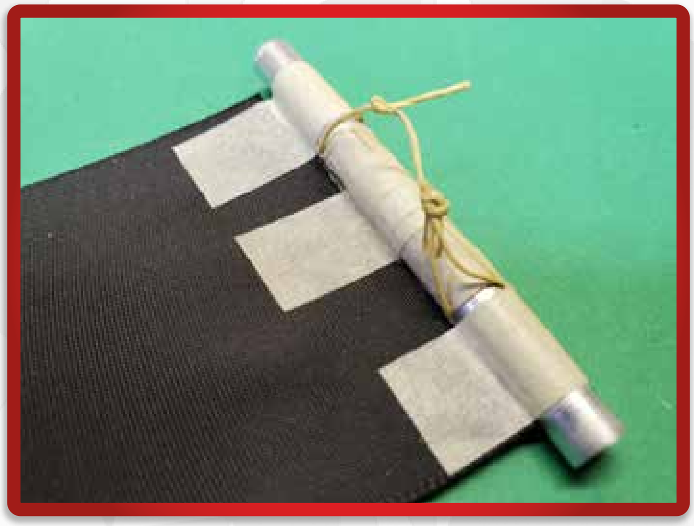

FIGURE 5: CONNECTING THE STREAMER TO THE ALUMINUM TUBE

and I could make as many of those as I needed!

Of course, the Chute Spool simply can't be as predictable or accurate as the electronic and pyrotechnic dual deployment devices, but it was never intended to be. Technically, I'm not even sure the Chute Spool qualifies as a dual deployment device. Perhaps "delayed deployment" is a more accurate term for its function. Its sole purpose is to delay the parachute from opening at ejection to reduce drift time and the subsequent retrieval walk. And that can be substantial.

For example, sims with my scratch Electron rocket on a C6 motor show an apogee of 600ft. The rocket will drift 49 seconds after ejection under a 15" parachute before hitting the ground. With an average wind speed of about 10.5mph for our area, that results in about 750ft of drift. Now, I really don't mind walking 250 yards….as long as it's down the middle of a fairway! With the Chute Spool, the Electron still manages 515ft of altitude. But after falling 250ft while the streamer is unfurling, it will drift just 23 seconds under parachute. That's 26 seconds less in parachute drift time, reducing drift by 350ft! That could result in a retrieval walk that is shorter by 233 yards round trip. Not too

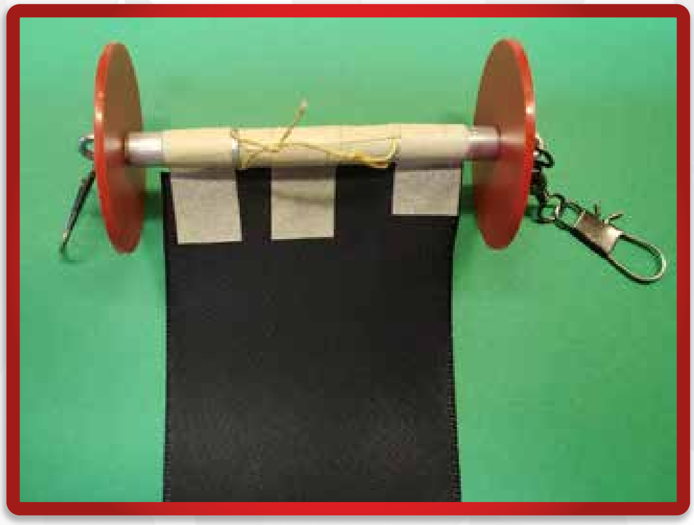

FIGURE 6: SPOOL ASSEMBLY

shabby.

How do I know it will take about 250ft for the streamer to unfurl? I don't, really. It's my best guesstimate based on the flights I've done so far. I've used 3 different rockets for seventeen flights, each experimenting with different streamer materials, lengths, and widths. And the Chute Spool worked every time except once, when the streamer

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got tangled with the shock cord. But without being able to accurately calculate how fast or how far each falls while the streamer is unfurling, the only real data I have is from 2 controlled flights.

For those I used a streamer so long that it couldn't completely unravel before the rocket hit the ground. Upon retrieval, I divided the altimeter reading by the number of inches the streamer had unraveled. After the 2 flights this way, the average was about 5 feet of descent per inch of streamer. So I put 50 inches of polyester streamer into the Chute Spool for my Estes Patriot launch. And it worked! While I can't be sure that the rocket fell 250 feet before the chute opened, I am sure it fell under streamer for a good portion of the descent. Using a rangefinder, the rocket landed 73 yards from the pad. For comparison, I immediately flew the Patriot again, this time without the Chute Spool. Using the same motor, delay, and parachute, launching from the same pad and rod angle, it drifted 157 yards, landing over twice as far from the pad.

FIGURE 7: LAYING THE PARACHUTE ON THE STREAMER TO ROLL IT UP

Naturally, there are some conditions and limitations when using the Chute Spool. First, it is not universal in its use; meaning that different payload tube sizes will require their own sized Chute Spool. I've only used it in a BT-60 application, although I see no reason why it couldn't be designed for larger tubes. But a BT-55 may be as small as you can go, given the space limitations. And your rocket must have a smooth and unobstructed payload area that is at least 4" long. No tea bag attachments or couplers here that can restrict movement. The rocket's flight should also have an altitude of at least 300'.

Small plastic chutes work great, but a 15" nylon and an 18" plastic parachute are the largest that I have been able to fit into the BT-60 application. Finally, there's always a chance that the streamer could get tangled or the parachute doesn't deploy at all. But isn't that the case every time we launch, regardless?

There are two versions of the Chute Spool that I have used. Their construction is identical, but some materials are different. One uses a 7/32" wooden dowel and a 21/64" paper straw from a popular coffee chain. The other a 3/16" wooden dowel and ¼" aluminum tubing. The 1.5" bulkheads are either ⅛" balsa or plastic counting chips. The screw eyelets are ⅝" long with 5/16" washers, and the streamers are 2 ¼" and ⅞" wide polyester ribbons. The tethers are blinds cord or Kevlar thread. Except for the counting chips that my school was throwing out, all these items are readily available at your local hobby or hardware store. And you can always use different materials. For instance, lite-ply instead of balsa for the bulkheads, or 3/16" or ¼" launch lugs for the tubing or the straw, or even plastic cut-outs for the counting chips.

The balsa and paper version weighs only 14.84 grams, while the plastic and aluminum version comes in at 16.13

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grams. But I prefer the latter for two reasons: first, the plastic bulkheads are probably more durable than the balsa; Second, the smaller axle and tube allows more room to roll the parachute.

So here's the build for the 3/16 axle with the aluminum tube:

Cut a 2-11/16" length of 3/16" wood dowel for the axle. Sand it lightly until smooth. Drill 1/16" pilot holes into each end, ⅜" deep without splitting the wood. Use a pin vise if needed. Cut a 2-⅝" length of ¼" aluminum tubing. Remove any crimps or burrs so the tube slides and rotates easily over the axle. Drill 1/16" holes in the center of each bulkhead. Attach a bulkhead with an eyelet and washer to one end of the axle and tighten. Do not glue. Slide the tube over the axle, checking for fit. The axle should be about 1/16" longer than the tube. If not, sand either for fit.

Attach the other bulkhead. The bulkheads should be perpendicular to the axle. The tube should spin easily with just a little play. Remove one bulkhead and the tube. Tie a tether to the tube. Center and tape in place. Tape a 14" length of smooth 2-¼" polyester ribbon to the tube as shown, being careful not to cover the tether. This is the "cover" ribbon.

Attach a snap swivel (or just the snap to save weight) to an eyelet and washer and reconnect the bulkhead. You can put a little glue in this pilot hole to strengthen the bond. This will be the aft end of the spool that will attach to the shock cord. Attach a snap swivel (or Kevlar thread connected to a snap) to the remaining screw eyelet. Replace the tube over the axle and attach the remaining bulkhead. Hand tighten the eyelet, but do not glue. This will connect to the nose cone. Cut a 50" piece of ⅞" polyester ribbon and tape sparingly to the cover ribbon. This is the "streamer" ribbon. This can always be shortened or lengthened as needed.

Now it's time to attach and roll the chute! First attach your chute to the tether and then fold the chute as shown with the shroud lines inside. Begin rolling the chute up with the cover ribbon, keeping everything inside the bulkheads. It's a little tricky at first, but becomes easier with practice. Once all of the cover ribbon is wound, begin wrapping the streamer ribbon around the center several times before evening out over the spool. Tape to temporarily hold in place.

FIGURE 8: CHUTE SPOOL PREPPED FOR LAUNCH

Test fit your Chute Spool in your payload. It should slide fairly easily. It may take some fidgeting or a tighter winding to get a good fit. Connect your shock cord and nose cone, and put a small piece of foam or pipe insulation over the screw eyelet to prevent it from damaging the nose cone during ejection. Remove the holding tape, put the Chute Spool in, and you're ready to launch!

If your parachute gets released too late, try shortening the streamer. If it opens too early, you can lengthen the streamer. It may also help to try winding up the parachute

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in a way that it lightly brushes up against the bulkheads, increasing the rotational friction. Remember, the Chute Spool is in its infancy stage of development here, so I can't be sure about what works best! But model rocketry people are a very resourceful and innovative group. My hope is that if enough of us use and experiment with it, the Chute Spool will become a better and more measurable delayed deployment device.

About the Author

Michael Moran is an active member of the Fox Valley Rocketeers Club in Illinois, boasting an impressive 266 launches since becoming a member. He is the inventor of the 'Chute Spool and the author of this week's Peak-of-Flight.

Currently he is hard at work building a 1:22 scale Electron rocket, with .063 Lexan fins and custom decals.

The Calypso Rocket Plan

Story By Bobby Potter

"What's it been, 7 years since Earth?" I said it, knowing there would be no response. Just the emptiness of the ship echoing back at mve, with barely enough oxygen left to vcarry the sound. By the time I lost my engines, I was at the edge of the Milky-Way, several lightyears from Earth. Even if they got my S.O.S. it's too late.

Computer - "Warning, Oxygen is low, equip your spacesuit".

Like I wasn't aware. I can already feel the fatigue getting worse, and I used up the O2 tanks for the space suit during hull repairs some time ago.

I just wanted to be the first to leave the Milky-Way, that's why I became a test pilot. This ship, the Calypso, started as a wonder of engineering. One of the first deep space rockets, capable of faster-than-light travel and able to sustain life for many years without re-supply. She was gorgeous when I started my journey.

And she lived up to her promise at first. I knew things were risky, being an untested ship, but I was enamored by the possibilities. From launch, it felt like mere moments before I reached the edge of our solar system. Maybe an hour later I couldn't even pick out our sun amongst the sky full of stars. It was intoxicating, and I loved the Calypso.

She's lost her luster to me now. Calypso is barely able to maintain power now, as the time in deep space has treated her poorly. The makeshift repairs have barely been able to keep the cold out and the oxygen in. She's dirty and worn, and she was never designed to be in space this long without maintenance. Now I just wish I could go home.

Computer - "Warning, Oxygen levels are critically low".

There's nothing left to do now but go to sleep. I'm sure my funeral was many years ago, but I'm sure they spoke of me in reverence. As an explorer who dared to touch the furthest reaches of space. Maybe I'll be remembered like a star in the night's sky.

Computer - "Oxygen Depleted"

I could barely make out the sound as everything went black...

"[Radio crackling] This is the Homeric Galley to unknown vessel, please identify".

"This is the Homeric Galley to unknown vessel, you appear to be in distress. We are coming aboard."

Download the ***RockSim*** design file for the Calypso at: https://www.apogeerockets.com/Peak-of-Flight-Rocket-Plans

Calypso Parts List

20068 - (1) PNC-33 Nose Cone
12007 - (1) Motor Mount Kit 18mm/BT-55
10131 - (1) 33mm Body Tube (15 inches long)
00000 - (1) Balsa Sheet 3/32" X4" X 18"
30325 - (1) Kevlar Cord 100# X 8 feet
29091 - (1) 15" Printed Nylon Parachute
13052 - (2) 1/8" Launch Lug

Recommended Motors

B6-4, C6-5, C12-4, D16-6

For additional tips on building a model rocket, from plans like these, see: https://www.apogeerockets.com/Advanced_Construction_Videos/Rocketry_Video_287

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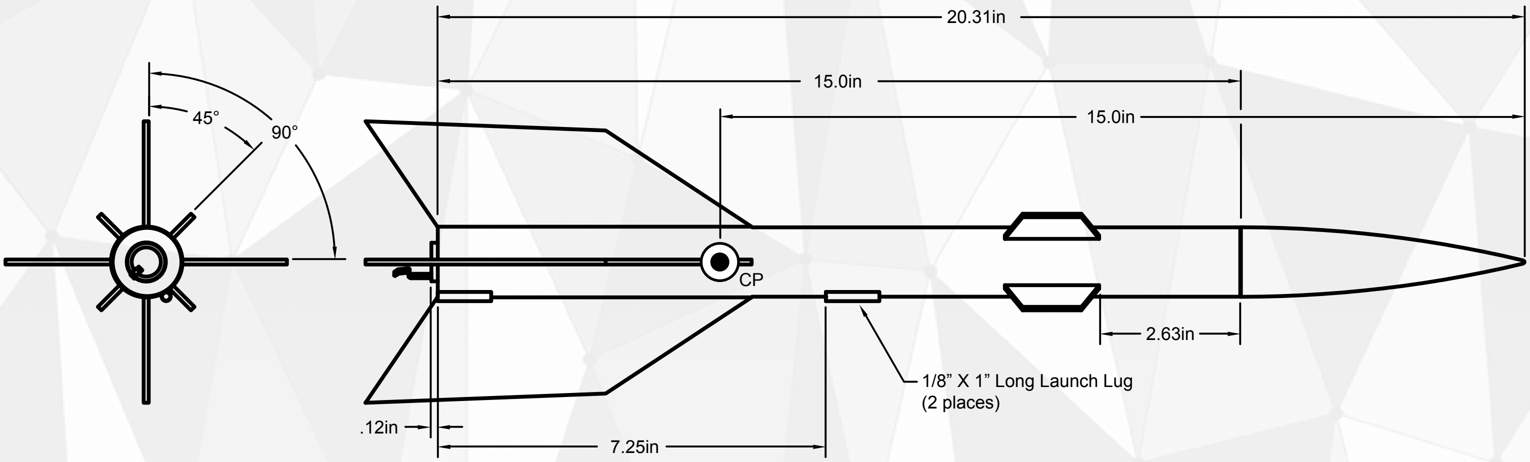

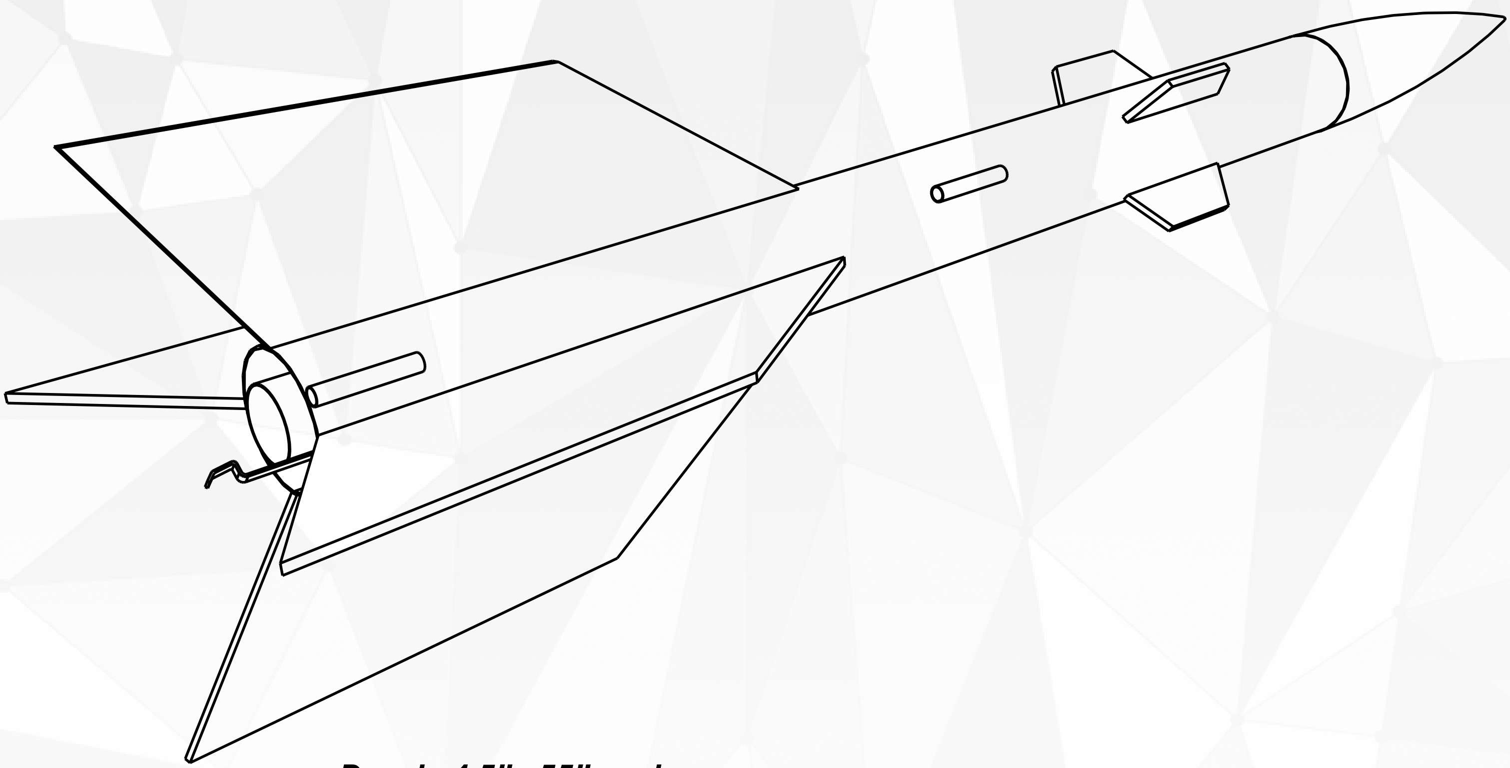

Decals 4.5"x.55" each

CALYPSO

CALYPSO

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