

# Spinning Parachutes

*Do they Slow the Descending Rate?*

NARAM-53  
R&D  
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## Summary

In this Project I compared the decent rate of a parachute that spun to a parachute that did not spin. I kept the shape, overall weight, size of the parachute, and type of lines I used the same. I wanted to test this project because of a book called The Parachute Manual. It said that a spinning parachute had a higher drag coefficient.

After I made the parachutes, I did drop tests from my roof. My dad would drop them from the top of my house. I timed them with a stopwatch, and then I recorded the numbers.

Then, I decided to launch the parachutes in a rocket. I would launch one non-spinning parachute along with one spinning parachute.

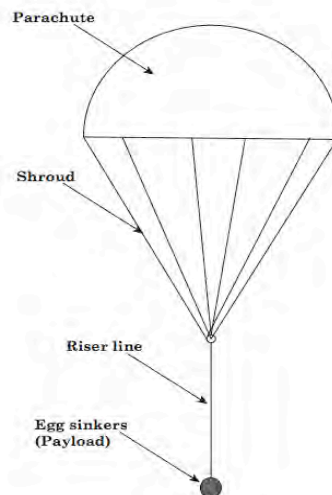
There was an AltimeterTwo that took the height, speed, duration, and other rocket launch data. I took that data for each parachute. I wanted to launch each parachute three or more times, but since there was a fire ban here in Colorado, I couldn't launch the rockets. When I was able to launch it was too windy so the rockets kept crashing and I couldn't get accurate data.

From the drop tests and launching the parachutes I found out that in the drop tests the spinning parachute had a faster descending rate. When I launched the rocket I found out that the non-spinning parachute had a slower descending rate.

Although the non-spinning had a slower descending rate the spinning parachutes did come down straighter and didn't swing as much.

If you would like to have your parachutes come down much straighter I would recommend making your parachutes spin. If you want a longer duration I would go with the non-spinning parachute.




























## Drawing 1: Parts Of My Parachute



## The objectives of the work

I am trying to find out if a parachute rotates (spins) coming down, would it slow the descending rate compared to a non-spinning parachute? I wanted to test this since a book called The Parachute Manual said that the drag coefficient for a normal parachute is .75 and for a spinning parachute it is .78. This means that the spinning parachute should stay in the air longer. I tested one normal parachute vs. one spinning parachute.

Drawing 2 Below: This chart from The Parachute Manual shows that a rotating parachute should fall slower because it has a high Drag Coefficient

Type	Planform Uninflated Flat View (Top)	Profile View Uninflated (Side)	Cone Shape	Projected Diameter	Nominal Diameter	Drag Coefficient	Average Angle of Oscillation
Solid Flat Circular				.70	1.0	.75	30°
Solid Flat Square				—	1.128	.79	20°
Solid Flat Triangular				—	.743	.80	15°
Solid Conical (30° angle)				~.70	1.08	.72	20°
Parabolic - Extended Skin				~.75	1.24	.70-.75	20°
Hemispherical				~1.0	1.41	.75	20°
Spherical				—	1.15	.86	15°
Airfoil						.86	very stable
Rotorfoil				.31	.35	.78	6° very stable

I made the parachutes the same, except the spinning parachute had trapezoid holes in it to make it spin. Since the overall weight of the one with holes was lighter I made them

all the same weight by adding tape to keep the variable the same.

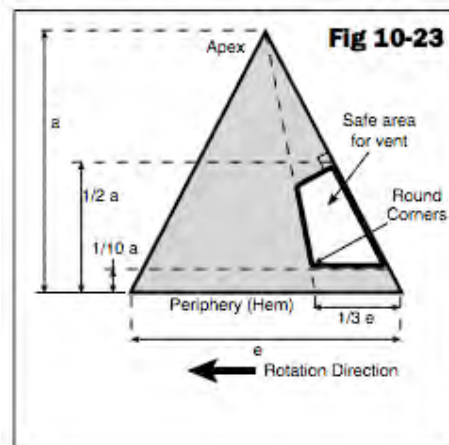
I tested this by flying them with an altimeter and doing drop tests off my roof to see which one has a slower descent rate.

## The Approach Taken

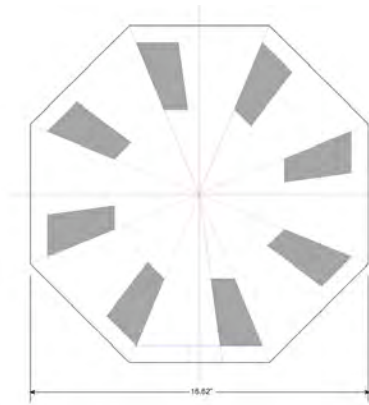
Step 1: I decided to make the parachutes 18in in diameter.

Step 2. I cut out six parachute canopies.

Step 3. I made three of the parachutes spinning by adding cutouts that I researched in a book called Model Rocket Design and Constuction. After I found out how to make the cutouts I made a template on a program called Adobe Illustrator.



Drawing 3: Gore Patteren for Rotafoil Parachute  
From Model Rocket Design And Construction



Drawing 4: Final Parachute Template - the gray spots are the part I cut out to make the parachute spin

Step 4. I cut the cutouts on the parachutes using my template. So it was a perfect cut.

Photo 1: Cutting out the spinning holes in the parachute

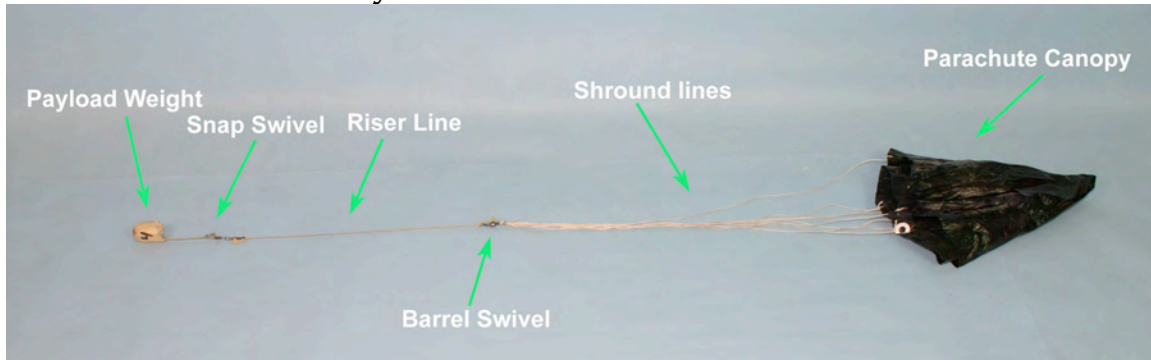


Step 5. I cut and put on the shroud lines on all 6 of the parachutes and tied each of the shroud lines to a barrel swivel.

Step 6. I tied each barrel swivel to a riser line to keep the shroud lines from tangling in a big knot.

Step 7. On the bottom of the riser line I put a snap swivel attached to a payload weight (egg sinker) to help the parachutes come down. This way they don't hang in the air and float away.

Photo 2: Parts Of My Parachutes



Step 8. Now it was time to weigh each parachute's assembly to make the controlled variable the same.

Step 9. I added weight to all of the parachute assemblies to make sure they all weighted 27.8g. To make them have more weight I added masking tape to the sinkers.

Step 10. I gave all the parachute assemblies a number. The non-spinning chutes were numbers 1-3 and the spinning chutes were 4-6. I wrote the number on the sinkers with a Sharpie marker.

Step 11. I weighed each parachute one more time to make sure they were perfect. Now I was ready to do the drop tests.

Chart 1: Weight of All Assemblies

Parachute Number	Weight Of Parachute	Weight Of Sinkers	All Together Weight	Weight Added	Final Weight
1	5.2g	20.0g	27.2g	0.6g	27.8g
2	5.1g	20.3g	27.6g	0.2g	27.8g
3	5.1g	20.4g	27.3g	0.5g	27.8g
4	4.5g	20.3g	26.7g	1g	27.8g
5	4.8g	20.3g	26.7g	1.1g	27.8g
6	4.4g	20.8g	27.4	0.4g	27.8g



## Drop Tests

Since there was a fire ban in Colorado I decided to do drop tests off the roof of my house. It was 24.77 ft high. I measured this by hanging a string from the point we dropped it from with a weight and my dad marked it with a black marker. Then we took it down and measured it with a tape measure on the ground. This was easier for me to measure.

Photo 2: Measuring The Height



To do the drop tests my dad would take all the parachutes up on the roof. He'd put his hand out with one of the parachutes assemblies. I'd ask what number, write it down, then say 3,2,1, DROP. I started the timer when the parachutes assemblies would fall down. When it hit the ground I would stop the timer and write it down.





Photo 3: My dad ready to drop the parachute

Then my little sister would help me pick them up and put them in a bucket. My dad would pull up the parachutes. I did this 4 times for each parachute. If they hit the house or a tree I would do it over again. If they got stuck in the gutter (which happened), I moved the ladder to where it was, climbed up and got it down.

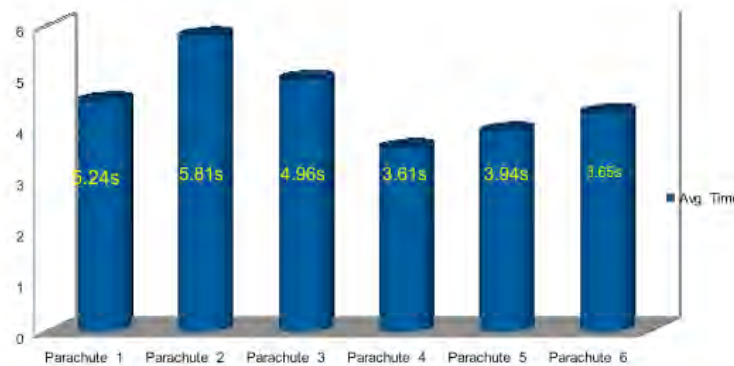
### **Conclusions From Drop Tests**

I learned that the nonspinning parachutes did have a slower descent rate than the spinning parachutes from the drop tests. But the spinning parachutes did come down a lot straighter.

## Parachute Drop Test Chart One

Chute Number	Test 1 Time	Test 2 Time	Test 3 Time	Test 4 Time	Arg. Time
1	6.81s	5.78s	3.88s	5.13s	5.24s
2	6.79s	4.66s	6.00s	////////	5.81s
3	5.25s	5.84s	4.09s	4.68s	4.96s
4	3.22s	3.54s	3.03s	4.68s	3.61s
5	3.82s	3.69s	4.09s	4.19s	3.94s
6	3.84s	3.44s	3.72s	3.62s	3.65s

Chart 2 Above: Parachute Drop Tests Times



Parachute Drop Test Avg. Times

Graph 1: Avg. Times Of Drop Tests

Parachute Type	Average Descent Time (s)	Drop Distance (ft)	Descent Rate (ft/s)
Normal Chute Avg.	5.33	24.77	4.65
Spinning Chute Avg	3.73	24.77	6.64

Chart 3: Parachute Avg. Drop Test Time

Step 12. I made two rockets that were a bt60. I chose this size body tube because I could fit two parachute assemblies and use a C-size motor.



Photo 4: Gluing my fins to my rockets

Step 13: I painted most of the rocket except for the nose cone. I wasn't allowed to paint the nose cone because my dad wanted to keep it the same color since it came from a different rocket.

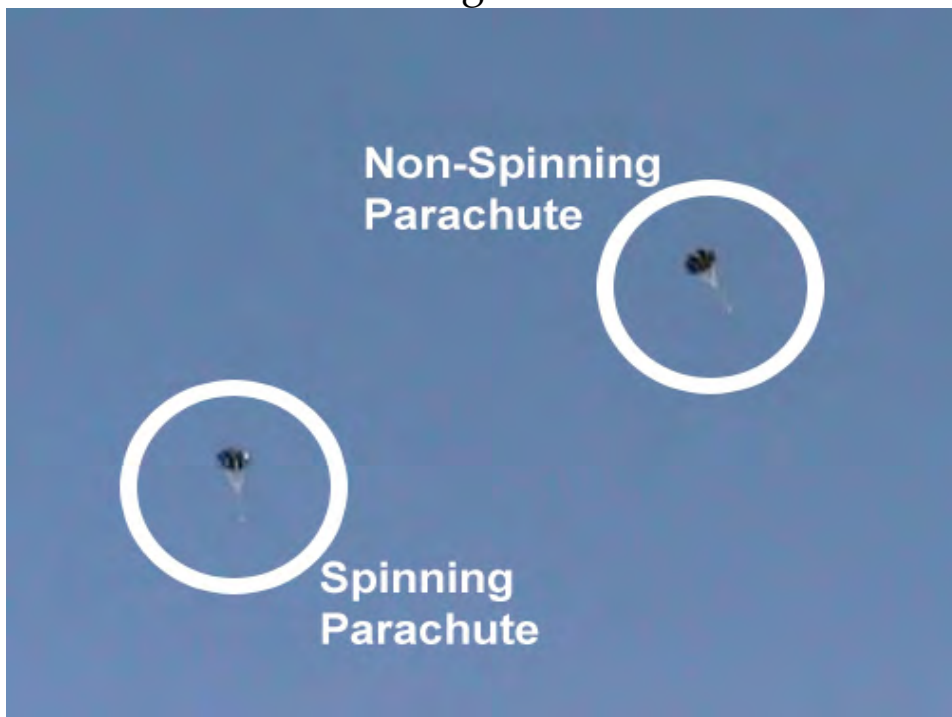
Step 14: I put the rocket I made into a program called RockSim. This helped me find out what motor would be the best to use. I found out that a Quest C6-3 would work the best.

## Launch Day

The fire ban was gone now so we could launch rockets. I put two parachute assemblies in the rocket at one time. I put the parachutes on top of the streamer so that the streamer would kick out the parachutes first.



Launching was not a big success. I only got three good data flights. Sometimes the chutes didn't deploy, the streamer had come off the rocket and got stuck to a parachute, the wind made the rocket go unstable, or the altimeter didn't work right. One thing I found out from launching the parachutes was that the spinning parachute did come down a lot strighter.



## Launch Conclusions

I found out that the spinning parachutes did not fall as slowly as the non-spinning parachute. But in real launches, the non-spinning swung back and forth more than the spinning chute. I would use a spinning chute when I wanted to have a more vertical descent, like an egglofting altitude rocket. The reason is that it makes the rocket come down straighter and a little bit quicker.

One thing you might worry about is that the spinning chutes can tear easier because they are already cut.

Parachute Data Log 2011

	Flight 1A	Flight 1B	Flight 2A	Flight 2B	Flight 3A	Flight 3B	Flight 4A	Flight 4B
Parachute #	1	4	2	5	3	6	1	4
Rocket #	Stripes	Stripes	Purple	Purple	Purple	Purple		
Motor	C6-3Q	C6-3Q	C6-3Q	C6-3Q	C6-3Q	C6-3Q	C6-3Q	C6-3Q
Apogee Alt.	225	238	208	213	179	172	232	230
Burn Time	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5
Coast 2 Apogee	3.3	2.9	3	3	4.2	2.1	2.9	3.3
Apogee 2 Eject	1	1.4	1.2	1.2	-0.1	2	1.2	0.8
Ejection Alt.	20.2	20.9	188	192	144	140	218	216
Descent Speed	5mp	5mp	5mp	18mp	16mp	4mp	1mp	1mp
Flight Dur	28.8	30.5	28.8	13	12.1	25.6	94.4	--
Para Time				23s				
Temp	67.5	67.5	68	68	83.1	83.1	83	83
Wind	6mp	6mp	6.4mp	6.4mp	6.0mp	6.0mp	1.3mp	1.3mp
Comments	chute 1 on the bottom	chute 4 on the top	chute 2 on the bottom	chute 5 on the top	chute 3 on bottom	chute 6 on top	chute 1 on top	Chute 4 on bottom and got Descent Speed off of para 1 because altinameter was wrong and don't know Flight Dur because of this.

**List of Any Related R&D Reports previously entered by Author, if any, with brief summaries**

Comparison Of The Number Of Parachutes Versus Descent Rate NARAM-52 R&D (2010) The previous project compared the number of parachutes vs. the descent rate. It consisted of drop tests and launch tests. The result was the larger number of the parachutes, the longer the descent rate. But they did get tangled a lot more.

**References**

Rotating Parachutes: Two Easy Ways to Make a Spinning Parachute By David T. Flanagan. Peak of Flight Newsletter #194. ©2007 Apogee Components.

Model Rocket Design & Construction, 3<sup>rd</sup> Edition, by Timothy S. Van Milligan. © 2008

Comparison Of The Number Of Parachutes v.s. Descent Rate by Allison Van Milligan. NARAM-52 R&D Report. ©2010

Technical Publication #3: Increasing The Descent Time of Rocket Parachutes By Tim Van Milligan © Apogee Components 1995

The Parachute Manual by Dan Poynter ©1977 Parachuting Publications



## **The Equipment Used:**

Two ALTIMETER TWO altimeters

Computer: to make template, etc.

Mini Thermo-Anemometer

Tape Measure

Bucket

Ladder

Stop Watch

Video Camera

Digital Still Camera

Normal Launch Equipment

Electronic Gram Scale

Normal Building Supplies

Clip Board

Trash Bags for the Parachutes

## **The Facilities Used**

The Facilities that I used were my house, our land in Canyon City, Hartsel, and Apogee Rockets.

**The Money Spent (budget)**

Egg Sinkers	\$01.36
C6-3Q	\$11.76
C6-3Q	\$11.76
C6-3Q	\$11.76
C6-3E	\$11.55
Wadding	\$06.41
Fins	\$06.48
Fins	\$06.48
Misc. Items (paper, string, ect.)	\$05.00
<b>Total Cost</b>	<b>\$66.08</b>

**The Data Collected:**

The data collected was listed in the steps above.

**The Results Obtained:**

The results from this project were that the non-spinning parachute had a slower descent rate, but the spinning parachute did come down a lot straighter. I got the data from doing drop tests and launching the parachutes in a rocket.

**Conclusions Drawn:**

I learned that the spinning parachute had a faster descent rate, but if I wanted a rocket to come down straighter, I would choose the spinning parachute. All the people that watch a spinning parachute come down like it because it is interesting and different.

In terms of making the parachutes, it is mostly easy to make a parachute spin. All you have to do is make a template and cut out holes on a regular parachute.

## **Other work that would clarify or extend the results obtained.**

I would try to make the rocket to fly higher and to eject the parachutes so they don't get tangled with each other or the streamer in the rocket.

For the drop tests, I would like to drop them off the top of Great Arch in St. Louis, Missouri, if possible.

I might like to see what happens if I changed the shape and size of the holes in the canopy.