Parachute Design Challenge

[redacted]

Period 7

Introduction to Technology/Art
Brooklyn Technical High School
Mr. Goldman, Teacher
Febuary 11, 2001

Name [redacted] Period 7 Excellent report (A) Excellent work Keep it up Mary. Glad you enjoyed it -

Parachute Report Assessment

1. **Cover** Neat ✓ Correct Format ✓ Correct Information ✓

nice!

2. **Table of Contents** Included ✓ Pages Numbered ✓ Page Numbers on T of C ✓

3. **The Design Challenge** Included ✓

4. **Orthographic Projection** Included ✓ (A-)

   3 views shown ✓ Views correctly oriented ✓ Major dimensions included ✓
   Ruled border ✓ Title Block ✓ Title Block information complete/correct ✓

   Nice job. You've got the idea.
   Front view too narrow, given width of top view.
   How many strings? (Needed to show them on top view as hidden lines.)
   Is there a hole in center? Not quite clear what top view looks like.
   (see me if you want some help with it.)

5. **Discussion** Included ✓ Titled ✓ (A+)
   Process described ✓+ Variables listed ✓ Variables' affect examined ✓+

   What worked well/what did not ✓- Changes suggested ✓ Extra Credit ____

   Well written. Thorough, thoughtful work + reflection here.
   Based on your data I don't see how you can say you were not able to lengthen time in air. (p. 5 #1) Design 1 - aver. time at 1.70 sec. #4 Average time = 2.00 seconds, 15% increase.
   Please double space when typing. (see note at bottom *)

6. **Appendix** Title Page ✓ Test Records included 4 (A) Other items —

   These Records suggest you did serious + thoughtful work. Good work.
   Keep it up.

* Note that it's always a bad idea to change more than one variable in a test. Example - in #2 which variable (string length) weight or size had any impact? Did they cancel each other out?

See back for additional comment

Parachute report.ass

Table of Contents

lame [redacted] Period 7.

Parachute Design Challenge I

ituation:

arachutes are devices most often used to increase the time it takes for an object to fall a given distance rough the air. (They are also be used to slow a vehicle or airplane to assist it in coming to a stop.) When sed in vertical drops, parachutes generally look like large canopies with a cargo tethered or tied to them.

he force of gravity causes objects, including parachutes, to fall towards the earth's surface. If we increase e mass (weight) of a falling parachute or the load it is carrying (without changing anything else) we icrease the force due to gravity, and the parachute and its load will fall faster.

. falling parachute is designed to resist the pull of gravity. As it falls through the air, it collides with air iolecules under it. Air has mass, and this provides a resistance to the falling motion of the parachute and its argo. This air resistance is called drag. If we increase the surface area of a parachute (without changing nything else) we increase the number of collisions between the parachute and surrounding air molecules, iat is we increase the drag, and it will drop slower.

'roblem:

esign a parachute that takes the longest time to fall a specified distance.

pecifications:

. Only the coffee filters provided by the teacher may be used to fabricate the parachute 'canopy."

. A minimum load of at least three washers (1/4", provided by the teacher) must be attached to the parachute as a load or cargo. Additional weight may be added.

. The drop height will be from the bottom of the light fixtures. Only one person may hold the parachute in preparation for dropping. The parachute must be touching the light fixture when it is dropped/released.

ules:

. Students will work in groups. Every student must make his/her own parachute for the final "contest."

. Drop time will be determined with a stopwatch provided by the teacher and will be kept by a students appointed by the teacher as "time keeper."

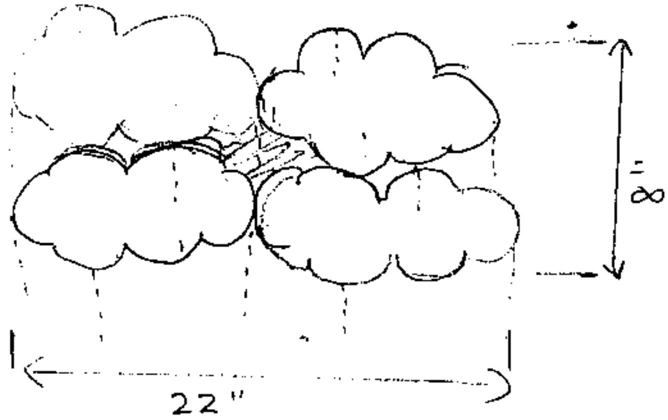
. Each student will drop his/her parachute a maximum of 3 times. The number of drops will be determined by the teacher, depending of the time available.. The longest time aloft will be counted.

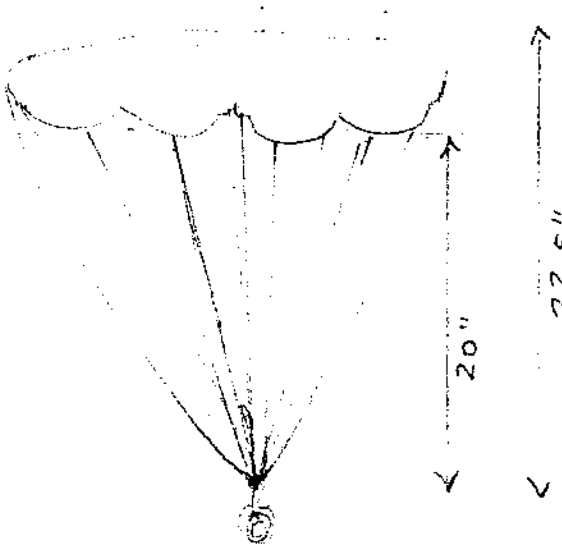
. Group drop times will be determined as follows:
All team members' drop times will be totaled and the sum divided by the number of team members. If a student does not have a qualifying parachute to drop on the day of the "contest" his/her drop time will be zero seconds and will be added to the teams total before dividing the total.

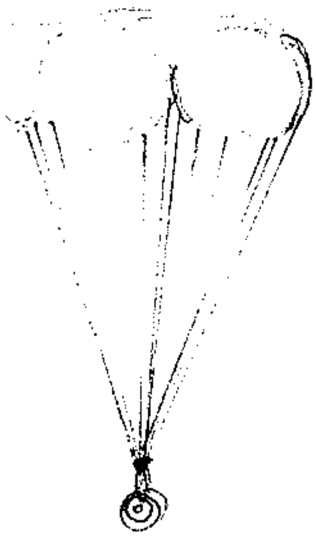
. The team with the highest score, calculated as defined in #4, will be declared the winner.

. The date of the contest will be Thurs Feb 8.

ORTHOGRAPHIC PROJECTION







Parachute	Period # 7 Group # 3	2/15/01	Drawn by: [redacted]

Process

My first design was made in respect to experiment the weight factor. I wanted to know if it was better to have fewer weights or to have more weights. Therefore, I made a basic parachute design, with one coffee filter and strings with the length of 3.25 inches from the canopy to the weights. I sectioned off the weights; having 2 washers, knot, and then have 4 washers, totaling 6 washers. My testing average for this design was 1.73 seconds for a 106 in. drop height. My conclusions were that if I had less weight, then it would probably be slower.

During group meeting, we discussed about what we learned, what works, and what doesn't. A group member had already done more than one design, and believes that having additional strings connected to the inside of the canopy instead of just the edges of the canopy helps to support the shape and distribute the weight. We conjectured that thicker canopy helps keep the air in, and are less likely to flow pass it.

With some of these first findings, I created my second design. I know that a bigger canopy would be better, so instead of having just one coffee filter, I had five. This time I had much longer strings, up to 3 times my first design. I cut down to 4 washers, because I didn't want too much, but I don't want to be too little and be on the minimum, so I chose 4. After I completed setting up the parachute, I had a small run-through of how it would look like in the air. I realized that the canopy seemed a little bit to floppy and flat, so that air escaped easily and the canopy can fall out of its shape. To solve this problem, I decided to fold and tape the edges of the 5 coffee filters together to form a somewhat pointy edge, resulting in a star shape. This action gives the parachute a more 3-D fold, advantaging me in holding the shape together with the tape and opening up and ready to take in the air.

My next design idea is derived from the Parachute pamphlet Mr. Goldman gave us. From that pamphlet, I learned that holes were made in our modern parachutes to avoid oscillation. However, in my case, I do want oscillation, because that would cause more motion in air, which results in a longer drop time. Instead of having holes, I thought that to promote more oscillation, I would have two sectioned canopies, such as two triangles. This way, not only would the parachute sway from air passing in one side and out the other side, it would also continue going in and out of the canopy making it a even more choppy wave. Therefore, I took a similar idea of my 2nd design, created another one, and connect them together.

Through testing, and observation of other people's design, I learned that big canopies (more than 15 coffee filters) could capture more air and float gently. Although I didn't get the oscillation effect that I would like, I like this new shape because it seems to be effective in holding the air. Keeping the design, I increased the size of the canopy by adding another exact model next to the third design, making it a 4-sectioned parachute instead of two.

Evaluation of Parachute

Overall, I am not that please with my results. Although I have learned a lot over the course, my last design's drop time didn't have a major difference to my first design's drop time. At the beginning of this project, we started out by making a list of factors that we think would affect the drop time of the parachute. A lot of things came up, such as length of strings, weights, depth and width of canopy, etc. Variables in effect of my 4th design were the length of the strings, the diameter of the canopy, the shape of the canopy, and the way it was released. If my strings were shorter, they would probably have pulled the parachute down faster because; the weight would not be as properly distributed due to size difference. Comparing my 4th design with the 1st one, the canopy is much, much bigger, 12x more coffee filters. This size creates a bigger canopy to capture more air. The shape of my canopy is also a factor in capturing the air because my canopy is shaped as 4 semi clouds. This roundness captures the air as it falls down and prevents it from going out by the sides, because the sides of this one is rounded up to block this escape. Finally, I learned the importance of the release while I was testing out my final parachute. Because this was a big parachute with lots of long strings, it can be quite complicated to hold and release into a full and complete fall. I don't want the shape to crumple on its fall, and neither do I want it to flip over. I realized that if my hands or in between lines when I take out my hand to release it, the strings would get tugged on, resulting in a lop-sided fall. Therefore, I had my hands right at the side of the parachute, where I can take my hands off without any interaction with the strings.

What I like best about my final parachute is its fall. Although the fall does not take a long time compared to others, I think it would be a relatively good parachute in the real life. When released correctly, the air, like I had guessed, is captured within the four sections of the canopy. That results in an open, full, and complete fall. But one aspect that did not worked as planned was the oscillation. I still don't know if it would have a longer stay in the air if there were oscillation. Theoretically, it would result in a longer drop time, but unfortunately, that factor did not work out. I think for this to work, I would need an even more 3-D canopy. In the pamphlet, it refers to oscillation in an upside down cone shape where air can really get moved around in there. If I could make another design, I would really test out this idea and I would have to actually make two upside down cones, although it would be hard due to the material.

Name [redacted] Period 7 Date 2/3/01

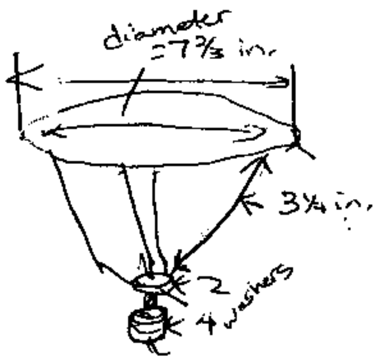
Parachute Design Test Record

Instructions:

1. You must complete a new "Test Record" each time you significantly change your parachute design.
2. You must complete all parts of the "Test Record."
3. Make at least three tests for each modification or each time you change or adjust a variable.
4. Record all data every time you test your parachute.

Design # 1

Sketch
(Include important dimensions)



Data

Test #	Drop Height	Drop Time
1	106in	1.87
2	106in	1.73
3	106 in	1.79
4	106 in	1.67
5	106in.	1.65

Changes since last test
Including changes in design of parachute, ropes, drop height, load, etc.

None

Conclusions:

1. Summarize your data. 2. State what you think you learned with this test. 3. What you plan to do next.
(Use the back of this paper if you need more space.)

1. I eliminated the highest and lowest drop time, which is 1.87 and 1.65 seconds, then I averaged the rest. The average is 1.73 seconds for 106 in height.
2. The more weight there is, the more drag there is, therefore there is a faster drop time.
3. To make a slower parachute, ~~then~~ the next trial should have less weight, perhaps just 3.

Name [redacted] Period 7 Date 2/5/01

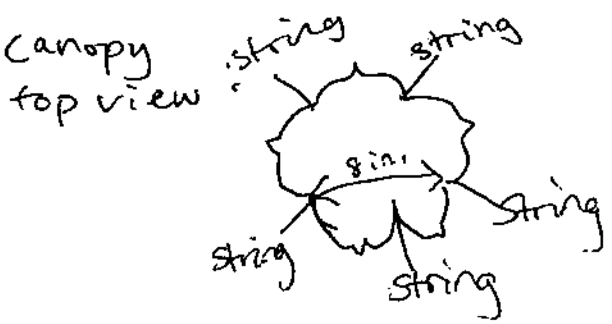
Parachute Design Test Record

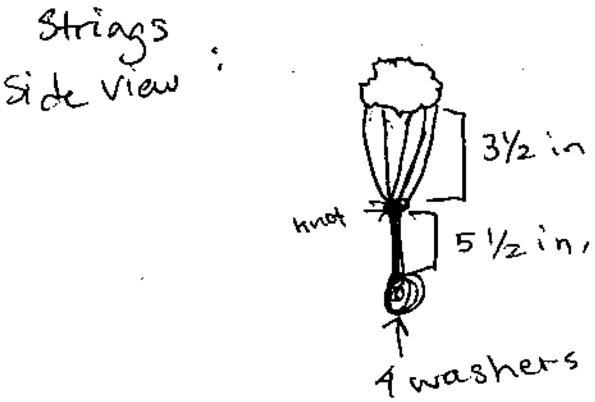
Instructions:

1. You must complete a new "Test Record" each time you significantly change your parachute design.
2. You must complete all parts of the "Test Record."
3. Make at least three tests for each modification or each time you change or adjust a variable.
4. Record all data every time you test your parachute.

Design # 2

Sketch
(Include important dimensions)





Data

Test #	Drop Height	Drop Time
1	106"	1.81
2	106"	1.57
3	106"	1.71
4	106"	1.71
5	106"	1.75

Changes since last test
Including changes in design of parachute, ropes, drop height, load, etc.

longer string (3x)
less weight (-2)
bigger canopy (5 coffee fit)

Conclusions:

1. Summarize your data. 2. State what you think you learned with this test. 3. What you plan to do next.
(Use the back of this paper if you need more space.)

1. The drop time seemed to be the same as my first design, or even diminished. My average of the entire testing is 1.71 sec.
2. I learned that the more 3-D the canopy is, the better, because the flat canopy would easily loose shape.
3. I want to add another similar copy of this, making it have 2 sections of canopy so that there is oscillation.