



PLTW Engineering

12/Parachute Design Challenge

May 4, 2020



12/EDD

Lesson: 5/4/2020

Objective/Learning Target: Students will apply the design process solve the challenge of creating a parachute device.

How do parachutes work?

Parachutes are used for many applications from skydiving to race cars. How do parachutes actually work? There are a few different designs depending on their purpose. Take a look at how skydiving parachutes work by visiting the links below:

[How skydiving parachutes work](#)

[Parachute opening in slow motion](#)



Gather materials

Today you will be applying the design process and the laws of physics to create your own parachute design. You will want to gather the following or similar materials.

- tissue paper
- napkins
- construction paper
- newspaper
- paper towels
- string
- tape
- weights (such as washers)
- measuring tape (to measure drop height)
- ruler (for measuring circle radius)
- stopwatch (for recording drop time)





Parachute Design

The design of a parachute is very important, especially in an extreme sport such as skydiving because someone's life is dependent on the parachute functioning correctly.

Engineers thoroughly test the materials and designs of parachutes to ensure that they open as intended and reliably, and are strong enough to withstand the air resistance needed to slow skydivers to safe landing speeds.



Parachute Design

A parachute is an umbrella-shaped device of light fabric used especially for making a safe jump from aircraft. Due to the resistance of air, a drag force acts on a falling body (parachute) to slow down its motion.

Without air resistance, or drag, objects would continue to increase speed until they hit the ground. The larger the object, the greater its air resistance. Parachutes use a large canopy to increase air resistance. This gives a slow fall and a soft landing.



Free fall motion

Free fall is a special type of motion in which the only force acting upon an object is gravity.

Objects that are said to be undergoing free fall, are not encountering a significant force of air resistance; they are falling under the sole influence of gravity.

Under such conditions, all objects will fall with the same rate of acceleration, regardless of their mass.



Newton's second law

Newton's second law of motion pertains to the behavior of objects for which all existing forces are not balanced.

The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.



Falling with Air Resistance

The main force encountered by a parachute is air resistance.

As an object falls through air, it usually encounters some degree of air resistance. Air resistance is the result of collisions of the object's leading surface with air molecules.

The actual amount of air resistance encountered by the object is dependent upon a variety of factors.



Brainstorm

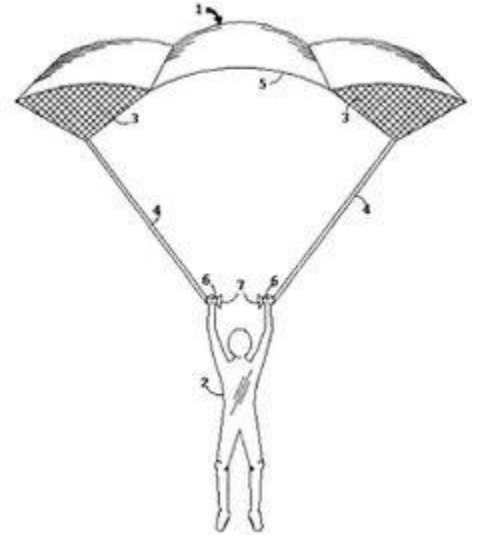
Go out to the internet and look at different types of parachutes.

You are trying to design a parachute that will slowly fall to the ground, giving you the most “air-time” as possible.

Record any notes or calculations to guide you during prototype construction.

Generate ideas

Make a few different sketches of different parachutes and choose one for the design you will test as a prototype.





Build your prototype

Cut a circle from the chosen paper - lets start with a circle that has a surface area of 3 square inches.

Make a small hole in the center of the shape.

Cut six pieces of equal length string and tape them at equal distances around the edge of the shape.

Tape the other ends of the string to a weight.



Test your prototype and refine

Test the parachute. Go outside and drop it from a specific height to see if it flies slowly and lands gently. Record your observations.

Repeat the process, modifying the variables of canopy material and shape, and size. Record your observations.

Scale the diameter of the parachutes by a common factor and determine the affect on surface area.



Quiz yourself

Once you have created 5 to 7 variations of your parachute, create a graph to communicate your results.

Calculate the area of your parachutes ($A=\pi r^2$).

Create a graph showing surface area vs. drop time.



Quiz yourself

Explain how the area of the parachute affects its flight.

What type of paper is the best material to make a parachute? Why?

What materials did not work well? Why?

What changes could you make to improve your design?