

Kashyyk



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Purpose Of the Experiment

When we were first assigned this project we were told to come up with an experiment using a weather balloon that will be launched to one thousand feet. This project will include a fairly detailed method, a step-by-step procedure, a log that we can write our data on as we are launching the balloon, and a PowerPoint presentation to present what we have discovered from our experiments. Our experiment was to see how the wind speed affected the altitude of the balloon. Our objective was to find a relation between the wind speeds on the ground's effect on the altitude of the balloon. We are going to use 1 six-foot diameter weather balloon, 1000 feet of string, 2 theodolites with horizontal, anemometer, and a barometer. The barometer and theodolites are going to be used for the altitude while the anemometer measures the wind speed.

Source and Origin of Data

This idea for our experiment was brought up by a group of three endeavor students. This idea was originated from the Atmospheric Research website which was linked from the endeavor academy website. With help from Mr. Kliewer, our mentor, and the people in our group, we were able to come up with a fair experiment.

Research:

Assuming constant temperature: $PV = \text{constant}$

$$\Delta P = \frac{V}{1.43 \text{ ft}^3} 14.7 \frac{\text{psi}}{\text{ft}^3}$$

Every 10 ft^3 will use up about 103 psi for this size cylinder.

Drag

$$F_d = \frac{1}{2} C_d \rho V^2 A$$

C_d = coefficient of drag ≈ 0.5

ρ = density of air = 1.23 kg/m^3

V = air speed (1 knot = 0.514 m/s)

A = cross sectional area = πr^2

$$F_d = \frac{1}{2} C_d \rho \pi V^2 (0.514 \text{ m/s/knot})^2 r^2 (1 \text{ m}/3.28 \text{ ft})^2$$
$$= k_1 V^2 r^2$$

$$k_1 = 0.23 \text{ N}/(\text{knot ft})^2$$

Flight String

150 #-test braided nylon twine

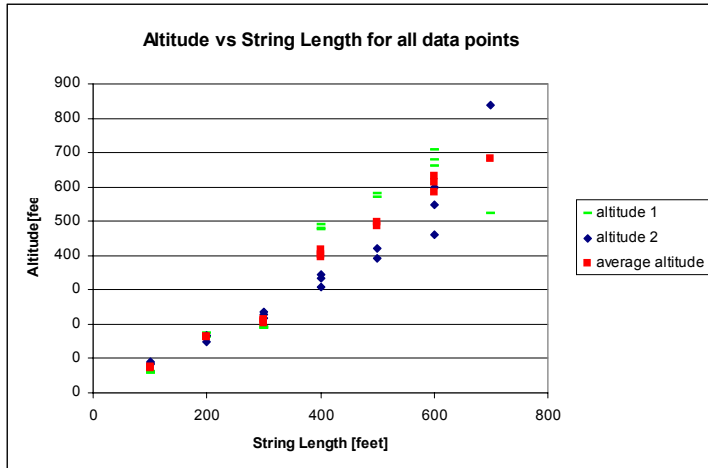
weighs 350g / 1000ft:

$$\mu = 0.350 \text{ g/ft} (9.8 \text{ N}/1000 \text{ g}) = 0.0034$$

N/ft

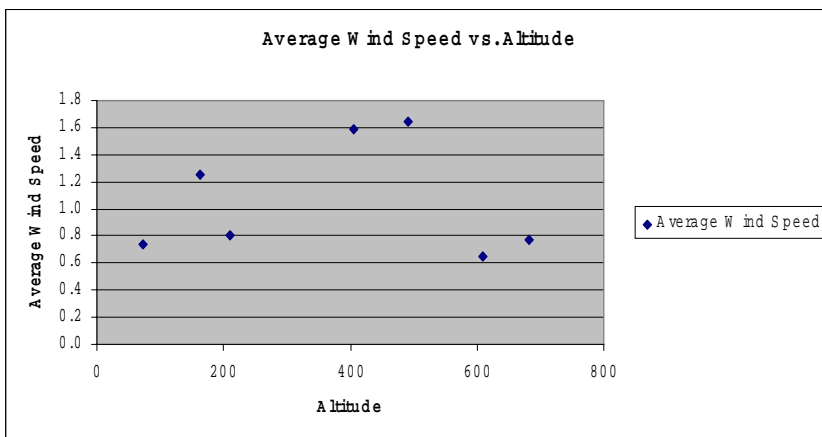
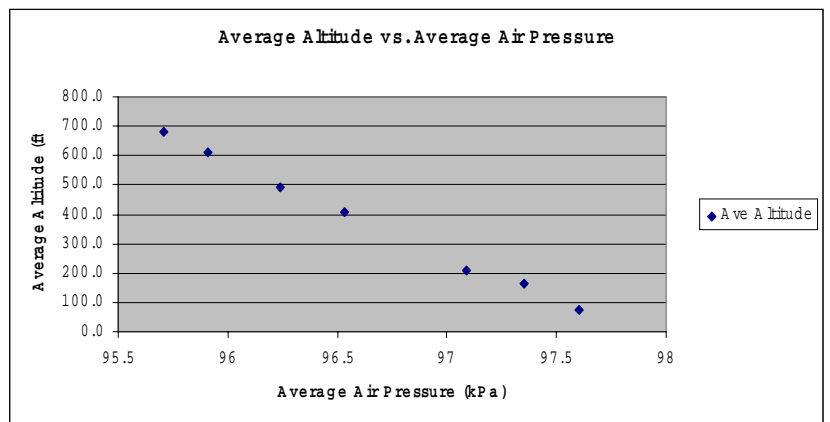
$$F_w = \mu L$$

Data & Graphs



This graph shows the two theodolites readings and the average altitude measured between these two stations for each 100 ft. of string

This graph shows the average air pressure measured with the average altitude for every 100 ft. of string.



This graph shows the average altitude with the average wind speed for every hundred feet of string.

Hypotheses 1

1. The higher the wind speed, the lower the altitude of the balloon

Test1: The altitude should decrease due to wind speed on the ground

Test2: The two-station theodolite altitude tracking system must be close to the string length

Test3: The wind speed should increase and the balloon must visually decrease in altitude

- Test1a: graph number 3 proves and passes this test
- Test2a: graph 1 proves and passes this test
- Test3a: during the project, this test passed

Hypotheses 2

2. There is a relation between decrease in air pressure and the increase in altitude of the balloon

Test1: We will send up a barometer with the balloon to find the barometric pressure

Test2: We will use the two-station theodolite altitude tracking system to find the altitude over time

- Test1a: graph 2 proves and passes this test
- Test2a: graph 1 proves and passes this test

Conclusion-

Due to lack of wind variation our experiment didn't come out as well as we had wished. We did not find a relation between altitude and wind speed on the ground. A second run was not possible to conduct due to time constraints but our data was accurate and useful to describe air pressure and altitude as well as actual height and ideal height. Our group was very stressed, but we had a lot of fun.