CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

J0813

Project Title

Flight of the Falcon: Measurement of Cosmic Rays in the Upper Atmosphere

Abstract

Objectives/Goals

The primary objective was to determine the relationship between altitude and the cosmic ray count. The secondary objectives were to make measurements of temperature, pressure, and wind speed as a function of altitude. Finally, three high resolution video cameras were used to record the flight.

Methods/Materials

An instrument package was constructed and then launched using a helium filled weather balloon. The primary instrument was a Geiger counter sensitive to beta and gamma rays. Prior to each flight, computer simulations were run to determine the likely flight path and landing spot. Two flights were made. The first was launched on 8 December 2013 near Gilroy, ascended to about 29,000 m, and landed in Death Valley. The flight lasted for 5 ½ hours. After the first flight, the instrument package was upgraded with solar panels to run the cameras and flight computer. The second flight was launched on 15 February 2014 from Kettleman City but was lost over the Sierras near Owens Lake when the GPS failed. A replacement instrument package was constructed but has not yet flown.

Results

It was found that at altitudes below 3,000 m, the cosmic ray count was small and constant. At altitudes up to 8,000 m, the count increased gradually. Above 8,000 m, the count increased dramatically but then leveled out at 550 cpm at 12,000 m. The radiation at high altitudes was a factor of 27.5 times higher than the radiation at ground level. Also, it was found that the horizontal wind speed increased steadily with altitude, topping out at speeds of about 50 m/s at altitudes between 8,000 and 9,500 m. At even higher altitudes, the wind speed decreased. Air temperature was found to drop gradually with increasing altitude before leveling out at a temperature of -34 C at an altitude of 9,500 m. Air pressure was found to decrease smoothly with altitude.

Conclusions/Discussion

On the first launch, I did not put enough helium in the balloon giving a balloon ascent rate of only 1.7 meters/second. The slow ascent rate meant that the balloon drifted much further than I had expected and the flight lasted longer. Although the balloon ascended to the expected altitude of 29,000 meters, the flight computer failed at 16,340 meters. Likewise, the cameras stopped working at an altitude of 10,000 meters. The most likely explanation is that the batteries ran out of charge due to the longer than expected flight time.

Summary Statement

I launched a weather balloon with a Geiger counter, cameras, and other instruments to an altitude of 30,000 meters.

Help Received

Father taught me how to solder, obtained helium, and drove me to Gilroy for the launch. Simon Gonzales and his friends drove to Death Valley to recover the equipment.