High in the Sky: An Elementary Physics Outreach Project

UWL Chapter, La Crosse WI

Andrew Prudhom (President of SPS):

Eric Gansen (SPS Advisor):

Total Amount Requested:

$295

Date of Submission:

November 15, 2012

1. Abstract

A tried and true method of inspiring a love for science is by exposing young students to the cooler aspects of the sciences. To accomplish this, the University of Wisconsin-La Crosse chapter is requesting funding for our chapter to complete a high-altitude balloon project, the story and results of which will be shared with local elementary school students.

2. The Annual Challenge

> The mission statement of the Society of Physics Students reads:
>
> The SPS exists to help students transform themselves into contributing members of the professional community. Course work develops only one range of skills. Other skills needed to flourish professionally include effective communication and personal interactions, leadership experience, establishing a personal network of contacts, presenting scholarly work in professional meetings and journals, and outreach services to the campus and local communities.

Although University of Wisconsin-La Crosse chapter was recognized as an outstanding chapter for the 2010/2011 academic year, we will never cease our efforts to improve ourselves. To work towards our goal of aligning closer with the mission of our parent organization, we are attempting to institute an annual challenge for successive generations of physics students to overcome.

These challenges will allow our students to attempt to work harmoniously in a small group to achieve a concrete goal, the successful execution of which will train them in how to communicate effectively, provide each of them with effective leadership experience, and begin the important process of establishing contacts within their discipline. Additionally, these challenges will increase student interest in physics, raise awareness of the SPS chapter within our department, train successive generations of students in how to produce quality work in a limited timeframe, and in how to present their work to a (very) non-technical audience, as we are attempting to incorporate yearly presentations to local elementary school students covering the story and results of our student's labors.

3. This Year's Challenge

A. Description

The challenge this year is to obtain a picture of the curvature of the earth. The students involved have already met and chosen a method of obtaining such a picture, deciding on a using a hydrogen balloon to lift their electronic payload (consisting of a GPS tracker and a digital camera) 18 miles into the atmosphere, with the camera programmed to take pictures at periodic intervals. In addition to the technical challenge, our students have been tasked with presenting the story of their challenge at an age-appropriate level to local elementary school children. This year's project is ideal for such a presentation, as it is a simple project that is easily explained to young students which has a wonderful visual as the result. It is our hope that this project, and projects in the years to come, will inspire those youngsters with an interest in science to pursue this interest throughout their education with the intention of someday participating in similar projects.

B. Methods

To successfully obtain a photograph of the earth's curvature, an electronics payload will be constructed from store-bought materials and a weather balloon will be utilized to lift it to an altitude of 18 miles (95,000 feet). The balloon and parachute will be purchased from certified rocketry/high altitude balloon vendors. The electronics bay will contain a digital camera that has been modified to take pictures at a set interval, a GPS system, an insulating material with chemical handwarmers dispersed within to keep the electronics at proper operating temperatures in the chill upper atmosphere, and aluminum foil to act as a radar reflector. The casing of the electronics bay is to be a Styrofoam cooler, with windows cut in the side for both the camera's lens and the GPS antenna. The electronics bay will be secured to the parachute in the manner demonstrated in Figure 1.

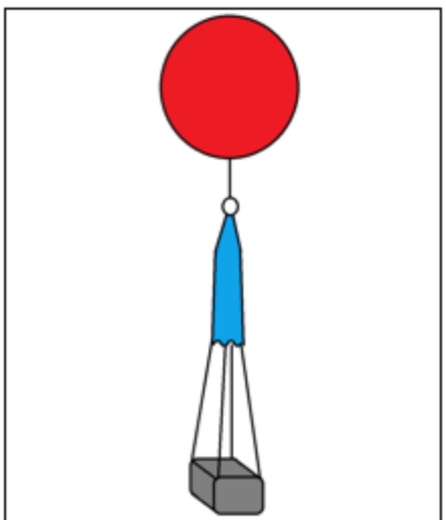

Figure 1: Current Electronics Bay/Parachute Configuration

The balloon will utilize gaseous hydrogen to produce the lift necessary to elevate the payload. The team chose hydrogen over helium due to the fact that recent increases in the prices of helium made its use infeasible. The design of the balloon ensures no elements that could act as ignition sources are anywhere near the balloon. The diameter of the filled balloon is dependent on atmospheric pressure, as the balloon elevates and the atmospheric pressure decreases the diameter of the balloon will increase. This process continues until the critical point where the increasing diameter of the balloon overtakes the elasticity of the balloon materials is reached, at which point the balloon bursts and the payload begins its descent. The parachute will begin to become effective once the payload reenters the lower atmosphere, where the air is dense enough to facilitate the operation of a parachute recovery system.

Once the payload has landed, the GPS transmitter will allow us to pinpoint its location to within a 20 feet radius. It has yet to be determined if we will equip the payload system with some sort of noisemaker or flashing light system to assist in the recovery process.

C. Budget & Justification

Item	Quantity	Unit Cost	Total Cost
Weather Balloon	1	$45	$45
Camera	1	$150	$150
GPS Tracking System	1	$100	$100
Total Cost:			$295

After researching the ideal components for this challenge, the camera and GPS tracking system were found to be by far the most expensive equipment necessary. The total cost of the project is estimated to be around $450, and while the team has other grant proposals submitted, at the time submission no positive decisions have been reached by funding organizations and as such the team is currently planning to cover any unfunded costs out of pocket.