Team ACES

GSBC Most Educational Initiative

Introduction

Team ACES is a collaboration between parent/volunteers engaged in promoting STEM education and Albert Cassen's Elementary School, Glen Carbon IL. Our program uses High Altitude Ballooning (HAB) as a tool to support existing curriculum in the school. We teach methods that promote goal setting, problem solving and critical thinking. Our goal was to integrate these methods into a HAB project targeted at fifth grade students that would attempt to break the Guinness World Record for "Highest Paper Plane Launch." We were successful in exceeding the current world record by more than 10,000 feet, setting an unofficial world record of 107,811 feet.

How Many Sudents Were Involved

Seven, fifth grade classes made up of 170 students were involved with the project. 490 students from all grade levels in the school were present for the launch.

Description and History of the Program

I provide a volunteer program that promotes STEM education in District 7, Edwardsville/Glen Carbon, IL. The program began in 2010 as an educational outreach with foundation in the Southwest Airlines Adopt A Pilot Program. It quickly evolved as resources and partnerships were established. Adopt A Pilot is a program that uses aviation as a vehicle to teach goal setting, math, science and geography to fifth grade classes around the country. In addition to the standard Adopt A Pilot curriculum, I added the extra element of a Near Space Balloon Launch. We used the project to anchor and support all areas of the school curriculum to a common theme. This concept promotes goal setting, problem solving and critical thinking. It also demonstrates a process that brings complex ideas to reality and the interrelatedness of all things. These concepts can be applied to any goal in life.

Our first launch was very successful. We recorded high resolution video and still images from 76,500 feet. The program was well received by all. Coverage by numerous media sources included the National NBC Nightly News. We attained sponsorship for equipment and engaged in creative fundraising through my employer's community outreach program. These efforts resulted in the project being fully funded. Surplus revenue was given back to the school.

The following year, two more balloon launches were accomplished that included education levels K-12. In addition to video and still images, data systems were installed that captured atmospheric data up to 85,000 feet. This data was provided to the district to support curriculum at all grade levels.

Our program then evolved to use model aviation as a vehicle for education. We established a partnership with the Academy of Model Aeronautics. Our project had fifth graders design, build and fly five radio controlled airplanes. It was a fantastic success. The project was featured in media outlets and highlighted by the Academy of Model Aeronautics both online and in their magazine.

In the summer of 2013, I lobbied our school district to formally highlight STEM education. I was successful and a full curriculum review was initiated by the district to integrate STEM education into the district in grades K-12. District 7 has approximately 7500 students.

2013 also brought a partnership with a Chicago coworker in a collaborative effort to expand the program. We entered a contest hosted by Popular Science and the crowdfunding site Rockethub under the banner "Reach for the Stars". We were selected as finalists and featured in Popular Science Magazine.

2014 brought a very ambitious project that served as a pilot program for District 7. We derived a project and supporting curriculum to convert a power wheels vehicle into our "Planetary Rover Project." The final product featured a semi-autonomous vehicle augmented by solar power, equipped with first person video capable of remote operation and fully autonomous waypoint navigation. The project concluded with the kids in the classroom solving a navigational puzzle and uploading a waypoint path via the internet to the rover. Waypoint navigation was

scored and prizes awarded. Partnerships were established with servocity.com and a local solar energy company. Numerous media sources covered the project.

How HABs Flown During the GSBC Were Used to Support this Program

This year's project had us revisiting high altitude ballooning in the biggest way yet. I was engaged with a new school, a highly motivated principal, seven fifth grade teachers and 170 students. The school district had loosely adopted aviation as a theme, using paper airplanes to teach concepts of force, motion and statistics. I wanted to build on this foundation and our experience in high altitude ballooning to create the extraordinary experience of setting a world record.

I started last fall with the standard Adopt A Pilot curriculum. Throughout the program, I integrated foundational elements to support the record breaking attempt without the students knowing about it. We used the paper airplane as a tool to study force and motion. We also studied geography, the atmosphere, temperature lapse rates, the jet stream, lift and buoyancy. I used our first balloon project as an example of how all of the topics relate to each other. I tasked each student to come up with their own paper airplane design. The kids in each class then determined a single design to represent their class.

The Adopt A Pilot series concluded with an assembly of all 7 classes to review the program. We had a guest speaker highlighting women in aviation, the military and STEM fields. At the conclusion of the assembly, we announced our intent to break the Guinness record for Highest Paper Plane Launch. One of the seven class designs would represent the school and make the record breaking attempt. The kids went wild.

Next, each class fabricated a full scale drop test model. Each model was lifted to a height of 200 feet using my multirotor drone. Kids were engaged in the process by filming, reporting altitude via the datalink on the drone and releasing the test airplane at the appropriate time. All seven designs were dropped and a winner was chosen for development and the record breaking flight.

Using design cues from the winning model, I fabricated the flight aircraft in accordance with the Guinness guidelines to make the record attempt. The final

design included APRS tracker, backup tracker based on cell phone technology, a data logger and two cameras. The balloon was a Kaymont 3000g model. All equipment was approved by Guinness. All additional coordination and requirements for the record attempt ran concurrently with the construction.

Throughout the build, teachers were covering weather, the jet stream geography and running the prediction software with the students. We defined rules of engagement for the parents and children who would chase the balloon in the recovery effort. It was important that the recovery effort be organized, safe and provide a collective "Moment of Discovery" to as many kids as possible in the field. Prior to launch day, the finished flight aircraft was brought to the school and the flight mission was reviewed.

Launch day provided perfect weather with light winds from the surface to infinity. The entire student body assembled in front of the school for the fill and launch. St. Louis television, local newspaper and area internet news sources attended as well as the Mayor, Police Department and School Board. After a slight overfill of Helium, we corrected the issue and the kids accomplished the pre-launch checklist. The countdown began and at zero the young boy who designed the plane released it for its record breaking attempt. Fourteen cars filled with parents and students proceeded to the rally point downrange. Flight path for the ascent was accurate. Upon burst, the group caravanned toward the anticipated landing area. APRS worked flawlessly. All kids made the "Moment of Discovery" together in a farmer's back yard. The airplane was completely intact. Altitude data was immediately evaluated with our expert witnesses. Our APRS altitude of 107,811 feet is more than 10,000 feet above the current world record. We were confident in reporting an unofficial Guinness World Record. Data and supporting documents are being sent to Guinness for validation.

<u>How Effectiveness Was Measured</u>

Reception by the community as a whole was fantastic as evidenced by the presence of the Mayor, school board, police department, three sources of media, parents and students on launch day. Feedback from teachers, educators, parents and students is very positive. School administration and teachers reported

students remained very engaged throughout the project. Teachers reported that this project supported existing curriculum while enhancing the educational experience. Teachers liked that they were given the freedom to play to their instructional strengths. We demonstrated a method to bring complex ideas to reality and provided a template for goal setting that applies to anything these students decide to accomplish in any area of their lives. Our project spanned the complete process of classroom idea to breaking a Guinness World Record. Data from the flight will be used at all levels of education within the district. Parents have reported that this experience has "Transformed" their child. One young scientist was quoted in local media as saying this was "The best day of his life!"

Cost Summary

Funding came from three sources. I used my employer's community volunteer program to donate my time in exchange for an airline ticket. We raffled off the airline ticket as a fundraiser generating $675. We received a $500 grant from our school district's Citizens Advisory Council. We had a local businessman donate $500 to the cause. Total budget was $1675. Expenses included the balloon, helium, video camera, memory cards, lithium batteries, building materials and ground support equipment. The APRS tracker, cell phone, data logger and one of the cameras was on loan from STEM+C Inc at no charge. Expenses totaled $1100. We were able to donate more than $500 in surplus funds back to the school.

How HABs Will Be Used in the Future of our Program

We are hopeful that the techniques that we have developed and documented over the years will be utilized in annual HAB missions in our school district. The straightforward methods we have documented for photography and atmospheric data missions below 100,000 feet are easily repeated at a relatively low cost.

The GSBC has given us a framework and timeline to accomplish something extraordinary at this level of education. Since the beginning of our program, I have wanted to present it to the scientific and educational community in a formal way. The GSBC has provided that opportunity.