

# ATMOSPHERIC DYNAMICS: BALLOONSAT IN THE CLASSROOM

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## Abstract

Building upon the success of the Arkansas BalloonSAT Project, the authors have developed an Atmospheric Dynamics class that combines a traditional classroom learning experience with a hands-on field-based component to study issues affecting our atmosphere. Students in the class research current issues involving the atmosphere and then use this information to build payloads that fly on balloon launches during the semester. During the same launches, payloads developed by area high school students are also flown, and students from both groups get to interact. This project was funded by the Arkansas Space Grant Consortium.

## Background

The Arkansas BalloonSAT Project was started in the summer of 2006 when nine science teachers from Arkansas State University and 4 local middle and high schools attended and participated in the *Starting Student Space Hardware Programs: A How To Workshop* (July 12-15, 2006) at the University of Colorado. The four day space hardware program hosted by the Colorado Space Grant Consortium provided participants with detailed information on current successful balloon programs and instructions on how to adapt/implement these programs at ASU and in K-12 schools throughout Arkansas.

Over the last two years, this project has demonstrated the feasibility of this "edge of space" exploration for the purpose of creating a collaborative network of teachers from different K-12 schools and universities across Arkansas. This program has shown great promise in engaging students at the K-12 level in authentic research utilizing an inquiry-based approach to learning with hands-on experience.



Figure 1. High altitude balloon being filled with helium by students, teachers, and other volunteers.

## Approach

During SSI-2007, work began on modifying this program for the inclusion of a post-secondary class designed for science majors. The course that was developed (PHYS 4193: Atmospheric Dynamics) is a team-taught class that combines a traditional lecture/discussion format with a hands-on field-based component. Students in the class learn about atmospheric dynamics through a combination of in-class discussion, lecture, and independent research. They then use this knowledge to investigate some important issue (ex. stratospheric ozone depletion, heat island effect) by first designing an experiment that they can perform. The students build an instrumentation package that will gather data that can be flown on future BalloonSAT launches, as well as instruments that are ground-based or tether-based.

During BalloonSAT launches, the college students interact with local grade 7-12 science students and their teachers to discuss their various experiments and take part in performing the launch. Data from all of the experiments that ride on the balloon are shared through a central website so that students are able to broaden their studies.

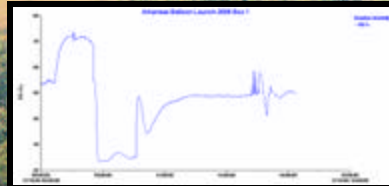
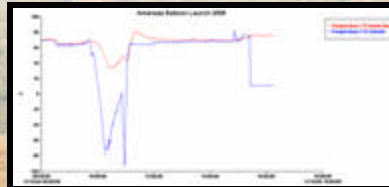


Figure 2 and 3. Temperature and relative humidity during balloon ascent and descent.

## Results

The initial offering of the class this semester (Spring 2008) enrolled a total of 4 physics majors. Students have built and launched telemetry package to measure atmospheric temperature with height. They have also built payloads to measure carbon dioxide, temperature, pressure, UV, and humidity, as well as record audio and video during the ascent and descent. Work is also proceeding on developing a payload with an IR video camera that will allow students to measure Earth surface temperatures during BalloonSAT launches as well as during tethered balloon studies. However, the weather in Arkansas this spring has been exceedingly wet and gusty, prohibiting launches since January. It is hoped that launches will be able to take place during the remainder of April and May that will allow the research to be completed.



Figure 4. Students launching a telemetry package that measures atmospheric temperature

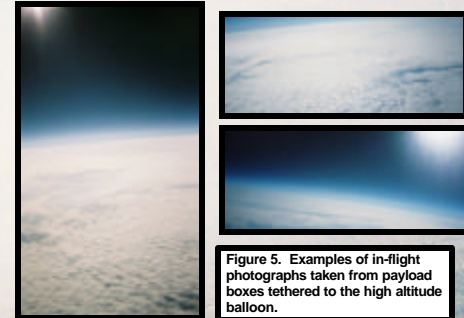


Figure 5. Examples of in-flight photographs taken from payload boxes tethered to the high altitude balloon.

## Future

The course is being modified for permanent inclusion in the curriculum and will be taught again during the spring semester of 2009. Recruitment of teacher education majors and teachers will be done to increase the diversity of students taking the course. Workshops will be done with area teachers during the summer to increase interests in the project amongst the local school systems.

Two of the current students in the course have written grant proposals to continue their research past the end of this semester. Successful funding will more in-depth research on specific atmospheric issues of interests to the students. Weather permitting, these students will be presenting their research and finding at this year's ASGC Symposium.

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For More Information about the Atmospheric Dynamics class:

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