Application of High Altitude Ballooning Activity in a Course for Pre-Service Science Teachers

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High Altitude Ballooning at Bemidji State

- First launch/recovery activity was in October of 2011.
- Is a collaboration between the Professional Education, Physics, and Geology Programs.

Additional collaborators include the Physics and Earth Science programs at Central Lakes College (Brainerd, MN) and Bemidji Middle School.

SCI 3100, Integrative Science for Teachers

- Required course for Professional Education students seeking secondary school licensure in a science discipline or the middle school science endorsement.
- 4-credit course; team-taught between Geology and Physics.
- Primary goal was have students understand and apply the “interconnectedness” between science disciplines. Course also addresses several other standards required by Minnesota Administrative Rule 8710.4750.

Primary Learning Objectives

- Relate specifically to the state standards (8710.4750).
  - Understanding and conducting science inquiry
  - Evaluate data qualitatively and quantitatively.
  - Identify sources of error and evaluate validity of conclusions.
  - Understand connections between domains of science and technology
  - Communicate experimental results.

Application of HAB in SCI 3100

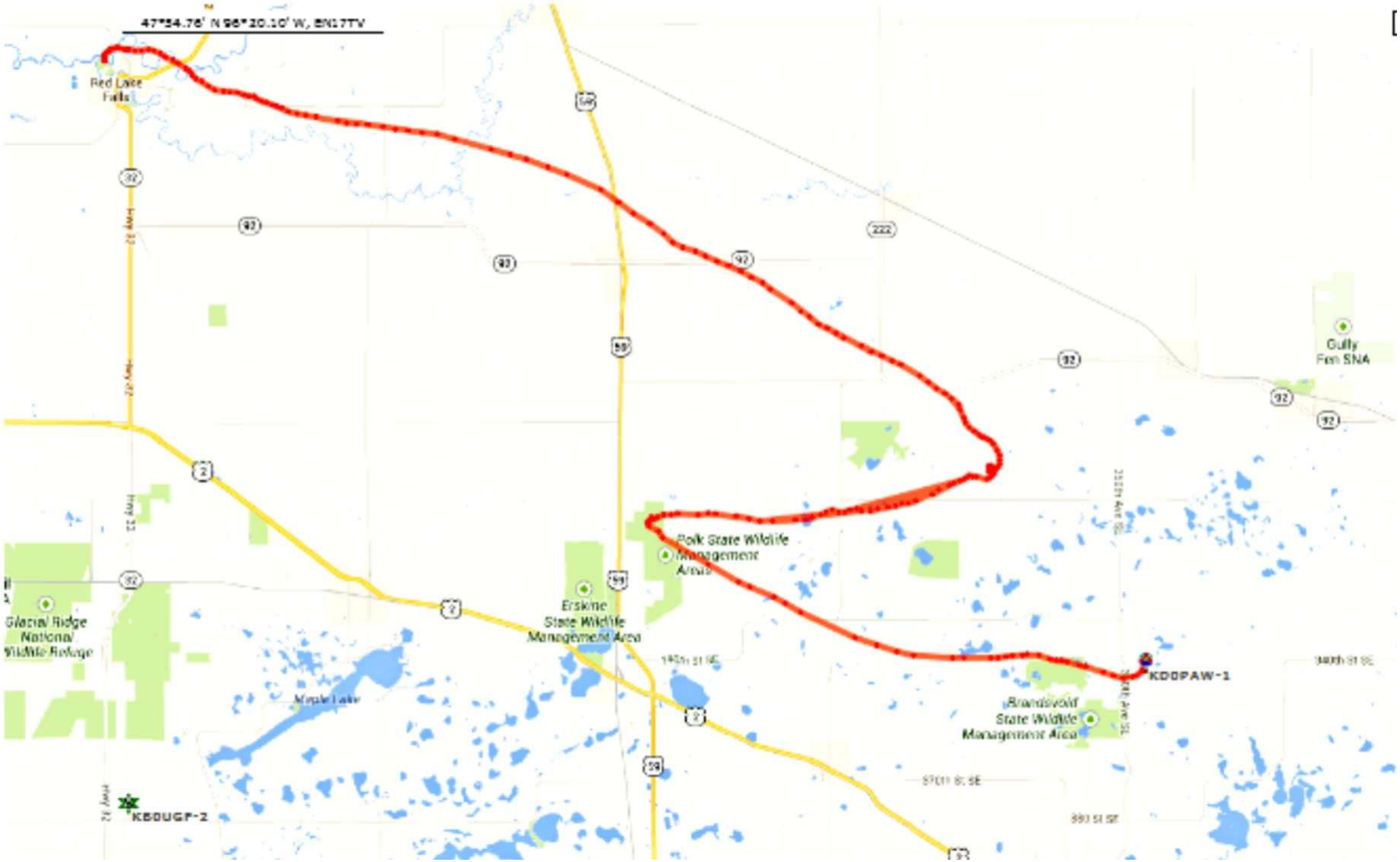
- Ballooning was brought into the course in Spring of 2012.
- Funding was acquired to improve activity design for Spring of 2013.
- 2014 activity was modified based upon feedback from 2013 students. Primary modifications included:
  - Additional class time (HAB activities increased to about 30% of total class time).
  - Additional discrete activity steps were included in project evaluation.

-- More opportunities for critique of experimental design and construction.

Spring, 2014 HAB Activity

- Seven SCI 3100 students were the BSU participants. Student designed experiments included:
  - Survivability of yeast and bacteria to high altitude exposure.
  - Comparison of ultraviolet intensities at altitude to human environmental UV exposure.
  - Development of an Arduino microprocessor-sensor array to collect UV and altitude data and control servo operated sampling port
  - Sampling of atmospheric particles through sampling port.
- Central Lake College and Bemidji Middle School students also contributed to launch & recovery operations.

March 20, 2014 Flight Track; maximum altitude = 29900 meters



HAB Activity Challenges: Faculty Perspective

- TIME—required extensive syllabus modification to meet additional learning objectives (state standards).
- Maintaining student engagement—especially after flight.
- No opportunity for forensic analysis.
- Spring break interrupted project.

Student Perspective

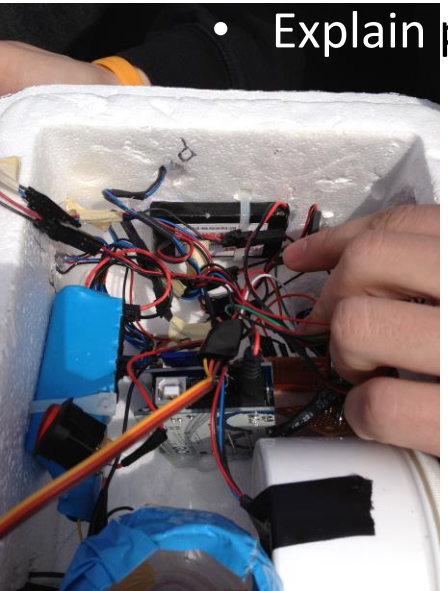
Presented by:
Michelle Jipson

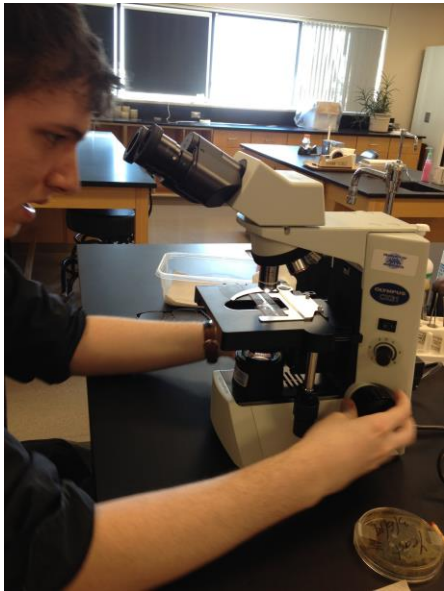
Class Requirements

- Cover topics in Earth Science and Physics
  - Climate change
  - Fossil identification
  - Physics labs
- High Altitude Ballooning (HAB) activities
  - Design scientific experiments and payloads
  - HAB launch/recovery
  - Collect data using radio transmission
  - Flight predictions
  - Test communications

Pros of HAB project

- Connects and fine tunes several science topics
- Scientific experiments
  - Collaboratively work in a team
  - Authentic
  - Higher level thinking
  - Hands on/engaging
  - Allowed students to experiment in science of choice
  - Explain projects to Middle School students





Pros of HAB project cont.

- Launch and Recovery
  - Learn about other schools' experiments
  - Participate with the technical set up of the weather balloon
  - Turn on sensors and cameras
  - Feeling student excitement during launch
  - Track balloon via GPS on APRS.fi website?
  - Data recorded via HAM and 900 MHz radio transmissions?
  - Interpret data
- Present Results at Student Academic Conference

Cons of HAB project

- Time
  - Challenge to meet all coarse objectives
  - No time to effectively communicate with other groups about their projects
  - Arranging time to meet with group outside of class
  - Short amount of time to evaluate data and put together presentation after launch and recovery
- Launch and Recovery
  - Weather appropriate
  - Interference with other classes
- HAB Terminology

Recommended Changes, Student Perspective

- Clearly define HAB terminology
- More in-class time to work on projects
- Work more with Middle School students
- Have more than one GPS tracking system

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