

## **Omaha Public Schools High Altitude Ballooning Science Students Experiments in Near Space**

In Spring 2011, two projects designed by five students from Omaha North High and Omaha Burke High were selected to fly on STS-131, the next-to-last NASA Space Shuttle mission. Even though there was considerable expense to support the projects' eventual launch and return for student analysis, the excitement around the Space Flight Student's Experiment's Program (SSEP) was so undeniable that we searched for a way for students to conduct high altitude research at a more accessible price point. For the cost of one experiment on SSEP, the equipment for a high altitude balloon system could accommodate launches, flights and return of thousands of students' experiments to near space and back.

Since 2012, Omaha Public Schools Science Office, led by Science Supervisor Dr. Chris Schaben, Science Lead Teacher Christina Wildhagen, and the district's Science Instructional Coaches, and the generous support of a community grant have supported students to investigate the effect of near space on experimental items. The program aligns with Nebraska College and Career Ready Standards for Science for 6<sup>th</sup> grade and the high school Physical Science course taught in 8<sup>th</sup> and 9<sup>th</sup> grades across the district, as well as including student ideas from other grade levels and courses. Regardless of the course and grade level, this is a unique opportunity for students to demonstrate their ability to generate a testable question, design and conduct an experiment, analyze the results, and communicate the findings.

Over the years, OPS High Altitude Balloon launches with students' experiments have been featured events at the Nebraska Science Festival, National Science Olympiad, Nebraska Association of Teachers of Science Fall Conference, Stratospheric Ballooning Association National Conference, and halftime of a University of Nebraska Lincoln Husker football game. Collaborative partnerships over the years have included Nebraska Space Grant, Metropolitan Community College, University of Nebraska Omaha graduate STEM courses, and UNO Aim for the Stars Camp. Currently, OPS Science Office is collaborating with Atlantis Educational Services and Space Trek at Kennedy Space Center to incorporate and refine a lift system that is about the price of two high quality classroom microscopes. This collaboration not only opens another door for thousands of students in OPS, but will be available to school districts across the nation should districts choose to incorporate the activities.

OPS students have presented their findings within their classrooms, at school science fairs, Metropolitan Science and Engineering Fair, Nebraska Junior Academy of Sciences, and American Junior Academy of Sciences. Two students, seeking a solution to limit the variation of temperature inside the experimental pods during flights, designed a solution that led to students' abstract "*Heating Devices and Temperature-Regulating Sensors Stabilize Temperatures in Flight Pods*" being published (<https://aaas.confex.com/aaas/2016/webprogram/Paper18165.html>).

Participating teachers are encouraged to guide students to develop a question that goes

beyond “will \_\_\_\_\_ survive the flight.” Below are some of the many student questions that have been investigated by launching their experiments on a high altitude balloon flight:

How will the conditions of near space affect...

- The frequency of a cello string (pre-launch and post-recovery)?
  - The size of a Wubble® inflatable toy during flight?
  - The germination rate of seeds? (tomato, pumpkin, orange, various flowers)
  - The growth rate for *K-12 E. Coli*?
  - Green grapes (will they turn to raisins)?
  - On the color of (Bananas, broccoli)?
  - The intensity of color in UV beads as altitude increases?
  - The intensity of light from a light bulb?
  - The level of ozone exposure inside versus outside the sealed pod?
  - The sealed wrapper of a (Twinkie®, potato chips, Little Debbie® snack cake)?
  - The drying rate of (wet gro-beasts, lipstick, wet paper)?
  - The mass and popping rate of popcorn kernels?
  - Kool-aid that has been mixed with water (will it turn back into powder)?
  - The survival rate of (mealworms, cockroaches, crickets earth worms) if internal temperature is constant?
  - An uncapped (Sharpie® marker, ball point pen) writing quality?
  - Sun print paper if it is covered with a sunglasses lens?
  - The size and shape of (marshmallows, Peeps®, gummi bears, an inflated balloon, a water balloon, lacrosse ball, contact lenses, crayons)
  - A density column of different liquids (tempera paint, water, oil)?
  - A running stopwatch (will it run faster or slower than one on the earth’s surface)?
  - The freezing temperature for water (at what altitude will it freeze)?
- At what altitude is noise at ground level no longer audible from the balloon?
  - How accurate are Habhub.org flight predictions when compared to the actual flight path?

OPS launches have been covered by KETV, KMTV, the Omaha World-Herald, *Grand Island Independent*, *Lincoln Journal Star* and [flyingclassrooms.com](http://flyingclassrooms.com). In addition to media coverage, the Omaha Public Schools’ Science Office records video using on-board cameras during the flight, capturing spectacular views of the landscape, clouds, and the balloon burst, as well as serving as a visual data collector for some of the experiments during the flight. The images are incorporated into a several-minutes long highlight video for each flight and posted on the OPS Science You Tube channel. Since 2017, the highlight videos’ soundtrack feature original compositions and performances

by Omaha Public Schools students. Links to each of these videos are provided in the accompanying spreadsheet. Since March 2016, OPS Sciences has tweeted about the missions using the hashtag #OPSHABxx (with the xx representing the mission number, starting with #OPSHAB29. OPSHAB28 used the hashtag #HAB28).

Some suggested videos might be helpful to better understand the process and build upon research previously completed by other OPS students.

- <https://youtu.be/l-JHtdsktME> (HAB 28, showing the highest altitude achieved by OPS and students doing initial observations of their projects)
- <https://youtu.be/Kb7MexohXPQ> (using one experiment from HAB 27 as a tool to inspire "I notice, I wonder")
- <https://youtu.be/6i1nFS6cZ4o> (HAB 34 from set up, launch, flight, recovery, and through initial analysis)
- <https://youtu.be/eQyOybEtE3U> (HAB 28 stills with altitudes listed)
- <https://youtu.be/Bob9HL9AkW0> (HAB 37 being set up prior to launch day)
- <https://youtu.be/j7DcqI43748> (1 minute "highlight" video)
- [https://youtu.be/4zWjRiq\\_Wxl](https://youtu.be/4zWjRiq_Wxl) (HAB 39: a 3 minute highlight video)

Some others videos from previous years include:

- Bryan High, May 2016 with principal on football field <https://youtu.be/MnzNSOkBQIQ>
- North High, May 2015 <https://www.youtube.com/watch?v=oG34ool7gww>
- Northwest High, April 2016 with time lapse of density column inside pod during ascent <https://youtu.be/jGmknFp6m98>
  
- Bryan High, May 2015 through rain <https://youtu.be/HLdsDkaB6VM>
- OPS HAB 3 with UNL from student perspective, Sept 2012 [https://www.youtube.com/watch?v=Nlu4Ja\\_zVTg](https://www.youtube.com/watch?v=Nlu4Ja_zVTg)
- UNL from university perspective, Sept 2012 <https://www.youtube.com/watch?v=Tn6dL6AZcrs>
- UNL from crowd's perspective, Sept 2012 <https://www.youtube.com/watch?v=T1IQNjQPAXE>

Schools who have had students' experiments launched into near space:

Alice Buffett Magnet MS  
Beveridge Magnet School  
Bryan Middle School  
King Science and Technology Magnet  
Nathan Hale Magnet Middle School  
Lewis and Clark Middle School  
McMillan Magnet Center  
Morton Magnet Middle School  
Norris Middle School  
RM Marrs Magnet Center

Benson High School  
Bryan High School  
Burke High School  
North High Magnet School  
South High Magnet School  
Northwest High Magnet School

Career Center  
Blackburn High School  
Acceleré  
Parrish

Zoo Kindergarten  
Ashland Park-Robbins Elementary  
Sunny Slope Elementary  
Miller Park Elementary  
Columbian Elementary  
Fontenelle Elementary

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