High Altitude Ballooning
At UND

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UND AEROSPACE
UNIVERSITY OF NORTH DAKOTA

UND SPACESTUDIES
University of North Dakota
www.space.edu
NORTH DAKOTA
SPACE GRANT CONSORTIUM

NASA
What is a High Altitude Balloon?

- Sometimes called a Weather Balloon or Near Space Balloon
- Filled with Hydrogen or Helium
- Carry scientific payloads high into the stratosphere
How High Does a High Altitude Balloon Go?

- Our balloons can go up to about 100,000 feet or 19 miles high (30.5 km)!
- That’s high enough that you can see the dark of space and the curvature of the Earth!
Activities

- Near Space Balloon Competition (NSBC)
  - Annual event, invite schools across North Dakota
  - Each team proposes, designs, builds experiment
- Mega Launch
  - Annual event, every student in eighth grade of Schroeder MS
  - April 29, 2015
  - Global Space Balloon Challenge
Collaborative Activities

- HASP (High Altitude Student Payload)
  - Working with University of North Florida
  - Since 2008, had proposal accepted and flown for NASA
  - Ozone sensor, pollutant gas sensors
  - Over the years, most workload shifted to UNF
The MEGA LAUNCH

- Started in October 2014, pre NSBC
- Continued in February, emphasis on April
- used surveys to assess STEM impact
- students filled out proposal forms...
High Altitude Ballooning Project

The Mission: You are the Research and Development team for a High Altitude Balloon launch to take place in April 2015.

Your Task:
1. Design a scientific experiment to fly with the balloon.
2. Submit a proposal.
3. Build a payload to carry your experiment.
4. Analyze the experimental results after the launch.

Part 2 - Submit a Proposal:

I. Describe your experiment ideas to your group then together decide which experiment you would most like to fly.

Group Name: _________________________________

Group Members:

The experiment we chose is:

________________________________________________________________________
________________________________________________________________________

II. In the space below describe how each member of your group will contribute to your experiment. All team members should contribute equally.

Example team roles:
Team Leader - manages the group's time and ensures that teammates stay on task
Chief Scientist - uses feedback from teammates to write a proposal (next page)
Payload Engineer(s) - design, build and install payload components
Payload Technician(s) - in charge of final payload preparations before launch (turning on sensors, etc.) and collection of data from payload
Budget Analyst - keeps track of materials and makes sure the experiment fits the specified requirements
**Payload Requirements:**

1. It can be any shape but must be no bigger than 6 x 6 x 6 inches.
2. The total weight of your experiment and payload must be less than 1 lb.

**Payload Limitations:**

- **Prohibited items**:
  - Animals (live or dead)
  - Anything hard that may explode (e.g., pop cones, aerosol cans, etc.)
  - Anything that may cause fire or burning
  - Cell Phones

- **Encouraged items**:
  - Plants/microbes
  - Digital Sensors
  - "Spacesuit"/innovative containers that may protect sensitive items (e.g., marshmallows, plants, etc.) from the conditions in near space.

The following list of sensors are available from UNO for use in your experiments:

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Sensor range</th>
<th>Quantity</th>
<th>Mass (grams)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>-150°C to 150°C</td>
<td>1</td>
<td>53</td>
</tr>
<tr>
<td>Oxygen</td>
<td>0-25%</td>
<td>1</td>
<td>160</td>
</tr>
<tr>
<td>Humidity</td>
<td>0-95%</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td>Pressure</td>
<td>0.700 kPa</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Magnetic Field</td>
<td>+/- 10 mT</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>CO2</td>
<td>350-10000 ppm</td>
<td>1</td>
<td>120</td>
</tr>
<tr>
<td>Acceleration</td>
<td>-30-80 m/s²</td>
<td>2</td>
<td>44</td>
</tr>
<tr>
<td>LVR</td>
<td>0-1500 mg/m²</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>Wide Range Temperature</td>
<td>-200°C to 1200°C</td>
<td>1</td>
<td>55</td>
</tr>
</tbody>
</table>

**III. Answer the following questions about your experiment:**

1. What hypotheses can be drawn from the experiment?
2. What will be the control group for the experiment?
3. What materials will be needed for this experiment?
4. How will the data be recorded?

**IV. Draw a sketch of your experiment (attach another sheet of paper if more space is needed):**
Example Experiments

- **Green Thumb**
  - send up seeds at different germination stages

- **Magnetic Monkeys**
  - Send up magnet + ferrofluid + camera

- **Flying Butter Socks**
  - send up cream + sugar + cold = ice cream?
Global Space Balloon Challenge

- Second year it has taken place
- Participation requirements:
  - Sign up on website, [www.balloonchallenge.org](http://www.balloonchallenge.org)
  - Fly with a camera
  - Launch between April 10 – April 27 2015
    - (unless weather causes delay)
- Great community, global community
- First year had 60 teams from 18 countries
There are 295 teams in 47 countries signed up
High Altitude Balloon Launch
Flight Coordinates and Information

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Launch Latitude</td>
<td>47.92530</td>
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<tr>
<td>Launch Longitude</td>
<td>-97.03250</td>
</tr>
<tr>
<td>Launch Elevation</td>
<td>257.0</td>
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<tr>
<td>Balloon Ceiling</td>
<td>30000.0</td>
</tr>
<tr>
<td>Est. Landing Elevation</td>
<td>257.0</td>
</tr>
</tbody>
</table>

UWYO Sounding Wind Data Site

Closest Site: INT.FALLS/FALLS_INT

Rise Rate Calculation

Ascent:

<table>
<thead>
<tr>
<th>Altitude [m]</th>
<th>Rise Rate [m/s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000.00</td>
<td>5.10</td>
</tr>
<tr>
<td>3000.00</td>
<td>5.10</td>
</tr>
<tr>
<td>4000.00</td>
<td>5.10</td>
</tr>
<tr>
<td>5000.00</td>
<td>5.10</td>
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</tbody>
</table>

Descent:

<table>
<thead>
<tr>
<th>Altitude [m]</th>
<th>Fall Rate [m/s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000.00</td>
<td>-5.00</td>
</tr>
<tr>
<td>3000.00</td>
<td>-5.00</td>
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<tr>
<td>4000.00</td>
<td>-5.00</td>
</tr>
<tr>
<td>5000.00</td>
<td>-5.00</td>
</tr>
</tbody>
</table>

Prediction Date/Time GMT:  Wednesday, 29 April 2015 at hour 14
Near Space Balloon Competition
2014

- Invited schools across North Dakota, K-12
- Received over 25 proposals from 9 different schools
- Accepted 7
- Including Mayport CG Science Geeks....