Revenge of the 6th
Conceptual Design Review

Team Members: Kieran O’Day, Phoebe Riley, Nate Bennett, Hayden Foote, Srikanth Venkataraman, Percy Bell, Adam Hu
Mission Overview

- Use geiger counters to test the radiation-blocking capabilities of materials that could be used in long-term human spaceflight applications.

- Manned missions to Mars by both private companies and NASA are planned within several decades.\textsuperscript{1,2}

- The astronauts aboard these spacecraft will need effective protection from cosmic rays and other radiation.

- Our mission will attempt to prove that low-cost and low-weight materials provide suitable protection.

- One geiger counter will be left unprotected, one will be shielded with polypropylene, and the third will be shielded with low-density polystyrene.
  - Both are low-density plastics

- Phoebe came up with this idea, and we were all interested in testing different materials that could shield radiation.
How to Complete the Mission?

- We will use two Arduino Uno microcontrollers to control the systems of our BalloonSat.
- One Arduino will control and record data from our standard sensors.
  - These include pressure, humidity, and temperature sensors as well as a 3-axis accelerometer.
- The other Arduino will control and take data from the three geiger counters.
- Each Arduino will have its own power system and data storage to compartmentalize our systems and minimize the cost of a component failure.
- In addition, we will use a GoPro Hero4 Session camera to take images of the Earth during our flight.
- After the flight we will recover our Balloon Sat and analyze the collected data.
- We will compare the shielded counters’ data to the control to assess the effectiveness of our radiation shields.
Design: Axonometric Representation
Design: Overhead
Design: FBD

Functional Block Diagram

Block Key
- Power/Thermal
- Storage
- Arduino
- Sensor
- LED

Arrow Key
- One-way comm.
- Two-way comm.

Arduino 2
- 9V Battery
- Switch
- LED

9V Battery x3
- Switch
- Heater

Imaging
- Camera
- 2GB SD Card

Heating
- LED

Each circuit on its own power system is outlined and labeled in bold.

Arduino 1
- Internal Thermometer
- External Thermometer
- Accelerometer
- Humidity Sensor
- Pressure Sensor
- Geiger Counter

2GB SD Card
- Arduino

Incorporating all elements for comprehensive functionality.
Management: Team Organization

- **Team Leader**
  - Adam

- **Science**
  - Kieran
  - Percy
  - Phoebe

- **Structures & Thermal**
  - Adam
  - Hayden
  - Srikanth
  - Percy

- **C&DH, Software, Power**
  - Hayden
  - Nate
  - Srikanth
  - Kieran

- **Systems Engineering**
  - Phoebe
  - Nate
Project Schedule

<table>
<thead>
<tr>
<th>Date Range</th>
<th>Activity Description</th>
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<tbody>
<tr>
<td>February 6 - 13</td>
<td>CoDR Presentation, finish detailed project proposal</td>
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<tr>
<td>February 13 - 20</td>
<td>Begin coding in Arduino, ATP appointment with Chris</td>
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<tr>
<td>February 20 - 27</td>
<td>Work on Preliminary Design Review (PDR) Focus on budget, weight</td>
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| February 27 - March 6 | PDR due March 2\textsuperscript{nd}  
|                    | Acquire sensors, all materials                                                      |
| March 6 – March 13 | Mid semester team evaluations  
|                    | Finish construction                                                                  |
| March 13 – March 20| Whip test, drop test, etc.  
|                    | Payload inspection by Chris (March 16\textsuperscript{th})                           |
| March 20 – March 27| In-Class Mission Simulator Test (March 23\textsuperscript{rd})                       |
| March 27 – April 3 | Work on Launch Readiness Review (LRR): Due April 4\textsuperscript{th}              |
| April 3 – April 7  | Present LRR  
|                    | Final touches, ensure everything works 5 times over                                  |
| April 8\textsuperscript{th} | LAUNCH DAY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!                                    |

Team Philosophy:

Work ahead every week; never fall behind

Plan:

2 meetings per week (T/R) optional 3rd on Sunday

Min. 5-6 Hours per person, per week
Budget

Geiger Tube : 19.99 x 3 = $ 59.97
Geiger Kit : 33.25 x 3 = $ 99.75
Low-Density Polystyrene Plastic: $ 7.14
Polypropylene Plastic: $ 13.83
Total: $ 180.69
Conclusion

- Future manned space missions will last multiple months, requiring effective radiation protection for the crew.

- When designing spacecraft, cost and weight are extremely important factors.

- If either or both of our shields prove effective, they will enable more lightweight and cost-effective spacecraft to provide the same radiation protection that more expensive designs currently do.
Bibliography