“Team Six”
Conceptual Design Review

Oregon State University
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Mission Overview

• Mission Statement
  • Any sustainable ecosystem contains organisms that are capable of living normally in that area. Extremophiles are organisms that live in a range of extreme environments thus, they are more likely to start ecosystems in space which can eventually lead to environments sustaining larger organisms.

• Mission Requirements
  • Successfully recording the extremophiles throughout their exposure to microgravity, while also quantifying the environment they are being sustained in.
Mission Overview

• Expected Discovery
  • We anticipate that our findings will prove that colonizing off of Earth is possible.
  • If extremophiles have the capability to thrive in microgravity, organisms can start forming an ecosystem that can later be inhabited by humans.
Mission Overview

• Those who will benefit
  • Biologists can gain from this experiment.
    • Knowing that microorganisms can thrive, ecosystems can be formed.
    • Also knowing which environments they thrive best in will assist researchers further.
Underlying Theory

• Extremophiles are known to be able to survive extreme environments, from temperatures near absolute zero up to environments near lava craters
• With most planets, besides Earth, having extreme environments, the extremophiles should be able to withstand microgravity
Further Theory

- Tartigrades have been sent into space before and survived.
- Tartigrades typically go into defense when they are put into these extreme environments, known as the process of cryptobiosis. We are hoping that our extremophiles do not undergo this process and maintain their natural activity levels throughout flight.
Previous Research

• Tardigrades have survived microgravity before
• Tardigrades have been frozen at levels near absolute zero and were still able to resume normal activity when taken out of the cold environment
• Plants in space have proven successful in being able to grow in microgravity, so a tardigrade’s food supply is possible to maintain
Minimum Requirements

- Systematically
  - Accelerometer recording changes
  - Cameras to observe extremophiles
  - Temperature probe measuring the environmental impact
  - Proper G-Switch activation
  - SD Card recording everything
Minimum Success

- Properly recording the extremophiles in their different environments, with respect to how the overall environment is changing
**Time Reference**

- **t = 0 min**
  - G switch triggered
  - All systems on
  - Begin data collection

- **t ≈ 1.3 min**
  - Altitude: 75 km

- **t ≈ 1.7 min**
  - Altitude: 95 km
  - Apogee
    - t ≈ 2.8 min
    - Altitude: ≈115 km

- **t ≈ 4.0 min**
  - Altitude: 95 km

- **t ≈ 4.5 min**
  - Altitude: 75 km

- **End of Orion Burn**
  - t ≈ 0.6 min
  - Altitude: 52 km

- **t ≈ 5.5 min**
  - Chute Deploys

- **t ≈ 15 min**
  - Splash Down

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Main Section of Interest
Expected Results

• Our anticipation is that we will find out how the extremophiles will react to the microgravity, with respect to their environments.
• This may be a defensive response or an unsuspecting response
Expected Results

- Our expectation is that the extremophiles will begin to protect themselves at first exposure, but then they will withdraw from defense when they recognize microgravity is not a threat to their well-being
Small, Low Power 3 axis +/- 16 g Accelerometer ADXL326

The ADXL326 accelerometer has 3-axis sensing and has signal conditioned voltage outputs. It can measure the static acceleration of gravity in tilt sensing applications, and can supply between 1.8 V to 3.6 V. We will use the accelerometer to record the axes from the start of the launch to landing.
Design Overview

SD Card and Flash

The following is are components for the schematic for the SD card and Flash. The SD card will be used to record all of the data throughout the launch. It will record acceleration on three axes, and data from the G-switch.
Design Overview

Blink LEDs

Three LEDs will be used to provide lighting for the three cameras. Cameras are used to help monitor the progress and reactions of the extremophiles tested during flight. Each LED is responsible for providing light for one camera and the cameras used will be distributed evenly on the Arduino shield.
Arduino Mega 2560

Our payload will also consist of an Arduino Mega 2560, which will be used to program to collect data during the launch.
Power Source

Two 5 Volt batteries will be used as our power source. An Arm LED will be implemented to keep track of when the power from the batteries run out. The power source is needed to run the Arduino board and to record data throughout the launch.

This will be activated by the G-Switch
Top Layer of Payload

The payload has three circles, each 2.5 inches from the center, and three smaller extruded circles that are 5.5 inches from the center. The larger circles will be small containers, each containing one of the three different environments tested during flight. The same type of microorganism will be used in all three containers.
**Bottom Layer of Payload**

The bottom layer of the payload consists of the G-Switch, the Arduino board, and the accelerometer. The thin wide rectangle at the top of the payload will be where the G Switch will be placed. The area on the left is where the accelerometer will be located, and the rectangle on the lower end of the payload is where the Arduino board will be.
3 Small Containers

Our payload includes three small containers. Each canister will have its own environment, but all three will contain the same microorganisms. Each canister will also hold a temperature probe, a small camera to record microorganism activities, and an LED.
Collaboration with LBCC

• Weekly meetings
  • To be determined
• Potentially systematically
  • On our bottom layer that holds the SD Card and the Accelerometer
Management

- Sophia
  - Schematics and Mechanical Design
- Cristina
  - Research and Data Collection
- Alexis
  - Communication and Management
Management

• Monetary Budget
  • To be further determined
  • Oregon Space Grant is going to match funding with other sponsors

• Mentors
  • Dr. Milstein
Fall Term Organization

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Conclusion

• Mission Statement
  Any sustainable ecosystem contains organisms that are capable of living normally in that area. Extremophiles are organisms that are capable of living in many extreme environments thus, making them capable of starting ecosystems in space that can eventually sustain larger organisms.

• Further Design Modification
  • The containment of the extremophiles are subject to change