The effects of a modified microalgae chlorella vulgaris under stratospheric conditions

Faith Alagan, Victor Bibriesca, Cristian Gonzalez, Anathi Kubeka, Brandon Mendoza, Christopher Miranda, Nathan Rossiter, & Maritrini Sarabia Mentor: Josue Juarez
Arizona Western College ASCEND! Team

Overview: Using a novel culture combination of *Chlorella Vulgaris* is it possible for it to survive within the constraints of the stratosphere? And how will it perform if it does?

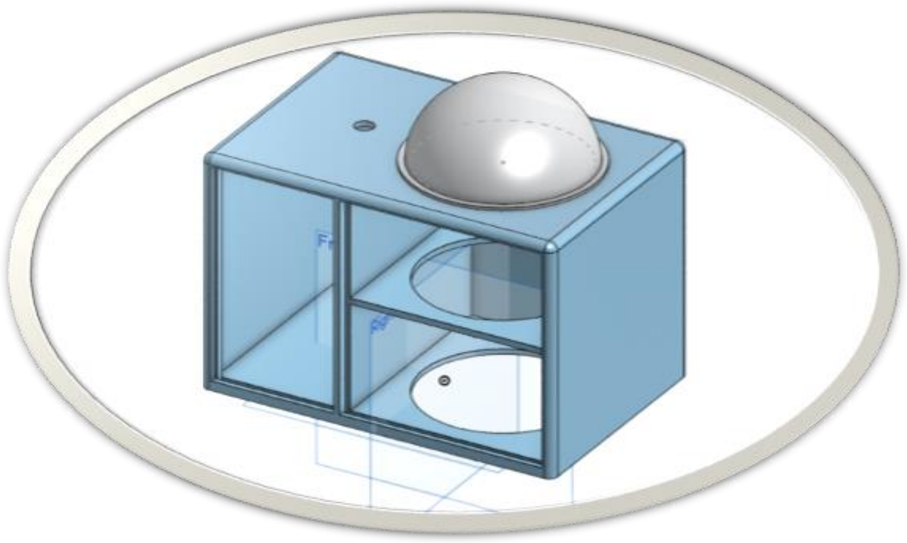
Introduction & Project Description:

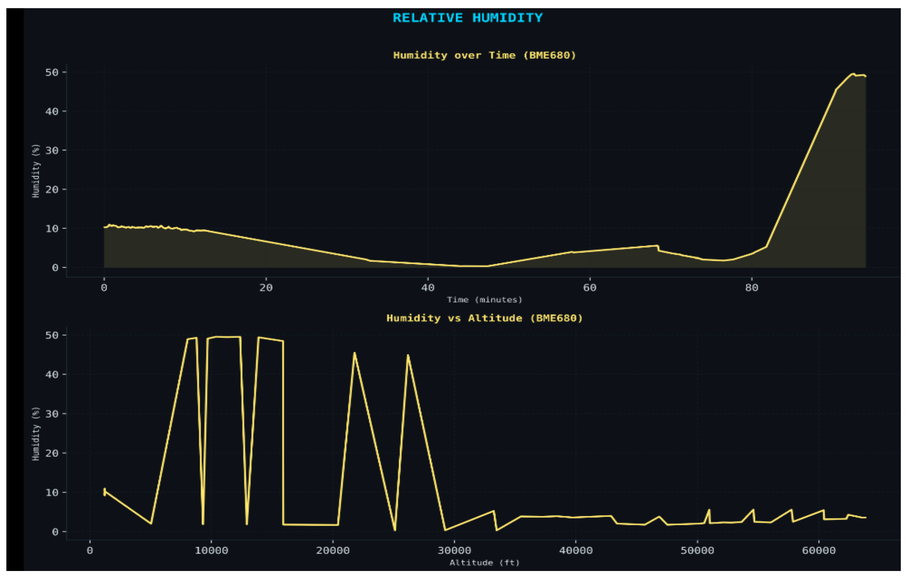
This work investigates whether a novel culture combination of Chlorella vulgaris can survive in the stratosphere and how it performs under extreme conditions. High-altitude balloon flights expose biological samples to harsh stratospheric environments including intense UV radiation, extreme temperatures, low pressure, and reduced oxygen. Environmental data collection documents the precise atmospheric conditions that Chlorella cultures experienced, enabling correlation of biological responses to specific environmental stressors at altitude.

Results:

During the flight, several sensors experienced intermittent cutouts, resulting in gaps across the dataset. The most reliable sensors were the O_2 and UV sensors, which produced consistent readings throughout. The CO_2 sensor cut out completely and yielded no usable data. Despite these limitations, the collected data revealed clear atmospheric trends: temperature and pressure decreased steadily with altitude, UV intensity increased with elevation due to reduced atmospheric shielding, and O_2 levels varied with atmospheric density as the balloon climbed above 60,000 feet.

*Design And structure composed by our structural team**





Graph by our electrical *team*

Data Collection and Analysis Methods:

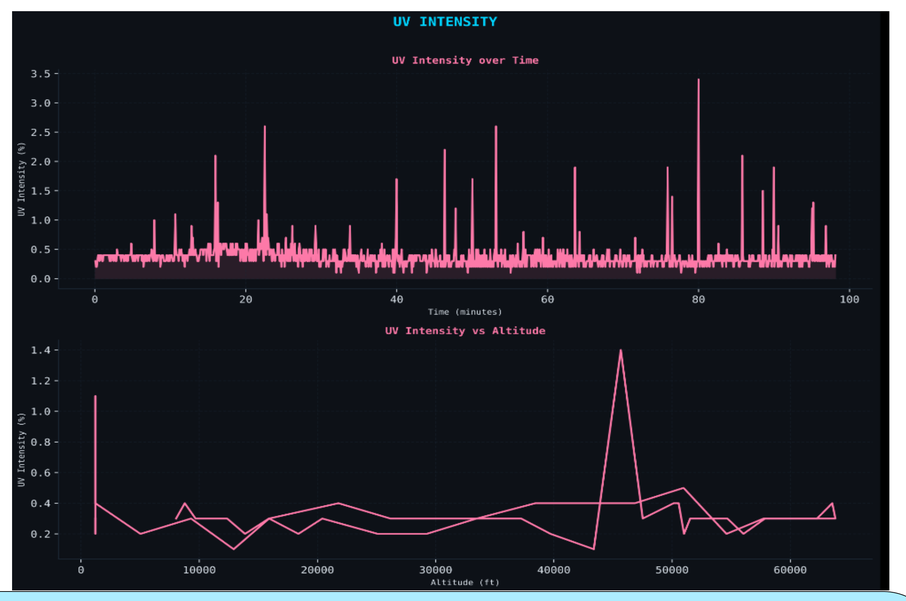
Three sensing systems collected data during the flight: a BME680 (temperature, pressure, humidity, and gas resistance), a UV sensor, and an O_2 sensor. A CO_2 sensor was included but failed to record valid data. All outputs were logged at five-second intervals over one hour and thirty-eight minutes. Data was cleaned in Microsoft Excel and graphed using graphing software to visualize trends across the flight profile.

Conclusion:

Despite exposure to extreme stratospheric conditions including temperatures of -5° F, pressures dropping to 100 hPa, and elevated UV radiation, the novel Chlorella vulgaris culture survived with observable changes. These findings demonstrate microalgae resilience and adaptation under extreme stress. This research has significant implications for astrobiology and space exploration

All graphs were made by our electrical team

Graphs on left and right show the change in oxygen and UV in respect to the altitude of the payload



Future Projects: Future work will focus on three key areas, reducing payload weight and improving sensor reliability, investigating the causes of sensor failures during the flight and implementing solutions to ensure consistent data collection, and developing a method to pressurize the capsule containing the Chlorella vulgaris with carbon dioxide to better determine if oxygen was produced during the stratospheric exposure.

2026 Arizona Space Grant Consortium
Statewide Student Research Symposium

ARIZONA WESTERN COLLEGE

NASA Partner