Research Questions
1. How can we avoid false negative biosignature results as we continue our exploration of life relevant to Mars missions as well as the Lithopanspermia hypothesis?
2. Would an alteration in the biological community and post-flight diagenesis affect interpretation of results for biosignatures?

Payload design
The original payload consisted of 4 microbial mat containers that were exposed to all outside factors, a foamcore shell with an insulated foam casing that contained all of the hardware (sensors, wiring, and micro-controllers). We used a netting to leverage the microbial mat samples for full exposure to UV radiation and it was supported by carbon-fiber rods. UV sensors were exposed at the sample level. The second payload contained all of the components shown in Figure 3. The second launch included minor engineering changes and the biological sample still included 4 microbial mat containers as well as 4 isolated live culture petri dishes (Figure 4). Internal and external temperature and pressure were also monitored.

Figure 1: Early morning balloon launch

Figure 2: March 2015. Students at Badwater, CA sample retrieval site.

The Red Rocks Community College DemoSat Program
The Colorado Space Grant Consortium is a state-wide program that provides Colorado students access to space through innovative courses, real-world hands-on satellite programs, and interactive outreach programs. The Red Rocks Community College launched the first DemoSat project in 2015. We are funded by NASA as part of the National Space Grant Program. The students were encouraged to develop, test, or invent a new experiment that could further the understanding of aerospace and engineering concepts. Inspired by astrobiology, the students at Red Rocks Community College decided upon an experiment that would test the resiliency of extremophilic bacteria when launched into the stratosphere on a high-altitude balloon.

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The Red Rocks Community College Team consisted of 21 members during the spring launch. Seven of those members continued with the program throughout the course of the summer. The team designed a unique DemoSat flight package and obtained permission from the National Park Service for collection of the microbial mats from Bad Water, CA. The team devised a unique approach for studying the microbial community response to edge of space conditions focusing on viability studies and DNA probe analysis. The students launched a payload which included 4 biological samples mounted for exposure. The payload also included 12 sensors which measured data such as ultraviolet intensity, internal and external temperature, pressure, humidity, and many others. The experiment was conducted two times, once on April 1st and was repeated again on August 1st.

Figure 3: The first high-altitude balloon flight was conducted on April 1, 2015. Samples are mounted in the netting to allow for maximum exposure.

Figure 4: The second launch was performed on July 1, 2015. The design was altered to allow for mounting of petri dishes for exposure, in addition to the suspended sample takers.

Results
The CellRox Green reagent test provided us with a 100 percent false positive due to over-saturuation of the dye, this test resulted in inconclusive results because it dyed cells that were damaged due to oxidative stress and dyed cells that were not impacted. The BacLight test provided us with results that showed approximately a 10 percent viability. Some errors occurred while conducting the research:
1. The stain concentration was oversaturated.
2. The staining procedure occurred 4 days after the high-altitude balloon flight resulting in too long of a time span for the bacteria to recover and multiply.

Excellent team work and learning experience
CellRox Green Test was oversaturated and resulted in a 100 percent false positive