

# Cell Research Experiment In Microgravity (CRExIM) Suborbital Payload: Operational Testing and Design of a 2U NanoLab



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## Abstract

CSO and AE students are working together with students and faculty from UTHSCSA and MUSC to launch a suborbital payload onboard Blue Origin's New Shepard rocket set in Summer of 2017.

## Introduction

CRExIM project is a multidisciplinary effort between various colleges at ERAU and other universities nationwide. This experiment will be exposed to microgravity for about 3 and a half minutes, and consists of T-cells primed with different cytokines that may help us expand our understanding of future treatments for terminal diseases. This project involves critical phases in payload integration, engineering, science, preflight operations, in-flight operation, and post-flight operations.

**Flight Operations:** Responsible for the overall operating efficiency during pre-flight and launch. This includes the development of procedures used to accomplish launch objectives while assuring requirements are met.

**Engineering:** Responsible for the design, analysis and development of the 2U cube-structure that will house the experiment and will be capable of withstanding the forces experienced during the suborbital mission.

## Mission Objectives

- Detailed operating procedures for all tools, instruments, and personnel for pre-flight and launch
  - Determine an efficient and reliable method of determining data logger delay time
  - Integration of subsystems into 2U NanoLab (10 cm x 10 cm x 20 cm) before launch



## Hardware

- Marathon Products edl-XYZ Data Logger
  - Temperature
  - Relative Humidity
  - Vibrations
- Marathon Products edl-4S Data Logger
  - Temperature
  - Relative Humidity
  - Vibrations
  - CO<sub>2</sub> Levels

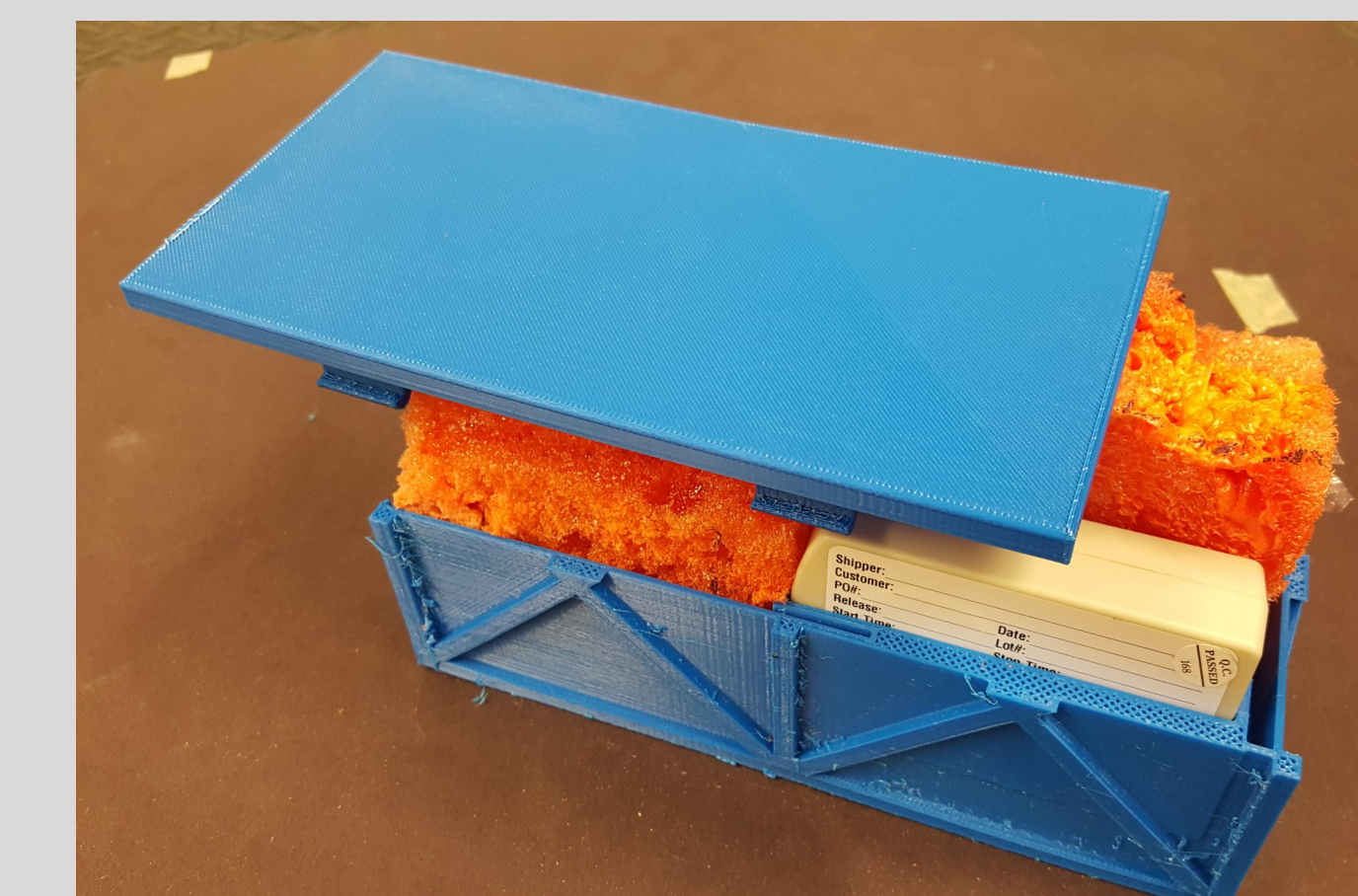


## Deliverables

- edl-XYZ user's manual
- edl-4S user's manual
- Pre-launch checklist
- Post-launch recovery procedure
- MATLAB code for time delay
- Data Analysis

## Materials

- Structure**
  - ABS plastic
- Vibration Dampener**
  - GREAT STUFF - polyurethane spray foam
- Thermal Protection**
  - Aluminum Tape
- Sealant**
  - Waterproof Tape
- Onboard Sensor**
  - Marathon edl-XYZ
- Experiment Container**
  - Eppendorf Tubes
- Experiment Sealant**
  - Ziploc Vacuum Seal Bags



## Future Work

- Level two and three certified rockets will be flown with a 3D printed payload bay to physically launch and test future payloads and compare to computer analyses.
- New designs will be made for experiments that will require a small contained life support system

## Results & Conclusion

- Payload is compliant with Blue Origin launch regulations.
- ANSYS Simulation found that the structure can withstand 15 G's.
- ABS was found to surpass all requirements while maintaining a low weight.



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