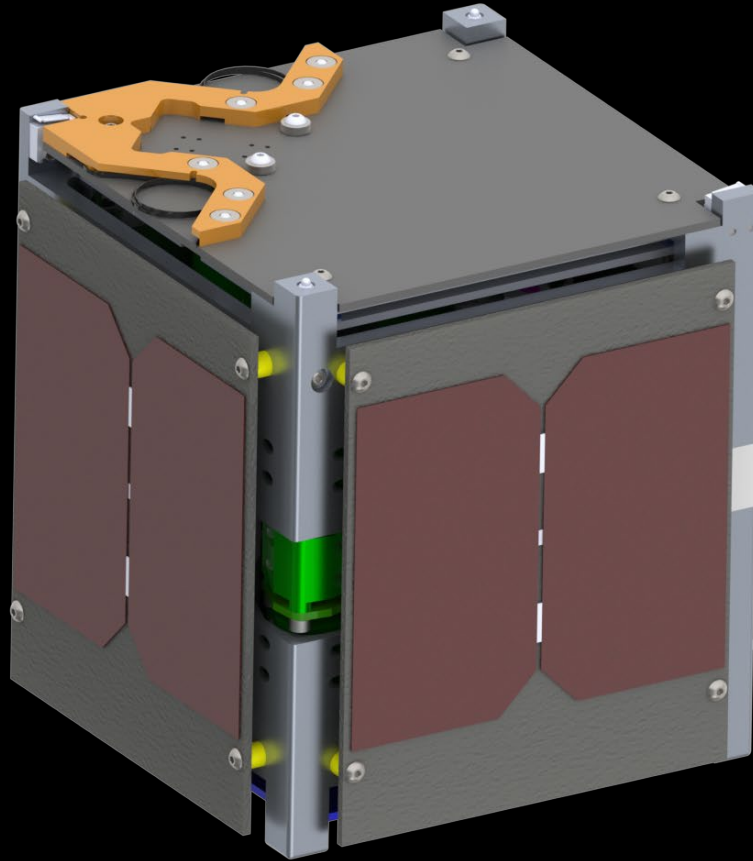


# Damping and Vibrations Experiment

On-Orbit Performance of a CubeSat Particle Damper



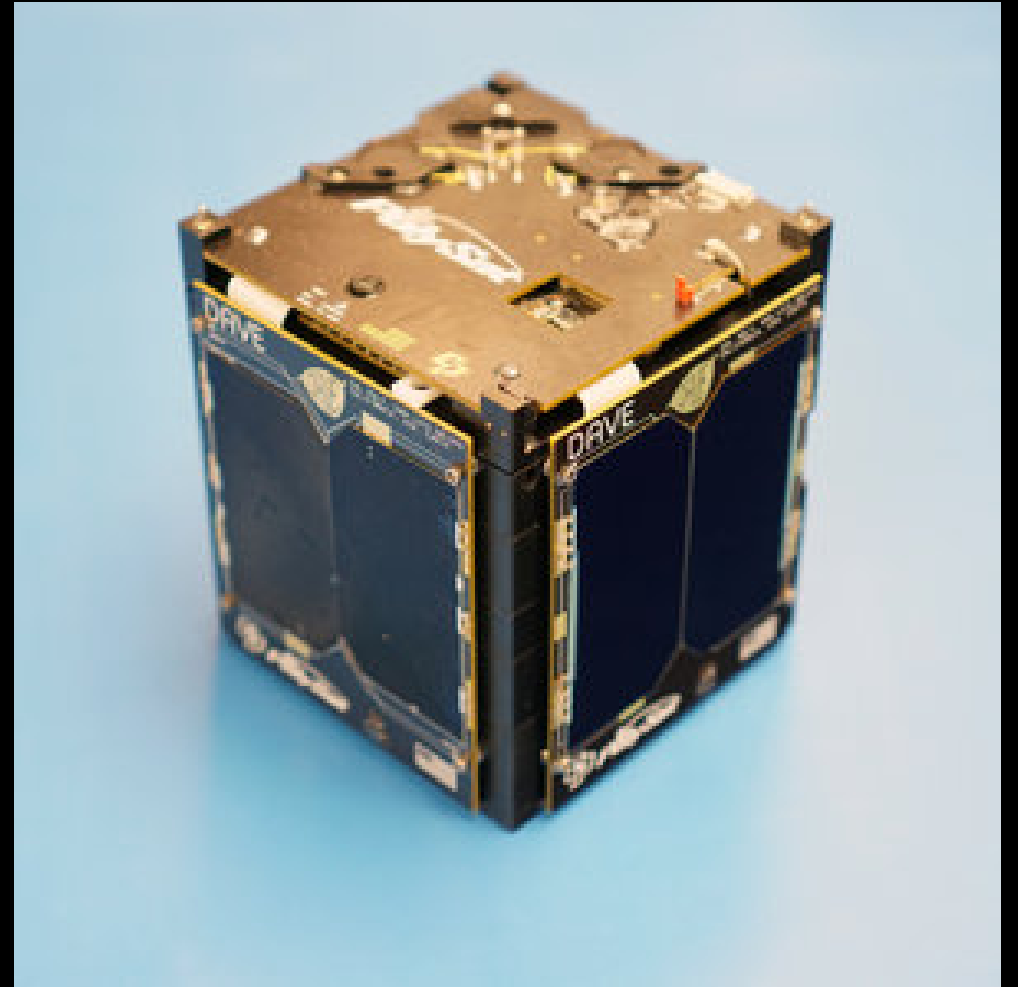
California Polytechnic State University San Luis Obispo

# What is DAVE?

- 1U CubeSat
- Particle Damping Experiment
- 3MP Camera
- New Antenna Restraint System
- Cal Poly and Northrup Grumman
- Project began over 10 years ago
- Previous flight on ZERO-G airplane



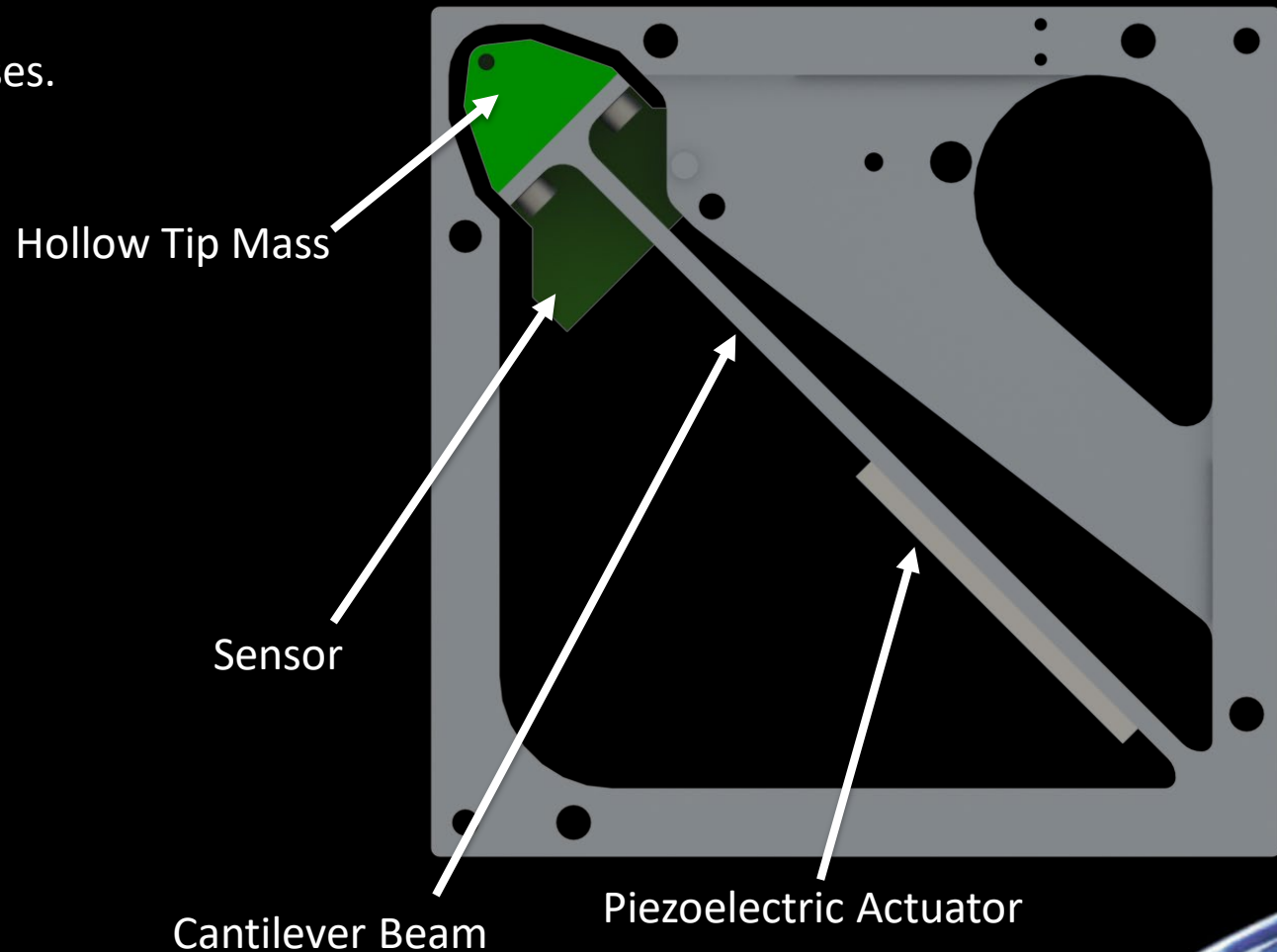
***NORTHROP  
GRUMMAN***



How do particle dampers  
behave in the space  
environment?

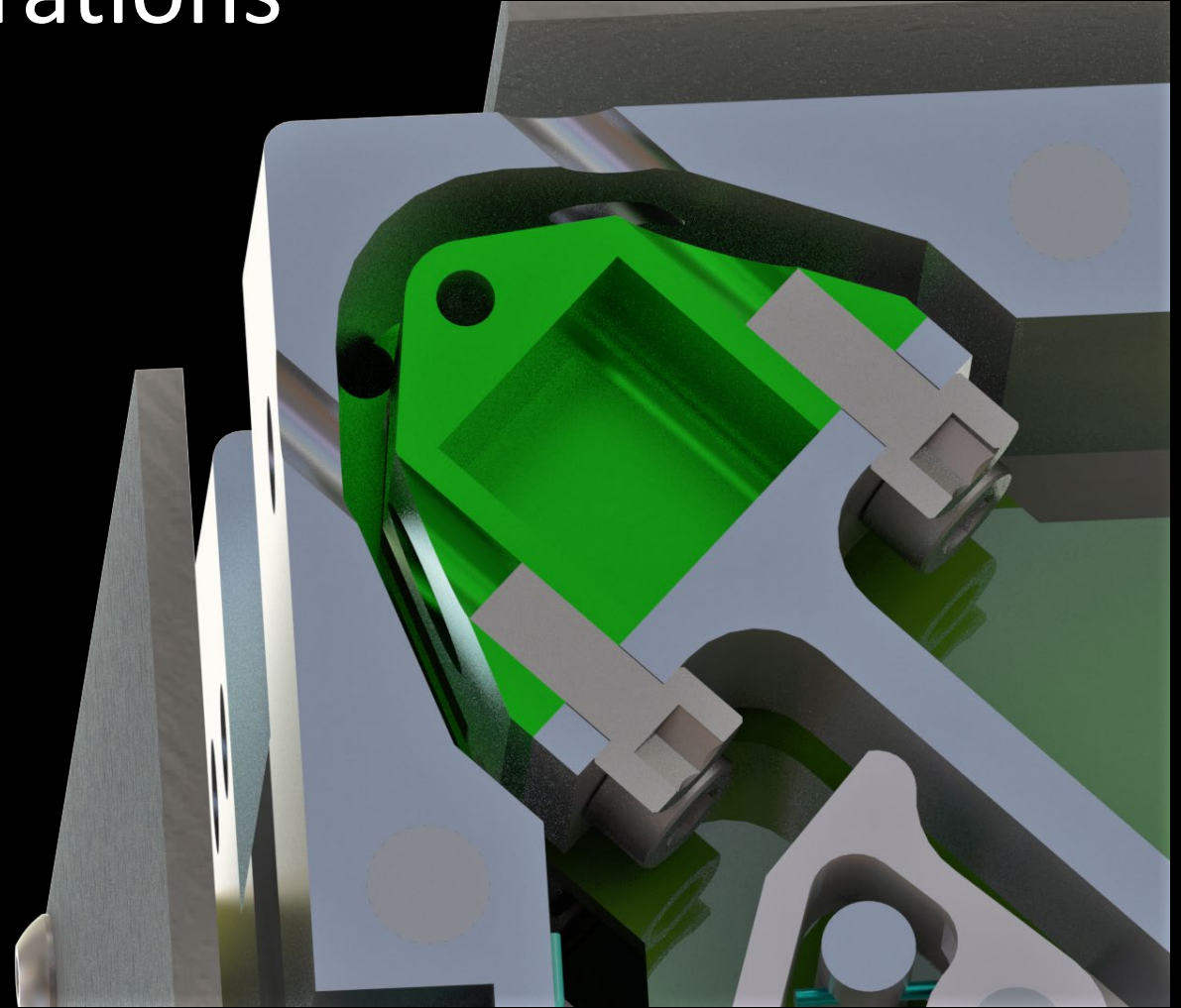
# Experimental Design

- Three cantilever beams with hollow tip masses. Each beam is slightly different mass due to damping material.
  - Empty control
  - 90% Fill Ratio
  - 95% Fill Ratio
- Piezoelectric actuator to excite each beam
- Sensor to record the response of the beam



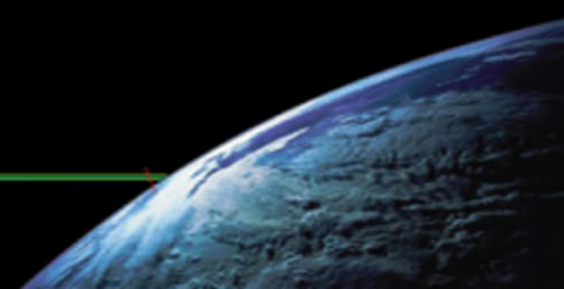
# Damping Cavity Considerations

- Damping Material – Tungsten Powder
  - Dense
  - Uniform shape
  - Significant ground testing
- Cavity size of  $0.742 \text{ cm}^3$ 
  - Based on desired mass
  - Calculated from fill ratio & packing ratio
- Cubic cavity to decrease orientation dependence

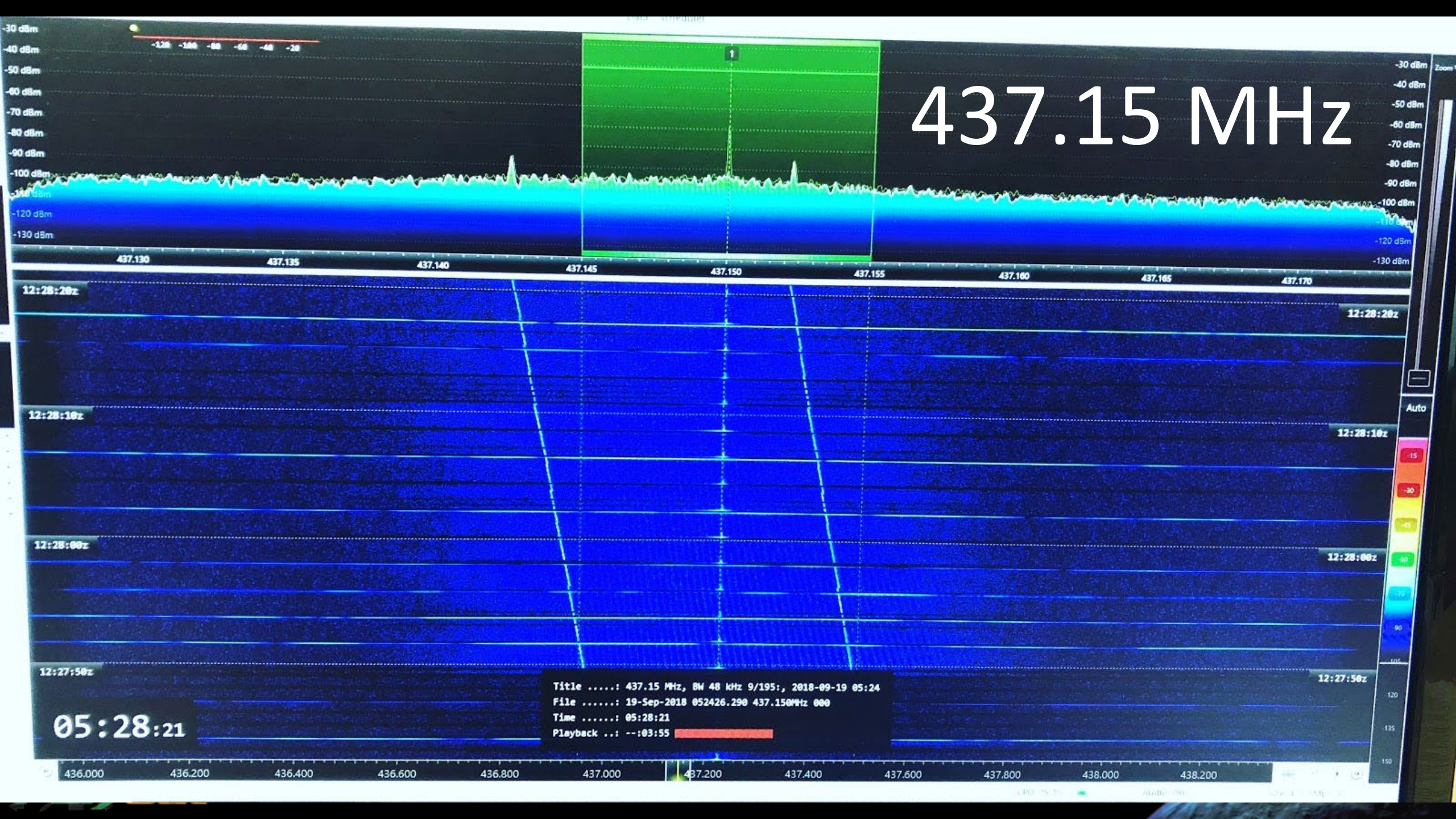


# Mission Objectives

- Capture vibration data from all three beams on the spacecraft
- Analyze vibration data to determine the effects of particle damping in the space environment
- Capture and transmit images of Earth with onboard camera

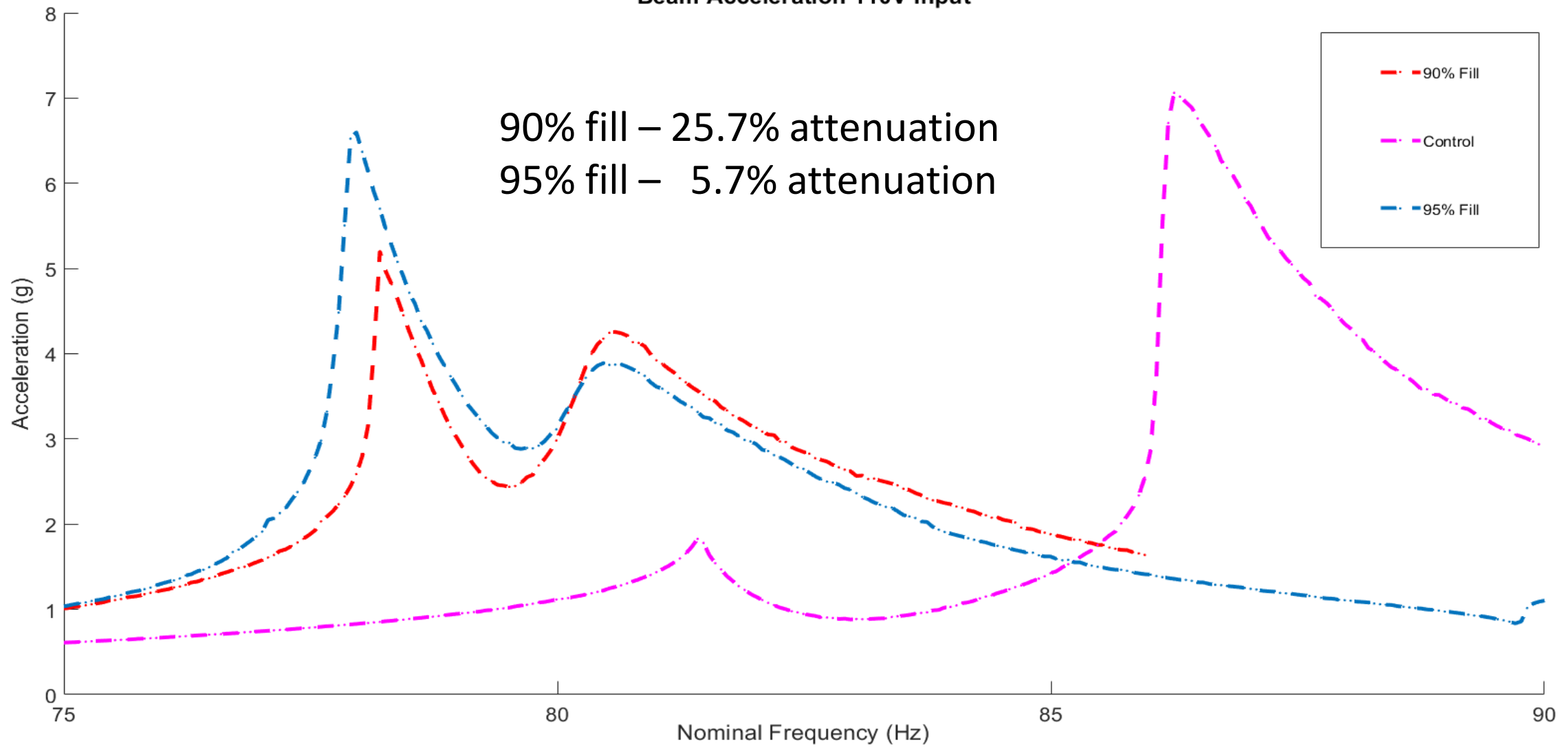








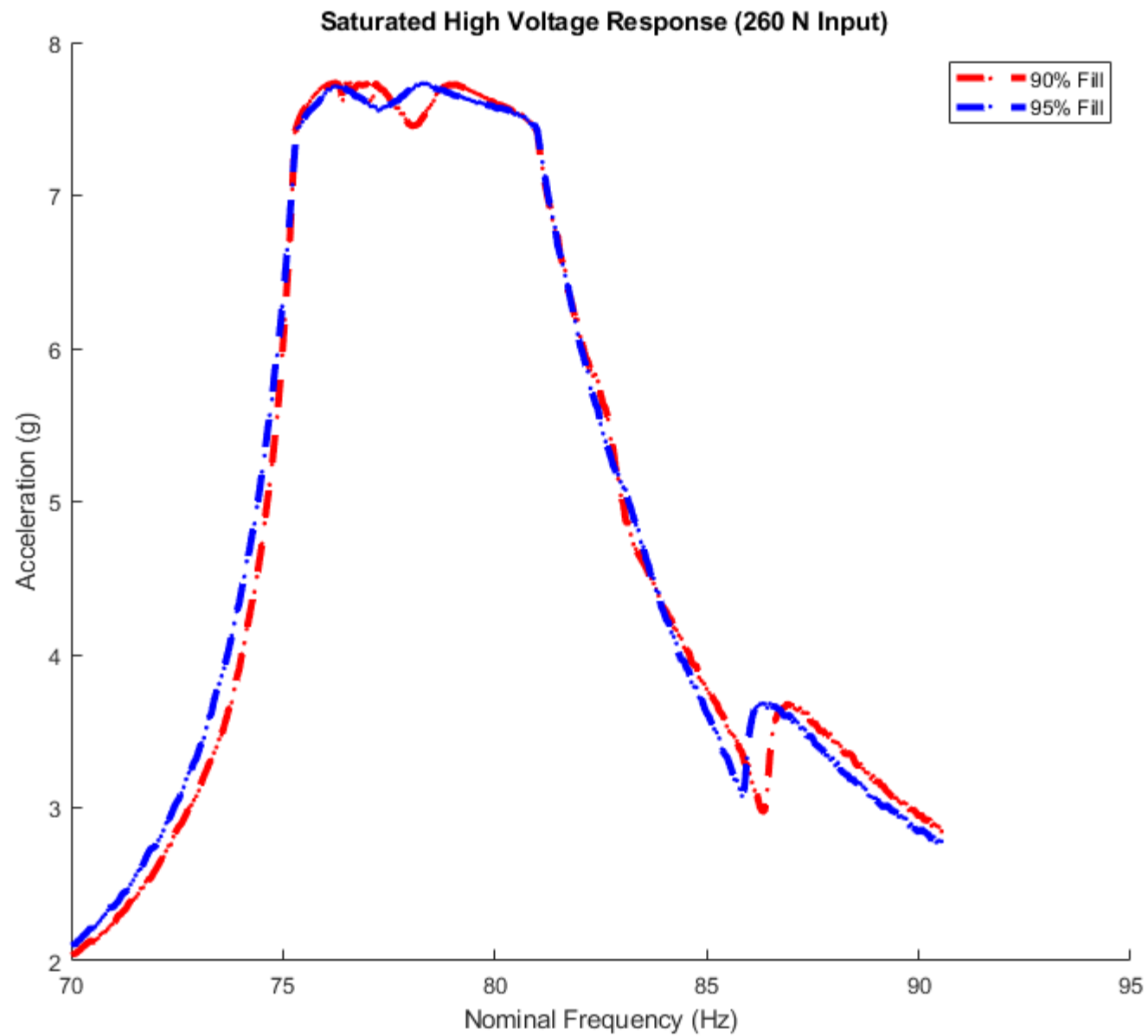
# Beam Acceleration 110V Input



Beam Response: 82 N Input



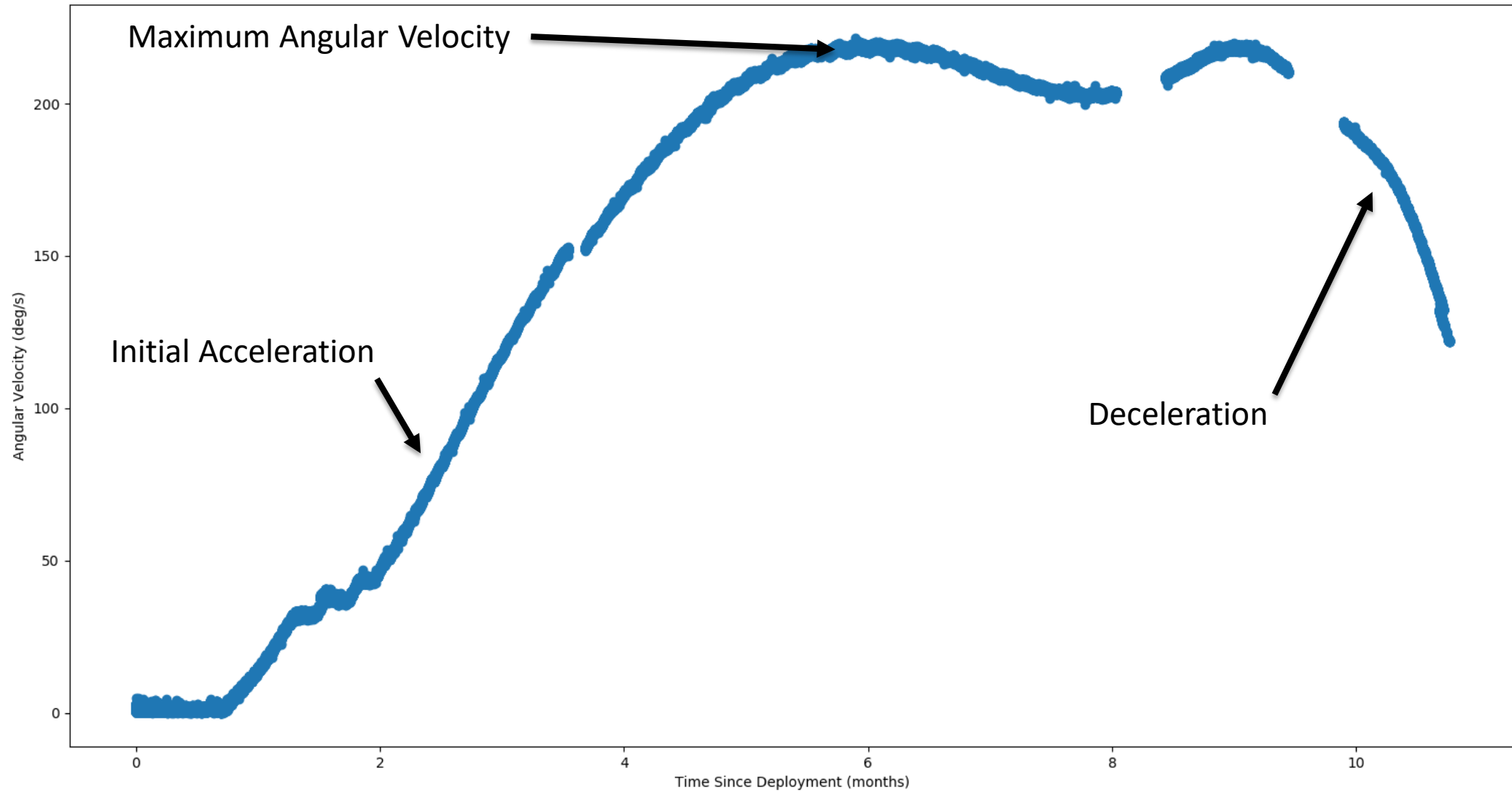




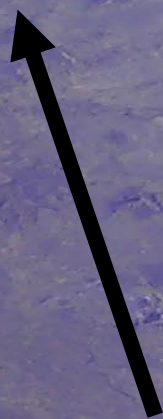
Beam Response: 260 N Input

# Operational Anomaly

DAVE/CP7 Angular Velocity about Z-Axis







Logan, UT



CUBESAT

Taken by DAVE/CP7 (Cal Poly)



A satellite image of Earth from space, showing a curved horizon and a detailed view of a coastline. The land is brown and textured, with some white patches. The ocean is dark blue. The sky is a lighter blue with some white clouds.

# Mission Success!

The CUBESAT logo features a stylized satellite icon above the word "CUBESAT" in a bold, sans-serif font.

**CUBESAT**

Taken by DAVE/CP-7 (Cal Poly)



# Contact Us!

Come see us at our booth!

Booth U1 & U2

Michael Fernandez

[mferna32@calpoly.edu](mailto:mferna32@calpoly.edu)

Cal Poly CubeSat Lab

[polysat@calpoly.edu](mailto:polysat@calpoly.edu)

