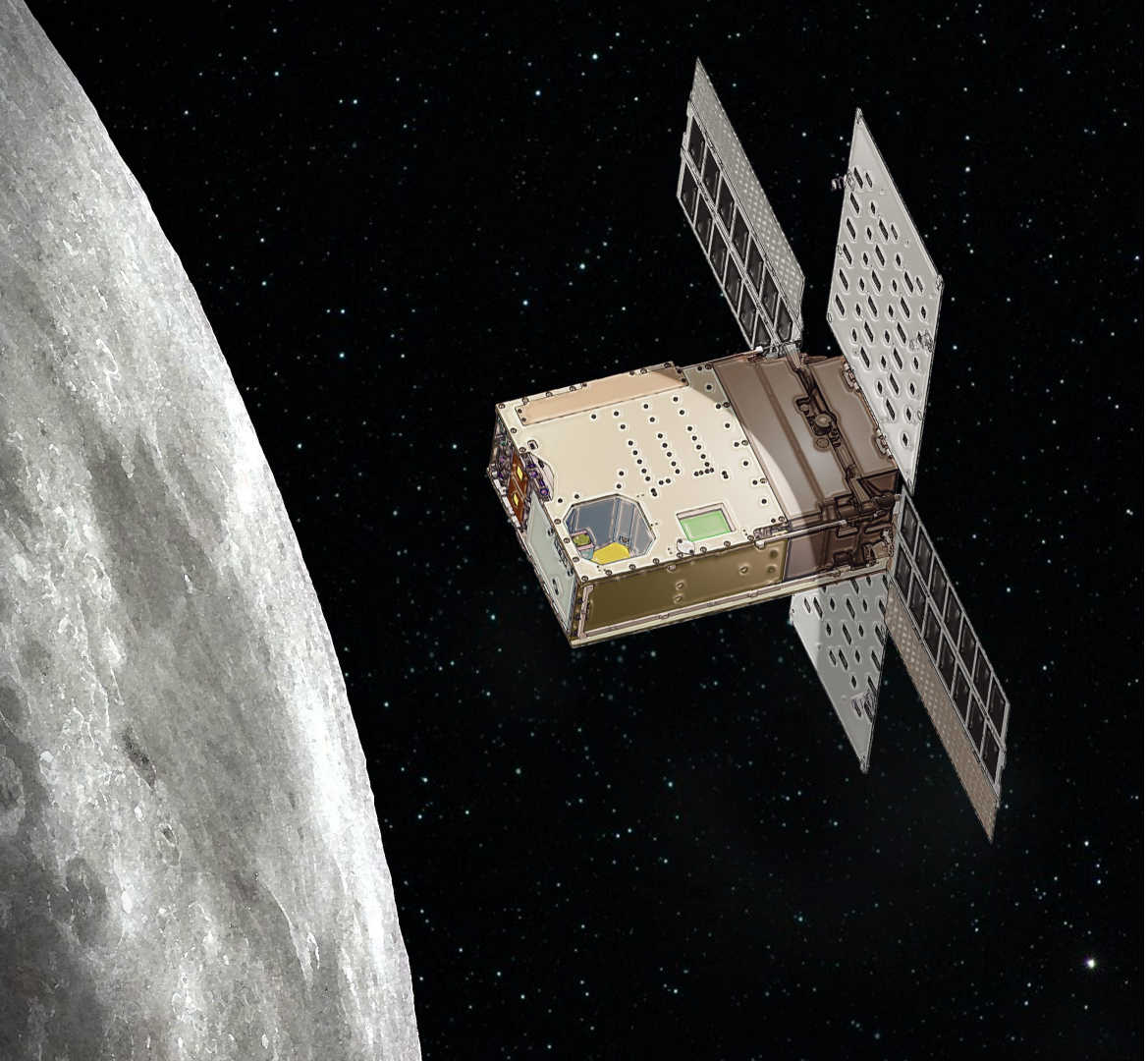


Systems Integration and Test of the Lunar Flashlight Spacecraft

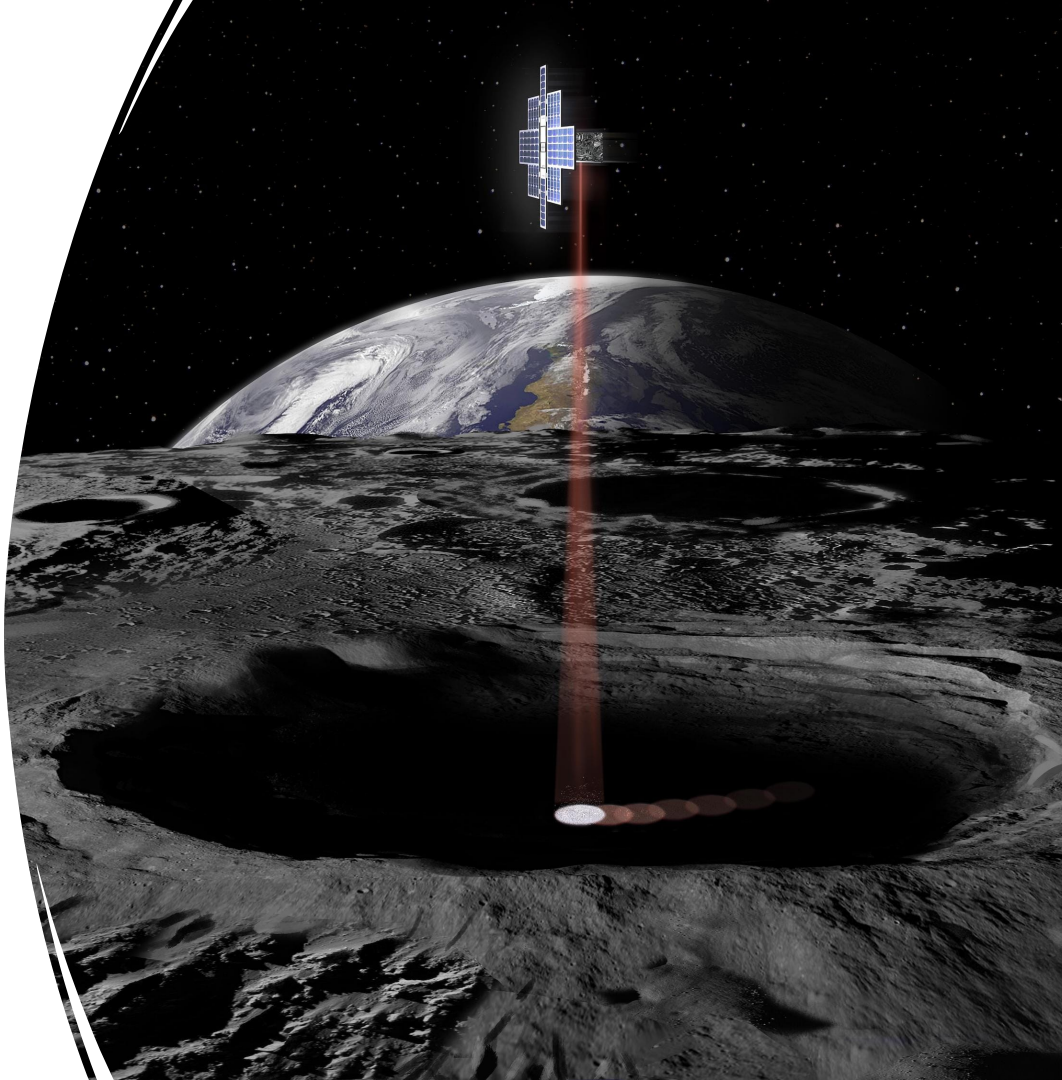
Celeste Smith

August 8, 2022

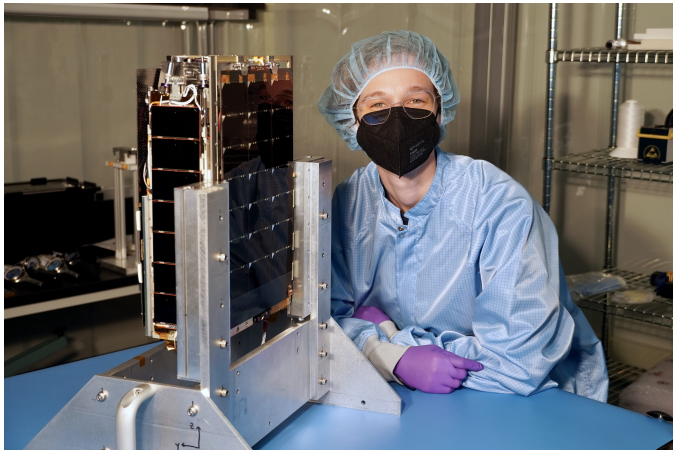
Jet Propulsion Laboratory
California Institute of Technology

Lunar Flashlight Mission

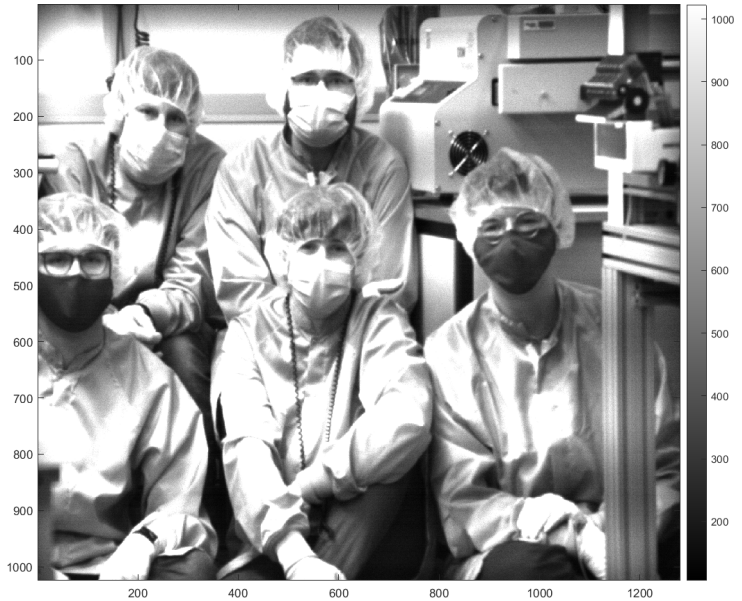
- 14kg 6U CubeSat
- Launching early 2023 alongside IM-1 lunar lander
- ASCENT green monopropellant propulsion system performs Lunar Orbit Insertion (LOI), Trajectory Correction Maneuvers (TCMs), and Reaction Wheel Desats
- Four-point infrared spectroscopy payload searches for surface water frost in permanently shadowed craters



I&T Team



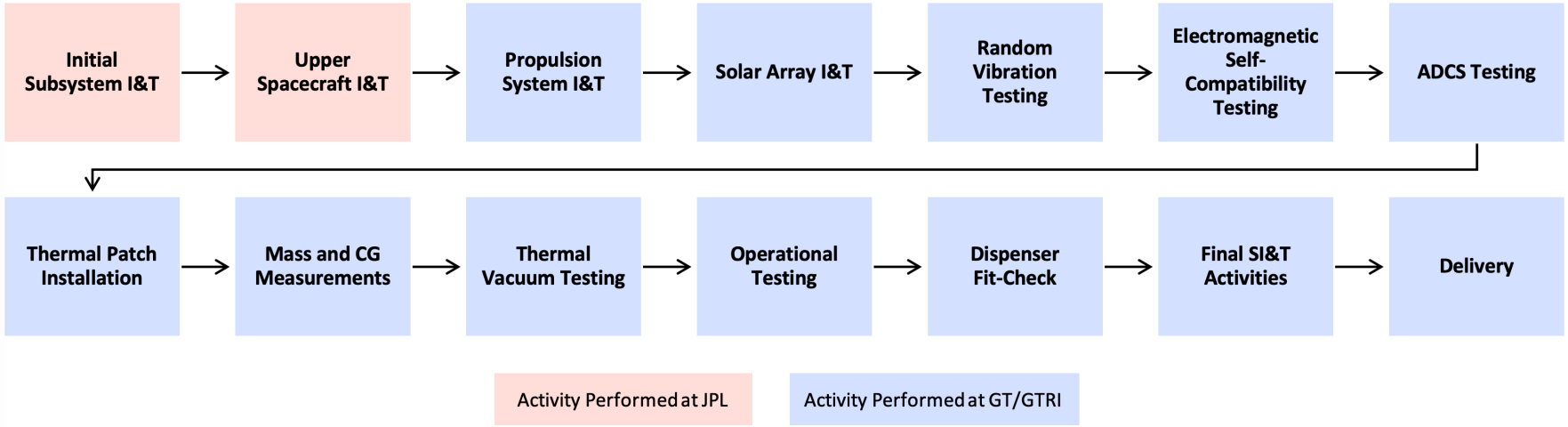
Celeste Smith (Georgia Tech / Jet Propulsion Lab)



Members of I&T and Ops teams at Georgia Tech (BCT XACT Star Tracker Camera Test)

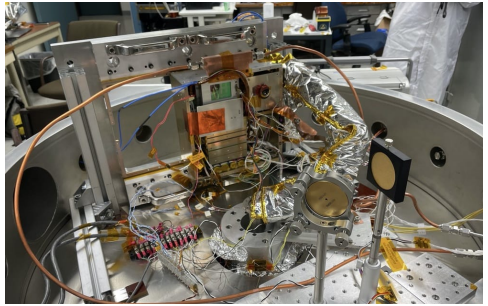
Philippe Adell, Conner Awald, Vinh Bach, Eric Brown, Missy Catlin, Nathan Cheek, Jesse Cortez, David Duperre, Collin Gonzalez, Ian Harrison, Michael Hauge, Dylan Jean-Baptiste, Zhitao Kang, Ryan Lewis, Lacey Littleton, Dillan McDonald, Jishnu Medisetti, Duy Nguyen, Mason Placanica, Ben Quick, Jud Ready, Valentin Richter, Chad Ryan, Paul Simmons, Celeste Smith, Mason Starr, Shannon Statham, Brandon Vaughan, and Yuelan Zhang

Lunar Flashlight Systems Integration & Test Flow

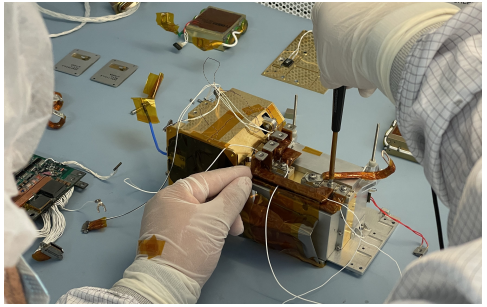


Integration Overview

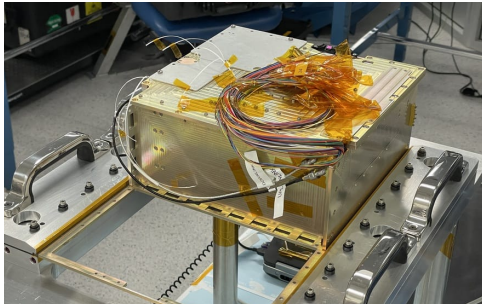
- Integration at JPL
  - Avionics
  - Telecom
  - ADCS
  - Science Instrument Payload
- Integration at GT/GTRI
  - Propulsion System
  - Solar Arrays
  - Thermal Patches
  - Peripherals



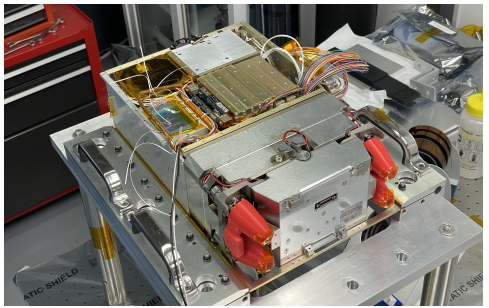
Payload End-To-End Test During Integration



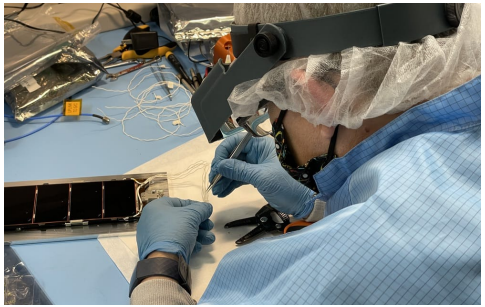
Payload Integration at JPL



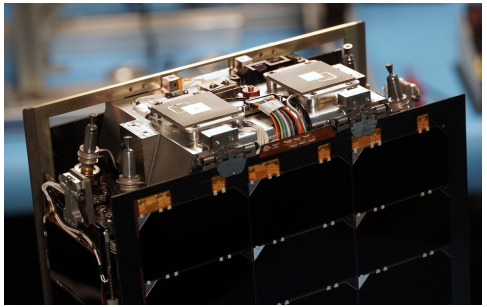
Upper Spacecraft Integrated at JPL



Propulsion System Integrated at GTRI

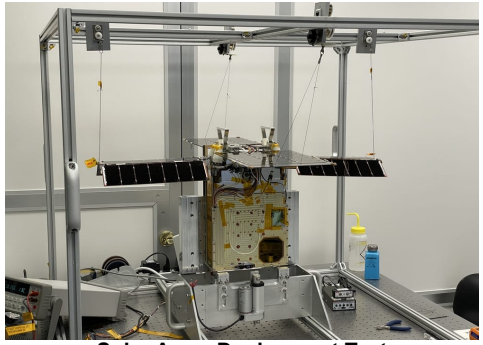


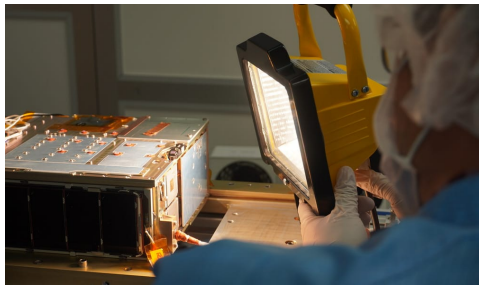
Solar Array Harnessing at GTRI



Solar Arrays and “Muffin Tin” Peripherals

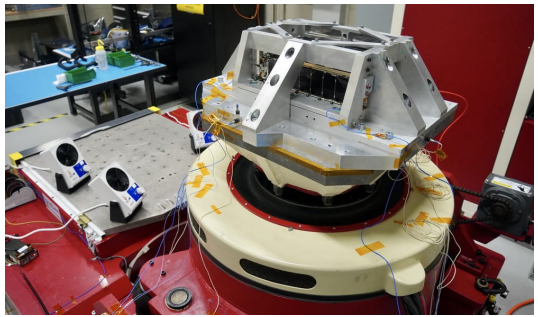

Propulsion System Functional Test

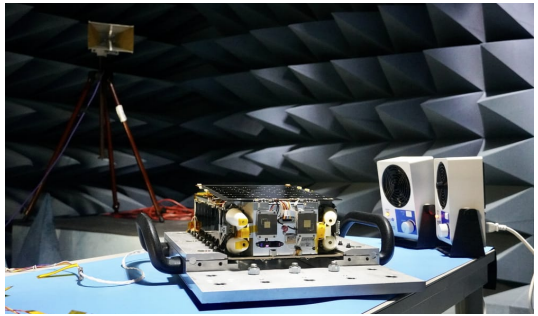

Solar Array Deployment Test

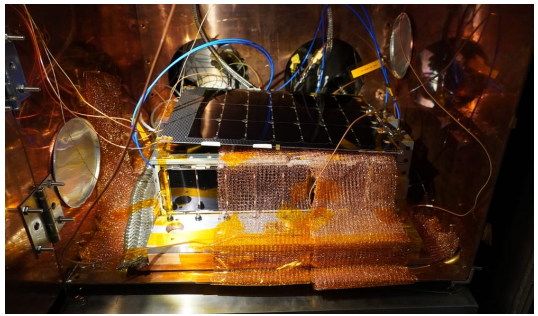

Sun Sensor Phasing Test

Test Overview

- Functional Tests
  - Propulsion System
  - Solar Arrays
  - ADCS
  - Science Instrument
- Environmental Tests
  - Random Vibration
  - Electromagnetic Self-Compatibility
  - Thermal Vacuum


Random Vibration (GTRI-CCRF)


EM Self-Compatibility (GTRI-CCRF)

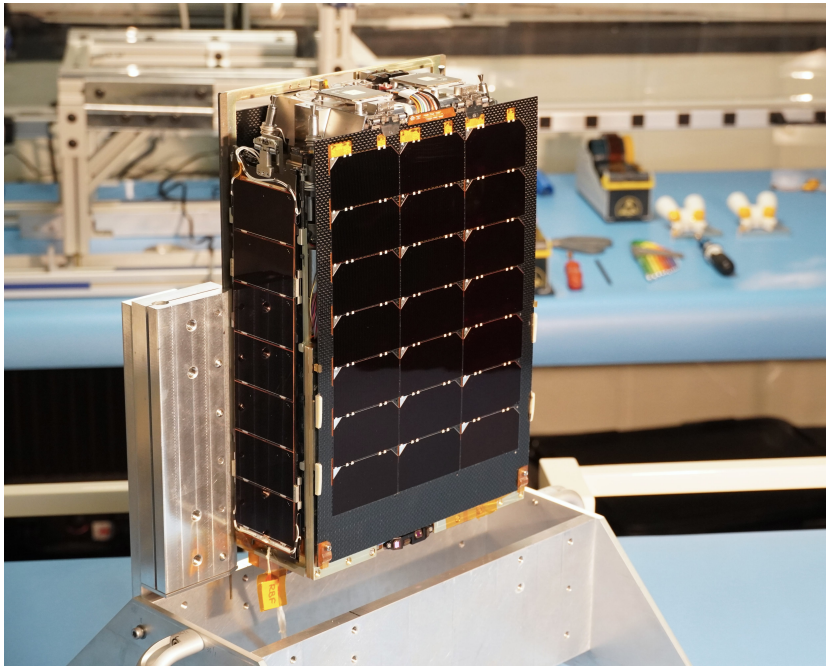

TVAC (GT-AE)

Preparing for Operations

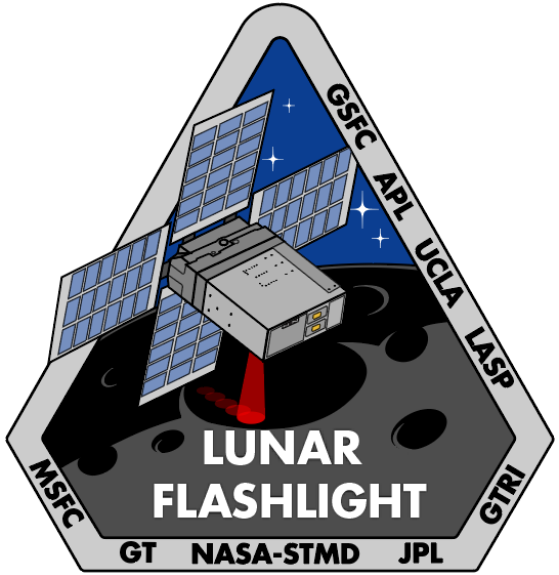
- Close collaboration between SI&T and Ops teams
- Ops team gained hands-on experience with flight hardware
- Learning Opportunities:
  - Flight Software Updates
  - Operating S/C During TVAC
  - Day-In-The-Life Test
  - Fault Protection Test

GT Operations Team Performing Day-In-The-Life Test with LF Spacecraft

Conclusion



- Lunar Flashlight is awaiting fueling this fall
- Scheduled to launch early 2023
- Will be operated by Georgia Tech using JPL's Deep Space Network
- Demonstrating new technology in the CubeSat form-factor:
  - ASCENT propulsion system
  - Infrared laser reflectometer science payload



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