Lessons Learned from Operating in the Radiation Environment of a Highly Elliptical Orbit

Hezekiah Austin*, Chris Major, Jake Davis, Tyler Holliday, Rubin Meuchel, Connor Parrott, Zach Hull, David Klumpar, Larry Springer, John Sample, & Brock LaMeres

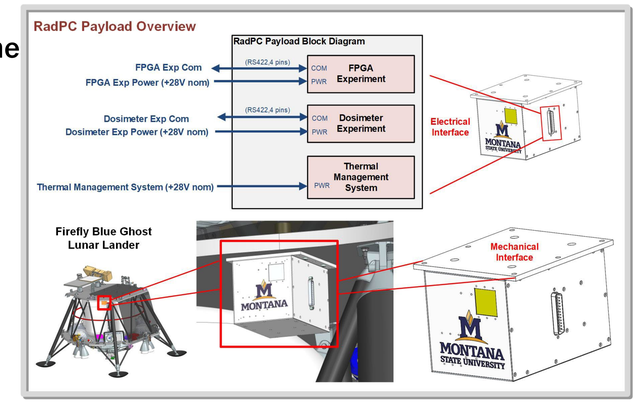
(*corresponding author: hezekiah.Austin@resilient-computing.com)

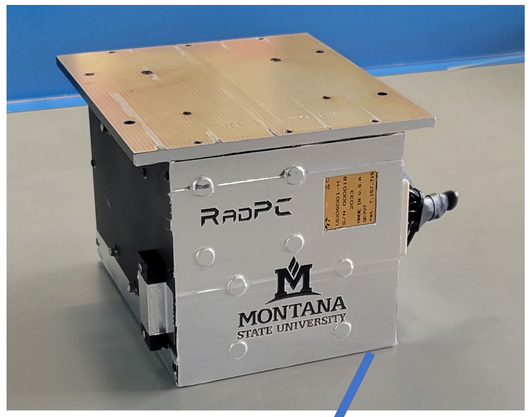
Introduction

- In January of 2025, the Firefly Aerospace Blue Ghost Mission 1 (BGM1) lunar lander launched as part of the 19D task order through NASA's Commercial Lunar Payload Services (CLPS) program.
- One of the payloads it carried was the "Radiation Tolerant Computer", or RadPC.
- RadPC tested a novel FPGA-based computer technology designed to recover from single-event-effects (SEEs).
- The RadPC payload also carried three dosimeters tuned to different energy levels to measure total ionizing dose (TID).

Payload Design

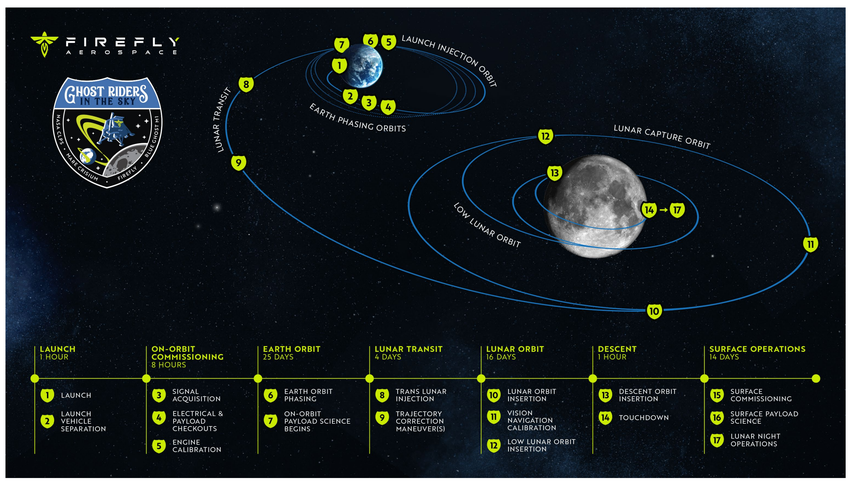
- The payload held 3x subsystems: 1) Radiation-tolerant computer; 2) Dosimeters; 3) Thermal Management
- The radiation detectors used the Teledyne *uDOS* solid-state sensors.
- The payload streamed telemetry data continuously to the lander for downlink.



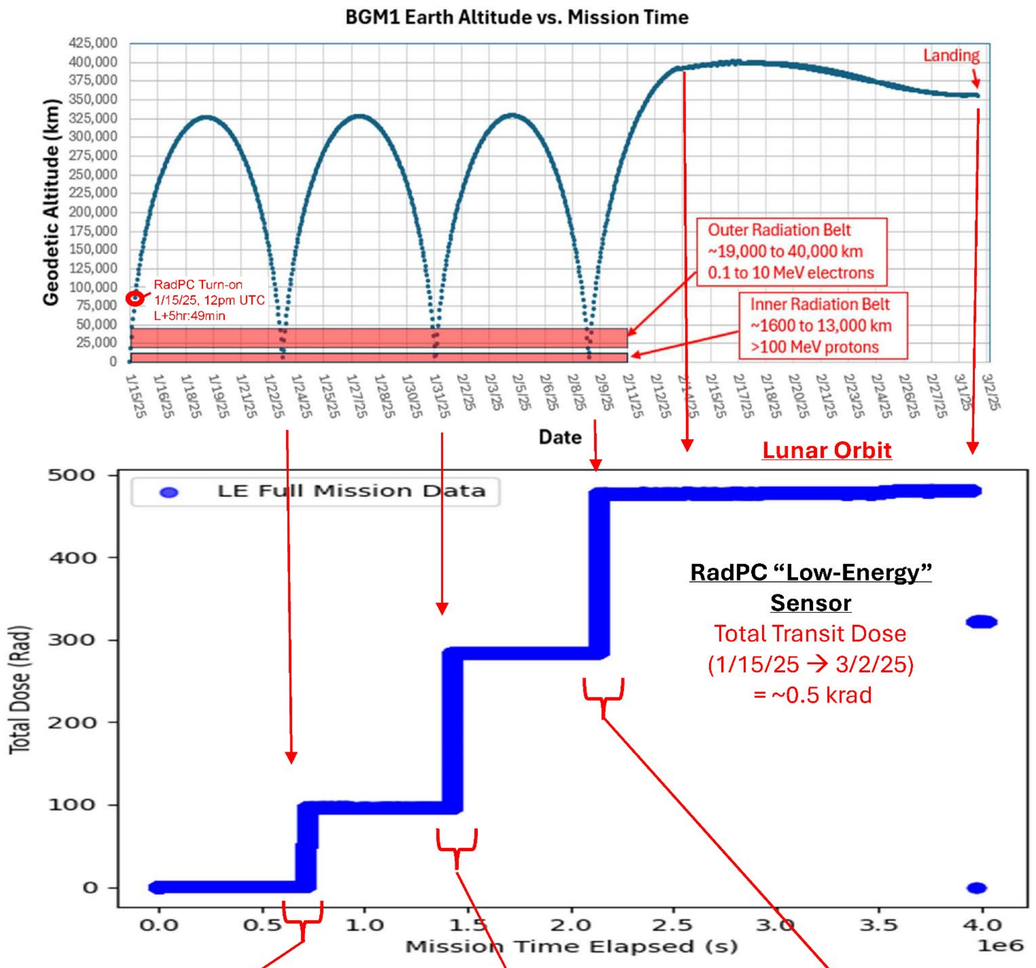


Mission Plan

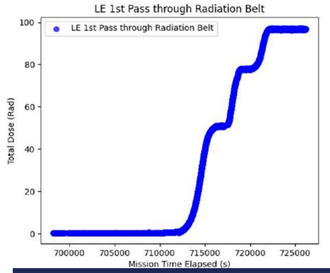
- The lunar transit took ~45 days beginning with a highly elliptical orbit around earth.
- During this time, BGM1 operated RadPC during three passes through the Van Allen Belts.



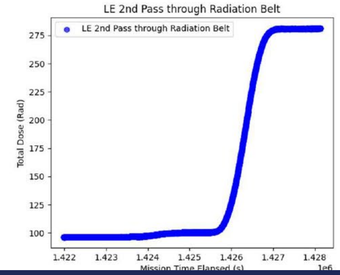
RadPC Dosimeter Data vs. Mission Time (1/15/25 → 3/2/25)



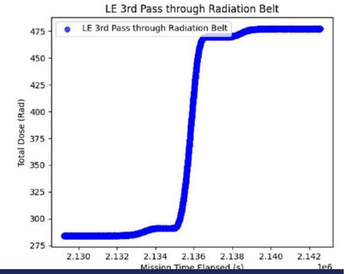
Zoom of 1st Pass



Zoom of 2nd Pass



Zoom of 3rd Pass



Take Aways

- The majority of TID occurred when passing through the Van Allen belts.
- SEEs are the primary concern outside the Earth's radiation belts.

2025 Small Satellite Conference
Salt Lake City, UT. August 10-13, 2025
Poster Reference: SSC25-P2-60

This material is based upon work supported by the National Aeronautics and Space Administration under Grant/Contract/Agreement No. 80MSFC20C0032 issued through the Lunar Surface Instruments & Technology (LSITP) Program.