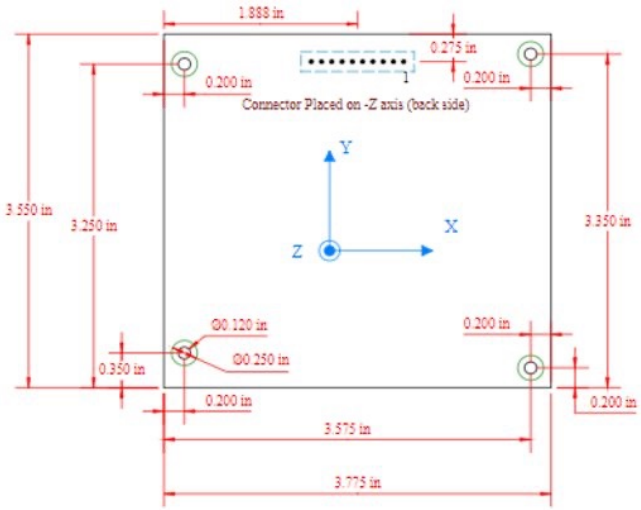
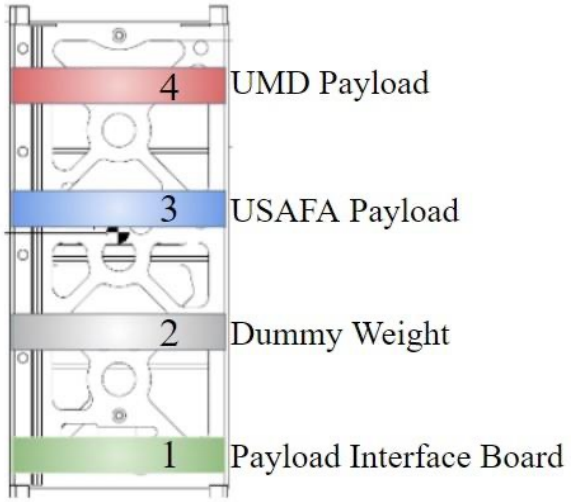
FALCON-RAD

23 April 2024





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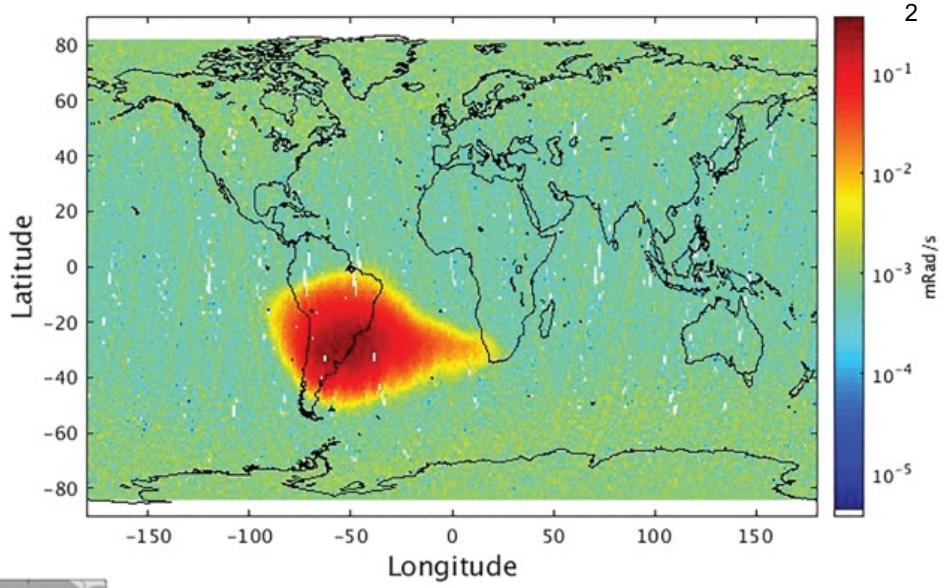
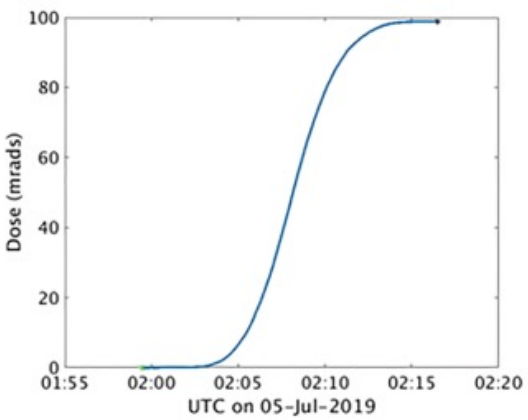
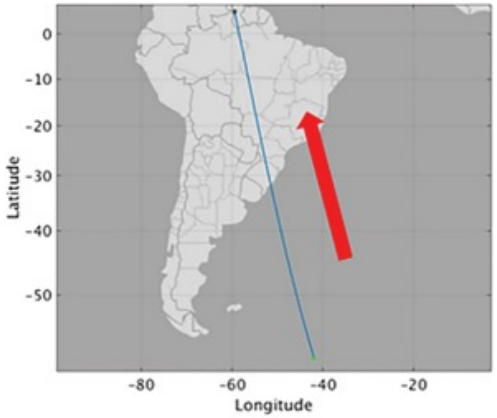
Research Purpose

- South Atlantic Anomaly (SAA)
  - Misalignment of Earth's dipole magnetic field & rotation axis
  - Results in weaker magnetic field in south
- Allows high energy particles access to LEO



[2]



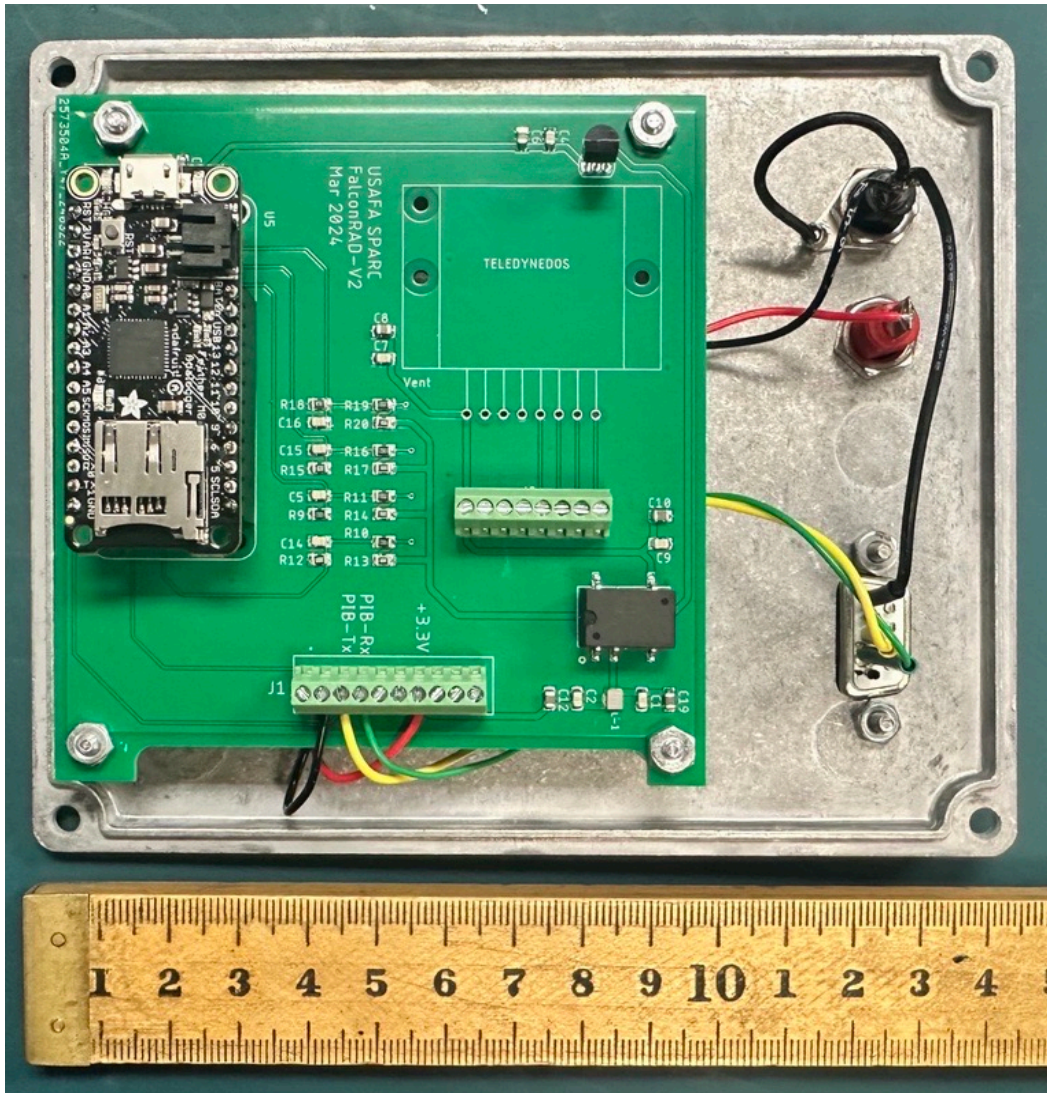


[2]

Energetic electrons primary cause of spacecraft charging [2]

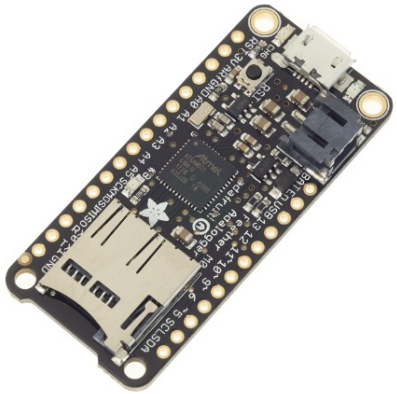
Charging caused more than half (161/198) of documented environmental anomalies[1]

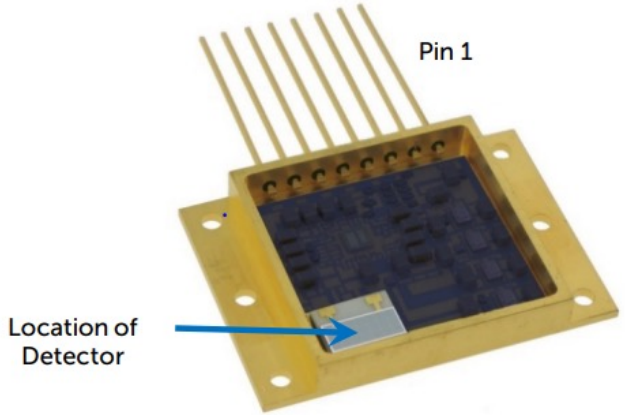
Component Overview



Component Overview

- Adafruit Feather M0 Adalogger
- Teledyne UDOS001-c commercial off the shelf micro-dosimeter
- TMP-36 Temperature Sensor





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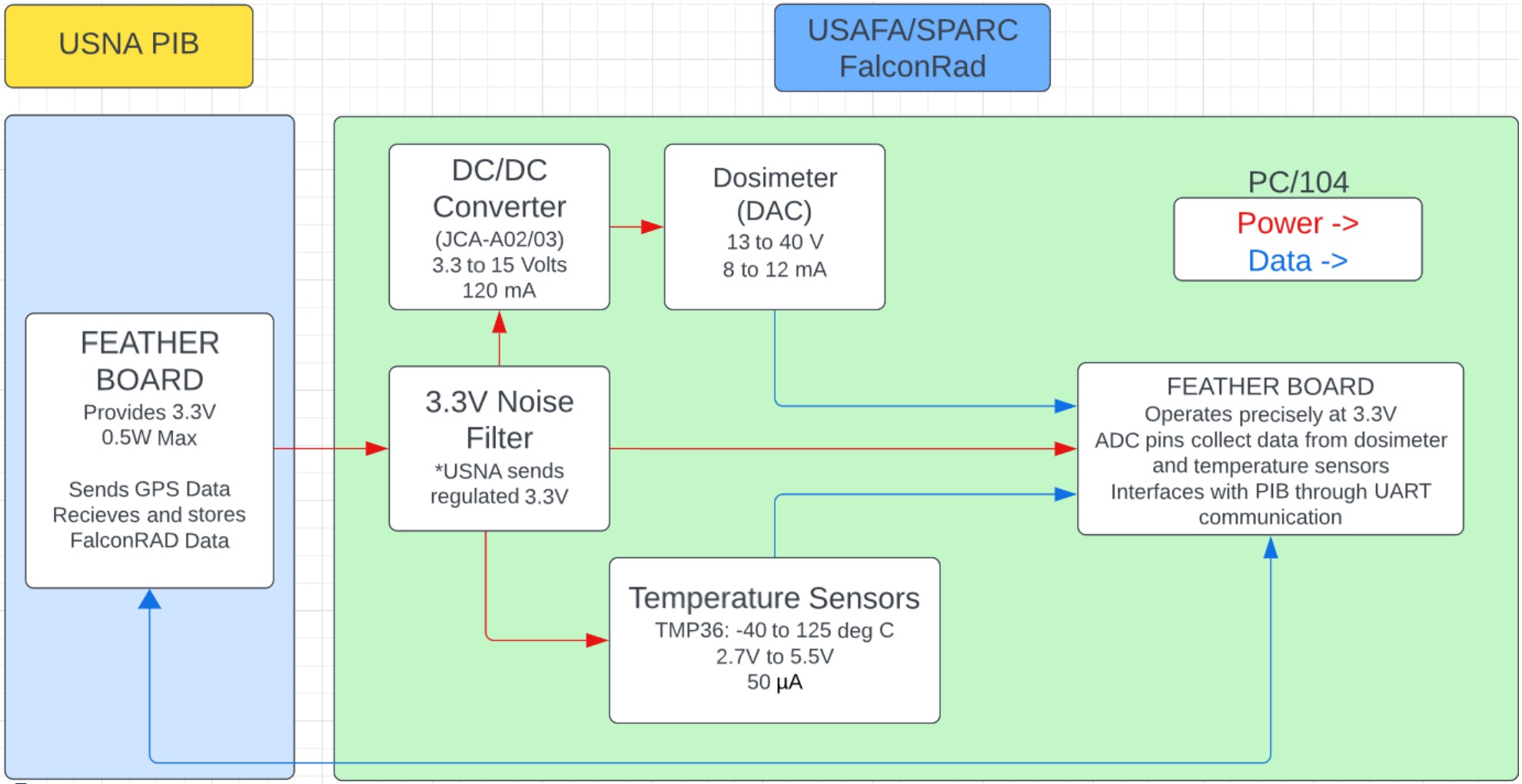
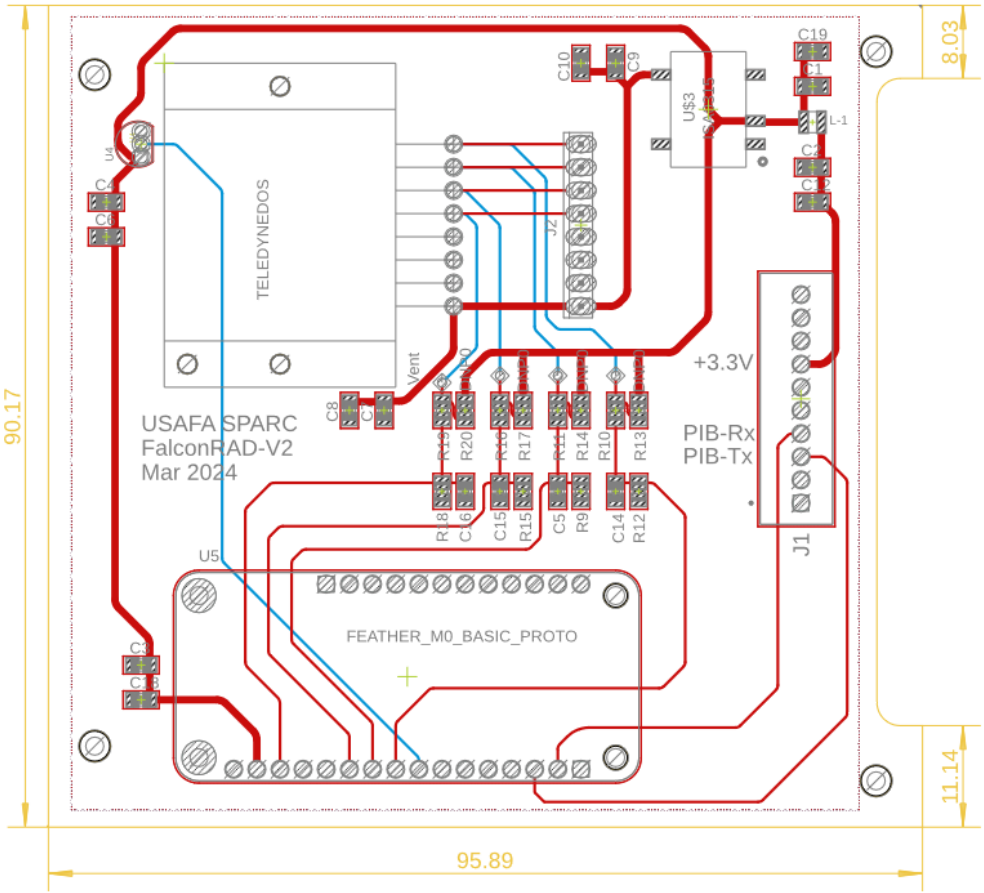
DACx	Dose Conversion	Range
Low (Pin 5)	14 µrad(Si)/19.5 mV	0 – 3.6 mrad(Si)
Medium (Pin 6)	3.6 mrad (Si)/19.5 mV	0 – 0.9 rad(Si)
High (Pin 7)	0.9 rad(Si)/19.5 mV	0 – 235 rad (Si)
Log (Pin 8)	Detailed table will be provided upon request	0 – 40 Krad(Si)

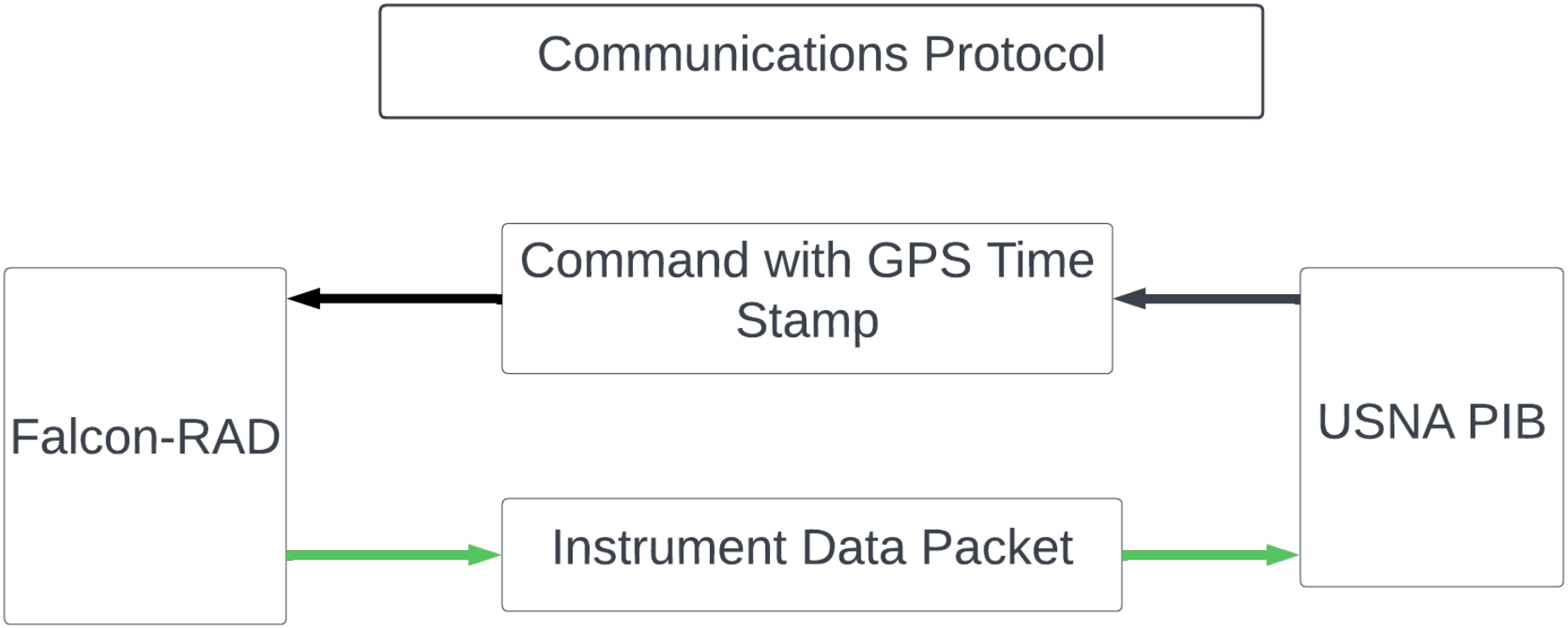
Electrical Overview
Functional Block Diagram



Electrical Overview
Prototype Testing Board

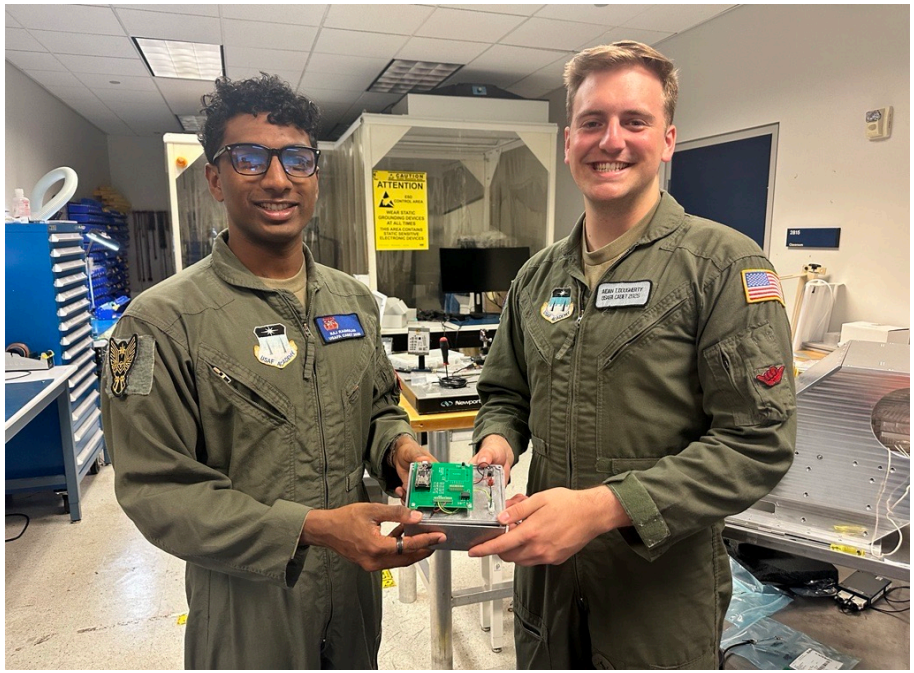


Software Communication Protocol



Lessons Learned and Way Forward

- Integration Challenges: It's crucial to have a clear understanding and plan before initiating integration efforts. Attempting to figure things out after starting can significantly complicate the process.
- Regular Communication: Keeping open lines of communication is key to navigating and resolving issues effectively.
- Documentation: Joint ICD created with Naval Academy essential for smooth integration and future reference.
- Sink Navy...



Planned Calibration Testing

- Looking to test complete system at Kirtland AFB with realistic radiation environment
- Data recorded from all outputs
- Produce calibration between dosimeter counts and rads for on-orbit use

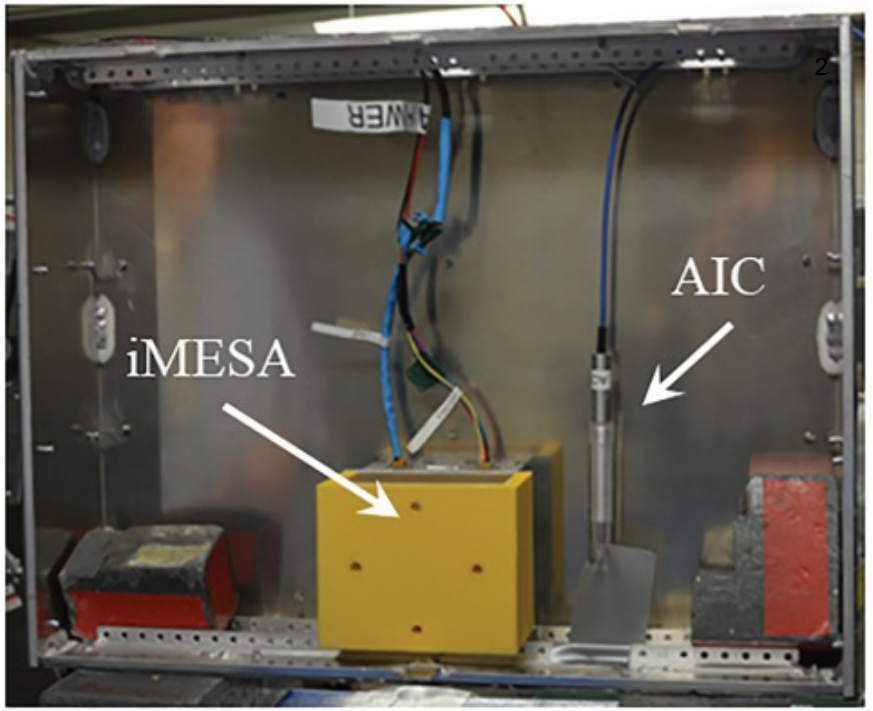


Image of previous dosimeter payload experiment setup

U.S. AIR FORCE

Space Physics and Atmospheric Research Center (SPARC)

Questions?

References

- [1] J.F. Fennel, H.C. Koons, J.L. Roeder, and J.B. Blake, Spacecraft charging: Observations and Relationship to Satellite Anomalies, Spacecraft Charging Technology, Proceedings of the Seventh International Conference held 23-27 April, 2001

- [2] Maldonado, C. A., Cress, R., Gresham, P., Armstrong, J. L., Wilson, G., Reisenfeld, D., et al. (2020). Calibration and initial results of space radiation dosimetry using the iMESA-R . Space Weather, 18, e2020SW002473. https://doi.org/10.1029/2020SW002473

- [3] "μDOS001/007 Micro Dosimeters," Teledyne Defense Electronics, Apr 2021.