



Automated Radiation Measurements for Aerospace Safety - Dual Monitor (ARMAS-DM)

FIRM: SPACE ENVIRONMENT TECHNOLOGIES, LLC

PI: W. Kent Tobiska Proposal #:S5.06-8082



NON-PROPRIETARY DATA

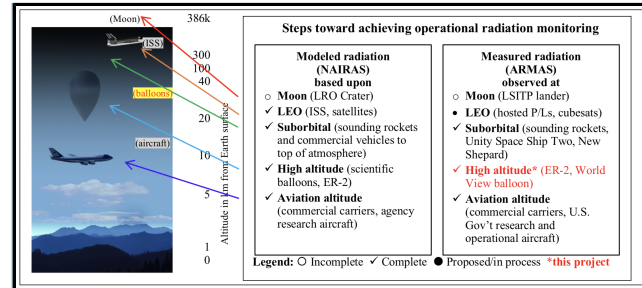
Objectives

Main objectives for Phase II

- Tech demo 30-day radiation monitoring for aviation
- Understand how gamma-rays may contribute to overall exposure risk compared to the background GCR radiation

Work plan

- Prepare two-instrument payload (FM5 and G-RAD5)
- Conduct 30-day balloon flight with Iridium real-time data
- Recover payload, process and analyze the dose data



ACCOMPLISHMENTS

Notable Deliverables Provided

Four major results concluded from Phase I study (see Final Report)

1. **science motivation** - understand the excess, enhanced radiation environment above GCR background; if from gamma-rays, it points to Van Allen Radiation belt energetic electrons as the source for a medical community finding that aircrew have twice the incidence of shallow tissue cancers than the general population
2. **instrument package refined** - total ionizing dose ARMAS FM5 and GAMMA-RAD5 gamma-ray detector
3. **concept of operations developed** - Phase II balloon flight with a Plan A (launch from Tucson AZ) or Plan B (launch from McCall ID) with additional instruments for science enhancement; final CONOPs to be decided after 1-year if supplemental, non-SBIR funding can be acquired
4. **Interface Control Document** - started in Phase I

Key Milestones Met

1. Planned calibration strategy
2. Determined GPS needs
3. Determined power needs
4. Determined data requirements
5. Determined mechanical requirements
6. Determined thermal requirements
7. Identified flight region and CONOPS
8. Determined data validation process

FUTURE PLANNED DEVELOPMENTS

Planned Post-Phase II Partners

- World View Enterprises** - balloon flights with ops payloads
- Baron** - commercial weather provider for aviation radiation NOTAMS
- Oklahoma State University** - tissue equivalent proportional counter (TEPC) instrument
- NASA LaRC & MSFC** - NAIRAS model, Liulin instrument, Advance Neutron Spectrometer instrument
- NASA AFRC** - ER-2 under flight during ARMAS DM Phase II mission
- LANL** - neutron beam line calibrations

Planned/Possible Mission Infusion

Consider lower cost alternatives to Teledyne micro dosimeter chip including

- Medipix
- Liulin
- TEPC

Add regular monitoring with gamma-ray detector and retrieve data via Iridium satellite link along with ARMAS Flight Module 5 (FM5) data

Planned/Possible Mission Commercialization

1. **Demonstrate** aviation radiation monitoring with ARMAS DM Phase II
2. **Develop** at least 3 followup balloon missions for NoPAC, NAT, and northern CONUS long duration flights
3. **Operationalize** the NASA LWS RADIATION system using ARMAS data assimilated into NAIRAS
4. **Sell** RADIATION radiation weather information via Baron to commercial aerospace for their ops planning
5. **Provide** DoC, FAA ops radiation weather info

CONTRACT (CENTER): 80NSSC18P2111 (GSFC)
SUBTOPIC: S5.06 Space Weather R2O/O2R Technology Development
SOLICITATION-PHASE: SBIR 2018-I
TA: 6.5.0 Radiation

