RadWorks Project

Active Technology Project (2011 - 2019)

Project Introduction

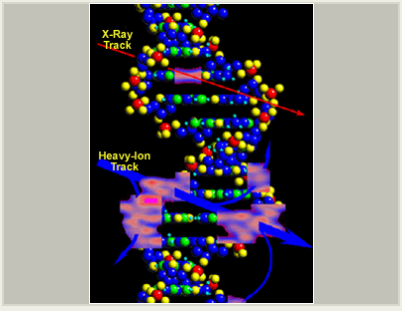
The overarching objective of the RadWorks project is to mature and demonstrate affordable, enabling solutions that mitigate radiation-related challenges of human exploration beyond Earth's orbit.

RadWorks technology is categorized as a hardware system for other applications. Since its inception in FY12, the RadWorks project has had as its overarching objective to mature and demonstrate affordable, enabling solutions to mitigate the radiation-related challenges of human space exploration. This has been done through the maturation and demonstration of system-level monitoring and design solutions. Since FY12, the project has continued to develop and deliver affordable, prototype and flight caliber element-integrated monitoring and alert/warning subsystems capable of enabling both ground-supported and autonomous architectural operations. In addition, the project has been doing comparative assessments of data collected utilizing radiation modeling programs, as well as producing advancements of modeling capability to enable protection and operational efficiencies for radiation shielding.

Every year the portfolio of technology work can change. In FY19, the RadWorks project is continuing its maturation and flight certification of advanced, miniaturized radiation measurement technologies, along with their demonstrations. The RadWorks project successfully flew the Battery Operated Independent Radiation Detector (BIRD), a simplified, non-integrated version of Radiation Environment Monitor (REM) aboard the Multi-Purpose Crew Vehicle (MPCV) Exploration Flight Test-1 (EFT-1) to validate system operation in a space radiation environment and record charged particle data for post-flight analysis. In addition, there are ten REM sensors flying on the International Space Station (ISS). These sensors are plugged into laptops and are measuring the ionizing radiation environment at different locations in the vehicle. Seven of these sensors transitioned to Flight Operations in June of 2019.

The Miniaturized Particle Telescope (MPT), a stacked version of the REM sensor is also flying on the ISS as a test instrument to investigate alternate configurations of the TimePix technology. The Hybrid Electronic Radiation Assessor (HERA), which is slated to fly as a Flight Test Objective (FTO) on the MPCV Experimental Module-1 (EM-1) flight, has been successfully integrated into the capsule awaiting flight in 2020. The flight spare for this launch is currently on ISS and successfully collected data for a 30-day end-to-end test that began in March 2019.

The next generation of the HERA is slated to fly on the MPCV EM-2 flight, as an integrated part of the Caution & Warning System (CWS). A payload, the Fast Neutron Spectrometer (FNS), developed by Marshall Space Flight Center (MSFC) is currently flying and collecting data on the ISS. Modeling work conducted by the project, which is being utilized by multiple vehicle developers, includes updates to modeling capabilities for determining sheltering needs in vehicle designs, as well as assisting with vehicle layouts to maximize crew protection



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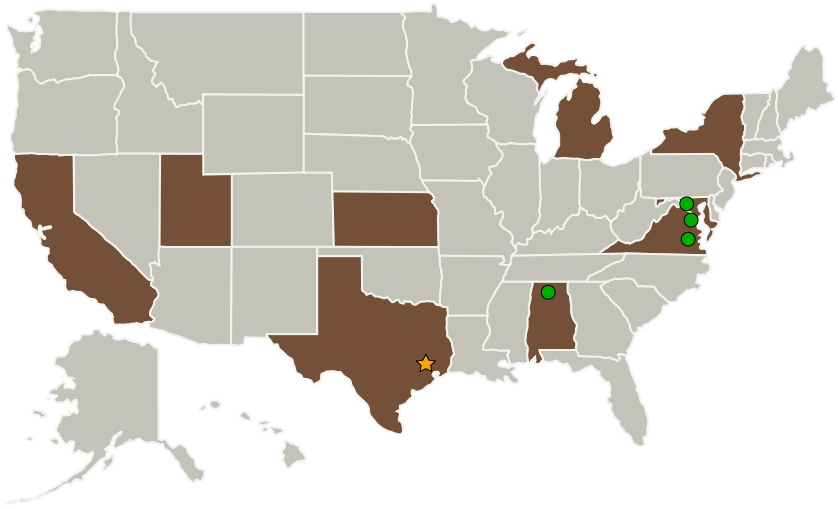
capabilities. Shielding concepts are being assessed to enhance safe days in space.

Anticipated Benefits

The technologies can protect crew health through compact, low mass, low power radiation monitoring/alert and mitigation using strategic arrangement of vehicle assets.

Primary U.S. Work Locations and Key Partners



Organizational Responsibility

Responsible Mission Directorate:

Human Exploration and Operations Mission Directorate (HEOMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Advanced Exploration Systems Division

Project Management

Program Director:

Christopher L Moore

Project Manager:

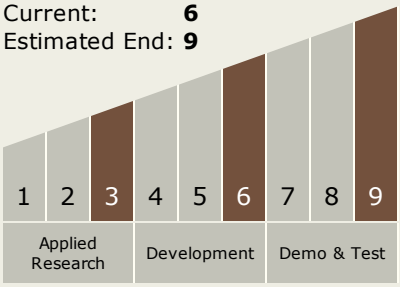
Catherine D Mcleod

Principal Investigator:

Edward J Semones

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **9**



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, TX
Analytical Mechanics Associates, Inc.	Supporting Organization	Industry	Hampton, VA
Brookhaven National Laboratory	Supporting Organization	Industry	
Futron	Supporting Organization	Industry	
●Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, MD
Jacobs	Supporting Organization	Industry	
Kansas State University	Supporting Organization	Academic	Manhattan, KS
KBRwyle	Supporting Organization	Industry	
L-3 Communications	Supporting Organization	Industry	TX
●Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, VA
●Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, AL
MRI Technologies	Supporting Organization	Industry	
●NASA Headquarters(HQ)	Supporting Organization	NASA Center	Washington, DC

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Technology Areas

Primary:

- Human Exploration Destination Systems (TA 7)
  - Cross-Cutting Systems (TA 7.6)
    - Construction and Assembly (TA 7.6.2)

Other/Cross-cutting:

- Human Health, Life Support, and Habitation Systems (TA 6)
  - Radiation (TA 6.5)
- Science Instruments, Observatories, and Sensor Systems (TA 8)
  - Remote Sensing Instruments and Sensors (TA 8.1)
    - Detectors and Focal Planes (TA 8.1.1)
    - Electronics (TA 8.1.2)
    - Lasers (TA 8.1.5)
  - In-Situ Instruments and Sensors (TA 8.3)
    - Field and Particle Detectors (TA 8.3.1)
- Entry, Descent, and Landing Systems (TA 9)
  - Aeroassist and Atmospheric Entry (TA 9.1)
    - Thermal Protection Systems for Rigid Decelerators (TA 9.1.1)
- Nanotechnology (TA 10)

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Organizations Performing Work	Role	Type	Location
Space Technology Corporation	Supporting Organization	Industry	
The University of Michigan	Supporting Organization	Academic	Ann Arbor, MI
University of Alabama at Huntsville	Supporting Organization	Academic	Huntsville, AL
University of Hawaii	Supporting Organization	Academic	Honolulu, HI
University of Houston	Supporting Organization	Industry	Houston, TX
University of Utah	Supporting Organization	Academic	Salt Lake City, UT
USRA	Supporting Organization	Industry	

Primary U.S. Work Locations	
Alabama	California
District of Columbia	Kansas
Maryland	Michigan
New York	Texas
Utah	Virginia

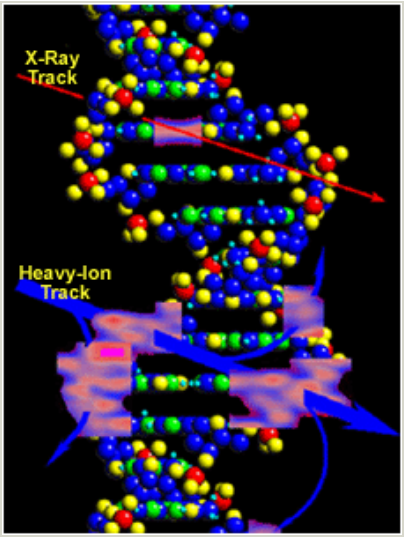
Technology Areas *(cont.)*

- Sensors, Electronics, and Devices (TA 10.4)
  - Sensors and Actuators (TA 10.4.1)
  - Nanoelectronics (TA 10.4.2)
- Materials, Structures, Mechanical Systems and Manufacturing (TA 12)
  - Structures (TA 12.2)
    - Lightweight Concepts (TA 12.2.1)
    - Innovative, Multifunctional Concepts (TA 12.2.5)
  - Manufacturing (TA 12.4)
    - Electronics and Optics Manufacturing Process (TA 12.4.3)

Target Destinations

Earth, The Moon, Mars

Images



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Stories

EFT-1 RadWorks BIRD Success Story
(https://techport.nasa.gov/file/52919)

EFT-1 RadWorks Bird Technology Infusion
(https://techport.nasa.gov/file/52920)