

# Thick GCR Shield Project

Game Changing Development Program | Space Technology Mission Directorate (STMD)



## ANTICIPATED BENEFITS

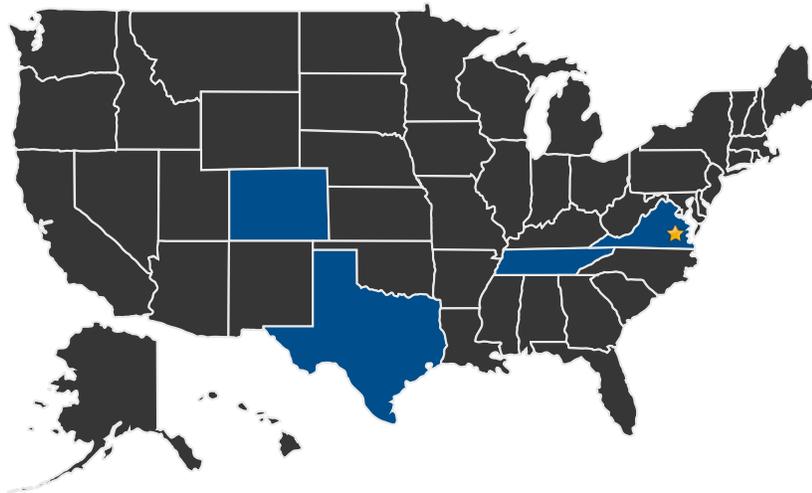
### To NASA funded missions:

Identification of optimal GCR shield thicknesses and quantification of the uncertainty associated with shielding efficiency for thick shields will enable minimal mass vehicle design and reduce uncertainty in astronaut risk predictions.

## DETAILED DESCRIPTION

Insufficient data exist to validate thick shield space radiation exposure predictions. This task seeks to validate the shielding efficiency of spacecraft materials and verify an optimum Galactic Cosmic Ray (GCR) shield thickness needed for minimal mass vehicle design.

## U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States With Work

★ **Lead Center:**  
Langley Research Center

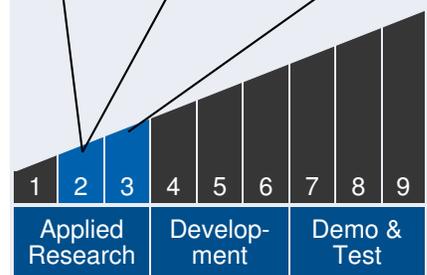


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### Technology Maturity

Start: 2 | Current: 2 | Estimated End: 3



### Management Team

**Program Executive:**

- Lanetra Tate

**Program Manager:**

- Mary Wusk

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## Other Organizations Performing Work:

- Human Exploration and Operations Mission Directorate
- Southwest Research Institute
- University of Tennessee (Knoxville, TN)

## Management Team *(cont.)*

### Project Manager:

- David Moore

### Principal Investigator:

- Denise Podolski

## Technology Areas

### Primary Technology Area:

Human Health, Life Support, and Habitation Systems (TA 6)

- └ Radiation (TA 6.5)
  - └ Protection Systems (TA 6.5.3)
    - └ Radiation Protective Materials and Material Systems for Primary and Secondary Structures (TA 6.5.3.1)
    - └ Radiation Protective Materials and Material Systems for Primary and Secondary Structures (TA 6.5.3.1)

### Secondary Technology Area:

Human Health, Life Support, and Habitation Systems (TA 6)

- └ Radiation (TA 6.5)
  - └ Risk Assessment Modeling (TA 6.5.1)
    - └ Transport and Nuclear Physics Modeling Tool(s) for Radiation Exposure (Transport Codes) (TA 6.5.1.7)

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## DETAILS FOR TECHNOLOGY 1

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### Technology Title

Thick GCR Shield

### Technology Description

This technology is categorized as complex electronics software for engineering, design, modeling, or analysis

The Advanced Radiation Project to date has focused on SEP events. For long duration missions outside Earth's geomagnetic field, the galactic cosmic ray (GCR) environment provides an even greater risk to astronauts. Interplanetary space is filled with low fluxes of highly energetic, extremely penetrating ions believed to have been accelerated by supernova shocks in our galaxy. These ions range from protons and alpha particles to heavier atoms such as carbon, oxygen, and iron stripped of their electrons. These ions range in energy from a few eV to tens of GeV. When GCR ions interact with shielding materials, secondary particles including charged ions, neutrons, pions, muons, and electrons are produced. Under some conditions, the dose may be larger behind thick shields than behind thinner shields. The thick GCR shield task will seek to validate the calculated shielding efficiency of hydrogen-dense materials and verify optimum GCR shield thicknesses necessary for minimal mass vehicle design.

### Capabilities Provided

Mission planners and vehicle designers need an optimal GCR shield thickness to aim for and accurate shielding efficiency data to develop minimal mass vehicle architecture

### Potential Applications

HEOMD: AES Exploration Augmentation Module (EAM)

Human Spacecraft Architecture Team (HAT)

Human Research Program (HRP)

Department of Energy (DOE)

National Institute of Health (NIH)