

Mass Data Storage for Space Missions



Name of Technology:

Onboard Mass Data Storage

Participating NASA Centers:

ARC (Lead)

Technological Area:

S4.05Smart, Autonomous Command and Data Handling System, Algorithms and Data Management

Vision for the Technology:

Exploration missions to the moon, Mars, and other locations will require mass data storage systems to endure long-term missions, the harshness of space environment and massive data I/O. Autonomous vehicle/spacecraft health monitoring, crew medical operations, research data, and logistics are just a few of the groups of data that will need to be stored.

Challenges:

Future exploration spacecraft data storage needs for are not well understood. Further architectural design is needed for crew medical operations, logistics management, and autonomous vehicle health monitoring, all of which can significantly drive onboard data storage requirements.

Due to the harshness of space, data storage devices must endure working in various temperatures, radiation, and different pressure environments, possibly vacuum of space. Hard Disk Drives (HDD) do not work well in space. Magnetic tape drives have had some success but are limited in the functionality that is required. Although, Solid-State Drives (SSD)

have been successful and are the most reasonable technology. SSDs have been used on Mars rovers and satellites with success. However, large data SSDs has not been tested.

NASA Seeks to Meet the Following Specs:

Successful closure of this gap will be determined through:

- Innovative flight software development techniques
- Planning and scheduling software
- Modular routines for repeatability on future missions
- Autonomous fault tolerant software development that acts in a repeatable, predictable manner
- Automated system level testing
- On board automated approaches for data compression and payload data analysis to enable low bandwidth communications to the ground station.
- Participatory, distributed analysis techniques utilizing public interest and resources

Overview of Student Project:

NASA seeks innovative mass data storage systems to store and have quick access to information for long-term usage in space environments. Spacecraft and space stations will need mass data storage systems to collect, store, and access data such as spacecraft health monitoring, crew medical operations, logistics, and science data.

Innovative Areas Student Projects Can Address:

- Improvements in big data methods
- Improvement in data storage architecture
- Improved performance in space environments with existing Solid-State Drives (SSD), flash memory or other drives
- Reduction in device size
- Reduction in system complexity

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Project Phases

- I. Conceptual and feasibility study with characteristics
- II. Proof of Concept/Prototype in lab environment

Research Funded by NASA on this Topic:

Proposal Number: 19-1- H9.07-3158
[Onboard Data Infrastructure for Spacecraft \(ODIS\)](#)

Proposal Number: 09-1 S6.04-9644
[Towards Efficient Scientific Data Management using Cloud Storage](#)

Proposal Number: 92-1-12.12-6465
[Multi-Layered Optical Data Storage](#)

References:

[S4.05 Smart, Autonomous Command and Data Handling System, Algorithms and Data Management](#)

[T11.01 Machine Learning and Data Mining for Autonomy, Health Management, and Science](#)

[S8.03 On-Board Science for Decisions and Actions](#)

[S5.03 Algorithms and Tools for Science Data Processing, Discovery and Analysis, in State-of-the-Art Data Environments](#)

[S6.04 Data Management - Storage, Mining and Visualization](#)

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