

IAF SPACE EXPLORATION SYMPOSIUM (A3)
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INNOVATIVE REGOLITH TRANSPORT SYSTEMS FOR EXTREME LUNAR AND SPACE
CONDITIONS

Abstract

This abstract details the development of In-Situ Resource Utilization (ISRU) technologies aimed at the efficient management, movement, and processing of lunar and space materials, including:

- Moving regolith from excavation sites to processing plants.
- Transferring materials between vehicles, space shuttles, and storage units.
- Handling large volumes of regolith for the construction of lunar landing pads and roads.
- Transporting raw materials from asteroids to shuttles or storage facilities.

There is an increasing need for technologies that can handle greater quantities of regolith and swiftly adapt to changes in transportation routes. The handling of regolith presents several challenges, such as:

- The abrasive nature of regolith.
- Extreme temperature variations.
- Dust emissions.
- Static electricity buildup.
- Variability in site locations and transportation paths.
- Limited availability of power.
- Restrictions on launch weight.
- The effects of low gravity environments.

Our novel approach addresses these issues through the use of modular, motorized drums with internal flights, designed for flexibility over different distances and paths. The system encases regolith during transport to minimize abrasion and exposure to moving parts, suitable for a range of operations including attachment to lunar rovers for secure transport and efficient loading. It also incorporates processing capabilities like sieving and mixing. Its simplistic design is suitable for 3D printing using local materials, enhancing its practicality for space applications. This method demonstrates a significant improvement in energy and resource efficiency, potentially increasing operational efficiency by at least 50

Following the development of several advanced prototypes, the system has entered a crucial testing phase, utilizing lunar regolith simulants to validate its effectiveness in regolith extraction and seamless delivery to processing units. Concurrently, efforts are underway to refine associated components, including specialized containers for regolith storage and transport. This holistic approach underscores our commitment to optimizing the entire ecosystem for handling and processing lunar materials, ensuring readiness for real-world/space applications.