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Author: Ms. Arianna Sánchez
National Aeronautics and Space Administration (NASA) / Stellar Solutions Inc, United States

Dr. Kristen John
National Aeronautics and Space Administration (NASA), United States

NASA'S SPACE TECHNOLOGY ADVANCEMENTS IN CROSSCUTTING CAPABILITIES TO ENABLE SUSTAINED LUNAR SCIENCE & EXPLORATION

Abstract

In 2022, NASA initiated its Moon to Mars Objectives, a comprehensive exploration strategy encompassing Foundational Exploration and Sustained Lunar Evolution as pivotal architectural segments essential for establishing a robust lunar economy. As NASA prepares to usher humanity back to the Moon, the validation of advanced capabilities to enable the systems of sustained operations for both robotic and crewed missions to the Moon's surface stands as a cornerstone for the success of these ambitious campaigns. Critical advancements in crosscutting capabilities, therefore, are not only necessary but imperative, serving as catalysts for technological and economic expansion beyond Earth.

The Space Technology Mission Directorate (STMD) at NASA has collaboratively engaged with internal and external stakeholders, focusing on crosscutting areas such as dust mitigation, extreme environments, extreme access, interoperability, and lunar simulants, to identify the technology needs and assess the readiness of relative systems and components. The development of these crosscutting capabilities is pivotal in effectively advancing lunar exploration and pushing boundaries of lunar surface utilization. Collaborations with agency stakeholders, U.S. industry, academia and other key partners is crucial to integrate technology development priorities of these areas, ensuring a cohesive and executable strategy for developing the building blocks of a sustained lunar infrastructure.

Envisioning sustained lunar operations necessitates foundational infrastructure for surface power, in-situ resource utilization, and excavation and construction, forming the bedrock for interoperable global lunar utilization. This paper aims to delve deeper into the progress made in crosscutting capabilities, exploring ongoing studies and analyses aiming to advance these areas and efforts to identify gaps within these three lunar infrastructure areas.