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ON-DEMAND INFRASTRUCTURE FOR LUNAR EXPLORATION - NASA'S MOON-TO-MARS PLANETARY AUTONOMOUS CONSTRUCTION TECHNOLOGY PROJECT

Abstract

The Artemis Accords state that the Artemis program will "establish, together with international and commercial partners, the sustainable human exploration of the solar system." Sustainable long-term presence on the lunar surface requires infrastructure, including power, in situ resource processing for consumables, environmental control, and life support systems; civil engineering-type structures such as landing pads, roads, blast shields, habitats, foundations, etc. NASA's Space Technology Mission Directorate (STMD) aims to spur the creation of novel technologies needed for lunar surface exploration and accelerate the technology readiness of key systems and components. STMD has established four primary technology thrust areas: Go, Land, Live, and Explore the Moon. The Lunar Surface Innovation Initiative (Live thrust area) includes the following technology focus areas: sustainable power; dust mitigation; in-situ resource utilization; surface excavation, construction, and outfitting; and extreme access/extreme environments.

Maximum use of in situ resources, living off the land, is envisioned to reduce the dependency on consumables, materials, and hardware that would be required to be launched from Earth for deep space exploration. NASA's Moon-to-Mars Planetary Autonomous Construction Technology (MMPACT) project is focused on the development of selected processes utilizing lunar regolith for the construction of lunar infrastructure elements to protect the astronauts from the lunar environment. Processes being evaluated include both extrusion and thermal systems and materials which require a binder with the lunar regolith and those which use solely regolith.

The presentation will focus on feedstock materials development, hardware operation and manufacturing under lunar environmental conditions, testing of candidate lunar construction materials, preliminary design concept for future lunar landing pad and planar elements, and the vision for a future construction technology demonstration on the lunar surface. The demonstration, targeting the late 2020s, is envisioned to enable landing pad construction and habitat construction resulting in commercial capabilities early in the next decade.