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NASA'S MOON-TO-MARS PLANETARY AUTONOMOUS CONSTRUCTION TECHNOLOGY PROJECT: OVERVIEW AND STATUS

Abstract

NASA plans to land the first woman and next man on the Moon by 2025 through the initial Artemis missions. NASA and its international partners plan to establish a sustainable long-term presence on the lunar surface and build up infrastructure in the subsequent Artemis missions. The Lunar Surface Innovation Initiative (LSII), within NASA's Space Technology Mission Directorate, aims to spur the creation of novel technologies needed for lunar surface exploration and accelerate the technology readiness of key systems and components. The primary thrust areas of LSII include sustainable power; dust mitigation; in-situ resource utilization; surface excavation, construction, and outfitting; and extreme access/extreme environments. The Moon-to-Mars Planetary Autonomous Construction Technology (MMPACT) project was initiated to address the lunar surface construction thrust area of LSII. The goal of the MMPACT project is to develop, deliver, and demonstrate on-demand capabilities to protect astronauts and create infrastructure on the lunar surface via construction of landing pads, habitats, shelters, roadways, berms and blast shields using lunar regolith-based materials. The MMPACT project is leveraging technology derived from NASA's 3D Printed Mars Habitat Challenge along with contributions from other Government agencies, and multiple partners within industry and academia. The MMPACT project is comprised of three interrelated elements, construction hardware and process development; feedstock materials development; and microwave structure construction capabilities. These elements are working together to address the multiple challenges of infrastructure construction on the surface of the Moon including increased autonomy of operations, hardware operation and manufacturing under lunar environmental conditions, long-duration operation of mechanisms and parts, scale of construction activities, and material and construction requirements and standards. This presentation will summarize the status of development activities in each of the three elements, including testing of the various candidate materials, preliminary design concepts for future lunar infrastructure elements, and the vision for future technology demonstrations on the lunar surface. These demonstrations, targeting the mid-to-late 2020's, are expected to enable landing pad construction and habitat construction resulting in commercial capabilities early in the next decade.