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Author: Ms. Carol Galica
NASA Headquarters, United States

Ms. Niki Werkheiser
NASA, United States
Dr. Prasun Desai
National Aeronautics and Space Administration (NASA), United States

NASA LUNAR SURFACE INNOVATION INITIATIVE: ENSURING A COHESIVE, EXECUTABLE STRATEGY FOR TECHNOLOGY DEVELOPMENT

Abstract

Establishing a sustainable human presence on the Moon allows NASA to develop and test new approaches, technologies, and systems that will enable us to function in other, more challenging environments. The Lunar Surface Innovation Initiative (LSII) was established in 2019 and has evolved into a key agency asset to spur technology development and provide risk reduction for lunar surface system development and flight demonstrations. LSII coordinates activities implemented through a combination of in-house activities, competitive programs, and public-private partnerships to create transformative technologies needed for lunar surface exploration. This paper will outline the LSII model used to develop a technology pipeline that will retire the primary technology hurdles in six capability areas. In-situ resource utilization technologies for collecting, processing, storing, and using material found or manufactured on the Moon. Surface power technologies that provide the capability for sustainable, continuous power throughout the day and night for lunar missions. Dust mitigation strategies that diminish lunar dust hazards on lunar surface systems such as cameras, solar panels, space suits, habitats, and instrumentation. Extreme environments technologies that enable systems to operate throughout the full range of lunar surface conditions, including lunar noon (up to 150 at the equator), night (down to - 180 at the equator), multiple day/night cycles, and in permanently shadowed regions (down to -250). Extreme access technologies that enable humans or robotic systems to access, navigate, and explore previously inaccessible lunar surface or subsurface areas. Excavation and construction technologies that will allow affordable, autonomous manufacturing or construction. We outline key results, including milestones and achievements related to the capability areas and outcomes from partnerships with the commercial sector. A key tenet of the LSII is the Lunar Surface Innovation Consortium (LSIC), a collaboration across industry, academia, and government to successfully develop the transformative capabilities for lunar surface exploration. LSIC provides a forum for NASA to communicate technological requirements, needs, and opportunities and for the community to share existing capabilities and identify critical gaps with NASA. By working side by side with commercial enterprises and our international partners, NASA is able to combine the knowledge and expertise needed to explore the lunar surface and make technical advances that will feed technological and economic growth. Since its inception, LSII has engaged over 600 organizations across the United States and 38 countries to shape the technologies and systems needed to explore the lunar surface and stimulate a lunar surface economy.