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Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Systems (2A)

Author: Mr. John Scott

National Aeronautics and Space Administration (NASA), United States, john.h.scott@nasa.gov

INFRASTRUCTURE FOR THE EXPLOITATION OF THE LUNAR SURFACE: POWER AND
ENERGY STORAGE**Abstract**

The establishment of lunar infrastructure is critical for creating a permanent Lunar settlement and vibrant space economy. Of primary importance to enabling large scale industrial activity on the Lunar surface is infrastructure for power. This infrastructure must enable energy storage, along with electric power generation and distribution. Power infrastructure spreading throughout and outward from the initial outpost of the Artemis Program at the South Pole should include modular units with tens of kilowatts in generation capacity and single megawatt-hours of storage capacity distributed over distances of several kilometers. The power demand may ultimately grow as industrialization spreads toward the Lunar Equator up to a gigawatt level distributed across the Lunar surface.

NASA's Space Technology Mission Directorate is tasked with supporting the development of the technological building blocks needed by industry to create this power infrastructure. These building blocks must be reliable and durable for a decade or more in the Lunar surface thermal, dust, and radiation environment. The highest priority building blocks include: nuclear fission power generation, suites of maintainable power management and control circuits, power transmission cables which can be unspooled in across the surface, wireless power beaming, deployable and directable photovoltaic arrays, regenerative fuel cell energy storage, and batteries operable at the cryogenic temperatures of the permanently shadowed regions. NASA is supporting industry in creating the intellectual property necessary for these building blocks through a range of contractual and partnership vehicles.

This paper provides a high-level overview of NASA's plans for the development of power and energy storage capabilities, a description of the state of the art, capability goals, technical challenges and gaps, and thoughts on partnerships with industry and other agencies towards developing a robust power infrastructure to support a Lunar economy.