

IAF SPACE EXPLORATION SYMPOSIUM (A3)  
Moon Exploration – Part 2 (2B)

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## LUNAR LIFE SCIENCES PAYLOAD ASSESSMENT

**Abstract**

The Moon provides a unique site to study living organisms. The fractional gravity and unique radiation environment have similarities to Mars and will help us understand how life will respond to conditions on the red planet. Martian and lunar environments can be simulated on the ground but not to high fidelity. Altered gravity and increased radiation are difficult to replicate simultaneously, which makes studying their combined effect difficult. The International Space Station, and previously, the Space Shuttle, provided a microgravity environment, and could simulate fractional-g only via an onboard centrifuge. Because the ISS and Space Shuttle orbits were within the Earth's magnetosphere, experiments on those platforms have not been exposed to the same level of galactic cosmic rays and solar radiation than what would be seen on missions to Mars.

The Space Life and Physical Sciences Research and Applications (SLPSRA) Division in the Human Exploration and Operations Mission Directorate commissioned a study to assess what systems are needed to study microbiology and cell biology utilizing Gateway, free flyers, and lunar landers. Even though SLPSRA focuses on Space Biology and the Human Research Program, this assessment looked at life sciences more as a cross-program discipline including astrobiology and planetary protection, as well as biotechnology applications. For this presentation, only the study results specific to lunar surface science are discussed.

It is concluded that to perform life science experiments on the Moon, Commercial Lunar Payload Services (CLPS) and Human Landing System (HLS) should plan to support specific types of payloads. These experiments will answer critical research questions for multiple NASA programs, alleviating risks associated with long duration human spaceflight, and understanding the fundamental nature of life in our solar system.