Breakout Session: Technology and Infrastructure
STMD’s Investments Support Later Segments

**Human Lunar Return**
Initial capabilities, systems, and operations necessary to re-establish human presence and initial utilization on and around the Moon.

**Foundational Exploration**
Expansion of lunar capabilities, systems, and operations supporting complex orbital and surface missions to conduct utilization and Mars forward precursor missions.

**Sustained Lunar Evolution**
Enabling capabilities, systems, and operations to support regional and global utilization, economic opportunity, and a steady cadence of human presence on and around the Moon.

**Humans to Mars**
Initial capabilities, systems, and operations necessary to establish human presence and initial utilization on Mars and continued exploration.

Future Segments
Lunar Infrastructure Technology Investments

**LI-1**: Develop an incremental **lunar power generation and distribution system** that is evolvable to support continuous robotic/human operation and is capable of scaling to global power utilization and industrial power levels.

**LI-2**: Develop a lunar surface, orbital, and **Moon-to-Earth communications architecture** capable of scaling to support long term science, exploration, and industrial needs.

**LI-3**: Develop a lunar **position, navigation and timing architecture** capable of scaling to support long term science, exploration, and industrial needs.

**LI-4**: Demonstrate **advanced manufacturing and autonomous construction capabilities** in support of continuous human lunar presence and a robust lunar economy.

**LI-5**: Demonstrate **precision landing** capabilities in support of continuous human lunar presence and a robust lunar economy.

**LI-6**: Demonstrate local, regional, and global **surface transportation and mobility capabilities** in support of continuous human lunar presence and a robust lunar economy.

**LI-7**: Demonstrate industrial scale **ISRU capabilities** in support of continuous human lunar presence and a robust lunar economy.

**LI-8**: Demonstrate technologies supporting cislunar orbital/surface depots, construction and manufacturing maximizing the use of in-situ resources, and support systems needed for continuous human/robotic presence.

**LI-9**: Develop **environmental monitoring, situational awareness, and early warning capabilities** to support a resilient, continuous human/robotic lunar presence.
Demonstration of ISRU technologies to extract oxygen from lunar soil, to inform eventual production, capture, and storage.

79 Submissions from 73 Unique Organizations representing 21 US States and 8 Foreign Countries

RFI Released 6 Nov 2023
RFI Responses Received 18 Dec 2023

Organization Type
- Industry 81%
- NASA Center 6%
- Individual 7%
- Academia 4%
- FFRDC 1%
- OGA 1%
- Unknown 1%

Power
Dust Mitigation
Autonomy & Robotics
Construction (Option)
Excavation
Lunar Surface Innovation Consortium (LSIC)

Current LSIC Organization

- In-Situ Resource Utilization
- Excavation & Construction
- Surface Power
- Lunar Simulants
- Interoperability
- Dust Mitigation
- Extreme Access
- Extreme Environments

6 Focus Areas
+ 2 Working Groups
+ 32 Subgroups
New LSIC Structure

- Excavation & Construction
- In-Situ Resource Utilization
- Surface Power
- Crosscutting Capabilities

3 Focus Areas
Crosscutting Capability Area

2024 Spring LSIC meeting
23-25 April 2024
Laurel, MD & Hybrid
Lunar Surface Power Investments

EXPLORATION POWER
Advancing power generation, distribution, and storage technologies to enable long-term exploration

- Fission Surface Power
- Regenerative Fuel Cells
- Power Management and Distribution
- Vertical Solar Arrays
- Inductive Charging

- Related to:
  - Advanced Power Capability Review completed Aug 2023 (internal)
  - Investments to enable LI-1, MI-1
Nuclear Propulsion

- Provides a robust and reliable energy to human and scientific exploration missions
- Offers energy-dense systems with high ratios of power to mass and volume
- Shares a strong interest from industry and other government organizations for space transportation

Propulsion: Speed, Maneuverability, Resiliency
- High-thrust gravity maneuvers
- Rapid cis-lunar transit
- Robust transportation for Mars human exploration
- Higher value deep-space science missions

Interagency Commonality

Industry Engagements

DoD-SCO  AFRL  DARPA
STMD 2024 Role in Architecture Development

- Supporting Objectives Decomposition
- Participating in virtually all SAC24 tasks: coordination, SME analysis
- Significant role in Mars Surface Power Technology Decision activity
- Working gap prioritization processes across the architecture
- Leading task to define and document technology on-ramp strategies