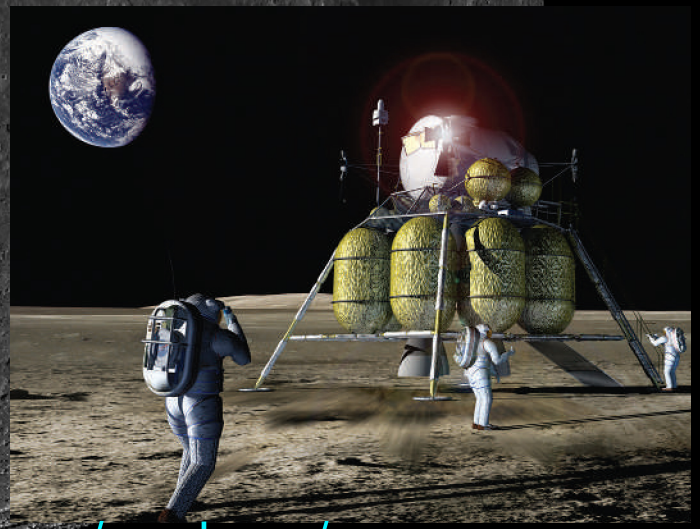
LEAG Lunar Exploration Roadmap

Learn from history - Apollo not sustainable.

Establishing a sustained lunar exploration program requires international collaboration, ISRU, and commercial sector involvement.

LEAG is at the center of integrating such efforts – it serves as a community-based, interdisciplinary forum for future science and exploration.



http://www.lpi.usra.edu/leag/roadmap/

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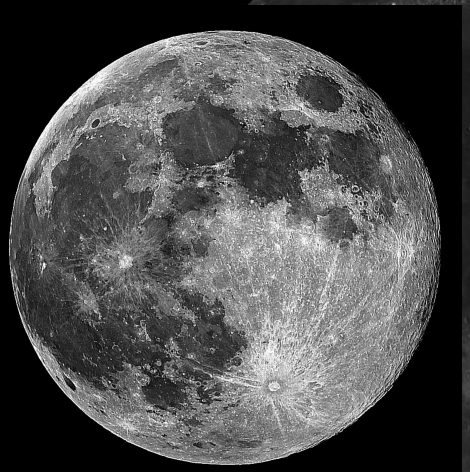

Why should we go to the Moon?

Science (Sci) Theme: Pursue scientific activities to address fundamental questions about the solar system, the universe, and our place in them

Feed Forward (FF) Theme: Use the Moon to Prepare for Future Missions to Mars and Other Destinations

Sustainability (Sust) Theme: Extend Sustained Human Presence to the Moon to Enable Eventual Settlement

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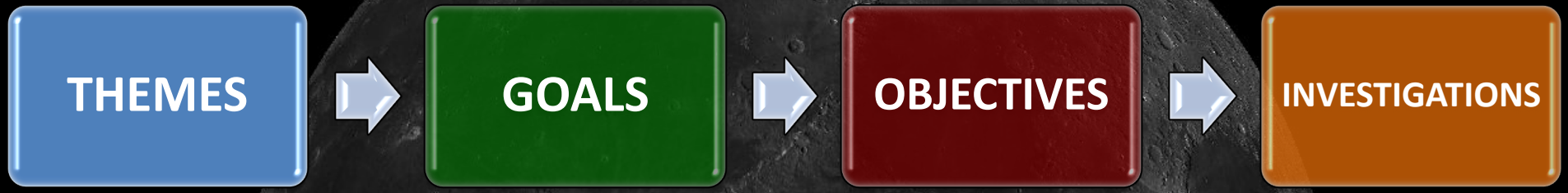

Three Themes:

- Science (Sci)
- Feed Forward (FF)
- Sustainability (Sust)

- Community effort.
- Living document.

Sustainability is the key:

- Don't abandon assets – leverage them;
- Commercial "on ramps" are defined;
- International cooperation is critical.

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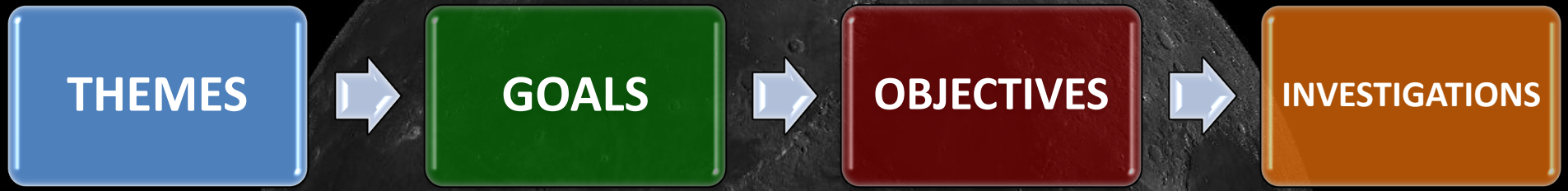

Sustainability Theme:

Sustained lunar activities are only possible when they are *sustainable* through ongoing return of value.

Self-sustained settlement is most defensible when strongly linked to science and feeding forward to other destinations in the Solar System.

The role of commercial activity as an indispensible aspect of sustainability.

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Implementing the LER: Robotic Precursor Missions

Phase I: Lunar Resource Prospecting.

- Defining the composition, form, and extent of the resource:
- Characterizing the environment in which the resources are found;
- Defining the accessibility/extractability of the resources;
- Quantifying the geotechnical properties of the lunar regolith in the areas where resources are found;
- Being able to traverse several km and sample and determine lateral and vertical distribution on meter scales.
- Identifying resource-rich sites for targeting future missions.

Implementing the LER: Robotic Precursor Missions

Phase II: Lunar Resource Mining.

- Feedstock acquisition and handling;
- Resource extraction, refinement, transport, and storage;
- Usability of resources (e.g., fuel cell, small engine test, propellant depot test);
- Regolith handling and size sorting technologies (only for mineral-based resources);
- Operable life to give information on the longevity of systems and materials in the lunar environment;
- Dust mitigation strategies.

Implementing the LER: Robotic Precursor Missions

Phase III: Lunar Resource Production.

Based upon the results of Phase II a larger-scale (i.e., more appropriate scale) continuous processing capability would be deployed to the most appropriate site.

Greater quantities of resources will be produced and be used to undertake more extensive demonstrations such as life support, mobility technologies, and fuel for a robotic sample return.

An automated full-scale production capability would be established prior to the first extended human stay on the lunar surface.