

LEAG Report Planetary Sciences Subcommittee



9 July 2009

LROC-SAT

Next Mission Town Hall Meeting

Lunar Science Forum/Decadal Survey Input

SS-SAT

Lunar Exploration Roadmap

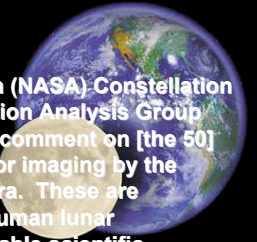
LEAG Annual Meeting



LEAG Report to the PSS: 9 July 2009

LROC-SAT

The National Aeronautics and Space Administration (NASA) Constellation Program Office (CxPO) requests the Lunar Exploration Analysis Group (LEAG) to form a special action team to review and comment on [the 50] targets and regions of interest identified by CxPO for imaging by the Lunar Reconnaissance Orbiter Narrow Angle Camera. These are intended to be representative of regions of future human lunar exploration activities and are meant to provide valuable scientific, operational and resource information.



The review and comment on the 50 regions of interest identified by Constellation should include:

1. Reprioritization between Tiers 1 and 2, if deemed appropriate.
2. Adjustment of the target coordinates if deemed appropriate.
3. Additional suggested targets and regions of interest that could replace those identified by CxPO.
4. Suggested additional regions of interest for a lower priority ranking (i.e. "Tier 3").



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Charter received February 1st 2009
Report delivered May 14th 2009



- Chair, Paul G. Lucey, U. Hawaii
- Science Subgroup
 - Jeffrey Gillis-Davis, U. Hawaii
 - B. Ray Hawke, U. Hawaii
- ISRU subgroup
 - Larry Taylor, U. Tenn, Knoxville
 - Mike Duke, At-large lunar scientist
- Operations subgroup
 - Tye Brady, Draper Lab
 - Todd Mosher, Sierra Nevada Corporation
- Observers
 - Mike Wargo, NASA
 - Steve Mackwell, LPI
 - Clive Neal, LEAG



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- Uniform debiased methodologies applied to tasking
- CxPO site selection endorsed by LEAG SAT
- Detailed assignment to Tiers not supported by analysis
- Gaps in Science and Operational parameters overall
 - Unsampled geochemical terranes underrepresented
 - Polar sites underrepresented
 - Midlatitude sites underrepresented
 - Light plains underrepresented
- Two sites replaced with SPA/polar sites
- Three sites moved to improve science value



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Next Mission Town Hall Meeting LPSC 40, March 25th 2009

Compiled for SMD, Planetary Sciences Division.
Became the first stage of Decadal Survey input.

Summary

SPA Basin Sample Return: South-Pole Aitken Basin sample return is still a high priority for constraining the impact flux of the inner solar system and is part of the last decadal survey that has not yet been addressed.

Lunar Poles: It is important to explore the lunar poles (specifically the volatile deposits) before the lunar environment is disturbed by future human landings, as the volatiles emitted from such landings may compromise the pristine nature of the volatile deposits.

Nectaris Basin Sample Return: Nectaris Basin is another old impact basin (older than Imbrium) so returning impact melt from this basin will also help constrain the impact flux. The advantage is that it is on the lunar nearside as compared to SPA of the inner solar system.

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Summary

Aristarchus Plateau Exploration and Sample Return: Exploration of pyroclastic deposits from early lunar explosive volcanism and volatiles from the lunar interior. Possibility of fossil regolith trapped between lava flows/pyroclastic eruptions.

Technology Developments:

- Generic robotic sample return missions;
- Long-range rovers that are not solar powered;
- Instruments that can detect volatiles from a distance;
- Instruments capable of *in situ* age dating with a goal of just a few million years resolution in age determinations;
- Develop Hoppers to visit several places on the lunar surface during one mission.

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Summary

Aristarchus Plateau Exploration and Sample Return: Exploration of pyroclastic deposits from early lunar explosive volcanism and volatiles from the lunar interior. Possibility of fossil regolith trapped between lava flows/pyroclastic eruptions.

Technology Developments:

- Generic robotic sample return mission for the Moon;
- Long-range rovers that are not solar powered;
- Instruments that can detect volatiles from a distance;
- Instruments capable of *in situ* age dating with a goal of just a few million years resolution in age determinations;
- Develop Lunar Hoppers to visit several places on the lunar surface during one mission.

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Potential for SMD-ESMD Joint Missions (similar to LRO/LCROSS)

- In Situ Resource Utilization (ISRU) Technology Demonstration
- Lunar Dust Toxicity
- Exploration of Lunar Magnetic Anomalies

Commercial Partners: The ability to “buy rides” to the lunar surface needs to be explored, especially if the Google Lunar X-prize participants are successful

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Lunar Science Forum July 20-23, 2009

Special session to gather community input to the decadal survey process.

Plenary talks and breakout sessions.

White papers on ILN, SPA, Lunar Poles, and other high science priorities.

LEAG has set up a procedure for submitting white papers from the community into the decadal process.



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Surface Scenarios (SS) SAT

May 27-29, 2009, GSFC.

- Chair, Jim Head, Brown University
- Dean Eppler, NASA-JSC
- Terry Fong, NASA-Ames
- Matt Fouch, Arizona State University
- Ralph Harvey, Case Western Reserve
- David Kring, Lunar & Planetary Institute
- Joe Levy, Brown University
- Clive R. Neal, Notre Dame

Report Pending.

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NASA hereby requests the Lunar Exploration Analysis Group (LEAG) to form a Specific Action Team (SAT) to provide evaluation of and, as required, develop new lunar science scenarios for human exploration at the Moon in collaboration with OSEWG.

1. Conduct an evaluation of given sets of multi-mission scenarios and utilizing the framework provided by the OSEWG Support Team.
2. Upon completion of the evaluation, provide comments on the evaluation tool and suggestions to NASA for improvement.
3. Assess the limitations of the scenario assumptions.
4. Determine if further scenario development and analysis work is in order to build upon Phase 1. Suggest content of such work.

Lunar Exploration Roadmap

May 4-7, 2009, LPI

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

4 Goals, 36 Objectives, 131 Investigations

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

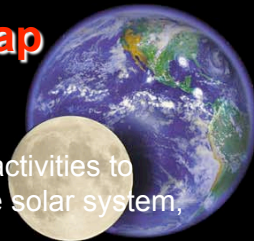
2 Goals, 12 Objectives, 51 Investigations

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

3 Goals, 23 Objectives, 106 Initiatives



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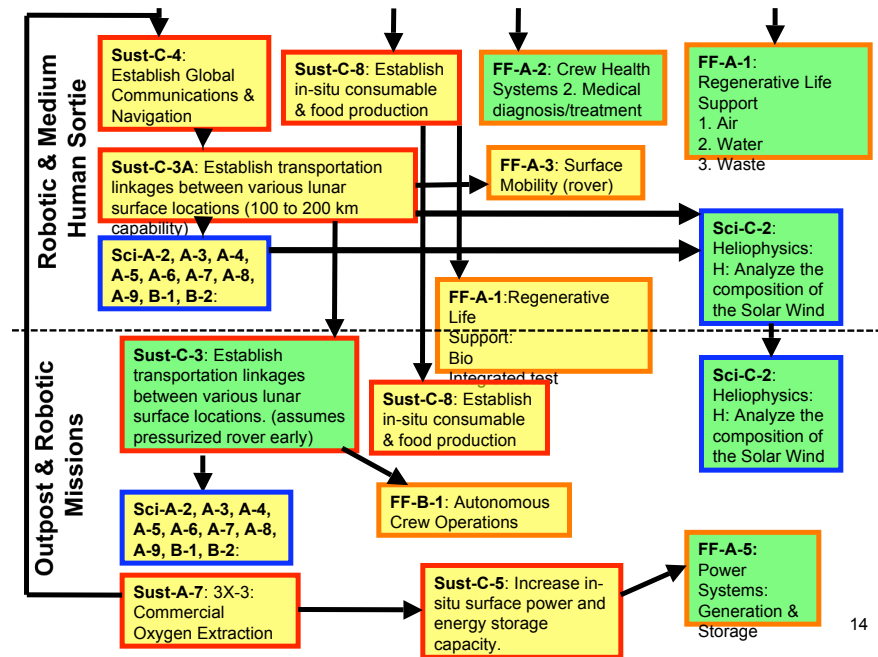
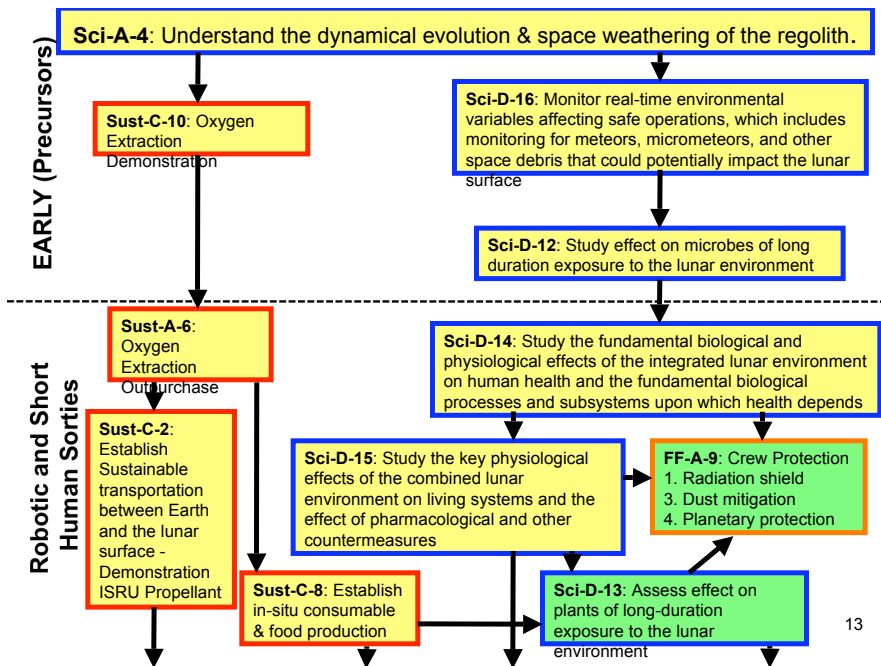


Draft Example of Inter-Related Science Objectives over Different Time Phases.

Full details will be in Lunar Exploration Roadmap version 1.0 (not to be multiplied!)

Blue Outlines = Science
 Orange Outlines = Feed Forward
 Red Outlines = Sustainability

Yellow Fill = High Priority
 Green Fill = Medium Priority



LEAG Annual Meeting

November 16-19, Lunar & Planetary Institute, Houston.

Focus: Sustainability Theme of the Lunar Exploration Roadmap (LER).

Rationale: this theme needs the most work and we need to actively engage more people from the commercial/ISRU sector.

Format: The meeting should allow lots of discussion, just like the LEAG 2007 meeting did.

Goal: Iteration of the Sustainability Theme of the LER that includes the latest results from lunar missions – results to be integrated back into the roadmap.

Length: 3.5 days, single plenary session.

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LEAG Annual Meeting

Day 1: Morning. Community Updates

Day 1: Afternoon. *Why are we going back to the Moon?*
How does a sustainable lunar exploration program benefit Lunar Science and Solar System Exploration?

Current & Future Missions: How will the results of current & future missions facilitate a sustainable lunar architecture?

Day 2 Morning & Afternoon. Results from LRO-LGROSS

Day 3 Morning. In Situ Resource Utilization – developments, capabilities, mission scenarios, commercialization on ramps.

Day 3 Afternoon. The need for Lunar Samples and Simulants: Where engineering and science meet.

Day 4 Morning: Sustainability Theme of the Lunar Exploration Roadmap.

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