LUNAR EXPLORATION ANALYSIS GROUP

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

Thursday June 30, 2011

To: James Green
Director, Planetary Science Division
NASA
Washington, DC 20546

Dear Dr. Green:

The Lunar Exploration Analysis Group (LEAG) Roadmap Specific Action Team has reviewed the *Vision and Voyages for Planetary Science in the Decade 2013-2022* ("Decadal") and explored the interface between that report and the Science Goals in the *Lunar Exploration Roadmap* developed by the lunar community through LEAG over the past 5 years (available at http://www.lpi.usra.edu/leag/ler_draft.shtml). We observed and conclude:

- First and foremost, we endorse the lunar science objectives identified in the Decadal Survey.
- The science objectives in the Roadmap parallel those in the Decadal.
- Scientific results from lunar research teach us not only about the Moon, but also processes that have shaped the entire solar system. In some cases, the planetary science objectives in the Decadal are best captured on the Moon, including those central to our understanding of the Earth, Mars, and outer solar system.
- Major science objectives can be advanced in the next decade through Research and Analysis, Discovery and New Frontiers missions, and more diversified Stand Alone Missions of Opportunity Notice (SALMON) opportunities (including Human Exploration and Operations Mission Directorate, Office of Chief Technologist, and commercial missions).
- As human exploration moves beyond LEO and begins to explore planetary surfaces, exploration activities should be designed with the knowledge and expertise developed within the SMD community.
- Science return can be significantly enhanced by cooperative missions between SMD and ESMD. The Lunar Reconnaissance Orbiter (LRO) provides an example of maximizing science and exploration objectives through cooperative missions.

With respect to the top-priority missions in the "Decadal:"

- We note that the South Pole-Aitken Sample Return Mission directly addresses LEAG Roadmap science objectives associated with impact processes and the

bombardment history of the inner solar system and testing models of the dynamics of the outer solar system. Furthermore, this mission demonstrates sample-return technologies and protocols.

- The Lunar Geophysical Network Mission addresses LEAG Roadmap science objectives associated with structure, differentiation, and dynamics of the lunar interior, and provides constraints on the interior of the terrestrial planets, and demonstrates technology for a Mars and other network missions.

With regard to other issues discussed in the "Decadal":

- Missions to understand lunar polar volatiles, explore potentially recent vents, reconstruct lunar thermal-tectonic-magmatic evolution, and evaluate the impact history of the inner solar system are identified in both the Decadal and LEAG Roadmap. We note that Discovery class missions can address some of these objectives, although a New Frontiers class mission, like Lunar Polar Volatiles Explorer, would provide greater insights. As some missions objectives overlap with ESMD interests in lunar resources, the missions could be conducted jointly.

- Recent robotic missions and continued sample studies have documented an astonishing variety and quantities of volatile elements within and on the Moon. We do not understand all the processes and histories associated with these new discoveries and characterization of the physical, chemical, isotopic and mineralogical nature of volatile deposits is urgently required.

- Decadal recommendations for curation and technology development enable science goals identified in the LEAG roadmap. Demonstration of technology in a lunar application is a valuable assessment of its capability for missions to other bodies. We feel that it is important that technology development be part of mission development, in order to reduce the time lag between technology maturation and its use.

- We endorse NASA's continued work with DOE to establish funding to restart Plutonium-238 production. The domestic production of Plutonium-238 is critical to NASA's leadership role in the exploration of the solar system. The availability of Plutonium-238 is critical for the exploration of the outer planets and would be a valuable asset for prolonged robotic missions on the surface of the Moon (i.e. Lunar Geophysical Network) as outlined in both the Decadal and LEAG Roadmap.

- A critical issue that was not specifically addressed by the Decadal is the need for establishing ground truth for volatile elements on planetary surfaces. In the last several years major discoveries have been made using remote sensing data (lunar OH and H_2O, martian phyllosilicates), but such discoveries are model-dependent and in some cases controversial. In situ measurements, perhaps followed by sample return, to verify and quantify these discoveries are a critical step in advancing our understanding of planetary volatile reservoirs.

Sincerely,

Charles Shearer
Chair, Lunar Exploration Analysis Group

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