LUNAR EXPLORATION ANALYSIS GROUP

http://www.lpi.usra.edu/leag 12 June 2019

Dear Colleagues,

The Lunar Exploration Analysis Group was formed in 2004 to support NASA objectives regarding lunar exploration, and organizes and leads the large and diverse lunar exploration community, including scientists, engineers, academia, government, and commercial entities.

It came to our attention that the AAS / DPS sent a letter to its membership on 23 May 2019 detailing its concerns about three issues associated with the NASA proposed budget amendment and the rollout of the NASA Artemis program. These concerns include: the proposed Pell Grant offset, the NASA Administrator's proposed transfer authority, and "lack of community consensus on the science program."

The first two concerns have to do with priorities within the administration, and the AAS/DPS stance is echoed by other professional societies. However, the third concern, that "there is not a community-wide consensus" on the lunar science to be accomplished with the requested $90M within the amendment, is incorrect and deserves clarification. LEAG was consulted extensively by NASA in the formulation of LDEP.

The AAS / DPS letter states its concern under the heading "Science Priorities":

> In addition to the Administration's already-proposed Lunar Discovery and Exploration Program (LDEP) — which the House Appropriations Committee appears to be on track to support — the new $1.6 billion amendment allocates $90 million to NASA's Science Mission Directorate (SMD) "for the purchase of commercial services to deliver a rover to…explore the Moon's polar regions in advance of a human mission." Since the changes in civilian space policy to return to the Moon have occurred after the last planetary science decadal survey in 2013 and that survey's midterm assessment in 2018, there is not a community-wide consensus on where the Administration's proposed lunar science program would rank within the relative priorities for lunar science, let alone within the priorities for the overall planetary science enterprise.

As recognized by the AAS letter, the Lunar Discovery and Exploration Program (LDEP) is a program within the Science Mission Directorate (SMD). The LDEP program exists at the intersection of high priority science and opportunities presented by NASA's emerging strategy to resume a vigorous program to send robots and humans to the lunar surface. As a NASA-chartered program analysis

group, LEAG maintains the community-driven goals document for lunar science and exploration, the Lunar Exploration Roadmap (LER). LEAG helped the Science Mission Directorate set its science priorities for LDEP via the Advancing Science of the Moon Special Action Team (ASM-SAT), a diverse interdisciplinary 30-person team (including representatives from the planetary science, Exploration, and astrophysical communities) who assessed progress made towards achieving the goals and objectives articulated in the 2007 National Research Council report on the Scientific Context for the Exploration of the Moon (SCEM) and determined the current science goals for lunar exploration. One of the several key outcomes of the ASM-SAT activity was that it reaffirmed the goals and objectives of the 2007 NRC Report.

The ASM-SAT team also had available for consideration the 2003 and 2011 Planetary Decadal Surveys, the 2014 NRC *Pathways to Exploration* report, the 2010 Astrophysics Decadal Survey, and the community goals articulated in the LER. Separately, LEAG also conducted for SMD the "Next Steps on the Moon" Special Action Team, which considered how commercial opportunities could enable the science goals identified by SCEM and reaffirmed by ASM-SAT.

We also note that separately, in 2019, NRC's Committee on Astrobiology and Planetary Science released its *Review of the Planetary Science Aspects of NASA's Lunar Exploration Initiative,* which states:

> CAPS concludes that NASA's Planetary Science Division (PSD) has responded rapidly and effectively to Space Policy Directive-1 (SPD-1). PSD has taken early measures to ensure participation of the lunar science community and that decadal lunar science priorities are or will be addressed in its Lunar Discovery and Exploration Program. The initial, near-term steps taken toward implementing the lunar program—including introducing new programs and realigning or enhancing existing programs with new lunar focus—emphasize high-priority science and are useful directions for SMD's lunar discovery and exploration initiative.

Finally, LDEP is also charged with considering opportunities to achieve technology goals via the NASA Technology Roadmaps and human exploration goals via the HEOMD Strategic Knowledge Gaps. In sum, LDEP is explicitly designed to create opportunities to achieve multi-disciplinary community-wide science, technology, and exploration goals and objectives. Therefore, to say there is no community consensus driving these priorities is incorrect.

It is our understanding that the requested $90 million allocation to SMD within the amendment would be directed to the LDEP program, and not to the Planetary Science Division (PSD). The AAS/DPS letter acknowledges that "The LDEP program within SMD appears to be doing an admirable job of finding synergies between efforts to kick-start a lunar commercial services industry and solid peer-reviewed science investigations and payloads, while adhering to science priorities described in the 2013 planetary decadal survey." LEAG supports the Decadal Survey as the guiding document for PSD and stands behind the Decadal priorities. But again, the Decadal Survey is only one input to the ASM-SAT, which is the guiding document for science within the LDEP program.

Finally, we disagree that "the upcoming planetary science decadal survey will certainly need to consider the changes to civil space policy and commercial spaceflight capabilities as they impact the survey committee's holistic approach to prioritizing lunar and planetary research." The role of the Decadal Survey is to identify and prioritize the most important planetary science research that can and should be done in the upcoming decade. ***Lunar science goals are planetary science goals and deserve full consideration in their own right***. As explicitly stated by the 2007 NRC Scientific Context for the Exploration of the Moon report, the Moon has profound science value independent of human spaceflight goals; prioritization of lunar science is not, and should not be, tied to the tides of human space flight. However, we do agree that new opportunities presented by evolving capabilities and architectures can enable NASA and the community to implement these goals, which is the charge of the LDEP program.

LEAG leads a large, diverse, and inclusive community. LEAG is happy to facilitate a broad understanding of the community-driven priorities for lunar exploration to all interested parties, a role we have performed since 2004.

S. J. Lawrence

Chair, Lunar Exploration Analysis Group

For the executive committee

LINKS TO DOCUMENTS:

Lunar Exploration Roadmap (LER)

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

The Scientific Context for Exploration of the Moon

https://www.nap.edu/catalog/11954/the-scientific-context-for-exploration-of-the-moon

Decadal Survey: Vision and Voyages for Planetary Science in the Decade 2013-2022
https://www.nap.edu/catalog/13117/vision-and-voyages-for-planetary-science-in-the-decade-2013-2022

Astro2010: The Astronomy and Astrophysics Decadal Survey

http://sites.nationalacademies.org/bpa/bpa_049810

National Research Council. 2014. *Pathways to Exploration: Rationales and Approaches for a U.S. Program of Human Space Exploration*. Washington, DC: The National Academies Press. https://doi.org/10.17226/18801.

Next Steps on the Moon Specific Action Team (NEXT-SAT)

https://www.lpi.usra.edu/leag/reports/NEXT_SAT_REPORT%20(1).pdf

Advancing Science of the Moon Specific Action Team (ASM-SAT) Final Report

https://www.lpi.usra.edu/leag/reports/ASM-SAT-Report-final.pdf

NASA Technology Roadmaps

https://www.nasa.gov/offices/oct/home/roadmaps/index.html

NASA HEOMD Strategic Knowledge Gaps (SKGs)

https://www.nasa.gov/exploration/library/skg.html

NRC Review of the Planetary Science Aspects of NASA SMD's Lunar Science and Exploration Initiative

https://www.nap.edu/read/25373

ABOUT THE LUNAR EXPLORATION ANALYSIS GROUP

The Lunar Exploration Analysis Group (LEAG) was established in 2004 to support NASA in providing analysis of scientific, commercial, technical, and operational issues to further lunar exploration objectives. LEAG was jointly established by the Science Mission Directorate (SMD) and the Human Exploration and Operations Mission Directorate (HEOMD) and now includes participation from the Space Technology Mission Directorate, and blends members of all these diverse communities, building bridges between science, exploration, and commerce whenever and however possible. LEAG is led by a Chair and Vice-Chairs who serve as the principal representatives of the United States lunar exploration community to all stakeholders, including NASA and the international community. LEAG has a standing Commercial Advisory Board (CAB) to offer programmatic insights into the capabilities provided by industry. LEAG is a community-based, volunteer-driven, interdisciplinary forum. Membership is open to all members of the lunar exploration community and consists of lunar and planetary scientists, life scientists, engineers, technologists, human system specialists, mission designers, managers, policymakers, and other aerospace professionals from government, academia, and the commercial sector.

ABOUT THE LEAG LUNAR EXPLORATION ROADMAP

The LEAG Lunar Exploration Roadmap (LER) is the cohesive strategic plan for using the Moon and its resources to make fundamental science discoveries, build a sustainable future on the Moon, and pioneer the trail to all other destinations within the Solar System by leveraging affordable investments in lunar infrastructure. Created at the request of the NASA Advisory Council, the LER is a living document developed over four years through a comprehensive community-based process featuring contributions from over 200 individuals and was released in 2012, and updated in 2013 and 2016. The LER lays out an attainable plan for Solar System exploration that allows NASA to use its lunar exploration infrastructure to explore small bodies, Mars, and beyond. Following the LER will enable commercial development, through early identification of commercial opportunities that will create wealth and jobs to enhance the economy and offset the initial investment of the taxpayer. The roadmap will also, with careful planning, enable international cooperation to expand our scientific and economic spheres of influence while enabling an expansion of human and robotic space exploration. The Roadmap is located at:

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