

Lunar Exploration Analysis Group (LEAG)
Town Hall Meeting to Discuss
Future Lunar Exploration Opportunities
03.03.10
41st Lunar & Planetary Science Conference



Goals of the Town Hall:

- ⇒ Explore lunar opportunities within the FY 2011 budget considering the switch to “flexible path/multiple destination”;
- ⇒ Suggestions for revisions of the Lunar Exploration Roadmap (LER).

Summary of Discussion Points

- Community suggestions already made prior to the town hall meeting (apart from the Decadal survey):
 - Develop a Class D PI-led “Lunar Explorer” program within the Lunar Quest program (this is a white paper idea from the Lunar Science Institute with Bill Farrell as the lead. The white paper will be open to comments from community once the paper has been edited);
 - ISRU technology demonstration on lunar surface;
 - Student lunar lander engineering missions. There needs to be a connection to stimulate and inspire the next generation of lunar scientists and engineers (e.g., small student-led engineering/technology demonstration missions).
- Technologies to be developed now should support sustainability when we get back to Moon. Four broad categories:
 - Robust transportation (heavy lift launch, extracting fuel);
 - Reducing supply cost;
 - Learning to live off the land;
 - Developing products that will pay back.
- An enabling technology would be an orbital communications relay satellite to lower cost of farside exploration. This may become a reality, but the community wishes to show it is strongly in favor of this.
- Nuclear power should be considered for the Moon in order to enable exploration of areas outside “permanently” sunlit areas.
- Developing robotic sample return from the Moon would enable such sample returns from other airless bodies (leverage from the Moonrise technology development).
- Resources (polar and non-polar) need to be quantified.
 - The next step should have “prospecting” missions to explore the extent of non-polar deposits in the third dimension (depth);
 - Prospecting tools need to be mobile;
 - Polar volatile deposits need to be explored and characterized: extent, composition, and nature (pore space ice, blocky ice, ice layers, etc.). This is best done with a series or campaign of missions to truly define what is present;
 - If permanently shadowed regions are to be explored, systems that operate at ultra-low temperatures need to be developed;

- There is a collaboration between NASA and CSA to develop coring, extraction of volatiles, and production of oxygen. Are there science aspects that could be incorporated?
- ISRU Technology Demonstrations:
 - An obvious mission that has exploration and potential feed forward implications to other locations is production of oxygen from lunar regolith;
 - **Science implication:** We don't really know solar wind & Helium-3 content of lunar soil because we don't know how much was lost from the Apollo samples because of agitation during the return.
 - Another ISRU technology demonstration is the growth of food crops in lunar regolith on the lunar surface.
 - Efficiency of microprobes in extracting lunar resources needs to be explored in the lab and eventually on the lunar surface.
 - Pneumatic mining is a totally dry procedure using Nitrogen to efficiently segregate the $\leq 2 \mu\text{m}$ fraction of the lunar regolith, which is highly enriched in solar wind. This needs further development in the lab and eventually on the lunar surface.
- Telerobotics should be a part of the precursor missions.
- Synergies between exploration and science need to be identified and capitalized upon. Options:
 - ESMD develops the mission, provide certain mass to enable a mission of opportunity;
 - SMD finds a budget wedge to provide healthy opportunities for mission of opportunities.
- Development and promotion of a “lunar orphans list” of payloads looking for a ride to the Moon:
 - A start could be the payloads from the Google lunar X-prize teams who don't win.
 - The list could contain a database of countries that want to fly, who is PI, what are they proposing to do, how ready are they, mass and volume associated with instrument, Technology Readiness Level (TRL), etc.
- LEAG is looking at setting up a web-based community forum to identify needed technologies and allow the community to comment on the list as well as add to it. The details will need to be worked out. Examples of such technologies include low power and low temperature electronics, batteries (long-lived and environmentally sturdy), sensor heads, etc.