LEAG Report

Planetary Sciences Subcommittee

October 7th, 2007

LEAG Annual Meeting, October 1-5, 2007

IMP-SAT Update

Other Activities/Future Plans
LEAG Annual Meeting
October 1-5, 2007
Houston Hobby Airport Hilton Hotel
http://www.lpi.usra.edu/leag2007/

“Enabling Exploration: The Lunar Outpost & Beyond”

Meeting Goal: Define pathways to offset cost and risk of achieving the next steps in space exploration.

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Meeting Outline

Day 1: Briefings and Community Updates.
Day 2: International Partnerships,
    CSA, ASI, ISRO, BNSC, JAXA
    ISRU & Outpost Sustainment Demos.
Day 3: The Role of Robotic Missions,
    Commerce: Incremental Steps from Earth to Lunar
    Enterprise.
Day 4: Sample Return and Lunar Exploration,
    Role of Technology in Field Exploration & Astronaut
    Training.
Day 5: Site Selection and the Lunar Outpost.
    Summary Discussion.

Poster Sessions Wednesday and Thursday,
6-8 p.m. in the SW Grand Ballroom D/E.

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Sessions focused by specific questions & discussion aspects.

Overarching Question: *How can risk/cost be reduced through cooperation & partnerships in technological developments and demonstrations?*

Mars feed-forward discussions in Briefings, Sample Return, ISRU, FEAT, & Outpost Site Selection.

110 people registered.

Sessions were 60% presentations, 40% discussion.

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Meeting Outcomes

Concerns:
What is the Vision? Why are we going back to the Moon? The Vision appeared blurred.

We are going to work and learn how to live on another planet.

Our national policy, declared by President Bush and endorsed by Congress last December in the NASA authorization act, affirms that, "The fundamental goal of this vision is to advance U.S. scientific, security, and economic interests through a robust space exploration program."

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Stated this way, the "fundamental goal" identifies the benefits against which the costs of exploration can be weighed.

The current vision policy document says the U.S. will "Extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of Mars and other destinations."

John Marburger, 44th Robert H. Goddard Memorial Symposium, March 15, 2007, Keynote Address

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Meeting Outcomes

Assumption: Moon, Mars and Beyond - learning to live off the land with feed forward to Mars. This wasn’t clear in the LAT-2 report.

International and ISRU

International participation in the lunar outpost. Of great value to focus on those elements NASA is NOT base lining (e.g., mobility) - NASA has made a good start. Trust needs to be built up between partners.

An ISRU demonstration mission is critical for outpost sustainability and Mars feed forward.

ISRU can be enabling without being in the critical path. It can be done anywhere, but S Pole is favorite although the nature of the H deposits are unknown. ISRU can be used to mitigate ΔV issues and facilitate feed forward technologies.

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Meeting Outcomes

Robotic Missions

- Establish an aggressive lunar science campaign to the lunar surface.
- Enabled by commercial leveraging with NASA:
  - Could follow approach to develop Commercial Orbital Transportation System (COTS).
- Could lead to near-term technology demonstrations on the surface (e.g., ISRU).
  - Campaign (series of missions) would provide information needed for exploration and science.
  - LEAG through the NAC could define such a campaign.

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Meeting Outcomes

How to reduce risk & cost with technology development?

Precision landing.
Sample containment/preservation.
Coring & manipulation:
  Sampling subsurface
    Don’t forget Apollo coring experience/knowledge
    Coring/drilling polar regolith;
    Controlled or deep regolith stratigraphy

On-surface curation.

Contamination mitigation: need a “Contamination Czar” (for samples, not PP!)
  Alteration/contamination of ‘pristine’ nature of samples by exposure to atmosphere is a concern.

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Meeting Outcomes

Some important comments related to technologies the field.

- “KISS” philosophy (scientifically useful)
- Relieve astronauts of detailed sample documentation by employing new technologies.
- Use potential analytical tools in the field during training (e.g., hand-held XRF, portable Raman spectrometer, digital microscopy).
  - Importance of the work bench and rock splitter near the habitat for sample high grading.
  - Use of telepresence technology in field training.

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Meeting Outcomes

Site selection process needs to be open, build on history, and be inclusive of all stakeholders.

**Trust:** International-Commerce-NASA partnerships.

**Commerce:** site needs to be resource/energy rich; provide entertainment/public engagement value; be accessible to areas of scientific interest.

**NASA:** exploration that enables development.

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Meeting Products

On-line report. Presentations will be on the LEAG web site (PDF format).

Letter to the NAC. This Report to the PSS. EOS meeting report.

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Original Charge: “The LEAG has been charged to map the 16 lunar science objectives to an implementation plan.”

Modified Charge: “The LEAG has been charged to map the 16 lunar science objectives to an implementation plan. Such evaluations should include any potential commercial and/or international partnerships and highlight any ISRU linkages.”

Correlation will include measurement objectives, geographic coverage, and sampling and documentation strategies. Objectives will be distinguished on the basis of major progress that can be made through the current exploration architecture.

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Center it around the 5 themes identified by the PSS under which are the 16 GEO objectives - each theme has a point person.

The LEAG Executive Committee will create a template for each GEO under each theme.

The point people for each theme send this out to individuals to fill out (one GEO per person) - 4 weeks to do this.

All the responses come back and are collated by the IMP-SAT committee (the point people for each theme and the IMP-SAT chair.

The report is then refined on the basis of these responses into one document that basically follows the outline of the IMP-SAT template.

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LEAG IMP-SAT

- Investigation of the geological evolution of the Moon and other terrestrial bodies (GEO-1, -2, -3, -5).
- Improved knowledge of impact processes and impact history of the inner solar system (GEO-6, -7, -8).
- Characterization of regolith and mechanisms of regolith formation and evolution (GEO-9, -10, -11, -14).
- Development and implementation of sample documentation and return technologies & protocols (GEO-15, -16).
- Study of endogenous and exogenous volatiles on the Moon and other planetary bodies (GEO-4, -12, -13).

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LEAG Other Activities/Future Plans

Input to NRC Committee working on the next New Frontiers AO.
LEAG 2008: Coincide with LRO launch (week of October 27).
Lunar Goals Document.
Robotic Campaign Plan?
SATs?

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Meeting Outcomes

Concerns:

What is the Vision? Why are we going back to the Moon? Appeared blurred.

The fundamental goal of this vision is to advance U.S. scientific, security, and economic interests through a robust space exploration program. In support of this goal, the United States will:

Implement a sustained and affordable human and robotic program to explore the solar system and beyond;

Extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of Mars and other destinations;

Develop the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration; and

Promote international and commercial participation in exploration to further U.S. scientific, security, and economic interests.
Why are we going? The Vision.

Science/Exploration

ISRU

Commerice

Feed-backward from Mars.

Robotic-Human exploration;

Outpost location;

Feed-forward to Mars.
Given the NRC framework for prioritized lunar science missions, it is suggested that the LEAG Executive Committee assess the possibility of establishing a proposed, integrated, strategic science campaign for lunar surface science missions. The campaign would be similar in nature to Mars Discovery class missions...except instead of 26 month centers to Mars, it would 24 month centers for the moon (as example). This campaign definition should cover the lunar decadal emphasis from 2008-2018.

It is recommended that the LEAG develop a product for SMD (Stern) that characterizes frequency of flights, class of missions and type of science that would strategically lead to small lander missions to the surface. Additionally, it could include those technology development missions that could feed-in to the science flight.
Meeting Outcomes

The major consensus was that ISRU was important for sustained human presence on the Moon.

- Landers & Surface System elements should be compatible with use of ISRU products.

Space commercialization of the Moon is enabled by ISRU however lots of debate on how to commercialize ISRU and developing ‘markets’.

Early demonstration of ISRU capabilities is important for sustained human operations and commercialization. Eliminate concern of putting ISRU in ‘critical path’.

- An ISRU demonstration mission is highly desirable.
- Insertion into a highly linked deployment schedule is difficult.

How much and when ISRU is needed is highly a function of what is the actual goal/purpose for the Lunar Outpost and NASA human exploration of the Moon.
Overarching Question:

*How can risk/cost be reduced through cooperation and partnerships in technological developments and demonstrations?*

What were the lessons learned from Apollo (i.e., what worked and what didn’t)?

What technologies need to be developed to facilitate field operations for the establishment and maintenance of a lunar outpost, as well as for scientific exploration?
International Partnerships

What are the synergies between the exploration goals of potential international partners and the Vision for Space Exploration?

What are the (perceived) obstacles to international cooperation in the Vision for Space Exploration and what are the solutions?

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08:00  Welcome and Logistics  Clive Neal
08:10  Exploration Partnership Strategy Briefing  Marguerite Broadwell
08:50  ESMD Briefing  Doug Cooke
09:30  SMD Briefing  Jim Green
10:10  SOMD Briefing  W. Michael Hawes
10:50  LAT-2 Briefing  Geoff Yoder
11:30  Questions and Discussion  Clive Neal
12:00  Lunch

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13:30  Constellation Office Briefing  Jeff Hanley
14:15  Report of the NAC Tempe Wksp  Brad Jolliff
14:40  Report of the OSEWG Wksp  Kelly Snook
15:05  FEAT Activities and Goals  Mark Helper
15:30  Report of the Lunar Dust Wksp  Daniel Winterhalter
15:50  Report of the NRC SSB Wksp  Mike Duke
16:10  Report: Feed Forward to Mars  Brett Drake
16:40  Questions and Discussion  Clive Neal
17:10  Overview of the Meeting & Product  Clive Neal
17:15  END