

REPORT
of the
Planetary Science Subcommittee
of the NASA Advisory Council Science Committee

Washington, D.C.
7-8 June 2007

Introduction

The Planetary Science Subcommittee (PSS) of the NASA Advisory Council (NAC) Science Committee met for the fifth time on 7-8 June 2007 at NASA Headquarters. A total of 15 of the 18 subcommittee members attended the meeting.

The agenda (attached) included a number of presentations and discussion topics. On the morning of the first day of the meeting, the subcommittee graded the Planetary Science Division's Government Performance Reporting Act (GPRA) progress. Phil Crane first presented background on performance parameters that are reported to the Office of Management and Budget (OMB) and Congress and asked PSS to rate the division's self-assessment on Annual Performance Goals (APGs) in terms of Green, Yellow, and Red grades. The performance goals are based on the 2006 Strategic Plan, which had been worked into the 2007 Performance Plan, and resulted from the collapse of a number of concepts into four, more briefly worded goals. The remainder of the morning was devoted to presentations by chairs or representatives of the analysis groups — including the Venus Exploration Analysis Group (VEXAG), Lunar Exploration Analysis Group (LEAG), Mars Exploration Program Analysis Group (MEPAG), Outer Planets Assessment Group (OPAG), and Curation and Analysis Planning Team for Extraterrestrial Materials (CAPTEM) — and to a discussion, led by Paul Hertz, of new requirements for Principal Investigators (PIs) for proposals in response to announcements of opportunity (AOs) for PI-led mission lines.

The afternoon of the first day opened with a presentation by Joe Veverka, chair of the National Research Council (NRC) Committee on Lunar and Planetary Exploration (COMPLEX), on COMPLEX plans for advising NASA on how to specify mission opportunities for the next New Frontiers AO. Wes Huntress, co-chair of an NRC committee evaluating the progress of the Planetary Science Division against the solar system exploration decadal strategy, summarized the status of his committee's deliberations and the plans to complete and release committee findings. Yvonne Pendleton discussed new initiatives within the Science Mission Directorate (SMD) to streamline proposal evaluation and grant processing in the directorate's Research and Analysis (R&A) programs. In a portion of the agenda open to community presentations, Art Snoke summarized recent progress by the Field Exploration Analysis Team (FEAT).

On the second day of the meeting, James Green, Director of the SMD's Planetary Science Division (PSD), updated the subcommittee on Division activities and responses to PSS and NAC recommendations from earlier meetings. Brad Jolliff led a discussion of ongoing responses to recommendations from the NAC-sponsored Workshop on Science Associated with the Lunar Exploration Architecture in January; Kelly Snook, Michael Wargo, and Geoff Yoder made additional contributions. Recently appointed SMD Associate Administrator Alan Stern, who joined the subcommittee for the full morning, led a discussion of recent changes in SMD organization, management directives, and programs. Presentations on the Dawn mission by David Lindstrom, the Phoenix mission by Bobby Fogel, and the status of outer planet flagship mission studies by Curt Niebur rounded out the afternoon. The meeting ended with a consensus formulation of subcommittee findings and recommendations.

Research & Analysis Programs

The PSS applauds strongly the creation of the new position within SMD of Senior Advisor for R&A (SARA), the Appointment of Yvonne Pendleton to that position with Max Bernstein as her deputy, and the early actions taken by her office to streamline programs, improve communications with proposers and R&A PIs, and reduce the proposal review burden now borne by the community. These actions address, in a comprehensive and considered manner, concerns long voiced by the community and this subcommittee. The subcommittee looks forward to hearing of the effects of these actions on timeliness of grant awards, more effective use of review panels, enhanced ties between R&A decisions and strategic mission planning, and generally improved communication with the community.

New Frontiers Mission Candidates

The PSS was pleased to hear that COMPLEX was in the process of forming a committee to study options for specifying candidate missions for the next New Frontiers opportunity. This action is fully responsive to a recommendation that the subcommittee made last year. The PSS affirms that those New Frontiers mission candidates described in the solar system exploration decadal survey but not yet selected for flight remain of high scientific priority. In particular, as recommended by VEXAG (see below), the PSS regards a mission to explore the Venus near-surface environment as high priority, as is a comet nucleus sample return and a sample return from the lunar South Pole-Aitken basin on the Moon's farside. The PSS is heartened that a process is now in place to expand the menu of mission opportunities, as well as to explore related cost cap, launch vehicle, and power source issues, and we look forward to the report of the NRC committee early in calendar 2008.

PI Qualifications

The PSS was briefed by Paul Hertz on the new qualifications for Principal Investigators to the Small Explorer (SMEX) Program, as described in a draft AO recently released for that program, and to the expectation that similar qualifications would be made requirements for all future SMD solicitations for proposals to PI-led mission competitions (e.g., Discovery, Scout, New Frontiers). In brief, proposing PIs must have at least two years prior experience as PI or deputy PI, project scientist (PS) or deputy PS, or project manager (PM) or deputy PM, for an instrument or experiment on a previous suborbital, Earth orbiting, or deep-space mission or for such a mission overall. The rationale given was that PI-led missions having PIs with such an experience base are more successful in general and are less susceptible in particular to cost growth. Alan Stern's remarks to the subcommittee reiterated this rationale.

The subcommittee discussed this new requirement at length. Those discussions would have benefited from tabular or graphical summaries of the documentation that such specific prior experience does improve chances for mission success or limits to cost growth, and the PSS requests that NASA provide such documentation to the community in the near future. (For example, an informal assessment by PSS of past and current Discovery Program PIs could identify only one of 10 who met the new required qualifications, and that mission experienced no less cost growth than what has been typical for the program.)

The committee expressed further concerns with the new requirements. Opportunities to serve as PS or PM for a mission are greater at NASA centers and analogous implementing organizations than they are at universities, so the new qualifications put university researchers at a distinct disadvantage. Further, the cadre of individuals who possess the newly stated qualifications includes few women or underrepresented minorities. Limiting the pool of potential PIs might also mean limiting the most innovative or promising mission concepts, an outcome that would not be to NASA's advantage. The new requirements do not address the roles of NASA centers, other implementing organizations, and commercial contractors in helping mission PIs ensure that a mission remains beneath a cost cap and on schedule. Moreover, it was not made clear to the subcommittee that NASA has a plan in place to evaluate the impact of these new requirements

on proposal submissions or on cost containment and mission success in the future.

The PSS is not advocating that NASA consider selecting missions for which the proposing PI is not appropriately experienced. Nonetheless, the experience of the entire proposing team is at least as important as that of the individual PI, and the background and expertise of the PI and team have always been important selection criteria in past competitions for PI-led missions. It was not clear to the PSS that PI experience is a defining factor in mission success and cost growth, or that the new qualification requirements would have a significant impact on cost containment for future missions.

The PSS is concerned that the newly announced qualifications for PIs on space missions, if unmodified, could exclude many potentially successful mission leaders, particularly from the university community as well as women and underrepresented minorities. The subcommittee was told that NASA intends to encourage suborbital experiments, missions of opportunity, and other options for members of the community to gain the requisite experience to serve at a later date as mission PI, although we did not hear plans for how these opportunities are to be made better known within the community.

The PSS recommends that NASA reconsider PI qualifications and share with the community the historical basis for any relationship between PI qualifications at selection and either mission cost growth or mission success. We recommend further that NASA advertise vigorously the routes by which interested scientists can gain the requisite experience to serve as mission PI. Finally, we recommend that NASA develop mechanisms to address other historical factors in mission cost growth as well as metrics for assessing how the new PI qualification requirements are achieving the intended outcomes.

In Alan Stern's discussion, a mission management scenario in which an experienced scientist serves as PI for the science payload but a PM manages the overall mission was presented as a possible alternative to a PI-led mission. The Mars Exploration Rover missions are good planetary science examples of where this model has worked well, in large part because both payload PI and mission PM have been skilled managers who have comparably strong personalities, developed mutual respect, and functioned well as a team. The PSS is aware of other examples, however, in which an instrument or experiment team leader and PM did not work well together, and the delivered payload suffered as a consequence. This alternative management scenario should be used with care, and only in situations where the scientist lead and PM have demonstrated an ability to work cooperatively to optimize mission scientific return.

Mars Program

The PSS was pleased to hear from Jim Green and Alan Stern that the architecture for the Mars Exploration Program for the coming decade is now committed to a Mars Sample Return (MSR) mission in 2020. Sample return from Mars has been a goal of the highest priority to the planetary science community for more than three decades, so it is heartening to see this milestone as a clear objective of the Mars Exploration Program. The subcommittee looks forward to hearing more over the next several months about the implications of this decision for other mission plans for the period between 2013 and 2020, as well as on the outcome of ongoing discussions with possible international partners for an MSR mission. As noted below, the MEPAG Science Analysis Group (SAG) for the 2013 Mars Science Orbiter (MSO) has developed three science-based scenarios for that mission and has called for the chartering of a Science Definition Team for that mission within the next few months as a needed step to take full advantage of the 2013 launch window. ***The PSS requests that it be kept informed of progress on planning for MSO and in particular how that mission will help to advance the objective of launching an MSR mission in 2020.***

Launch Vehicles

The Delta II has been the workhorse launch vehicle for Planetary Science Division missions, so the termination of this launch vehicle line by Boeing within the next several years raises the question of how medium-sized deep-space missions will be launched when Delta II vehicles are no longer available. The PSS heard from Alan Stern that NASA is exploring an alternate launch

provider, as well as the possibility of purchasing as many as six or seven Delta II vehicles for future use. Whereas this information provides some comfort, ***the PSS is increasingly concerned about the future of affordable access to Delta II-class launch vehicles and recommends that NASA decide expeditiously on a future approach to acquiring appropriately sized launch vehicles and make that decision and the supporting documentation public.***

Lunar Science Workshop Recommendations

The PSS was pleased to hear from Brad Jolliff that the recommendations from the February Workshop on Science Associated with the Lunar Exploration Architecture, including those led by members of the PSS, were discussed at length at the April NAC meeting and were forwarded as NAC recommendations to NASA. ***The PSS re-affirms its support of the recommendations from the Lunar Science Workshop and urges that they be integrated fully into the current lunar architecture.***

The PSS notes that many of the science recommendations from the Lunar Science Workshop forwarded to NASA by the NAC differ significantly from the "notional" lunar architecture being developed by Lunar Architecture Teams (LATs) 1 and 2. Notable differences concern global access, robotic exploration, and outpost siting at the South Pole. To assure that the NAC recommendations are built into the mission architecture, the PSS endorses the need for a designated scientist who will interface among SMD, the Exploration Systems Mission Directorate (ESMD), the LATs, and Constellation Program managers. The subcommittee was pleased to learn from Alan Stern that Daniel Durda will be joining SMD to serve in this role. His immediate involvement in lunar architecture planning is critical, as the LATs are scheduled to report on their mission architecture by August.

Veterans of the Apollo Program remember well the thoughtful deliberations that went into the selection of each lunar landing site. ***The PSS recommends that an individual with Apollo experience be a member of the Lunar Site Selection Working Group in order to benefit from and build constructively on the lessons learned during the Apollo Program.*** More generally, the lunar architecture development process should expand the involvement of interested members of the lunar and planetary science communities to as great an extent as is feasible.

Activities of Assessment and Analysis Groups

VEXAG representative Stephen Mackwell reported that Venus sample return should remain a long-term goal for Venus exploration, but the formidable technological obstacles to such a mission dictate that other, more technologically feasible missions be undertaken first. It is the view of VEXAG that the Jet Propulsion Laboratory's Venus Mobile Explorer concept represents a logical next step in Venus exploration but requires significant investments in technology prior to a new start. VEXAG recommends that a Science Definition Team be formed to guide the study of one or more Venus flagship mission concepts and to provide recommendations on needed new technology investments in the areas of power, electronics, mobility, sample acquisition, and science instrumentation in the Venus surface and near-surface environments. News on VEXAG activities is posted regularly on <http://www.lpi.usra.edu/vexag/>.

LEAG chair Clive Neal summarized the group's charter and recent LEAG activities. The group has an Executive Committee to help manage requests made to the group by NASA Directorates, NAC, and NAC's committees and subcommittees. LEAG is partnering with the Outpost Science and Exploration Working Group (OSEWG) to host a workshop later in the month on architecture issues associated with sampling by astronauts and robotic vehicles on the Moon and Mars. LEAG plans an annual meeting to provide a forum to communicate among the diverse communities served by the group. The next such meeting will be 1-5 October near Houston. News on LEAG activities is posted regularly on <http://www.lpi.usra.edu/leag/>.

Outgoing MEPAG chair Ray Arvidson described the status of group activities and planning for the group's next meeting in July. A Science Analysis Group (SAG) chartered to assess options for the 2013 Mars Science Orbiter mission completed its final report shortly before the

subcommittee meeting. Three mission scenarios were evaluated — one emphasizing atmospheric signatures and near-surface change, one emphasizing polar and climate processes, and one emphasizing geological and geophysical exploration — without prioritizing among scenarios. The SAG raised several questions that should be addressed by a Science Definition Team (SDT) in order to focus on one of the three scenarios. That SDT should be chartered within the next few months if mission planning is to remain on track for a 2013 launch. Another MEPAG SAG was chartered on the human exploration of Mars (HEM-SAG) as part of a larger study jointly sponsored by SMD and ESMD. The HEM-SAG enunciated the overarching conclusion that “Understanding habitability and life in the context of Mars as a planetary system and its spatial and temporal interplay of climatic and tectonic cycles is the ultimate goal of human scientific exploration.” A revision of the MEPAG Goals document is underway, and MEPAG is involved in planning for COSPAR-sponsored workshops. News on MEPAG activities is posted regularly on <http://www.mepag.jpl.nasa.gov/>.

OPAG chair Fran Bagenal reported on a Jet Propulsion Laboratory study of missions to Titan and Enceladus. The JPL study concluded that significant advances in scientific understanding of either of these moons of Saturn could not be accomplished within the New Frontiers mission line, *i.e.*, under a cost cap of ~\$1B. The group is monitoring the progress of Science Definition Teams for flagship missions to Europa, Titan, Enceladus, and the Jovian system (Ganymede) and welcomes collaboration with European and Japanese colleagues in developing strategies and priorities for outer solar system exploration. OPAG is concerned that investments in key technologies that will be critical to future outer planets missions are not being made; these technologies include aerocapture flight qualification, balloon technology development, high-efficiency radioisotope power system (RPS) development and qualification, and low-temperature materials and systems. There is also a need for NASA, together with the Department of Energy, to clarify the issue of ^{238}Pu availability for power sources for future outer planet missions. News on OPAG activities is posted regularly on <http://www.lpi.usra.edu/opag/>.

CAPTEM chair Chip Shearer described the group’s role in the allocation of extraterrestrial material, including lunar samples, Stardust and Genesis samples, and cosmic dust samples. Further, CAPTEM provides expertise and guidance to NASA in the area of curation of the current sample collection and the sampling and curation of future materials to be returned from the Moon, Mars, and other bodies. The group also sponsors sample-oriented workshops and other initiatives and for 2008 is planning workshops on Stardust science and on future sample return technology capabilities. At the February Workshop on Science Associated with the Lunar Exploration Architecture, CAPTEM was charged to produce a white paper detailing the same return mass needed per launch from the lunar surface. The white paper was completed in May and delivered to the NAC. A copy of the white paper and other news on CAPTEM activities may be found at <http://www.lpi.usra.edu/captem/>.

Planetary Science Subcommittee Meeting Agenda
7-8 June 2007
Program Review Center (9H40)
NASA Headquarters
300 E Street, S.W.
Washington, DC 20546

7 June (8:30 AM – 5:15 PM)

8:30	Welcome & Administrative Matters	Sean Solomon, Michael New
8:45	Evaluation of GPRA Metrics	Phil Crane
10:15	Break	
10:30	Analysis Group Reports <ul style="list-style-type: none"> • VEXAG • LEAG • MEPAG • OPAG • CAPTEM 	Stephen Mackwell Clive Neal Ray Arvidson Fran Bagenal Chip Shearer
11:30	New PI Requirements in Explorer AO	Paul Hertz
12:00	Lunch	
12:30	Science Talk: New Horizons at Jupiter	Hal Weaver
1:30	State of COMPLEX Planning for New Frontiers Program	Joe Veverka
2:30	Overview of NRC Review of Planetary Science Division	Wes Huntress
3:30	Discussion of NRC Activities	Sean Solomon
4:00	Overview of New R&A Initiatives	Yvonne Pendleton
5:00	Presentations for Community Representatives <ul style="list-style-type: none"> • FEAT • Others as requested 	Art Snoke
5:15	Recess for the Day	

8 June (8:00 AM – 3:00 PM)

8:00	Planetary Science Division Update <ul style="list-style-type: none">• Status of Arecibo discussions• Future plans for PI-led mission lines• Mars Program update	James Green
9:30	Discussion	Sean Solomon
10:00	Lunar Science Workshop Recommendations	Brad Joliff Kelly Snook Mike Wargo Geoff Yoder
12:00	Lunch	
12:30	Q&A with the New AA, S. Alan Stern	
12:45	Overview of the Dawn Mission	David Lindstrom
1:15	Overview of the Phoenix Mission	Bobby Fogel
1:45	Status of Outer Planet Flagship Mission Studies	Curt Niebur
2:15	Formulation of Recommendations	Sean Solomon
3:00	Adjourn	