

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

**Greenbelt, MD
23-24 June 2008**

Introduction

The Planetary Science Subcommittee (PSS) of the NASA Advisory Council (NAC) Science Committee held its eighth meeting on 23-24 June 2008 at the NASA Goddard Space Flight Center. Twelve of the 14 current members of the subcommittee attended the meeting, and six pending subcommittee members attended as guests.

The agenda (attached) included a broad range of presentations and discussion topics. The morning of the first day began with a briefing by James Green, Director of the Planetary Science Division (PSD) of NASA's Science Mission Directorate (SMD), on division activities, as well as responses to PSS and NAC recommendations from earlier meetings. Michael Meyer, Mars Exploration Program Lead Scientist, summarized the current status of the Mars Exploration Program. Curt Niebur, Outer Planet Flagship Program Scientist, presented an update on outer planet flagship mission studies, and over lunch the subcommittee heard a talk on the latest results from the Phoenix mission by Principal Investigator Peter Smith.

The afternoon began with presentations by chairs 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), Small Bodies Assessment Group (SBAG), and Curation and Analysis Planning Team for Extraterrestrial Materials (CAPTEM). Those presentations were followed by one on Mars Sample Return (MSR) planning by Lisa May, MSR Program Executive. Clive Neal, LEAG chair, then gave a summary of the Lunar Capability Concept Review (LCCR) meeting, which had just been held on 18-20 June. The last agenda item of the first day was an evaluation of how well PSD had met its 2008 performance goals, an exercise led by Philippe Crane and carried out in conformance with the Government Performance and Results Act (GPRA). The subcommittee deliberated on the four PSD performance goals (3C.1 through 3C.4) for the year and judged that each goal had been achieved (and merited a rating of green).

The second day of the meeting began with three presentations that summarized the results of independent studies of the factors that affect cost growth for NASA missions. Paul Gilbert, Manager of the Discovery, New Frontiers, and Lunar Science Program Office at NASA Marshall Space Flight Center, summarized a study that his office had completed on improving life-cycle cost management of planetary missions. Claude Frenner summarized a recent Headquarters study of 40 NASA missions on the effect of optimism in early conceptual designs on cost and schedule growth later in mission history. Cindy Bruno, from the NASA Science Support Office at the Langley Research Center, summarized the results of an SMD study of cost and schedule performance on 15 flight projects. Following a lunch break and a discussion period, the subcommittee was joined by SMD Associate Administrator (AA) Ed Weiler, who answered questions for nearly two hours. The meeting ended with a review of subcommittee findings and recommendations stemming from the two days of discussion.

General Assessment of PSD Programs

The time of the PSS meeting was a time of transitions for the PSD. Some of those transitions were obvious, such as the departures of such long-term Headquarters staffers as Denis Bogan,

Kurt Lindstrom, and John Rummel and the return, transfer, or arrival of others (Max Bernstein, Len Dudzinski, Gordon Johnston, Tom Morgan, and Joan Salute). The National Research Council will be undertaking studies on how best to balance Research & Analysis with planned and ongoing missions and on the detection and mitigation of near-Earth objects, and plans have already begun for the next decadal survey for solar system exploration. The growth to date in the Mars Science Laboratory budget has been largely addressed, and the pressures on other elements of the Mars Exploration Program are not as acute as at the time of our last meeting. At the same time, the change in AAs at SMD has meant that the mix of priorities for PSD has been to some extent shuffled, and there is the added uncertainty of an election year in which a change in administration is certain but the changes in national space policy are not.

Flagship Missions

The PSS is encouraged that PSD is proceeding thoughtfully and carefully with the definition of an Outer Planet Flagship (OPF) mission and with a possible Mars Sample Return (MSR) mission, although the large cost for each type of mission and the similarity in their development and launch schedules under current plans raise the immediate question of how both can be accomplished without a more distinct phasing of efforts.

The OPF plans are the more mature of the two. Two mission concepts are being studied in potential partnership with the European Space Agency (ESA): a Europa – Jupiter system mission, and a Titan – Saturn system mission. The Office of Management and Budget (OMB), in the course of preparation of the President’s fiscal year 2009 budget, was encouraging of an OPF mission. A change in the assumptions underlying mission planning since the last PSS meeting has been the directive to find the “sweet spot” in science return versus mission cost rather than design the mission to a given cost cap. That cost cap had been \$2.1B, and the OPF study teams have provided an interim report that such a cap shortchanges the scientific return relative to the recommendations of the last solar system decadal survey. While the new directive is applauded, the reality of the foreseeable budgets of NASA and ESA dictates that an OPF could be launched no sooner than 2018 or perhaps even 2020. **The PSS reiterates that an OPF mission is of the highest scientific primacy for planetary science, and we support NASA efforts to find a route toward matching mission concept and budgetary plan that will bring such a mission to reality.**

Current plans for MSR call for an international mission for which there are multiple elements that can be contributed by participating space agencies. New technology development for key flight elements as well as for a Sample Receiving Facility (SRF) must be initiated at least 10 years before launch of the first MSR flight segment. Both the technical definition and the cost profile of an MSR mission remain to be worked out in detail. Available launch opportunities have been examined with respect to launch mass, landed mass, and lander stay time on the Martian surface, and it is already clear that some compromises will be needed. The 2020 and 2022 launch opportunities are tight for launch mass, the 2022 and 2024 opportunities are tight for stay time to the point of compromising roving and sample collection, the 2026 and 2028 are tight for stay time but less so than 2022 and 2024, and the 2028 and 2030 opportunities are tight for landed mass.

The subcommittee has long endorsed a thoughtfully selected OPF mission, and **the PSS affirms the recommendation made at our last meeting that the return of appropriately selected and documented samples from Mars is the highest-priority scientific objective for Mars exploration over the next 10-15 years.** Both missions are costly relative to foreseeable resources available to PSD, and it appears likely to us that careful planning will be needed to optimize the phasing between these two ambitious endeavors. **The PSS recommends that the completion of both an OPF mission and an MSR mission should continue to be an overarching goal of NASA’s planetary exploration program.**

The Next Decadal Survey for Solar System Exploration

The PSS is pleased that NASA intends to request that the National Research Council (NRC) initiate a new decadal survey for solar system exploration within approximately the next 12 months. As the PSS has recommended repeatedly over the past two years, it will be critical that the developers of such a survey take a fully integrated view of the entire solar system, including Mars and the Moon. The integration of heretofore largely independent strategies for the exploration of Mars, the Moon, and other solar system bodies will be essential if the strategy is to provide useful advice to NASA regarding the relative priorities among possible flagship missions and the relative importance of large missions and medium and smaller mission program lines.

In the context of the next decadal survey, the PSS wishes to raise the question of the scientific breadth of the committee that will eventually be tasked with the development of a decadal strategy. We note that the current membership of the NRC Committee on Planetary and Lunar Exploration (COMPLEX) does not have the sort of ideal balance of expertise that we hope and expect would be sought for the decadal survey committee; the committee has only a single atmospheric scientist, for instance. Although we understand that neither the subcommittee nor NASA can be involved in an NRC committee selection process, **the PSS recommends that careful attention to disciplinary breadth be paid during recruitment of the committee that will oversee the next decadal survey for solar system exploration, so that the segments of the planetary science community studying planetary magnetospheres, atmospheres, surfaces, and interiors; gas-giant planets, ice-giant planets, rocky planets, dwarf planets, and small bodies; rings; dynamics; planetary materials; organic chemistry; and astrobiology all feel as though their scientific interests are well represented in strategic planning.**

Mars Exploration Program

Compared with the situation at the time of the last PSS meeting, the Mars Exploration Program has seen several notable changes. The Phoenix Scout mission landed successfully on Mars on 25 May. Concept Study Reports for the two candidate Scout missions for the 2013 opportunity were received, and a selection is planned for September. Additional funding was supplied to NASA-supported instrument candidates for flight on the ESA ExoMars mission. The Mars Odyssey, Mars Exploration Rover, Mars Express, and Mars Reconnaissance Orbiter missions continue to operate more or less nominally.

The PSS is pleased that NASA remains committed to launching the Mars Science Laboratory (MSL) in 2009, as the subcommittee recommended at our last meeting because of the large cost penalty (~\$350M) that would be incurred by slipping one launch opportunity. Meeting the current schedule still presents difficulties, particularly the accommodation of the approximately \$200M in mission cost growth (with the precise figure dependent on the baseline assumed). Needed funds this year (approximately \$115M) are coming from the Mars Exploration Program, other PSD programs, and elsewhere in SMD. An additional \$75M must be found in fiscal year 2009; the sources of those funds will be decided in October. A Continuation Review with the SMD AA is planned for September. The PSS looks forward to a briefing on MSL at its next meeting, and we remain optimistic that the technical and fiscal challenges posed by this mission will be met so that a timely launch can be completed.

Even with an MSL launch next year, the Mars Exploration Program faces the considerable challenge of developing a decadal architecture that is scientifically compelling and fiscally responsible, yet is resilient to the evolving understanding of combinations of mission opportunities that will accomplish the long-term goal of returning a broad selection of well-documented and well-preserved samples from Mars. The PSS understands that a new architecture is under development by a Mars Architecture Tiger Team (MATT), that the architecture will be reviewed by a Red Team headed by Scott Hubbard, and that a report on the current planning process is expected by September. The PSS is pleased by the strong MEPAG

involvement at each stage in this planning, and we look forward to a report on the architecture at our next meeting.

As noted above, an MSR mission will be complex and will contain many elements that require advanced planning, including mission architecture and cost as well as mission operational protocols, such as appropriate sample handling protocols and design of the SFR. The PSS endorses the current NASA activities to update existing planetary protection documents and to establish initial steps in sample handling protocols. We ask that the appropriate analysis groups review the results of these activities as soon as is feasible. Further, **the PSS recommends that over the next two years NASA refine cost estimates and candidate mission timelines for MSR.** A clarified timeline will aid in planning with respect to the SRF, National Environmental Policy Act (NEPA) issues, a competed site selection process, and associated public communication activities.

The PSS recognizes that, without appropriate planning and in the absence of a well established and suitable sample receiving and containment facility, samples could not be returned from Mars without violating our international agreements. Critical exploration and science activities that depend on Mars sample return could be delayed or precluded. Further, these steps are necessary to be able to understand how to budget for the mission, how to manage potential international partnerships, how to manage the communication of risk to public audiences, and how to structure the processes and timeline for the SRF site selection process.

New Frontiers Missions

The report of the NRC study committee on *New Opportunities in Solar System Exploration (NOSSE): An Evaluation of the New Frontiers Announcement of Opportunity*, released shortly after the last PSS meeting, calls on NASA to expand the list of candidate missions for the New Frontiers Program and to continue to emphasize science objectives in mission selection. The PSS is pleased that NASA has acceded to these recommendations, and we look forward to the release of the new New Frontiers Announcement of Opportunity (AO) by the end of this calendar year. The PSS is also pleased to see that some of the formal requirements on those proposing to lead a New Frontiers mission as Principal Investigator have been relaxed, with the understanding that the qualifications of the entire mission leadership team will continue to be an important criterion in mission selection.

An important objective of the New Frontiers mission line is to accomplish high-priority scientific objectives that cannot be achieved with a Discovery- or Scout-class mission but do not demand the resources of a flagship. These two aspects of New Frontiers should continue to be communicated to potential proposers to this mission line. The latter aspect may mean that a mission concept can be scientifically compelling even if it does not accomplish every element of the mission as described in the last decadal survey, as the selection of Juno has demonstrated, or the recent NOSSE report. The former aspect should mean that missions proposed for New Frontiers are more ambitious, but not less cost-conscious, than proposals to the Discovery and Scout Programs.

Discovery Missions

The Discovery Program remains one of the most successful mission lines within PSD, and the PSS hopes to hear that a specific release time in 2009 has been set for the next Discovery AO. The PSD is to be applauded for the award of nine concept studies for missions seeking to utilize an advanced Stirling radioisotope generator (ASRG) as a government-furnished power source, and we note that several of the concepts receiving study funds could lead to Discovery-class missions. A major issue for Discovery remains the availability of a launch capability appropriate for small missions, once NASA's last Delta II has been successfully launched. This issue, long recognized, continues to receive attention across NASA, and the PSS looks forward to reports of progress at upcoming meetings.

Lunar Missions

The PSS continues to support the expanded program in robotic lunar exploration and lunar science within PSD. We look forward to the launch of Chandrayaan-1 and its NASA-supplied instruments this fall and of the Lunar Reconnaissance Orbiter (LRO) and the Lunar CRater Observation and Sensing Satellite (LCROSS) this winter, as well as the transfer of LRO operations to PSD after the first year in lunar orbit. Planning for the Lunar Atmosphere and Dust Environment Explorer (LADEE) mission and two International Lunar Network (ILN) landers, which together address two of the broad Science Goals recommended in the 2007 NRC report on *The Scientific Context for Exploration of the Moon*, has progressed since the time of our last meeting. The announced plans to develop, in partnership with the Department of Energy, a small (10-100 W) radioisotope power source is responsive to the PSS recommendation, made at our last meeting, that PSD take steps to ensure the availability of long-lived power supplies for landed networks such as the ILN. The Lunar Science Institute is underway, with an interim director named and proposals for team participation due in late August.

Lunar Exploration and SMD

The PSS was given a thorough briefing on the LCCR meeting that NASA held immediately prior to the PSS meeting. The PSS commends NASA, and the Exploration Systems Mission Directorate (ESMD), for the maturing architecture for lunar exploration presented at that meeting, an architecture that promises the opportunity for substantial scientific return and builds on the successful results of previous human and robotic lunar missions. We are particularly pleased to see that the architecture includes the concept of dedicated sortie missions to non-outpost landing sites and that planning is underway for access to a significant part of the Moon (nearside, farside, high and low latitudes) by these missions, which have been described as critically important by the 2007 NRC report on *The Scientific Context for Exploration of the Moon*.

The PSS is concerned, however, that insufficient attention is being placed on astronaut mobility at the outpost and at the sortie sites. We view the availability of Apollo-style Lunar Roving Vehicle (LRV) mobility to distances of at least 10 km from the landing site as essential to the realization and optimization of scientific return on the investment of sending an astronaut crew to the surface. **The PSS recommends that rover mobility be considered a minimum requirement for sortie missions to the Moon.**

The PSS is also concerned that the returned mass of lunar samples and other materials that is currently being considered is inadequate to meet the complex scientific objectives that the astronauts will be endeavoring to address during either sortie or outpost missions. Although there have been technological advances in making measurements on small samples in laboratories on Earth, the scientific objectives for sortie sites call on a wide range of sampling strategies, types of samples, and sample sizes. For example, large regolith breccia samples are required to understand the context of the individual rock clasts they contain and to establish the relationships that reveal the processes responsible for their formation. This issue was raised by the PSS at the Workshop on Science Associated with the Lunar Exploration Architecture held in Tempe, Arizona, in February 2007, and CAPTEM was tasked with the development of a specific recommendation for sample return specification. A CAPTEM report issued on 7 May 2007 in response to this charge, and which took into account the current scenarios for the duration and activity suite of typical sortie missions, recommended that the returned mass of lunar samples per mission be at least 230 kg. **The PSS endorses the CAPTEM recommendation that the mass of returned lunar samples be at least 230 kg per mission.**

In early March of this year, the NAC requested that LEAG review the Lunar Architecture Team (LAT-2) concept developments. That request was not accepted, on the grounds that the LAT-2 developments had been completed and could not be affected by any LEAG recommendations. LEAG therefore suggested in a letter sent to the NAC Chair on 24 March that LAEG could be more useful as a reviewer of the Constellation Architecture Team (CxAT) Lunar

effort, the follow-on to LAT-2, and LEAG requested that NAC facilitate participation by LEAG in CxAT Lunar activities. As of the date of the meeting, LEAG has not received a response to this request. **The PSS requests that the NAC respond formally to LEAG's request to facilitate community involvement in the CxAT Lunar effort.**

The NRC report on *The Scientific Context for the Exploration of the Moon* recommended that "NASA conduct a thorough review of all aspects of sample curation" for new samples collected during future lunar missions. In response to that recommendation, the PSS has asked that CAPTEM conduct a review of the current lunar curation capabilities and capacity at the NASA Johnson Space Center lunar sample laboratory. That initial analysis should be followed by a review of future curation needs that is based on projected lunar surface activity architectures. Without appropriate planning for the future curation of new lunar samples, critical exploration and science activities tied to the return to the Moon could be deleteriously affected.

Mission Cost Management

The three detailed presentations – by teams from the Discovery, New Frontiers, and Lunar Science Program Office at Marshall; the NASA Science Support Office at Langley; and NASA Headquarters – made to the PSS on lessons learned from past SMD missions on cost management were extremely informative. We understand that planning is underway to offer tutorials on this and related topics in mission management to newly selected Principal Investigators on SMD missions. While that effort is extremely worthwhile, we recommend that the outcomes of the three cost studies presented to us be shared broadly with the PSD community. Copies of the presentations will be posted, of course, on the PSS web site. We hope that the lessons derived from these studies will be reiterated as well in broadly disseminated articles and in presentations at major meetings of the planetary science community.

Technology Development

Across many elements of the planetary exploration program, there are new technologies whose development and validation in space would enable missions that cannot currently be completed. The Venus community as represented by VEXAG, for instance, has identified aerocapture as a capability that could enhance the scientific return of future missions to that planet, as well as to Mars, Titan, and the outer planets. VEXAG has recommended, and PSS endorses, that **PSD should develop a plan in the near term to test and validate aerocapture system technologies.** In the current absence of a New Millennium program or other mission line specifically tailored to enable such technology validations, PSD and SMD should select among other opportunities to test aerocapture concepts at Earth or in the course of missions to other bodies with sufficiently massive atmospheres.

Activities of Assessment and Analysis Groups

VEXAG chair Ellen Stofan summarized current VEXAG activities and the principal issues facing the Venus science community. A Science and Technology Definition Team (STDT) for a Venus Flagship Mission study was formed in early January, with Mark Bullock (Southwest Research Institute) as chair. An interim report, issued in May, favored an integrated mission architecture with an orbiter, two instrumented balloons, and two short-lived landers that acquire information on the atmosphere during descent. Technology development needs are less demanding than some alternative mission architectures, and essential components could be brought to technical readiness level (TRL) 6 by 2015. A VEXAG Technology Focus Group is prioritizing technology needs for near-term investments. A particular technology capability that would enhance the scientific return from future Venus missions is aerocapture. The final report from the STDT is due in November. VEXAG is also promoting a Comparative Climatology research program – emphasizing comparisons among Venus, Earth, and Mars – for inclusion in the 2009 ROSES announcement. A session at the Fall AGU Meeting on this topic is planned, and an AGU Chapman Conference on this theme is under discussion. VEXAG is also proposing

a Venus Laboratory Research Initiative. The next VEXAG meeting will be 25-27 February 2009. News on VEXAG activities is posted regularly on <http://www.lpi.usra.edu/vexag/>.

LEAG chair Clive Neal summarized recent LEAG activities. In response to a charge by the NAC to develop a "Lunar Goals Roadmap" that maps science goals to objectives, needed observations, and measurement requirements, LEAG is coordinating a community-wide effort entitled "Exploring the Moon in the 21st Century: Themes, Goals, Objectives, Investigations, and Priorities, 2008." LEAG has formed five Specific Action Teams (SATs) to further the goals of this effort, with initial reports due to LEAG from the SATs by the end of the month. LEAG will solicit further community input at the Lunar Science Conference in July. The next LEAG meeting will be 28-31 October in Cape Canaveral, Florida, and will be held jointly with the International Lunar Exploration Working Group (ILEWG) and the Space Resources Roundtable (SRR). Themes will include the sustainable Moon, the international Moon, and the productive Moon. News on ongoing LEAG activities is posted on <http://www.lpi.usra.edu/leag/>.

MEPAG chair Jack Mustard summarized recent activities of the group. Developments in Mars exploration since the previous PSS meeting in March include the Phoenix landing in May, approval given to MSL to proceed toward a 2009 launch, and Mars exploration architecture planning by MATT and the International Mars Architecture for Return of Samples (iMARS). MEPAG Science Analysis Groups (SAGs) completed Mars Priorities for Sample Return and Mars Strategic Science Assessment activities and posted reports on the MEPAG web site. An update to the MEPAG Goals Document is underway and will be completed this summer. MATT is considering architectures with a variety of options (and program cost profiles) for the 2016 launch opportunity, including a lander or rover (Mars Science Prospector), an orbiter (Mars Science Orbiter), and an orbiter in support of a Mars Sample Return lander or rover in 2018. The next MEPAG meeting will be on 18 September in Monrovia, California. News on MEPAG activities is posted regularly on <http://mepag.jpl.nasa.gov/>.

OPAG chair Fran Bagenal provided an update on OPAG activities. OPAG applauded the plans for a Cassini Extended Mission, approved by NASA, and supports ongoing plans for an "extended extended" mission that will focus on detailed observations of Saturn. The group is following closely the progress in defining and initiating an OPF mission to the Jupiter or Saturn system, with a focus on in-depth exploration of Europa or Titan, respectively. OPAG noted that five of the nine Discovery and Scout Mission Capability Enhancement (DSMCE) concepts, selected for study of how best to utilize a NASA-supplied ASRG, target the outer solar system. For the next New Frontiers Program AO, OPAG recommends that ample funds be allocated to Phase A to permit readiness demonstration of essential technologies; for the fourth New Frontiers Program AO, OPAG recommends that radioisotope power systems be included to expand the menu of scientific targets. The next OPAG meeting is 6-7 November in Tempe, Arizona. News on OPAG activities is posted regularly on <http://www.lpi.usra.edu/opag/>.

SBAG chair Faith Vilas discussed the group's formative plans. SBAG has initiated a web site and will be holding its inaugural meeting during the *Asteroids, Comets, Meteors 2008* conference in July. The group is planning a white paper on small bodies, with sections targeting remote sensing, sample return, population identification and characterization, in situ resource utilization, and hazard assessment. Leads for each section will be identified at the July meeting. SBAG plans to hold a "town hall" session during the Division for Planetary Sciences meeting in October. News on SBAG activities is posted regularly on <http://www.lpi.usra.edu/sbag/>.

CAPTEM chair Chip Shearer summarized recent CAPTEM activities. Together with MEPAG, CAPTEM sponsored a workshop in April on Mars Sample Return that addressed mission strategies and sample requirements from the perspectives of astrobiology and planetary evolution, with a particular focus on sulfates and hydrous minerals. Different MSR science objectives require different samples, so landing site selection and sampling strategy will be important issues. Preservation of fragile and possibly reactive samples should also be factored into strategies for sampling, delivery, and curation. CAPTEM's Facilities Committee reviewed

the engineering study for a new air handling system in the lunar sample facility at Johnson Space Center, and the committee is evaluating the form of future reviews of the curation facility and capabilities that will be needed under possible lunar exploration architectures. CAPTEM is also planning for the preliminary examination of interstellar dust samples collected by Stardust and will be cosponsoring a Stardust Science Workshop in 2009. News on these and other CAPTEM activities may be found at <http://www.lpi.usra.edu/captem/>.

As a final action, the PSS scheduled its next meeting for 2-3 October 2008 in the greater Washington, D.C., area.

**Planetary Science Subcommittee Meeting
23-24 June 2008
NASA Goddard Space Flight Center
Building 1, Room E100E**

23 June (8:30 AM – 6:30 PM)

8:30	Welcome & Other Administrativia	Sean Solomon, Michael New
8:45	Planetary Science Division and Mars Exploration Program updates	Jim Green, Michael Meyer
10:45	Discussion	Sean Solomon
11:45	Lunch Science talk: Update on <i>Phoenix</i> mission	Peter Smith
12:45	Update on Outer Planet Flagship Mission studies	Curt Niebur
1:30	Analysis Group Reports <ul style="list-style-type: none"> • VEXAG • LEAG • MEPAG • OPAG • SBAG • CAPTEM 	Ellen Stofan Clive Neal Jack Mustard Fran Bagenal Faith Vilas Chip Shearer
3:30	Break	
3:45	Update on IMARS	Lisa May
4:15	Overview of recent Lunar Capability Concept Review	Clive Neal
4:45	Evaluation of GPRA outcomes	Phil Crane
6:30	Adjourn PSS dinner	Sean Solomon

24 June (7:00 AM – 4:30 PM)

7:00	Tour of GSFC	
8:30	Administrative matters	Sean Solomon, Michael New
8:45	Discovery and New Frontiers Program Office Lifecycle Cost Study	Paul Gilbert
9:45	SMD Mission Cost and Schedule Drivers Study	Claude Freaner
10:45	SSO Study of Mission Cost Drivers	Cindy Bruno
11:45	Discussion of Mission Cost Drivers	Sean Solomon
12:00	Lunch	
1:00	Discussion of Mission Cost Drivers (continued)	Sean Solomon
2:00	Discussion with new AA, Ed Weiler	Ed Weiler
3:30	Discussion, formulation of recommendations and planning of future meetings	Sean Solomon
4:30	Adjourn	Sean Solomon

Tour for the Planetary Science Subcommittee (PSS) of the NASA Advisory Council (NAC) Science Council

Tuesday, June 24, 2008
7:00 a.m. – 8:15 a.m.

NASA's Goddard Space Flight Center

- 7:00 am: Board Bus, Depart Building 1
- 7:05 am: Arrive Building 7
Met by Tour Guide Carmine Mattiello
- 7:10 am: Walking Tour of GSFC Integration and Test Facilities
- Featuring Flight Hardware from:
Solar Dynamics Observatory (SDO)
Lunar Reconnaissance Orbiter (LRO)
Hubble Space Telescope (HST)
- 7:35 am: Depart for Building 33
- 7:45 am: Arrive Building 33
Met by Tour Guide Dr. Paul Mahaffy
- Overview of the Sample Analysis at Mars (SAM) Lab
- 8:15 am: Board Bus to Return to Building 1
- 8:25 am: Return to conference room