

NAC Planetary Science Subcommittee Meeting, June 7, 2016
National Aeronautics and Space Administration
Washington, D.C.

NASA ADVISORY COUNCIL

PLANETARY SCIENCE SUBCOMMITTEE

June 7, 2016
NASA Headquarters
Washington, D.C.

Meeting Minutes

Jonathan Rall, Executive Secretary

Janet Luhmann, Chairman

*Report prepared by
Joan Zimmermann, Ingenicomm, Inc.*

NAC Planetary Science Subcommittee Meeting, June 7, 2016

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Welcome and Administrative Matters

Dr. Jonathan Rall, Executive Secretary of the Planetary Science Subcommittee (PSS), opened the meeting and made administrative announcements. Dr. Janet Luhmann, PSS Chair, called the meeting to order and thanked members for attending.

PSD Status and Findings Update

Dr. James Green, Director of the Planetary Science Division (PSD), presented a briefing focused on previous findings and recommendations of the PSS, beginning by thanking members who were about to rotate off the PSS for their service. Planetary events of recent note include the imminent arrival of Juno at Jupiter 4 July. PSD is lining up press conferences and other outreach activities in preparation. Later in July, NASA will celebrate the 40th anniversary of the Viking mission, for which the Jet Propulsion Laboratory (JPL) and Langley centers will hold events marking the occasion. The Cassini mission is starting maneuvers for its grand finale at Saturn in 2017. On 8 September, the launch of the Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer (OSIRIS-REx) mission will take place at Kennedy Space Center (KSC). Dr. Green asked members to email him for an invitation if they wished to attend the launch.

Several missions have completed a Senior Review for extended mission (EM) status: Mars Odyssey; the Mars Exploration Rover Opportunity; Mars Science Laboratory (MSL) Curiosity; the Mars aeronomy mission, MAVEN; the Mars Reconnaissance Orbiter (MRO); Mars Express; New Horizons; Dawn; and the Lunar Reconnaissance Orbiter (LRO). Among some new National Academies of Science (NAS) reports is one on cubesats, which has just been released and would be of interest to the community. A review of extended missions is in its final phases and will be complete by the end of September, when it will get a brief-out. The EM report is expected to highlight the importance of such missions, and it will be important that the NAS weigh in on the report and set the tone for future surveys. A Research and Analysis (R&A) review is under way and will report at the end of 2016. A review of large strategic NASA missions is also kicking off; its report is due in more than a year. NASA is planning to task the National Research Council (NRC) by the end of the summer for a mid-term review of the 2013-2022 Planetary Decadal Survey. There will be many NAS studies for input to this review, a fortunate aspect of timing. The third planetary Decadal Survey, 2023-32 will be tasked before October 2019, to report back to NASA by the first quarter of 2022. The next survey will help PSD to move forward strategically as well as to consider a new Ocean Worlds program. PSD is also moving towards its second Small, Innovative Missions for Planetary Exploration (SIMPLEx) call targeted at Mars.

Dr. Green addressed previous PSS findings and recommendations. The first was a recommendation on a Europa Lander Science Definition Team (SDT) report that was to include how the mission meets the goals of the Decadal Survey. PSD has been conducting a pre-phase A study on a lander concept, and the SDT report is due no later than 30 September. The lander's overarching science goals include biomarker detection and the search for extant life *in situ* on Europa, an assessment of habitability, and surface property characterization in the context of

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orbiter observations. The last time life detection was a science goal for NASA was 40 years ago for Viking. The SDT will eventually be comprised of an 18-member team, and will work to create a traceability matrix to feed into a model payload. The team includes Jonathan Lunine and other well-known planetary scientists.

Responding to a PSS finding on Ocean Worlds and the Outer Planets Assessment Group's (OPAG) Roadmap to Ocean Worlds, PSD fully concurs with a recommendation to think about the Outer Planets missions in a different way, instead of one new start per decade, to a set of connected missions such as the ocean worlds. PSD has obtained funding from Congress for a, Concepts for Ocean Worlds Life Detection Technology (COLDTech) instrument development opportunity, which will help furnish instruments for a Europa lander and other potential spacecraft for exploring the Outer Solar System. The COLDTech call was issued in May; NASA will put out an Announcement of Opportunity (AO) for a lander at a later date. This plan will hopefully will provide sufficient time for instrument maturity. Dr. Green noted that PSD had followed this approach successfully for the Europa Clipper.

Regarding Ocean Worlds in New Frontiers call #4(NF 4), PSS had recommended that the Committee on Astrobiology and Planetary Science (CAPS) consider whether the Ocean Worlds strategic theme could be included in NF 4 (as it had not been included in the current Decadal Survey). CAPS was briefed in March, who then briefed the Space Studies Board (SSB) on 24 April, which concluded that the proposed change does not alter science priorities as laid out in the Decadal Survey. It is believed that a sound management approach should allow Headquarters the flexibility to add elements, through the peer review process, as the decade progresses. NASA recognizes that any mission must be capable of accomplishing New Frontiers-class science.

Responding to a recommendation on the progressing Mars Sample Return (MSR) mission sequence, for comprehensive studies on sample retrieval and a Sample Receiving Facility (SRF), PSD concurred and is prepared to act on a significant amount of information already available on Department of Defense facilities that can accommodate quarantined samples. The plan is to begin to take a look at the sample-receiving chain and other factors.

Responding to a PSS finding on special regions and a designation of these areas for scientific study, PSD concurs and recognizes that planetary protection (PP) measures will be critical, and to that end is establishing a PP Technology Definition Team (PPTDT) to enable the division to make wise investments into PP technologies and techniques that will allow spacecraft to visit special regions. A more dedicated investment in this area must be accomplished. The PPTDT will delineate what is available currently for measuring bioburden and such items as state-of-the-art techniques for cleaning medical equipment, and will catalog materials and components that are compatible with PP protocols. PSD is currently writing a charter for the team, which will report out by November, in order to provide input for a ROSES 2017 solicitation.

PSS has recommended that PSD increase its level of R&A funding. PSD concurs with the recommendation, and Dr. Green pointed out that, following a low point in 2012, R&A funding has increased by \$70M between FY08-FY16, from \$160M/year to roughly \$239M/yr. PSD has worked very hard to continually increase this budget and will continue to do so.

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In response to PSS encouragement for continuing support of the Arecibo radiotelescope facility, Dr. Green sent a letter to the National Science Foundation (NSF) on 18 April, stating NASA's intent to maintain Arecibo for near-Earth object (NEO) detection and other observations. NSF responded immediately as a partner.

In response to a PSS recommendation encouraging US participation in foreign planetary missions, Dr. Green noted that for the last ten years, NASA has greatly increased the number of its international partnerships, including a Participating Scientist (PS) program on the European Space Agency's (ESA) ExoMars 2016 lander, provision of a communication system for the Mars Trace Gas Orbiter, and a mission instrument partnership on ESA's JUpiter ICy moons Explorer (JUICE). NASA is working with the Japanese space agency, JAXA, on the Akatsuki, Hayabusa-2, and Hisaki missions, as well as a mission to explore martian moons, Phobos and Deimos. NASA is currently working with the Indian Space Research Organisation (ISRO) on its Mars Orbiter Mission (MOM) and also discussing future partnerships, and has just joined a joint SDT for Russia's future Venera-D mission to Venus. With Spain, NASA continues an instrument partnership on Curiosity and for Mars 2020 (M2020).

Recently, PSD has set up a Planetary Defense Coordination Office (PDCO), feeling it was the right thing to do. PSD also continues to monitor the Deep Space Network (DSN), having been alarmed by reports of data loss, and it continues to keep an eye on issues. The one dip that occurred was still within NASA's commitment to data robustness; DSN is now back up to its prior level of 99% data delivery (the requirement is 95%).

Discussion

Dr. Nancy Chabot expressed appreciation for Dr. Green's efforts on Arecibo, conceding that there is no easy solution. Dr. Green reported NSF is doing a Senior Review-like review for all of their facilities to determine their viability, and felt the assessment process is proceeding as it should. Scientific significance, programmatic support and international interest will all feed into the ultimate decision. NASA is monitoring the situation. Dr. Luhmann asked about any issues on the Human Exploration and Operations (HEO side) and commercial enterprises in planetary exploration. Dr. Green noted that Elon Musk of SpaceX is planning for Mars exploration. NASA has a memorandum of understanding (MOU) with Musk and has had some discussions on NASA's abilities to provide navigation, landing site advisement, and coordination of assets for tracking. The Mars Interior Exploration using Seismic Investigations, Geodesy and Heat Transport (InSight) mission is now scheduled for 2018, and any other Mars launches at that time must be coordinated. It is exciting to hear about SpaceX planning for human habitats. NASA is also looking at human landing sites, and has had one workshop on the concept, while MRO is obtaining data on additional sites. In-situ resource utilization (ISRU) will be needed for any long-term human mission. For this purpose, NASA plans to pick one spot and visit it several times.

Moon Express is a commercial plan to land on Moon. NASA is looking forward to a successful demonstration and will examine how to leverage it from a scientific perspective; the project may

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provide opportunities NASA may not have otherwise. NASA plans to stay plugged in and enter into appropriate partnerships at the right time.

R&A Update

Dr. Rall gave an update on the results of the ROSES 2016 call, reporting the receipt of 822 step-1 proposals, with many fewer step-2 proposals from Emerging Worlds (EW). Solar System Workings (SSW) has moved to employ two step-2 deadlines for SSW pushed a large chunk of SSW deadlines to fall and late winter to better manage panel reviews. PSD is seeing a change in proposal pressure, represented by a drop of 15% from 2014 to 2015. The overall selection metric for ROSES 2014 is 21%. ROSES 2015 is almost complete, and it is doubtful the 21% rate will change dramatically. ROSES 2015 is continuing to release money through RAPTOR, while dealing with a little administrative turmoil.

PSD is in the process of developing a solicitation for a facilities review, in an ongoing process. Dr. Rall reviewed the R&A budget, which currently allocates \$154M for Planetary, \$9.4M for the Mars program, \$8.4M for Outer Planets, \$11.4M for Discovery research, and \$25M for COLDTech. PSD has delayed due dates for Maturation of Instruments for Solar System Exploration (MATISSE) in order to invite folks to propose for instrument technologies for Titan/Europa. In the meantime, a National Academies R&A study is in progress. NASA is making progress in increasing access to scientific research. Dr. Rall stressed that NASA's research solicitations now require a data management plan (a requirement for all 2016 solicitations). PSD will be sending out reminders, as it has had a few proposals that lack data management plans.

A Target Object Keyword analysis for 2011-2015 has been updated and refined, and has shown a significant increase for Mars, and a slight increase for Outer Planets. The analysis takes into account a mixture of one-, two- and three-year grants. Saturn and Jupiter have averaged \$8-9M/year. Over the fiscal years 2011-15, there has been a dramatic increase in exoplanets (\$9.2M in 2015). In 2015, \$10.2M was invested in nonspecific planets.

Discussion

Dr. Larry Nittler asked if a reported drop in early Solar System proposals had been intentional. Dr. Rall responded that the outcome only reflects proposals received and proposals funded. A more sophisticated analysis would be needed for a strategic evaluation. Dr. Green noted that while PSD now has the ability to use R&A data for strategic analysis, it has taken a long time to implement this ability, and it has required a lot of manual effort to extract meaningful statistics. That said, everyone should realize that the NAS will ask NASA to drill down further, and that this task will be a priority for PSD in order to satisfy their questions in August. Dr. Nittler was concerned about the homogeneous complexion of the panel. Dr. Green noted that NAS had struggled for quite some time to get the R&A review panel together, illustrating to the community the critical importance of responding to NAS when it needs panel members. Dr. Lori Glaze was intrigued by the keyword analysis, and wished to see data tagged to the balance of fieldwork, lab work, and theory, as well as data for the various disciplines. Dr. Lisa Pratt, echoing the thoughts of other members, asked if there were any way to see where the money is going, such as to

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universities vs. field centers. Dr. Rall noted that NASA is just starting to look at this, and at other ways to fund civil servants. In PSD, 25% of R&A money goes to field centers, which in turn could very well be sending money to academia. In terms of Mars research, the money reflects more individual awards, and not a larger size of individual awards. Dr. Glaze asked about the PSD response to a finding on special regions. Dr. Green explained that a special regions determination does not preclude exploration; it means that there is a different level of planetary protection that each mission must accommodate. The planetary protection field has grown independently and significantly, internationally and domestically, so PSD must figure out how it can develop instruments in a more routine way, while understanding the technological availability that will allow exploration in a safe and cost-effective way. The Planetary Protection Office (PPO) can't take care of this technology development on its own. A joint meeting of PPS and PSS is planned for this reason; the two communities must discuss these topics in a way from which everyone can benefit. Dr. Luhmann commented, considering the growing exoplanet emphasis, on how this might change the vision of the Nexus for Exoplanet System Science (NeXSS). Dr. Green noted that NeXSS was an experimental effort aimed at getting a different critical mass of scientists together, similar to efforts at NSF. NeXSS is nearly a year old and will be subject to a review next year, after which NASA will build on it or improve it for the next call sequence. NeXSS is doing well, and PSD has been pleased with it. Dr. Luhmann asked to see more regular reporting on NeXSS in such forums as town halls, and talks.

Dr. Rall gave a brief account of the anticipated new structure and charter being implemented for the NAC. NASA is delaying appointment of new PSS members for this reason, but it continues to write letters for AG chairs. Dr. Chabot noted that she would be rotating off in August 2016, and Dr. Tim Swindle would be coming on. Dr. Luhmann reminded members that she will not be representing PSS at the NAC in July.

Mars Update

Mr. Jim Watzin provided an update on the Mars Exploration Program (MEP), with a focus on looking forward. Orbital assets at Mars continue to be productive. MRO is supporting assets on the Mars surface, and providing remote sensing both for tactical assets and future exploration. Odyssey continues to support telecommunications relay and remote sensing. NASA is supporting ESA's Mars Express, as well as the ESA Trace Gas Orbiter (TGO) that is currently on its way to Mars, where it will release a short-lived demonstration lander. NASA will be providing communications support for TGO in about 6 months. Other orbital missions in the planning stages are moving forward. The United Arab Emirates is sending a spacecraft to Mars, in cooperation with the University of Colorado; the mission has just finished preliminary design review (PDR). A Senior Review recently evaluated all Mars surface assets. Curiosity is providing spectacular images and data, and all of its components remain healthy. The key decision point C (KDP-C) milestone was just completed for Mars 2020 (M2020), the beginning of Mars Sample Return (MSR). In 2020, ESA's ExoMars rover will also land on Mars. NASA is contributing part of their instrument suite, MOMA. As noted previously, the Mars InSight Lander has been delayed to 2018 due to instrument difficulties.

In the strategic view forward, MEP will continue to use Decadal Survey science goals to

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prioritize elements of the MSR campaign. M2020 will perform *in situ* science, encapsulate samples for return, and place the sample tubes on the surface of Mars to be retrieved by a future mission. Mr. Watzin was encouraged that the President's Budget Request for 2017 recognized the importance of a future Mars orbiter mission, to support infrastructure for 2020, to include telecommunications and reconnaissance, and measurements to advance the MSR campaign forward. Program planning is now helping the campaign take shape. A new Mars orbiter will help to support and replace the aging infrastructure. For sample return, there is a critical need for an ability to obtain what is now being referred to as the Orbiting Sample (OS), an element that requires rendezvous, capture, and secure containment for the journey home. MEP is exploring ways to do this, such as turning over the encapsulated OS to a courier spacecraft, a scenario in which ESA has expressed some interest in participating. There are currently some trade studies in how to get the OS off the surface. It's possible that a stationary lander could be used to retrieve samples and launch them into orbit, supported by heritage precision landing abilities. There could also be the development of a fetch function to retrieve the OS to move to a launcher. Mars Ascent Vehicle (MAV) studies are getting close to understanding the simplest implementation. At present the technology readiness level (TRL) risk of a MAV is relatively modest. The MAV itself maybe as small as 2-3 meters in height, more like a two-stage missile than a rocket. NASA released a request for proposals (RFP) to industry on architecture studies, and is looking to award in the next few weeks. It is felt that MEP has planetary protection challenges for M2020 in hand. Mr. Watzin expressed confidence in understanding cost and schedule risk for M2020, but added that the next challenge would be the containment and encapsulation aspect. M2020 will require robust, redundant encapsulation. MEP is experimenting with three different technologies to clean, contain and seal the sample. MEP is also doing basic experimentation with parachute-less landers, and is considering blunt body deceleration impact into the desert floor. NASA is also discussing a re-entry capsule with ESA. In the next year, MEP will have to turn greater attention to a secure, biocontainment sample-receiving facility, and will take advantage of some prior studies as well as current facilities. Dr. Green commented that the PPO takes the approach that Mars is full of dangerous microbes, while PSD wants to find a microbe on Mars. These desires seem to be on opposite ends of the spectrum, thus NASA needs to do some hard thinking about sample acquisition philosophy. Dr. Pratt asked if scientists had been involved in the discussion on the integrity of the sample, given that researchers would prefer to avoid shattered sample. Mr. Watzin assured her that science is engaged in the process, and added that a proposed re-entry site in the Utah Test Range provides fairly compliant geology.

Discussion

Mr. Lamont diBiasi asked who would be defining cubesat science for Mars exploration, and for details of a procurement plan. He also asked about any imminent AOs for the Next Mars Orbiter (NeMO). Dr. Green replied that PSD is developing a modified call in ROSES, and is looking for a ride in the 2020 time frame, but that no launch vehicle has been chosen yet for M2020. He recommended looking at previous SIMPLEX calls for details. Mr. Watzin added that MEP had not yet laid out a timeline for the next Mars orbiter. If remote sensing were to be added to a 2022 orbiter, NASA would likely do an AO at the front end.

PSS Laboratory Survey

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Dr. Ariel Anbar provided a briefing on a laboratory survey conducted to determine the health of and support for analytical facilities that are available to planetary science. The survey had been an action item from the last meeting of PSS. The survey was developed by McSween, Nittler, Neal, and Anbar and evangelized at LPSC and via email lists. A Google forum survey was used to ask US planetary scientists: Is your laboratory adequately supported? The online survey, which is not anonymous, can be found at <http://tinyurl.com/psslabs>.

The survey originally received 61 responses; 52 of these individuals were supported by PSD, but not in terms of technical support. (to date, 74 responses). There was poor representation by Astrobiology, but there is more input to come. There is no deadline for the survey; it can be advertised further. Survey responses indicate that viable funding mechanisms must be found to support the analytical cosmochemistry community. Development of state-of-the-art (SOTA) instrumentation takes years and needs basic continuity in funding. SOTA labs also need personnel, and their positions cannot be regarded as ephemeral. The general consensus is that it is not realistic to include technical support in NASA grants, as the tenuous nature of supporting staff on three-year grants makes it difficult to retain professionals.

Other conclusions

The return on investment for research proposals is diminishing. Overseas colleagues tend to support staff in a more stable manner compared to NASA. Current practice may lead to a loss of young talent, and loss of national capability and leadership in the field. It was noted that labs are accepting Chinese PhD students who must subsequently return to China 2 years after completing their degree; this talent may never return to US. University labs have no reserves to enable planetary labs to get through funding gaps. A dedicated pit of money for lab technical support would be most welcome.

Dr. Green asked Dr. Anbar if the survey provided the information needed to formulate constructive comments upon which a future PSS session could act. He added that he understood the frustration, and had expected universities to fund technicians through proposals. If the idea is untenable, then the community must reach a different sort of understanding on using R&A money for this purpose. Dr. Anbar noted that as the survey is not anonymous, he could dig deeper to come up with actionable items, better understand funding frameworks, and perhaps float some models. Dr. Green noted that because those universities receive government funding, there should be something NASA can say within that environment that the universities should respond to. Dr. Anbar felt that individual decisions had led to the winnowed support; the bridging has just become less tenable. Dr. Pratt said that there is also increasing regulation of any (university) laboratory that could be construed as a so-called profit center. There are also looking some plans in the works for minimum salary regulations for post-docs; perhaps NASA could have specific programs where the university provides 50% of the support for the technicians. Dr. Anbar felt it might make sense to put together a subgroup or committee to follow up on the survey and come forward with specific recommendations. Dr. Swindle noted that administrations believe that colleges are losing money by doing research, meaning that it is very difficult to get state universities to support technical staff. It is also worth noting that NSF is having a similar problem. Dr. Chabot felt that the survey may also reflect the cosmochemistry crunch over the last

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few years, the same issue that initiated the R&A structuring. Dr. McCoy added that there also may be an institutional basis for some of these pressures, rooted in the practice of support on an instrument-by-instrument basis.

Findings and Recommendations discussion

Dr. Luhmann led a discussion on findings and recommendations, first addressing a more general idea of a facilities report, in the context of societal and economic circumstances. PSS needs constructive and focused ideas on how to address lack of support for SOTA laboratories. Dr. Anbar said he had been surprised to get such a high return on the survey questions, particularly with detailed thoughtful comments; this in itself sends a message of importance. He asked Dr. Green for thoughts on what can be done. Dr. Green replied that he could approach the issue through NASA centers, find the right civil servants, and coordinate with end-to-end support; he didn't know if universities could approach the problem in the same way. He offered to write letters and see people if necessary. Dr. Anbar again suggested putting together a group to delve into the issue further. Dr. Green suggested that in addition, especially given that sample analysis with respect to MSR is in NASA's future, that consideration be given to facilities that are available abroad. It may be worthwhile to look strategically at facilities that should be closed down in favor of opening/utilizing others. A dedicated subgroup such as CAPTEM could take a well-defined look. NASA really needs guidance on what to do next in terms of sample analysis. Dr. Luhmann felt that the issue may be a problem suitable for posing to the NRC; universities are no longer supporting the infrastructure; there are no secretaries or technicians. Dr. Green agreed, adding that NSF does fund a variety of labs and may have some rules that are useful. He promised to make a point of talking to NSF program managers during the summer. Dr. Luhmann asked Dr. Anbar to sketch out a paragraph on survey results to help clarify a finding or recommendation. She added that PSS might just document it as a problem for now. Drs. Glaze and Chabot agreed to iterate with Dr. Anbar on the writing process.

Dr. Luhmann addressed the rapidly changing landscape at Mars in terms of commercial exploration, and asked if PSS should recommend more expeditious involvement of PSD with these outside initiatives, such as having SpaceX representatives at the Mars Exploration Program Analysis Group (MEPAG). Dr. Green noted that the Moon Express project is already well connected with the Lunar Exploration Analysis Group (LEAG), and that LEAG also has a commercial advisory board.

Discussing a response to Ocean Worlds, Dr. Alfred McEwen noted that there are cost implications to this, and that maybe PSS should just watch it closely and be available to weigh in on decisions going forward. Dr. Chabot echoed Dr. McEwen's comments, and added that planetary protection is a big issue not only for Mars but for Europa, Enceladus, and Titan.

Dr. Luhmann gave an action to Dr. Rall to highlight DSN queries in the relevant AGs. Dr. Green also took an action to close the loop and ask all projects about DSN performance. Dr. Chabot asked to get a package onto the agenda that could be distributed to the community to explain the DSN issue.

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Dr. Jeff Johnson suggested a PSS finding to support trade studies on MSR, and that the subcommittee request similar details at future meetings. Dr. Luhmann tasked Dr. Rall to put another MSR briefing on the agenda. Dr. Johnson also recommended putting continued pressure on the SRF issue. Dr. Luhmann suggested a finding on more expeditious transmission (to the community) on Mars activities and offered to write up a paragraph with Dr. Pratt on the subject.

Dr. Luhmann adjourned the meeting at 4:16 pm.

PSS Findings from the June 7, 2016 meeting at NASA HQ

Communications about Mars Sample Return and other Developments

The Committee was encouraged to hear positive updates regarding ongoing trade studies of Mars sample retrieval architectures that included: (1) the use of a stationary lander with precision landing; (2) a fetch vehicle to gather cached samples from the Mars 2020 mission; (3) the development of a small Mars Ascent Vehicle (MAV) with modest technology readiness level (TRL) risks for placing the samples in orbit; (4) a next orbiter than can receive the samples; (5) a potential ESA-collaboration mission to return the samples; and (6) ongoing considerations regarding sample reception and management (including possible use of non-NASA facilities). The rapid development of these engineering architectures will be spurred further by upcoming industry participation. Because these activities have implications for Mars 2020 sample caching and future analyses of returned samples from Mars (and potentially other bodies), the Committee encourages the PSD to provide:

- (1) frequent updates regarding the progress of these activities to the PSS; and
- (2) opportunities for dedicated science involvement (e.g., through the use of MEPAG and CAPTEM) in studies regarding sample issues such as encapsulation and preservation, sustainability during cruise, integrity during hard-landing returns to Earth, and optimizing expeditious distribution to sample scientists.

We extend this request for more frequent communication to other developments, such as the Europa lander mission.

PI-Led Laboratories

The PSS is impressed by the vigorous community response to the PSS survey on support for PI-led laboratories, with responses received from 73 individuals to date (the survey remains open). The survey responses reveal that there is widespread concern about the sustainability of laboratories that do critical work in support of the PSD mission. Many respondents were from the community that specializes in the analysis of planetary (and Earth) materials, raising a specific concern about whether the scientific laboratories and expertise in this area are being maintained at a level sufficient to meet PSD's overall strategic goals in cosmochemistry and key aspects of astrobiology. Respondents report

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that their ability to support technical staff is squeezed between decreases (over many years) in institutional support for infrastructure, and increased competitiveness in the grant funding landscape. Concerns were also expressed about the erosion of training opportunities for the next generation of laboratory investigators needed to support NASA missions, and the recognition that these facilities cannot be shut down and restarted only when specifically required. Similar issues were reported by laboratories at universities, NASA Centers, and other institutions. The PSS is concerned that these pressures will steadily erode the ability of the US-based research community to meet PSD's science objectives, particularly given the role of sample acquisition and retrieval in formulating mission science objectives and the increasing interest in analyses of returned samples. The PSS also recognizes that many respondents perceive the recent PSD R&A reorganization as a contributing factor in shifting support for laboratory research to other areas, and that this problem is part of a larger, emerging crisis in research infrastructure support that extends beyond PSD and beyond NASA.

The PSS encourages PSD to:

- a) discuss these concerns with counterparts in other NASA divisions and other federal science agencies to ascertain their extent and the need for NASA-wide or government-wide solutions, before our next meeting;
- b) create a committee to identify the specific laboratory capabilities critical to PSD that are at risk based on the survey responses, to suggest solutions that could be implemented within PSD to address these cases as well as future needs in the context of the Decadal Survey.

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Appendix A

Attendees

Subcommittee Members

Janet Luhmann, **Chair, Planetary Science Subcommittee, University of California, Berkeley**

Ariel Anbar, Arizona State University

Nancy Chabot, Applied Physics Laboratory

Lori Glaze, NASA Goddard Space Flight Center

Amy Mainzer, Jet Propulsion Laboratory

Tim McCoy, Smithsonian Institution

Samuel Lawrence, NASA Johnson Space Center

Larry Nittler, Carnegie Institute

Lisa M. Pratt, Indiana University

James Skinner, Department of the Interior

Anne Verbiscer, University of Virginia

Jonathan Rall, Executive Secretary PSS, NASA HQ

NASA Attendees

Doris Daou, NASA/SSERVI

Lori Glaze, NASA HQ

James Green, PSD, NASA HQ

Sarah Noble, NASA HQ

James Watzin, NASA HQ

Other Attendees

Joan Zimmermann, Ingenicomm

Alfred McEwen, University of Arizona

Webex attendees

Dwayne Brown, NASA HQ

Jason Callahan, Planetary Society

Stephen Clark, SpaceFlight Now

Monte Dibiasi, Southwest

Casey Dreier, Planetary Society

Jeff Foust, Space News

Jim Gaier, NASA Glenn Research Center

Jeff Grossman, NASA HQ

David Gump, Deep Space Industries

Grace Hu, Office of Management & Budget

Jeffrey Johnson, APL

Jennifer Kearns NASA HQ

Linda Karanian, Reference Point Consulting

Greg Lee, Northrup Grumman

James Lochner, USRA

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Victor Lucas, NASA

Michael Meyer, NASA

Michael New, NASA HQ Noah Petro, NASA

Washito Sasamoto, NASA Langley

Marcia Smith, SpacePolicyOnline.com

Micheline Tabache, ESA

JD Taylor, USA in Space

Shannon Therone, Freelance

Gregg Vane, NASA JPL

Van Williams, Busek Company Inc.

Rich Zurek, NASA JPL

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Appendix B
Membership Roster
Planetary Science Subcommittee

Janet Luhmann, Chair
University of California, Berkeley

Nancy Chabot
The John Hopkins University
Applied Physics Laboratory

Lisa Gaddis
U.S. Geological Survey
Astrogeology Science Center

Lori Glaze
NASA Goddard Space Flight Center

Candy Hansen
Planetary Science Institute

Mihaly Horanyi
University of Colorado
Laboratory for Atmospheric and Space Physics

Samuel Lawrence
Arizona State University

Amy Mainzer
Jet Propulsion Laboratory

Timothy J. McCoy
Smithsonian National Museum of Natural History

Clive Neal
University of Notre Dame

Larry Nittler
Carnegie Institution of Washington

Lisa M. Pratt

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Indiana University

James Skinner
Department of the Interior

Anne Verbiscer
University of Virginia

Jonathan Rall
Executive Secretary
NASA Headquarters
Science Mission Directorate: Planetary Science Division

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Appendix C
List of Presentation Materials

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3. Mars Exploration Program Update; *James Watzin*
4. Planetary Science Subcommittee Survey; *Ariel Anbar*

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Appendix D

Agenda

Planetary Science Subcommittee Meeting

June 7th, 2016

Virtual Meeting

NASA Headquarters

Washington D.C.

Tuesday, June 7, 2016, 1:00 p.m. – 5:00 p.m.

1:00 Welcome, Agenda, Announcements (J. Luhmann, J. Green,
J. Rall)

1:05 PSD Status & Findings Update (J.
Green)

1:30 PSD R&A & Findings Update
(J. Rall)

2:30 Mars Update (J.
Watzin)

3:00 PSS Laboratory Survey (A. Anbar/H.
McSween/C. Neal)

3:30 Discussion
(All)

5:00 Adjourn

Teleconference Information:

Toll free conference call number

call number 1-877-918-9234, *Listening Mode* passcode 1594921

WebEx Link:

<https://nasa.webex.com/>

the meeting number is 995 334 647, password is PSS@June7.