

National Aeronautics and Space Administration
Washington, D.C.

NASA ADVISORY COUNCIL

PLANETARY SCIENCE SUBCOMMITTEE

Teleconference and Webex

November 21, 2014

NASA Headquarters

Washington, D.C.

Meeting Minutes

Jonathan Rall, Executive Secretary

Janet Luhmann, Chair

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*Report prepared by
Joan Zimmermann, Zantech IT*

Welcome

Planetary Science Subcommittee (PSS) Executive Secretary Dr. Jonathan Rall called the teleconference to order and established meeting rules. Dr. Janet Luhmann, Chair of the PSS, welcomed participants and provided opening remarks.

PSD Status and Update

Dr. James Green, Director of the Planetary Science Division (PSD) provided a status of recent activities. Planetary mission highlights include the Mars mission, Mars Atmosphere and Volatile Evolution (MAVEN), which has been inserted into orbit, the Curiosity rover's arrival at Mt. Sharp, the successful landing of Rosetta's Philae on the comet Churumoyov-Gerasimenko, an European Space Agency (ESA) mission that is going well and providing much data. The Japanese Aerospace Exploration Agency (JAXA) sample return mission, Hayabusa-2, is scheduled to launch late this month; its destination is the JU₃ 1999 asteroid. NASA and JAXA have an agreement to share samples from this mission. In the upcoming calendar year, NASA will be holding discussions with the India Space Research Organisation (ISRO) as to how they might expand cooperation more at Mars now that its Mars Orbiter Mission (MOM) has entered its prime mission. MESSENGER is scheduled to impact Mercury in late March/early April, depending on its fuel status. The Dawn spacecraft will enter Ceres' orbit in late March, while taking images on its way in February, to the accompaniment of much public engagement. In April, Step 1 selections will be made for Europa instruments. New Horizons will fly through the Pluto system on July 14, 2015. In 2016, Juno will enter Jupiter's orbit, the sample return mission Origins Spectral Interpretation Resource Identification and Security-Regolith Explorer (OSIRIS-REx), will be launched to the asteroid Bennu, and Cassini will enter its final trajectory through the planet's rings, prior to its mission-ending impact in 2017.

A new Discovery Announcement of Opportunity (AO) was released on 5 November; step 1 proposals are due February; on 24 November this was followed by a pre-proposal briefing on Webex. The Europa instrument AO attracted a good set of proposals, which are currently under review. Mars missions this decade include a set of operational satellites. PSD has tested MAVEN's relay capability with the Mars Science Laboratory (MSL) Curiosity rover, and it worked perfectly. NASA also contributed to ISRO MOM's orbital maneuvers. ESA's Trace Gas Orbiter is moving along with the NASA contribution, an Electra communications module. ESA's ExoMars rover will carry a joint NASA/DLR contribution MOMA (molecular analyzer), which is proceeding towards delivery. The Mars 2020 rover mission is also proceeding nicely; instrument teams are on board, and all contracts have been let. The Mars Opportunity rover has now logged over 40 km on the planet's surface, MSL 9.5 km or so, and Spirit (no longer operational), a little less than 8 km

The MAVEN insertion on 21 September went very well. The mission has begun its primary science operation. In its initial 35-hour orbit, MAVEN obtained unique observations of escaping atmosphere in measurements of atomic C, H, O. MAVEN

has also provided spectacular ozone mapping; cold dark conditions near the martian pole allow ozone to accumulate, where it is then primarily destroyed by water vapor and sunlight. The Siding Spring comet encounter with Mars, representing the first witnessed pass of an Oort cloud comet within 130K km of the planet's surface on 19 October, was observed from many NASA space assets, including the Hubble Space Telescope (HST), Chandra and Spitzer, as well as assets on Mars. Observations were also made by balloons and Astrophysics assets. Images taken of the encounter were captured by MAVEN, the Mars Reconnaissance Orbiter (MRO) HiRise camera, Opportunity, and MRO's CRISM instrument. The comet's nucleus appears sub-kilometer in size thus far. Good images of the coma and tail were obtained, and Opportunity got a glimpse as well. MSL did not observe it as there was dust in the high altitude atmosphere during the day. The comet coma may have affected Mars in several ways; science papers describing these effects are in progress. About 100 minutes after passage through the dust tail, MAVEN obtained some in-situ observations of ionized magnesium in the atmosphere in the wake of the dust. Spectral signatures of potassium and manganese were also observed.

NASA's contribution to Rosetta is comprised of 3 instruments: MIRO (microwave spectrometer and radiometer), ALICE (ultraviolet imager) an Ion and Electron Sensor (IES), and part of ROSINA. All instruments worked well, and represented funding for over 40 investigators. Rosetta also used NASA's Deep Space Network (DSN; 70- and 34-m dishes). Dr. Green displayed images from the Philae landing, noting that at landing on the surface of comet, Philae weighed about a penny. The lander became lodged in a dark cove, nestled up against a wall mostly in shadow, eliminating temporarily the use of solar power. The comet will reach perihelion in August 2015, while Philae is designed to last until March. It is hoped that when the comet reaches 1.5 astronomical units (AUs), there may be sufficient sun exposure to allow the solar panels to operate once again. Data was successfully transmitted before the lander's batteries died. Public engagement was very reminiscent of the MSL landing; NASA needs to continue this public engagement to demonstrate the return on the public's investment in planetary.

Dr. Green reviewed planetary usage of former Astrophysics (AP) assets. The Wide-Area Infrared Survey Experiment (WISE) mission has been reborn as Near-Earth Object WISE (NEO-WISE), and is continuing to work well for PSD's emphasis on the infrared (IR) search for NEOs. PSD is also taking advantage of increased opportunities with AP telescopes and has made successful proposals to HST. PSD has received approval for 57 HST orbits to examine Europa to confirm the presence of the plumes, and has also obtained discretionary time to make observations of the Outer Planets to facilitate the construction of global maps of Jupiter, Saturn, Uranus and Neptune, a task that will begin after the end of the Cassini mission. The Spitzer mission has been extended for two years, and PSD is working to bring opportunities to propose to the extended mission (EM). The Keck Observatory will also be taking more Solar System proposals in upcoming competitions. PSD is also working with the Kepler EM (K2), which is making more observations in the ecliptic and encouraging proposals. In the Spitzer cycle 11 overview, 157 proposals were

received for IR observations of comets, asteroids, KBOs, etc. Selections are still to be determined. October 2017 will mark the first proposal cycle for the James Webb Space Telescope (JWST). Dr. Green encouraged the community to contribute a healthy number of Solar System and planetary proposals, and get an oar in the water early to participate in a critical opportunity.

A Cooperative Agreement Notice (CAN) draft has been issued for the new Science Mission Directorate's (SMD) Education and Public Outreach (EPO) program; comments are welcomed. The CAN will emphasize Science, Technology, Engineering and Mathematics (STEM) education, scientific literacy, advancing national educational goals, and leveraging science through partnerships. The final CAN will be released in December and projects are targeted to begin in October 2015.

Dr. Dave Draper asked if the due date for the Discovery AO could be changed from a federal holiday to another day. Dr. Green advised him to ask this question in the open forum on 24 November. In response to a question, Dr. Green reported that the midterm Decadal Survey review will occur in the 2017/8 timeframe. Dr. Luhmann asked about the status of the Europa mission. Dr. Green relayed that concept study results have been analyzed and briefed to NASA Headquarters, the Office of Management and Budget (OMB) the Office of Science and Technology Policy (OSTP), and Congress. It has been verified that a proposed \$1B mission cap can't provide a way to answer the questions posed by the Decadal Survey. NASA will continue development of concepts at the Jet Propulsion Laboratory (JPL). Dr. Luhmann requested a written comment on the issue. Dr. Green agreed to task Dr. Niebur to write up the process and submit it to the Outer Planets Analysis Group (OPAG) newsletter. Remarking on the still outstanding Planetary Data System (PDS) CAN, Dr. Green reported that it is still under development; when finalized, its completion will be announced via the community newsletters.

Dr. Lori Glaze asked for assurances that planetary science would be included in the EPO CAN, and received them from Dr. Green. Dr. Clive Neal asked if there had been any fallout from the Inspector General (IG) report with respect to the planetary program. Dr. Green explained that SMD is following up on the IG recommendations, is performing an internal review of approaches, procedures, and compliance with the law, and will document these responses in a revision to the handbook, details of which will be released when they are complete. Dr. Hansen noted that the Europeans are currently working on M-class proposals, and asked if there would be any NASA participation re: co-investigators, and provision of instruments or launch vehicle. Dr. Green replied that no launch vehicle would be offered, but other offers are certainly open, based on invitation from ESA. NASA has put out information through the NSPIRES website on the opportunities. Proposers must obtain an appropriate letter of recognition for ESA proposals. Dr. Green encouraged everyone to read the requirements that have been published in NSPIRES. Dr. Luhmann expressed approval of expanding use of telescope assets, but observed that the recent briefings on telescope facilities opportunities seemed to be geared toward

people who already use them, and recommended that NASA hold workshops or tutorials to help other users and communities work with data. Dr. Kelly Fast agreed.

PSD R&A Update

Dr. Rall reviewed the Research and Analysis (R&A) program status. The Emerging Worlds (EW) and Exoplanets programs are processing through the first cycle of the restructured program. The Habitable Worlds program is still open, while everyone else has received their Step 2 proposals. Step 1 proposal notifications have been averaging about 21 days to PI notification (encourage, discourage with redirect, or discourage). The only exception has been PDART, at 36 days, which had suffered a bumpy start with difficult communications. Solar System Workings received 509 submissions, other themes much fewer. The bulk of Step 1 proposals were encouraged, a small number discouraged with redirect, and a very small fraction were discouraged, most of which were in Solar System Observations, many of which were NEO proposals.

The trend for Step 2 proposals, to date, is that $\frac{3}{4}$ of encouraged step 1s have been coming in as Step 2s. Of the encouraged Step 1s, a consistent attrition rate of 20% has been observed. About 0.75% of redirected proposers submit a Step 2 to the original program. Dr. Rall emphasized that no stigma would be attached to a discouraged proposal.

Regarding the Regional Planetary Image Facility (RPIF) Senior Review, PSD will hold its next RPIF-Senior Review in FY15 to evaluate proposals for a 5-year plan to operate through FY20. Proposals will be evaluated through an independent panel. Teams will have an opportunity to meet with panel at Headquarters. The review will evaluate the merit and performance of 9 facilities, including those at Brown and Cornell Universities, the University of Hawaii at Manoa, and the University of Arizona. Draft guidelines are due out in early December, comments due back on 8 December 8, and final proposal submissions are due in February 2015. There will be a face-to-face meeting in early March/April 2015. RPIFs will be notified at the end of May 2015.

PSD is collecting post-panel survey input on executing the re-organization; by Spring the program will have collected a complete data set. With respect to other planetary facilities, PSD is working on an approach to the Ames Laboratory and Aeolian Facility, among others that are still to be determined.

Dr. Chabot asked if there were any ways to get guest investigators (GIs) onto small body missions such as Dawn at Ceres and Hayabusa 2. Dr. Rall replied that efforts were still in progress. Dr. Jeff Grossman added that PSD has received 80 Step 1 and 48 Step 2 proposals to the Dawn at Ceres GI program, which are being processed as quickly as possible. Dr. Lisa Pratt asked how reviews were being handled for Step 2 proposals. Dr. Rall reported that the system is working as intended, and that he had been hearing from Program Officers (POs) that the reviews are the same; the only difference has been that more POs per review have been available. Actual

discussions of proposals are working out very well. The concept of discussing the proposals with strengths and weaknesses, and then voting the next day on the basis of strengths and weaknesses, is evolving, and seems to result in more consistent outcomes. Dr. Glaze noted that the SSW call had a large number of proposals, and asked if there had been any difficulties in getting enough panel members or managing conflicts. Dr. Sarah Noble observed that the system had worked well despite having had more trouble getting external reviewers due to timing issues. Despite these issues, every proposal received a fair review. Asked about selection rates, Dr. Rall felt that if the Continuing Resolution (CR) remained in effect, it would constrain the R&A budget to last year's spending rate, while PSD will still be compelled to fund legacy programs, which will impact the selection rates in new elements. Dr. Green felt it important to note that the President's Budget Request is \$65M less for PSD, and that the subsequent spending rate would be held to that lower amount. Asked about the fates of investigators who were selected early on in the new program, Dr. Rall reported that for Exoplanets, the top 10% have been recommended for funding, and the program is still holding about 20% as selectable. The program is trying to fund all proposals that have been rated Excellent and Good. The SSO and EW elements are about to be selected along the same lines. Dr. Dave Draper asked about bridge funding being made available to PIs selected in the new program who also had grants in former programs. Dr. Rall replied that the bridge must originate from an award to a pending award. Thus far the program has pulled SSW back so that there isn't a large gap. Bridge funding is situational; the PI must contact the PO and negotiate with Dr. Rall.

Dr. Luhmann asked about the timing of the next review for planetary facilities. Dr. Rall replied that the last half of 2015 might be appropriate, however the cost associated with the review will be quite substantial. Regarding the relationship between facilities and the Planetary Data System (PDS), one of the questions to be answered centers on the fact that many of the RPIFs manage hard copy data that have not been digitized. There is some coordination between the PDS managers and the RPIFs for hands-on assistance in this area. Dr. Glaze expressed a nagging concern about balance, and asked if there were a metric that can give a feel for the programmatic distribution of proposals that were selected. Dr. Rall suggested a key word search on awards in NSPIRES for a rough indication, but agreed to explore the matter further. Dr. McSween noted that given the angst associated with the R&A restructure, it would be nice to share with the community the notion that there is still a careful attempt to maintain balance in the program. Drs. Green and Rall took the item as an action.

Report from the US Geological Survey

Drs. Jim Skinner and Sam Lawrence reported on the US Geological Survey (USGS) process of Planetary Geologic Mapping, or the mapping of solid objects beyond Earth. USGS has been providing high-quality maps of Mars, Moon, Venus, Mercury, Io, Ganymede, as driven by community need and as guided by NASA, PSS and the AGs. NASA and USGS have worked together for 5 decades on planetary cartography,

coordinated campaigns on geologic mapping. To date, on behalf of NASA, USGS has published 150 planetary geologic maps.

Modern planetary geologic maps deal with large data volumes, and a variety of different data types and spatial scales. Modern products include hard copy and digital maps. These can be topical vs. contextual maps. Topical science maps are flexible in approach and involve short-range geologic mapping, in which interpretations are key. Contextual maps are very rigid, characterized by set scales with set boundaries, strategic timelines, and a very low response to data curves. These are published by standard survey, where observations are more important than interpretation.

A typical work-flow for mapping includes a pre-proposal discussion, followed by review and selection. NASA notifies USGS of “new starts,” after which a base map and Geographic Information System (GIS) are created, followed by mapping by author, technical reviews, a map coordinator review, and nomenclature review. The map is then accepted for publication, GIS and map files are formatted, a submission is made to the USGS Publication Services Center, and the map is printed and distributed. The idealized timeframe is 48 months from start to finish. Common deviations from work-flow include multiple notices of new starts which over-commit USGS, which can be mitigated by coordination of new starts. Sometimes maps are not possible as proposed, therefore USGS encourages pre-proposal contacts and the education of proposers as to USGS work flow. Scales and bases necessitate an adapted approach (e.g., Mars HiRise data), for which community input is solicited. Maps are often submitted after project funds are over, therefore USGS encourages proposers to be realistic in expectations (4 years). Funding requires some finesse and can be done through NASA ROSES to individuals, or via cartography funds (proposing to USGS). The cost to produce each map is approximately \$37k (\$22K for technical cartography and printing).

Dr. Skinner reported that community concerns had been raised in a July 2014 letter, wherein PSS, the AGs, and NASA stated that standardized cartographic analyses would be needed for science, robotic, and human exploration, and recommended creating a Planetary Cartography and Geologic Mapping Analysis Group, described as more analytical than a panel. The USGS recognizes that maps are critical infrastructure to the conduct of science, and that the USGS process and the mapping community are important resources. Must have cooperation, collaboration and community oversight. Maps are also very popular with the public.

Dr. McSween asked about opportunities to wrap maps onto globes and other non-flat surfaces for outreach and science. Dr. Lawrence reported that USGS has been working with NASA to produce 3D maps of Mars and Apollo landing sites, as well as on software for usage. Dr. Luhmann asked if USGS had major concerns beyond standing up an AG. Dr. Skinner replied that the group should be a working group instead of a review panel, and that USGS maps should not be equated with maps in journal articles. The community needs to understand the detailed process of

mapping and cartography in order to get things done efficiently as possible. Dr. Lawrence added that one problem is the issue of long-range planning. USGS responds on an annual basis, but a working group could help to guide the long-range mapping needs of community. The second issue is to recognize the importance of the issue, as the entire community uses these products. Dr. Neal commented that it seems that it would make sense to have mapping and cartography represented in PSS. Dr. Rall reported that PSS had come to the same conclusion and planned to have the chair of the working group as a member of the PSS.

Lunar Reconnaissance Orbiter Lessons Learned

Dr. John Keller briefed PSS on the outcome of a Lunar Reconnaissance Orbiter (LRO) Lessons Learned study. LRO has been a highly successful mission of both exploration and science, the result of a joint AO between the former Exploration Systems Mission Directorate (ESMD) and SMD. A Lunar Exploration Analysis Group (LEAG) was established for community participation. LEAG benefited greatly from the strong leadership of the late Dr. Mike Wargo, the Chief Lunar Scientist. LRO also had buy-in at the AA and division levels, a factor seen as important to mission success. LRO was a high-priority Discovery-class mission designed to enable astronaut return to the Moon, and began as an idea contained within President George Bush's Visions for Space Exploration Speech, which mentioned LRO as first step. The exploration mission returned temperature maps, high-resolution imagery, multi-wavelength observations, and radiation environment characterization. The mission's rapid schedule required fast implementation. NASA Goddard Space Flight Center (GSFC) designed and built the spacecraft, using a team with a strong background in fast development. LRO's launch in 2009 was affected by some minor scheduling delays caused by some overlap with the Lunar Crater Observation and Sensing Satellite (LCROSS) mission. LRO is now an extended mission (EM) that will operate until 2016. ESMD measurement requirements for the EM included acquiring data to describe safe landing sites, as well as high-resolution maps of the lunar polar regions. LRO's instruments had strong planetary heritage, with teams lead by planetary scientists. Clear requirements for ESMD, coupled with resources available for science, contributed to LRO's success. The ESMD mission ended in 2010 and was transitioned at that time to SMD.

LRO has robust and resilient capabilities, and has exceeded exploration requirements both qualitatively and quantitatively, reflecting a true partnership between SMD and ESMD, while revealing sites of value for both science as well as human and robotic exploration. LRO data supports future US and international mission planning. The Human Exploration and Operations Mission Directorate (HEOMD) is currently using the data sets, and NASA scientists are using the data for developing Discovery and New Frontiers proposals. Recent LRO highlights include the publication of a *Space Weather* special issue on results from CRaTER, and new evidence of young lunar volcanism (as recently as 50 million years ago) in *Nature Geoscience*.

LRO proves that cross-directorate partnerships can work, and has added over 525 TB of data and data products to the PDS. Lessons Learned from LRO are: the mission benefited greatly from buy-in at the AA and Division levels; a strong advocate for science in ESMD (implying that a counterpart on the SMD side should be identified).

Dr. Chabot commented that NASA needs a chief exploration person in SMD. Dr. Green noted that he has been taking charge of developing connections with HEO, and is going to devote more time to this as the new Mars czar comes to Headquarters on 1 December. Dr. Neal asked when Dr. Wargo would be replaced. Dr. Friedensen replied that a Chief Exploration Scientist should be announced as well on 1 December. Dr. Neal asked if the transition from ESMD to SMD had gone smoothly. Dr. Keller replied that the mission had to show it was linked to the Decadal Survey, and went before a review panel to do this. Dr. Friedensen, who was Program Executive (PE) for LRO at the time of transition, worked with ESMD to document mission criteria, and contributed a memo for the record that the spacecraft was sound for usage by SMD. Dr. Johnston added that there had also been an SMD scientist functioning as a Program Scientist for LRO, and an SMD PE on loan to ESMD. Dr. Keller noted that from a Lessons Learned point of view, following SMD practices helped to make the mission successful. Mr. Greg Williams added that LRO was established before the publication of NPD 7120.5; and that looking forward, the mission would probably have the Space Technology Mission Directorate (STMD) as a third partner; in light of this, he asked what sort of advice could be given to the Mars czar to set up a similar process. Dr. Keller reiterated that the mission was really about getting people to buy in; a strong advocate, support at both levels at Headquarters would be necessary. Dr. Green commented that LRO was just starting its prime science mission at the time of the transition. The next mission of this nature is Mars 2020, a mission that will have cross-cutting experiments, and which can easily leverage data for both HEO and SMD. It would be good to see more *in-situ* resource utilization (ISRU) on Mars, as well as collaboration for selecting sample sites, etc., in order to build a strong set of missions. Dr. Keller recommended showing the link to the Decadal Survey up front to get enthusiastic participation from the science community.

Dr. Luhmann asked whether PSS should include a representative from HEOMD, and was told that Dr. Wargo often sat on the subcommittee as an *ex officio* member.

Dr. Stansbery provided a brief update on the Johnson Space (JSC) re-organization, in response to the perceived need for a high-level scientific voice at JSC. A newly integrated science and exploration directorate has been merged, and is led by Dr. Steve Stich; Dr. Stansbery now serves as Deputy Director of the newly integrated directorate, as well as the Chief Scientist at JSC. In this capacity, she felt he could provide a scientific voice to strategic planning at JSC. The reorganization will have little effect on the curation organization ARES, which has been moved intact into the new organization. ARES's previous management has been retained.

Findings and Recommendations

The subcommittee discussed potential findings and recommendations. Dr. McSween suggested adopting a Mapping Analysis Group, to be perhaps defined more broadly (Geospatial AG, e.g.). Such an AG could provide the community with a long-term mapping strategy. Dr. McSween took an action to craft the language of the finding. Dr. Chabot noted that this is in fact a previous finding, which could be re-used. Dr. Luhmann explained that only broad issues are passed up to the NASA Advisory Council, and that PSS can revisit findings and make the connection if appropriate; she agreed to fold the previous meeting findings into the next presentation to the Science Committee.

Dr. Hansen suggested a finding on the programmatic balance in R&A selections and accompanying metrics. Drs. Hansen and Glaze took the lead on writing the finding. Dr. Luhmann recommended a follow-up finding on the Europa mission concept studies for a \$1B option. Dr. Curt Niebur agreed to write up language and send it to Dr. Hansen, for inclusion in the Outer Planets AG newsletter and the American Astronomical Society's (AAS) Division for Planetary Sciences (DPS) membership communications.

Dr. Luhmann called for formalization of the charters of the Small Bodies AG (SBAG) and LEAG to recognize the partnership with HEOMD. Dr. Rall noted that formal charters existed for both AGs. Dr. Green took an action to revise the language to reflect the new relationship, and Dr. Neal undertook to write the finding.

Dr. Pratt suggested that PSS say something positive about re-purposing assets to image the comet Siding Spring, which yielded an extraordinary set of data. Dr. Pratt agreed to write up the item as an observation.

Another finding, on articulating the status of foreign participation opportunities in some centralized way, was agreed upon. Dr. Green agreed to write up a comprehensive description about how to participate in international missions, and then post it.

Dr. Luhmann adjourned the meeting at 3:18 pm.

Appendix A Attendees

Planetary Science Subcommittee Members

Janet Luhmann, **PSS Chair**, University of California, Berkeley
Nancy Chabot, Johns Hopkins University
Nancy Chanover, New Mexico State University
David Draper, NASA Johnson Space Center
Lisa Gaddis, US Geological Survey
Lori Glaze, NASA Goddard Space Flight Center
Candy Hansen, Planetary Science Institute
Mihaly Horanyi, University of Colorado
Christopher House, Pennsylvania State University
Amy Mainzer, NASA Jet Propulsion Laboratory
Harry McSween, University of Tennessee
Clive Neal, University of Notre Dame
Larry Nittler, Carnegie Institution of Washington
Lisa Pratt, Indiana University
Anne Verbiscer, University of Virginia
Jonathan Rall, **PSS Executive Secretary**, NASA SMD

Other Attendees

Gale Allen
Brent Archinal
Stephen Clark
Barbara Cohen
Doris Daou
Casey Dreier
Kelly Fast
Jeff Grossman
Lindsay Hays
Gordon Johnston
John Keller
Samuel Lawrence
Greg Lee
James Lochner
Steve Mackwell
Tim McCoy
Sarah Noble
Adriano Ocampo
Bob Pappalardo
Richard Passmore
Jim Skinner
Eileen Stansberry

Jeremy Stembler
Tommy Thompson
Gregg Vane
Richard Vondrak
Alexandra Witze
Dan Woods
Joan Zimmermann

Appendix B

Membership Roster Planetary Science Subcommittee

Janet Luhmann (Chair)

Space Sciences Laboratory
University of California, Berkeley

Jonathan Rall
Exec. Secretary
NASA Headquarters
Science Mission Directorate
Planetary Science Division

Nancy Chabot
The John Hopkins University
Applied Physics Laboratory

Nancy Chanover
New Mexico State University
Astronomy Department

David Draper
NASA Johnson Space Center

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

Christopher House
Pennsylvania State University
Department of Geosciences

Amy Mainzer
NASA
Jet Propulsion Laboratory

Harry McSween
University of Tennessee
Department of Earth and Planetary Sciences

Clive Neal
University of Notre Dame

Larry Nittler
Carnegie Institution of Washington

Lisa M. Pratt
Indiana University

Anne Verbiscer
University of Virginia

Subcommittee Administrative Support:

Ms. Ann Delo
NASA Headquarters

Appendix C Presentations

1. Planetary Science Division Status Report; *James Green*
2. Planetary Science Division Research and Analysis Update; *Jonathan Rall*
3. US Geological Survey Briefing; *J.A. Skinner*
4. Lunar Reconnaissance Orbiter Lessons Learned; *James Keller*

Appendix D
Agenda
Planetary Science Subcommittee Meeting
November 21, 2014
NASA Headquarters, Washington D.C.
Friday, November 21, 2014
12:00 noon – 3:00 p.m. (3W42)

- 12:00 Welcome, Agenda, Announcements(J. Luhmann, J. Green, J. Rall)
12:10 Introductions
12:15 PSD Status Update (J. Green)
1:00 PSD R&A Update (J. Rall)
1:30 USGS (J. Skinner)
2:00 LRO Lessons Learned (J. Keller)
2:30 Findings(All)
3:00 Adjourn