National Aeronautics and Space Administration

Washington, D.C.

NASA ADVISORY COUNCIL

PLANETARY SCIENCE SUBCOMMITTEE

March 12, 2014
NASA Headquarters
Washington, D.C.

Meeting Minutes

_____	_____
Jonathan Rall, Executive Secretary	Janet Luhmann, Chair

Report prepared by
Joan Zimmermann, Zantech IT

Table of Contents

Welcome and Administrative Matters

Dr. Jonathan Rall, Planetary Science Subcommittee (PSS) Executive Secretary, opened the Spring 2014 teleconference and referenced alterations to the published agenda, precipitated by Dr. James Green's sudden change in schedule to provide a briefing to Congressional staffers. Dr. Janet Luhmann, PSS Chair, approved the agenda changes.

Planetary Science Division Update

Dr. Green, Director of the Planetary Science Division (PSD), presented a high-level review of activities in recent months, concentrating primarily on the President's submitted budget for FY2015. PSD is anticipating the arrival of the Mars Curiosity Rover at Mount Sharp this summer, the rendezvous of the European Space Agency (ESA) Rosetta spacecraft with comet 67P/C-G, and the insertion of the Mars aeronomy mission MAVEN into orbit on 21 September. One month later, Comet Siding Spring, an Oort cloud comet, will pass close to Mars.

The FY2014 budget for PSD is $1.345B, which is above the President's budget request, and PSD is grateful for this. Elements clearly specified are $130M for Research and Analysis (R&A), $40.5M for the Near-Earth Object Observation (NEOO) program, $288M for the Mars Exploration Program (MEP), $65M for the Mars 2020 Rover, and $158M for the Outer Planets (OP), with $80M allotted to pre-formulation on Europa. The Technology budget is $146M. The Lunar Quest line has no funding for FY2014, however PSD is identifying resources for the Lunar Reconnaissance Orbiter (LRO) for FY2014.

Dr. Green addressed specific elements of the FY15 budget, and sought to make clear that while it provides $1.28B for planetary science in 2015, the five-year runout (showing a slight increase in the planetary budget toward 2019) is notional and subject to change. Top-line elements include $165.4M for Research and Analysis (R&A), an increase that is due to moving funding lines into the program so as to provide full accounting. There is also $17M to be distributed throughout the year for bridge funding, as was promised to the community. The NEOO program maintains a $20M increase throughout the notional years.

There will be no funding for the Lunar Quest program, as is the case for FY2014. While Lunar Quest is officially concluded, it is important to note that LRO will go through a Senior Review and funding decisions will be made after the review is completed. The plan is to move LRO into the Discovery program if it is continued in FY2015. Within the Discovery program, the Interior Structure from Seismic Investigations, Geodesy and Heat Transport (InSight) mission to Mars is fully funded. In New Frontiers, there is $281M, fully funding the Origins Spectral Interpretation Resource Identification Security Regolith Explorer (OSIRIS-Rex) asteroid sample return mission. Insight and OSIRIS-REx both launch in 2016. The Mars program contains $288M in FY2014 and $279M in FY2015. Funds for the Mars 2020 mission are to be increased to $92M in FY2015.

The FY2015 budget contains $95.7M for Outer Planets (OP), including Cassini. This includes funding for ESA's Jupiter Icy Moons Explorer (JUICE) mission, and $15M for Europa studies, the first time the Administration has provided funds for efforts on Europa. PSD is very pleased

with this development. The Technology program is funded at $137M, which includes plutonium (Pu-238) funding and the radioisotope power source program. PSD no longer funds propulsion technologies, which have been moved to the Space Technology Mission Directorate (STMD).

There are important changes in program content with regard to selection of Discovery missions, a Discovery Announcement of Opportunity (AO) in 2014, and continued pre-formulation work for Europa, including an AO for instruments to address the technology challenges of the radiation environment. PSD is still restructuring R&A. The budget provides for ongoing activities for the Agency's commitments to ESA and the Japanese Space Agency (JAXA) for the STROFIO mission, JUICE instruments, Rosetta, Mars Express and Venus Express, the Akatsuki Venus Climate Orbiter (VCO), and a memorandum of understanding (MOU) that will enable NASA to obtain 10% of Hayabusa-2 samples. Full funding for mission extensions are dependent on Senior Review results and although funding for two of those missions, LRO and MER Opportunity rover are book kept in the Opportunity, Growth and Security Initiative (OGSI), if they are recommended for continuation, funding will be found regardless of the fate of OGSI. To maintain enhanced asteroid detection capabilities, PSD has turned the Wide-Field Infrared Survey Explorer (WISE) back on, which has since found 6 large NEOs.

PSD is preparing the next Discovery AO, and is currently in the process of writing the draft. The cost cap is at $450M in FY15 dollars, which includes funding for phases A-D, excluding Phase E and the launch vehicle. Any mission beyond the Moon will require deep space laser communication capability to capitalize on the Science and Technology Mission Directorate's (STMD) investment in laser communications. STMD is ready to take the next step beyond the recently accomplished Lunar Atmosphere and Dust Environment Explorer (LADEE) laser communications demonstration.

The Discovery program will be unable to provide radioisotope power systems for the upcoming AO. While PSD had considered using a Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) for Discovery, it was informed by DOE that there are limitations on fueling the generators in time for the next Discovery AO. Dr. Green emphasized that it is important to understand what caused this change. Major budget changes have occurred in PSD, including the transfer of responsibility from the Department of Energy (DOE) to NASA to manage Pu-238 production capability and development of radioisotope power systems (RPS). Approximately $50M a year is needed for this. NASA continues to fund the Pu production capability, and good progress is being made. There are now about 35 kg of Pu, of which 17 kg is in specification for power systems. Old and new Pu is being blended to increase the utility of available material. Upgrades on equipment (i.e. a hot press for producing pellets) are in progress; it will take about 3.5 years to replace these units fully.

Dr. Green provided some background on the evolution of the Europa mission concept. Europa, rated at the top of the most recent Decadal Survey recommendations, has major goals in exploring the moon's ocean, ice shell, global composition, chemistry, habitability, surface features and geology, future landing sites, and space environment. PSD had at one time been working on a Jupiter Europa Orbiter (JEO) mission, which had eventually been deemed unaffordable at $4.7B. The Decadal Survey then recommended that NASA find major cost savings in re-structuring the mission, thus the Agency studied three options to reduce cost: a Europa orbiter, a Europa lander, and a Jupiter orbital mission with multiple Europa flybys (Cassini-like), also known as the

Europa "Clipper." The Clipper carries out the preponderance of the Decadal Survey objectives and answers key questions for Europa, thus NASA has continued to move this concept forward. However, NASA will release a request for information (RFI) to elicit brief descriptions of science concepts for missions of less than $1B (A-E phases, excluding launch vehicle). PSD is in the process of developing a release as soon as possible. Launch vehicle options are also being studied, including space launch system (SLS). A competitive instrument AO for Europa is also under way.

A total of 58 Mars 2020 instrument proposals have been received, many of which are foreign, including concepts for *in situ* resource utilization (ISRU) capabilities. Selection will take place in late spring. Michael Meyer, currently the MEP Lead Program Scientist and Curiosity Program Scientist, has been asked to be the interim director at the NASA Astrobiology Institute, beginning 7 April. PSD will be looking for a replacement.

Discussion

Dr. Paul Steffes asked if there had been any word on a science definition team (SDT) for the Russian Venera-D mission. Dr. Green explained that NASA is still working with Russia on the International Space Station (ISS), and that the Russians remain NASA's good colleagues. Venera-D is proceeding with the business of science for a Venus mission. Dr. Luhmann asked if the intent were to squeeze Europa into a New Frontiers class mission, and if foreign collaborations would be acceptable. Dr. Green replied that these issues would be addressed in the RFI- the intent is to thoroughly investigate the cost space of the proposed $1B mission concept. He saw no reason why the international community couldn't participate. However, NASA would not anticipate a 50-50 partnership; Europa is intended to be a NASA-led mission. Dr. Luhmann commented that a mission that achieves the predominance of decadal survey science goals for ~$1B would be hard to do. Dr. Green remarked that the intent is to run out all leads. Dr. Julie Castillo-Rogez asked if there were insufficient funding for New Frontiers. Dr. Green replied that the funding is not sacrosanct and reiterated the fact that the budget is notional. Dr. Dave Draper asked about the status of the 2014 Operating Plan. Dr. Green noted that as the President's budget has only recently been released to the Hill, thus the NASA Operating Plan is currently in review, and will be completed in good time.

Dr. Candy Hansen asked why Mars 2020 would be carrying nuclear power to an equatorial region, which is not necessary; couldn't these MMRTGs be redirected to Discovery? Dr. Green noted that Mars 2020 is in phase A, and the program is still looking at site selection (a site selection workshop will be held in May 2014) and it is too early to make a decision to go solar. Then and only then will the mission know where it is going. The sites will not necessarily be equatorial. Past habitable regions would be at the top of the list, but these may or not be "special regions" as defined by the NASA Planetary Protection Office and the Committee on Space Research (COSPAR). During phase A, the MMRTG is baselined as the power source, as it is capable of operating for several years to help gather and analyze samples, possibly caching them. Dr. Hansen felt that MMRTGs would rule out certain locations. Dr. Green remarked that a decision to omit MMRTGs would require a complete redesign of Curiosity, which would have a cost impact and a thermal impact. At this stage it is completely unnecessary to go through the exercise of considering a solar powered mission.

Dr. Louise Procker asked about any potential impact of LRO on the Discovery program. Dr. Green replied that the Senior Review will provide relevant information about any extended missions (EMs), after which funding would be distributed accordingly. LRO has been through a previous Senior Review and did extremely well, but it is still subject to further peer review. Dr. Prockter also asked about the lack of a Dawn Participating Scientist Program (PSP), as noted by a PSS finding, Dr. Green explained that the rewrite on the Dawn Focused Research and Analysis Program (DFRAP) is still being reviewed, and apologized for not having read it yet. He hoped to complete this task and issue guidance as soon as possible. Asked if a PSP was off the table, Dr. Green anticipated that the current rewrite will contain his guidance. Dr. Lori Glaze asked Dr. Green to speculate on the probability of Congress enacting the OGSI. Dr. Green replied that Congress passed a law that also provided the Administration budget guidance. The Administration has recognized that certain contents are important; Congress will have to decide whether or not the overguide is important. Asked about any changes in the Operating Plan for LRO, Dr. Green noted that NASA has not issued a stop-work order for LRO, but there probably was not enough current funding to get to the end of the year. He didn't feel that it was Congress's intent to have NASA cancel LRO or LADEE; they just can't be restored within the current budget. NASA is doing everything it can to address the LRO shortfall. LADEE is doing fine. LRO is the top element of concern and will be addressed in the FY14 Operating Plan. Dr. Green noted that in the past PSD has been accused of taking money out of R&A, a charge that is simply not true.

R&A Program Restructure

Dr. Rall addressed various PSS individual findings on the R&A program restructuring. First, as to a finding on the immaturity of changes and a lack of consistency of guidance, PSD has made progress, refined its draft Research Opportunities in Space and Earth Science (ROSES) call, and will be adding the Lunar Data Analysis Program (LDAP) and Planetary Data and Archive Restoration Tools (PDART) sections shortly. Boundaries between core programs have been refined and established. Overall, PSD has tried to make it easier on the community to identify what is available.

Responding to a finding on the scope of the Solar System Workings (SSW) program being too large, with subject matter boundaries inexplicitly stated, PSD program managers reiterated their availability to the community for answering questions regarding where to submit their proposals. They also expressed confidence in being able to manage a broad panel review process. PSD has committed to having a single call this year, after which it will evaluate multiple deadlines for future calls. A panel chair has already been recruited, and a 3-week window has been established for the panel. PSD anticipates 7 panels per week; this structure has been used successfully by the Astrophysics Division.

PSS members expressed concern that PSD's reorganization plan must identify adequate sources of funding for extended mission (EM) science. PSD responded that it was aware of the challenges. In light of the fact some scientists will be turning to other programs for mission science support, it has tightened up definitions for the various data analysis programs (e.g. LDAP, DFRAP). Missions falling outside the new definitions would go to the core programs.

Responding to PSS's finding to change the DFRAP call to a PS program, Dr. Green is currently

reviewing broadened language in the DFRAP call to accommodate those desires. Results will be made public after a decision has been made.

Remaining items: Analysis Group chairs are in the process of being confirmed for appointment to the PSS; paperwork has been initiated. The deadline for the SSW call has been changed. The PSS appreciates and recognizes the hard work that has been done regarding this matter. Dr. Rall displayed the most recent ROSES 2014 chart with due dates. A newer chart will be released, and it was noted that the current NSPIRES website now has the correct due dates.

PSS briefly discussed outstanding issues with the recent changes, and Dr. Christina Ritchey provided further guidance on the matter. Dr. Nancy Chabot commented that she was pleased that the SSW due date had been moved up and asked whether the SSW one-year gap between selection and award be reduced to 6 months. Dr. Rall felt it was unrealistic to do this.

Dr. Mary Voytek added that the restructuring effort has set its expectations to be as realistic as possible, and that PSD has already hit the ground running to address all the pitfalls expected in this large panel review. PSD recognizes that there is not a one-size-fits-all solution. Dr. Rall noted that PSD will review and update solicitations as needed. Dr. Castillo-Rogez asked if R&A programs would have the same selection rates as last year, given that there is more money for R&A overall. Dr. Rall noted that the FY15 budget contains a dramatic increase for R&A, as a result of pulling content from the Outer Planets, Mars fundamental research, and the LASER program. The increase will likely translate to slightly higher selection rates, but the rates should be consistent with previous years. Dr. Rall felt encouraged by the fact that the Administration recognizes the importance of R&A, and was cautiously optimistic for a stable plan for Planetary R&A.

Dr. Luhmann thanked Dr. Rall for responding to the findings, and asked if there would still be an interim step of "selectable" proposals. Dr. Rall replied that every year is special, given that every year has been subject to a Continuing Resolution. Money comes in chunks, thus there will probably always be selectables; the aim is to fund every excellent proposal. There was continuing discussion referencing the clarity of proposal language, and Dr. Rall ultimately asked for specific examples in an effort to address any remaining ambiguities regarding the content of the data analysis programs. Dr. Voytek added that the basic premise behind the restructuring is to try to be inclusive and not contradictory; i.e., to find a category for data analysis if possible. Any data not falling under mission-specific solicitations should be directed to SSW or Emerging Worlds. Dr. Rall mentioned that NASA staff would be out in force at the Lunar and Planetary Science Conference (LPSC) to answer any questions, via a "Meet and Greet" with Program Officers.

Discussion continued on the subject of R&A restructuring. Dr. Clive Neal commented that the perception of the new SSW organization is chaotic. Dr. Rall responded that PSD will entertain the idea of more NSF-style calls next year; however, this first year it is the goal to organize as much upfront as possible. Dr. Neal noted that there will be many different requests for samples (Apollo, meteorites, Stardust, Genesis). Dr. Voytek pointed out that SSW or Emerging Worlds are suitable categories for addressing sample analysis proposals. She also wanted the community to know that PSD is responding to a PSS finding on the review process, working to create a better-coordinated review process to increase the quality and usefulness of reviews. Dr. Luhmann asked if the practice of using mail-in reviews to provide external expertise were still being used. Dr. Rall

responded that NASA is indeed supporting the incorporation of more external expertise. Dr. Glaze, referring to past problems with conflicts of interest and external reviews, was glad to hear of a little more relaxation of restrictions. In this vein, Dr. Plescia noted that proposers have often been told to ignore external reviews. Dr. Rall made it clear that NASA is not "relaxing" conflict of interest rules, just making it clear when an external reviewer has a possible bias. Dr. Jens Feeley added that the timing of peer reviews can potentially expose procurement-sensitive information, such that conflict-of-interest matters must remain well governed.

Dr. Voytek addressed the apparent community perception that proposals would not be reviewed in a timely manner, and assured PSS that the staff is doing everything possible to process very large numbers of proposals. Dr. Hansen noted that the implementation problems associated with a large number of proposals feels like a self-inflicted wound. Dr. Voytek responded that the Program Officers (POs) have worked hard to distribute the labor and have done data analysis on how to decrease the latency periods between selection and award. The Astrophysics Division (APD) does the best job on getting proposals out; PSD is trying to learn from them, and also wants to be transparent and realistic about the process.

Dr. Rall related that he had been told the monthly PSS tag-ups were not keeping up with the intent of the Federal Advisory Committee Act (FACA), and envisioned having 3-4 meetings per year. In the meantime, POs are always open to the community for interaction. Dr. Luhmann asked a question on changes in facilities management, given the community had not been given details on what the changes are. Dr. Rall explained that NASA facilities don't undergo regular reviews, but they do have individual POs evaluate them on a regular basis. The strategy NASA has now undertaken is to have a Senior Review of all its facilities to support decision-making. The Ames Vertical Gun (AVG), for instance, has changed its management of the science portion; it is now managed by an Ames scientist. For other facilities, NASA is coming up with a plan on how to review them. Science Mission Directorate Associate Administrator John Grunsfeld has questioned why NASA still has Research Program Regional Planetary Image Facilities (RPIFs). Subcommittee members raised concerns about appropriate oversight, questioning whether some of the newly assigned managers had a true understanding of a facility's impact. Dr. Jessica Sunshine felt that recent management changes effectively removed two levels of oversight. Dr. Plescia commented that the facilities need an understanding of the science and the experimental procedure, and perhaps require oversight from a science advisory committee or in the manner of a time allocation committee for telescopes. Dr. Rall suggested that if the community truly needed a facility, relevant proposals should be submitted to indicate this need.

Dr. Mihaly Horanyi commented that a Senior Review for facilities would be great to rolling old ones off and bringing new ones on to best serve the community. Dr. Louise Prockter commented that the AVG is a unique facility, which is another consideration applicable to wind tunnel facilities such as the Planetary Aeolian Laboratory. The subcommittee discussed how facilities will be newly costed in PI budgets, given that proposal budgets will be asked for, in extensive use cases. Dr. Rall agreed that this cost estimate process is different from the past, and understood that the community is concerned about it. PSD is working on determining the process for including user costs in proposals, once this is finalized we will amend it into the C.1 Overview of ROSES.. He added that Center Management and Operations (CM&O) is decreasing, and NASA can't close facilities fast enough on this decreasing budget. The Agency is being forced to go to this model. Dr. Sunshine felt that the move seems to be taking money from R&A (PI money). Dr.

Rall agreed that a good point has been raised, which will have to be further discussed.

Dr. Luhmann asked how the institutes fit into the big picture, as they have overlapping goals and people; how does this get integrated into the R&A restructure? Dr. Rall explained that some institutes are outside the R&A line, and some are inside. The Solar System Exploration Research Virtual Institute (SSERVI) funding is provided by the Joint Robotic Precursor Activity; all of the SMD money from that line and $4-6M of HEOMD money pays for the institute. PSD will have to gauge how effective the institutes are; PSS can help in this regard. Dr. Sunshine commented that institutes seem to pose an overhead problem in terms of every dollar that a post-doc gets from the R&A program vs. from the institutes. Dr. Rall noted that because the institutes are virtual, there should be no difference. Dr. Horanyi supported this comment. Dr. Luhmann suggested that it would be worthwhile to revisit institutes at some point to determine how much management costs are involved. Dr. Rall agreed that PSD can task Yvonne Pendleton and Michael Meyer to do this.

Dr. Chabot commented on the illogical nature of the Planetary Mission Analysis Program (PMDAP) to Dawn Data Analysis Program (DDAP) change, re: having a DDAP and a Dawn-focused R&A program (DFRAP). Dr. Rall replied that PSD wanted to have a Discovery DAP, but realized that a full 50% of PMDAP activities were non-Discovery. Because PMDAP was funded through the Discovery program, it should only be responsible for Discovery activities. It is all science money, but NASA must respect the appropriator's intentions. Dr. Richey also noted that PMDAP is supporting a lot of archiving, which is now being solicited differently, as well. Dr. Rall explained that DFRAP is a short-term program that was created to point up the temporal importance of the Dawn mission. Dr. Michael New commented that the DFRAP call was always meant to be separate from DDAP; the purpose of this separation was to highlight the data and encourage people to use it, and also to prepare for the Ceres encounter. Dr. Chabot noted that Dawn will be at Ceres in about a year, making it impossible to get a proposal selected by that time; she hoped that the new text on proposal guidance allows for this urgency. Messenger should have its own DAP, by that reasoning. Dr. New agreed there should be a Messenger DAP, and had engaged in conversation about DAPs for high-priority data, but the concept was not accepted. However, he was still willing to look into a Messenger DAP. PSD continues to explore ways to get more scientific expertise in place for the Ceres encounter. One way to do this is to encourage the appointment of co-investigators (co-Is); PIs are free to do this.

FY15 Budget Discussion

PSS addressed the new budget. Dr. Luhmann asked how well the budget matched NASA planning. Dr. Rall noted that he had long been an advocate for stabilizing the R&A budget, and was very happy that the Administration had responded to this plea, which is reflected in the FY15 budget rollout. The budget allotment for R&A exceeded expectations, and Dr. Rall felt this could mark the start of a stable period. Selection rates will continue to be driven by proposal pressure. That said, the average proposal request ($ per year) has remained relatively flat. Pressure has increased by 50% in the last 5 years. The budget increase should reduce the pressure. The community has also grown (in terms of the number of unique PIs).

Dr. Green returned from his Hill briefing and re-engaged in discussion with PSS. He reported that the briefing had gone well. Dr. Luhmann asked how PSD could manage to grow R&A in this environment. Dr. Green noted that when PSD received a 21% cut in its budget, R&A did not take

that cut, so in a way that represented growth for R&A. Instead, PSD chose to delay the flight rate of Discovery and to reduce key technologies. R&A remains the most stable part of PSD. NASA is still in the process of taking content out of the program, but fortunately Congress has provided funding above the Presidential budget for 2014, with some direction. PSD plans to move quickly on Congressional direction, and must continue using the budget to make these directions a reality. Dr. Luhmann commented that Extended Mission (EM) science is being cut back, and is slowing new missions, a lot of people are starting to go to the R&A budget, which is a zero-sum game. Dr. Green agreed with this assessment. Dr. Luhmann noted that EM-wise, the budget seems to be more specific about certain mission investments: will this change the Senior Review process? Dr. Green replied that this would not be the case; the huge decreases in the Outer Planets line have been seen previously as a threat to Cassini. PSD has a planning wedge for Cassini to address this threat. He read a quote from budget language that alluded to achieving savings by reducing funding for some lower priority missions, which enables support for extended operations for the Cassini Saturn mission. Dr. Green assured PSS that this does not mean that Astrophysics money is being used to solve PSD problems, this is not how it happens. APD is also taking severe cuts, and made a decision to not fund its SOFIA mission in the FY15 budget. The entire SMD budget is lower in 2015 than in 2014; this is a sign of the times. The NASA divisions must solve their own problems. PSD is still planning to execute its Senior Review and go forward to the best of its ability. The EM teams should concentrate on writing the best Senior Review proposals possible, and allow the peer review process to move forward, while recognizing that NASA is operating within an austere budget. Dr. Hansen noted that she was happy to see the Cassini line restored. Dr. Green reminded her that this funding is a planning wedge, and cannot be taken for granted. The Senior Review must be able to show that a Cassini EM provides value.

Dr. Plescia raised the issue of the proposed OSGI vs. EM funding. Dr. Green commented that as NASA gets to the end of the fiscal year, it will provide projects a funding profile based on the Senior Review outcome. There will likely be another Continuing Resolution. NASA will enact the budget accordingly, and will continue operating to the constraints of the previous year's budget, which will be lower. Contrarily, Congress could pass a budget that is higher. No one can predict what will happen.

Dr. Hansen asked about the status of the Education/Public Outreach (EPO) budgets within PSD. Dr. Green replied that in 2014, SMD lost $50M in EPO funding, but despite this loss, SMD has continued to fund EPO to the extent possible within individual divisions, when there are project reserves. In 2015, there is about $15M in funding to bring some EPO back. NASA is going ahead with a plan to use that funding; all of the EPO grants in their second or third years will be funded. A new solicitation would have to be described in a new FY2015 Operating Plan, which is not yet determined.

Dr. Luhmann asked about the status of the Asteroid Redirect Mission (ARM). Dr. Green noted that the ARM concept was initiated in the 2014 Congressional budget; it has not been cancelled, but ARM is not part of SMD, although SMD must find the targeted body. This is the purview of the Human Exploration and Operations Mission Directorate (HEOMD), and will not be managed by SMD. The NEO part of the budget for FY13 is $20M, and for FY14 it is $40.5M; from FY15 on, it is $40M per year. PSD has reactivated the Wide-Field Infrared Survey Experiment (WISE) with additional funding, which is working well for finding potentially hazardous NEOs. The Panoramic Survey Telescope & Rapid Response System (PanSTARRS) and the Air Force Space

Surveillance Telescope system will also be used to hunt NEOs. Increased radar observations at the Goldstone and Arecibo facilities have been detecting about 80 NEOs per year between them. Dr. Luhmann asked if these observations were supported by redirected or additional funds. Dr. Green replied that the funding came from somewhere within PSD. Dr. Hap McSween asked if PSD would be taxed when the samples return. Dr. Green said he felt good about how the situation has been evolving; there has been no pressure to pony up more money. He felt that Congressional support thus far has reflected this. Dr. Luhmann observed that it sounds as though PSD is making lemonade- taking a mandate and turning it into great science.

Dr. Green addressed the involvement of private initiatives such as B612, which has been attempting to obtain private funding for a telescope to do a more comprehensive NEO survey. NASA has signed a Space Act Agreement (SAA) with B612, through which NASA will obtain access to their data. Tracking will come from the Deep Space Network (DSN). This is a high-level, well-delineated agreement. The other initiative is an asteroid mining concern, with which NASA has no agreement. Dr. Chabot commented that B612 does not have a well-defined schedule: can it really help NASA make its 2005 mandate to identify 80% of 140m+ NEOs? Does this put NASA at risk of not accomplishing mandate? Dr. Green felt that NASA was viewing the venture as a new way of business. Dr. Luhmann asked if there were some sort of handbook governing private enterprise at the Moon or Mars. Dr. Green replied that there is no handbook *per se*, but many existing examples to draw from, such as cooperative agreements, and SAAs.

Dr. Green further reported that ESA's JUICE mission has received approval to move forward, and ESA has invited NASA to participate in the AO for instruments. NASA had the Administration's backing to provide $100M for the AO, which has now gone through the selection process. As JUICE gets closer to launch, there will be a Participating Scientist (PS) opportunity in the 2020s, funded through a future budget wedge. PS proposals would go through a competitive R&A call.

Dr. Luhmann commented that the community feels disconnected from Ames Research Center (lunar) mission activities. Dr. Green explained that these are HEOMD activities, and suggested the PSS receive a briefing at the next opportunity. The HEOMD missions could provide beneficial to planetary science. The Small Bodies Analysis Group (SBAG) and Lunar Exploration Analysis Group (LEAG) have dual charters, each group has exploration and science roles, and NASA feels it is important to bring science and exploration people together in these forums.

There is additional unallocated funding in R&A (bridge funding), which is meant to be used for old, existing grants until new grant is received. The intent is to smooth the transition to a new R&A timetable.

Senior Review

Dr. Bill Knopf briefed PSS on the 2014 Planetary Mission Senior Review (PMSR), which includes Cassini, LRO, MER (Opportunity), MEX/Aspera-3, Mars Odyssey, Mars Reconnaissance Orbiter (MRO), and the Mars Science Laboratory (MSL). A draft guideline narrative was released in January, comments were received on 14 February, and a final guideline released on 21 February (including budget targets). The PMSR will follow largely the same

format as 2012: the maximum length of proposals will be 30 pages, but has been extended to 40 pages for Cassini due to a proximal orbits extension. Three subpanels have been formed for Mars, LRO and Cassini. The Mars review will exclude the Mars relay asset budgets for programmatic support. Three budgets are being addressed: a 100% in-guide target; a reverse-priority science de-scope (what are you willing to sacrifice to reduce cost) to set the lowest science-value floor; and an over-guide target. Proposals are due 11 April, the review panel date is set for May 2014, and results will be announced in June. Hard copies of proposals will not be required. Dr. Luhmann asked how the guidelines are determined, as to what is weighted and with respect to interactions with the project. Dr. Knopf responded that there have been no interactions yet, but there has been a series of PMSR coordination meetings on what is evaluated and weighed. He understood that the operations of most missions (MSL is an exception) have been scrubbed a number of times, so there will not be a big operations scrub, everything will be graded on science. Dr. Luhmann asked if there would be cries of pain due to the MSL competition. Dr. Knopf admitted to having a personal concern about a "strategic investment fund" to help save certain missions, but otherwise he believed the review will be a reasonable process; he reported hearing no concerns from any program executives or scientists. Dr. Mark Sykes asked whether a review of the Dawn mission would be part of the PMSR process. Dr. Knopf replied that the review is considering only the primary mission performance to date, to ensure that all is prepared for meeting Level 1 science requirements.

Discovery Update

Dr. Michael New provided a briefing on the Discovery program, in particular with respect to the upcoming AO. InSight, a geophysical lander at Mars, is now in phase C. The SERENA suite instrument has been delivered for the ESA Bepi-Colombo mission, which is now due to launch in 2016. Dawn, now in phase E of its mission, is *en route* to its encounter with Ceres. The Messenger, now in EM status, has just passed its 13th Mercury year (third Earth year). The lunar mission GRAIL is closing out its high-fidelity model of the Moon's gravity field. Congress has given direction to release the next AO in calendar year 2014, beginning with a community announcement in February of this year. A clarification will be issued soon. The draft AO is due in May, and the final AO in September.

The parameters of the previous AO included an unlimited range of targets (except Earth and Sun); $425M cost cap for phases A-F; an Atlas V 401 launch vehicle; incentivization for 4 technologies (xenon thruster, bipropellant rocket, thermal protection systems, guidance algorithms for aerocapture); and two Stirling radioisotope generators (less $20M for environmental/nuclear costs). Spacecraft entering a Mars orbit will be required to carry an Electra telecommunications module, and a Mars lander will be required to carry an Electra-lite module.

For the 2014 AO, the targets remain the same, the cost cap will increase to $450M FY15 for phases A-D (phase E budgeted but not evaluated); the launch vehicle is to be determined given new commercial competition in the market (this is still under discussion with the Launch Services Program); Launch Readiness Date to be no later than the end of CY21. There will be a technology demonstration option (with funding outside cost cap). Proposals will also require instrumentation to acquire technical/engineering data for missions that enter atmospheres. The 2014 AO will not offer radioisotope power systems. There will be an overall 1/3 foreign contribution limit on the PI controlled costs and 1/3 cost of science payload cost for foreign

instruments; missions may be asked to carry demonstration payloads as GFE re: Deep Space Optical communications. There will be no change in phase A (9 months, $3M).

Responding to issues raised by a Lessons Learned exercise on previous Discovery AOs, Dr. New noted that the largest set of comments regarding preliminary major weaknesses included the observation that 24 hours is too short a response time. There were also complaints about the intensity of constraints (that are set up to avoid "entering discussions" that increase costs and time). He understood that these constraints were frustrating to proposers, and was considering means to ameliorate this with both legal staff and management at NASA. Referencing ESA governance, Dr. New noted that ESA leaves it to member agencies to procure instruments; NASA is governed by procurement laws that prevent the same process. He also noted that the ambiguity in language on archiving had been eliminated by making some amendments. Addressing access to flight spares (who owns them and who controls access), NASA is considering putting language into the AO that requires a published catalogue of flight spares. Other issues, such as the ubiquitous problem of non-uniform TRL definitions, are being worked at the Agency level. The program is also moving back end-dates for answers to questions and correcting a reversal-of-column formatting error. Dr. Hansen thanked Dr. New for his responsiveness to OPAG, and suggested that the Deep Space Laser Communication hardware that NASA is considering requiring would consume too much power and mass for many missions to accommodate. Dr. New responded that if required, it would be government-furnished equipment. Developers are stating that the Deep Space Laser Communication hardware would be 25 kg in mass and require 75W of power, although these are preliminary specifications. It may be that this hardware is not ready for prime time.

The next version of the communication hardware is being developed by JPL and will need to function over longer distances (Earth-Mars), thus will need new detectors and lasers. Dr. Neal asked about the bookkeeping of reserves with respect to foreign contribuitons. Dr. New noted that an explicit reserve to mitigate against the failure of a foreign contribution had never been a requirement, however the proposal needs a discussion of how the team mitigates the risk of not receiving its contributed instrument. Dr. Neal recommended that explicit language to that effect should exist in the AO.

<u>Curation and Analysis Planning Team for Extraterrestrial Materials (CAPTEM Update)</u>

Dr. Hap McSween, Chair of CAPTEM, reported on its status. NASA is still negotiating with the National Science Foundation and the Smithsonian Institution on the disposition of Antarctic meteorites; this is still ongoing and delaying delivery of materials to Johnson Space Center (JSC). Meteorites collected during the last field season could not be transported and will remain in a frozen state at McMurdo Station until next year. CAPTEM is conducting a rapid study on the proposed ARM with regard to extravehicular activities (EVAs) for sample collecting. The intent of the study is to maximize the science to be gained from the sample without levying costly requirements. Thus far there are 10 findings that maximize science content, which will be made available on the CAPTEM website. CAPTEM is also in the process of inspecting and reviewing JSC sample curatorial facilities in response to a JSC request, to help prepare for new advances in analytical methods, microanalytical techniques, etc. Dr. Voytek suggested that CAPTEM contact Jeff Grossman for a possible follow-up on previous findings.

Lunar Exploration Analysis Group (LEAG)

Dr. Plescia gave an update on LEAG activities, including a discussion about the Global Exploration Roadmap (GER). LEAG has also been working with SSERVI on the human exploration portions of the GER. LRO had a minor issue with its wide-angle camera, but is planning to go back to operational status. LEAG will hold a lunchtime Executive Committee meeting at LPSC. Last March Marshall observed an impact event on Moon, and another in Oct observed by Europeans; will help with calibrations of those terrestrial observations. LRO continues to lose budget dollars and anxiously awaits a 2015 guideline. Dr. Green commented that the LRO issue rests with some past budget carryover from FY12-13. Having previously described the 2014 problem, he added that PSD is still discussing it. LEAG discussed the Resource Prospector Mission (RPM) mission concept to a polar region on the Moon, to sample regolith for water, and conducted a sanity check on science goals; accomplishments are to be determined.

Mars Exploration Program Analysis Group (MEPAG)

Dr. Lisa Pratt provided an update on Mars missions within the purview of the MEPAG. The InSight seismological mission is ready for its Critical Design Review (CDR). The payload selection for the Mars 2020 mission will take place this summer, and the first landing site workshop will take place in May. Recent science findings suggest that the John Klein site looks more and more like an ancient lakebed, as its constituents are not strongly oxidizing and are characterized by low salinity. There are also mineral couples that hint at potential energy sources for organisms. A paper on Gale Crater has yielded some credible dates for rock exposures, at less than 100 million years, which implies rapid surface erosions (Farley, 2013). If present, surface evidence of past organic life on Mars might still be preserved. There is a new group (SR2-SAG) that is investigating special regions, which was initiated in January and which has reported out some preliminary work. Given the low water activity limit for terrestrial life, an early finding of the SR2-SAG holds that there is no evidence for cell division or metabolism. Another finding regarding recurring slope lineae (RSL) holds that they are more widespread than previously thought, although the physical process behind their appearance is still not well understood. RSLs seem to be best explained by seepage of water and should probably be treated as special regions for now. High-resolution monitoring from orbit will be critical to further RSL observations. MEPAG and HEOMD are building a collaboration and actively working with John Connelly in addressing strategic knowledge gaps (SKGs), *in situ* resource utilization (ISRU), and actively updating goal 5 (preparation for humans). The next MEPAG face-to-face meeting is scheduled for 13-14 May in Washington, D.C.

Dr. Luhmann suggested that more presentations from the AGs be given at meetings of the Committee on Astrobiology and Planetary Science (CAPS), as they can provide strong advocacy for the planetary community. Dr. Rall took an action to put a briefing from the CAPS on the next PSS meeting agenda. Dr. Green commented that CAPS is the keeper of the Decadal Survey, and their perspectives are similar to those of PSS. It is critical to get more tactical interaction with the community. CAPS also considers the mid-term review of the Decadal Survey.

Outer Planets Analysis Group (OPAG)

Dr. Hansen briefed the status of the OPAG, which last met in January 2014. One of OPAG's top findings conveys a deep community concern about the looming gap in the next major mission to the outer Solar System, due to the necessarily long lead times of such missions. The near-term future is bright, with Juno, Cassini, and the New Horizons flyby of Pluto. Both the Juno and Cassini end-of-mission scenarios occur in 2017, with very similar parameters. Not having a mission on the drawing board at this point leaves a large gap in OP science. OPAG is however pleased at the notional budget for Cassini in the out years to 2017, which will enable several more Enceladus flybys, and 26 Titan flybys. OPAG is also pleased at the fraction of funds that has been allotted to the Europa Clipper mission concept. The community is also thankful that NASA has persisted in the Pu-238 re-start, and in helping keep the gates to the outer Solar System open through the Discovery program. OPAG is setting up a subcommittee on determining needs for aerocapture, particle/ring hazards, etc. for future exploration of the outer atmosphere of "ice giants."

Small Bodies Analysis Group (SBAG)

Dr. Chabot, SBAG Chair, provided an update on recent activities. SBAG had its last meeting in January, and its next meeting will take place 29-31 July. SBAG continues to hold monthly Steering Committee teleconferences, and was recently asked to provide input to the ARM. Consequently, a 6-member special action team was created, which produced a report, with findings, that is available on the SBAG website. SBAG was also asked to consider a number of parameters for weighing proposals for ARM; SBAG provided background information on such things as presence of free-standing boulders, etc. on bodies of interest. This information was briefed in February, and there will be further opportunities to provide input to ARM for both the science and planetary defense communities. Dr. Chabot reiterated community concern at the lack of a PS opportunity for Dawn at Ceres, and stressed that there is little time for internal debate on this matter. The SBAG Steering Committee took an action to directly contact all 18 Dawn-at-Vesta Participating Scientists, and received positive feedback with regard to their willingness to participate in a PS opportunity at Ceres. The asteroid Ceres is emitting water vapor, which was not known when Dawn was proposed. The community needs to observe this phenomenon more closely. Dr. Chabot remained hopeful that NASA can make it happen. Dr. Voytek and Dr. New raised the issues that would attend a possible redirection of a mission that is already straining Level 1 requirements, although there may be a possibility for extra observations to be made. It is not clear what NASA could provide further, beyond added hands and data analysis, through a PSP. Dr. Green added that he had seen no constructive comments about the DFRAP call, but planned to put some quality time into understanding the proposed changes. NASA already has data analysis (DA) on Vesta and a set of scientists that will participate on the Ceres DA. Dr. Chabot noted that these data are excluded in the Planetary Data System (PDS), which will prevent Ceres scientists from access. Mr. Lindley Johnson, Program Executive for the NEO program, commented that he believed the latest DFRAP language would be most useful for completing the analysis of data at both bodies, although it does not provide for a full PSP.

Dr. Chabot highlighted three findings from the SBAG: a recommendation for establishing a Planetary Defense Coordination Office (PDCO); support for the development of a NEO Survey Telescope; and concerns about the reduction in the technology budget. Dr. Green commented that PSD has been working very hard on the STMD connection, and expressed appreciation for SBAG's comments on Discovery. Commenting on the PDCO finding, Dr. Green noted that PSD

is moving in a more focused direction, freeing up Lindley Johnson to devote time to NEOs.

Venus Exploration Analysis Group (VEXAG)

Dr. Lori Glaze, VEXAG Chair, presented results of the group's latest meeting. In February of this year, five U.S. members were named to the Venera-D SDT, a 2024 opportunity to return to Venus. At the VEXAG town hall meeting at LPSC, there will be an early career scholars' mixer. VEXAG's primary activity at present is the preparation for the next Discovery AO; to that end members have been revising an update for the document *Goals, Objectives and Investigations for Venus Exploration*, a Roadmap for Venus Exploration, and a draft Technology Plan. All three final documents will be rolled out at the VEXAG town hall next week. Findings from November 2013 meeting- 5 major- concern that technologies are being halted just short of maturation; need a next generation version of RPGs for surface Venus operations. Need new TPS, ASRGs. VEXAG is pleased to see that the Heat-shield for Extreme Entry Environments Technology (HEEET) is on the table for discussion in the new Discovery call. Dr. New commented that having HEEET at TRL 6 by 2017 is a bit optimistic. VEXAG reinforced Decadal Survey recommendations on Discovery cadence, and recommends including AG documents in the AO Libraries. Dr. New agreed that the latter was a good idea. VESAG issued a last finding on encouraging PSD support of an exploration targets workshop (19-21 May); Comparative Climates of Terrestrial Planets; Venus Instrumentation Workshop; and a Venus Express Science Team meeting in the U.S. in 2014/15. The Venus Express spacecraft is still in excellent condition and is expected to run out of fuel in late summer; an aerobraking campaign is being planned. Akatsuki will achieve another flyby of Venus in November 2015; the eventual hope is to achieve orbit in 2016.

Discussion

Dr. Luhmann received a committee consensus to issue only observations, and not findings, for the interim, and offered to write up observations on the NASA Institutes, NASA Ames missions, an invitation to the CAPS chair, pending AG chair appointments, and on a Senior Review for NASA facilities. She noted that Dr. Castillo-Rogez would be representing PSS to the Science Committee budget teleconference in April. Dr. Green commented that it would be important to let the NAC know that Administration support for the Europa Clipper is welcomed. Dr. Luhmann felt it would be sufficient to convey the point that it will be challenging to satisfy the Decadal Survey recommendations for Europa science with the Clipper mission. Dr. Prockter offered to dig up previous studies on Enceladus, Titan, etc. for inclusion in the Europa RFI. In answer to a question, Dr. Green noted that there is no intention to make the Clipper a New Frontiers mission, although the solicitation would be in the cost range. Dr. Plescia agreed to draft a statement on an immediate approach for FY14 LRO support. Dr. Luhmann noted that members Dr. Castillo-Rogez, Dr. Prockter, Dr. Sunshine, and Dr. Steffes would be rotating off PSS on April 15, and thanked them for their service. Dr. Luhmann adjourned the meeting at 4:57pm.

Planetary Science Subcommittee
Teleconference March 12, 2014
Findings and Observations

The Planetary Science Subcommittee (PSS) held a virtual meeting on March 12, 2014 primarily to hear about and discuss the newly released NASA Planetary Science Division (PSD) budget version, the status of the Research and Analysis (R&A) Program restructuring, the Extended Mission Senior Review plans, and the recent Analysis Group (AG) activities. The major observations and findings of the subcommittee resulting from that meeting are documented here.

PSS Attendance: In person: Nancy Chabot, Lori Glaze, Jeff Pleascia
PSS Attendance: Telephone: Janet Luhman, Jessica Sunshine, Louise Prockter, David Draper, Hap McSween, Lisa Pratt, Julie Castillo-Rogez, Candy Hansen,

FY15 Budget:
-The inclusion of a new Discovery Mission start, allowing a draft announcement of opportunity to be released in May, followed by the final AO in September, represents a significant and welcome step forward toward reestablishing a high frequency cadence for these highly productive, moderate cost, PI-led missions. The PSS is grateful for all of the hard work on the part of both NASA headquarters and the community, and Congress' support, that led to this development and looks forward to a similar near-term recovery of New Frontiers class mission opportunities.

-The PSS is also encouraged by the ongoing emphasis on the realization of a mission to Europa in the form of additional study and instrumentation development funds. PSD plans to release a Request for Information (RFI) to consider what science can be returned for a $1B class mission to Europa. As indicated by previous studies, however, ~$1B class options will present challenges to accomplishing the Decadal Survey goals for the mission. The extent to which concepts resulting from the RFI fulfill these goals must be a key element of PSD's and NASA's consideration of the results.

- The cancellation of the Lunar Quest Program and the inability to move LRO into the Discovery line for FY14 results in the Lunar Reconnaissance Orbiter not having a programmatic home and thus an identified source of funding. LRO is returning important, high-quality data and was highly reviewed last year, with a ranking #2, as part of the Senior Review of extended missions. The PSS believes it is critical that PSD identify funds to sustain the current operation in FY14. It is our understanding that as part of the NASA operating plan to be submitted to Congress, funding is identified for the FY14 operations of LRO at the amount originally based-lined after the Senior Review.

- We recognize that an extended mission for any project is contingent upon an appropriate rating from the CY2014 Senior Review, but funding for extended missions for several currently active, highly productive projects (e.g., LRO, Opportunity) is only identified as part of the proposed Opportunity, Growth, and Security Initiative. This raises a concern that if this explicit initiative is not funded, no funding will be available for the extended missions of these projects even if they are highly rated by the Senior Review.

R&A Restructuring:
-The PSS notes that the R&A Restructuring plans are moving forward as planned. We encourage the planetary community to take advantage of resources and information being made available by the PSD via town halls at meetings, such as upcoming at LPSC, personal contacts with program managers at meetings and via email, and information provided on the LPI website where meeting

minutes and related documents on this topic are posted. Following a request by the PSS, a list of the core program 'caucus' members has been made available so that the community is aware of the program manager groups that will be in charge of conducting the newly expanded review panel activities.

- Concern still exists regarding the implementation of the restructuring with respect to the scope of work required to review and decide on the proposals as the number to be submitted to any given program will be considerably larger than in the past and given that the decisions will be made by a caucus rather than an individual program manager. An important example concerns program scopes that include wording to effect that proposals that seek to do "data analysis" of the data returned by the PSD space missions should only be submitted to Data Analysis programs. The result may be a serious over-subscription to Data Analysis programs and a relatively low subscription to the core programs. It is important that both the program calls and responses to program manager inquiries provide clear and consistent guidelines for proposers regarding what makes a project including data analysis as part of its methodology appropriate for a core program versus a DAP.

Facilities:
-The PSS requests that PSD conduct a Senior Review, or similar review involving external and internal experts, of PSD-supported facilities and their management in the near term. Its purpose should be to evaluate their use and operators as resources available to the science community, and to determine whether modifications should be made at this time of program restructuring and budgetary constraints. For example, this group should consider requirements for scientific oversight in cases such as the Ames Vertical Gun Range (AVGR), where proposed management plans have elicited concern from the user community because they do not appear to include it.

Next meeting:
-The PSS is interested in hearing at their next meeting about the PSD R&A carried out through Institutes instead of the regularly competed programs, how it compares in terms of effectiveness and productivity per science dollar, and how the Institute concept fits into the larger framework of the newly restructured R&A programs. We are also interested in obtaining updates on science-related missions being conducted and planned by HEOMD, and in an exchange on general planetary science matters with the chair and/or members of the NRC CAPS group. Finally, PSS intends to establish as a regular agenda item a follow up discussion on previous meeting findings and observations, including in this case developments on the PSD facilities review, the Europa mission studies, and R&A Program restructuring developments.

Appendix A

Attendees

Subcommittee Members

Janet Luhmann, Chair PSS, University of California, Berkeley
Julie Castillo-Rogez, NASA Jet Propulsion Laboratory
David Draper, NASA Johnson Space Center
Lisa Gaddis, United States Geological Survey
Lori Glaze, Goddard Space Flight Center
Candy Hansen, Planetary Science Institute
Mihaly Horanyi, University of Colorado
Louise Prockter, The Johns Hopkins University
Paul Steffes, Georgia Institute of Technology
Jessica Sunshine, University of Maryland
Donald Yeomans, NASA Jet Propulsion Laboratory
Jonathan A. R. Rall, Executive Secretary, NASA HQ

NASA Attendees

Nora Alonge, NASA HQ
Louis Barbier, NASA HQ
Dwayne Brown, NASA HQ
Janice Buckner, NASA HQ
Barbara Cohen, NASA MSFC
Doris Daou, NASA HQ
Kelly Fast, NASA HQ
Robert Fogel, NASA HQ
James Gaier, NASA GRC
James Green, PSD, NASA HQ
Jeff Grossman, NASA HQ
Doug Isbell, NASA JPL
Lindley Johnson, NASA HQ
Gordon Johnston, NASA HQ
John Keller, NASA GFRC
Michael Kelley, NASA HQ
William Knopf, NASA HQ
Michael New, NASA HQ
Curt Niebur, NASA HQ
Adriana Ocampo, NASA HQ
Robert Pappalardo, NASA JPL
Greg Vane, NASA JPL
Richard Vondrak, NASA GSFC
Mary Voytek, NASA HQ
Donald Yeomans, NASA HQ

Non-NASA Attendees

John Andrews, SWRI

Brent Archinal, USGS
Dallas Bienhoff, Boeing
Darrell Branscome, NASA Consultant
Nancy Chabot, The Johns Hopkins University / APL
Kurt Claus, Boeing
Dominick Conte, Millennium Space Systems
James Dean, Florida Today
Brett Denevi, The Johns Hopkins University / APL
Monte DiBiasi, SWRI
Cynthia Dinwiddie, SWRI
Casey Dreier, The Planetary Society
Lisa Gaddis, USGS
Leslie Gertsch, Missouri University of Science and Technology
Heidi Hammel, Aura
Christine Hartzell, University of Maryland
Briony Horgan, Purdue University
Jeff Johnson, The Johns Hopkins University / APL
Richard Kerr, Science Magazine
Irene Klotz, Reuters
Kurt Klaus, Boeing
Melissa Lane, Planetary Science Institute
Gregory Lee, Northrop Grumman
Dan Leone, Space News
James Lochner, USRA
Mackenzie Lystrup, Ball Aerospace
Joseph Makowski, Orbital Sciences Corporation
John McCarthy, Orbital Sciences Corporation
Alfred McEwen, University of Arizona
Michael McGee, Lockheed Martin
Harry McSween, University of Tennessee
David Millman, Unaffiliated
Clive Neal, University of Notre Dame
Larry Nittler, Carnegie Institute
David Oberg, Orbital Sciences Corporation
Ronald Polidan, Northrop Grumman
Kurt Retherford, SWRI
William Ruch, Louise Burke Associates
Marcia Smith, Space Policy Online
Mark Sykes, Planetary Science Institute
Elizabeth Tuttle, The Johns Hopkins University / APL
Ann Verbiscer, University of Virginia
Janet Vertiss, Princeton University
Alexandra Witze, Nature Magazine
Joan Zimmermann, Zantech IT

Appendix B

Membership Roster
Planetary Science Subcommittee

Janet Luhmann (Chair)
Senior Fellow
Space Sciences Laboratory
University of California, Berkeley

Julie Castillo-Rogez
NASA Jet Propulsion Laboratory

Nancy Chanover
Astronomy Department
New Mexico State University

Mihaly Horanyi
Laboratory for Atmospheric and Space Physics
University of Colorado

Christopher House
Department of Geosciences
Pennsylvania State University

Louise Prockter
Applied Physics Laboratory
Johns Hopkins University

Paul Steffes
School of Electrical and Computer Engineering
Georgia Institute of Technology

Jessica Sunshine
Department of Astronomy
University of Maryland

Donald Yeomans
NASA Jet Propulsion Laboratory

Jonathan A. R. Rall, Executive Secretary
Research & Analysis Program - Lead
Planetary Science Division
Science Mission Directorate

Appendix C

List of Presentation Materials

PSD Status Update and FY15 Budget (Green)

PSD Senior Review Update (Knopf)

Discovery Update (New)

CAPTEM (McSween)

MEPAG (Pratt)

OPAG (Hansen)

SBAG (Chabot)

VEXAG (Glaze)

Appendix D

Planetary Science Subcommittee Meeting
March 12, 2014
NASA Headquarters
Washington D.C.

Wednesday, March 12, 8:30 a.m. - 4:30 p.m.

8:30 Welcome, Agenda, Announcements ..... (Luhmann, Green, Rall)

8:35 PSD Status Update and FY15 Budget ..... (Green)

9:20 PSD R&A Restructure ..... (Rall)

10:20 Break

10:35 PSD R&A Restructure Discussion ..... (All)

11:35 Lunch ..... (On own)

12:30 FY15 Budget Discussion ..... (All)

1:30 PSD Senior Review Update ..... (Knopf)

2:00 Discovery Update ..... (New)

2:30 CAPTEM Discussion..... (McSween & All)

2:45 LEAG Discussion..... (Plescia & All)

3:00 MEPAG Discussion ..... (Pratt & All)

3:15 OPAG Discussion ..... (Hansen & All)

3:30 Break

3:45 SBAG Discussion ..... (Chabot & All)

4:00 VEXAG Discussion ..... (Glaze & All)

4:15 Q&A Session with the Committee ..... (All)

5:00 Adjourn

SUPPLEMENTARY INFORMATION:

The meeting will be available telephonically and by WebEx. Any interested person may call the USA toll free conference call number 888–957-9861, pass code 64849, to participate in this meeting by telephone.

The WebEx link is https://nasa.webex.com; the meeting number is 996 838 402, password PSS@Mar12;