

January 25, 2014

On the afternoon of Friday, January 17, 2014, the email below was sent to the planetary science community, asking for the community to send feedback to the AG chairs. As SBAG chair, I received an impressive number of comments in the few days prior to the PSS meeting on January 22, 2014. This document captures those comments, with my hope that the specific comments from the community may be used to best develop the Planetary Science Division's R&A solicitations and programs. This document is organized as follows:

- Dawn Focused Research and Analysis Program comments and letters, including the SBAG steering committee finding
- Emerging Worlds comments
- Solar System Workings comments
- Solar System Observations comments
- Community letters, with cross program comments

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### **Draft Solicitations of Some PSD R&A Solicitations for ROSES14 Released to Public**

Hello,

PSD has posted the draft versions of several of the R&A program's solicitations for ROSES 2014 on the LPI website (where PSD has been previously posting updated information with regards to the reorganization of the PSD R&A portfolio). The draft solicitations include all 5 new core programs, as well as solicitations for the Dawn Focused Research Analysis Program, the Cassini Data Analysis and Participating Scientist Program, and the Exoplanets Research Program. Please send any constructive feedback to the Assessment Group (AG) chairs:

For CAPTEM, email Hap McSween ([mcsween@utk.edu](mailto:mcsween@utk.edu))  
For LEAG, email Jeff Plescia ([Jeffrey.Plescia@jhuapl.edu](mailto:Jeffrey.Plescia@jhuapl.edu))  
For MEPAG, email Serina Diniega ([Serina.Diniega@jpl.nasa.gov](mailto:Serina.Diniega@jpl.nasa.gov))  
For OPAG, email Candy Hansen ([cjhansen@psi.edu](mailto:cjhansen@psi.edu))  
For SBAG, email Nancy Chabot ([Nancy.Chabot@jhuapl.edu](mailto:Nancy.Chabot@jhuapl.edu))  
For VEXAG, email Lori Glaze ([Lori.S.Glaze@nasa.gov](mailto:Lori.S.Glaze@nasa.gov))

Please visit the LPI website to view these draft solicitations:  
<http://www.lpi.usra.edu/PSD-RandA/>

Thank you,  
Jonathan Rall

## **Dawn Focused Research and Analysis Program**

Consolidated comments sent to Nancy Chabot, SBAG chair, by community members. The order of the comments does not indicate any relative priority.

**Consolidated:** January 24, 2014

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First and most importantly, the draft call for the Dawn Focused Research and Analysis Program has some significant shortcomings. I am writing as a current "Dawn at Vesta" Participating Scientist (DAPS). I have worked primarily with data from the Gamma Ray and Neutron Detector (GRaND) on Dawn and I have found the DAPS program to be excellent. It has allowed new scientists not originally involved with the Dawn program to become part of the Dawn team and play a significant role in both the operation and early analysis of Dawn data. I can speak from first hand experience that the DAPS enabled the scientific return from the Vesta mission to be fully realized in a way that was not possible without the DAPS-funded scientists.

Unfortunately, the new Dawn Focused Research and Analysis Program explicitly precludes the type of full science operation and analysis proposals at Ceres that were so successful for Vesta. The reason is that the new program requires proposed data analysis to only include data that have been in the Planetary Data System for 30 days. This requirement has the effect (especially for Dawn GRaND data) to provide no funded opportunity for participating in the operation and early analysis in a manner that can provide the best science return from the data. I find it a shame that NASA has decided it does not want to follow the recipe for another successful program for the Dawn at Ceres program. If there is any way you can pass this message along as part of your overall senior review, I would be greatly appreciative.

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One item of comment/concern for the new R&A program regards the new Dawn mission research line (I forget the exact name). In contrast to the prior participating scientist program, the new program explicitly excludes the possibility of working with Dawn data for the Ceres mission while the mission is in progress. I find this troubling as the prior Dawn participating scientist program was hugely productive, and especially so because it provided for new scientists to work directly with Dawn mission folks to improve the science from the Vesta; this is now not possible with the Dawn at Ceres mission.

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We have learned a lot about Ceres since the Dawn proposal was submitted and since the launch of the mission. We know that it might have subsurface water reservoirs today. Evidence that liquid water may be erupting on the surface of Ceres today has been discovered by Herschel. This may put demands on the mission to use some its margin to make unplanned observations of unexpected phenomena on Ceres that could have huge impact on astrobiology and future mission plans for PSD. Since the announcement of this discovery is January 22, scientists would have the opportunity to propose to a participating scientist call informed by this information and bring expertise to the Dawn science team that it does not otherwise have that would be of inestimable value.

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In my opinion the losers in this situation will be the US scientists who are shut out of the

discovery phase of the mission. The schedule for data deliveries to the PDS is within 2 months of collection for Level-1a, and within six months of the end of the encounter for Level-1B (mainly due to the fact that the same people are doing operations and data analysis). It is expected that data deliveries will proceed more smoothly than for Vesta data now that formats, labels and calibrations are worked out with SBN. However, it likely means delay of 6-12 months from the time of collection until the data are certified by PDS, and then there will be the delay of the proposal cycle, so it will be more like 1-2 years post-collection before the funded investigators begin work with the data.

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I've done a quick read of the draft for the Dawn Focused Research and Analysis Program, and it seems rather unclear that it is supportive of proposals to conduct data analysis for the Dawn at Ceres encounter as a Visiting (not Participating) Scientist would do. You may get many emails about this, so I hope you can read through the text yourself. Jim Green told me in front of the OPAG audience on Monday that the intention was that DFRAP would do both Vesta data analysis and Ceres analysis during the encounter. So I'm hoping this is just an oversight.

For example, the text reads: Scientific investigations proposed to the DFRAP must enhance the science return from the Dawn mission or demonstrably perform research that will facilitate the planning of Ceres observations and/or the analyses of data from that phase of the mission. Or more clearly: Scientific investigations must demonstrably perform research that will facilitate the analyses of data from that [the Ceres] phase of the mission. This does not say anything about Ceres data analysis itself. Later: The DFRAP will only support data analysis investigations that use data from the Dawn mission available in the Planetary Data System (PDS) (<http://pds.nasa.gov/>). The data must be archived and publicly available 30 days prior to the submission deadline for DFRAP proposals. This clearly excludes any Ceres data analysis like a visiting scientist should have.

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So despite promises that the DFRAP will accommodate Ceres-PS-type proposals, the language makes it clear that this is not the case. The lack of the ability to propose to be a Ceres-PS is highly unfortunate, and I feel a bit deceived based on prior statements made at AG meetings, which suggested this call would allow Ceres-PS-type proposals.

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<NAME> is an associate member of the DAWN team from the Italian side, but he gets no money. According to this wording, however, he is not allowed to apply for research funds for DAWN because of the wording "regardless of the level of support from the project." This is overly restrictive and should be changed.

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As I mentioned after the SBAG meeting, I find this program very puzzling. On what basis was the Dawn at Vesta Participating Scientist Program judged a failure (as stated at SBAG)? I resonate with some of the critical comments made by SBAG members about the changed nature of this new Dawn solicitation. Some of the problems stand out in the draft language for this ROSES "DFRAP" solicitation. Below are my bulleted comments.

\* **Very important:** What are the actual dates for this program and what do they imply about investigations relevant to Ceres? The tables specify that the program duration is limited to three years, beginning about 6 months after the as-yet-undefined proposal due date. Let's consider

two proposal due dates: May 2014 and February 2015. The first means that research could begin November 2014, using archived data from April 2014 and before, and the research program would last until November 2017. For a February 2015 due date, research could begin August 2015 using data archived by January 2015 and continue until February 2018. As best I can understand, the prime mission at Ceres begins April 2015 and lasts for about one year (perhaps followed by an extended mission?). Therefore, there will be no Ceres data available to selectees despite the fact that Dawn will be investigating Ceres shortly after, or at the time, the selectees' 3-year research programs begin. The concept of doing a 3-year research project in "preparation for Ceres" while the spacecraft is already at Ceres yet Ceres data are not available to the researchers seems – let's be blunt -- stupid. What am I missing? What was the intent, anyway?

\* **Related** to the former point, is it expected that there will be a Ceres Participating Scientist program, or some other kind of program that involves research on Ceres data as it is coming down...or six months after it comes down?

\* **Primary questions** about the solicitation are (a) why is it for only 10 to 12 awards and (b) why is the expected award (~\$110K/yr for 3 years) smaller than the average planetary R&A award?

\* **The introduction ("Programmatic Overview") lists four topic areas**, but then the draft language discusses just three topic areas. Perhaps "higher-order data products" and "improved calibrations" are both folded into "Data Archiving". Do proposers have to specify which topic area they are proposing for and, if so, is it one of 4 or one of 3 topic areas? Can a single proposal be both Data Analysis \*and\* Preparation for Ceres?

\* **"Dawn team" members may not propose.** How is "Dawn team" defined? Does it include Vesta Participating Scientists?

\* **In Section 2.2 about Geologic Map Production**, there is discussion of mapping Ceres. But the timeline I've evaluated above makes that impossible.

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**Issue:** The language in some DAP programs are overly restrictive to modeling.

As an example, I find big differences in the language between the Cassini DAP programs and the new Dawn DFRAP programs in terms of how modeling and theoretical studies are treated. Consider: Cassini Data Analysis: "Investigations that incorporate theory, modeling, laboratory studies, correlative analyses; and/or other research that would greatly increase the use of, or significantly facilitate the interpretation of, data from the mission are also eligible for CDAP. Such proposals that don't directly analyze data but are intended to amplify its interpretation will be judged upon the perceived impact of the proposed work on the interpretation of Cassini data." DFRAP: "In support of any mission data analysis proposal to the DFRAP, but as a secondary emphasis and only as needed to interpret and analyze Dawn's archival data, the proposed research may include the use and application of theoretical research or numerical modeling, may use existing data from ground-based observations, or may use suborbital observations and/or laboratory measurements."

My view is that the Cassini DAP language is ideal in terms of allowing modeling work. Let the panel decide whether the work is relevant and whether it will have high impact. The DFRAP language, however, makes no sense to me, and I believe it is unnecessarily exclusive. For

example, suppose one wanted to analyze terrain on Vesta that had (i) lots of small craters, (ii) lava flows, (iii) off-world material, or (iv) evidence for escaping volatiles. In many of these cases, the DAWN science team has already extracted the cream that exists from the available images. Given the language above, how could one get a program funded to actually analyze and model the formation of these regions? The panel would bounce the data collection as "old hat", and by the definition above the modeling can only be secondary. As a second example, suppose one wanted to model the origin of the Rheasilvia basin, which dominates the surface of Vesta and much of its geology (e.g., giant faults along the surface, ejecta burial of features, etc.). How could one do any of this work with modeling as a "secondary emphasis"? What does this even mean?

**Requested Action.** If DFRAP does not turn into a participating scientist program, as requested by SBAG, I would like to see the AO language rewritten to be more similar to the language in the Cassini DAP in terms of how it treats modeling and theoretical studies. Specifically, I would like the option to have modeling be a main priority, rather than being a secondary objective, provided the modeling is specifically designed to explain DAWN data.

**Requested Action.** Since other NASA programs are being moved/modified to be a DAP (e.g., LASER), I would like the other NASA DAP programs follow the language of Cassini DAP, which is more open to modeling, rather than that of DFRAP, which restricts modeling.

As an example, consider PMDAP. Several years ago, PMDAP changed their AO language to seriously limit modeling work -- at present, it cannot be more than 10% of any funded program (!) I would argue this AO language has negatively impacted the science performed in the PMDAP program. I believe it should be rewritten to follow the guidelines of the Cassini DAP.

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This is a request/plea for allowing additional scientist participation for the upcoming arrival of Dawn at Ceres. The Dawn Participating Scientist program at Vesta was enormously successful and productive (this is easily documented and confirmed by any perusal of recent Vesta publications). Ceres is a completely different planetary body, most comparable to the active icy satellites (see *Nature* paper released 1.22.14) and merits strong focus from diverse expertise across the science community (terrestrial bodies, asteroids, icy satellites). Dawn Ceres arrival is now less than 16 months away and no preparation for additional science involvement during operations has yet been made. Here is a summary of timeline experience and recommendations.

#### Timeline for Dawn (Vesta) Participating Scientists:

- ROSES 2009:
  - C.21 Dawn at Vesta Participating Scientists
- NOI due: 11/13/2009
- Proposal due date: 1/15/2010
- Review panel evaluation: April 2010
  - 20-21 PS selected, 3 of whom are European.
  - This doubled the science workforce in preparation for Vesta
- PS announced to the team: August 3, 2010 telecon
- Telecon briefing for PS by PI/Deputy: September 1, 2010
- PS first Dawn Team meeting/interactions: November 2010
- Dawn arrival at Vesta: July, 2011
  - ~1 year of intense operations, data processing, and analysis
  - PS were an integral part of everything, analysis, discussion, press releases, and leading several initial and follow-on science manuscripts.
- Time from NOI to Vesta arrival: 20 months

#### Timeline for Dawn at Ceres:

- Comparable date needed for Ceres NOI: September, 2013 [*overdue*]
- See *Nature* science manuscript released 1/22/14: Ceres science may be comparable to that of major icy satellites (+/- ocean)
- Dawn arrival at Ceres: April 2015
  - ~1 year of intense operations, data processing, and analysis
  - Comparable level of scientist hands-on involvement with additional diverse talents are needed

Summary: In order to harvest the return from Dawn's activities at Ceres, the due date for DFRAP (C.20) proposals should be made ASAP and at least one of the following is needed:

- The DFRAP should be amended to accommodate Dawn Participating Scientists at Ceres.
- If there is no involvement of Participating Scientists during the Dawn Ceres activities, then the Dawn Science team funding will need to be increased to bring in comparable numbers of young scientists who can actively participate in data planning and analysis for Ceres.
- If the DFRAP is the only means by which new scientists can be involved with Ceres activities, then the last sentence of C.20-3 should be deleted so that selected DFRAP investigators who are able to collaborate with Dawn Team members can work closely together quickly to optimize the science return at Ceres.

To: Nancy Chabot, SBAG chair and Candy Hansen, OPAG chair  
From: Lucy McFadden, NASA/GSFC, Planetary Systems Laboratory.  
CC: Hap McSween (CAPTEM), Mark Sykes (PSI)  
Date: January 21, 2014

Thanks, Nancy, for sending out notice of the opportunity to review the draft ROSES AO's, as I didn't get a copy from Steve Mackwell.

I reviewed the draft Dawn Focused Research and Analysis Program AO and compared it with the Cassini Data Analysis and Participating Scientist program AO. Because of the significant icy component in Ceres, I am also sending this to Candy Hansen as OPAG chair.

I have the following comments and I appreciate your passing them on to the program manager with a copy to Jim Green. It has been suggested that a copy to the division director for documentation purposes is a good idea. Would you let me know if you are sending comments forward with the identity of the commenter? I'm just curious.

General Comment:

It is indeed unfortunate that there is no opportunity for participating scientists at Ceres as there was at Vesta. In my experience, the scientific return from the Dawn mission was enhanced tremendously by the participating scientists' program. I believe Chris Russell, Dawn's PI has publication statistics.

I think the community would like to know why there is no PS program. A lot is being left to speculation. The Dawn team and the small bodies community would appreciate some information so we don't resort to speculation. I hope you will ask for that from Jim Green.

1.1 Programmatic Overview-

There is no reference to documents related to the Dawn mission and its scientific objectives. This would be helpful if not necessary for any proposer and should be included in section 1.1. There is a Dawn at Ceres science plan as well as one for Vesta, both would be essential for any proposal.

1.2 Data Analysis Investigations

Missing from this AO is a statement saying that "Once the award is granted, succeeding years of work may address data that subsequently comes into the archive." There is such a statement in the Cassini DAP AO. I think it should be the case for Dawn too.

Additionally, missing from the AO is the availability of data from Ceres while that data is under preparation and review at PDS. It is not clear how a proposer could complete their work without access to Ceres data from Dawn.

I note that the Cassini DAP/PS program includes eligible data "in the public domain via

open literature publications and other freely available sources.” There is a stated caveat that using such data, if the calibration is not validated may result in a stated weakness of the proposal. Shouldn’t the same situation be applicable for DFRAP? The intent of Discovery missions is to open access to a broad scientific community and this AO seems restrictive of that intent. If not, why not?

1.4 The Dawn Vesta data have been geologically mapped by the Dawn science team and participating scientists at US and European institutions. While I can imagine other types of maps may be produced, shouldn’t a statement be included that the maps should be demonstrably different than those already produced resulting in new scientific results. Again, without access to Ceres data, only Vesta can be mapped and there are special issues containing geological and mineral and elemental maps already published. I am concerned that efforts not be duplicated in an environment of constrained resources.

It seems to me that there will be few proposers eligible for this AO and that some restrictions should be removed. In contrast to the Cassini DAP/PS, there are no statements of encouragement, rather a statement of exclusions. This approach seems punitive, not supportive.

One example of a supportive component of the Cassini DAP is the Early Career Fellowship program. I would suggest that this be included as it would broaden participation across the planetary community with a focus on bringing young scientists into planetary mission work.

Respectfully submitted,  
Lucy McFadden  
Dawn, Co-Investigator

January 21, 2014  
SBAG Steering Committee

## **Dawn at Ceres Participating Scientist Opportunity and an Analysis of the Draft DFRAP Solicitation**

SBAG strongly supports a Participating Scientist (PS) program for Dawn at Ceres, with scientists selected before the encounter, contributing to the mission prior to orbit insertion, and participating in the orbital mission at Ceres. A PS program brings in scientists outside the team to augment and broaden the expertise of the team and has proven integral to many NASA missions across the solar system. PS programs have enabled NASA to maximize the scientific return from their large investments in a cost effective manner by enabling scientists with the specific scientific expertise to participate in the active data collection phase of missions. The importance and contributions of PS programs to NASA's planetary science missions is recognized across the community and not debated.

In about April 2015, Dawn will become the first spacecraft to visit Ceres, a fascinating and mysterious rock-ice dwarf planet world with roughly one third the mass of the entire asteroid belt. Enabling participation from scientists with expertise related to Ceres is critical for NASA to maximize the science accomplished at Ceres and realize the full potential of their large investment in this mission. Without a PS program in the active mission at Ceres, the mission science will suffer to the detriment of NASA and the planetary science community.

Participating Scientists involved in the Dawn at Vesta phase of the mission made many key contributions, including providing expertise in volatile processes, cratering processes, geologic mapping, and photometry; running a ground-based observing program prior and during orbital operations; validating and calibrating data; heading key working groups; leading "first look" papers that appeared in Science and Nature, as well as many other early papers; speaking at press conferences; and convening the Dawn at Vesta workshop in February 2014. Dawn at Vesta PSs also played key roles in Education and Public Outreach activities.

**SBAG finds that the draft text for a "Dawn Focused Research and Analysis Program" has a fundamental issue that needs to be revised. The Program's core requirement that "Spacecraft data that have not been obtained (i.e., future mission data), or those that have not been placed in approved archives may not be proposed for use in DFRAP investigations" will not enable any new scientists to participate prior to and during the Dawn at Ceres encounter.** SBAG opposes the announcement text as presently written and suggests modifications that will allow scientists to participate in the active science mission at Ceres. Time is of the essence if the full potential of NASA's investment in the Dawn mission is to be retained.

Our assessment of the four main goals in the announcement with this constraining requirement is as follows:

***1. Analysis of data archived, to date, by the Dawn mission.***

The announcement states that data must be in the PDS 30 days prior to the due date of the proposal, with commencement of the work for selected proposals to start 6 months after the due date. With this requirement, no investigations will be funded to analyze Ceres data from the main mapping mission during the encounter. There would be no participation of new scientists during the Ceres encounter. The only additional U.S. scientists allowed to participate would be those with existing attachments to the team as Dawn Associates, funded by team members or the mission; since continuation of non-US participating scientists is not impacted, the effect would be to diminish the relative participation of US scientists in this mission.

***2. Production of higher data products***

With selected scientists prohibited from accessing data from the Ceres encounter in “real time”, the Ceres data would not have the advantage of being processed and analyzed with the techniques developed as part of this production, to the detriment of the overall Dawn mission.

***3. Improved calibrations of existing data products.***

If there is an improved calibration, it should be applied to all data products from the Dawn at Vesta and the Dawn at Ceres mission phases. Indeed, the inspection of data from another target and over a longer excursion in time would be key factors in producing a better calibration.

***4. Research in preparation for Dawn’s upcoming rendezvous with Ceres***

One of the hallmarks of the scientific method is that theories need to be tested with data, and that theories are modified as data is gathered. By having an investigator produce a model that needs to “contain a detailed and articulate description of how the proposed research will aid in observation planning or data analysis for the Ceres phase”, but not have that scientist be able to test and model his or her theory as new data is gathered, flies in the face of the scientific method and does not serve the best interests of the Dawn mission of planetary community. Furthermore, selected researchers cannot effectively communicate their findings to the Dawn team if they are not part of the team.

Parts of this section (1.3) were also poorly defined. What “field-based research” would be appropriate for this mission, and what are “earth-based analogues of Ceres”? Correlative data analysis, e.g. combining ground-based, Hubble Space Telescope, or similar observations to Dawn data is missing from the announcement.

## Emerging Worlds

Consolidated comments sent to Nancy Chabot, SBAG chair, by community members. The order of the comments does not indicate any relative priority.

**Consolidated:** January 24, 2014

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Comets? I've read all of these and am listening now and have no clue which program my research on the origin and evolution of comets should go? Split it in two? Evolution on comets are on-going processes, we've got cryovolcanism to look at so does that make in SSW? But of course we are also looking for evidence of formation.

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Another issue with the draft ROSES text: I had asked at the SBAG meeting about restrictions on specific investigation techniques (such as ground-based observing) that I believe have discouraged interdisciplinary science in the past, especially harmful to small bodies science (where multiple data points require multiple objects, and you can only get data from a large sample of objects with remote techniques). Jim and Jonathan had responded encouragingly to my question, but I'm sorry to see those restrictions persist in the draft text for ROSES 2014. The Solar System Workings and Emerging Worlds drafts specifically exclude ground-based observing components. This impairs interdisciplinary investigations in those scientific areas.

For example, let's say someone wants to do a project that scientifically fits under Solar System Workings, but would benefit from including a small observational component. That's forbidden by the draft language, so they would have to propose to Solar System Observations instead (or strip out the observing component, to the detriment of the science). Since the observations were just a small part of the overall project, it won't be well-received in a Solar System Observations panel that's evaluating only observational projects, with panelists who are primarily observers. They could be reluctant to spend funds that are allowed to fund observing on a mostly non-observing project if there's a perception that funds permitted for that use are in limited supply, relative to other funds.

I have not seen any compelling case for these kinds of technique-based restrictions yet. If the programs elements are really meant to be organized around scientific goals, then such restrictions make no sense to me at all. Let investigators propose any technique that advances the scientific goal, and let the panels pick whatever mix of techniques will work best.

If there must be technique-based restrictions, language like this might be a reasonable compromise: "This program element is not intended to support investigations that are primarily observational in nature, although small observational contributions in the context of a broader interdisciplinary investigation are permitted. Proposals that are primarily observational should be submitted to Solar System Observations."

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**Issue:** The language for portions of SSW appears to be confused. For example: "System should be submitted to the Emerging Worlds program element (see Appendix C.2). The scope for Emerging Worlds includes the processes occurring before accretion, during accretion

and, for those bodies that move beyond just accretion, global planetary differentiation, including those processes of separating the body into compositionally distinct layers, such as a core, mantle, crust, and primitive oceans and atmospheres. Investigations into large planetary system events, such as the Late Heavy Bombardment, that affect this differentiation process belong in the Emerging Worlds program. Investigations into processes that occur after global planetary differentiation (such as mantle crystallization or atmospheric escape) and on regional scales (such as volcanism or later cratering events) should be submitted to Solar System Workings. "

I think I now understand what NASA is trying to accomplish here – they would like to place issues like the Nice model and the Late Heavy Bombardment on one side of a fence, and other dynamical issues on the other side of the fence. The problem is that the boundary is \*very\* fuzzy, and some issues are so interdisciplinary they could go either way. For example, if I wanted to develop a chronology for Mars's crater history over the last 4 Gy, which includes many implications from the "Nice Model", where should it go? I would say SSW. I believe such a task would never be funded in EW. On the other hand, numerical studies of planetary rearrangement should probably be in EW. This is hard, and I want to avoid an overly legalistic definition of this issue -- this will cause trouble down the road. However, I am also concerned that a high fence between SSW and EW on this issue will effectively kill many of the interdisciplinary programs NASA says it is trying to promote.

**Requested Action:** I would like some procedure put in place so proposers can determine whether their tasks are more relevant to SSW or EW prior to writing a full proposal. In this fashion, the proposer can write to the goals of the program without having to worry about getting beat up by the panel (or the program manager) on relevance.

**Requested Action:** The Late Heavy Bombardment term above should be defined. It can mean different things to different people (i.e., is the LHB all early bombardment, or just the just the basins forming near 3.9 Ga)?

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Suggestions (nit piks and clarifying text):

#### 1. Scope of Program

1<sup>st</sup> paragraph, 4<sup>th</sup> line down: read "...including dust, and relevant to the early history of these bodies."

2<sup>nd</sup> paragraph, 1<sup>st</sup> line: read "...are defined as those that may result..."

4<sup>th</sup> paragraph, 3<sup>rd</sup> bullet point: read "...to understand the formation and the early evolution..."

#### 4. Summary of Key Information

This AO calls for a two-step proposal submittal process but the table only calls for a NOI date and the proposal due date. We don't need the NOI date but we do need the due dates for the 1<sup>st</sup> and 2<sup>nd</sup> proposals.

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1) When I read the Emerging Worlds solicitation, I found some conflicting sentences on the topic of observational studies. The sentences in questions are copied here:

Paragraph 1: “A wide range of investigations will be covered, including theoretical studies, analytical and numerical modeling, sample-based studies of extraterrestrial materials, laboratory studies, data synthesis, **and observational studies relevant to the formation of planetary systems.**”

Paragraph 4: “Investigations may involve, but are not limited to, studies in the following areas: **star formation as it relates to planetary system formation**, protoplanetary disk formation, . . . .”

**“Observations: This program element is not intended to support the acquisition of new ground- or space-based observations nor support ground-based observing facilities. Such proposals should be submitted to the Solar System Observations program (see Appendix C.6) if they are for observations within this Solar System. However, proposals that include analysis of existing ground observations of Solar System objects are encouraged to apply to this program.”**

End of page C.2-2: “. . . **Note, for interdisciplinary proposals involving observational studies of planetary systems outside our Solar System, tasks for those observations must only be a minor component of the proposed work; otherwise, such proposals should be submitted to Exoplanets (Appendix E.3).**”

Depending on how the program managers interpret these sentences, Emerging Worlds may support proposals to make observations with various telescope assets or not. Personally, I think it is a bad idea to solicit observational proposal in this program element. The observing community is much larger than the sample community and the group of folks who do theoretical modeling of the early solar system. The observers have their own funding streams and most people from the old Cosmochemistry program do not have access to them. Allowing observing proposals into this program dilutes the money for the “core” components of Emerging Worlds. The people who wrote this document apparently agree with this to some extent, because some of the words attempt to discourage wholesale observing proposals. Currently the document gives mixed signals. It would appear to be possible to permit interdisciplinary proposals involving observational work if that component of the project is to be funded from the historical observations funding stream. Is there any way to write the document with that in mind? At the very least, the document should be clear on the extent to which observing research is going to be allowed (hopefully none paid from this program).

2) There also appear to be some mixed signals with regards to studies of the origin of life.

Paragraph 2: **“The Emerging Worlds program also solicits research seeking to delineate the galactic and planetary conditions conducive to the origin of life.”**

Paragraph 4: “Investigations may involve, but are not limited to, studies in the following areas: . . . . **models of early environments in which organic chemical synthesis could occur.**”

Astrobiology is already set up to fund research into the origin of life, including the conditions

necessary for life and for chemical synthesis to occur. I realize that the search for life is the main driving idea for most of NASA science currently, but do we really need to have it bleed into every research program? This will mean less money for traditional “cosmochemistry” research

3) The bigger issue: It seems clear that going forward, we should expect fewer proposals to do cosmochemistry to be funded and the amount of money in each grant is likely to be smaller, on average. For those of us who are trying to run a major laboratory, this is a very bad trend. My ion probe lab has the “luxury” of being able to provide analyses for many users. We were told by NASA that we must run our laboratory on a fee-for-service basis. This turns out to be good, because I do not have to generate money from my research grants alone to keep the lab running. Fortunately, as well, is the fact that we now generate a significant fraction of our support from researchers in Europe and Japan. So in many ways my lab is insulated from all this. (But it does look like I will have to downsize my personal research program.)

However, there really is a fundamental problem. People who run TIMS and ICPMS labs cannot operate the way I do with the ion probe. They need to pay for at least one person to keep the lab running and keep one or two experienced people with the appropriate sample preparation skills to prepare samples for analysis. The instruments themselves also have significant operational costs. If those who operate these laboratories cannot generate enough money to support the lab from Emerging Worlds, they will have to go elsewhere or close down and this capability will gradually be lost to NASA. Once lost, it will be very hard to replace. We are already well down this road. Europe, Japan, and now China, have analytical capabilities similar to ours and are investing in research at higher levels than we are. This will come back and bite us sooner rather than later.

It seems that the upper level NASA folks either don't know or have forgotten why the NASA sample analysis program exists. This program was created to develop techniques to measure lunar samples. The demands of this work led to major advancements in mass spectrometry, electron beam instrumentation, and other technologies. NASA-funded research has driven the technical advancements in these fields for 30 years. The resulting advancements have diffused into terrestrial geochemistry. The science that has been done has served as the main driver to NASA mission design since Apollo. Without the Cosmochemistry program, many missions would not have been developed. Remember when some cosmochemists from JSC reported finding evidence of life in ALHA84001? This gave rise to the Astrobiology program and has been a driver of the Mars program ever since. There are many other examples.

In recent years, new developments have come as often from Japan and Europe as from the US. This trend is accelerating. I remember visiting Japan at their invitation in 1996 for a symposium on cosmochemistry. During that visit I saw several new state-of-the-art labs at the University of Tokyo. My thought at that time was that within 10 years of that time, Japan would move from a minor player in cosmochemistry and space science to a major player and leader in the field. This has come to pass. Now China is in about the same place that Japan was in the 1990's. In spite of Congress's attempts to frustrate Chinese science, the Chinese will be major players in another decade. The question is whether US science will still be relevant.

If the powers that be realize this and it an intended consequence of what they are doing, then so be it. However, if it is an “unintended” consequence, then this current express train must be redirected in some way.

According to the proposed draft of ROSES, cosmochemists will now have to compete for funds with several much larger and rapidly expanding groups of scientists: astronomers and astrophysicists who study the formation of stars, protostars, and disks, and biologists who study the origin of life. The cosmochemistry program will suffer greatly unless these topics are deemphasized in Emerging Worlds. Changes are needed if NASA is serious about funding scientists who work on extraterrestrial materials so that they can continue to participate in the development and planning of future missions to asteroids and comets.

Specific changes that are needed:

1. Paragraph 1: “A wide range of investigations will be covered, including ... observational studies relevant to the formation of planetary systems.”

“Observational studies relevant to the formation of planetary systems” should be deleted as page 2 of the draft says that new observations of solar system objects will not be supported by the Emerging Worlds program. Observations of protoplanetary disks and protostars should be supported by the NASA Astrophysics Division.

2. Scope of program: sentence 3 states: “The Emerging Worlds program also solicits research seeking to delineate the galactic and planetary conditions conducive to the origin of life.”

This sentence should be removed. It is clearly inappropriate for Emerging Worlds as is the stated goal of NASA's Exobiology program to “understand the origin, evolution, distribution, and future of life in the Universe.” Indeed, the Exobiology Program draft Page C5-c specifically states that Exobiology supports “research on the forms in which prebiotic organic matter has been preserved in planetary materials, *and the range of planetary environments amenable to life.*” Research on galactic conditions conducive to the origin of life is clearly outside the scope of NASA’s Planetary Science Division.

3. Scope of program, paragraph 3 lists seven areas of research that will be supported. The first and most prominent of these is “star formation as it relates to planetary system formation”. This is clearly more appropriate for the Astrophysics program.

4. Scope of program, paragraph 3 states that “Investigations may involve but are not limited to, studies in the following areas: ...models of early environments in which organic chemical synthesis could occur.’ This should be deleted as the Exobiology Program draft C5 page 1 specifically supports research on “models of early environments in which organic chemical synthesis could occur.”

5. Page C2-1, Types of studies supported”. If NASA wants to maintain a vigorous program of cosmochemical research they should list it more prominently under “Types of studies that may be supported.” In the draft, research on extraterrestrial materials is listed in 6<sup>th</sup> and final position.

Typo:

C2-2, 5 lines from bottom:

Change, “scientific question” to “scientific questions”.

6. Line 2. “Research in the area of “Emerging Worlds” aims to understand the formation and early evolution of the Solar System, as well as planetary systems in general.” The phrase “as well

as planetary systems in general” should be deleted or modified as research on the origin and evolution of exoplanets clearly belongs in the Exoplanets program. Page E3-2 of the draft for Exoplanets states that it supports investigations to develop the theory of exoplanetary systems. It states specifically that studies that relate directly to our Solar System belong in “Emerging Worlds.”

Some of these topics seem to have been inserted into Emerging Worlds because other program managers didn't want to review them, e.g., organic molecules in space. Others seem to have been inserted because they are trendy and high profile, e.g., "planetary systems in general". Either way, they should be excluded.

Page C2-1: "formation of organic molecules in space". This needs revision or elimination as formation of organic molecules in the interstellar medium and in circumstellar envelopes is totally outside the scope of the planetary science division.

## Solar System Workings

Consolidated comments sent to Nancy Chabot, SBAG chair, by community members. The order of the comments does not indicate any relative priority.

**Consolidated:** January 24, 2014

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One thing of concern to me regarding the SSW Program is it never explicitly mentions Small Bodies (comets nor asteroids were never mentioned explicitly) though one can argue they may fall under "other minor bodies". None of the various examples cited also never mention Small Bodies. So, I wonder whether there is any de-emphasis on Small Bodies in the proposed SSW Program. In other words, is there a shift in the science priorities in the new SSW Program?

One way to alleviate these concerns is to determine how many grants and funds were allocated say during the last three years to Small Bodies under the relevant Programs that new SSW Program claims to cover and whether that funding level is preserved within the statistical noise. I think this should be done for not only Small Bodies but for all sub-disciplines.

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Comets? I've read all of these and am listening now and have no clue which program my research on the origin and evolution of comets should go? Split it in two? Evolution on comets are on-going processes, we've got cryovolcanism to look at so does that make in SSW? But of course we are also looking for evidence of formation.

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Another issue with the draft ROSES text: I had asked at the SBAG meeting about restrictions on specific investigation techniques (such as ground-based observing) that I believe have discouraged interdisciplinary science in the past, especially harmful to small bodies science (where multiple data points require multiple objects, and you can only get data from a large sample of objects with remote techniques). Jim and Jonathan had responded encouragingly to my question, but I'm sorry to see those restrictions persist in the draft text for ROSES 2014. The Solar System Workings and Emerging Worlds drafts specifically exclude ground-based observing components. This impairs interdisciplinary investigations in those scientific areas.

For example, let's say someone wants to do a project that scientifically fits under Solar System Workings, but would benefit from including a small observational component. That's forbidden by the draft language, so they would have to propose to Solar System Observations instead (or strip out the observing component, to the detriment of the science). Since the observations were just a small part of the overall project, it won't be well-received in a Solar System Observations panel that's evaluating only observational projects, with panelists who are primarily observers. They could be reluctant to spend funds that are allowed to fund observing on a mostly non-observing project if there's a perception that funds permitted for that use are in limited supply, relative to other funds.

I have not seen any compelling case for these kinds of technique-based restrictions yet. If the programs elements are really meant to be organized around scientific goals, then such restrictions make no sense to me at all. Let investigators propose any technique that advances the scientific

goal, and let the panels pick whatever mix of techniques will work best.

If there must be technique-based restrictions, language like this might be a reasonable compromise: "This program element is not intended to support investigations that are primarily observational in nature, although small observational contributions in the context of a broader interdisciplinary investigation are permitted. Proposals that are primarily observational should be submitted to Solar System Observations."

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**Issue:** The language of the "Solar System Workings" draft AO does not make any dynamical studies explicit except for planetary rings. This is strange, given that PG&G typically has a dynamics sub-panel with 20+ proposals every year. Those working on the dynamical evolution of planets, planetary satellites like the Moon (e.g., tidal evolution), asteroids, comets, Kuiper belt objects, Phobos and Deimos, meteorites, etc. should be treated the same in SSW as they were in PG&G. In other words, they should be allowed to continue to do the same kind of work in SSW.

**Requested Action:** I would like to see dynamical studies made explicit in the AO call for SSW. What I see there now is dangerous to non-ring dynamical studies.

**Issue:** The language for portions of SSW appears to be confused. For example: "System should be submitted to the Emerging Worlds program element (see Appendix C.2). The scope for Emerging Worlds includes the processes occurring before accretion, during accretion and, for those bodies that move beyond just accretion, global planetary differentiation, including those processes of separating the body into compositionally distinct layers, such as a core, mantle, crust, and primitive oceans and atmospheres. Investigations into large planetary system events, such as the Late Heavy Bombardment, that affect this differentiation process belong in the Emerging Worlds program. Investigations into processes that occur after global planetary differentiation (such as mantle crystallization or atmospheric escape) and on regional scales (such as volcanism or later cratering events) should be submitted to Solar System Workings. "

I think I now understand what NASA is trying to accomplish here – they would like to place issues like the Nice model and the Late Heavy Bombardment on one side of a fence, and other dynamical issues on the other side of the fence. The problem is that the boundary is *\*very\** fuzzy, and some issues are so interdisciplinary they could go either way. For example, if I wanted to develop a chronology for Mars's crater history over the last 4 Gy, which includes many implications from the "Nice Model", where should it go? I would say SSW. I believe such a task would never be funded in EW. On the other hand, numerical studies of planetary rearrangement should probably be in EW. This is hard, and I want to avoid an overly legalistic definition of this issue -- this will cause trouble down the road. However, I am also concerned that a high fence between SSW and EW on this issue will effectively kill many of the interdisciplinary programs NASA says it is trying to promote.

**Requested Action:** I would like some procedure put in place so proposers can determine whether their tasks are more relevant to SSW or EW prior to writing a full proposal. In this fashion, the proposer can write to the goals of the program without having to worry about getting beat up by the panel (or the program manager) on relevance.

**Requested Action:** The Late Heavy Bombardment term above should be defined. It can mean different things to different people (i.e., is the LHB all early bombardment, or just the just the basins forming near 3.9 Ga)?

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In the SSW wording:

“NASA Ames Vertical Gun Range (AVGR). The NASA AVGR is a national facility funded by the NASA Science Mission Directorate (SMD) to enable investigations of impact phenomena and processes. Exploratory or proof-of-concept programs requiring a limited number of experiments can be accommodated at no cost. More extensive programs are subject to review in order to assess feasibility and cost effectiveness. For more information, potential users of the AVGR should contact John Karcz at [john.s.karcz@nasa.gov](mailto:john.s.karcz@nasa.gov).”

My current concerns:

- 1) **Funding and access:** There seems to be little to no information out there as to how the AVGR will be funded and at what level. In the past, PGG users were permitted to use the gun ‘for free’ as a part of their grants, since the facility was already funded by PGG. This ability was really enabling – a week at the AVGR is extremely expensive. The SSW wording above makes it seem only exploratory or proof-of-concept programs with limited impacts would be ‘free’ – can you imagine a grant being actually funded where the proposers weren’t sure something would work? In the current funding climate, such a proposal would receive a major weaknesses for uncertain experimental outcomes. Otherwise, “more extensive programs are subject to review in order to assess feasibility and cost effectiveness”. What does this even mean? Is this review pre-proposal? Part of the proposal? Who is doing the review? What does ‘extensive’ mean? There really is not enough information out there about how this facility will be funded and accessible to the community for use.
  - 2) **Management:** Although admittedly I do not know John Karcz’s background and experience, he is not an impact scientist, nor has he been a user of the AVGR. It seems appropriate to have one or more (e.g., a small committee) of scientists familiar with the use of the AVGR and the challenges, quirks, and design of experiments to help new users and make recommendations for upgrades of instrumentation and capabilities there. Also, why is the person in charge of the AVGR in a different division of Ames than the AVGR itself? This sounds like someone in heliophysics being in charge of the planetary ROSES funding.
  - 3) **Data release (not in the ROSES language):** I have heard rumors suggesting that there are movements to make data collected at the AVGR become publically available 6 months after collection. Although I fully believe data should be made public, 6 months is completely unrealistic for this situation. The majority of users of the AVGR do not reside at Ames – they are traveling in from afar to spend a week or two collecting data, then they travel back to their home institutions where they will analyze the data. Even under a circumstance where they have no other responsibilities (which obviously is an unrealistic scenario), turning around the data analysis and publication in 6 months is impossible. Not to mention the fact that a paper’s worth of impact experiments often cannot be performed in only a week or two. Analysis often yields changes or improvements or curious new phenomena to examine in future runs. If the data are to become public, a longer time frame would be appropriate. Also, if the run is paid for not by the AVGR funds itself, I don’t see how they should have ownership of the data at all.
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Beyond the general anxiety about funding gaps and oversubscription to SSW that I'm sure have

been expressed either recently, or are pretty well known throughout the community, I did want to bring up some concern about the facilities currently funded by PG&G, specifically the Ames Vertical Gun Range. The language in the SSW draft is sufficiently vague that I am concerned about the future viability/use of the facility.

Currently, the PG&G program pays for a certain amount of experimenter time at the Gun each year, and potential experimenters apply for use of the time. If funded on a PG&G grant, the time is then free; if funded on a different program, money is included in the grant for gun time (which is not all that cheap, really). The good thing about this is 1) guaranteed experimenter time for those funded, and 2) assured money for the facility. The new call language implies more of a "pay as you go" approach, which is concerning to me. The gun crew are contractors, and so if enough users do not show up in a given year (because, say, the time isn't free and the proposals get knocked a bit for adding an additional \$60k/yr for experiments), the gun might not be able to stay open. The contractors have to be paid or the facility closes, right? I think the language needs to be clarified to determine whether or not the SSW program will pick up where the PG&G left off or if something different is going to happen.

Furthermore, the language in the call includes: "More extensive programs are subject to review in order to assess feasibility and cost effectiveness.", but this is very unclear; how will programs be reviewed? And who will be doing that reviewing? Is that the proposal review? Will the new administration team for the AVGR (now that Pete is no longer doing it) be responsible for that? How will experimental plans be deemed "feasible" or "cost effective"?

## Solar System Observations

Consolidated comments sent to Nancy Chabot, SBAG chair, by community members. The order of the comments does not indicate any relative priority.

**Consolidated:** January 24, 2014

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**Issue.** The NEO Observation program has traditionally folded together characterization of NEOs with "population studies". The interpretation is that this language leaves some room for modeling the NEO population, provided the results are consistent with the major goals of the program. In the new AO, it does not explicitly include this language, though the idea may still be there. I cannot tell.

**Requested change.** I would like NEOO language consistent with the previous AOs in allowing one to do some modeling of the NEO population.

**Issue.** The NEO Observation program has the following language:  
"In addition to this goal, the Human Exploration and Operations Mission Directorate has expressed an interest for the NEOO Program to search for a Human Spaceflight accessible Near Earth Asteroid (NEA) target destination, regardless of its size. Therefore, investigations that provide capability to detect the smaller NEAs that are in low delta velocity orbits relative to Earth will receive additional consideration"

The language "provide capability to detect" is really vague. Does this language allow population modeling of diameter  $D < 100$  m objects in order to better understand and assess the human accessible small body population?

**Requested change.** I would like the language modified to allow population modeling of human assessable targets (e.g., their orbital distribution, their size distribution, their composition -- are they all lunar ejecta, or are they typical NEAs, etc.).

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I would like further guidance on what section of ROSES will accept proposals for, and fund, investigations into NEO impact effects, impact effects modeling, and development of impact assessment tools to aid policy makers in response to a future, credible NEO threat.

Lindley's SBAG presentation:

[http://www.lpi.usra.edu/sbag/meetings/jan2014/presentations/08\\_1330\\_Johnson\\_NASA\\_Planetary\\_Defense\\_Update\\_SBAG.pdf](http://www.lpi.usra.edu/sbag/meetings/jan2014/presentations/08_1330_Johnson_NASA_Planetary_Defense_Update_SBAG.pdf)

Which of his efforts described by Lindley on p. 26 will be funded by the ROSES AO specifically? There should be some room in a \$40M budget to support analytical and risk modeling for impacts, even as observational support increases.

Could we not have the draft ROSES AO "map" these research areas on p. 26 into the correct and appropriate funding areas in the AO?

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In particular, I am concerned about apparent mismatches between Lindley's 39-slide presentation to SBAG early last week (available on the LPI SBAG website by clicking on his name in the agenda), which presented a rather broad picture for how NASA will address the NEO hazard (among other goals), and the draft AO, which seems extremely narrow in scope. Given that the budget of NEOO has gone up by a factor of ten from its budget of a few years ago, to \$40 million, I think we (e.g. SBAG and the NEO/Small Bodies community) need to know where the money is going. If it is going to NEOO, then the wording of the program's scope needs to be expanded. If the funds are going elsewhere, those cases ought to be explained...and defended. I offer numerous bullet points below, some addressing broader issues, then some narrower errors/questions/etc.

Broad issues:

\* I understand that the increased funding of NEOO a few years ago from ~\$4 million per year to ~\$20 million was in response to a Congressional directive. Concerning the increase to ~\$40.5 million in the FY14 budget, apparently signed into law last Friday: is this also a Congressional mandate or is it a Presidential request? And is the language available that specifies the purpose of the enhancement?

\* Lindley stated at SBAG that some of the enhanced NEOO budget would now support IRTF operations and ANSMET (the search for Antarctic meteorites, which -- he said -- used to be supported by NSF). I think it was also said that \$2 million would support Arecibo, which I think has been the case since the budget increased to \$20 million. How much NEOO support is going to IRTF, ANSMET, Arecibo, ATLAS, Pan-STARRS-2, reactivated NEOWISE, and other specific programs? Or are some of the NEO programs he discussed (e.g. some of those above and perhaps ARM, NEOCam, NASA's role in Sentinel, NEO-Star, NEST, NASA's role in COPUOS and interagency activities, AIDA, etc.) wholly supported by other NASA programs or funds?

\* Is it Congressional (or Administration) intent that NEOO funds be used to support IRTF, a telescope primarily used for non-NEO observations? Same question for meteorite searches: the ANSMET website says that the Case Western program is supported by competitive grants from NASA, but has it always been (or ever been) from NEOO? (Indeed, it isn't mentioned in the SSO draft.)

\* Because the rationale for the Solar System Observation program provided at the "town hall" (and I think at SBAG) referred only to hazards and resources, there has been concern in our office and beyond that the balance of even the PAST element of SSO might be tilting toward NEOs. Indeed the descriptions in the introductory paragraph of this draft AO and in Sect. 1.1 ("Planetary Astronomy") never mention which bodies in the Solar System can be addressed in SSO and people interested in outer planet atmospheres, for instance, are concerned. Rather than listing all the planets, moons, asteroids, comets, etc., maybe there should be words about "all bodies in the Solar System excluding the Sun." Maybe there is also a question of whether NEOs can be observed with PAST funds or solely through NEOO funding.

\* Indeed, it is unclear how cleanly PAST and the Congressionally mandated NEOO programs are separated in budgetary accounting. One presumes from this draft AO that proposals are not submitted separately to PAST or NEOO, as was previously the case, but simply to SSO. Do proposers specify which part of SSO they are applying to, or is this decision made by the review panel or Program Official? Can a single proposal be partly supported by PAST and partly by NEOO?

Narrower questions about the draft NEOO section of ROSES:

\* There is a serious and confusing typo. Perhaps the Suborbital Program should be numbered 1.3, not the duplicatory 1.2. Or does the typo reflect some intention to call this program 1.2.3? If the latter, then it should be questioned, because the scope does not appear to restrict observations to NEOs. Note also that the introduction to "Scope of the Program" (Sect. 1) refers to the program as having just two elements (PAST and NEOO), not including the third element of Suborbital Flight Investigations. Or is the intent a subterfuge to use Congressionally mandated NEO funding to support suborbital observations of, say, outer planet atmospheres?

\* The NEO survey and characterization scope says that it addresses NEOs "with sizes down to ~100 meters." Why is that? Is it meant to exclude "tens of meters"? The official NASA \*goal\* is to survey NEOs, to 90% completeness, >140 meters. Of course, most NEOs found by surveys attempting to meet the 140 m goal will be much smaller than 140 m...indeed most will be smaller than 100 meters. Given Chelyabinsk, it is clear that potentially hazardous NEOs extend down at least to 20 meters diameter. While it is not feasible to do a census down to that size, certainly we are interested in finding and characterizing representative NEOs down to that size, at least. And ATLAS is addressing NEOs primarily <100 m diameter. So why the limitation to "~100 meters"?

\* Later in the paragraph, there is an exception made to the size limitation. It says that there is HEOMD interest in finding target NEOs "regardless of size". Is this in support of the long-stated goals of sending astronauts to a low-delta-v NEO or does it also include searching for potential candidates for ARM? If the latter, is HEOMD providing funding or does it come out of Planetary/SMD?

\* Section 1.2.2 concerns "Impactor Characterization and Mitigation Studies." Despite an annual NEOO budget of \$40 million, this section suggests that only 1% of NEOO funds will support this, perhaps three proposals. Why the limitation? Why not let proposal pressure dictate the funding level? Because of the NEO size distribution, nearly all expected "mitigation" measures will involve short-term warnings based on observations by facilities like ATLAS leading to steps like evacuation and warnings to stay away from windows, rather than spacecraft missions to deflect or destroy NEOs. Yet the wording of Sect. 1.2.2 seems to limit "mitigation" just to the tiny fraction of cases warranting mitigation by spacecraft missions. Why? I think that non-telescopic studies of NEOs in the hazard context deserve a larger share of the pie. This wasn't practically feasible when the program was just \$4 million a year, but a balanced approach now (as reflected in the

topics discussed at PDC meetings) should provide ample funding for these broader topics, as reflected in Lindley Johnson's Jan. 2014 SBAG presentation.

\* Since a stated goal of the reorganized R&A programs is to minimize gaps between programs, it is a concern that the narrowly-written draft may exclude studies pertinent to aspects of the NEO hazard. If there are other funding programs (e.g. "Innovative Advanced Concepts") that fill these gaps, they should be cross-referenced here, just as APRA is mentioned in the Suborbital context.

\* Another question about Sect. 1.2.2 "Impactor Characterization..." is what is meant by "Characterization"? What is normally meant by that word is supposedly supported by Sect. 1.2.1, although the words "sizes, shapes, and compositions" (and an earlier mention of astrometry) hardly represent the full range of characterization obtainable from radar. Perhaps other words should be substituted for a very narrowly-defined 1.2.2, like "Theoretical or Laboratory Studies Pertinent to NEO Break-up or Deflection."

\* Lindley's SBAG presentation (slide 26) refers to "mitigation effects grants" in the NEOO program. Is that Sect. 1.2.2? If so, what are "effects"?

\* Sect. 2.2 discusses Goldstone but not Arecibo. Are Arecibo observations supported by a different program? If so, there should be a cross-reference here (or a clarification that the words about Goldstone do not exclude Arecibo).

\* There needs to be more transparency, in ROSES, about the disposition of the \$40.5 million appropriation for NEOs. Is it all going to NEOO? If NEOO is to support ANSMET by competitive grants, why aren't there words here about that program? At the time this was drafted, the FY14 budget wasn't approved, perhaps explaining the "TBDs" in the tables. Now the numbers should be made public. What fraction of the \$40.5 million is going to this NEOO R&A program solicitation? Where is the remainder going? Is there any funding of NEOO from NASA sources other than the \$40.5 million line item?

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Suggestions (nit piks and clarifying text):

### 1.1 Planetary Astronomy

2nd paragraph, 1<sup>st</sup> line: read "...sources where the data are...."

### 1.2.1 NEO Survey and Characterization Proposals

1<sup>st</sup> paragraph, last line: read "Therefore, investigations will receive additional attention if they provide the capability to detect, or the ability to better characterize, this NEA population that is in low velocity orbits relative to Earth (i.e., Earth-like orbits)."

2<sup>nd</sup> paragraph, last sentence: read "NASA will also consider within this program proposals that characterize the entire population of these smaller NEAs or provide, for a subset, information on their physical characteristics."

1.2 Suborbital Flight Investigations (1.2 seems to be mis-numbered here)

1<sup>st</sup> paragraph, first line: Read “Solar System Observations supports....”



# United States Department of the Interior

## GEOLOGICAL SURVEY

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January 22, 2014

Re: Geologic Mapping Subcommittee (GEMS) Comments to ROSES 2014 Draft  
To: NASA Planetary Science Subcommittee, NASA Assessment Groups

All-

The Geologic Mapping Subcommittee (GEMS) is an advisory group to NASA's Planetary Cartography and Geologic Mapping Working Group (PCGMWG) as well as community researchers who conduct geologic mapping investigations. On behalf of PCGMWG and GEMS, I am providing comments regarding the draft verbiage for ROSES 2014 draft, posted on LPI websites for community review, that incorporate highly re-structured elements of NASA's R&A programs. My comments center on – and emphasize – the absence of planetary geologic mapping as a standalone scientific or cartographic endeavor in the draft AOs.

“Geologic mapping” is not mentioned directly in any of the draft verbiage posted online, leaving it unclear how (or if) NASA plans to maintain planetary geologic mapping either as a standalone scientific investigative endeavor or a method for producing higher-order data products. It is also unclear whether multiple programs (*e.g.*, Solar Systems Working (C.3) and Data Analysis Programs) will each individually support geologic mapping investigations that intend to produce a USGS Scientific Investigations Map (SIM).

- *Recommend including “geologic mapping” as a viable scientific investigation fundable through Solar System Workings and/or DAPs. For example, mention “geologic mapping” throughout C.3, particularly in the introductory paragraph (page 1); section 1.1 introductory paragraph (page 1); and bullets # 4 and #6 under section 1.1 “Surfaces and Interiors” (pages 1-2).*
- *Recommend including the following verbiage in relevant program AOs, updated from ROSES 2012 PG&G AO: “Proposed geologic mapping or topical science investigations of any planetary or satellite surface that are intended to result in the publication of a Scientific Investigations Map (SIM) by the U.S. Geological Survey (USGS) should check the relevant box on the proposal Cover Page and clearly indicate this intention in the Proposal Summary, as well as in the text of the proposal. Investigators who choose to produce a geologic map as a USGS product will be required to follow current guidelines for the production and submission of digital products, including the generation of maps that are compatible with Geographic Information System (GIS) software packages for review, edit, and publication. To support this requirement, the USGS will provide a GIS project that contains the projected, geographically rectified, and scaled mapping base or mosaic as well as other relevant global- or regional-scale data sets (if available and*

- needed). Investigators selected to publish USGS geologic maps will be expected to (1) provide peer reviews for two geologic maps generated by other planetary mappers, and (2) attend the annual Planetary Geologic Mappers Meeting to present map status to the mapping community and receive updates on current guidelines. Proposers are encouraged to contact James Skinner at USGS (jskinner@usgs.gov) in order to obtain further information pertaining to the production of USGS geologic maps (e.g., map bases, scales, extents, formats, guidelines), or visit <http://planetarymapping.wr.usgs.gov/>.*
- *Recommend including standards, requirements, and point of contact verbiage (summarized in preceding bullet) in each of the program AOs that will support geologic mapping OR a direct pointer to a single program where such verbiage is presented.*

Please consider these comments during revision of the draft of ROSES 2014 in order to ensure that the broader science community continues to benefit from the objective, high-level context science that is provided by the planetary geologic mapping program.

Regards,

James A. Skinner, Jr.  
Research Geologist  
Chair, Geologic Mapping Subcommittee



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Jan. 21, 2014

Re: Comments on NASA PSD R&A Restructuring

Dear Dr. Nancy Chabot (Chair of SBAG) and Dr. Harry McSween (Chair of CAPTEM),

We write as principal investigators in NASA Planetary Science Division R&A programs that are responsible for analytical instrumentation facilities doing research on cosmochemical and planetary materials. We are very concerned with the restructuring plans. We are all involved in multidisciplinary (cosmochemistry-astronomy-astrophysics-astrobiology) research that cuts across the boundaries of the new R&A structure. We would like to express our concern that the restructuring in the new PSD R&A plan may have some unintended negative impacts on the laboratories that NASA relies on for the success of current and future sample return missions. We ask that you convey our concerns to NASA HQ, and hope that these are addressed in the revisions to ROSES 2014 for the affected programs.

The details of our concerns are expressed and elaborated in the attached document.

Dr. Rhonda Stroud, Chair of Cosmo MOWG is cc-ed for her information.

Respectfully,  
Qing-zhu Yin  
on behalf of the co-signers on the list

A handwritten signature in black ink that reads "Qing-zhu Yin".

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Comments on NASA PSD R&A Restructuring (Jan. 21, 2014)

Dear Dr. Nancy Chabot (Chair of SBAG) and Dr. Harry McSween (Chair of CAPTEM),

We write as principal investigators in NASA Planetary Science Division R&A programs that are responsible for analytical instrumentation facilities doing research on cosmochemical and planetary materials. We are very concerned with the restructuring plans. We are all involved in multidisciplinary (cosmochemistry-astronomy-astrophysics-astrobiology) research that cuts across the boundaries of the new R&A structure. We would like to express our concern that the restructuring in the new PSD R&A plan may have some unintended negative impacts on the laboratories that NASA relies on for the success of current and future sample return missions. We ask that you convey our concerns to NASA HQ, and hope that these are addressed in the revisions to ROSES 2014 for the affected programs.

The first order questions that deserve serious attention are:

- (1) How do we maintain and develop laboratories with sophisticated analytical instrumentation that are actively carrying forward research?
- (2) How do we develop new instruments that will be necessary for past, current, and future sample return missions?
- (3) How do we retain the technical competence and capability to carry forward this research?
- (4) How do we train students and bring innovative young people into the areas of active and future research?
- (5) How can funding mechanisms be found so that the analytical cosmochemistry community can avoid writing (and reviewing) infinitely large numbers of proposals in the process of supporting and maintaining the complex activities referred to above?

It is our view that NASA should ensure the vitality of cosmochemistry research related to the origin and formation of the Solar System and the connection to astrophysical research. We consider it to be of the highest importance that this area of activity be maintained and not be placed in jeopardy by the proposed reorganization.

We elaborate our two major concerns further below:

(1) We recognize the need for restructuring the PSD's R&A programs to be effective and efficient in this financially challenged time. However, in planning this restructuring effort, careful consideration must be given to providing adequate funding opportunities to maintain support for laboratories with expensive, complex analytical equipment and capabilities that cannot be easily duplicated. This cannot be done with many small grants to a group. The continued development of analytical capabilities and associated human resources are critical for maximizing scientific knowledge gained from solar system materials and for training the next generation of scientists. This is an ongoing need as emphasized in the latest NRC planetary decadal survey, which has prioritized several sample return missions in the New Frontiers and Flagship categories.

The development of state-of-the-art instrumentation and high precision, high sensitivity analytical techniques often takes many years of dedicated effort and thus requires a basic

continuity in funding. Such facilities require highly trained personnel and operating budgets that are significantly higher than average grants for specific science investigations by individual PIs. NASA has made a large investment in such facilities and has succeeded in maintaining the expertise, developed following the Apollo program, in the analysis of precious returned lunar samples and other extraterrestrial materials. We are concerned that the reorganization will limit submission opportunities and/or grant sizes, thereby making it exceedingly difficult to maintain technical capability. Without a commitment from NASA for support and further development of laboratory infrastructure, competitive advantage and young talent will move overseas. The loss of national capability and the choking-off of the pipeline for training the next generation in technical excellence must not be unintended consequences of a top-down reorganization scheme. We were always told that NASA viewed their role as one of funding national assets as much as funding individual projects. NASA has been able to take a long-term strategic view consistent with its exploration missions in the past and we believe that this must continue for future success.

A first order question that we would ask NASA management is: How does the restructuring ensure the retention of technical capability and maintenance of the United States' status at the forefront of cosmochemistry research? If the restructuring does not adequately address the funding level for analytically intense research groups, the viability of the field cannot be sustained, as the specialized skills and capabilities are either greatly diminished or lost. Within a few years, the predictable consequence is that groups in Europe and Asia, where significant investments are being made to PI-driven research in cosmochemistry (*e.g.*, through multimillion-euro ERC grants in Europe) will take over all leadership of the field.

(2) We believe that not only laboratories with complex analytical facilities will be affected by the R&A restructuring, but individual PIs as well. The number of proposals submitted from our field is likely to be reduced, as are overall funding levels. The PIs currently funded by several programs will be affected the most. Although it is presently allowed, reviewers and panelists are strongly biased against one PI having multiple grants from a single program. If this culture remains in the new R&A restructuring, almost of all of the PIs would be limited to submitting fewer proposals (mostly likely 1 in every 3 years), given the consolidated nature of this new restructuring. The question is: how do we ensure that those PIs who have been successful and productive in multiple programs in the previous system continue to have sufficient opportunities to be as productive in the newly restructured R&A program?

The PSS needs to give all these questions serious consideration before the restructuring is implemented.

Respectfully,

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Response to Draft of ROSES 2014 Solicitations made public on Friday, January 17, 2014.

Prepared by: Laszlo Kestay on behalf of the United States Geological Survey

Date: January 22, 2014.

In reviewing the draft ROSES 2014 text we have found the following section on page 7 of C3 (Solar Systems Workings) to contain false and misleading information about the USGS.

“Planetary Cartographic Products. A variety of planetary cartographic products such as topographic, orthophoto, geological, and other special maps and geodetic information are available. Requests from NASA-funded investigators for production of special maps or other cartographic materials will be accommodated when possible. Request available data or specific maps from [http://ask.usgs.gov/to\\_order.html](http://ask.usgs.gov/to_order.html).

Request information related to the availability of planetary base maps and materials or U.S. Geological Survey criteria for planetary map publication through <http://astrogeology.usgs.gov/DataAndInformation/ImagesAndMaps/> and/or to the data manager at [RPIF-flag@usgs.gov](mailto:RPIF-flag@usgs.gov).”

There is no agreement between NASA and the USGS for the USGS to accommodate requests for special maps or other cartographic materials. The link provided does not allow for such data to be requested, only the printing of past maps for a fee. The second paragraph contains correct but highly incomplete information. We request that these two paragraphs be replaced by the following text:

Planetary Cartographic Products. NASA has a long-term contract with the U.S. Geological Survey (USGS) to provide a variety of cartographic support functions for NASA researchers through the Planetary Cartography Program. This support includes the Integrated Software for Imagers and Spectrometers (ISIS, <http://isis.astrogeology.usgs.gov/>); the management, review, and publication of geologic maps (Planetary Geologic Mapping Program, <http://planetariummapping.wr.usgs.gov/>); a search capability for raw planetary image data (PILOT, <http://pilot.wr.usgs.gov/>); on-demand production of higher level data products (Projection On the Web and Map and Planet, <http://www.mapaplanet.org/>); coordination of IAU approval of nomenclature <http://planetariumnames.wr.usgs.gov/>; training in planetary GIS methods (MRCTR GIS Lab, <http://astrogeology.usgs.gov/facilities/mrctr/>); training in the generation of topographic data from stereo images (Photogrammetry Guest Facility, <http://astrogeology.usgs.gov/facilities/photogrammetry-guest-facility/>); and free hardcopies of USGS planetary geologic maps and a wide variety of historical information through the USGS node of the Regional Planetary Information Facility (RPIF, <http://astrogeology.usgs.gov/rpif/>) Network. For cartography support beyond what is provided by the Planetary Cartography

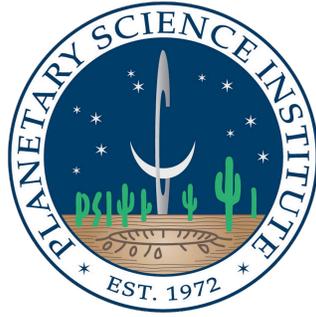
Program, the USGS is willing to join proposal teams to produce or assist in the production of specific cartographic tools or products. However, the USGS is required to recoup the full cost of such activities in the proposal budget. Visit <http://astrogeology.usgs.gov/> or e-mail [laz@usgs.gov](mailto:laz@usgs.gov) for further information.

The above paragraph would be useful to include in the other solicitations, especially the data analysis programs (including CDAPS and Dawn FRAP). This cartographic support has not been previously advertised to the Exobiology, Planetary Astronomy, and Exoplanets communities, but is potentially useful to them.

Sincerely,

Laszlo Kestay

Science Center Director  
U.S. Geological Survey  
Astrogeology Science Center  
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January 20, 2014

Dear Janet & other members of the Planetary Science Subcommittee –

I understand that the PSS has been asked by PSD management to provide findings/comments on the research program reorganization in response to the following questions:

1. Do they correctly map to our science goals? In the mapping from an old Call to a new one(s) did we carry all the appropriate elements with it? Did we leave anything out?
2. Do they address fully the science question?
3. Are there gaps in any of the solicitations?
4. Are the new Calls written clearly or if not, which sections are awkward or are unclear.

As a member of our community involved in the generation of the primary PSS and NRC documents used as a basis for and guidance in the proposed restructuring, and having been involved with these issues for many years, I thought I would contribute a few comments for your consideration. I hope they are of some use. My apology for the length.

In general, while I feel it is very important for the late February 2015 call for Solar System Workings to be brought forward nine months to avoid funding gaps for large numbers of people (too large to be accommodated by any bridge funding scheme), I think there are a number of other serious concerns that need to be addressed before and not during or after the restructuring plan is implemented.

In the meantime, it would be a straightforward matter to appropriately modify the ROSES13 call, maintaining existing programs and their proposal due date (with modest adjustments) for ROSES14.

Sincerely,

A handwritten signature in black ink, appearing to read "Mark V. Sykes". The signature is stylized and cursive.

Mark V. Sykes

## QUESTIONS ASKED BY PSD

*1. Do they correctly map to our science goals? In the mapping from an old Call to a new one(s) did we carry all the appropriate elements with it? Did we leave anything out?*

The PSS report “Assessment of the NASA Planetary Science Division’s Mission-Enabling Activities” (August 29, 2011) demonstrated in some detail that all current R&A program elements map to the Planetary Science Division goals and objectives in the NASA Science Plan (referred to in recent PSD materials as “science themes” and “science goals”). Therefore, any combination or division of these program elements will also map to these goals. Table 2 shows that all program elements are either directly or somewhat relevant to multiple goals (with many directly or somewhat relevant to all goals) indicating that there are activities supported by each element that could be appropriately linked to different goals.

PSD proposes five new programs that are intended to correspond to the five PSD science themes provided in the NASA Science Plan. Table 2 of the above PSS report suggests that the numerous activities supported by each current program elements should map into most of the proposed program elements. PSD presentations show current program elements mapping into only one or two of these new programs. This raises the serious concern that some previously supported activities may no longer supported in the proposed structure.

It is not reasonable to ask the PSS to determine whether the mapping of activities supported by current program elements are conserved in the proposed restructuring without first providing a detailed breakdown of the activities supported by each current program element along with the mapping of those activities to the proposed program elements. PSS (with input from the broader planetary community) would then have to assess whether the activities listed for each current program element were complete.

Failure of PSD to clearly demonstrate at a minimum the conservation of supported activities from current program elements to the proposed restructured program elements undermines the confidence of the planetary community in the management of these programs and the Administration policy driving the hasty implementation of these programs.

*2. Do they address fully the science question?*

Assuming the science question is the strategic goal or theme around which the proposed programs are designed, the answer is unknown and would be difficult for the PSS to provide on a short timescale. This is because PSD has not undertaken a fundamental exercise identified by the NRC (An Enabling Foundation for NASA’s Space and Earth Science Missions, NRC 2010):

“However, it is not sufficient to determine that a mission-enabling activity supports a strategic goal of the agency. The committee provides an approach for using a traceability matrix as an example of how SMD could derive the range and scope of mission-enabling activities via a systematic flow-down analysis of all tasks and requirements needed to address SMD strategic goals.”

The reader may substitute “research” for “mission-enabling” and “PSD” for “SMD.”

Merely saying that a group of activities supports a science goal is not the same as identifying all of the activities needed to advance that goal. To date, PSD has not identified all of the activities required to advance its science goals.

The PSS subcommittee that generated the earlier referenced report, was originally created to generate the traceability matrix recommended by the NRC to identify all of the activities needed to support PSD science goals. It was expected that many activities would be required to support several science goals and that having gone through the exercise we would have a valuable tool that

“... provides a mechanism that allows balance to be determined among different activities by weighting costs by duration and priority. Mission-enabling activities can then be consolidated into higher-level tasks and into program elements through which activities are funded. The generation of such a traceability matrix can be an important tool for the active management of mission-enabling activities. It provides a means by which missing activities can be identified, optimal funding levels can be determined and compared with current budgets, and performance can be evaluated.”

Consolidation into high-level tasks (i.e., restructured programs) would be based on scientific and managerial efficiency.

This effort by the PSS failed. Within a few months it was apparent the scope of the task was beyond the time and resources available to the committee. Maj. Gen. Paul of the NRC committee had described this process, in the case of (in my recollection) AFOSR, as requiring a couple of years, several dedicated FTEs, and corresponding financial investment. He described the product as arduous but well worth the effort.

A similar rigorous flow-down exercise for Planetary Science Division science goals would be equivalent in level of effort to a decadal survey. It would require the open and transparent engagement of the community in the entire iterative process (to tap the breadth of their subject matter expertise). This would include not only the identification of activities, but an assessment of their importance to advancing the science goals (i.e., weighting factor). I presented a web-tool to the PSS subcommittee designed by myself and Terrill Yuhas (the PSI IT Manager), both as a means of facilitating this effort and by working through a very limited example to illustrate the scope of the project before us. It

was at that point that the subcommittee realized the project was much larger than originally contemplated, and it was decided to limit our deliberations to linking existing program elements to PSD science goals to demonstrate that connection could be explicitly made.

*3. Are there gaps in any of the solicitations?*

Not possible to determine with the information provided.

*4. Are the new Calls written clearly or if not, which sections are awkward or are unclear.*

If the proposed program elements are fundamentally flawed in their design or planned execution, then the quality of writing of their AOs is not important.

## INFORMATION THAT SHOULD BE PROVIDED BY PSD

### *Research program restructuring objectives*

In several presentations, PSD has listed various objectives that are suggested to be addressed by the proposed restructuring. However, what is missing is a detailed accounting of why those objectives are not met by the current research program elements, their due dates and/or their management, and how proposed program elements, their due dates and/or management specifically meet these objectives.

For instance, one objective mentioned is to improve the time between proposal submission and selection, yet in a discussion of the relative performance of PSD to other SMD divisions (particularly Astrophysics), it has been determined that improvement required not restructuring of program elements, but a commitment of budget to these programs at the beginning of the fiscal year to allow for appropriate planning by program officers. Hence, the latest draft PSS finding from the 5/8/12 meeting that

“Specific recommendations include commitments by the Division Director to program budgets near the beginning of the fiscal year, which is essential to helping program officers achieve the GPRA metric (80% of proposers officially notified within 150 days of proposal receipt).”

[I note that PSS findings from many of its meetings have never been published.]

Another objective given by PSD has been the need to link program elements to PSD strategic goals. This has been done by PSS for current research program elements.

Workload for program officers and members of the planetary community (proposers) has been raised as a concern in the past by the PSS. Metrics for managerial efficiency include

FTEs required and administrative costs. In the same PSS findings above, it is suggested that there be

“... the strategic combination of subprogram panels and shared proposal due dates, where possible and appropriate, to minimize the proposal and review process burdens on both PSD and the community.”

However, as I will note below, the proposed restructuring may actually increase this burden.

### *Revenue neutrality*

The PSS has found that funding levels for all SR&T activities should be made available in reviewing any consolidation of programs and that such consolidation should be “revenue neutral” (not a means of reducing overall research program funding). This may be sufficiently modeled in the proposed restructuring using FY14 budget information, the obligations of existing awards and the availability of funds for new awards in current research program elements and mapping these to the proposed program elements (funds for new awards being possibly done on a prorata basis for the division of current program element obligations across proposed programs elements).

PSD should also provide an estimate of implementation costs to its proposed restructuring and an assessment of how costs associated with the administration of the proposed program elements compare with current program elements.

Revenue neutrality must be demonstrated within a fiscal year, heeding the Congressional warning to NASA in the FY14 Omnibus bill.

### *Workforce Assessment*

To determine the detailed composition of the workforce needed to support all of the activities required to advance PSD science goals, those activities need to be defined through the rigorous flow-down exercise generating the supporting traceability matrix. The planetary community has grown organically in response to the expanding range of solar system exploration activities and targets that have been supported by NASA. In the absence of a traceability matrix and in the absence of NASA identifying solar system exploration activities and targets to be henceforth abandoned, it is reasonable to assume to first order that the planetary community today is that needed to support PSD goals.

Existing studies, including one I conducted on behalf of the PSS, indicate that the stability of the planetary workforce (particularly its younger members) is very dependent upon the stability of the planetary research and data analysis programs. The impact of instability is inelastic. Loss of planetary scientists tends to mean a permanent loss. This is not a semi-infinite workforce that can be turned on and off at the convenience of PSD managers. In the referenced NRC report earlier, workforce development and maintenance is considered “fundamentally important to NASA and to the nation.” This why in the

recent planetary decadal survey R&A stability and slow growth was a primary recommendation even in circumstances (as experienced today) of worse than assumed fiscal climate.

However, maintaining and even growing a total budget number is not adequate in workforce management. The originally planned late February 2015 due date for Solar System Workings threatens the continuity of funding for a large number of planetary scientists, as has been already publicly discussed. While bringing this date forward nine months cures that particular problem (and PSD has yet to commit to doing this), there is still the need for PSD to provide PSS with a detailed assessment of workforce impact in its planned transition between current and proposed program elements along with the actions it intends to take to address negative impacts identified.

“Bridge funding” (vaguely defined) has been identified as one possible tool for addressing negative workforce impacts, though there is a cost that makes it more amenable to situations dealing with small numbers of investigators and not at all amenable to massive programs such as Solar System Workings.

### *Management Plan*

PSD should demonstrate that it has figured out how to manage its proposed program elements and their proposal reviews. There should be a comparison between existing and proposed program elements in this regard. How does PSD ensure that management of existing program elements is informed by subject matter expertise to ensure appropriate continuing support for important subdisciplines? How, in detail, will this be executed for the proposed program elements? This should include the identification of all program management personnel.

With regard to reviews, of particular concern is the proposed Solar System Workings program to which (by PSD estimate) 1/3 of all research and data analysis proposals will be submitted to PSD. Given the topical breadth of this program, it is conceivable that proposals could be received from every institution in the United States at which there are planetary scientists (when including PIs and Co-Is). Conflict of interest rules, applied at the program element level, would result in there being no reviewers available with any subject matter expertise.

### *Additional Question*

The PSS should be asked if the proposed restructuring makes simple sense.

The strategic “science themes” on which the restructuring is based were written in an effort to capture the scope of what NASA strives to learn in its solar system exploration program. In no way was that language ever intended to represent an organizational structure. The fact that the proposed restructuring produces on the one hand a giant program of highly diverse science activities from atmospheres to geophysics that will receive 1/3 of all proposals submitted to planetary research and data analysis programs

and on the other hand to a program that represents the subdivision of a single current program in exobiology should give anyone pause. “Planetary Geology and Geochemistry” was divided in the 1990s into “Planetary Geology and Geophysics” and “Cosmochemistry” because it was felt that the disparate science could not be effectively managed together. This was at a time when program management benefited from closer ties to their communities (through the Management Operation Working Groups) and headquarters benefited from a larger administrative workforce for its programmatic burdens (half of which was supplemented by a senior scientist program that cycled scientists from the community to headquarters on temporary assignment).