

Planetary Data System Management Council Meeting
21-22 April 2015 – Face-to-Face Meeting (Executive Summary)
Student Technology Center, Gregg Hall
Washington University, St. Louis, MO

Notes from the PDS Management Council (MC) face-to-face (F2F) meeting by Dick Simpson. This was a two-day meeting. The first two pages is an executive summary; it is followed by detailed notes from days 1 and 2. Action Items, in **UPPERCASE RED**, are embedded within the detailed narrative and are also summarized at the end. Presentations can be found on the meeting web site at:

https://wufs.wustl.edu/meetings/pdsmc_apr2015/



Group photo in meeting room at the end of Day 2. Rear, left-to-right: Boris Semenov, Lars Arvidson, Chuck Acton, Sean Hardman (partly hidden), Lisa Gaddis, Mark Showalter, Reta Beebe, Tom Stein, Mitch Gordon, Lynn Neakrase, and June Wang. Middle, standing: David Schurr, Ralph McNutt, Bill Knopf, Ed Grayzeck, Steve Hughes, and Ray Arvidson. Middle, seated: Ray Walker, Todd King, Joe Mafi, and Ludmilla Kolokolova. Front: Mike A’Hearn, Anne Raugh, Tom Morgan, Stef McLaughlin, Dan Scholes, Ed Guinness, and Susie Slavney. (IMG_4508.JPG and IMG_4509.JPG).

Much of the first day was spent on topics related to long-range planning, which could be used in developing a PDS strategic plan or ‘roadmap’ for the 2017-2026 time frame. NASA uses roadmaps to align the hierarchical structure of agency goals. The PDS Roadmap should ensure that PDS activities effectively support both science objectives and the mission set contained in the Science Mission Directorate Roadmap. A second use is to summarize future PDS activities to non-specialists. The current PDS Roadmap runs through 2016; with the CAN process well underway, now is a good time to begin this renewal and refurbishment exercise.

PDS Chief Scientist Ralph McNutt has been charged with leading the Roadmap effort. He plans to collect governance documents, review the existing Roadmap, seek community input, and make preliminary decisions on revisions while existing personnel are in place. More definitive planning, review by PDS and the community, and iteration will begin in September after the CAN selections have been announced. NASA wants to make planetary data more easily accessible and to integrate its several planetary ‘archiving’ organizations; the new PDS Roadmap must support these objectives.

The following presentations provided background: Tom Morgan on forecasting planetary data volumes over the next 20 years, David Schurr on NASA’s vision and principles for planetary archiving, Laslo Kestay on Cartography (currently supported by Planetary Geology and Geophysics, but looking for a new home), Eileen Stansbery on the JSC Astromaterials Acquisition and Curation Office, and Dan Crichton on PDS technology forecasting. A presentation on the Minor Planets Center had been scheduled, but no speaker stepped forward. Max Bernstein provided an overview of the data management plan requirement that has been added to ROSES 2015, Sarah Noble summarized results and lessons learned from the PDART 2014 evaluation, and Tom Statler described the benefits and registration procedures for ‘persistent identifiers’, commonly known as the ‘doi’ system.

Lead node representatives reported on archiving status for the New Horizons, Dawn, MAVEN, InSight, Mars 2020, and OSIRIS-REx missions; in general, the work is on schedule, but there are a few potential trouble spots that need to be watched. The JPL MGSS group reported on the AMMOS-PDS Pipeline Service (APPS), which can automate label design and generation. InSight is using APPS, and Mars 2020 is considering it; SBN has used it, and PPI is studying the possibilities. APPS should be fully tested and operational by October 2015. There was a brief report from NSSDCA (the PDS deep archive) and a longer report from the Engineering Node on the status of PDS4 itself.

Some MAVEN data are being archived as CDF files, a popular choice in the heliophysics community. For delivery to PDS these must be organized as PDS4 products, collections, and bundles with PDS4 labels; but PDS reviewers (without CDF tools) have repeatedly had trouble working with example products. MC, by a 7-2 vote, decided that the current PPI/MAVEN implementation for CDF is not adequate and that improvements must be made. New reviews of upgraded examples will be conducted over the next few weeks with results reported to the 11 May MC telecon. There was consensus that CDF is important to significant fractions of the solar system exploration community, including IPDA partners; so an outright ban on CDF was not approved. This latest decision puts CDF on track to status similar to that currently held by FITS — products that simultaneously meet PDS4 and suitably constrained external requirements. MC also rejected CCB-90, which would have allowed line-feed only record delimiters on certain ASCII files and which had been requested specifically for the MAVEN archive by PPI. During the second executive session, MC endorsed PDS4 design principles first recorded in Tech Session notes from June 2009 but never formally recognized before.



Spring on the Washington University campus (IMG_4504.JPG)

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Notes from the PDS Management Council (MC) face-to-face (F2F) meeting by Dick Simpson. This was a two-day meeting. These are minutes from Day 1; minutes from Day 2 follow. An executive summary precedes both. Action Items, in **UPPERCASE RED**, are embedded within the detailed narrative and are also summarized at the end. Presentations can be found on the meeting web site at:

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Dogwood blossoms near the meeting site (IMG_4492.JPG).

Participants:

Chuck Acton (NAIF)
Mike A'Hearn (SBN)
Sterling Algemissen (MGSS)
Lars Arvidson (GEO)
Ray Arvidson (GEO)
Reta Beebe (ATM)
Max Bernstein (NASA HQ)[#]
Nancy Chanover (ATM)
Dan Crichton (EN)
Amy Culver (IMG/JPL)
Andy Downen (AMMOS)
Lisa Gaddis (IMG/USGS)
Patty Garcia (IMG/USGS)[#]
Mitch Gordon (RINGS)
Ed Grayzeck (Mgmt)
Ed Guinness (GEO)
Sean Hardman (EN)
Lyle Huber (ATM)[#]
Steve Hughes (EN)

Chris Isbell (IMG/USGS)[#]
Laslo Kestay (USGS)[#]
Todd King (PPI)
Bill Knopf (NASA HQ)
Ludmilla Kolokova (SBN)
Emily Law (EN)
Joe Mafi (PPI)
Mike Martin (Mgmt)[#]
Stef McLaughlin (Mgmt)
Ralph McNutt (CS)
Tom Morgan (PM, GSFC)
Lynn Neakrase (ATM)
Carol Neese (PSI)[#]
Michael New (PS)[#]
Sarah Noble (NASA HQ)[#]
Jordan Padams (IMG+EN)
Eric Palmer (SBN/PSI)
Costin Radulescu (MGSS)
Anne Raugh (SBN)

Mark Rose (UCD)
David Schurr (NASA HQ)
Dan Scholes (GEO)
Boris Semenov (NAIF)
Mark Showalter (RINGS)
Dick Simpson (RS)
Susie Slavney (GEO)
Eileen Stansbery (JSC)
Tom Statler (NASA HQ)[#]
Tom Stein (GEO)
Ray Walker (PPI)
June Wang (GEO)
Jen Ward (GEO)[#]
Dave Williams (NSSDCA)[#]
Feng Zhou (GEO)
[#] by phone

Welcome (Arvidson):

Host Ray Arvidson called the meeting to order at 08:30 local time. He reminded attendees that there would be a reception (for those able to attend) Tuesday evening, hosted by the McDonnell Center for the Space Sciences. Susie Slavney summarized logistics.

Program Executive Report (Knopf):

Funding Status: The bulk of PDS FY15 funds have been distributed; in a few cases awards have hit award level limits, which complicates the transfer and may require a revised budget from the recipient. Bill will be working this over the next month with affected DNs.

Grant Close-Outs: Current grants expire on 30 September; extensions of about 3 months are being planned. Structure of PDS as of 1 October is unknown because of possible changes resulting from the CAN process. Where there are DN transitions, those will be coordinated and funded appropriately. Questions about the CAN should not be raised during this meeting or in upcoming MC telecons. Instead, they should be addressed to Michael New as described in CAN Section 4.7.

Archiving Initiative: PDS is the core of Planetary Science Division (PSD) digital data/metadata archives; other components include the JSC Astromaterials Acquisition and Curation Office, the Minor Planets Center at Harvard Smithsonian, RPIFs (various locations), and Cartography. PSD wants to take a long-range view of planetary science archiving (up to 40 years). David Schurr will give a presentation later on how NASA archives can work together.

Roadmap Update: Ralph McNutt will lead this activity, updating the original Roadmap activity coordinated by Reta Beebe nearly a decade ago.

Forecasting Future Data Deliveries (Morgan):

The mission of PDS is to facilitate achievement of NASA's planetary science goals by efficiently collecting, archiving, and making accessible digital data and documentation produced by or relevant to NASA's planetary missions, research programs, and data analysis programs.

Many current missions (*e.g.*, Cassini) are expected to be delivering data in 2017 and beyond, but most of these continuations will require successful completion of senior reviews. Other missions range from concepts (future New Frontiers and Discoveries opportunities) to implementation (InSight). Experience suggests that actual archives are larger than early estimates predict. There may also be deliveries to PDS from Research and Analysis (R&A) and other programs. PDART is a possible new, large source. Laser communication with spacecraft could increase downlink capacity significantly. Morgan's current estimate for additions to PDS holdings over the two decades (ending in 2036) is about 134 TB.

To make this estimate more accurate, PDS needs to obtain and incorporate the plan for future Mars missions (not included in this estimate), work with the NEO program, make a better estimate for R&A, and ask Space Communications and Navigation about their strategic plan.

Vision and Principles for Planetary Archiving (Schurr):

NASA's response to the White House directive to make government-sponsored research more widely available is not significantly different from what PDS is doing now; the effort will include making sure the public knows about the data and making sure that NASA's response is consistent across the agency.

Solar system exploration and its data harvest are unique because of the long time scale over which exploration is conducted, the relatively small number of missions, and the sparse time sampling at any target. Archives must be accessible to current researchers, must be sustained for future generations, and must be protected against corruption and loss. The people who conduct planetary exploration today will not be available when some data are called up for additional studies in the future.

Current objectives include integrating the different planetary archives within NASA, linking to archives managed by international partners, and ensuring that the archive is independent of changes in supporting IT technology. With regard to the last point, Schurr noted that some previously acquired planetary data are still only available in analog formats.

Schurr's task today is to bring the important high-level concepts together, query the missions being closed out for lessons learned, and track the development process for missions currently in the selection process. For example, what should we be doing to document the return from five missions that will be wrapping up in the next three years (DAWN, GRAIL, Cassini, Rosetta, and MESSENGER)? What (improved) guidance should we be giving new selections?

Schurr would be interested in hearing 'lessons learned' from groups like PDS. Ray Walker asked what can be done to speed up the archiving and distribution process; it can take years to get some planetary data into archives. On the other hand, heliophysics already has 24-hr real-time for some data. Arvidson noted that the biggest delays are often with the calibrated data and (more so) with the highly-derived products; it may be necessary to put more incentives into the mission contracts. A'Hearn suggested that PDS be more directly involved in writing Phase A data management and archive plans (DMAPs) and that archiving commitments be nailed down before final selection; this could be particularly effective if the DMAP is given some small fraction of the selection score (for example, 5 percent).

Strategic Planning Process for a 2017-2026 PDS Roadmap (McNutt):

NASA uses roadmaps to align the hierarchical structure of agency goals. The PDS Roadmap should ensure that PDS activities effectively support both science objectives and the

mission set contained in the Science Mission Directorate Roadmap. A second use is to summarize future PDS activities to non-specialists.

The current PDS Roadmap expires in 2016. CAN proposals are due in early June. Since time frames are an important component of roadmaps, now is an excellent time to generate a new PDS Roadmap.

The new Roadmap should be constructed so that future planning is easy as the IT landscape evolves. Sample tasks include:

- Reviewing the existing Roadmap
- Forming a working group after the CAN selections are made
- Seeking community input
- Reviewing NASA guidelines and plans
- Storyboarding
- Developing a consensus summary and outline
- Iterating

REVIEW OF THE CURRENT ROADMAP, ITS SHORTCOMINGS, AND ITS OUTCOMES CAN BE DONE WITH CURRENT PDS PARTICIPANTS BEFORE THE CAN RESULTS ARE ANNOUNCED (*e.g.*, during summer 2015). Although McNutt is optimistic that he can find good ideas within PDS, he suspects the major challenges will be at the internal interfaces within PDS and between PDS and the rest of the world.

The following need to be determined at the beginning:

- Who approves the Roadmap?
- What is the time scale for approval?
- What is possible, what makes sense, and what does not make sense with regard to IPDA?
- A non-public Roadmap has little value; are there publication issues?

Acton recommended that a lot more attention be paid to international MOUs. In his experience with NAIF (which gives him substantial international contact), past MOUs have not been very effective.

Data and IT Technology Roadmapping (Crichton):

NASA has been a leader in developing scalable archives for science data, and NASA's Office of the Chief Technologist (OCT) has been working on technology roadmaps for some time. PDS is well-positioned to take advantage of PDS4 in planning its next technology roadmap. The NRC report *Frontiers in Massive Data Analysis* addressed some of the issues — what is the life cycle of data, how should different disciplines be integrated, and what novel techniques can be applied?

The initial OCT Roadmap was released in 2010. TA-11 (in which Dan was involved) considered computing, modeling, simulation, and information processing. Continuing studies since 2010 have also included computer security. There are trades in the planetary context: if downlink capacity is a limiting factor, should there be more upstream ‘triage’ — that is, on board processing? What are good ways to deal with the multi-disciplinary nature of planetary data? Should more analytical tools be provided so users can work from raw data; or should PDS focus on archiving data that have been processed to different levels in static pipelines?

Cartography (Kestay):

Astrogeology is USGS people supporting NASA missions “from conception to beyond the grave”. Annual funding is approximately \$9M, about 98 percent of which comes from NASA. Astrogeology has been in existence for more than 50 years; the work is split roughly equally among cartography, missions, and science.

Cartography grew out of Apollo and Viking support; it came under the Planetary Geology and Geophysics Program (PG&G) umbrella in the 1980s and is now funded at about \$3M/year. Cartography includes:

- A. digital planetary data bases (*e.g.*, IAU nomenclature, cartographic web services, and THEMIS controlled mosaics, LRO maps, Kaguya mosaics, Map-a-Planet 2, and controlled Mini-RF mosaics of the lunar poles)
- B. photogrammetry and geodesy (photogrammetry support, research, and development; planetary geodesy; integrated photogrammetric control environment software; and pattern matching)
- C. geologic mapping support (planetary geologic map coordination, and the MRCTR GIS Lab)
- D. software systems (ISIS project management, ISIS support and maintenance, and limited camera model development)
- E. program support (PG&G Shoemaker Postdoctoral Fellowship, and RPIF oversight)

But PG&G is being phased out, and there is no mechanism in place to continue Cartography support beyond FY16. There is no real overlap between Cartography and PDS; but they need each other and the community needs both.

Mike Martin asked how many people at the meeting use ISIS; about half a dozen people raised their hands. Mike said he uses both ISIS and ISIS 2; he felt that more people would use the software if there were a version that ran on PCs. Kestay said that a package has been prepared for a ‘virtual’ platform, which can be run on a PC; Gaddis added that more information on this (including a demo and hands-on training by K. Becker) will be presented at the 2nd Planetary Data Workshop (see below). Arvidson asked whether ISIS will ever generate output that is directly PDS compatible; Kestay said that such an upgrade is on the list of future improvements and there is no reason (in principle) that it can’t be done. However, there have been a large number of retirements recently from the ISIS team.

Astromaterials Curation Data Initiatives (Stansbery):

JSC curates all NASA astromaterial samples. Its charge is to preserve and protect the samples and to provide for their use in science research. The collection includes Apollo samples, Antarctic meteorite samples, cosmic dust from the stratosphere, Stardust comet and interstellar grains, Genesis solar wind samples, and Hayabusa samples.

Data associated with samples include descriptive information about missions, overview information about collections, information about individual samples, and handling histories. The Astromaterials Curation Database (<http://curator.jsc.nasa.gov/>) contains 20 TB of information; it provides enough context that a scientist should be able to decide which among the available samples is most appropriate for an investigation. A review panel evaluates proposals for scientific merit; permission to *borrow* samples is granted by NASA HQ. Requirements for archiving the results of investigations are set by ROSES.

The individual data bases supporting each collection have slightly different architectures. One current initiative is to place these into a common framework. Another is to upgrade supporting information so that all records are digital — for example, scanning high resolution images and notebooks, some of which currently exist only in hard copy form. A third is to create new mechanisms for characterizing samples (3D images, CT images, etc.). JSC has been working with PDS/IMG for several years to ensure PDS compatibility of the metadata.

Discussion followed on what kinds of information are required for an archive that integrates PDS, Cartography, Curation, and other components of the NASA system. Crichton said he believes PDS4 provides a framework that may be useful; the fact that PDS4 is being used by IPDA increases its reach. Gaddis noted that PDS/IMG is working with JSC on developing compatible metadata so that PDS4 searches can find relevant samples in the JSC data base. There has also been some recent work with samples from Meteor Crater, which have previously been in private hands. JSC has been increasing contacts with international partners — for example, Hayabusa scientists.

New Horizons Report (Kolokolova):

New Horizons was launched in 2006; there was a Jupiter Flyby in 2007, and the Pluto flyby will occur in mid-July 2015. A KBO encounter is planned but not yet fully approved. Data reviews have been conducted in 2007 and 2014; 160 GB of data have been archived. Most of the data delivered so far have been certified with minor liens. Ralph (MVIC and LEISA) and REX calibrated data are not yet certified. Lien resolution has been postponed until after the Pluto encounter.

Raw data from the Pluto encounter will be downlinked by September 2015 and delivered to PDS two months later. The final delivery from Pluto will be in March 2017. The expected volume of the Pluto archive is 45 GB. Simpson raised the problem of radio tracking data that are

not being made available for gravity science even though the REX team has a member selected for that task; Schurr suggested that REX contact the program scientist.

2nd Planetary Data Workshop (Gaddis):

The Workshop will be 8-11 June 2015 at the High Country Conference Center (Northern Arizona University). LPI is handling the meeting organization and logistics. There is a \$325 registration fee (if completed by 11 May). There were 150 attendees in 2012, but the number may be slightly lower this year because of the fee. LPI needs 130 registrants to meet expenses. 72 abstracts have been submitted (compared with 80 last time), and Lisa has received 125 expressions of interest so far. The program is being finalized; there will be a mix of invited speakers, contributed speakers, and other presentations.

ROSES 2015 Data Management Plans (Bernstein):

The biggest change to ROSES is a new requirement that data management plans (DMPs) be included with most proposals. The requirement is being broadly applied across all federal agencies that support research; instrument calls are one of the few exceptions.

Most NASA DMPs will be collected during proposal submission through the NSPIRES interface; A.36, A.37, B.7, and C.7 supersede this procedure by asking for more specific information in the body of the proposal. The ideal DMP will have up to 8000 characters covering:

1. Data types, format, volume, etc.
2. Intended repositories
3. Schedule for delivery and retention
4. Roles of personnel involved in the archiving

Some investigations will not generate archival data; others can meet the requirement by including supplementary data with submissions to journals. Still others will generate data that are not published but which can be delivered to PDS (or an equivalent) at a later time.

No personal, proprietary, or ITAR data should be in the DMP. No proposal will be rejected because of an inadequate DMP; however, NASA may withhold start of a new award until an acceptable DMP has been negotiated.

Martin asked whether NASA will make information from DMPs available to PDS; Bernstein thinks that is feasible for proposals that have been selected. Walker noted that NSF requires a DMP for each proposal; the NSF final report must be approved by the program officer, who can refuse approval if the DMP has not been followed. Bernstein doesn't believe NASA will be so 'draconian', but what the agency might do is still being considered. A'Hearn said that proposals submitted with a letter from a PDS DN verifying that the data would be of interest might prevent late stage disconnects when a data provider is rebuffed by PDS.

Palmer asked whether code developed with NASA funding (for example, a simulator) must be archived with PDS. Bernstein said ‘not yet’; but there may be program exceptions, such as PDART, which uses GITHUB as a software repository.

PDART and PDS (Noble):

PDART received 143 Step 1 proposals in 2014, of which 105 were followed by Step 2 proposals; 25 were selected. Of those selected, 22 PIs have announced intentions to deliver data to PDS — 18 to ATMOS, GEO, or IMG with the remainder spread among other nodes.

Frequently asked questions from proposers include: Does PDS take this type of data? Which node should I talk to? How do I budget for this? The review process last year included only one person with PDS expertise on a sub-panel; Noble would like more PDS experts next year (or a floating PDS person who moves among subpanels). She is willing to receive software or data requests from PDS, which might be offered to potential proposers.

King said the addition of GITHUB was an important new step; Noble agreed, but she said some investigators had trouble making initial contacts with GITHUB.

Grayzeck asked whether PDS should set up a working group to develop new guidelines for archive budgeting. A’Hearn thinks developing a costing tool would be difficult at this point because we don’t have enough experience. Simple R&A archives may be straightforward; mission archiving is much more complicated. Gordon suggested that costing questions should be referred to an appropriate DN in lieu of publishing a costing algorithm.

Persistent Identifiers for PDS Data (Statler):

Statler has been with the Planetary Science Division at NASA HQ since the beginning of the year. His previous experience was with NSF, where he worked on ‘persistent identifiers’ which are long-lasting, location-independent, and globally unique. The digital object identifier (doi) is the predominant identifier in scholarly publishing; each is resolved at <http://dx.doi.org>.

The International DOI Foundation provides governance and management for the federation of registration agencies providing DOI services. Primary entities in the U.S. are CrossRef (primarily for publications) and DataCite (primarily for data). CrossRef costs are typically borne by publishers; DataCite provides services for a fee. The two entities are now officially collaborating.

The Department of Energy (DoE) Office of Scientific and Technical Information (OSTI) is a member of DataCite. Statler wondered whether PDS could work with OSTI? Data sets would not be uploaded or stored at OSTI; instead, registration records would be on its web service URL. PDS would submit and edit data set registration records through OSTI. To complete registration, PDS would have to ensure that data sets would be available indefinitely.

The following information would be involved in registration: an OSTI ID (issued upon submission); a doi (also issued upon submission); the data set title; the creator or author; the originating organization; the publication date; the URL of the landing page for the data set; and contact information for a cognizant individual familiar with the data set.

Statler discussed cost briefly, estimating that registering the PDS3 holdings would cost a few thousand dollars per year; but he was unable to defend this number when Raugh and others asked what would be registered. Several noted that billions of individual PDS4 data products would probably cost a lot more than a few thousand PDS3 data sets. King said he has had interactions with similar services (*e.g.*, Thomson-Reuters); the cost depends on granularity at which the data are registered. **CRICHTON ACCEPTED AN ACTION ITEM TO FOLLOW-UP ON THE REGISTRATION COST QUESTION.**

Raugh also questioned the requirement for a ‘landing page’ for each registered product; SBN does not have URLs for most of its products. She is also concerned about the issuing process since permanent identifiers may need to be assigned in a pipeline for products that are still in development. Statler said OSTI is willing to reserve prefixes. King and Showalter thought that the granularity could be adjusted — registration for data sets and collections could be for bulk data, while particularly important or popular individual products could also be given a doi. Raugh asked how much of the registration would be manual; King felt that at least parts of the process could be automated.

One advantage of using doi is that there is software that counts doi references in publications whereas there is no comparable tool or service that counts LIDVIDs (or LIDs).

For more information, Statler recommended looking at OSTI’s document *Interagency Data (IAD) Web Service* or contacting Mark Martin (martin.m@osti.org).

Dawn Report (Palmer):

Pre-Vesta data are mostly archived or certified; remaining lien resolution is slow, however. Vesta Level 1 and 2 data are mostly done. Level 1B GRaND data have been certified with minor liens. Framing Camera and VIR Level 2 data are not archived. Framing Camera mosaics have been submitted and are in review. Vesta higher-level products are lagging, mostly because of coordinate issues and required reprocessing; but most of the higher level products were never defined in the data management plan, so have never been guaranteed. It is not clear how much leverage PDS has on instrument teams that are based in and funded in Europe.

Ceres Coordinate System: Everyone involved wants to avoid the issues that came up at Vesta. IAU has delegated coordinate system review authority to PDS/SBN. Dawn will use 9 May observations (RC3) to determine the Ceres coordinate system, which will be documented in a report submitted to SBN. There is every expectation that the coordinate system will be consistent with the IAU update procedure. The review is planned for June; data delivery is

expected in August. Level 1A data will be reviewed shortly after, followed by Level 1B. High level products should be reviewed by the end of 2016; but they are largely undefined.

MAVEN Report (Mafi):

The Release #1 PDS delta review is in progress (March-April), revised products are due on 2 May, and Release #1 goes public on 15 May. Information Model v1.4.0.0 is sufficient to describe the CDF data structure. However, SEP and in-situ KP data and updated SISs are overdue; KP is also using 'NaN' in data files, which is not allowed by PDS. MAVEN labels are being prepared. LDDs are used to describe CDF logical structure. PPI has responded to AI 2014-11-18/03; a new appendix was distributed to MC about a week ago. LPW, SEP, KP, and (possibly) MAG are in jeopardy of not making the 15 May release date.

CDF-A (King):

A team of about ten people from a number of institutions and disciplines looked at CDF with the intent of specifying an archival format (CDF-A). Ray Walker noted that resistance from the heliophysics community was much lower than when the subject of archival formats was raised a few years ago. The document that resulted has been posted at

<http://ppi.pds.nasa.gov/doc/CDF-A-Specification-v1.0.pdf>

According to the new specification, CDF meets a minimum set of requirements for archiving when:

- A. The file contents comply with a released version of the CDF format specification.
- B. The file includes at least a minimum set of metadata as defined by the ISTP metadata guidelines with SPDF extensions
- C. All data variables which are part of the CDF file are included in the same file.

Specific requirements include:

- 1. The CDF must adhere to specification version 3.4 or later
- 2. No compression
- 3. No 'unused' records
- 4. No 'fragmented' variables
- 5. No 'sparse' variable
- 6. No 'virtual' variables
- 7. Storage must be in row major order
- 8. Only zVariables are used for data.

Is CDF-A Consistent with PDS4 Archiving Principles? (Gordon):

Showalter questioned the PDS direction regarding CDF at the January MC telecon — specifically questioning whether PDS had abandoned design principles thought to have been accepted during the early stages of the PDS4 development. Although there appears to be no unambiguous documentation of these principles, Gordon has found the following in notes from a PDS Tech Session meeting in June 2009:

The data model:

- Is defined in a formal language
- Is independent of implementation
- Defines a few fundamental data structures that do not evolve over time
- Is extensible, enabling it to handle more complex data formats
- The archive data formats shall be designed independent of data provider and data consumer formats
- The data architecture shall include a standard data dictionary model

Mitch echoed Showalter's January remarks in wondering whether this is an accurate representation of the original design philosophy? If so, does PDS still follow the philosophy? If not, what needs to change?

After a brief discussion on the design principles, Gordon moved on to an example MAVEN/PPI/CDF product. A tiger team was established in January to evaluate whether such products could be interpreted using only the information available in the PDS4 label. Mitch was a member of the tiger team, and he proceeded to dissect one SWIA file. He could not understand how some of the axes were defined and he was never able to obtain additional information that would allow him to move farther. For him, the exercise was unsuccessful.

On the basis of that result, Mitch recommended:

1. Do not permit CDF as a primary archive format
2. Do preserve and distribute the data in CDF-A as a contemporary format

He suggested introducing a new PDS4 product — perhaps Product_Contemporary, which would be similar to Product_Native. This would treat CDF-A as an encoded byte stream. PPI would then need to generate the 'acceptable' archive in a format that met PDS4 basic structures requirements. This would approximately double the total data volume because there would be two roughly similar binary files.

Several noted that IPDA members wish to use CDF as a primary archive format; Mitch's proposal would force them to do more work and archive more bits. Rough would like to see some of this discussed as a 'translation' question — are there tools that can be used to convert CDF-A to other formats (and back)? If not, can they be developed? Huber argued that the physical structure of CDF-A meets PDS4 requirements; therefore CDF-A should be allowed. King would like MC to bring this discussion to a close.

Executive Session (McNutt):

CDF in PDS: Showalter suggested that MC resolve the CDF-A question; there seem to be no positives in continuing to drag this out, and there are considerable negatives. McNutt agreed.

Walker said that PPI has spent the past couple years working toward a MAVEN archive based on CDF. The format itself has been around for 30 years. No one needs to know whether CDF metadata are buried in the files. He is afraid that a rejection of CDF-A will drive away international partners. In the end, Ray favors the current direction — a PDS4 label on a constrained CDF file (now limited by the CDF-A specification).

Arvidson asked about the dual-format possibility; what would be involved in generating a second version of each product where the second version complies with ‘classical’ PDS4 basic structure requirements? Walker said the work falls onto PPI, but it is not out of the question; PPI has agreed previously to do this if it were required.

A’Hearn said he was disturbed that Gordon was unable to extract numerical data from the SWIA files; we need to stay with relatively simple formats for archiving.

McNutt reminded attendees that New Horizons uses FITS for all data products; in some ways, these CDF issues mirror those with FITS. That is, the data objects are constructed to an external specification; but the user does not need to know this. A PDS4 label provides a complete description of the format and content of each product.

Schurr asked what the future holds. Beebe is concerned that an outright rejection of CDF would be interpreted badly by IPDA partners. On the other hand, she does not think IPDA partners will have trouble creating PDS4 labels for CDF-A files.

Simpson said the problem has 4 possible solutions. PDS can accept

1. CDF-A as an archivable format (*e.g.*, an approved encoded byte stream) with its own label and no conversions
2. the current PPI solution — the CDF-A file including CDF headers and a detached PDS4 label; but the label and documentation must work for PDS4 users.
3. dual data files — the original CDF-A and a converted file with a label describing both
4. a converted file with a PDS label (and no CDF-A file)

Dick was not ready to accept (1) and felt (4) is a non-starter because of IPDA concerns. Option (2) still seemed viable and is much less work than (3); but the PDS4 labels and documentation *must* work for the PDS community.

Discussion moved toward a solution in which the dual-label CDF-A file remains the preferred solution. PPI was asked again to upgrade the PDS4 labels (and documentation) so that products could be used for science without the need for CDF tools and software. By a vote

of 7-2 (RINGS and SBN dissenting) MC agreed to this resolution. Several action items followed:

WALKER AGREED THAT PPI/MAVEN WILL PROVIDE NEW EXAMPLES WITH UPGRADED LABELS THAT CAN BE REVIEWED BY MC-RECRUITED VOLUNTEERS BEFORE THE MAY MC TELECOM.

BEEBE AGREED TO FIND AT LEAST ONE REVIEWER IN THE UV COMMUNITY, WHICH SOMETIMES USES CDF, TO EVALUATE THE EXAMPLES BEFORE THE MAY TELECON.

SIMPSON AGREED TO REVIEW THE EXAMPLES AND REPORT TO THE MAY TELECON.

Action Items: Action Items and Engineering Node Directives were reviewed; results are shown in the attached lists.

Adjournment (McNutt):

McNutt adjourned the Tuesday session shortly after 18:00 local time.

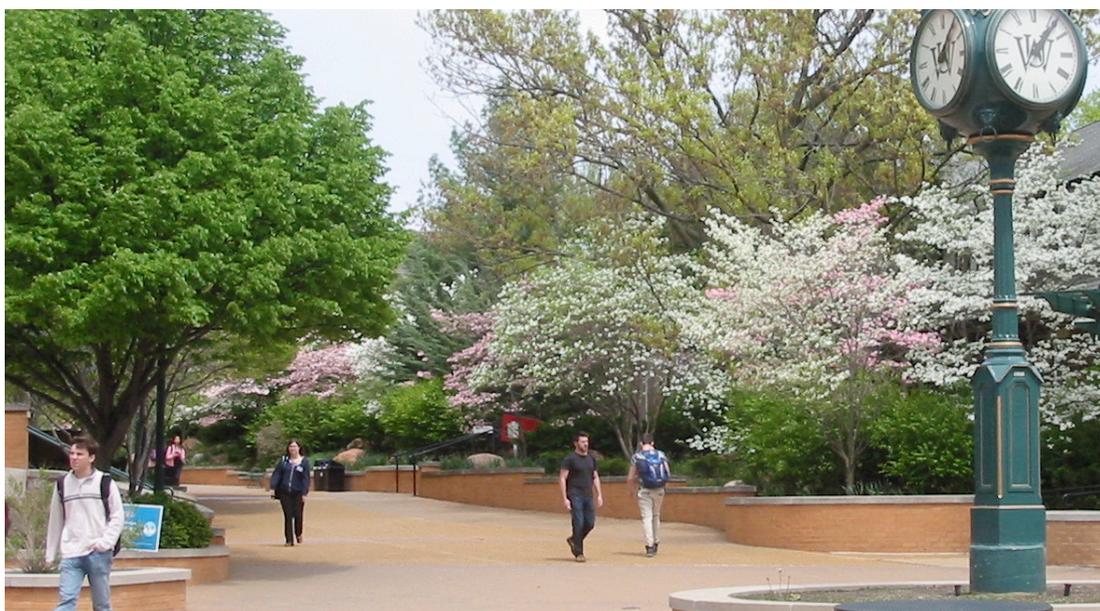


Part of the GEO host team. Rear: Ray Arvidson. Front, left to right: Dan Scholes, Susie Slavney, and Ed Guinness (IMG_4487.JPG).

Planetary Data System Management Council Meeting
22 April 2015 – Face-to-Face Meeting (Day 2 of 2)
Student Technology Center, Gregg Hall
Washington University, St. Louis, MO

Notes from the PDS Management Council (MC) face-to-face (F2F) meeting by Dick Simpson. This was a two-day meeting. These are detailed minutes from Day 2; minutes from Day 1 precede these, and an executive summary is first. Action Items, in **UPPERCASE RED**, are embedded within the detailed narrative and are also summarized at the end. Presentations can be found on the meeting web site at:

https://wufs.wustl.edu/meetings/pdsmc_apr2015/



Walkway near the meeting site (IMG_4491.JPG).

Participants:

Chuck Acton (NAIF)	Todd King (PPI)	Anne Raugh (SBN)
Mike A'Hearn (SBN)	Bill Knopf (NASA HQ)	David Schurr (NASA HQ)
Sterling Algemissen (MGSS)	Ludmilla Kolokova (SBN)	Dan Scholes (GEO)
Lars Arvidson (GEO)	Emily Law (EN)	Boris Semenov (NAIF)
Ray Arvidson (GEO)	Joe Mafi (PPI)	Mark Showalter (RINGS)
Reta Beebe (ATM)	Mike Martin (Mgmt) [#]	Dick Simpson (RS)
Nancy Chanover (ATM)	Pat McCaslin (NSSDCA) [#]	Susie Slavney (GEO)
Amy Culver (IMG/JPL)	Stef McLaughlin (Mgmt)	Eileen Stansbery (JSC)
Andy Downen (AMMOS)	Ralph McNutt (CS)	Tom Stein (GEO)
Lisa Gaddis (IMG/USGS)	Tom Morgan (PM, GSFC)	Ray Walker (PPI)
Mitch Gordon (RINGS)	Lynn Neakrase (ATM)	June Wang (GEO)
Ed Grayzeck (Mgmt)	Carol Neese (PSI)	Dave Williams (NSSDCA) [#]
Ed Guinness (GEO)	Jordan Padams (IMG+EN)	[#] by phone
Sean Hardman (EN)	Dan Price [#]	
Steve Hughes (EN)	Costin Radulescu (MGSS)	

Housekeeping (Morgan):

Morgan called the meeting to order at 08:20 local time, noting that agenda changes should be expected in real-time. Stein invited attendees on a mid-day tour of the GEO facilities.

InSight and Mars 2020 Reports (Guinness):

InSight will be launched in March 2016 and lands in September. SIS and EDR peer reviews are scheduled this year, starting in May. Instruments include:

- Heat flow and physical properties package (HP³/RAD)
- Seismometer (SEIS) — data are in SEED format plus ASCII tables
- Instrument Deployable Arm (IDA) — data are in CSV tables; there are some Export Administration Regulations (EAR) issues associated with descriptions of arm operation
- Rotation and Interior Structure Experiment (RISE) — radio tracking; raw data need to be sorted for more efficient archiving
- Meteorology Package (APSS/TWINS)
- Magnetometer (MAG) — added for SEIS calibration
- Cameras (IDC/ICC) — instrument specs and delivery are still pending

PDS4 tools are needed for bulk label generation from templates and for content validation to confirm that the label describes (structurally) what is in the data product.

Mars 2020 carries 8 instruments generating data:

- X-ray lithography
- Ground penetrating radar
- Raman and luminescence scanner
- Cameras (3)
- Oxygen analyzer
- Meteorological package

There will be a SPICE archive. The first DAWG meeting was held last week; it will meet every two months, chaired by Nicole Spanovich, who brings experience from MER and MSL. There is a PDR this fall; a draft archive plan and team-to-PDS ICDs are needed before the review. Data will be handled by JPL's Instrument Data System (IDS, formerly MIPL).

David Schurr mentioned that the 'cache' is also an important part of the Mars 2020 mission. After discussion, there was agreement that Eileen Stansbery should be involved.

OSIRIS-REx Report (Neese):

Instruments include:

- Camera suite
- Laser altimeter
- Thermal emission spectrometer
- Visible and IR spectrometer
- Sample collection instruments
- Regolith X-ray imaging spectrometer

Data product design reviews are in progress, delayed six months until PDS4 design and tools stabilized; pipeline reviews are scheduled next year. Launch is in September 2016. There is an Earth gravity assist in 2017; data from that encounter will be reviewed in early 2018. The spacecraft arrives at Bennu in October 2018.

Relations between PDS and OSIRIS-REx have been very good. Having a single archive lead (Kate Crombie) on the mission side improves coordination, and focus on early planning has kept bottlenecks to a minimum. Crombie was a Ph.D. student under Arvidson, so she has a long track record in which archiving played an important role. The configuration-controlled pipeline streamlines review. Teams will be using PDS products, which maximizes science review.

AMMOS-PDS Pipeline Service (APPS) Update (Algemissen):

APPS includes a label design tool (LDT); transformation, validation, and report services; a bundle builder; and an APPS web console that will automate label design and generation. InSight is designing PDS4 labels based on Phoenix PDS3 labels using APPS; Mars 2020 is considering APPS. There have also been discussions on collaboration with SBN and PPI.

Current work is focused on LDT updates and transformation implementations. Final delivery is scheduled for 2015-06-29. Test and integration will follow and the project will wind up in October. There will be an APPS presentation, poster, and workshop at the Planetary Data Workshop in Flagstaff in June.

Schurr asked how he can levy the right requirements on missions entering Phase A; he has four such missions this year (Europa and three Discovery preliminary selections). It is easier to establish best practices at this stage than later. What should be required in the CSR report to ensure the best archive? **MORGAN ACCEPTED AN ACTION ITEM FOR MANAGEMENT TO WORK WITH MICHAEL NEW TO SET REQUIREMENTS.**

Challenge Update (Grayzeck):

A series of contests supported by the NASA Tournament Lab (NTL) has been created at the rate of approximately one per year since 2012. DNs involved so far have included SBN and

RINGS. The most recent contest was a search for new structure in Saturn's rings; one tool was able to work through 30,000 images after showing about 67 percent success rate and 'learning' in preliminary tests (on 800 images). The problem so far has been too many false positives.

NTL recommends that another contest be scheduled with PPI in 2015; but there is a question about funding. Some support may be available through NASA's Science Mission Directorate.

PDS4 Status (Law):

The system is operational and under configuration control. LADEE data have been ingested and are being distributed; MAVEN ingestion and distribution will begin in May. InSight, BepiColombo, OSIRIS-REx, ExoMars, JUICE, Hyabusa-2, and Chandraya'an-2 are expected to use PDS4.

Build 5b was delivered at the end of March and is undergoing integration and test; no serious anomalies have been discovered. Major 5b components include the Harvest, Catalog, Generate, Transform, and Validate tools and the Registry, Search, Transport, and Report Services. The Information Model has been updated to v1.4.0.0; document and software updates are in progress.

Geometry and Cartography local data dictionaries (LDDs) are nearly ready for review. The Geometry LDD captures requirements from across disciplines; the work is currently focused on flyby, orbital, and landed missions; some requests from InSight are being incorporated before the dictionary is released for review by the end of April. When that happens, it will be available on the PDS4 Schema web page.

The PDS/NSSDCA interface is being redesigned for PDS4, which is product-based rather than volume-based. Goals include making deliveries automatic, providing the ability to recover individual products, and performing integrity checks. A detailed definition of the ingest process should be finished within the next two months. Operations procedures, including design of an automated submission interface, will be refined by late 2015.

Every DN has a version of PDS4 software installed. GEO has Build 5b; ATM and RINGS have Build 5a, and other nodes have Build 4b. Node logs have been successfully transferred to EN, but some flow more smoothly than others; Hardman hopes to base the April system report on these inputs. Mike Martin asked whether there is a way to remove internal DN traffic from the logs, and Tom Stein asked whether EN assumes the logs are unfiltered. Dan Scholes said he filters out known bots from the GEO logs; but Sean and Jordan said they assume the DN logs are unfiltered.

Build 6a development plans include an emphasis on content validation, developing and deploying a Software/Tool Registry, implementation of a rudimentary Tracking Service (archive and certification status), and continuing to integrate registry content and search results with available tools and services.

Mike Martin asked how the system is handling attributes such as file creation date, MD5 checksum, and file size, which are optional in most labels. CCB-103 was submitted to make these required; but DDWG recommended against forwarding it to CCB. Hardman can capture some of this information (such as file size) during ingestion; but there was skepticism that <creation_date_time> is definitive, and the fact that <md5_checksum> cannot protect against label corruption means that requiring it only for data files would have limited value.

NSSDCA Report (Williams):

No ingestion or archiving problems have been reported. Before this meeting, NSSDCA archive status reports were sent to DNs as requested by MC. All five LROC volumes received from IMG on Network Attached Storage (NAS) devices have been ingested. NSSDCA now has a 10 Gb/s connection from its servers to a router connected to Internet2 and a 40 Gb/s backbone; only GEO is known to have a comparable setup, but the transfer rate between NSSDCA and GEO has been lower than expected. NSSDCA is looking at using multiple streams to increase effective transfer rate.

CCB Report (Neakrase):

Since the 9 March MC telecom, CCB has closed 7 SCRs and seen 6 more opened; 13 (total) are currently open. CCB-75, 81, 82, and 92 were closed because other SCRs covered similar ground. CCB-108, 109, and 110 were approved for implementation. The work level is expected to increase as PDS moves out of the v1.4.0.0 deployment period. For details, see

<https://pds-engineering.jpl.nasa.gov/content/ccb>

Morgan announced that rotation of CCB members will be postponed until September, when results of the CAN selection will be known. There were no objections from node managers.

Node Concerns: (Morgan):

Tom asked for the top concerns at DNs over the next 3-4 months — that is, what will worry node managers the most between now and announcement of the CAN selections?

GEO (Arvidson): Guinness noted that GEO and InSight need PDS4 tools for bulk label generation from templates and for content validation to confirm that the label actually describes what is in the data product. **LAW ACCEPTED AN ACTION ITEM ON BEHALF OF EN TO ADDRESS THESE ISSUES.**

GEO also needs quick action on CCB-91 and CCB-111. **THIS WOULD BE AN ACTION ITEM ON DDWG; IT WAS ASSIGNED TO HUGHES.**

SBN (A'Hearn): SBN remains concerned about PSA's policy of releasing data to the public after only machine validation. To make matters worse, the software which does the validation (Dval) has been deployed to the instrument teams very late. A'Hearn expects to be receiving a very large volume of Rosetta data in the second half of May.

RS (Simpson): CCB-90 authorized line-feed <LF> as a single character delimiter for records in Stream_Text, Table_Character, and Table_Delimited. It was endorsed by DDWG and approved by CCB in December; but Showalter requested that MC reconsider the decision in January. The discussion was never completed, and CCB-90 has not been implemented in the Information Model v1.4.0.0 even though PPI would like it for the MAVEN archives next month.

Several argued for returning to the original <CR><LF> requirement while others favored relaxing the requirement to accommodate other delimiters. All agreed that taking no action was unacceptable. Through discussion, the choices were reduced to (1) rejecting CCB-90 and (2) amending the PDS standard for delimiter separated variables (Standards Reference 4C.1) to allow the <LF> delimiters followed by a number of revisions to the Information Model which would allow <LF> in some circumstances while retaining the <CR><LF> requirement in others.

By a 5-2 vote (with two members not voting), MC chose to reject CCB-90. There was no vote on the second option, it having been rendered moot by the first decision.

Action Items (McNutt):

Action Items (AIs) and Engineering Node Directives (ENDs) were reviewed. Current status is shown in the attached lists.

Executive Session (McNutt):

PDS4 Design Principles: Showalter reviewed the principles from June 2009 (see "Is CDF-A Consistent with PDS4 ..." Section in Day 1 minutes). The data model:

- Is defined in a formal language
- Is independent of implementation
- Defines a few fundamental data structures that do not evolve over time
- Is extensible, enabling it to handle more complex data formats
- The archive data formats shall be designed independent of data provider and data consumer formats
- The data architecture shall include a standard data dictionary model

Mark added that he thought there was a seventh principle: logical and physical structures should coincide where possible.

Arvidson said he thinks everyone subscribes to the principles, but there are sometimes extenuating circumstances. He hopes CDF-A is an extreme and that we won't run into anything comparable in the near future. Simpson asked whether there were any objections to the principles; if none, he would make an appropriate note in the minutes. No one objected.

Beebe wondered whether the discussion reduces to removing point 4 (on extensibility). She said that the decisions yesterday place CDF and FITS on the same level; they are both important to their communities, and we need to make those kinds of accommodations.

McNutt said the design principles will be in the PDS strategic plan. Can we step back, take a deep breath, and hammer out some good language that will go into the plan (on this and other topics)?

Morgan asked whether we are developing a strategic plan, a Roadmap, or both? David Schurr said it's something that can be decided later; a strategic plan and a Roadmap can be two versions of the same thing.

CCB Operations: Morgan suggested that the first item on the MC agenda (perhaps every 3-4 months) should be review of recent CCB actions. Showalter wondered whether a two-thirds vote (rather than a simple majority) might be a better requirement for CCB approval.

Adjournment (McNutt):

McNutt adjourned the meeting at 14:40 local time.



Charles F. Knight Center (middle of three buildings) from the south (IMG_4507.JPG).

Planetary Data System Management Council Meeting

21-22 April 2015

MC Action Items

Ordered by date of origin; current status is given in **red**;
action items which have been overstruck will be removed from future versions of this list.

~~2014-02-10/01 (Vilas, ASAP): Continue MC discussion of proposed geometry policy via e-mail. Vilas has not continued the discussion, but she will do so shortly. Closed by the passage of time.~~

~~2014-11-18/03 (King, 2015-04-17): For MAVEN SISs that do not have descriptions of file structure in PDS4 terms, write chapters that provide those descriptions. Todd will write the new chapters when the Local Data Dictionaries have been completed for the initial MAVEN release. The due date was changed. Superseded by new action items from the 2015-04-21 executive session.~~

~~2014-11-19/08 (Knopf, ASAP): Investigate at NASA HQ what would be required to set up a cooperative agreement with Thomson Reuters. Effectively superseded by the doi presentation and discussion on 2015-04-21 and the subsequent END assigned to Crichton on costing doi registration.~~

2014-11-19/09 (Mafi and Huber, 2015-05-11): Review DPH to determine whether text meets expectations of MAVEN/LADEE in their lessons learned. Huber believes the DPH needs little change; mission problems can be traced to failures to contact PDS personnel, which is a frequent recommendation in the DPH. Mafi said his review is still in progress and he expects to need DDWG help. There are special issues with DPH Appendix F. All were reminded that the current round of document updates is in progress and needs to be wrapped up by approximately April 15. Due date changed to 11 May.

2014-11-19/13 (Walker and Grayzeck, 2015-05-01): Write a two-paragraph statement of the CDF transformation problem to be posed as a Challenge. Added Grayzeck and changed due date.

~~2015-01-12/01 (All, ASAP): Nodes needing more FY15 money should contact Knopf. Closed.~~

~~2015-01-12/03 (Morgan, 2015-04-21): Schedule discussion and possible override vote on CCB-90 during the February MC telecon. Done. Closed.~~

~~2015-01-12/04 (Morgan, 2015-04-21): Schedule continued discussion on PDS guiding principles during the February MC telecon. Due date changed to April MC F2F. Closed by executive session discussion on 2015-04-22.~~

2015-02-09/01 (King; 2015-03-09): Provide a reasonably detailed schedule acceptable to PPI for incorporating (or not) CDF Tiger Team suggestions into the MAVEN archiving pipeline. Closed.

- ~~2015-02-09/03 (Grayzeek; 2015-03-12): Inquire at NASA HQ about possible restrictions on attendance at the 2nd Planetary Data Workshop in June. There are no known restrictions. Closed.~~
- ~~2015-02-09/04 (All; 2015-03-31): Make reservations at Knight Conference Center for accommodations during the April MC F2F at Washington University. Closed.~~
- ~~2015-02-09/05 (All; ASAP): Send Michael New thoughts on what NASA archiving should look like in 2040. New is moving forward, having received no input from PDS. Closed.~~
- ~~2015-03-09/01 (King; 2015-03-11): Distribute broader set of CDF examples for MC review. Remains open as a parallel action item to new ones added during the 2015-04-21 executive session. Superseded by 2014-04-21 action items.~~
- ~~2015-03-09/02 (Rough; 2015-03-13): Forward PDFs documenting early discussion of what constitutes a suitable science data archive to King. Closed.~~
- ~~2015-03-09/03 (King; 2015-04-21): Circulate draft definition of 'suitable science data archive' to MC. Closed.~~
- ~~2015-03-09/04 (New; 2015-03-13): Circulate HQ draft definition of 'suitable science data archive' to MC. Done. Closed.~~
- ~~2015-03-09/03 (Arvidson; ASAP) Buy a new phone for Susie and Ed. The existing phone produces 'propeller' noise even when muted. Closed.~~
- 2015-04-21/01 (All; ASAP): Contact McNutt if interested in participating in reviewing governance documents and related materials and doing ground work in preparation for the new PDS Roadmap.
- 2015-04-21/02 (Walker; 2014-04-30): Provide new example MAVEN CDF data files with upgraded labels for review by MC-recruited volunteers.
- 2015-04-21/03 (Beebe, 2015-04-30): Recruit at least one member of the UV community to review the new MAVEN CDF products and report to the May MC telecon.
- 2015-04-21/04 (Simpson, 2015-05-11): Review new MAVEN CDF products and report to the May MC telecon.
- 2015-04-22/05 (Morgan, ASAP): Management to work with Michael New to set requirements for best data management and archiving practices for missions entering Phase A.
- 2015-04-22/06 (Shaya; 2015-05-11): Review new MAVEN labels with PDS4/IDL software at SBN.

2015-04-22/07 (Morgan, ASAP): Develop language which will advise potential proposers regarding archive costing.

Planetary Data System Management Council Meeting
21-22 April 2015
Directives to EN

Ordered by date of origin; current status is given in **red**;
EN directives which have been overstruck will be removed from future versions of this list.

2015-02-09/A (Hardman, **2015-04-15**): Distribute requirements for PDS tools. **Hardman believes the discussion was primarily about validation. He is working on validation requirements and should have those completed within a month. Remains open as of 2015-04-21. New due date end of April.**

2015-04-21/A (Crichton, 2015-05-11): Investigate DOI registration costs presented by Tom Statler.

2014-04-21/B (Law, ASAP): Ensure that GEO and InSight have PDS4 tools for bulk label generation from templates and for content validation.

2014-04-22/C (Hughes, ASAP): Push CCB-91 and CCB-111 to resolution.

Original (Simpson): 2015-04-24
Clarified Dval deployment status (A'Hearn): 2015-04-24
Added Patty Garcia to list of attendees on Day 1 (Garcia): 2015-04-24
Clarified results of the CDF discussion and what is expected of PPI (Martin, Hughes, Simpson): 2015-04-27
Added Feng Zhou to list of attendees on Day 1 (Guinness): 2015-04-29