

Planetary Science Division Status Report



Jim Green

NASA, Planetary Science Division

June 7, 2016

Presentation at PSS

PSS Membership

- Thank you to Outgoing members:
 - Lisa Gaddis
 - Lori Glaze
 - Candy Hansen
 - Mihaly Horanyi
 - Janet Luhmann

Outline

- Mission Overview
- NRC studies and schedule for the mid-term
- Response to PSS Findings

Planetary Science Missions Events

2014

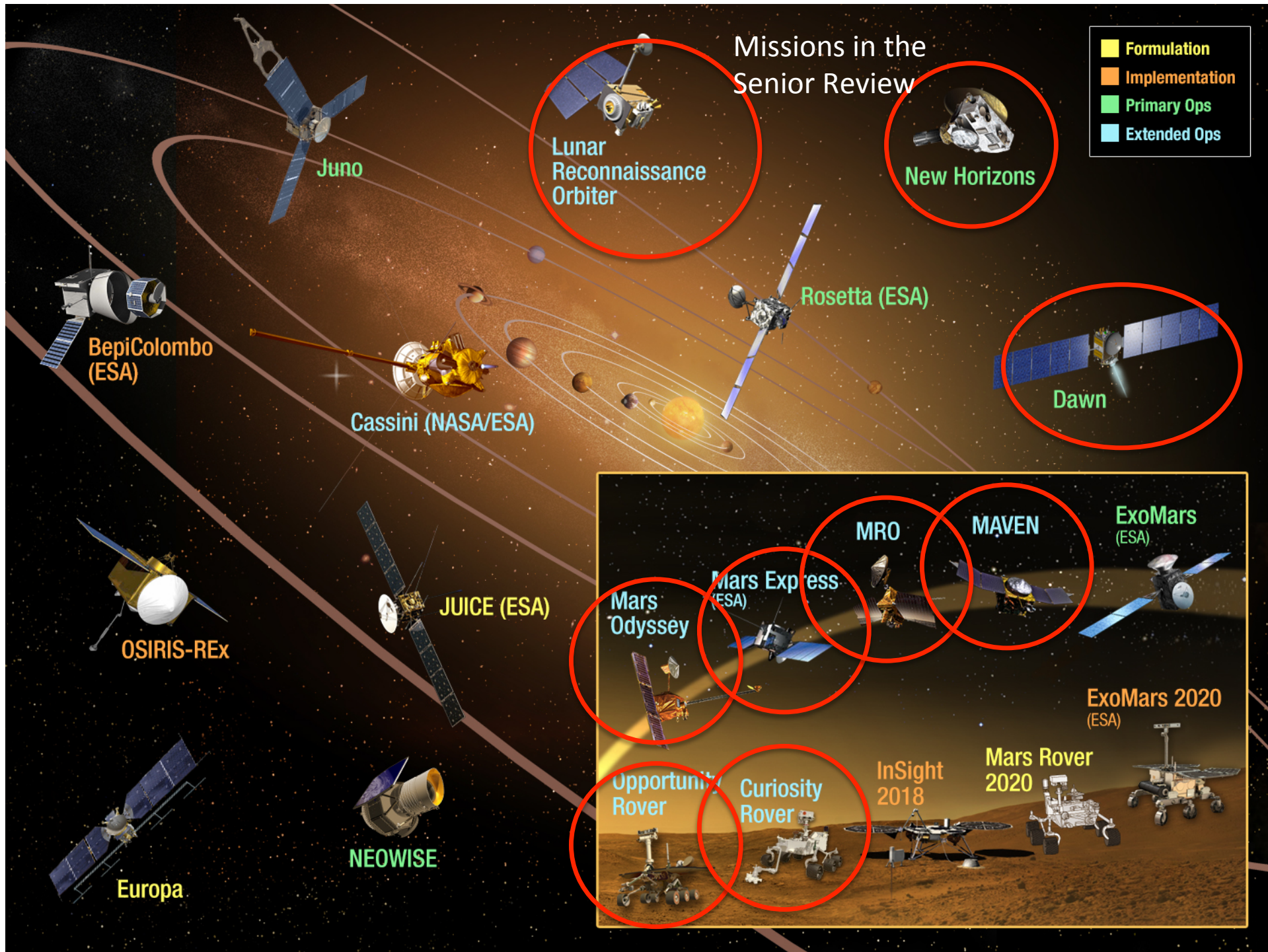
- July – *Mars 2020* Rover instrument selection announcement * **Completed**
- August 6 – 2nd Year Anniversary of *Curiosity* Landing on Mars
- September 21 – *MAVEN* inserted in Mars orbit
- October 19 – Comet Siding Spring encountered Mars
- September – *Curiosity* arrives at Mt. Sharp
- November 12 – ESA's *Rosetta* mission lands on Comet Churyumov–Gerasimenko
- December 2/3 – Launch of *Hayabusa-2* to asteroid 1999 JU₃

2015

- March 6 – *Dawn* inserted into orbit around dwarf planet Ceres
- April 30 – *MESSENGER* spacecraft impacted Mercury
- May 26 – Europa instrument Step 1 selection
- July 14 – *New Horizons* flies through the Pluto system
- September – Discovery 2014 Step 1 selection
- December 6 – *Akatsuki* inserted into orbit around Venus

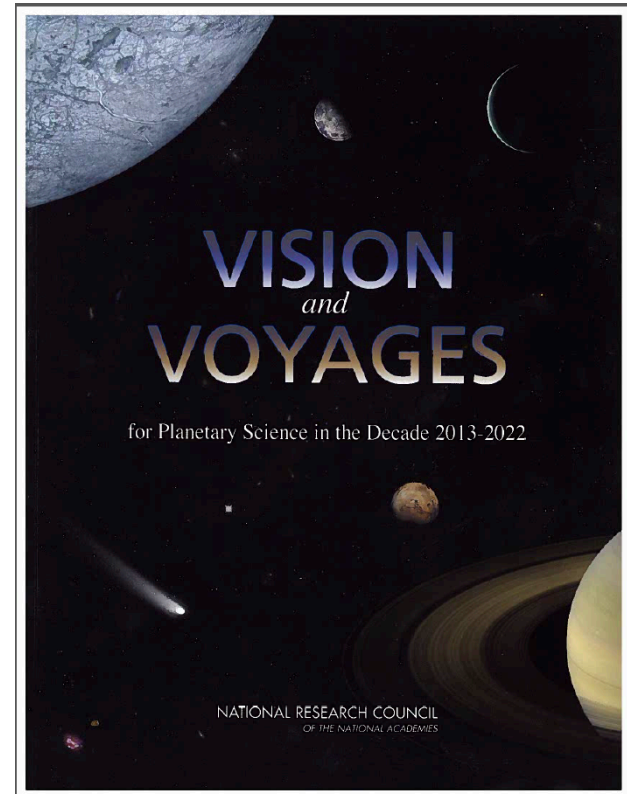
2016

- March – Launch of ESA's *ExoMars Trace Gas Orbiter*
- July 4 – *Juno* inserted in Jupiter orbit
- July 20 – 40th Anniversary of the Viking missions
- September 8 – Launch of Asteroid mission *OSIRIS – REx* to asteroid Bennu
- Cassini* begins plane change maneuver for the “Grand Finale”
- Late 2016 – Discovery 2014 Step 2 selection



Timeline of National Academy Studies

- 1st Planetary decadal: 2002-2012
- 2nd Planetary decadal: 2013-2022
- Cubesat study completed May 2016
- Extended Missions Review:
 - Tasked April 30, 2015
 - Report due to NASA September 2016
- R&A Restructuring Review:
 - Tasked August 13, 2015
 - Report due to NASA December 2016
- Large Strategic NASA Science Missions
 - Tasked March 2016
 - Report due to NASA August 2017
- Midterm evaluation:
 - To be tasked by September 2016
 - Cubesat, Extended Missions, R&A Restructuring, & Large Strategic Missions will be input
 - Expect report due December 2017
- 3rd Planetary Decadal: 2023-2032
 - To be tasked *before* October 2019
 - Expect report to NASA due 1st quarter 2022



PSS Findings from the meeting
on March 9-10, 2016

Europa Mission

- The PSS encourages the plan to carry the lander in a separate, independent spacecraft, which minimizes some of the risk of delaying arrival at Europa. [The PSS looks forward to the Europa Lander Science Definition Team report including how the science goals outlined in the Decadal Survey will be met by the Europa lander, as directed by Congress.](#)
- Response: Per congressional direction NASA is conducting pre-Phase A studies of a Europa lander mission. A Science Definition Team has been established. That final report is due to NASA Headquarters no later than September 30, 2016

Europa Lander Science Definition Team

- The overarching science goals:
 - Search for evidence of biomarkers and/or extant life.
 - Assess the habitability of Europa via *in situ* techniques uniquely available by means of a landed mission.
 - Characterize surface properties at the scale of the lander to support future exploration including the local geologic context
- Established an 18-member Science Definition Team (SDT) to:
 - Define a hierarchy of prioritized science objectives and derived measurements
 - Develop a Science Traceability Matrix (STM) that flows from the top level science goals above through science objectives and derived measurements

Europa Lander Science Definition Team

| Slot | Name | Institution | Comments |
|---|--------------------|-------------------|--|
| Science instrumentalists for biomarkers | Will Brinckerhoff | GSFC | Astrobio MS, SAM and MOMA Co-I |
| Science instrumentalists for biomarkers | Peter A. Willis | JPL | Microfluidics, lab on a chip |
| Applied biomarker detection | Sarah Horst | Johns Hopkins Un | surface comp, MS |
| Applied biomarker detection | Ken Nealson | Univ. Southern CA | Geobio, Astrobio |
| Applied biomarker detection | Alexis Templeton | Univ. Colorado | |
| Life detection in icy environments | Brent Christner | Univ. FL | Life in the cold |
| Ocean composition expert | Chris German | WHOI | Oceanography |
| Salts | Tori Hoehler | Ames | |
| Radiation processing | Chris Paranicas | APL | |
| Surface Ops | Aileen Yingst | PSI | Dep PI MAHLI, Co-I Mastcam and MARDI |
| Compositional Context at landing site scale | Bethany Ehlmann | CalTech | Spectroscopy (multiple instruments) |
| Geophysical Context | David Smith | MIT | laser altimeters, geophysics |
| Geophysical Context | Alyssa Rhoden | ASU | Geophysics, seismology |
| Surface Imaging for geologic context | Ken Edgett | MSSS | Imaging, microscope |
| Europa Geology | Britney Schmidtt | GA Tech | Geology, some geophysics, ice sampling |
| Europa Geology | Alex Hayes | Cornell | Geology, operations |
| Astrobiology | Lunine | Cornell | |
| Origin of Life | Michael J. Russell | JPL | Geochem oceans |

Ocean Worlds

- To maximize the scientific return of the Ocean Worlds initiative, we support NASA's continued engagement of the science community through roadmapping activities, including the Outer Planets Assessment Group's (OPAG) Roadmaps to Ocean Worlds (ROW). These community-based roadmapping activities optimize the balance of research objectives and scope for small, medium, and large missions. The OPAG ROW final report is expected by December 2016 and will provide input for the expected mid-term Decadal assessment.
- Response: Concur. In order to enable future mission opportunities one element of the OW program (as enabled by direct Congressional support) is in the area of technology investment. PSD released in May the COLDTech instrumentation development opportunity.

OW Instrument Technology Development

- Technical development of lander science instruments is needed prior to flight selection
 - Instrument readiness is a concern – many instruments to convincingly detect biomarkers and/or extant life are at low TRL
 - Such development is very applicable and beneficial to many planetary missions in addition to Europa lander
- Issued an instrument NRA (COLDTech) in May 2016 that will be followed by a lander AO at a later date
 - Same process used for the Europa Mission instruments
- This plan provides:
 - Sufficient time for developing instruments, maturing the mission concept, and settling programmatic issues;
 - Flexibility to respond to evolving programmatics and budgets

Ocean Worlds In NF-4

- The PSS encourages PSD to ask the Committee on Astrobiology and Planetary Science (CAPS) to [consider whether inclusion of Ocean Worlds in NF-4 can be done via the processes and practices available to the agency and the community... A major part of that process is the establishment of the science objectives](#) and subsequent confirmation that implementation concepts exist that can achieve those objectives within the New Frontiers cost cap.
- Response: The NAS CAPS was fully briefed on March 29, 2016, concerning the full list of New Frontiers-4 missions being solicited. Science Objectives have been established and released to the planetary science community in an announcement issued on April 24, 2016.

Planetary Science Status:

CAPS Chart, April 27, 2016
Presentation to the SSB

3. Discussed plans for next New Frontier mission AO with Jim Green
 - The draft solicitation for the New Frontiers 4 mission includes a strategic theme - Ocean Worlds - that was not included in the current planetary decadal survey
 - Proposed change does not alter the scientific priorities that are laid out in the current planetary decadal survey
 - Enceladus and Titan are significant elements of the decadal survey, and their inclusion consistent with the overall scientific priorities discussed in the survey report
 - A sound management approach should allow the program manager the flexibility to add elements as the situation changes throughout the decade
 - The peer review process is the appropriate means to rank all of the missions that are proposed for NF-4
 - It is essential that whatever mission is selected for NF-4 must be capable of accomplishing New-Frontier-class science

These slides are a personal assessment of issues discussed during recent CAPS committee meeting, and should not be cited or quoted as the views expressed do not necessarily reflect those of CAPS, the SSB, or the NRC.

Mars Sample Return

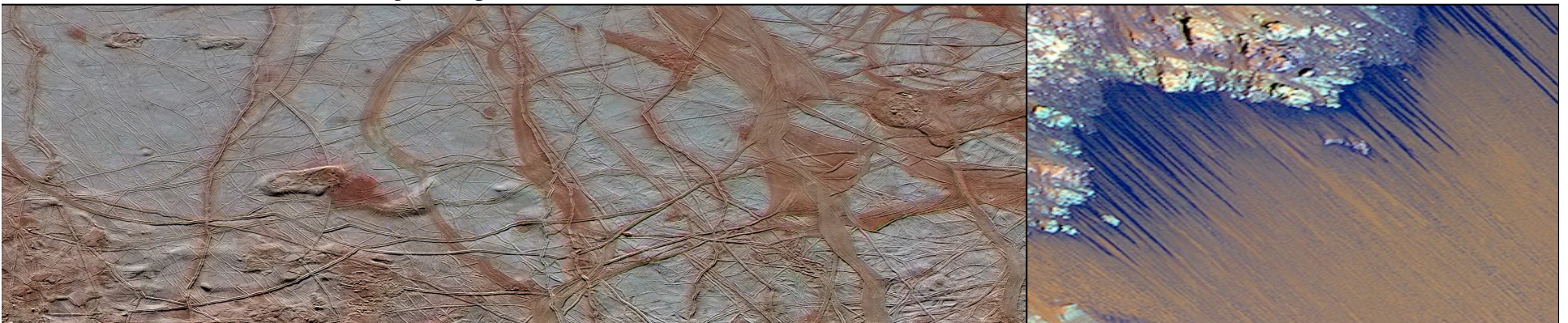
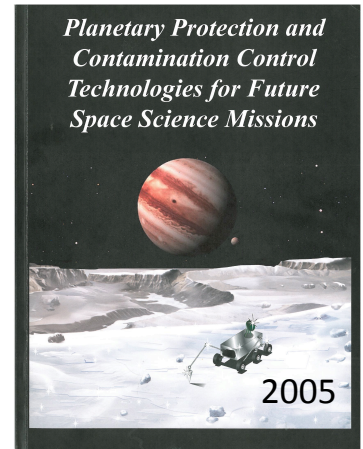
- In light of recommendations from the International Mars Architecture for the Return of Samples (iMARS) and International Mars Exploration Working Group (IMEWG), the PSS recommends a comprehensive and dedicated study of these design concepts in the context of both sample retrieval and a returned sample facility to handle and manage scientific study of samples.
- Response: Concur. This type of analysis has been done previously and will be updated at a later date.

Special Regions

- It is imperative for NASA and the National Academies to address how best to improve communication and to resolve conflicts related to robotic exploration of sites with seasonal or persistent liquid water. For planetary settings like Mars with discrete Special Regions rather than oceans, designation of particular areas of these regions for scientific study should be considered.
- Response: Concur. We are moving into an era of performing more sample return missions and we need to be better prepared to execute the missions and manage the samples. It is recognized that planetary protection will be a critical technology to accomplish these types of future missions. Therefore, I am establishing a Planetary Protection Technology Definition Team. PSD will need to make some wise investments into PP technologies and techniques.

Planetary Protection Technology Definition Team

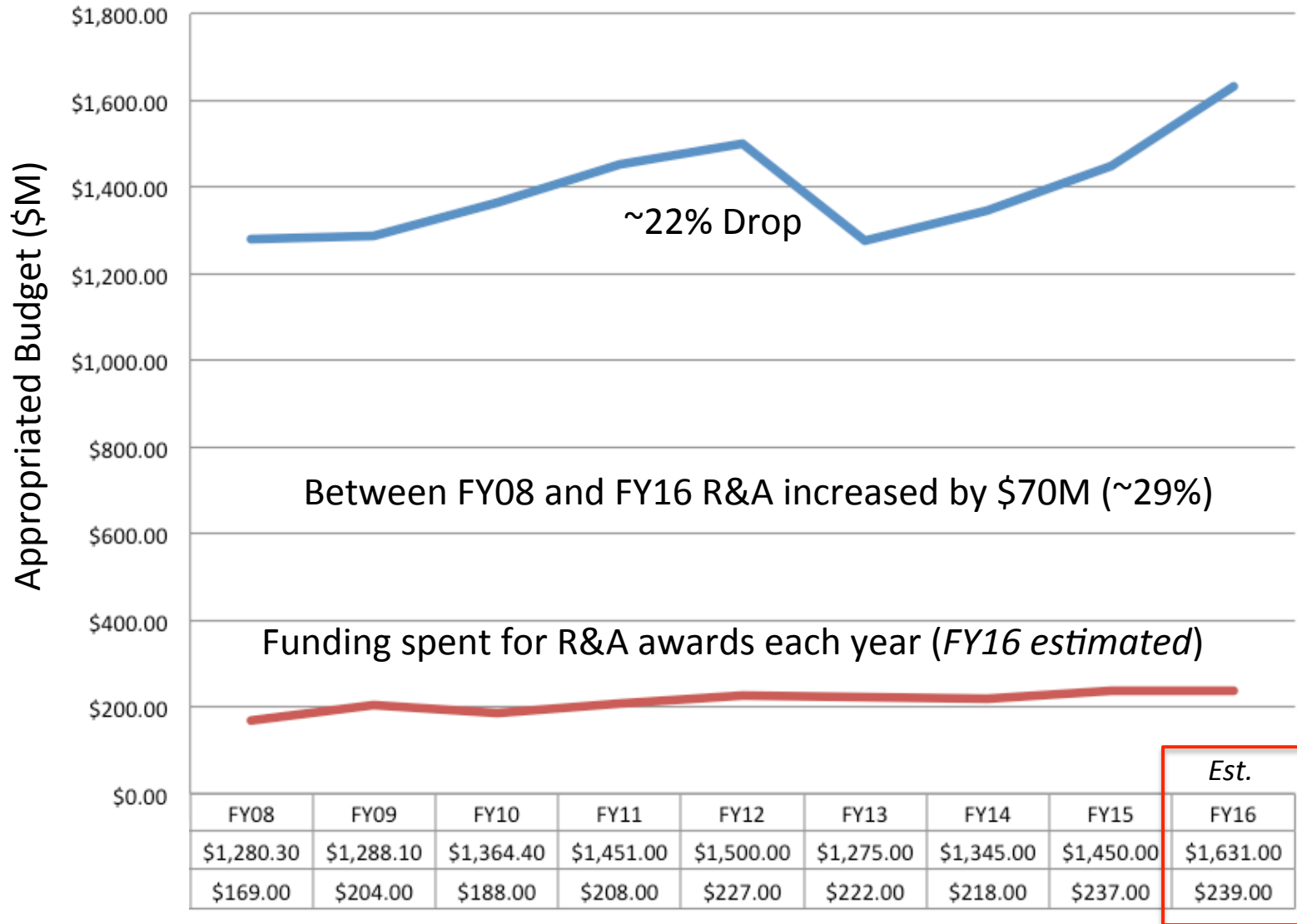
- Delineate planetary protection processes/techniques available or could be available to meet future planetary protection mission requirements
- Catalog materials & components compatible with planetary protection protocols
- Identify areas for technology development to verify processes or improve material compatibility
- Establish Team in late spring; report out by November
- ***Expected outcomes:***
 - ***Initial processes, techniques, and compatible materials list***
 - ***Identification of near-term research activities applicable to missions***
 - ***Provides Input for a Solicitation in ROSES 2017***



Assessment of Reorganized R&A

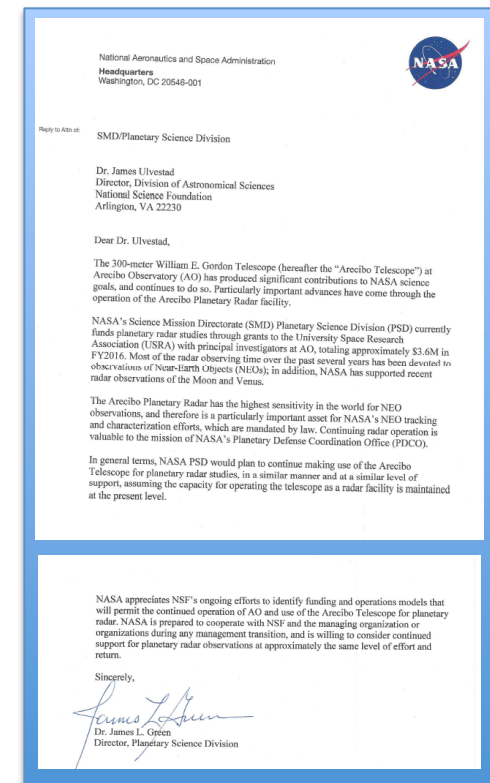
- One concern noted by the PSS is that the selection rates described (average of ~21%) may mean that an investigator can receive scores of Very Good (4.0) or Very Good/Excellent (4.5) and still not be selected for funding by NASA....[The PSS recognizes that one solution to this problem is more funding, and encourages NASA to continue to work to increase the level of funding for R&A programs in future years.](#)
- Response: From FY13D FY15 the Planetary Science Division's Budget was at levels below the FY12 budget. During this time period it was not possible to increase the R&A budget in any significant way but it did remain the same. As the PSD budget increases over time we will be able to provide additional funding.

Planetary Science Total + R&A Budget



Arecibo Observatory

- There is concern about a potential NSF divestment in Arecibo facilities and maintenance. The PSS encourages NASA to continue its current support of Arecibo and urges NASA to continue discussions with NSF to preserve the nation's science and security interests and provide for the stability and productivity of this critical national asset.
- Response: PSD Director sent a letter to Dr. J. Ulvestad of NSF on May 18, 2016, stating NASA's intent to continue Arecibo radar usage for NEO characterization "in a manner and at a similar level of support, assuming the capacity of operating the telescope as a radar facility is maintained at the present level."



US Participation in Foreign Planetary Science Missions

- Other nations are continuing to develop planetary science exploration capabilities and plans, to which NASA can potentially contribute, toward achieving Decadal Survey science goals. [PSS urges PSD to evaluate US opportunities to participate in and use data from foreign missions to planetary destinations throughout the Solar System ...](#)
- Response: Significant partnerships have developed over the last 10 years.

Select International Activities

- ESA
 - *Continued Past Mission Partnerships: Cassini, Mars Express, Rosetta*
 - Participating scientists program: ExoMars 2016 & lander
 - Provided the Electra surface communications HW for ExoMars 2016
 - Mission Instrument Partnership: JUICE (1 full & 2 partial instruments)
- JAXA
 - Participating Scientists Programs: Akasuki, Hayabusa-2, & Hisaki
 - Mission Instrument Partnership: Martian Moons eXplorer (MMX)
 - Shared samples: Hayabusa 1, O-REx/Hayabusa 2, MMX
- ISRO
 - Navigation support for Mars Orbiting Mission (MOM)
 - Correlative Mars Data Workshop w/MOM & NASA missions
 - Discussing Potential Future Mission Partnerships
- RSA - Joint Science Definition Team for a future Venera-D mission
- CSA - Instrument Partnerships on Phoenix & Curiosity
- CNES – Instrument Partnerships on Curiosity & Mars 2020
- Spain – Instrument Partnership on Curiosity & Mars 2020
- Norway – Instrument Partnership on Mars 2020

Planetary Defense Coordination Office

- The PSS welcomes the establishment of a Planetary Defense Coordination Office (PDCO) within the Planetary Science Division. We feel that this is an important step for NASA, as it responds to the need for detection of Near Earth Objects, and the necessary planning and coordination needed to address planetary defense. Notably, the creation of the PDCO was a top recommendation by the 2010 NASA Advisory Council Planetary Defense Task Force.
- Response: Concur.

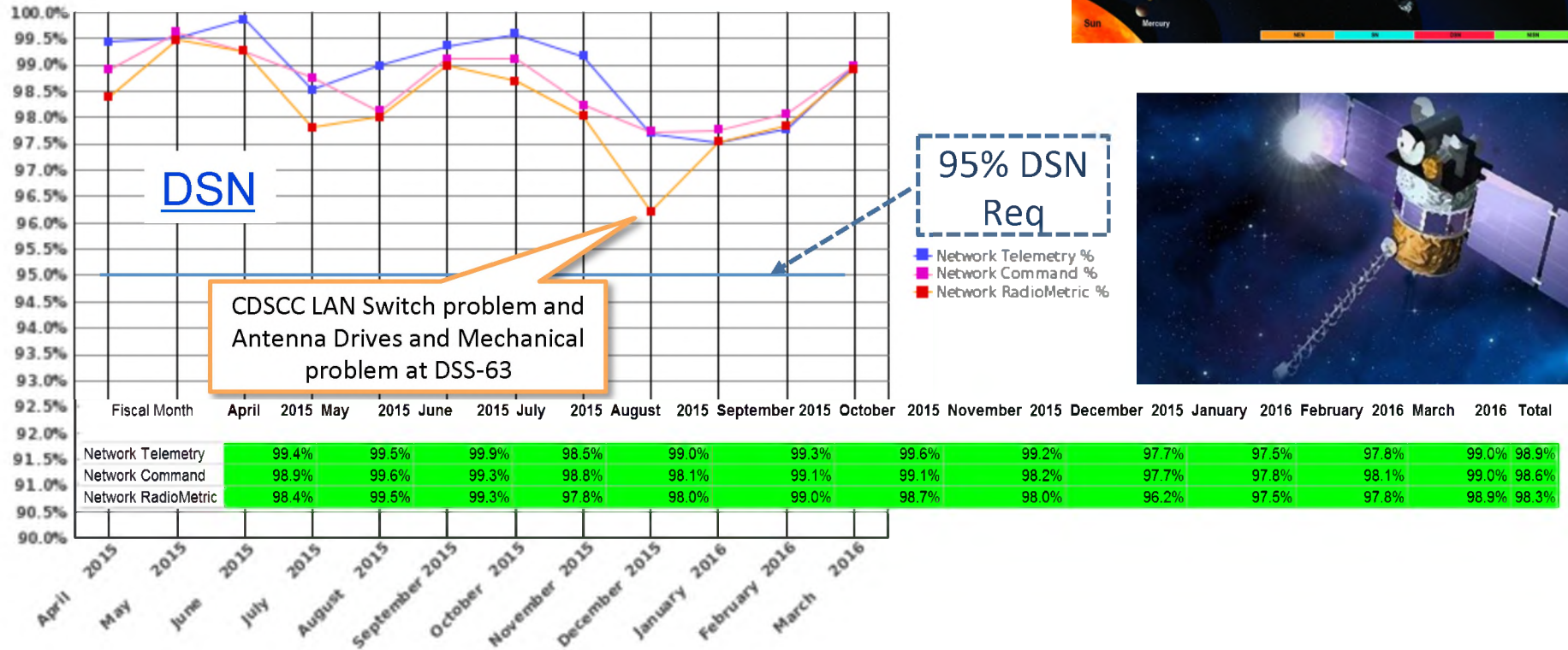
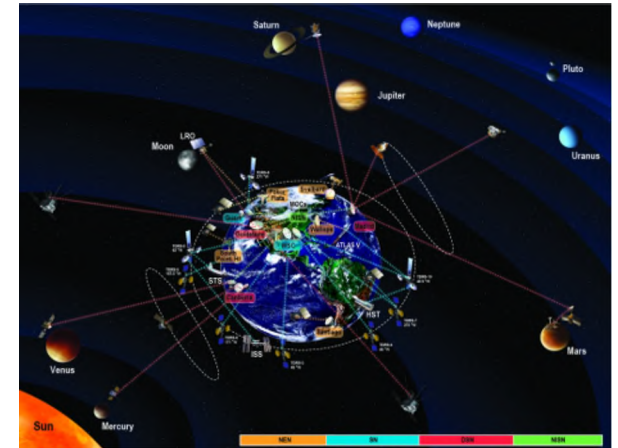
Deep Space Network (DSN)

- The PSS is alarmed by reports of increasing data losses by active planetary missions (e.g. Cassini, with details provided by OPAG in their February 2016 finding on the DSN), especially following a 10% funding cut to the DSN at the end of 2015. [The PSS supports aggressive efforts to address this issue and would like to hear updates as soon as possible.](#) In particular, current NASA science missions using the DSN should be asked to inform NASA about recent DSN performance changes they have experienced.
- Response: Updates to the PSS on DSN improved tracking statistics were provided on April 29th; We are keeping an eye on this situation. No other complaints have reached our attention.

DSN Tracking Metrics

SCaN Activity – March 2016

- **March 2016 Proficiency Metrics:**
 - *Measure of how well scheduled service was provided.*
 - Deep Space Network (DSN): **99.0%** (Tlm), **99.0%** (Cmd)
 - Near Earth Network (NEN): **99.83%**
 - Space Network (SN): **99.94%**



Questions?

