Planetary Science Division Status Report

James L. Green, Director Planetary Science
October 22, 2014

Presentation at the LEAG
Outline

• Planetary upcoming mission events
• Recent accomplishments
• R&A status
• Senior Review results
• Next steps in SMD supported STEM
• PSD role in the ARM mission
Planetary Science Missions Events as of Oct 16, 2014

2014

July – Mars2020 Rover instrument selection announcement
August 6 – 2nd Year Anniversary of Curiosity Landing on Mars
September - Curiosity arrived at Mt. Sharp
September 21 - MAVEN inserted in Mars orbit
October 19 – Comet Siding Spring encounters Mars
November 12 – ESA’s Rosetta mission lands on Comet Churyumov–Gerasimenko
Nov/Dec – Launch of Hayabusa-2 to asteroid 1999 JU₃

2015

March - MESSENGER spacecraft impacts Mercury
Late March – Dawn inserted into orbit at dwarf planet Ceres
April - Europa instrument Step 1 selection
May - Discovery 2014 Step 1 selection
July 14 – New Horizons flies through the Pluto system

2016

March – Launch of Mars missions InSight and ESA’s ExoMars Trace Gas Orbiter
March - Europa instrument step 2 selection
July - Juno inserted in Jupiter orbit
July – ESA’s Bepi Columbo launch to Mercury
August - Discovery 2014 Step 2 selection
September - InSight Mars landing
September – Launch of Asteroid mission OSIRIS – REx to asteroid Bennu
September - Cassini begins to orbit between Saturn’s rings & planet
Recent Accomplishments

- Released Europa Instrument AO – July 15, 2014
  - Proposals received October 17, 2014
- 2014 Senior Review completed
  - Report and response posted
  - All missions will continue
- RFI for Commercial buy of Mars Communications
  - Surface to Orbiter and to Earth also Orbiter to Orbiter
  - Deadline August 25th
  - Obtained more than a dozen responses
- R&A first cadre of reviews after the restructure are ongoing. Community is active and reviewers pleased with the process
- Released \textit{draft} Discovery AO – July 2, 2014
  - More than 100 comments received on July 16, 2014
  - AO release planned for October – any day now!
Discovery AO Status

• **Current Schedule:**
  – AO Release Date          NET Oct. 2014
  – NOI Deadline              Nov. 2014
  – Proposal Deadline         Jan. 2015
  – Step-1 Selections (target) June 2015
  – Phase A Study Reports Due (target) May 2016
  – Launch Readiness Date     NLT Dec. 31, 2021

• **Offered Technologies:**
  – Deep Space Optical Communications
  – Deep Space Atomic Clock
  – Advanced Solar Arrays
  – Green Propellant Thrusters
  – NEXT Ion Engine
  – HEEET Advanced Thermal Protection System
  – Autonomous Landing & Hazard Avoidance Technology (ALHAT)
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<th>Step-2 Due Date</th>
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*Due date has passed*
Review Panel Report

- Panel Report: “The science value (or science per dollar) of the extended missions exceeds the science gain from any planned mission, and all have important strengths. That is, they all represent added value to the Planetary Science Division and the American taxpayer because they are essentially new missions without the development and launch costs.”

- Panel voted on Guideline proposal plus an alternate mission content covering over-guide or de-scope options as the panel found appropriate.

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<th>Guideline Proposal</th>
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Legend:  E = Excellent, VG = Very Good, G = Good, F = Fair, P = Poor
Red = Final rating by PMSR Panel
o The final ratings include specific findings from the PMSR as to the best science investment PSD can make for a given Flight Project, identifying appropriate de-scopes or support for over-guides.
Panel Findings:
- The second extended mission for LRO will characterize changes in the lunar surface, beneath the surface, and in the exosphere. Five broad areas of investigation: seasonal volatile cycle, flux of small meteorites and their impact dynamics, vertical and horizontal structure of the regolith, the Moon’s interaction with the space environment, and probing the interior using observations of the surface.

- Some instruments are at the end of their useful science mission, and suggest de-scoping (in order of preference) Mini-RF, LAMP and CRaTER instruments. Based upon the suggested de-scopes the panel rating was raised from VG/G to E/VG.

PSD Response:
- PSD accepts the panel findings and has decided to de-scope (terminate) Mini-RF instrument operations.

- PSD accepts the panel finding that the LAMP and CRaTER instruments are potentially de-scopable – providing less ground breaking Lunar Science than the other instruments. However, PSD has decided to continue operations of both instruments because of their HIGH programmatic value to:
  - PSD: LAMP is reporting on lunar Water contents; a current significant area of research, and CRaTER is providing new data using Lunar Albedo Protons (LAPs), a new technique for probing the compositions variation in the regolith – including Hydrogen;
  - HEO: LAMP is reporting on Lunar Water {ISRU} and CRaTER is reporting on the Lunar Radiation environment; both important measurements for the Exploration Community, and
  - HELIO/HEO: CRaTER is reporting on Solar Energetic Particles (SEPs).
SMD Science Education Objectives

- Enable STEM Education
- Improve US Scientific Literacy
- Advance National Goals
- Leverage through Partnerships
SMD Science Education Cooperative Agreement Notice (CAN) Process
FY 2015

CAN Process Milestones

- OCT
  - Community Announcement
- DEC/JAN
  - Draft Text Released
- FEB
  - Final CAN Released
- APR
  - NOIs Due
- MAY/JUN
  - Full Proposals Due
- JULY/SEPT
  - Review
- OCT
  - Award Announcement
  - Award(s) 9/30/15

CAN (s) Operational

Events

- Community Interchange Meetings
- FY 2016 PBR
- NRC Workshop
- e.g. NSTA STEM Forum and Expo
Asteroid Redirect Mission: Three Main Segments

IDENTIFY
Ground and space based assets detect and characterize potential target asteroids

REDIRECT
Solar electric propulsion (SEP) based system redirects asteroid to cis-lunar space (two capture options)

EXPLORE
Crews launches aboard SLS rocket, travels to redirected asteroid in Orion spacecraft to rendezvous with redirected asteroid, studies and returns samples to Earth
ARM Milestones to Mission Concept Review, Feb. 2015

- FY14 Risk Reduction Plan for Boulder Capture Concept Option  Apr 3, 2014
- BAA Notice of Intent Due  Apr 4, 2014
- PPBE16 program submits due  Apr 28, 2014
- BAA Proposal Due Date  May 5, 2014
- STMD Solar Array Systems development Phase 1 complete  Jun 2014
- BAA Award Selection Announcement  Jun 19, 2014
- Option A Testbed Operational  Aug 2014
- STMD Integrated Thruster performance Test with 120V PPU  Sep 2014
- HEOMD MACES EVA end-to-end mission sim complete  Sep 2014
- Option B full scale 2D flat floor testing  Oct 2014

- Robotic mission concept Option A/B downselect  Dec 16, 2014
- BAA Period of Performance Ends  end of Jan – early Feb, 2014
- Mission Concept Review  Feb 26, 2015
Questions?
NASA-DOE RPS Production Status

• DOE continues its NASA-funded Pu-238 Supply Project
  – Goal of 1.5 kg/year of Plutonium Oxide production capacity by ~2021
  – Technology demonstration efforts continue on schedule
    • Target development, irradiation tests, and Pu-238 chemical recovery continue to be individually developed
    • The first of two integrated end-to-end demonstrations is planned to start in 2015
    • Assessment of Pu-238 product quality will occur at the end of each demonstration
  – The remainder of the project involves scaling up to the 1.5 kg/yr production rate

• NASA is now funding DOE Operations and Analysis (infrastructure)
  – Maintaining worker certifications and performing operational maintenance activities to support future RPS fueling and assembly capabilities at multiple DOE laboratories
  – Augmented funding to accelerate design and installation of a new Hot Press and furnace capability to reduce fuel clad production risk at Los Alamos National Laboratory (LANL)
  – Heat Source Manufacturing for potential Mars 2020 use will begin at LANL in 2015
RPS Status

• Fuel efficiency remains important even with restart of Pu-238 production
• Investments in thermoelectric technology to improve MMRTG capability
  – Enhanced thermoelectric couples could be on-ramped into future MMRTGs with minimal design change (improved couple life, and end-of-mission power)
  – Technology maturation evaluation in 2018 for an eMMRTG flight design
• Assembling Stirling hardware into Engineering Unit for testing
  – A 4x-efficiency improvement via Stirling still desired for certain missions
  – Study team assessing optimal Stirling sizes for Agency RPS and fission usage
• Mission pull continues
  – Heritage RPS on Voyager, Cassini, and New Horizons operating well
  – MMRTG operating well on Curiosity as it enters extended mission
  – MMRTG flight spares allocated for potential use by Mars 2020
  – Ready to support potential 2024 mission launch (possibly eMMRTG)
  – Future potential for 2028-and-beyond mission launches