Planetary Science Division Update

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May 8, 2012
Year of the Solar System
Planetary Science Mission Events

2010
• September 16 – Lunar Reconnaissance Orbiter in PSD
• November 4 - EPOXI encounters Comet Hartley 2
• November 19 - Launch of O/OREOS

2011
• February 14 - Stardust NExT encounters comet Tempel 1
• March 7 – Planetary Science Decadal Survey released
• March 17 - MESSENGER orbit insertion at Mercury
• May 5 - Selection of 3 Discovery-class missions for study
• May - Selection of the next New Frontier mission for flight, OSIRIS-Rex
• July 16 - Dawn orbit insertion at asteroid Vesta
• August 5 - Juno launched to Jupiter
• August 9 - Mars Opportunity Rover gets to Endeavour Crater
• September 10 - GRAIL launch to the Moon
• November 26 - Mars Science Laboratory launch to Mars
• December 31 - GRAIL-A (Ebb) orbit insertion at Moon

2012
• January 1 - GRAIL-B (Flow) orbit insertion at Moon

June 5 – Venus Transit – Last One in Our Lifetime
August 6 – MSL’s Curiosity Rover Lands on Mars
Mid-Aug - Dawn leaves Vesta starts on its journey to Ceres

http://solarsystem.nasa.gov
Dawn From Vesta To Ceres

• Leaves LAMO (~220 km) and begins journey to HAMO (~680 km) over the next few weeks
Vesta's Giant Impact Basins

• Rheasilvia is the largest crater, relative to body size, in the Solar System
• Scaled to Earth, it would stretch from Washington, DC over the North Pole to Tokyo
• Central peak rises 20-25 km above the basin floor (~2.5x taller than Mt. Everest)
• Appears to have formed on top of an older basin

South Pole topography: Blue=low, Red =high
Vesta Highlights

• Press conference Thursday, May 10, at 2 p.m. EDT to review science results to date on Vesta

From LPSC:

• Vesta confirmed to be parent body of HED meteorites
• Rheasilvia impact on top of an older impact basin
• Crater record has placed important constraints on the impactor flux distribution in the early solar system
• Vesta is differentiated with an iron core ~110 km radius
• Evidence of global tectonic strains from the giant impacts
Comparison of Ceres and Vesta

Ceres:
- ~3-2.5 AU
- ~920 km
- ~2.1 g/cm³

Vesta:
- ~2.2-2.6 AU
- ~529 km (mean)
- ~3.42 g/cm³
Top Priority for PSD in FY12

• Safely land MSL on Mars! Aug 6 (~1AM Eastern)
Curiosity’s Landing Site: Gale Crater

Mound is ~5 km high

Gale Crater

10 km
Mission Status
100-hour Mössbauer integration on “Amboy”, most likely an impact suevite (melted material, containing glass and crystal or lithic fragments)

Opportunity began its winter science campaign on a north-facing slope at Greeley Haven of the Endeavor crater.

With clean solar panels Opportunity will begin exploring again!
New Frontiers Program

1st NF mission
New Horizons:
Pluto-Kuiper Belt
Launched January 2006
Arrives July 2015
PI: Alan Stern (SwRI-CO)

2nd NF mission
JUNO:
Jupiter Polar Orbiter
Launched August 2011
Arrives July 2016
PI: Scott Bolton (SwRI-TX)

3rd NF mission
OSIRIS-REx
Asteroid Sample Return
Sept. 2016 LRD
PI: Dante Lauretta (UA)
Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer (OSIRIS-REx)

Science Objectives:

- Return and analyze a sample of pristine carbonaceous asteroid
- Map the global properties, chemistry, and mineralogy
- Document in situ the properties of the regolith at the sampling site
- Characterize the integrated global properties to allow comparison with ground-based telescopic data of entire asteroid population
- Measure the Yarkovsky effect

Mission Overview:

- Launch in September 2016
- Encounter asteroid (101955) 1999 RQ36 in October 2019
- Study RQ36 for up to 505 days, globally mapping the surface
- Obtain at least 60 g of pristine regolith/surface material
- Return sample to Earth in September 2023 in a Stardust-heritage capsule
- Deliver samples to JSC curation facility for world-wide distribution

P ~ 436 days
Discovery Program

Completed

Mars evolution:
Mars Pathfinder (1996-1997)

Lunar formation:

NEO characteristics:
NEAR (1996-1999)

Completed / In Flight

Solar wind sampling:
Genesis (2001-2004)

Comet diversity:
CONTOUR

Nature of dust/coma:
Stardust (1999-2011)

In Flight / In Development

Comet internal structure:

Mercury environment:
MESSENGER (2004-2013)

Main-belt asteroids:

Lunar Internal Structure
GRAIL (2011-2012)
Lunar Gravity

GRAIL after 1 month
Developing Missions
• MAVEN and LADEE in final phases of development for 2013 launch dates
Next Discovery Mission – Candidate Studies

CHopper: Comet Hopper  
PI: Jessica M. Sunshine, UMD

InSight  
PI: Bruce Banerdt, JPL

TiME: Titan Mare Explorer  
PI: Ellen Stofan, Proxemy Research

• Step-2 Proposals due March 19 (all arrived!)
• Selection announcement on track for mid-July
• Discovery-13 AO in FY15
Activities with Human Exploration
Interaction With Human Exploration

- Some solar system bodies are likely targets of future human exploration:
  - Earth’s Moon
  - Mars and its moons
  - Asteroids

- *It is vital to maintain the science focus of peer-reviewed NASA missions to these bodies.*

- Both the Space Science program and the human exploration program can benefit from carefully crafted intra-agency partnerships (LRO is a good recent example).
Science & Exploration Activities

The Planetary Sciences Division and the Exploration Systems Mission Directorate (ESMD) have a successful history of working together. A selection of past successes:

• Hardware:
  – Lunar Reconnaissance Orbiter (LRO): Joint AO
  – Mars Science Laboratory (MSL) payloads: Radiation Assessment Detector (RAD) and Mars Entry, Descent, & Landing Instrumentation (MEDLI)

• Co-funded R&A:
  – Lunar Advanced Science & Exploration Research (LASER), NASA Lunar Science Institute (NLSI)
  – Analog studies: Desert Research & Technology Studies (D-RATS)

• Working Groups:
  – Joint charters for analysis groups: Lunar Exploration Analysis Group (LEAG), Mars Exploration Program Analysis Group (MEPAG), and Small Bodies Analysis Group (SBAG); the Tempe conference convened by the NASA Advisory Council (NAC) for science and exploration
  – Human Exploration Framework Team (HEFT), Exploration Precursor Robotic Missions (xPRM), Near Earth Asteroid User Team (NUT), Near Earth Object Observation (NEOO), Blue Sky, Near Earth Asteroid Working Group (NEA-WG)

• Personnel Exchange:
  – LRO/LCROSS personnel coordination and exchange during development
OMB Direction to Create a Joint Robotic Activities

- Joint Robotics Activity:
  - “ESMD, working closely with the Planetary Science Division of the Science Mission Directorate (SMD), will develop instruments for SMD and international missions to destinations relevant to human exploration beyond LEO. These precursor activities will strive to characterize the engineering boundary conditions of representative exploration environments, identify hazards, and assess resources. These activities will provide knowledge to inform the selection of future destinations, support the development of exploration systems, and reduce the risk associated with human exploration. ESMD will also fund a small Research and Analysis effort with the goal of turning the data gathered by these instruments, as well as the data of other SMD instruments and missions, into strategic knowledge in support of human spaceflight planning and systems development...”

- As Well As:
  - “OMB encourages NASA to take a broad view of its exploration mandate, and to better leverage its ongoing activities in support of this mandate. To this end, $30 million/year is provided in FY 2013 and beyond for a program to identify and prioritize the data collection efforts necessary to enable future human exploration beyond LEO, and support missions of opportunity to acquire this data. This joint program office will be supported by $20 million/yr managed by Exploration Research and Development [HEOMD] and $10 million/yr managed by the Science Mission Directorate...”
Joint Robotic Precursor Activity (JRPA) Overview

Goal: Inform the selection of future destinations, support the development of exploration systems, and reduce the risk associated with human exploration while maximizing the mutual benefit to both science and exploration

• To meet this goal, NASA will jointly fund and conduct Robotic Precursor Activities
  – These activities will provide the strategic knowledge required to inform human spaceflight (HSF) planning. By developing an integrated set of priorities NASA will leverage mission opportunities, data, and the talents of both the exploration and science communities to enable human missions to NEAs, the Moon, and ultimately Mars.

• Such activities will include:
  – **Develop instruments for NASA and non-NASA missions** to destinations relevant to human exploration beyond LEO to gather needed information
  – **Research and Analysis** efforts to generate strategic knowledge in support of human spaceflight planning and systems development
  – **Perform strategic studies and hold joint workshops** to further inform and leverage community participation
  – Lay the groundwork for **future precursor missions**, should funding improve

• A new strategy for Mars exploration has begun and will include closer ties to HEOMD and OCT (Doug to present)
Updates: Senior Review, NEOs, Pu-238
Senior Review

- Issued draft guidelines for Senior Review Sept. 30
  - Comments received and guidelines revised
- Issued request for proposals in January 31, 2012
- Proposals due May 31, 2012
- Senior Review (June-July 2012)
- Final report to PSD Director (July-August 2012)
- Senior Review results executed beginning of FY13
NEO Update

• Entering into a “Space Act” agreement with B612
  – B612: Private funds for an asteroid survey mission-Sentinel
  – NASA: Provides (for example) DSN services; spacecraft navigation support; data processing and analysis; and interface to the Near Earth Object (NEO) data network

• Contract with Arecibo supporting Radar at $2M/yr
  – Many more NEO’s can now be observed with radar

Arecibo images of Marco Polo-R mission target (1996 FG3)
PU-238 & RPS Status

• DoE passed FY12 Omnibus Appropriations:
  – “The conferees provide no funds for the Plutonium-238 Production Restart Project”

• NASA/PSD has provided funding in FY12 to complete the necessary study and assessments
  • Expect the assessment to be completed this CY
  • Develop a new funding strategy to enable restart but with a larger share of the funding from NASA

• ASRG - will complete Engineering & Qual units and continue with life testing
Outer Planets Activities
JUICE Selection for ESA’s L1

• Letter from Fabio Favata (Head of Sci Planning & Community Coord. Office-ESA) received March 27th
  – Requesting a formal statement from NASA indicating level of interest
  – Kind and amount of contribution envisioned by NASA for US scientists participation in JUICE payload
  – If JUICE selected as the L1 mission intension is to issue an AO immediately
  – NASA statement needed before end of April

• NASA’s response coordinated with OMB and OSTP arriving before the ESA-SPC
  – NASA proposes to be a minor partner at ~$100M payload contribution

• More details to be determined in an upcoming bilateral meeting
NASA Europa Studies Status

• Congress FY12 Approps: “The conferees understand that required descoping studies for planetary flagship missions [Europa] are at or near completion and direct that those studies be submitted to the Committees on Appropriations as soon as possible…”

• JPL-Europa studies were delivered to NASA HQ last week (orbiter, fly-by, and lander missions)

• Although preliminary versions of the analysis have been presented at OPAG the reports will be reviewed internally FIRST before being released

• Next steps will include briefings to OMB, OSTP, and Congress
Planetary’s Future Budget
President’s FY13 Budget

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- Grey region is a “notional” budget – top line remains the same but details within may change
- Congress is deliberating on additional funding in FY13 for PSD
50 YEARS

solar system exploration

http://solarsystem.nasa.gov/50th
Planetary Science Budget Features

**What Changed:**

- Initiate a new Mars exploration strategy as an integrated approach by partnering with Human Exploration and the Office of the Chief Technologist:
  - Ending work on 2016 ExoMars Trace Gas Orbiter and Mars 2018 ExoMars rover
  - Looking at a robotic exploration mission
- Reduced Discovery flight rate with Discovery 13 AO release moved to FY15
- New Frontiers – 4 AO release moved to FY16
- Lunar Quest Program phased out after LADEE with remaining activities absorbed into Planetary Research Programs (NLSI & LASER) and Discovery (LRO)
- Establishes a Joint Robotic Precursor Activity with HEOMD
Future of Planetary Science

• Planetary Decadal lays out the next decade science strategy
  – We are in the middle of a major revolution in the understanding of the origin and evolution of the solar system and if there is life beyond Earth

• Human exploration is depending on planetary science to lead the way in understanding the environment and hazards humans will face beyond low Earth orbit. – Moon, Asteroids, Mars
  – President Obama has stated that we will visit an asteroid by 2025 circle Mars in 2030 and that Mars was the ultimate destination
  – This makes planetary science a critical component to his National Space Policy

• The National Space Policy also stresses international cooperation on mutually beneficial space activities

• Utility: finding potentially hazardous objects that threaten the Earth

• We are constantly rewriting the textbooks.
  – If any one has the “inspiration factor” it’s got to be Planetary Science!