NASA’s Planetary Science Program Overview

James L. Green, Director Planetary Science
Presentation to the SBAG
January 9, 2014
Outline

• Planetary Budget
• Selected Planetary Missions Status
• Upcoming PSD Mission Senior Review

Topics Covered by Others:
• Asteroid Initiative – Gates
• NEO program – Johnson
• ASRG and RPS – McNutt
• ISON Campaign – Lisse
• International mission cooperation: Rosetta, MP-R, Hayabusa 2
• SSERVI - Pendleton
• Research & Analysis Status and Plans – Rall
President’s FY14 Planetary Science Budget
Plus an Approved FY13 Budget

- NEO observations enhancement of $20M/yr ($40M/yr total)
- $50M/yr support of DoE PU-238 infrastructure support

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Selected Mission Status
LADEE Launch
WFF Sept. 6, 2013

Photo: Buddy Secor
Objective:
• Measure the lofted Lunar dust
• Composition of the thin Lunar atmosphere

Instruments:
• Science: NMS, UVS, and LDEX
• Technology: Laser Communications

Status:
• Several LLCD “block” tests complete
• Instruments in Science Mode
Lunar Laser Communication Demonstration

- Lunar Lasercom Ground Terminal
  - White Sands, NM
- Lunar Lasercom Optical Ground System (ESA)
  - Tenerife
- Lunar Lasercom Ops Center
  - MIT LL
- Lunar Lasercom Space Terminal
- 1.55 um band
- DL 622 Mbps
  - UL 20 Mbps
- DL > 38 Mbps
  - UL > 10 Mbps
- DL > 38 Mbps
- UL 20 Mbps
- DL > 38 Mbps
- UL > 10 Mbps
- DL > 38 Mbps
- UL > 10 Mbps
- DL > 38 Mbps
- UL > 10 Mbps

LADEE Spacecraft

Deep Space NW

LADEE Mission Ops Center

LADEE Science Ops Center

Payload: 8
Juno Earth Flyby

- EFB: 10/9/2013
- Launch: 8/5/2011
- DSMs: 8/30 & 9/14/2012
- JOI: 7/5/2016

- Sun terminator at C/A
- Madrid AOS (10° elevation) 20:38 UTC
- Perth AOS (10° elevation) C/A+21:37
- Eclipse end C/A+17:36
- EFB closest approach (C/A) 19:21:25 UTC
  - 34°S, 34°E, 559 km altitude
- Malargue LOS (10° elevation) C/A-7:22
- Eclipse start C/A-1:48
  - 700 km altitude, 1100 km from Cape Town

Tilted Ecliptic Pole View, Vernal Equinox Up, 30-day Tick Marks
Juno, launched on August 5, 2011, passed by Earth on its way to Jupiter in a gravity-assist maneuver on October 9, 2013. Images taken by JunoCam instrument.

Right: Earth as seen by JunoCam during Juno’s Earth flyby. This monochrome view shows exquisite detail in the clouds and coastlines of South America.

Inset, top left: The west coast of South America is visible in this image, taken when the Juno spacecraft was 15,091 km from the Earth. Processed by “Gerald” at unmannedspaceflight.com

Top: Methane band image of the terminator region taken at 12:15:30 PDT on Oct. 9.
Mars Missions in This Decade

**Operational 2001–2012**
- Odyssey
- Mars Reconnaissance Orbiter
- ESA Mars Express

**2013**
- MAVEN Aeronomy Orbiter

**2016**
- ESA Trace Gas Orbiter (Electra)

**2018**
- InSight

**2020**
- ESA ExoMars Rover (MOMA)
- 2020 Science Rover

**2022**
- Curiosity – Mars Science Laboratory
- Opportunity

Follow the Water ➔ Habitable Environments ➔ Seeking Signs of Life ➔ Future
MAVEN Launched November 18, 2013
Science:

- Determine the structure and composition of the Martian upper atmosphere today
- Determine rates of loss of gas to space today
- Measure properties and processes that will allow us to determine the integrated loss to space through time

Launched November 18, 2013
Mars orbit insertion in mid-Sept. 2014
Comet C/2013 A1 (Siding Spring) near Mars
Upcoming Missions
**OSIRIS-REx - Asteroid Sample Return Mission**

**Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer**

**Science Objectives**
- Return and Analyze a Sample
- Create Maps of the Asteroid
- Document the Sample Site
- Measure the Orbit Deviations
- Compare to Telescope-based Observations

**Mission Overview**
- Principal Investigator: Dr. Dante Lauretta, UA
- Launch in September 2016
- Encounter asteroid Bennu in August 2018
- Study Bennu for up to 505 days
- Obtain at least 60 g of pristine regolith/surface material
- Return sample to Earth in September 2023
- Deliver samples to JSC curation facility

**Science Instrumentation and Key Capabilities**
- OSIRIS-REx Camera Suite (OCAMS) – UA
- OSIRIS-REx Thermal Emission Spectrometer (OTES) – ASU
- OSIRIS-REx Visible & IR Spectrometer (OVIRS) – GSFC
- OSIRIS-REx Laser Altimeter (OLA) – CSA
- Regolith X-ray Imaging Spectrometer (REXIS) – MIT
- Spacecraft Telecom/Radio Science
- Touch-And-Go Sample Acquisition Mechanism (TAGSAM) – Lockheed Martin
- Sample Return Capsule (SRC, Stardust Heritage) – Lockheed Martin
- Sample Curation and Laboratory Analysis – NASA/JSC and worldwide
InSight: Interior Structure from Seismic Investigations, Geodesy and Heat Transport

Mission & Science Team:
PI: Bruce Banerdt, JPL
PM: Tom Hoffman, JPL
Deputy PI: Sue Smrekar, JPL
Management: JPL
Spacecraft: Lockheed-Martin
Operations: JPL/LM
Payload: CNES (France), DLR (Ger.), JPL

Mission:
• Geophysical lander mission on Mars using Phoenix heritage spacecraft

Goals:
• Understand formation/evolution of terrestrial planets via interior structure/processes of Mars
• Determine present tectonic activity and meteorite impact rate

Payload:
• Seismic Experiment for Interior Structure (SEIS)
• Rotation & Interior Structure Experiment (RISE)
• Heat Flow & Physical Properties Probe (HP³)
• Instrument Deployment System

Mission Details:
• Flight: 3/2016 launch w/ELV, 4m fairing; 9/2016 landing; ~6.5 mo cruise, 1 Mars yr surface ops
• System Features (Phoenix-based design): Phoenix EDL architecture, solar power, UHF relay comm with X-band backup, updated RAD 750-based avionics
• Mass: 597.6kg dry launch, margin ≥31% (depending on ELV)
• Schedule: 43.5 mo B/C/D, 105 days sched. reserve
• Threshold Mission: Descope: HP³, SEIS SP sensors
Process for Next Discovery AO

- Receive RFI Responses
- Analyse Responses
- (Virtual?) Town Hall
- Strategic Decisions
  1. Cost cap
  2. LV pricing
  3. Target list
  4. LRD etc.

- Release Draft
- Write Draft AO
- SMD SMaC
- Budget Analysis

57 responses received. RFI closed on 1 Nov 2013.

Michael H. New, Lead Discovery Program Scientist
Seeking Signs of Past Life

- FBO released August 12, 2013
- AO released September 24, 2013
- NOIs due November 4, 2013
- Proposals due January 15, 2014
Upcoming Senior Review for Missions
Senior Reviews

• Last Senior Review was completed in July 2012 for fiscal years FY13 and FY14
• Guidelines for the next senior review to be issued early 2014
  – Total funding available for extended missions is approximately constant at FY14 levels
  – Missions in the review: Cassini, LRO, Mars Express, MRO, Opportunity, Mars Odyssey, and Curiosity
• To the PSS: Due to a constrained budget what should be critical features/discriminators of the next call for SR Mission proposals?
“Flyby, Orbit, Land, Rove, and Return Samples”

NASA’s

Planetary Science

Advance scientific knowledge of the origin and history of the solar system, the potential for life elsewhere, and the hazards and resources present as humans explore space.
Asteroid Mission Would Consist of Three Main Segments

Identify

Asteroid Identification Segment:

- Ground and space based NEA target detection, characterization and selection
- PSD responsibility

Redirect

Asteroid Redirection Segment:

- Solar electric propulsion (SEP) based asteroid capture and maneuver to trans-lunar space

Explore

Asteroid Crewed Exploration Segment:

- Orion and SLS based crewed rendezvous and sampling mission to the relocated asteroid
FY14 EPO Status and Activities
Current SMD EPO Policy

• Under a CR, SMD projects are to continue planned EPO activities at the same level of effort and budget as during FY13
  – Except where decreases were already planned or where directed otherwise by their sponsoring HQ division

• NASA will not implement the proposed consolidation at this time but will continue to make changes during a CR in alignment with the COSTEM strategic plan

• Office of Education and Communications will still oversee a waiver process to approve all education and public outreach activities