

Discovery, New Frontiers, Outer Planets



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Presentation at LPSC

Discovery and New Frontiers

- ◆ Address high-priority science objectives in solar system exploration
- ◆ Opportunities for the science community to propose full investigations
- ◆ Fixed-price cost cap full and open competition missions
- ◆ Principal Investigator-led project



- ◆ Established in 1992
- ◆ **\$450M cap** per mission excluding launch vehicle and operations phase (FY15\$)
- ◆ Open science competition for all solar system objects, except for the Earth and Sun

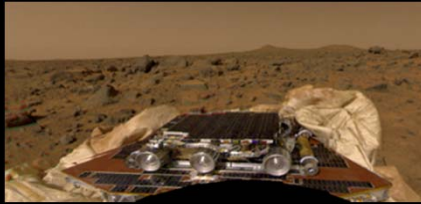


- ◆ Established in 2003
- ◆ **\$850M cap** per mission excluding launch vehicle and operations phase (FY15\$)
- ◆ Addresses high-priority investigations identified by the National Academy of Sciences

Discovery Program

Completed

Mars evolution:
Mars Pathfinder (1996-1997)



Lunar formation:
Lunar Prospector (1998-1999)



NEO characteristics:
NEAR (1996-1999)



Solar wind sampling:
Genesis (2001-2004)



Completed

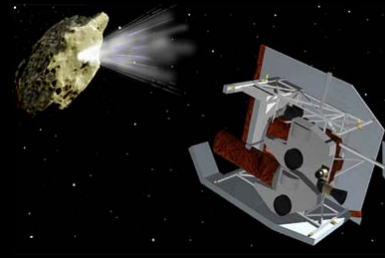
Comet diversity:
CONTOUR (2002)



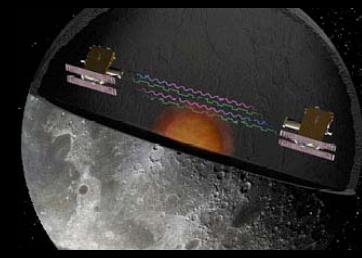
Nature of dust/coma:
Stardust (1999-2011)



Comet internal structure:
Deep Impact (2005-2012)

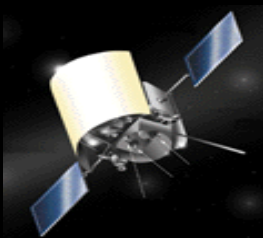


Lunar Internal Structure
GRAIL (2011-2012)



In Flight / In Development

Mercury environment:
MESSENGER (2004-2015)



Main-belt asteroids:
Dawn (2007-2016)



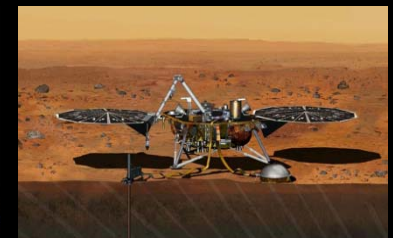
Lunar surface:
LRO (2009-TBD)



ESA/Mercury Surface:
Strofiio (2016-TBD)



Mars Interior:
InSight (2016-TBD)



Status of Discovery Program

Discovery 2014 - proposals in review for September Selection

Missions in Development

- InSight: Confirmation to begin ATLO on March 24, 2015
- Strofio: Delivered to SERENA Suite (ASI) for BepiColombo

Missions in Operation

- Dawn: In orbit around Ceres as of March 6

Missions in Extended Operations

- MESSENGER: In low altitude science operations before impact with Mercury in April
- LRO: In stable elliptical orbit, passing low over the lunar south pole.

Future Opportunities – planning for 3-year mission cadence

New Frontiers Program

1st NF mission
New Horizons:

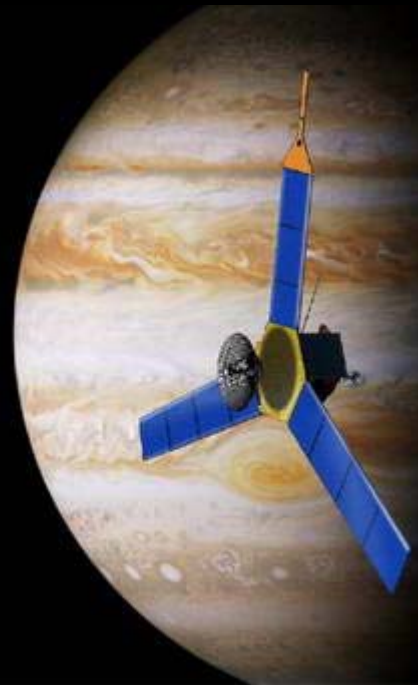
Pluto-Kuiper Belt



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



To be launched: Sept. 2016
PI: Dante Lauretta (UA)

Status of New Frontiers Program

Next New Frontiers AO - to be released by end of Fiscal Year 2016

- New ROSES call for instrument/technology investments to prepare
- Candidate mission list and nuclear power sources under consideration

Missions in Development - OSIRIS REx

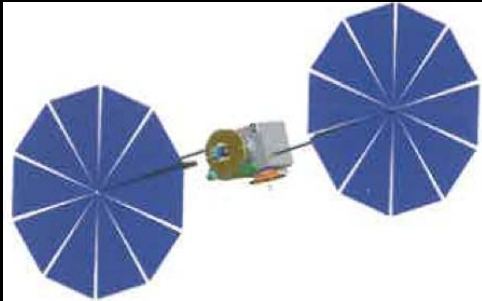
- Launch in Sept 2016 & encounter asteroid Bennu in Oct 2018.
- Operate at Bennu for over 400 days.
- Returns a sample in 2023 that scientists will study for decades with ever more capable instruments and techniques.

Missions in Operation

- New Horizons:
 - Spacecraft is 32 AU from the sun and <1 AU from Pluto
 - Pluto system encounter July 14, 2015
 - HST identified 2 KBO's beyond Pluto for potential extended mission
- Juno:
 - Spacecraft is 4.5 AU from the sun and 1.5 AU from Jupiter
 - Orbit insertion is July 4, 2016

New Frontiers Candidate Missions

Comet Surface
Sample Return



Lunar South Pole
Aitken Basin Sample
Return



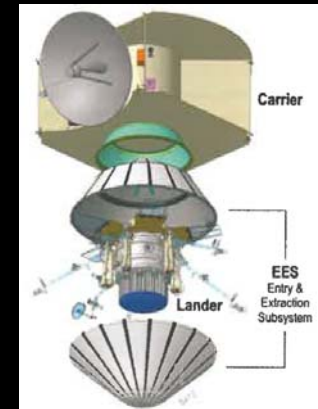
Trojan Tour &
Rendezvous



Saturn Probes



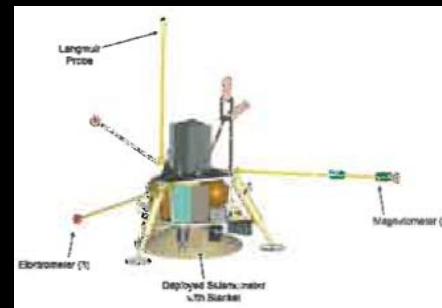
Venus In-Situ Explorer



Io Observer



Lunar Geophysical
Network



Outer Planets Missions

Cassini and JUICE

- Cassini
 - Titan flyby #110 on March 16
 - Operations budgeted through FY17
 - Planning underway for Grand Finale mission
- ESA's Jupiter Icy Moons Explorer
 - Adopted by ESA Nov 2014
 - 3 NASA instrument contributions, UVS, RIME, JEP1

Recent Europa Activities

- Europa mission formulation in the President's FY16 Budget
- Instrument selections for Europa mission expected early May
 - Released SALMON 2 PEA in July 2014 to solicit instrument investigations for an unspecified Europa mission
 - 33 proposals evaluated
- Dedicated Hubble time to verify existence of Europa plumes
 - Not confirming their existence does not mean they don't exist. Variability factors are currently not understood.
- Workshop Feb. 18, 2015 with leading astrobiologists and Europa scientists to discuss how to look for life
 - Previous 'plume' workshop fully endorsed mission concept and payload
 - Identify 'best' instruments and mission concepts to maximize likelihood of detecting current life if it exists
- Europa mission formulation continues
 - Solar power system selected as baseline
 - Highly successful Mission Concept Review held
 - Key Decision Point A to kick off formulation in planning

Europa Flyby Concept Overview

Science Objectives

Ice Shell & Ocean	Characterize the ice shell and any subsurface water, including their heterogeneity, and the nature of surface-ice-ocean exchange
Composition	Understand the habitability of Europa's ocean through composition and chemistry.
Geology	Understand the formation of surface features, including sites of recent or current activity, and characterize high science interest localities.
Recon	Characterize scientifically compelling sites, and hazards for a potential future landed mission to Europa

Model Payload

	<u>Instrument Type</u>
1	Ice Penetrating Radar
2	Shortwave Infrared Spectrometer
3	Topographical Imager
4	Neutral Mass Spectrometer
5	Reconnaissance Camera
6	Thermal Imager
7	Magnetometer
8	Langmuir Probe
9	Gravity Science

