Planetary Science Division Update

Presentation at the
Outer Planets Assessment Group

James L. Green
Director, Planetary Science Division

July 14, 2009

Outline

- Administrative & Announcements
- Planetary Science FY10 Budget
- Planetary missions status and plans
- New Frontiers/Discovery status
- Outer Planets Flagship status

Administrative & Announcements

- Personnel Changes:
  - Planetary Protection Officer (position closed – selection TBA)
  - Astrobiology lead – position posted & advertized widely
  - Jon Rall returned to GSFC – PIDDP now under Lisa May
  - Natasha Johnson (NASA postdoc) obtained position at GSFC

- Stand-Alone Mission of Opportunity Notification (SALMON)
  - Instrument Mission of Opportunity: Strofio on BepiColombo and Lander-Radio Science on ExoMars

- National Academy Studies
  - Radioisotope Power System & availability of Plutonium – Completed
  - Planetary Protection for Mars Sample Return - Completed
  - NEO - address issues in the detection and mitigation
    - Expect a “mid-term” letter report by September
  - R&A - Role and Scope of Mission-Enabling Activities
  - Planetary Science Decadal – just started!

2009-2011 Decadal Survey Committee Organization

Steering Committee
Steve Squyres, Chair
Larry Soderblom Vice Chair
Vice Chairs of Panels
~8 others

http://nationalacademies.org/

Inner Planets Panel
TBD Chair
TBD Vice Chair
~9 others

Outer Planets Panel
TBD Chair
TBD Vice Chair
~9 others

Primitive Bodies Panel
TBD Chair
TBD Vice Chair
~9 others

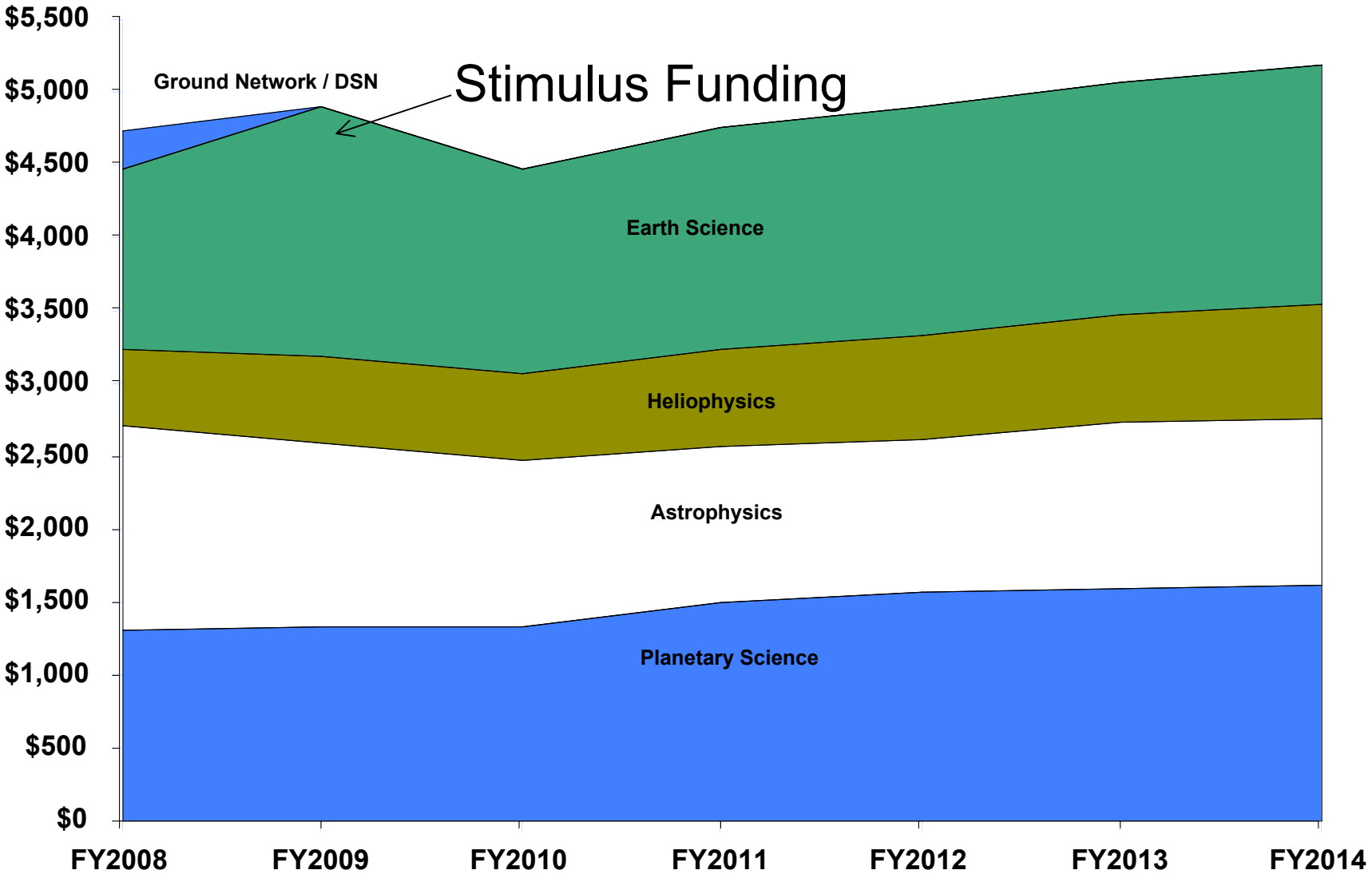
Mars Panel
TBD Chair
TBD Vice Chair
~9 others

Outer Planet Satellites Panel
TBD Chair
TBD Vice Chair
~9 others

NASA FY10 Budget Overview

	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014
Total NASA	$17,401.9	$18,784.4	$18,686.0	$18,631.0	$18,613.0	$18,607.0	$18,858.0
Science	$4,733.2	$4,903.0	$4,477.2	$4,747.4	$4,890.9	$5,069.0	$5,185.4
Earth Science	$1,237.4	$1,704.6	$1,405.0	$1,500.0	$1,550.0	$1,600.0	$1,650.0
Planetary Science	$1,312.6	$1,325.6	$1,346.2	$1,500.6	$1,577.7	$1,600.0	$1,633.2
Astrophysics	$1,395.6	$1,281.2	$1,120.9	$1,074.1	$1,042.7	$1,126.3	$1,139.6
Heliophysics	$536.4	$591.6	$605.0	$672.6	$720.5	$742.7	$762.6
Ground Network / DSN	$251.2						
Aeronautics Research	$511.4	$650.0	$507.0	$514.0	$521.0	$529.0	$536.0
Exploration Systems	$3,299.4	$3,905.5	$3,963.1	$6,076.6	$6,028.5	$5,966.5	$6,195.3
Constellation Systems	$2,675.9	$3,433.2	$3,505.4	$5,543.3	$5,472.0	$5,407.6	$5,602.6
Advanced Capabilities	$623.5	$472.3	$457.7	$533.3	$556.5	$558.9	$592.7
Space Operations	$5,427.2	$5,764.7	$6,175.6	$3,663.8	$3,485.3	$3,318.6	$3,154.8
Space Shuttle	$3,295.4	$2,981.7	$3,157.1	$382.8	$87.8		
International Space Station	$1,685.5	$2,060.2	$2,267.0	$2,548.2	$2,651.6	$2,568.9	$2,405.9
Space and Flight Support (SFS)	$446.2	$722.8	$751.5	$732.7	$745.9	$749.7	$748.9
Education	$146.8	$169.2	$126.1	$123.8	$123.8	$123.8	$125.5
Cross-Agency Support Programs	$3,251.4	$3,356.4	$3,400.6	$3,468.4	$3,525.7	$3,561.4	$3,621.4
Center Management & Operations	$2,011.7	$2,024.0	$2,084.0	$2,119.2	$2,142.5	$2,166.1	$2,189.9
Agency Management & Operations	$834.1	$921.2	$961.2	$956.9	$964.5	$972.3	$981.5
Institutional Investments	$325.5	$343.7	$355.4	$392.3	$418.7	$423.0	$450.0
Congressionally Directed Items	$80.0	$67.5					
Inspector General	$32.6	$35.6	$36.4	$37.0	$37.8	$38.7	$39.6

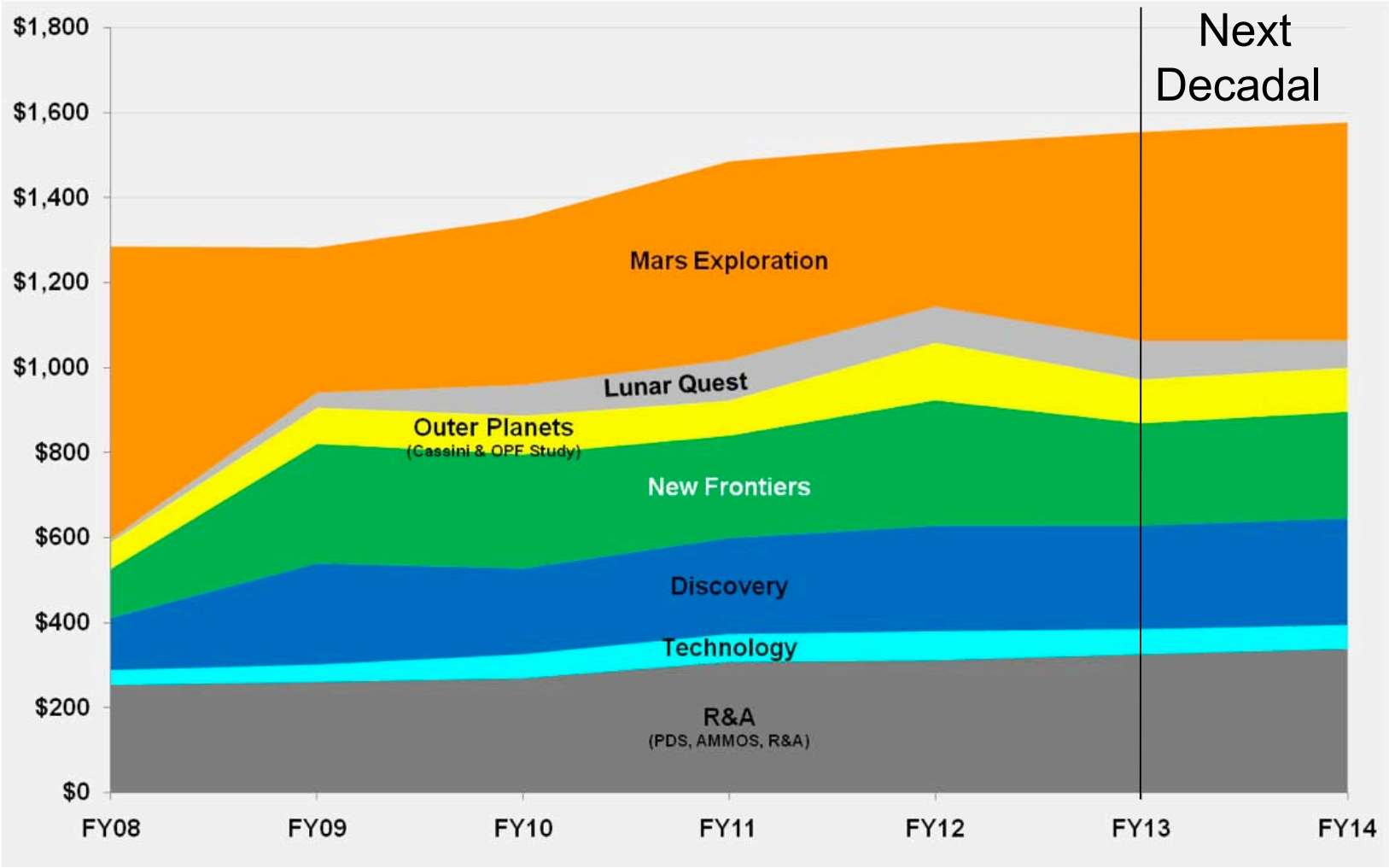
SMD Budget by Theme (RY $M)



FY10 Planetary Science Budget

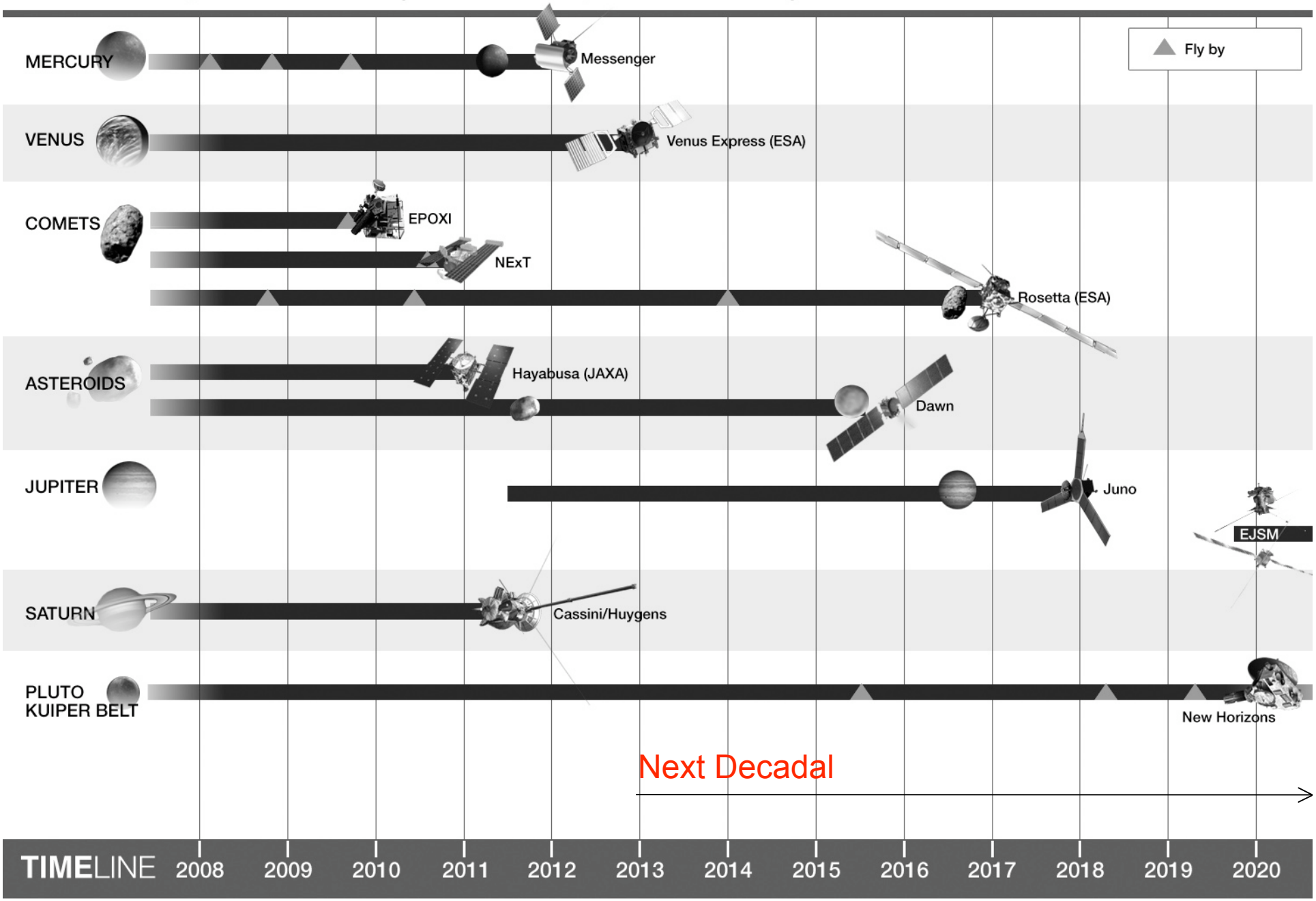
	FY09	FY10	FY11	FY12	FY13	FY14
FY10 President Submit	1,325.6	1,346.2	1,500.6	1,577.7	1,600.0	1,633.2
Discovery	247.0	213.2	234.6	256.8	256.5	264.3
GRAIL	122.4	124.1	104.8	41.4	4.7	
Operating Missions	47.4	50.4	52.8	30.1	12.9	10.1
Research / Management / Future	77.2	38.7	77.1	185.4	238.8	254.2
New Frontiers	263.9	264.1	239.9	294.2	239.8	249.6
Juno	245.0	237.2	174.2	71.4	17.8	18.1
New Horizons / Management / Future	19.0	26.9	65.7	222.8	222.0	231.5
Outer Planets	101.1	98.6	97.1	140.3	117.7	118.5
Outer Planets Flagship	5.1	13.7	20.7	69.3	70.0	70.0
Cassini, Research	96.0	84.9	76.4	71.0	47.7	48.5
Technology	64.9	89.0	98.4	102.1	93.5	91.4
Planetary Science Research	162.1	161.7	193.5	240.2	232.6	254.2
Research & Analysis, PDS, Curation, NEOO	152.8	153.6	163.4	172.5	176.6	180.9
Rosetta, MUSES-C	5.4	6.7	7.0	7.0	7.0	13.2
SMD Administrative	3.9	1.4	23.1	60.7	49.0	60.1
Lunar Quest	105.0	103.6	142.6	138.6	145.5	118.7
LRO extended mission		0.8	21.6	22.2	27.2	
LADEE	30.2	66.5	73.9	31.1		
ILN	10.0	3.7	16.3	48.9	81.2	79.3
Entry, Descent and Landing	0.5					
Lunar Science, Management and Future Msns	64.3	32.5	30.8	36.3	37.0	39.4
Mars Exploration	381.6	416.1	494.5	405.5	514.3	536.7
Phoenix	4.6					
MSL 2009	223.3	204.0	194.6	67.3	65.0	30.0
MAVEN 2013	6.7	53.4	168.7	182.6	138.4	30.6
ExoMars	10.5	9.0	14.0	24.0	20.0	15.0
Management / Future Missions	48.3	45.6	46.1	71.0	227.9	379.4
Operating Missions / R&A	88.1	104.1	71.1	60.6	63.1	81.6
JPL Building Support						

Planetary FY10 Budget



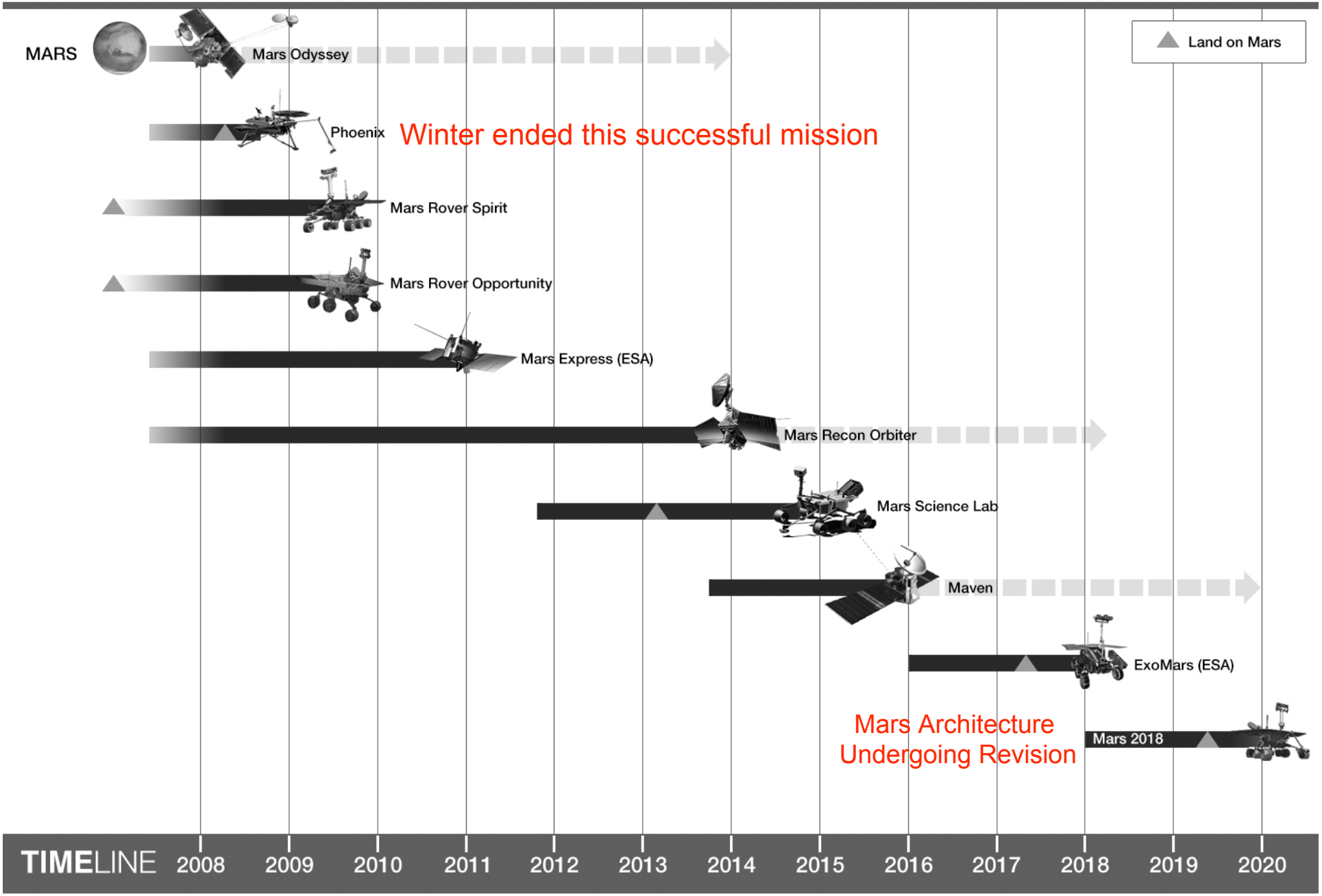
Planetary Missions Overview

Planetary Missions (Non-Mars, Non-Lunar) timeline



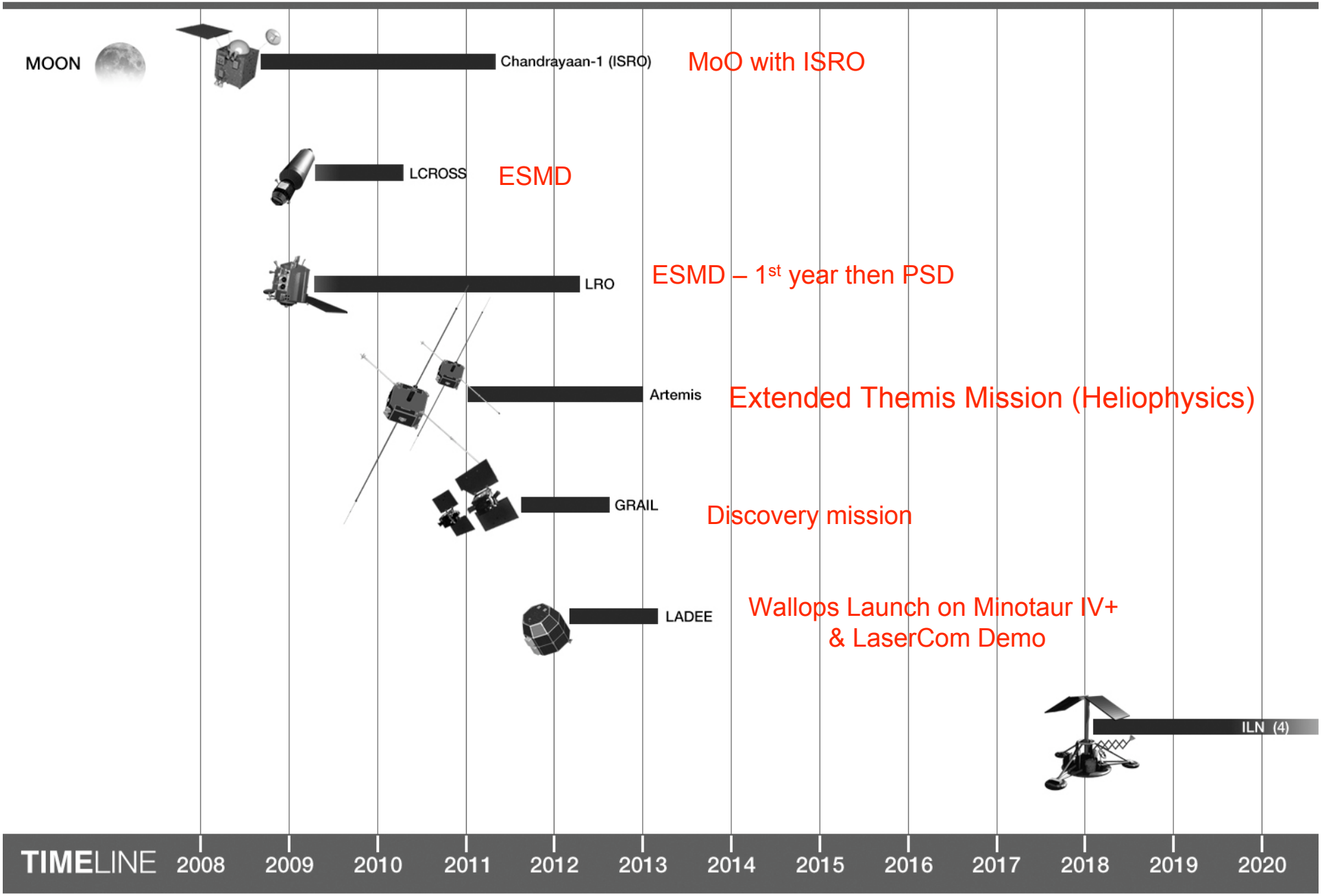
Mars Mission timeline

Next Decadal



Lunar Mission timeline

Next Decadal



New Frontiers & Discovery

PI Mission Opportunities

New Frontiers Program

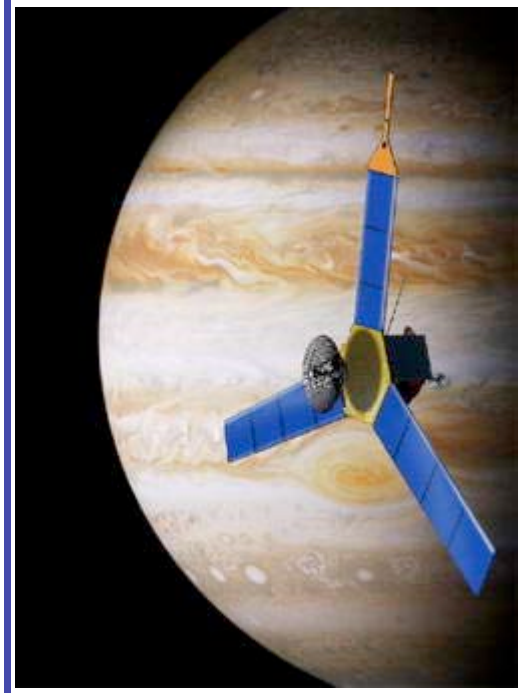
1st NF mission
New Horizons:

Pluto-Kuiper Belt Mission

Launched January 2006
Arrives July 2015

2nd NF mission
JUNO:

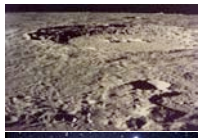
Jupiter Polar Orbiter Mission



August 2011 launch

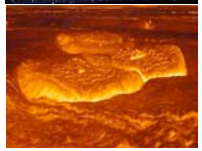
3rd NF mission AO

South Pole - Aitken Basin Sample Return



Comet Surface Sample Return

Venus In Situ Explorer

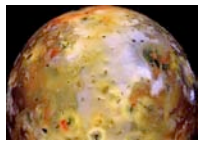


Network Science

Trojan/Centaur

Asteroid Sample Return

Io Observer



Ganymede Observer

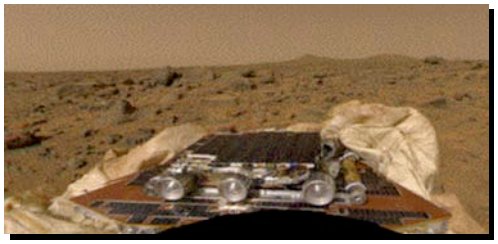
New Frontier-3 Announcement

- Open competition for PI class missions of strategic importance to Planetary Science in the < $1B class
  - Select up to 3 for a 10 mo. Phase-A then a downselect to 1
  - Launch window beginning late CY 2016 ending NLT the end of CY 2018, according to target
  - Technology infusion:
    - NEXT ion propulsion system & Advanced Materials Bi-propellant rocket
- Schedule:
  - AO released April 20, 2009
  - Proposals Due July 31, 2009

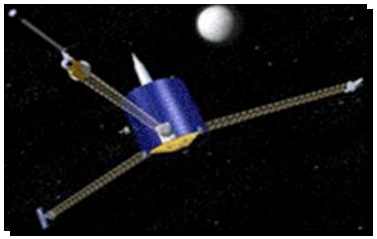
Discovery Program

Completed

Mars evolution:
Mars Pathfinder (1996-1997)



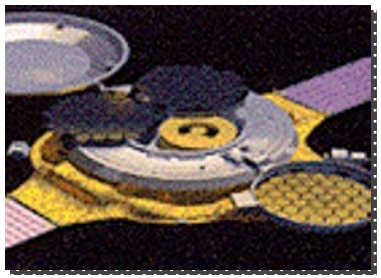
Lunar formation:
Lunar Prospector (1998-1999)



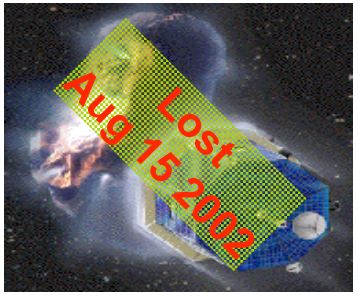
NEO characteristics:
NEAR (1996-1999)

Completed / In Flight

Solar wind sampling:
Genesis (2001-2004)



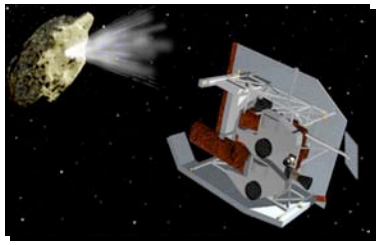
Comet diversity:
CONTOUR



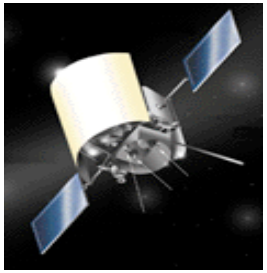
Nature of dust/coma:
Stardust(1999-2006)

In Flight / In Development

Comet internal structure:
Deep Impact (2005-2006)

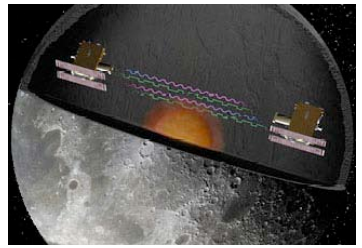


Mercury environment:
MESSENGER (2004-*2012*)



Main-belt asteroids:
Dawn (*2007-2015*)

Lunar Internal Structure
GRAIL (*2011-2012*)



Discovery-12 Announcement

- Planetary Decadal science for PI missions
  - Across entire solar system (including Mars)
  - Cost Cap: $425M FY10 (without LV)
  - Selection: 2 to 3 missions for a 9 mo. Phase-A then downselect to 1
  - Launch date NLT December 31, 2016
- ASRG is provided GFE as an option
  - Funded 9 feasibility studies
- Schedule:
  - Draft AO ~late July or early Aug 2009
  - Final AO ~ November-December 2009
  - Proposals due 90 days after AO release

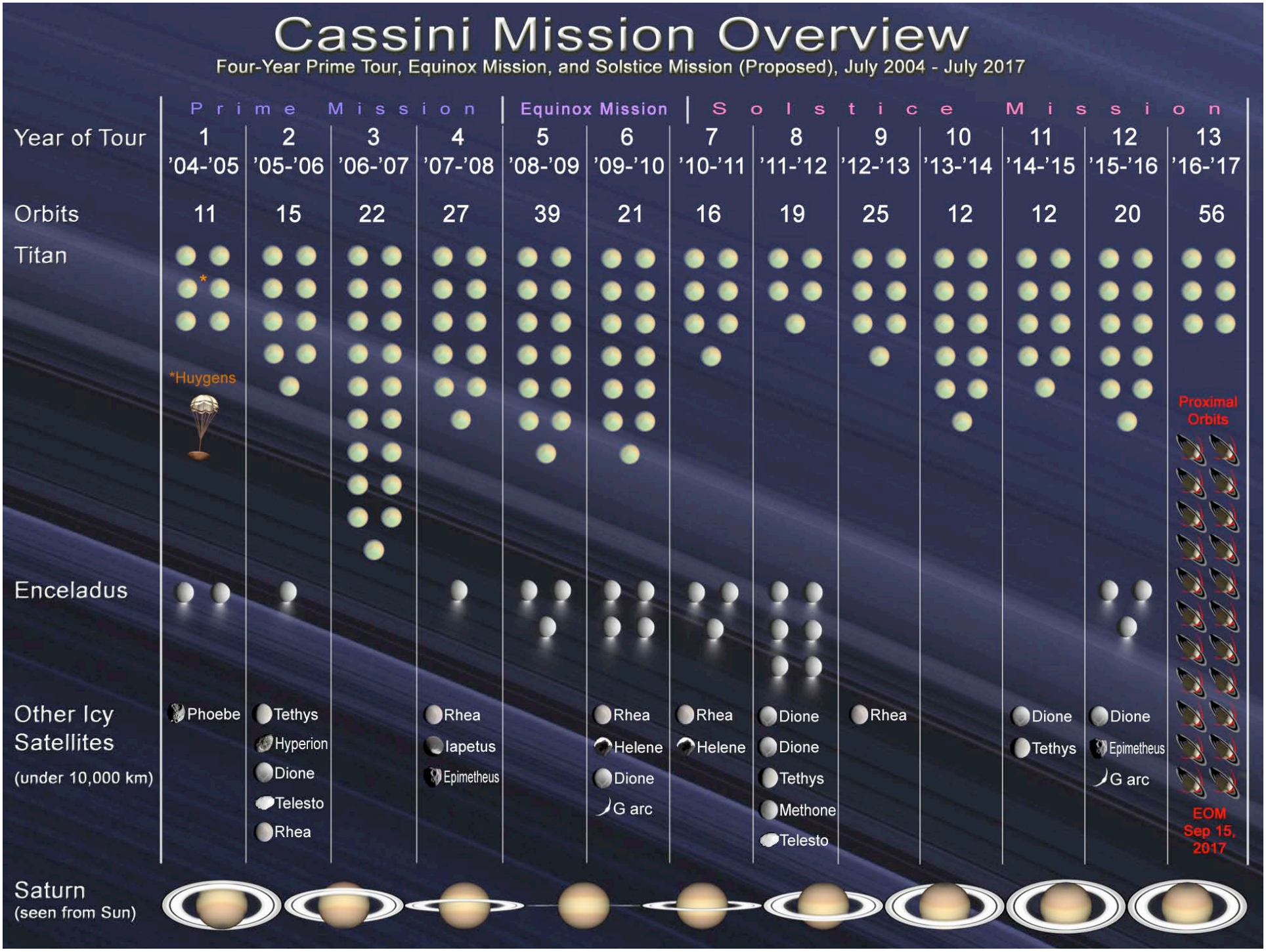
President's FY10 DOE Budget

The DOE Budget includes funding $30M to start preliminary design and engineering for a domestic capability to produce plutonium-238 for use in radioisotope power systems required for NASA's space missions and other federal government agencies needs

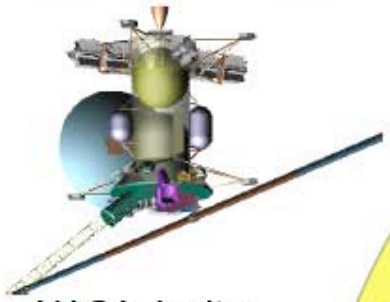
Outer Planets Flagships

Cassini

Europa & Ganymede missions

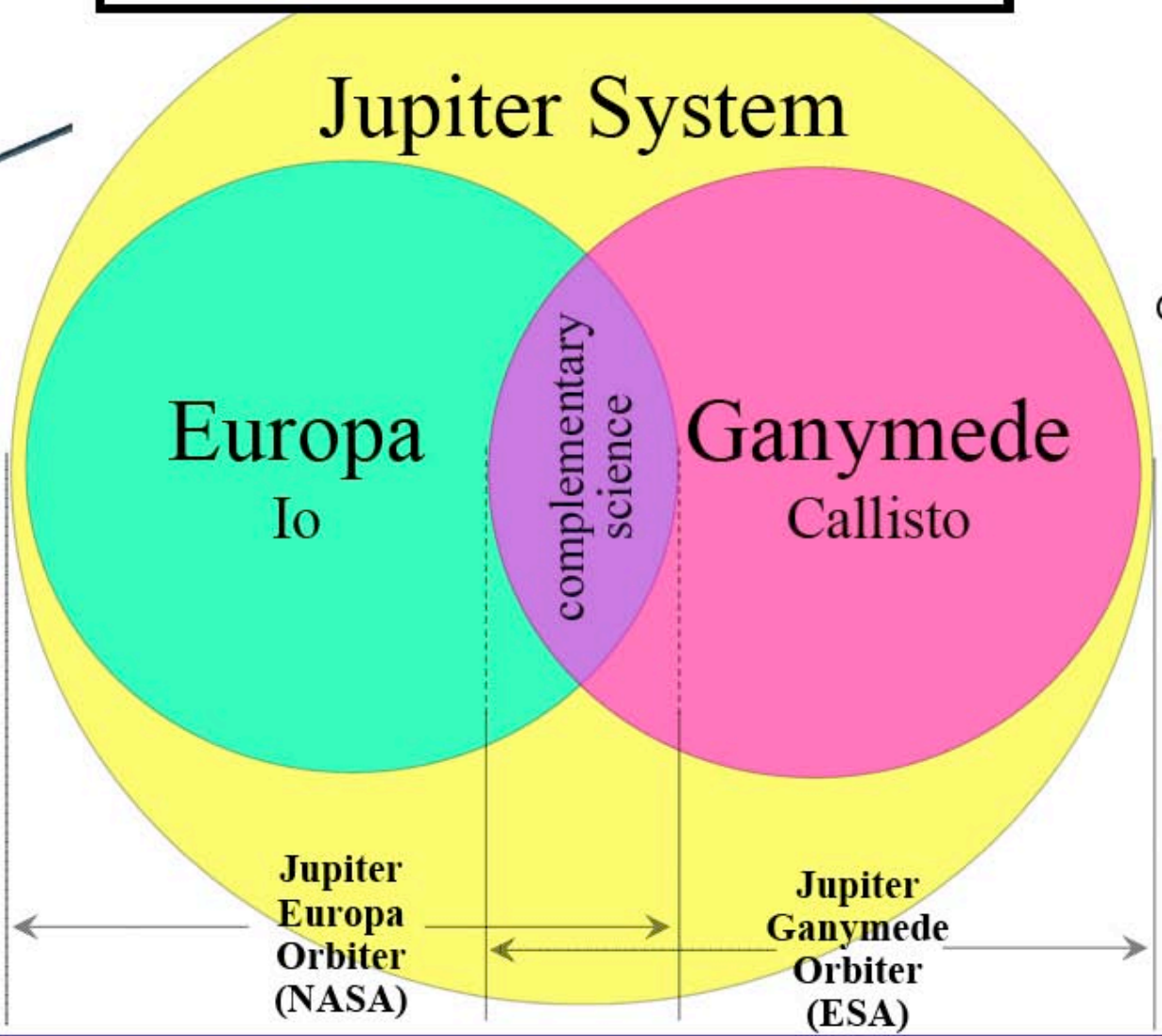

Cassini Mission Overview
Four-Year Prime Tour, Equinox Mission, and Solstice Mission (Proposed), July 2004 - July 2017
Prime Mission
Equinox Mission
Solstice Mission
Year of Tour
1 '04-'05
2 '05-'06
3 '06-'07
4 '07-'08
5 '08-'09
6 '09-'10
7 '10-'11
8 '11-'12
9 '12-'13
10 '13-'14
11 '14-'15
12 '15-'16
13 '16-'17
Orbits
11
15
22
27
39
21
16
19
25
12
12
20
56
Titan
*Huygens
Proximal Orbits
Enceladus
Other Icy Satellites
(under 10,000 km)
Phoebe
Tethys
Hyperion
Dione
Telesto
Rhea
Rhea
Iapetus
Epimetheus
Rhea
Helene
Dione
G arc
Rhea
Helene
Dione
Dione
Tethys
Methone
Telesto
Rhea
Dione
Tethys
Dione
Epimetheus
G arc
EOM Sep 15, 2017
Saturn
(seen from Sun)

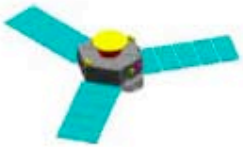
The Emergence of Habitable Worlds Around Gas Giants



NASA Jupiter Europa Orbiter (JEO)

ESA Jupiter Ganymede Orbiter (JGO)

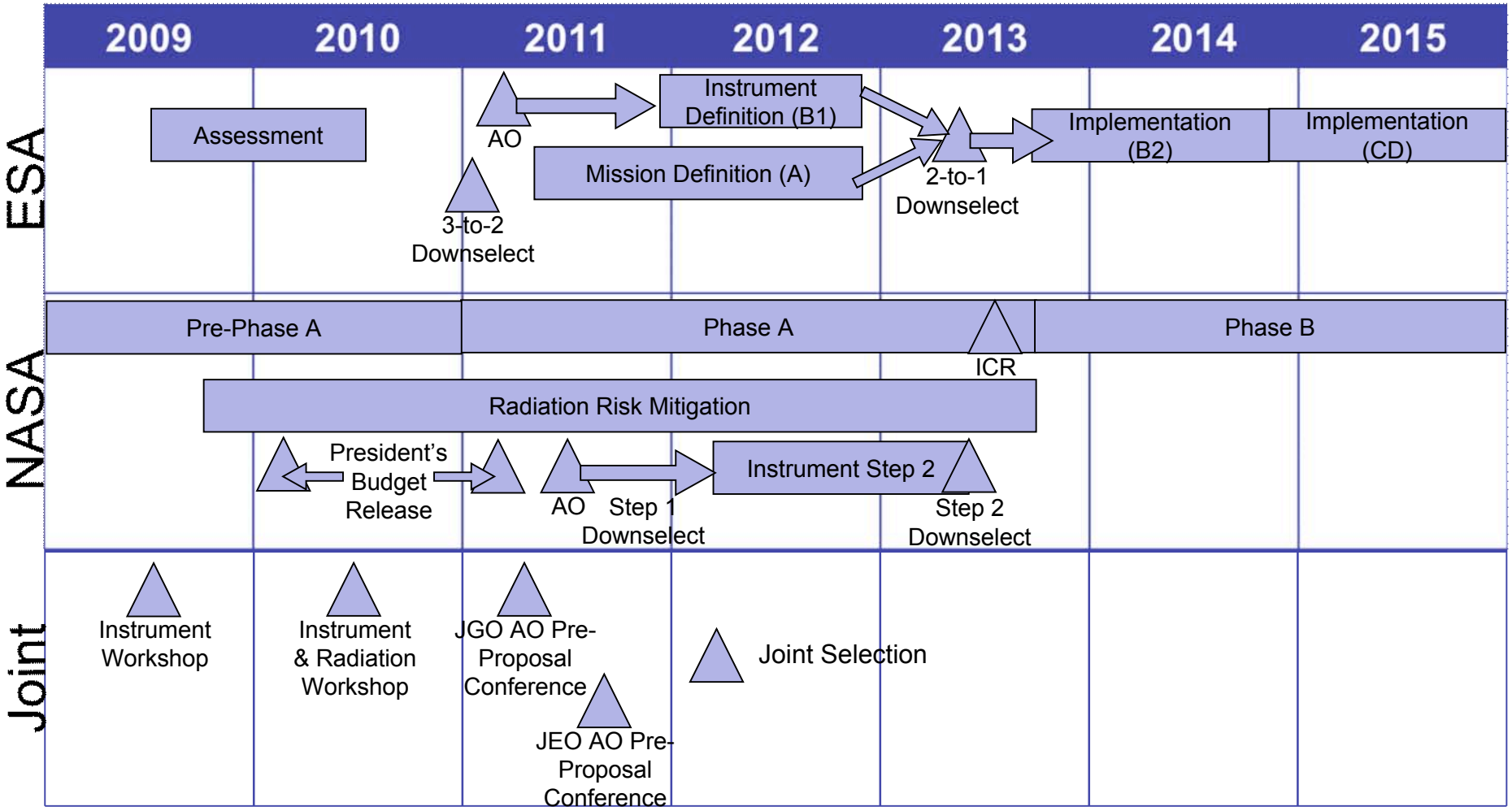




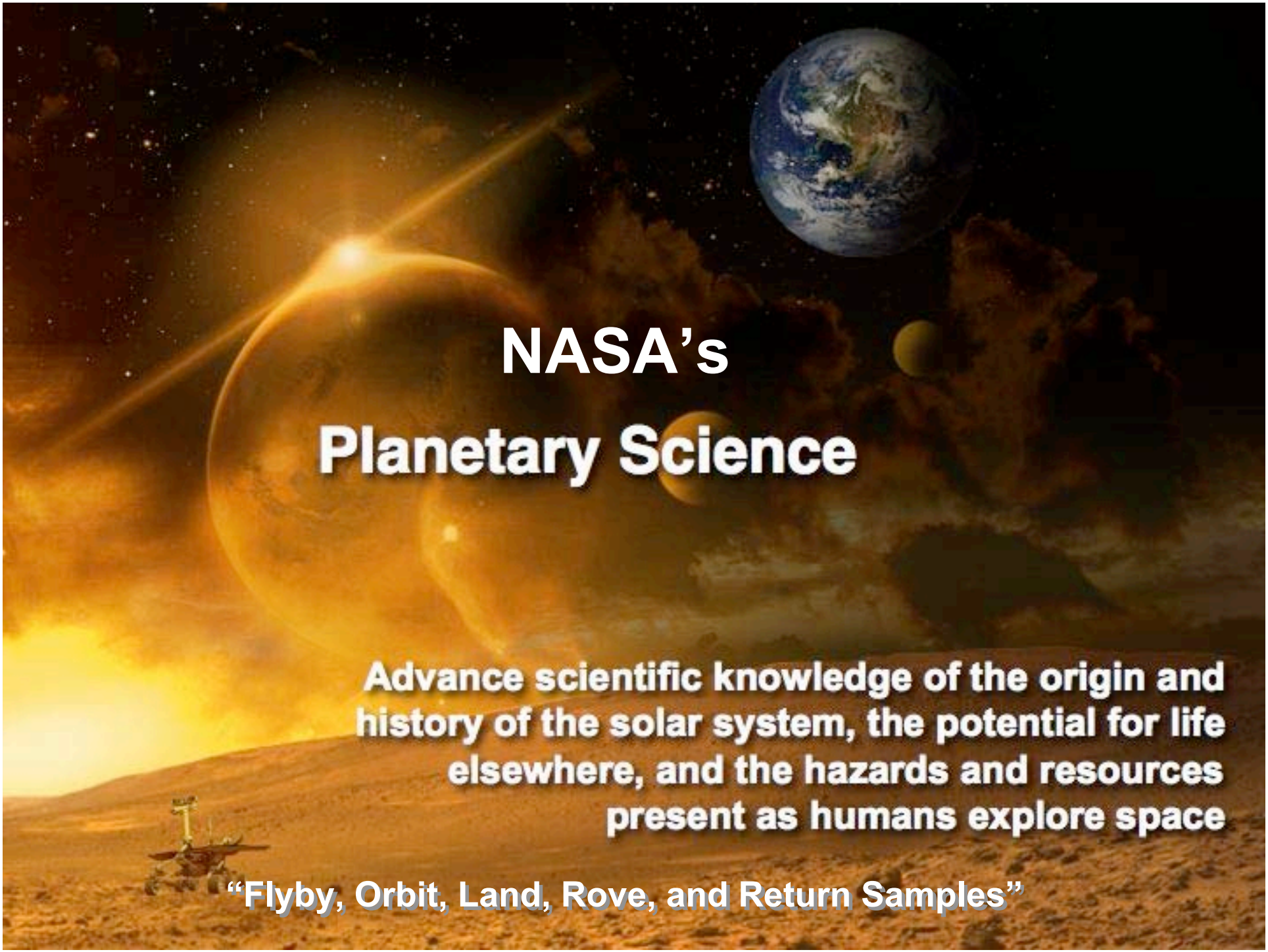
JAXA Jupiter Magnetospheric Orbiter (JMO)

JEO is designed to stand alone or operate synergistically with ESA JGO

NASA and ESA Schedules



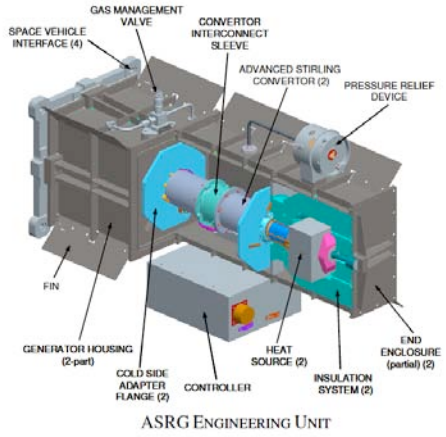
- Continued discussions on schedule & AO coordination


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
"Flyby, Orbit, Land, Rove, and Return Samples"

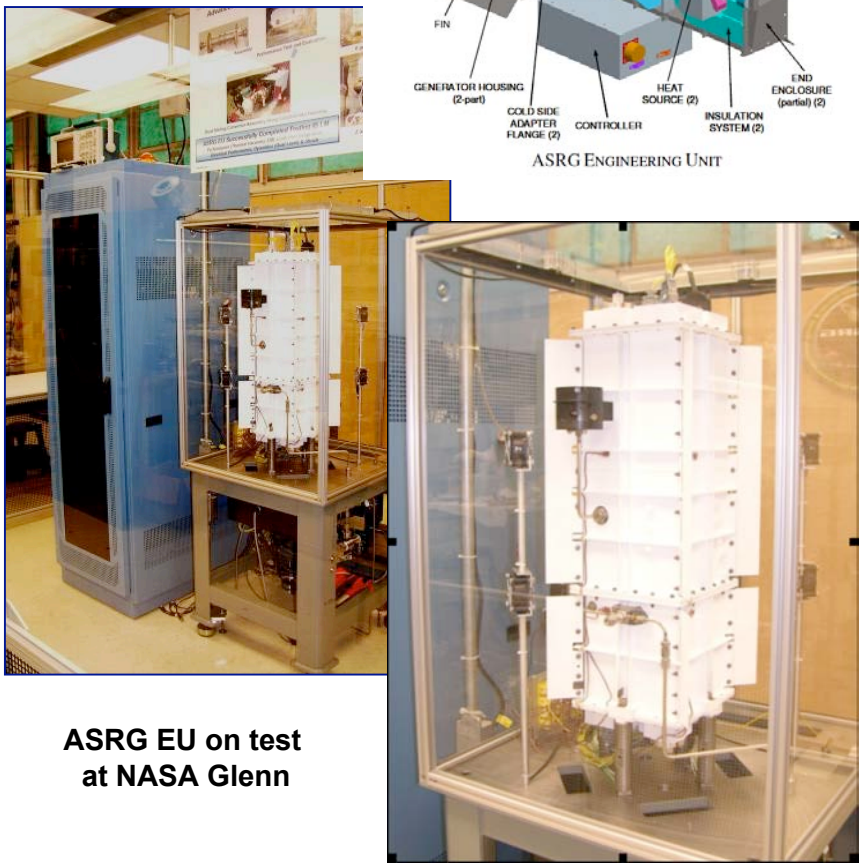
Advanced Stirling Radioisotope Generator Status

- Operation in space and surface of atmosphere-bearing planets & moons
- Characteristics:
  - ≥14 year lifetime
  - Nominal power : > 140 We
  - Mass: ~ 22 kg
  - Specific Power: > 6 W_e/kg
  - System efficiency: > 30 %
  - 2 GPHS ("Pu^{238} Bricks") modules
  - Uses only 0.88 kg Pu^{238}
- ASRG Engineering Unit (EU) delivered by DOE/LM to NASA Glenn for extended (24/7) operation to provide long-life test
- ASRG EU has operated over 4000 hrs of operation to date (June 09) with no performance degradation identified.
- 2 Flight units to be delivered in 2014

DOE/Lockheed Martin ASRG EU

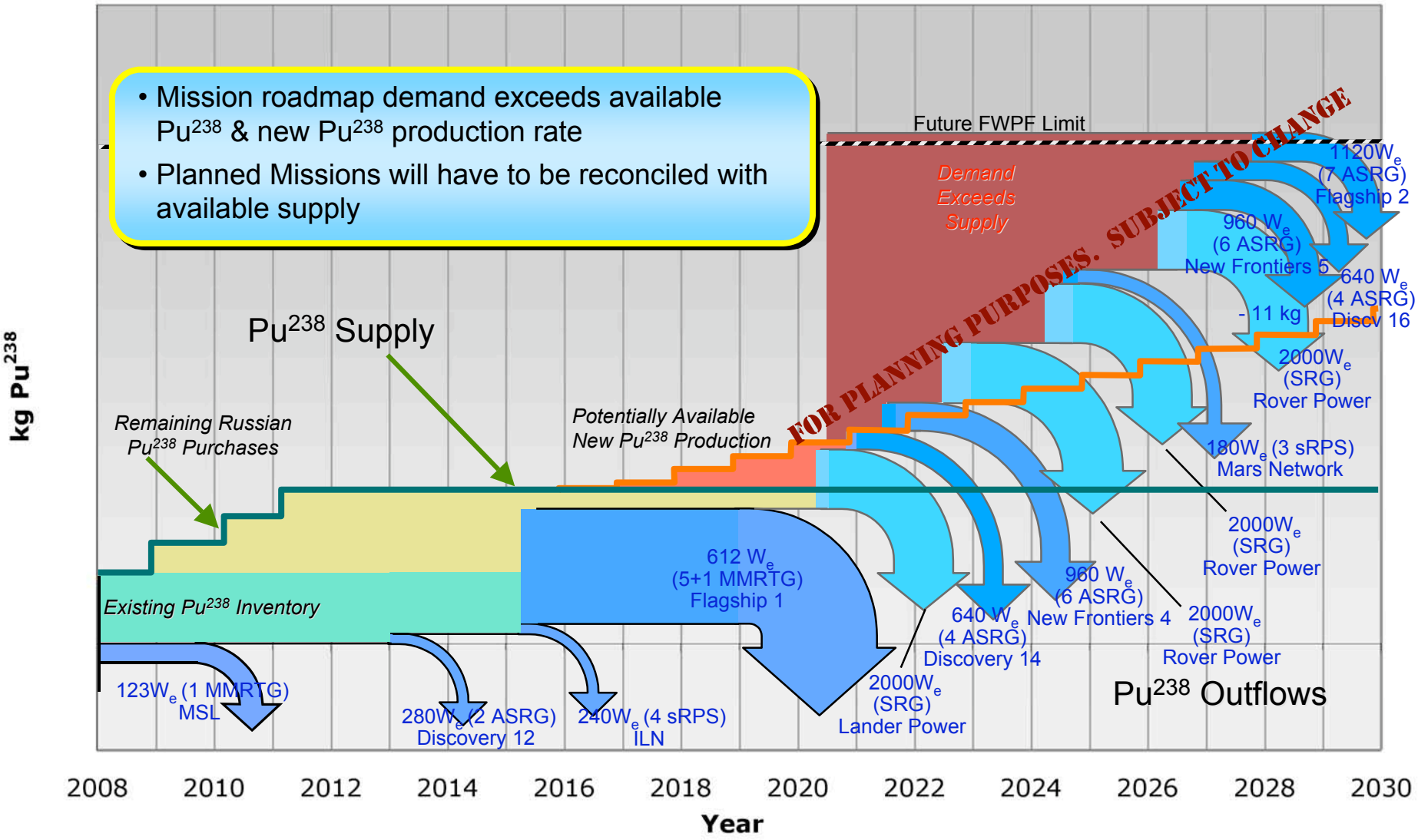


ASRG Engineering Unit



ASRG EU on test at NASA Glenn

Plutonium Supply vs Potential NASA Demand
Magnitude of the Potential Shortage



Planetary Science Division Budget History ($M)

	FY08	FY09	FY10	FY11	FY12	FY13	FY14
FY05 PFP (w/ DSN, O/H, & Lunar Robotics)	$2,955	$3,126					
FY06 PFP (w/DSN, O/H, & Lunar Robotics)	$2,832	$2,999	$3,066				
FY07 PFP (w/ DSN & O/H)	$1,599	$1,840	$1,900	$1,847			
FY08 PFP (include O/H)	$1,396	$1,677	$1,720	$1,738	$1,748		
FY09 PFP	$1,247	$1,334	$1,410	$1,537	$1,570	$1,609	
FY10 PFP	$1,313	$1,288	$1,346	$1,501	$1,578	$1,600	$1,633