OPAG Update - Feb 6th, 2008

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1 - OPAG meeting Mar 31-Apr 1 - Boulder, CO

The meeting will be held in the Boulderado Hotel in downtown Boulder, Colorado.
Information on rooms and on student/junior researcher travel grants will be posted soon.

The agenda will include discussions of the Outer Planets Flagship studies, New Frontiers 3 AO, the availability of Pu238, Cassini XM and XXM, Comet Surface Sample Return study, electric propulsion - probably not in that order. Plus discussions of any missions the OPAG community would like to address. There will be an open mike time, as usual. Please send me items you would like on the agenda or let me know if you would like to give a presentation.

Also.... I shall be representing OPAG at the March 3-4 Planetary Science Subcommittee of the NASA Advisory Council - let me know if there are specific OPAG issues that you would like me to raise.

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2 - Titan mission concept study report posted

The public report from the Titan mission concept study is now available:
http://www.lpi.usra.edu/opag/Titan_Explorer_Public_Report.pdf

Jim Green tells me that the reviews of the 4 flagship mission concept studies will be made public (in some form). Hopefully soon.

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3 - AO Workshop

The Science Mission Directorate (SMD) at NASA Headquarters has initiated an effort to simplify NASA Announcements of Opportunity (AOs). To support this effort, SMD is planning a Proposers Lessons Learned Workshop for proposers to the recent Discovery, Mars Scout, and Small Explorer (SMEX) AOs. The workshop will be held in central city (probably Dallas, Texas) on February 28-29, 2008. We hope you will be able to join us and are sending this notice so that you can "save the date." I will send you a follow-up email when the workshop details are posted at http://sso.larc.nasa.gov/aosimplification.html.

This workshop will provide critical feedback to NASA on the AO process and on improving future AOs. The workshop will focus on the experience and

lessons learned by proposers from the Discovery and Mars Scout 2006 proposal cycles, and also the recently completed SMEX proposal cycle. Additional information on the workshop (location, registration information, agenda, etc.) will be posted on the web at http://sso.larc.nasa.gov/aosimplification.html as soon as it is available.

The draft workshop agenda is being shaped by preliminary feedback that SMD has received on AO improvements; the agenda will be posted at http://sso.larc.nasa.gov/aosimplification.html as soon as it is available. The workshop will pay particular attention to the following topics: AO Requirements (perception and reality), Technical Data including Telecom (how much is too much), Cost and Schedule Data (how much is needed), Launch Services and other external factors (interactions with the cost cap), Education and Public Outreach (including student collaborations), and Letters of Commitment (including endorsements and foreign support).

==> If you wish to make a 5-7 minute presentation on one of these topics, or any other
appropriate topic, please send email to aosimplify@nasa.gov.

Many industry partners do not appear as team members on the cover of proposals, yet NASA is very interested in their participation as well. Please forward this email notice to the proposal lead at your industry partner as well as to any other participants in recent NASA AO proposal activities.

Even if you cannot attend the workshop, NASA is soliciting your input on improving the AO and the AO process. Please see the announcement requesting community input at http://sso.larc.nasa.gov/aosimplification.html.

For further information on the workshop or AO Simplification, please see http://sso.larc.nasa.gov/aosimplification.html, send email to aosimplify@nasa.gov, or contact Paul Hertz (202-358-0986) or Brad Perry (757-864-8257).

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5 - Enceladus Focus Group meeting

3nd meeting of the Enceladus Focus Group
https://encfg.ciclops.org/
for Monday 13 April, 2008

(The day before the/ Abscicon 2008/ conference which will be held near NASA Ames at the Santa Clara Convention Center Tuesday-Thursday April 15-17, 2008.
See http://abscicon.seti.org/science-program/agenda.php)

The purpose of the meeting is to discuss the physical properties and astrobiological potential of Enceladus, and future mission concepts.
Starting time: 9:30 am PDT, Monday 14 April 2008

Location: Is still TBD but will be at the Santa Clara Convention Center, or nearby.

If you are planning to come, pls email cpenceladus@ciclops.org and let Carolyn Porco know.

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5 - New Horizons data in PDS

[NASA] PDS RELEASES NEW HORIZONS DATA

The NASA Planetary Data System is pleased to announce the first delivery of the data from the NEW HORIZONS mission. The delivery includes POST-LAUNCH CHECKOUT and JUPITER FLYBY row and calibrated data for the following New Horizons instruments:

MVIC (Multispectral Visible Imaging Camera)
LEISA (Linear Etalon Image Spectral Array)
Alice (UV imaging spectrometer)
SWAP (Solar Wind Around Pluto)
PEPSSI (Pluto Energetic Particle Spectrometer Sciences Investigation)
LORRI (Long Range Reconnaissance Imager)
SDC (Student Dust Counter)
SPICE data are also available.

To see and download the data as well as mission and instrument information, go to

http://pdssbn.astro.umd.edu/missions/newhorizons/index.html

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6 - NASA Budget - last but not least important!

And it looks pretty good for Outer Planets.

See yesterday's PEN for Alan Stern's message
PLANETARY EXPLORATION NEWSLETTER
Volume 2, Number 9 (February 5, 2008)
PEN Website: http://planetarynews.org

Below I attach some extracts from the Planetary Science Division part of the NASA 2009 budget.

Planetary Science	**1,215.6**	**1,247.5**	**1,334.2**	**1,410.1**	**1,537.5**	**1,570.0**	**1,608.7**
Planetary Science Research	*181.9*	*242.1*	*270.8*	*315.8*	*355.6*	*373.2*	*382.6*
Planetary Science Research and Analysis	111.7	127.8	142.4	145.1	150.4	155.2	159.0
Lunar Science Research	-	22.7	105.0	122.0	140.0	150.0	151.9
Operating Missions and Analysis	20.4	19.1	19.5	21.4	22.2	22.3	22.7

	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Education and Directorate Management	49.8	72.4	3.9	27.4	43.1	45.7	49.0
Discovery	*128.3*	*153.0*	*247.0*	*258.3*	*256.0*	*326.1*	*140.5*
GRAIL	-	-	122.4	122.8	113.1	24.9	5.7
Moon Mineralogy Mapper	6.6	2.6	2.7	2.6	0.5	-	-
Discovery Future	13.1	103.9	50.4	49.1	65.4	239.8	90.7
Discovery Research	11.9	10.0	18.8	16.5	15.7	16.9	17.3
Operating Missions and Data Analysis	96.8	36.5	52.6	67.3	61.3	44.6	26.8
New Frontiers	*106.6*	*132.2*	*263.9*	*250.3*	*232.3*	*227.7*	*236.9*
Juno	87.8	108.3	245.0	225.2	168.0	14.4	17.8
Other Missions and Data Analysis	18.8	23.9	19.0	25.1	64.3	213.3	219.1
Mars Exploration	*634.9*	*553.5*	*386.5*	*299.6*	*344.5*	*341.1*	*413.8*
2009 Mars Science Lab	416.8	305.5	223.3	69.0	54.6	37.6	-
Mars Scout (2013)	5.3	57.7	6.7	68.5	152.5	170.7	121.8
Mars Research and Analysis	14.2	27.4	24.9	25.9	26.7	27.1	27.5
Operating Missions and Data Analysis	171.8	149.4	131.6	136.2	110.7	105.7	264.5
JPL Building	26.8	13.4	-	-	-	-	-
Outer Planets	*79.0*	*81.9*	*101.1*	*216.7*	*279.4*	*230.6*	*362.0*
Outer Planets	79.0	81.9	101.1	216.7	279.4	230.6	362.0
Technology	*84.8*	*84.8*	*64.9*	*69.3*	*69.6*	*71.3*	*73.0*
Technology	84.8	84.8	64.9	69.3	69.6	71.3	73.0

Mission Directorate:	Science
Theme:	Planetary Science

Explanation of Program Changes

Planetary Science Research

Funds a healthy Research and Analysis program; augments Lunar Science to include a series of small robotic lunar satellites; and will start the formulation and development work for the small lunar orbiter in FY 2008 and FY 2009. Cassini has been transferred to the Outer Planets Program.

Discovery

Reflects mission support for Dawn mission launched in September 2007; selections of three Missions of Opportunity (Deep Impact Extended Investigation of Comets (DIXI), Extrasolar Planet Observations and Characterization (EPOCh), and StardustNext); and three full-class missions (Origins Spectral Interpretation Resource Identification and Security (OSIRIS), Gravity Recovery and Interior Laboratory (GRAIL), and Vesper) concept study selections. Also, adjusts for GRAIL mission selection to continue into Phase B, the formulation phase.

New Frontiers

Realigns Juno funding profile consistent with a 2011 launch date; New Frontiers 3 Announcement of Opportunity to be released in late CY 2008.

Mars Exploration

Delays Scout 2011 to 2013, redirects the Mars Program to focus on Mars Sample Return mission after Scout 2013 opportunity, expands U.S. participation on the ESA/ExoMars mission by selecting two instrument Missions of Opportunity for study and technology development, maintains funds for a 2016 mission, and funds a healthy Mars Research and Data Analysis program.

Outer Planets

Adds an Outer Planets Flagship mission.

Technology

Realigns the In-Space Propulsion (ISP) and Radioisotope Power Systems (RSP) to focus on core-critical technology needs.

Mission Directorate:	Science
Theme:	Planetary Science

Theme Overview

Planetary Science is a grand human enterprise that seeks to discover the nature and origin of the celestial bodies among which we live, and to explore whether life exists beyond Earth. The scientific imperative for Planetary Science, the quest to understand our origins, is universal. How did we get here? Are we alone? What does the future hold? These overarching questions lead to more focused, fundamental science questions about our solar system: How did the Sun's family of planets and minor bodies originate? How did the solar system evolve to its current diverse state? What are the characteristics of the solar system that led to the origin of life? How did life begin and evolve on Earth and has it evolved elsewhere in the solar system? What are the hazards and resources in the solar system environment that will affect the extension of human presence into space?

To achieve progress in addressing these six fundamental science questions, NASA relies on a balanced program. There are six programs within the Planetary Science Theme -- Discovery, New Frontiers, Research, Technology, Mars Exploration, and the Outer Planets Programs.

Discovery has two full-class operating spacecraft, one radar instrument operating on an ESA Mars Express mission, one mission in its formulation phase, and four Missions of Opportunities.

New Frontiers has one operating spacecraft and one mission currently in its formulation phase.

Research supports two operating missions with international partners, as well as Research and Analysis, Sample and Data Curation, data dissemination and analysis, and Lunar Science Research.

The Mars Program has three spacecraft and two rovers in operation, one instrument operating on an ESA Mars Express mission, one mission in development, one mission in its formulation phase, and project activities for technology, next decade missions, and research.

The Technology Program includes advanced in-space propulsion systems and advanced power generation and storage.

The Outer Planets Program includes one operating mission and the Outer Planets Flagship mission.

Relevance

Relevance to national priorities, relevant fields, and customer needs:

Planets and satellites of the solar system and the ancient icy bodies far from the Sun are "Rosetta stones" that can tell unique stories about the evolution of the solar system. As researchers learn more about the origins of living organisms on Earth and about the solar system's planets and moons, they may learn that life has arisen in places beyond Earth.

The robotic exploration will generate knowledge about our solar system needed to identify the most promising human exploration missions. This knowledge will also help enable safe human space exploration in the forbidding environments they will encounter.

Relevance to the NASA Mission and Strategic Goals:

The Planetary Science Theme supports the NASA Mission, "To pioneer the future in space exploration, scientific discovery, and aeronautics research," and Strategic Goal 3: "Develop a balanced overall program of science, exploration, and aeronautics consistent with the redirection of the human spaceflight program to focus on exploration."

Planetary Science supports NASA's achievement of Sub-goal 3C: 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.

Robotic exploration is an integral part of an overall strategy to extend human presence throughout the solar system.

Relevance to education and public benefits:

The Planetary Science Theme uses its missions, research programs, and the human resources of the space science community to enhance the quality of American science, mathematics, and technology education, particularly at the pre-college level. The Planetary Theme is dedicated to sharing the excitement of discoveries and knowledge generated by space science missions and research, with the public, and thus contributing to educating and inspiring the next generation of scientists and technical workers needed for the 21st century.

Public benefits from Planetary Science include a growing understanding of the solar system and Earth's significance within it. Planetary Science's Discovery, Mars, and Research Programs were among the first at NASA to require a plan for education and public outreach, as NASA recognized the importance of communicating the excitement of space exploration to the public.

Mission Directorate:	Science
Theme:	Planetary Science

Performance

Performance Commitments, Current Ratings and Outcome Trends:

Measure #	Description	Contributing Program (s)	Multi-year Outcome ratings FY 04	FY 05	FY 06	FY 07
Strategic Goal 3	**Develop a balanced overall program of science, exploration, and aeronautics consistent with the redirection of the human spaceflight program to focus on exploration.**					
Sub Goal 3C	**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.**					
Outcome 3C.1	**Progress in learning how the Sun's family of planets and minor bodies originated and evolved.**		**Green**	**Green**	**Green**	**Green**
APG 9PS1	Demonstrate progress in learning how the Sun's family of planets and minor bodies originated and evolved. Progress will be evaluated by external expert review.	Multiple Programs				Green
APG 9PS2	Develop missions in support of this Outcome, as demonstrated by completing the Juno Critical Design Review (CDR).	New Frontiers				White
APG 9PS3	Develop missions in support of this Outcome, as demonstrated by completing the GRAIL mission Preliminary Design Review (PDR).	Discovery				None
APG 9PS4	Develop missions in support of this Outcome, as demonstrated by completing the Mars Science Laboratory (MSL) Launch Readiness Review (LRR).	Mars Exploration				Green
Outcome 3C.2	**Progress in understanding the processes that determine the history and future of habitability in the solar system, including the origin and evolution of Earth's biosphere and the character and extent of prebiotic chemistry on Mars and other worlds.**		**Green**	**Green**	**Green**	**Green**
APG 9PS2	Develop missions in support of this Outcome, as demonstrated by completing the Juno Critical Design Review (CDR).	New Frontiers				White
APG 9PS4	Develop missions in support of this Outcome, as demonstrated by completing the Mars Science Laboratory (MSL) Launch Readiness Review (LRR).	Mars Exploration				Green
APG 9PS5	Demonstrate progress in understanding the processes that determine the history and future of habitability in the solar system, including the origin and evolution of Earth's biosphere and the character and extent of prebiotic chemistry on Mars and other worlds. Progress will be evaluated by external expert review.	Multiple Programs				Green
APG 9PS6	Develop missions in support of this Outcome, as demonstrated by selecting the next Scout mission.	Mars Exploration				None
APG 9PS7	Conduct flight program in support of this Outcome, as demonstrated by achieving mission success criteria for Phoenix.	Mars Exploration				None

Performance

Performance Commitments, Current Ratings and Outcome Trends:

Measure #	Description	Contributing Program (s)	Multi-year Outcome ratings FY 04	FY 05	FY 06	FY 07
Outcome 3C.3	**Progress in identifying and investigating past or present habitable environments on Mars and other worlds, and determining if there is or ever has been life elsewhere in the solar system.**		**Green**	**Green**	**Green**	**Green**
APG 9PS2	Develop missions in support of this Outcome, as demonstrated by completing the Juno Critical Design Review (CDR).	New Frontiers				White
APG 9PS4	Develop missions in support of this Outcome, as demonstrated by completing the Mars Science Laboratory (MSL) Launch Readiness Review (LRR).	Mars Exploration				Green
APG 9PS6	Develop missions in support of this Outcome, as demonstrated by selecting the next Scout mission.	Mars Exploration				None
APG 9PS7	Conduct flight program in support of this Outcome, as demonstrated by achieving mission success criteria for Phoenix.	Mars Exploration				None
APG 9PS8	Demonstrate progress in identifying and investigating past or present habitable environments on Mars and other worlds, and determining if there is or ever has been life elsewhere in the solar system. Progress will be evaluated by external expert review.	Multiple Programs				Green
Outcome 3C.4	**Progress in exploring the space environment to discover potential hazards to humans and to search for resources that would enable human presence.**		**Green**	**Green**	**Green**	**Green**
APG 9PS10	Develop missions in support of this Outcome, as demonstrated by selecting instruments for the first Lunar Science Research mission.	Planetary Science Research				New
APG 9PS4	Develop missions in support of this Outcome, as demonstrated by completing the Mars Science Laboratory (MSL) Launch Readiness Review (LRR).	Mars Exploration				Green
APG 9PS7	Conduct flight program in support of this Outcome, as demonstrated by achieving mission success criteria for Phoenix.	Mars Exploration				None
APG 9PS9	Demonstrate progress in exploring the space environment to discover potential hazards to humans and to search for resources that would enable human presence. Progress will be evaluated by external expert review.	Multiple Programs				Green

Uniform and Efficiency Measures:

Measure #	Description	Multi-year Outcome ratings FY 04	FY 05	FY 06	FY 07
Planetary Science Theme					
APG 9PS11	Complete all development projects within 110% of the cost and schedule baseline.				Red

Uniform and Efficiency Measures:

Measure #	Description	Multi-year Outcome ratings FY 04	FY 05	FY 06	FY 07
APG 9PS12	Deliver at least 90% of scheduled operating hours for all operations and research facilities.				Green
APG 9PS13	Peer-review and competitively award at least 95%, by budget, of research projects.				Green
APG 9PS14	Reduce time within which eighty percent of NRA research grants are awarded, from proposal due date to selection, by five percent per year, with a goal of 130 days.				Red

Performance Achievement Highlights:

- Using Mars Reconnaissance Observer (MRO) observations, researchers delineated the locations of phyllosilicates, the alteration products of minerals sustaining contact with water. The data show that these minerals are widespread in the highlands of Mars, but restricted to the most ancient areas dating to the Noachian era, the oldest of three periods during which Mars' surface formed. The research provides new and important information about early Mars, the interaction of water with the crust, and consequences of the evolution of the planet's interior.

- Using observations by the Cassini spacecraft of Saturn's moon Enceladus, scientists detected water vapor and the decomposition products of water, as well as small amounts of molecular nitrogen and methane. This suggests that the interior of Enceladus is warm enough to contain liquid water and is, or once was, favorable to catalytic chemistry that would permit the synthesis of complex organic compounds. This makes Enceladus an exciting subject for further research to discover if the moon would be hospitable to primitive life and to reveal how such a small, icy body could have a warm core.

- Ongoing MRO mapping and analysis of sedimentary deposits in Holden crater on Mars found well-bedded deposits emplaced during two distinct wet intervals during the Noachian era, the oldest of three periods during which Mars's surface formed. During the first of these wet intervals, there was a lake in the crater that included the deposition of phyllosilicates. The second interval was shorter lived and related to flooding occurring when water impounded in the nearby Uzboi Vallis breached the crater rim and drained into the Holden crater. Access to these deposits, perhaps during a future landed mission, could yield important information about the conditions within these ancient lake environments and whether they may have been habitable.

For more information, see Sub-goal 3C in the FY 2007 Annual Performance Report, included in this budget.

Quality

Program Assessment Rating Tool (PART):

The Planetary Science Theme was subject to a PART review in 2003 and 2006 and received an "Effective" rating both times. The assessment found that this program is well-defined and well-managed, with a clear purpose and direct ties to NASA's Mission. The program has relevant research priorities that reflect the priorities of the planetary science community and successfully applies lessons learned from past mission failures.

Areas recently identified for performance improvement include:
- Reporting for major missions on: estimated mission lifecycle cost upon entering development; key schedule milestones associated with each mission phase for those missions formally approved for formulation; mission cost and schedule progress achieved in each phase before entering the next; and any plans to re-baseline lifecycle cost and schedule; and

- Exploring options for modifying the current approach to its competed planetary science programs to allow for a healthy mix of missions of various size and scope, potentially including missions to the outer planets.

The lifecycle cost and schedule figures for projects in development are provided quarterly to the Office of Management and Budget and annually to the Congress as the Major Program Annual Report. NASA continues to work the process and policy to refine this reporting.

The FY 2009 President's Budget includes an Outer Planets Flagship mission. After evaluating science, technical risk, and cost considerations, NASA selected Europa, Ganymede, and Titan mission concepts for further definition study. The final selection of mission target will be made by late FY 2008. Once the target is selected, an accelerated pre-Phase A effort which leverages the past two years of study will be initiated, culminating in a Mission Concept Review in late 2008 and start of Phase A formulation activities in early 2009.

Independent Reviews:

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Relevance	NASA Advisory Council	09/2007	Reviews science and program implementation strategies and relevancies to the NASA strategies and goals. Recommendations include rebalance the program, with R&A restoration; development of science plan; and better cost and risk management for missions.	02/2008
Relevance	National Research Council	12/2003	Decadal Survey of Planetary Science priorities/Published Decadal Report entitled "New Frontiers and the Solar System: An Integrated Exploration Strategy". Work on the next Decadal Survey will begin in 2008.	09/2013
Relevance	COMPLEX, MEPAG, OPAG, VExAG	12/2007	2003 Solar System Exploration Roadmap/Outcome includes publication of the 2006 Solar System Exploration Roadmap and the 2006 Mars Architecture.	05/2008
Relevance	National Research Council	12/2007	Assess NASA/Planetary Science performance against the NRC decadal Survey recommendations. Recommendations include Adding Neptune/Triton mission in the next decadal survey, a more robust technology investments, restoring Astrobiology R&A funding, actively plan for the Mars Sample Return, and others.	12/2017

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Planetary Science Research

FY 2009 Budget Request

Budget Authority ($ millions)	FY 2007 Actual	FY 2008 Enacted	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
FY 2009 President's Budget Request	**181.9**	**242.1**	**270.8**	**315.8**	**355.6**	**373.2**	**382.6**
Planetary Science Research and Analysis	**111.7**	**127.8**	**142.4**	**145.1**	**150.4**	**155.2**	**159.0**
Lunar Science Research	**0**	**22.7**	**105.0**	**122.0**	**140.0**	**150.0**	**151.9**
Operating Missions and Analysis	**20.4**	**19.1**	**19.5**	**21.4**	**22.2**	**22.3**	**22.7**
Education and Directorate Management	**49.8**	**72.4**	**3.9**	**27.4**	**43.1**	**45.7**	**49.0**
FY 2008 President's Budget Request	**184.1**	**273.3**	**307.1**	**320.9**	**346.9**	**355.6**	**0**
Planetary Science Research and Analysis	**100.4**	**133.7**	**132.7**	**125.3**	**127.9**	**132.4**	**0**
Lunar Science Rsrch	**0**	**27.0**	**55.0**	**75.4**	**97.1**	**97.0**	**0**
Operating Missions and Analysis	**22.9**	**22.6**	**24.4**	**26.7**	**27.3**	**27.7**	**0**
Education and Directorate Management	**60.8**	**90.0**	**95.0**	**93.5**	**94.5**	**98.5**	**0**
Changes from FY 2008 Request	**-2.3**	**-31.3**	**-36.3**	**-5.0**	**8.8**	**17.6**	**382.6**

Note: In addition to programmatic changes which resulted in budget changes, the Agency's decision to reallocate institutional overhead (Corporate G&A, CM&O, and Institutional Investments) also impacted budgets for FY 2009 through FY 2013. Therefore, the changes shown in the above budget tables consist of both programmatic and institutional adjustments.

Program Overview

The Planetary Research Program develops theoretical tools and laboratory data needed to analyze flight data, makes possible new and better instruments to fly on future missions, and analyzes the data returned. These capabilities allow Planetary Science to answer specific questions and develop an overall understanding of the origin and evolution of the solar system. This program represents an essential complement to flight missions, providing the scientific research and the theoretical foundation to allow the Nation to fully utilize the unique data sets returned from the missions exploring the solar system. It is also the primary interface with NASA for university faculty and graduate students in this field.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Planetary Science Research

Program Relevance

Planetary Science Research supports NASA's Mission "To pioneer the future in space exploration, scientific discovery, and aeronautics research."

This program supports NASA Strategic Goal 3: Develop a balanced overall program of science, exploration, and aeronautics consistent with the redirection of the human spaceflight program to focus on exploration. More specifically, the program supports the Outcomes of Subgoal 3C: 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.

Select 4 to 5 nodes supporting the NASA Lunar Science Institute based on a Cooperative Agreement Solicitation released in FY 2008.

In addition, this program provides key support in training the next generation of mission team members, principal investigators, and project scientists, as well as educates the general public.

Plans For FY 2009

Release Research Announcements soliciting Research and Analysis proposals and make selections.

Continue planetary science data archiving and releasing of this data to the science community in a timely manner for further scientific analysis.

Continue curation and distribution of solar system samples (Astromaterials) returned by NASA planetary missions such as Stardust.

Perform the Rosetta fly-by of Asteroid Steins (September 2008).

Continue to provide for Hayabusa (MUSES-C) navigation and Deep Space Network Tracking and coordinating Science Analysis to support an Earth Return in 2010.

A science definition team (SDT) will be formed that will define key instrument measurement characteristics for Lunar atmosphere and dust environment for the first lunar orbiter. From the SDT results we will solicit and select instruments to fly on NASA's next lunar orbiter after Lunar Reconnaisance Orbiter (LRO) and Gravity Recovery and Interior Laboratory (GRAIL). A second SDT will be formed to begin to define the instruments needed for the follow-on lander missions.

Project Descriptions and Explanation of Changes

Research & Analysis (R&A)

The scope of Research and Analysis (R&A) is wide because the effort must provide the new theories and instrumentation that enable the next generation of flight missions. R&A also provides the foundation for the formulation of new scientific questions and strategies. Discoveries and concepts developed in the R&A Project are the genesis of scientific priorities, missions, instrumentation, and investigations. R&A supports research tasks in areas such as: astrobiology and cosmochemistry; the origins and evolution of planetary systems; and the atmospheres, geology, and chemistry of the solar system's planets (other than Earth). Additionally, it provides for instrument and measurement concepts, and supports the initial definition and development of instruments for future Discovery, New Frontiers, or Mars missions. A new and fully competed call for missions studies will identify a range of outer planets science targets and mission options that could be achieved at various budget levels, creating a "menu" of mission options that NASA could pursue in the future. The R&A program funding is being increased to create a healthy and competitive Planetary research program. The R&A program will increase the award rate for most areas and award larger grant sizes. This should enable the science community to do more quality research while spending less time writing research proposals.

Lunar Science

The Lunar Science Project is a multi-element SMD program containing flight mission development and operations activities, instruments for lunar missions of opportunity, research and analysis efforts, data archiving, and the NASA Lunar Science Institute (NLSI).

NASA is considering options for: a small lunar orbiter (Lunar Atmosphere and Dust Environment Explorer) to address the lunar dust environment and the lunar atmosphere; small landers targeted for lunar-geophysical studies; and future networks of landers.

Two NASA lunar mini-lander missions will form the first U.S. nodes in the International Lunar Network (ILN) of geophysical stations. NASA envisions that the first two small landers will launch in the 2013-2014 time frame. NASA will provide a competitive opportunity for the lander instruments.

The Planetary Data System (PDS) will ingest the large data volumes expected from the Lunar Reconnaissance Orbiter (LRO) mission developed by Exploration Sciences Mission Directorate. In FY 2009 NASA will be releasing a competitive call for proposals for instruments for lunar missions from other space agencies in the Stand-Alone Mission of Opportunity notification. In the area of R&A activities, NASA will continue to release the Lunar Advanced Science and Exploration Research (LASER) call for proposals. LASER will also be soliciting competed opportunities to analyze scientific data from the LRO mission.

During FY 2009 NLSI will complete its first set of four or five research nodes. The NLSI nodes are the largest non-flight mission groups that SMD funds and contains five - eight FTE per year each. The nodes will be competed every three years. NLSI was newly established in FY 2008 and is an organization that supplements and extends the existing small NASA lunar science programs competed through LASER. NLSI is managed by Ames Research Center and is modeled on the NASA Astrobiology Institute, with dispersed teams across the Nation working together to help lead the Agency's research activities related to NASA's lunar exploration goals. The competitively selected team investigations will focus on one or more aspects of lunar science investigations of the Moon (including lunar samples), from the Moon, and on the Moon to advance lunar science.

Rosetta & Hayabusa (MUSES-C)

Rosetta, a European Space Agency/NASA comet rendezvous mission, launched in March 2004 and will arrive at comet Churyumov-Gerasimenko in 2014. The prime scientific objective of the Rosetta mission is to study the origin of comets, the relationship between cometary and interstellar material and the implications of comets with regard to the origin of the solar system. Hayabusa (MUSES-C), a joint Japanese/NASA mission to study asteroid Itokawa and return a sample, is currently planning for an Earth Return in 2010.

Planetary Data Systems (PDS) & Astromaterials Curation

The Planetary Data Systems (PDS) and Astromaterials Curation Projects provide funds for data archives, sample-holding facilities, and analysis tools needed to perform research. PDS is the active data archive for NASA's Planetary Science Theme. The Astromaterials Curation Facility, at Johnson Space Center, provides services for all returned planetary materials that do not require planetary protection laboratories.

Directorate Management

This project reflects Science Mission Directorate-wide management reserve. It is used to support unforeseen administrative and programmatic requirements that cannot and/or should not be funded by other programs and projects.

FIRST Robotics

For Inspiration and Recognition of Science and Technology (FIRST) is a non-profit organization dedicated to increasing interest in science, technology, engineering and mathematics among youth in the United States. There are annual activities and events to expose students to challenging applications of engineering and science. The FIRST Robotics competition consists of national contests in which high school students team with engineers from government, industry, and universities to get hands-on experience and mentoring from engineering and technical professionals.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Planetary Science Research

Program Commitments

Commitment/Output FY 2009	Program/Project	Changes from FY 2008 PB Request
Release of Research Announcements soliciting R&A proposals (annual selections)	Research & Analysis (R&A)	R&A augmentation allows for increased award rates, larger average grant sizes, and more research.
Release the Lunar Advanced Science and Exploration Research opportunity and make selections of research projects, postdoc fellows, and associated lunar EPO work.	Lunar Science Research	Same
Deliver science data to PDS consistent with science archive plan (within 6 months).	Cassini	Cassini moved from Planetary Research to Outer Planet Flagship.
Meeting commitments to the International Partners as agreed to in the MOU.	Rosetta and Hayabusa	Same
Archive and release mission data to the science community within 6 months of downlink.	Planetary Data System (PDS)	Same
Store new samples of Astromaterials and distribute them as requests are approved by CAPTEM.	Astromaterials Curations	Same

Implementation Schedule

Project	Schedule by Fiscal Year															Phase Dates		
	Prior	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21		Beg	End
R&A, PDS, Curation																	Tech		
																	Form		
																	Dev		
																	Ops		
																	Res	Oct-07	Sep-12
Rosetta																	Tech		
																	Form		
																	Dev		Mar-04
																	Ops	Mar-04	Sep-17
																	Res	Sep-08	Sep-17
Hayabusa																	Tech		
																	Form		
																	Dev		May-03
																	Ops	May-03	Sep-11
																	Res	Jun-10	Sep-11
Lunar Science																	Tech		
																	Form		
																	Dev		
																	Ops		
																	Res	Oct-07	Sep-20

Tech & Adv Concepts (Tech)
Formulation (Form)
Development (Dev)
Operations (Ops)
Research (Res)
Represents a period of no activity for the Project

Program Management

NASA Headquarters is responsible for R&A and Lunar Science; Jet Propulsion Lab (SPLAY) has operations responsibility for Rosetta and Hayabusa; Goddard Space Flight Center (GSFC) is responsible for the Planetary Data System (PDS) project management.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
Research & Analysis	HQ	Multiple (NASA Centers, Universities, industries, etc.)	None
Rosetta	JPL	JPL	The European Space Agency (ESA) built the spacecraft, provided the launch vehicle, and operates the spacecraft.
Hayabusa (Muses -C)	JPL	JPL	Japan Aerospace Exploration Agency (JAXA) responsibilities include the spacecraft, launch vehicle, and operations.
Planetary Data System (PDS)	GSFC	JPL and other Discipline Nodes	None
Astromaterials Curation	JSC	JSC	NSF and Smithsonian Institution for Antarctic meteorites
Lunar Science	HQ	ARC, GSFC, MSFC	None

Acquisition Strategy

The R&A and Lunar Science Research FY 2008 budget will fund competitively selected activities from the ROSES-07 (Research Opportunities in Space and Earth Science) Omnibus NRA.

All major acquisitions for Rosetta (JPL), Hayabusa (JPL), Planetary Data System (PDS [JPL, GSFC, and other]), and Astromaterial Curation (JSC) are in place. The following institutions operate the PDS nodes: Atmospheres Node (NMSU; Geosciences Node (Wash U St. Louis); HiRISE Data Node (UAZ); Imaging Node (USGS Flagstaff); Planetary Plasma Interactions Node (UCLA); Radio Science (SETI); Rings Node (SETI); Small Bodies Node (U of MD); JPL and ARC. A small lunar orbiter will be formulated by ARC, and the small lunar landers will be formulated by MSFC.

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Quality	Panel of scientists	10/2007	Curation and Analysis Planning Team for Extraterrestrial Materials (CAPTEM) reviews recent curation activities and future plans/Curation of Genesis, Stardust, and Apollo lunar samples are on track and meeting distribution requests; the Curation Project performing well overall.	03/2008

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Planetary Science Research

Program Risk Management

Title	Risk Statement	Risk Management Approach and Plan
Research Program Risk	There are no significant programmatic risks within the Research Program.	N/A

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Discovery

FY 2009 Budget Request

Budget Authority ($ millions)	FY 2007 Actual	FY 2008 Enacted	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
FY 2009 President's Budget Request	**128.3**	**153.0**	**247.0**	**258.3**	**256.0**	**326.1**	**140.5**
GRAIL	**0**	**0**	**122.4**	**122.8**	**113.1**	**24.9**	**5.7**
Moon Mineralogy Mapper	**6.6**	**2.6**	**2.7**	**2.6**	**0.5**	**0**	**0**
Discovery Future	**13.1**	**103.9**	**50.4**	**49.1**	**65.4**	**239.8**	**90.7**
Discovery Research	**11.9**	**10.0**	**18.8**	**16.5**	**15.7**	**16.9**	**17.3**
Operating Missions and Data Analysis	**96.8**	**36.5**	**52.6**	**67.3**	**61.3**	**44.6**	**26.8**
FY 2008 President's Budget Request	**179.9**	**184.9**	**320.7**	**370.2**	**355.2**	**341.1**	**0**
Moon Mineralogy Mapper	**8.1**	**3.1**	**3.6**	**2.1**	**0**	**0**	**0**
Discovery Future	**57.6**	**126.5**	**261.0**	**307.8**	**289.7**	**277.7**	**0**
Discovery Research	**15.8**	**11.8**	**12.1**	**12.5**	**12.8**	**13.2**	**0**
Operating Missions and Data Analysis	**98.4**	**43.4**	**43.9**	**47.8**	**52.7**	**50.2**	**0**
Changes from FY 2008 Request	**-51.5**	**-31.9**	**-73.7**	**-111.8**	**-99.2**	**-14.9**	**140.5**

Note: In addition to programmatic changes which resulted in budget changes, the Agency's decision to reallocate institutional overhead (Corporate G&A, CM&O, and Institutional Investments) also impacted budgets for FY 2009 through FY 2013. Therefore, the changes shown in the above budget tables consist of both programmatic and institutional adjustments.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Discovery

Program Overview

Robotic space exploration holds tremendous opportunity for exploration and discovery. Even with the vast amount of knowledge gained since exploration of the solar system began, there are many unanswered questions about the origin and evolution of our own solar system. NASA's Discovery Program gives scientists the opportunity to find innovative ways to uncover the mysteries of the solar system. It provides lower-cost, highly-focused planetary science investigations designed to enhance our understanding of the solar system and its evolution. The Discovery Program offers the scientific community the opportunity to assemble teams to design exciting, focused science investigations that complement NASA's larger planetary science missions.

All completed Discovery missions (NEAR, Mars Pathfinder, Lunar Prospector, Deep Impact, Stardust, and Genesis) have achieved groundbreaking science, with each taking a unique approach to space exploration. Current Discovery missions include: ASPERA-3, MESSENGER, Dawn, Moon Mineralogy Mapper (M3), EPOXI, StardustNExT, and GRAIL.

ASPERA-3 is an instrument aboard the European Space Agency's Mars Express spacecraft that has been in operation since 2004. MESSENGER, a mission to Mercury, will provide the first images covering the entire planet, and collect detailed information on the composition and structure of Mercury's crust, its geologic history, the nature of its thin atmosphere and active magnetosphere, and the makeup of its core and polar materials. M3 was selected as a Mission of Opportunity in February 2005. It will be part of the scientific payload for the Indian Space Research Organization's Chandrayaan-1 mission to the Moon. The EPOXI mission melds two compelling science investigations: the Deep Impact Extended Investigation (DIXI) and the Extrasolar Planet Observation and Characterization (EPOCh). Both investigations will be performed using the Deep Impact spacecraft, which finished its prime mission in 2005. The scientific goal of the GRAIL mission, a newly selected Discovery full-class project, is to determine the structure of the lunar interior from crust to core.

Additional details on the GRAIL mission are contained in the GRAIL "Project in Formulation" pages.

For more information regarding the Discovery Program, see http:/discovery.nasa.gov.

Program Relevance

The Discovery Program supports NASA Mission by enhancing our understanding of the solar system as it is today, as well as solar system's formation and evolution, and by protecting the public, our workforce, and our environment while achieving our science. The Discovery Program supports NASA Strategic Goal 3 by providing frequent flight opportunities for solar system exploration with high quality, high-value scientific investigations that can be accomplished under a not-to-exceed cost cap.

The Discovery Program supports Outcomes 3C.1 through 3C.4.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Discovery

Plans For FY 2009

The MESSENGER spacecraft will complete second (10/2008) and third (9/2009) fly-bys of Mercury during FY 2009.

The Dawn spacecraft launched successfully in September 2007 and will be cruising toward a Mars gravity assist in March 2009.

ASPERA-3 will continue to collect data as it orbits Mars on an extended mission of Mars Express.

The M3 instrument, scheduled to launch in 2008 as a part of the Indian Space Research Organization's (ISRO) Chandrayaan-1 payload, will collect science measurements.

Gravity Recovery and Interior Laboratory (GRAIL), the newly selected Discovery full-class mission, will complete its Preliminary Design Review by the end of FY 2009.

An Announcement of Opportunity (AO) for the next Discovery mission will be released by 2009.

Project Descriptions and Explanation of Changes

MESSENGER

MESSENGER, a mission to Mercury, launched on August 3, 2004, will collect the first images to provide coverage of the entire planet and collect detailed information on the composition and structure of Mercury's crust, its geologic history, the nature of its thin atmosphere and active magnetosphere, and the makeup of its core and polar materials. MESSENGER flew past the Earth for a gravity assist in August 2005, and flew past Venus twice in FY 2007 to use that planet's gravity to move the spacecraft's trajectory closer to Mercury. The spacecraft had its first flyby of Mercury in January 2008.

ASPERA-3

ASPERA-3 is a Mission of Opportunity. It is one of seven instruments aboard the European Space Agency's Mars Express spacecraft in orbit around Mars, with a goal to study the interaction of the solar wind and Martian atmosphere. The measurements taken by this instrument will help answer the question of how strongly the interplanetary plasma and electromagnetic fields affect the Martian atmosphere.

Dawn

The Dawn mission is just beginning a journey to the two largest and most massive asteroids in our solar system, Vesta and Ceres. Dawn launched from Cape Canaveral in September 2007, the Dawn spacecraft will encounter and orbit Vesta four years later, then travel an additional three years to reach and orbit Ceres.

Moon Mineralology Mapper (M3)

The Moon Mineralogy Mapper (M3) instrument will be part of the scientific payload for India's Chandrayaan-1 mission to the Moon. The primary objectives of the M3 are to assess the mineral resources of the Moon, and characterize and map the composition of the surface at high spatial resolution. It will launch via a Polar Satellite Launch Vehicle from Satish Dhawan Space Center, India, in 2008. The M3 payload will cruise 5.5 days, reach its final polar orbit of the Moon at an altitude of 100 kilometers and operate during the next two years (with four two-month periods with optimal imaging geometry and global access).

Discovery 2006 Announcement of Opportunity

Three full-class missions of opportunity were submitted: Origins Spectral Interpretation, Resource Identification and Security (OSIRIS): Vesper, a Venus chemistry and dynamics orbiter that would advance our knowledge of the planet's atmospheric composition and dynamics; and Gravity Recovery and Interior Laboratory (GRAIL). The down-select in Fall 2007 resulted in GRAIL being given approval to move forward into its Preliminary Design Phase (Phase B) in December 2007. These proposals were among approximately two dozen submitted in response to NASA's Discovery Program 2006 Announcement of Opportunity in April.

Additionally, NASA selected three missions of opportunity (DIXI, EPOCh, and Stardust NExT) on June 19, 2007.

EPOCh and Stardust NExT

On June 19, 2007 three 2006 Discovery missions of opportunity were selected:
The Deep Impact eXtended Investigation (DIXI) of comets will use the existing Deep Impact spacecraft for an extended flyby mission to a second comet to take pictures of its nucleus to increase our understanding of the diversity of comets.

The Extrasolar Planet Observations and Characterization (EPOCh) mission will use the high-resolution camera on the Deep Impact spacecraft to search for Earth-sized planets around other stars.

The Stardust NExT will use the existing Stardust spacecraft for a flyby of comet Tempel 1. Since the Deep Impact mission visited Tempel 1 in 2005, the comet has made another close approach to the sun, possibly changing its surface. This flyby is to look for surface changes to Tempel 1 since 2005.

GRAIL

The Gravity Recovery and Interior Laboratory (GRAIL) will perform high-quality gravity field mapping of the Moon to determine its interior structure. GRAIL was selected in December 2007 and given approval to proceed into its Preliminary Design Phase (Phase B). GRAIL is currently schedule for a launch in September 2011.

Discovery Research

The Discovery Research line provides funding for: Discovery Data Analysis; Sample Return Laboratory Instruments (SRLI)which supports development of new instruments for use in terrestrial laboratories to analyze samples returned from NASA Planetary Science missions; Data Analysis Program (DAP); and participating scientists for the MESSENGER mission.

As stated in the ROSES NRA, the DAP is "...to enhance the scientific return of the completed Discovery missions by broadening the science participation in the analysis of data collected and samples returned ...." Specifically, the DAP allows scientists not previously associated with Discovery missions an opportunity to perform data analysis of the data archived in the Planetary Data System or samples (such as those from Stardust) stored at the JSC curation facility, which is also funded by this project. Data access through the Discovery Research project allows a much broader, and perhaps more objective analysis of the data and samples, and also allows research to continue for many years after the mission has been completed.

Discovery Program Management

Discovery Program Management provides for the management of the Discovery selected flight missions. This line also provides for the development of Announcements of Opportunity (AOs), and supports independent panel reviews and selections process.

Discovery Future

Provides funds for future Discovery flight missions to be selected via a competitive Announcement of Opportunity (AO) process.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Discovery

Program Commitments

Commitment/Output FY 2009	Program/Project	Changes from FY 2008 PB Request
Launch an average of one mission per 24 months .	Discovery Program	Same
Complete current prime and funded extended operating missions.	Dawn, MESSENGER, ASPERA-3, EPOCh and StardustNExT	ASPERA-3 approved for 2nd extension; selected EPOCh and NExT as new MoO under the 2006 Discovery AO.

Implementation Schedule

Project	Schedule by Fiscal Year															Phase Dates		
	Prior	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21		Beg	End
MESSENGER																	Tech		
																	Form	Jul-99	Jun-01
																	Dev	Jun-01	Aug-04
																	Ops	Aug-04	Sep-12
																	Res		
ASPERA-3																	Tech		
																	Form		
																	Dev	Sep-00	Jun-03
																	Ops	Jun-03	May-11
																	Res		
Dawn																	Tech		
																	Form	Dec-01	
																	Dev	Feb-04	Sep-07
																	Ops	Sep-07	Nov-15
																	Res		
Moon Mineralogy Mapper (M3)																	Tech		
																	Form	Mar-05	Feb-06
																	Dev	Mar-06	Mar-08
																	Ops	Mar-08	Sep-10
																	Res		
Extrasolar Planet Observation and Characterization (EPOCh) and Deep Impact eXtended Investigation (DIXI)																	Tech		
																	Form		
																	Dev		
																	Ops	Jun-07	Oct-11
																	Res		
Stardust NExT																	Tech		
																	Form		
																	Dev		
																	Ops	Jun-07	Feb-11
																	Res		
Gravity Recovery and Interior Laboratory (GRAIL)																	Tech		
																	Form	Oct-07	Dec-08
																	Dev	Dec-08	Sep-11
																	Ops	Oct-11	Jul-12
																	Res		

Tech & Adv Concepts (Tech)
Formulation (Form)
Development (Dev)
Operations (Ops)
Research (Res)
Represents a period of no activity for the Project

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Discovery

Program Management

MSFC is responsible for Discovery program management. Scientific mission priorities and assignment of responsibilities reside with the Science Mission Directorate. The Planetary Science Director is the responsible official for this program.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
MESSENGER	MSFC	None	None
ASPERA-3	MSFC	None	Sweden; European Space Agency (ESA).
Dawn	MSFC	None	German Aerospace Center (DLR); Los Alamos National Labs (LANL).
Moon Mineralogy Mapper (M3)	MSFC	None	Indian Space Research Organization (ISRO), spacecraft provider. USGS.
Extrasolar Planet Observation and Characterization and Deep Impact eXtended Investigation	MSFC	None	Max-Planck-Institute in Garsching, Germany
Stardust-NExT (Stardust-New Exploration of Tempel)	MSFC	None	None
GRAIL	MSFC	None	None

Acquisition Strategy

With the exception of future NASA Announcements of Opportunity, all major acquisitions are in place.

Southwest Research Institute employs the Principal Investigator and Lead Scientist for ASPERA-3.

The University of California at Los Angeles sponsors the Principal Investigator and Lead Scientist for the Dawn mission.

Brown University sponsors the Principal Investigator and Lead Scientist for M3. SAIC, University of Hawaii, and University of Tennessee are also participants.

The Department of Terrestrial Magnetism at the Carnegie Institution of Washington employs the Principal Investigator and Lead Scientist for MESSENGER.

The University of Maryland employs the Principal Investigator for the EPOXI Mission of Opportunity, the combined Extrasolar Planet Observation and Characterization (EPOCh), and the Deep Impact Extended Investigation (DIXI) of comets.

Cornell University employs Principal Investigator for the Stardust New Exploration of Tempel 1 (NExT) Mission of Opportunity.

The Massachusetts Institute of Technology (MIT) employs the Principal Investigator and leads the Gravity Recovery and Interior Laboratory (GRAIL) mission.

The Discovery Program solicits proposals for full planetary missions and missions of opportunity. The proposals are put together by teams led by a PI which may include firms, small business, government and universities. The initial phase of each competitive selection is a concept study, and several missions and missions of opportunity are generally selected for this phase. At the completion of the study phase, one or more concepts may be selected for development, based on their continued scientific merit, technical, management and cost viability, and the availability of funding.

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	IPAO	10/2007	Verified compliance with Agency requirements for program implementation. Results were favorable.	9/2009

Program Risk Management

Title	Risk Statement	Risk Management Approach and Plan
Future launch vehicle cost and availability	As launch vehicle costs continue to grow, they place additional pressure on cost-capped Discovery programs.	Consider requesting an increase in the Discovery cost cap to specifically cover increases in launch costs that are beyond project control.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Discovery
Project In Formulation:	Gravity Recovery and Interior Laboratory

FY 2009 Budget Request

Budget Authority ($ millions)	FY 2007 Actual	FY 2008 Enacted	FY 2009
FY 2009 President's Budget Request	--	--	122.4
Total Change from 2008 President's Budget Request	0.0	0.0	122.4

Note: FY 2009 President's Budget Request is in Direct Dollars and represents the July 2007 Operating Plan for the 2007 actual, the 2008 Omnibus Appropriations Act (P.L. 110-161) for the 2008 enacted, and the five-year Proposed Budget Estimates for 2009 through 2013. FY 2008 President's Budget Request is in Full Cost and represents the as-delivered February 5, 2007 Budget Estimate Book. Due to the change from reporting full-cost to direct, NASA's program budgets will appear to have declined.

Project Purpose

The Gravity Recovery and Interior Laboratory (GRAIL) was selected in December 2007 under the 2006 Discovery Announcement of Opportunity. The overarching scientific goal of the GRAIL mission is to determine the structure of the lunar interior from crust to core. The GRAIL mission will also advance our understanding of the thermal evolution of the Moon and extend our knowledge gained from the Moon to the other terrestrial-type planets.

GRAIL will conduct six lunar science experiments:
- map the structure of the crust and lithosphere;
- study the moon's asymmetric thermal evolution;
- determine the subsurface structure of impact basins and the origin and of masons (i.e., high-gravity areas);
- study the temporal evolution of crustal brecciation and magmatism;
- constrain the structure of the deep lunar interior from lunar tides; and
- place limits on the size of the possible lunar inner core.

GRAIL achieves its science objectives by placing twin spacecraft in a low altitude (50 km), and nearly circular, polar orbit. The two spacecraft will perform high-precision range-rate measurements between them. Analysis of changes in the spacecraft-to-spacecraft range-rate data caused by gravitational differences will provide direct and high-precision measurements of the lunar gravity. GRAIL will ultimately provide a global, high-accuracy (<10 mGal), high-resolution (30 km) gravity map of the moon. The instrument is based on the successful Earth orbiting Gravity Recovery and Climate Experiment mission.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Discovery
Project In Formulation:	Gravity Recovery and Interior Laboratory

Project Management

The Gravity Recovery and Interior Laboratory Project is part of the Discovery Program managed by Marshall Space Flight Center. The Principal Investigator from Massachusetts Institute of Technology has delegated day-to-day project management to JPL.

Acquisition Strategy

All major acquisitions are in place. GRAIL was selected competitively in December 13, 2007 under a Discovery Program Announcement of Opportunity (AO-NNH06ZDA001O).

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	IPAO	N/A	Assess cost, schedule, and risk status of project/Findings for the review showed that cost and schedule for the 2011 launch are consistent with the project's plans.	12/2008

Project Risk Management

Title	Risk Statement	Risk Management Approach and Plan
Launch Vehicle	Continued availability of Delta II line and launch pad at affordable costs.	Work with Launch Support Program and contractor to assure availability of vehicle.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	New Frontiers

FY 2009 Budget Request

Budget Authority ($ millions)	FY 2007 Actual	FY 2008 Enacted	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
FY 2009 President's Budget Request	**106.6**	**132.2**	**263.9**	**250.3**	**232.3**	**227.7**	**236.9**
Juno	**87.8**	**108.3**	**245.0**	**225.2**	**168.0**	**14.4**	**17.8**
Other Missions and Data Analysis	**18.8**	**23.9**	**19.0**	**25.1**	**64.3**	**213.3**	**219.1**
FY 2008 President's Budget Request	**158.1**	**147.3**	**296.0**	**277.5**	**267.9**	**274.5**	**0**
Juno	**124.1**	**120.2**	**272.9**	**242.6**	**190.9**	**16.0**	**0**
Other Missions and Data Analysis	**34.0**	**27.0**	**23.1**	**35.0**	**76.9**	**258.5**	**0**
Changes from FY 2008 Request	**-51.5**	**-15.1**	**-32.1**	**-27.2**	**-35.6**	**-46.8**	**236.9**

Note: In addition to programmatic changes which resulted in budget changes, the Agency's decision to reallocate institutional overhead (Corporate G&A, CM&O, and Institutional Investments) also impacted budgets for FY 2009 through FY 2013. Therefore, the changes shown in the above budget tables consist of both programmatic and institutional adjustments.

Program Overview

The New Frontiers Program, comprised of medium-sized missions, constitutes a critical element of NASA's solar system exploration capability. Proposed science targets for the New Frontiers Program have included Pluto and the Kuiper Belt, Jupiter, Venus, and sample returns from Earth's Moon and a comet nucleus. The program is designed to accomplish high-quality planetary science investigations using efficient management approaches. The program's prime objectives are to enhance our understanding of the solar system as it is today, and of the solar system's formation and evolution.

New Horizons and Juno are New Frontiers selected flight missions. New Horizons will conduct reconnaissance of Pluto and its moon Charon. Juno's overarching scientific goal is to understand the origin and evolution of Jupiter.

For more information, see http://newfrontiers.msfc.nasa.gov.

Program Relevance

The New Frontiers Program supports NASA Strategic Goal 3 by providing frequent flight opportunities for high-quality, high-value scientific investigations that can be accomplished under a not-to-exceed cost cap. More specifically, the program contributes to Outcomes 3C.1 through 3C.4.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	New Frontiers

Plans For FY 2009

The Juno Mission will complete the Preliminary Design Review (PDR)/Non-Advocate Review (NAR) in FY 2008, and will start Critical Design Review (CDR) by the end of FY 2009, a Key Decision Point Review (KDP).

By FY 2009, New Horizons will have passed the orbit of Saturn on its cruise to Pluto. It is on track for a July 2015 arrival. The cruise period will include periodic spacecraft and instrument checkouts.

The third New Frontiers AO will be released late in calendar year (CY) 2008. Concept studies selection is expected by the end of CY 2009.

Project Descriptions and Explanation of Changes

New Horizons

On January 19, 2006, the New Horizons mission was successfully launched on an Atlas V launch vehicle. New Horizons will reach Pluto and its moon, Charon, in July 2015. New Horizons will conduct a reconnaissance of the Pluto-Charon system, mapping their surface composition and surface temperatures, characterizing their geology, characterizing the atmosphere of Pluto, searching for an atmosphere around Charon, and searching for rings and additional satellites around Pluto.

Juno

The Juno mission to Jupiter science goals are to: determine the oxygen to hydrogen ratio to determine water abundance and constrain core mass in order to decide among alternative theories of planetary origin; understand Jupiter's interior structure and dynamical properties, including internal convection and the size and mass of its core, through mapping of its gravitational and magnetic fields; map variations in atmospheric composition, temperature, cloud opacity and dynamics to depths greater than 100 bars at all latitudes; and characterize and explore the three-dimensional structure of Jupiter's polar magnetosphere and auroras. Juno uses a simple, spin-stabilized spacecraft in an elliptical polar orbit that minimizes radiation exposure by flying under Jupiter's radiation belts at perijove and outside them at apojove. Juno's baseline orbit remains continuously in sunlight, resulting in benign and stable thermal conditions. Spin stability eliminates complex, power-hungry attitude control components such as reaction wheels. Additional detail can be found in the Juno Project section of this document.

New Frontiers Program Management

This project manages the New Frontiers selected flight missions, and provides for the development of Announcements of Opportunity. The project also supports independent panel review and selection processes.

New Frontiers Future

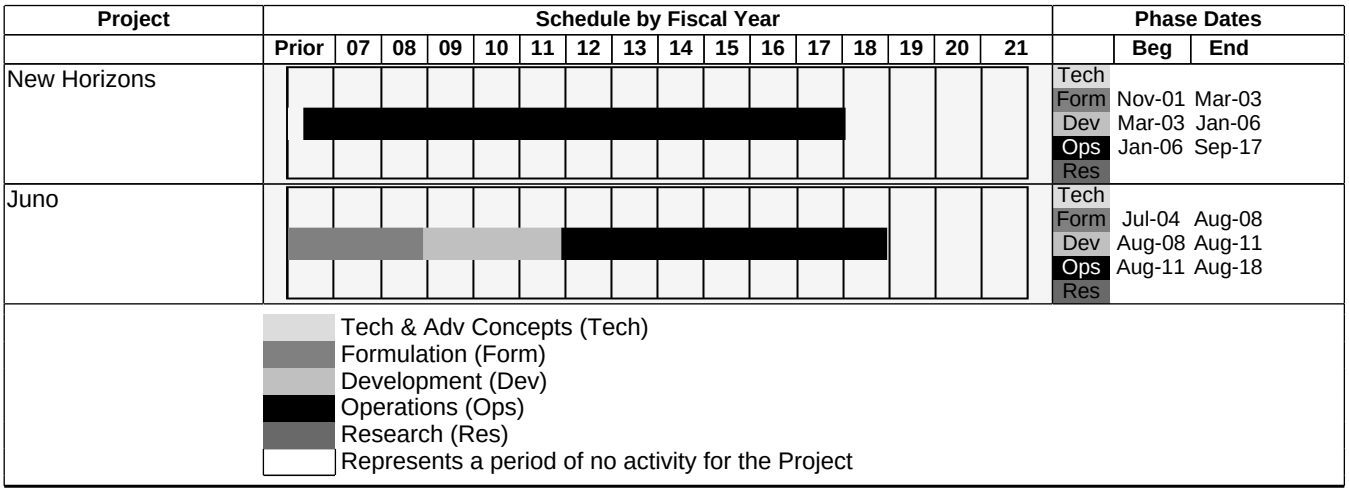
The New Frontiers Future Project provides funds for future New Frontiers flight missions to be selected via a competitive Announcement of Opportunity process.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	New Frontiers

Program Commitments

Commitment/Output FY 2009	Program/Project	Changes from FY 2008 PB Request
Launch an average of one mission per 52 months	New Frontiers Program	Same

Implementation Schedule



Program Management

The Science Mission Direct assigns scientific mission priorities and program responsibilities. Marshall Space Flight Center has New Frontiers program management responsibility. The Director of Planetary Science is the responsible program official.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
New Horizons	MSFC	APL	None
Juno	MSFC	JPL	Italian Space Agency (ASI)

Mission Directorate:	Science
Theme:	Planetary Science
Program:	New Frontiers

Acquisition Strategy

Future acquisitions of New Frontiers missions are carried out under open Announcement of Opportunity (AO) competitions. The New Frontiers Program will solicit proposals for an entire mission (including instruments), put together by teams led by PIs and comprised of people from industry, small businesses, government, and academia.

Major acquisitions for the New Horizons (APL) and Juno (JPL) projects are in place.

The Principal Investigator for New Horizons has been transferred from SouthWest Research Institute, Boulder, to NASA Headquarters; Johns Hopkins University/Applied Physics Laboratory has project management responsibility.

The Juno Principal Investigator is from the SouthWest Research Institute, San Antonio; Jet Propulsion Laboratory provides mission project management; Lockheed Martin Space Systems will build the spacecraft.

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	IPAO	05/2006	Verified compliance with Agency requirements for program implementation. Results were favorable.	9/2009

Mission Directorate:	Science
Theme:	Planetary Science
Program:	New Frontiers
Project In Formulation:	Juno

FY 2009 Budget Request

Budget Authority ($ millions)	FY 2007 Actual	FY 2008 Enacted	FY 2009
FY 2009 President's Budget Request	**87.8**	**108.3**	**245.0**
FY 2008 President's Budget Request	**124.1**	**120.2**	**272.9**
Total Change from 2008 President's Budget Request	**-36.3**	**-12.0**	**-28.0**

Note: FY 2009 President's Budget Request is in Direct Dollars and represents the July 2007 Operating Plan for the 2007 actual, the 2008 Omnibus Appropriations Act (P.L. 110-161) for the 2008 enacted, and the five-year Proposed Budget Estimates for 2009 through 2013. FY 2008 President's Budget Request is in Full Cost and represents the as-delivered February 5, 2007 Budget Estimate Book. Due to the change from reporting full-cost to direct, NASA's program budgets will appear to have declined.

Project Purpose

Juno was selected on July 15, 2005 under the New Frontiers Announcement of Opportunity. The overarching scientific goal of the Juno mission is to improve our understanding of the origin and evolution of Jupiter. However, as the archetype of giant planets, Jupiter can also provide knowledge that will improve our understanding of both the origin of our solar system and of planetary systems being discovered around other stars. The investigation focuses on the four science objectives:

Origin: Determine the oxygen-to-hydrogen ratio to determine water abundance and constrain core mass to decide among alternative theories of planetary origin.

Interior: Understand Jupiter's interior structure and dynamic properties through mapping of its gravitational and magnetic fields, including internal convection and the size and mass of its core.

Atmosphere: Map variations in atmospheric composition, temperature, and cloud opacity and dynamics, to depths greater than 100 bars, at all latitudes.

Magnetosphere: Characterize and explore the three-dimensional structure of Jupiter's polar magnetosphere and auroras.

These objectives have been rated very highly in the National Academy of Sciences' Solar System Exploration Decadal Survey and Sun-Earth Connections Decadal Survey. The Astrophysics Decadal Survey identified the study of star formation, their planetary systems, as well as giant and terrestrial planet birth and evolution as high priority. Juno fulfills key goals outlined in recent NASA and NRC studies and is relevant to NASA's Vision for Space Exploration.

Project Preliminary Parameters

Juno achieves the science objectives by using a simple spinning, solar-powered spacecraft to make global maps of the gravity, magnetic fields, and atmospheric composition of Jupiter from a unique elliptical polar orbit with a close perijove. The spacecraft carries precise, high-sensitivity radiometers, magnetometers, and gravity science systems. Juno's 32 orbits extensively sample Jupiter's full range of latitudes and longitudes. From its polar perspective Juno combines in-situ and remote sensing observations to explore the polar magnetosphere and determine what drives Jupiter's remarkable auroras.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	New Frontiers
Project In Formulation:	Juno

Estimated Project Deliverables

Juno launch date is August 2011, and after a five-year cruise to Jupiter, Jupiter Orbit Insertion (JOI) is scheduled for October 2016. Juno will perform one year of science operations.

Project Element	Provider	Description	FY 2008 PB Request	FY 2009 PB Request
Waves	University of Iowa	Measures radio and plasma emissions; 4 m elec. dipole and search coil	Same	Same
Jupiter Energetic particle Detector Instrument (JEDI)	John Hopkins Applied Physics Lab (APL)	Measures auroral distributions of electrons and ions; TOF vs. energy, ion & electron sensors	Same	Same
Gravity Science	Jet Propulsion Lab (JPL)	Maps Jupiter's gravitational field to determine structure of core; X & Ka-band precision Doppler	Same	Same
Flux-Gate Magnetometer (FGM)	GSFC	Maps Jupiter's Magnetic Field (Vector)	Same	Same
Scalar Helium Magnetometer (SHM)	Jet Propulsion Lab (JPL)	Maps Jupiter's Magnetic Field (Magnitude)	Same	Same
Launch Vehicle	KSC	C3 = 32.0 km2/s2, Capability=3545 kg	Same	Same
UV Spectrometer (UVS)	Southwest Research Institute (SwRI)	FUV spectral imager for auroral emissions	Same	Same
Microwave Radiometer (MWR)	Jet Propulsion Lab (JPL)	6 wavelengths (1.3-50 cm); sounds atmosphere to determine water and ammonia abundances	Same	Same
Spacecraft	Lockheed Martin	Solar-powered, spin-stabilized spacecraft in an elliptical polar orbit that minimizes radiation exposure	Same	Same
Jovian Auroral Distributions Experiment (JADE)	Southwest Research Institute (SwRI)	Ion mass spectrometer & electron analyzers; measures auroral distributions of electrons and ions	Same	Same

Mission Directorate:	Science
Theme:	Planetary Science
Program:	New Frontiers
Project In Formulation:	Juno

Estimated Project Schedule

Formulation started at project selection in July 2005. With approval to proceed, the project would enter implementation in August 2008.

Milestone Name	Formulation Agreement Estimate	FY 2008 PB Request	FY 2009 PB Request
Formulation			
PDR	5/2008	same	same
CDR	3/2009	same	same
ATLO Readiness	3/2010	same	same
Launch	8/2011	same	same

Project Management

Juno is part of the New Frontiers Program, with program management at Marshall Space Flight Center. The Principal Investigator, from Southwest Research Institute, has delegated day-to-day Juno project management to the Jet Propulsion Laboratory.

Project Element	Project Management Responsibility	NASA Center Performers	Cost-Sharing Partners
Plasma Waves Experiment (WAVE)	Jet Propulsion Lab (JPL)	None	None
Jupiter energetic particle instrument (JEDI)	Jet Propulsion Lab (JPL)	None	None
Management; Microwave radiometer, Scalar Helium Magnetometer, and Gravity Science Experiment	MSFC/New Frontiers Program Office	Jet Propulsion Lab (JPL)	None
Vector Fluxgate Magnetometer (FGM)	Jet Propulsion Lab (JPL)	Goddard Space Flight Center (GSFC)	None
UVS and JADE instruments	MSFC/New Frontiers Program Office	None	None
Flight System, Integration and Test	Jet Propulsion Lab (JPL)	None	None
Overall responsibility for the development, implementation, operation, and success of the mission	MSFC/New Frontiers Program Office	None	None
JunoCam	Jet Propulsion Lab (JPL)	None	None
KaBand and IR science	Jet Propulsion Lab (JPL)	None	Italian Space Agency (ASI)

Acquisition Strategy

All major acquisitions are in place. Juno was selected competitively in July 15, 2005 under a New Frontiers Program Announcement of Opportunity (AO-03-OSS-03).

Mission Directorate:	Science
Theme:	Planetary Science
Program:	New Frontiers
Project In Formulation:	Juno

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	IPAO	10/2006	Assess cost, schedule, and risk status of project/Findings for the review showed that cost and schedule for the 2011 launch are consistent with the project's plans.	05/2008

Project Risk Management

Title	Risk Statement	Risk Management Approach and Plan
Solar Array Performance	Solar array performance could potentially be less than expected in the low-intensity, low-temperature and high-radiation environment of Jupiter.	Performing early radiation tests on solar cells; conservative estimates of performance.
Stellar Reference Unit (SRU) performance	Possible degraded SRU performance on a spinning spacecraft in a high-radiation environment.	Initiated competitive study contracts and radiation testing to select SRU with best performance to meet project needs.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Mars Exploration

FY 2009 Budget Request

Budget Authority ($ millions)	FY 2007 Actual	FY 2008 Enacted	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
FY 2009 President's Budget Request	634.9	553.5	386.5	299.6	344.5	341.1	413.8
2009 Mars Science Lab	416.8	305.5	223.3	69.0	54.6	37.6	0
Mars Scout (2013)	5.3	57.7	6.7	68.5	152.5	170.7	121.8
Mars Research and Analysis	14.2	27.4	24.9	25.9	26.7	27.1	27.5
Operating Missions and Data Analysis	171.8	149.4	131.6	136.2	110.7	105.7	264.5
JPL Building	26.8	13.4	0	0	0	0	0
FY 2008 President's Budget Request	721.1	625.7	594.8	592.5	624.0	665.5	0
2009 Mars Science Lab	378.4	345.0	238.2	73.6	58.2	40.1	0
Mars Scout (2013)	0	65.3	155.0	170.8	121.6	38.4	0
Mars Research and Analysis	29.2	31.1	35.0	34.9	34.7	35.5	0
Operating Missions and Data Analysis	264.6	169.1	166.6	313.3	409.6	551.5	0
JPL Building	48.8	15.2	0	0	0	0	0
Changes from FY 2008 Request	-86.1	-72.2	-208.3	-293.0	-279.6	-324.4	413.8

Note: In addition to programmatic changes which resulted in budget changes, the Agency's decision to reallocate institutional overhead (Corporate G&A, CM&O, and Institutional Investments) also impacted budgets for FY 2009 through FY 2013. Therefore, the changes shown in the above budget tables consist of both programmatic and institutional adjustments.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Mars Exploration

Program Overview

Mars is the most Earth-like planet in our solar system, with land mass approximately equivalent to the Earth's and what appear to be familiar features such as riverbeds, past river deltas, and volcanoes. Mars holds valuable scientific clues to the development of the solar system, planets, and maybe life itself. The Mars Program has been developed to conduct a rigorous, incremental, discovery-driven exploration of Mars to determine the planet's physical, dynamic, and geological characteristics.

The Mars Phoenix lander successfully launched in August 2007, and is now on its way to Mars. It will arrive in late May 2008, and begin its exploration of the northern polar region, looking for evidence of water and fingerprints of life. Mars Reconnaissance Observer has used several of its instruments in coordinated observations to provide important new information about early Mars, the interaction of water with the crust, as well as the consequences for the tectonic evolution and the evolution of the planet's magma. It has also been a key contributor to finding a safe landing site for Phoenix, and has supported landing site selection for the Mars Science Laboratory. The Mars Rovers, Spirit and Opportunity, continued their exploration of the surface of Mars, and have returned a wealth of new results. Coordinated surface and orbital measurements indicate that liquid water might have existed close to the surface at some point in the past. Opportunity has also begun its descent into the Victoria crater, which will provide a detailed look into Mars' past as it explores the crater's exposed layers. Before ceasing to function early in FY 2007, the Mars Global Surveyor camera was able to spot several gullies that formed during the lifetime of the mission, which may have been formed by water. Although still controversial, detailed analysis suggests that liquid water probably flowed on the surface of Mars within the last seven years. The Mars Global Surveyor was also able to find newly formed impact craters on the surface of Mars.

For more information, see http://mars.jpl.nasa.gov.

Program Relevance

The activities within the Mars Program gather data that will enable NASA to search for evidence of life on Mars, to understand the history of the solar system, and to prepare for future human exploration by making measurements and discoveries that will characterize hazards and identify useable resources.

The program contributes primarily to Outcomes 3C.2, 3C.3, and 3C.4.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Mars Exploration

Plans For FY 2009

The next Mars Scout mission will be selected in FY 2008, in preparation for launch in 2013.

Mars Science Laboratory (MSL) will be in the final stages of preparation for its launch readiness date in September 2009.

Instrument developments (scheduled for selection in FY 2008) for the European Space Agency's ExoMars mission, will complete technology development studies needed to qualify for possible later selection for flight, in support of a 2013 launch date.

Detailed architectural studies of a Mars Sample Return mission will begin. These studies will be coordinated with our international partners.

Project Descriptions and Explanation of Changes

Mars Odyssey

In its extended mission phase, the primary scientific objectives of Mars Odyssey include monitoring of inter-annual variations of Mars climate and surface processes, new and improved elemental maps, extended monitoring of charged-particle radiation for human hazard assessment, acquiring future mission landing site data, and continuing as a key telecommunications asset at Mars. Funding to extend mission operations past FY 2009 may be available pending the outcome of the Mars mission review each year and availability of Extended Mission funding.

Mars Exploration Rovers (Spirit and Opportunity)

The rovers will continue to explore geological settings on the surface of Mars using a suite of remote sensing and in-situ instruments. The objective is to expand our understanding of the history and the geological processes that shaped Mars, particularly those involving water. Funding to extend mission operations past FY 2009 may be available pending the outcome of the Mars mission review each year and availability of Extended Mission funding.

Mars Reconnaissance Orbiter

The Mars Reconnaissance Orbiter (MRO), which began its science mapping phase at the beginning of FY 2007, has three general objectives: provide high-resolution spectral maps and images for interpretation of the geology of the Martian crust; use ground-penetrating radar to map compositional discontinuation and layering under the surface; and create planetary-scale maps of critical atmospheric properties. MRO is also the key telecommunications asset for the first half of the next decade at Mars. Although MRO's primary science phase extends only through December, 2008, additional funding may be available to extend science operations pending the outcome of the annual Mars mission review and availability of Extended Mission funding.

Mars Express

Mars Express is a mission launched by the European Space Agency and the Italian Space Agency, which has been exploring the atmosphere and surface of Mars from polar orbit since arriving in 2003. The mission's main objective is to search for sub-surface water from orbit. NASA participates in the scientific analysis of mission data, including the recent investigations into the mysterious deposits of the Medusae Fossae Formation.

Mars Mission Operations

Mars missions require special software tools for spacecraft navigation and communication, which are provided in cooperation with the Advanced Multi-Mission Operations System (AMMOS) project.

Mars Extended Operations

Once missions have concluded their primary mission phase, further funding for extended operations is allocated based on the findings of a senior review board. Their review of each mission enables them to make recommendations for the allocation of the extended operations budget based on scientific merit.

Mars 2007 Scout (Phoenix)

The Phoenix lander, currently en route to Mars, is the first Mars Scout mission and is led by the Principal Investigator from the University of Arizona. Phoenix will characterize the chemistry, mineralogy and isotopic composition of evolved gases in surface and subsurface soils and ices at a landing site in the high latitudes of the northern hemisphere. It will land on Mars on May 25, 2008.

Mars Science Laboratory

The Mars Science Laboratory (MSL) takes a major step forward in Mars exploration, both technically and scientifically, using a long-duration rover, and 10 payload elements for definitive mineralogical and organics measurements and a new entry, descent, and landing system. The primary scientific objective is to explore and quantitatively assess a local region on Mars as a potential habitat for past or present life. MSL will lay the ground work for future scientific missions, including Mars Sample Return, and will provide key information for human exploration. Additional detail can be found in the MSL Project section of this document.

Mars Scout 2013

NASA has selected for concept study development two proposals from members of the science community for future robotic missions to Mars. Both Scout missions are orbiters performing Mars aeronomy measurements. These missions would increase understanding of Mars' atmosphere, climate change and past habitability in greater detail than ever before. NASA intends to select one of the two proposals during 2008 for full development as a Mars Scout mission. The mission was originally planned to launch in 2011, but due to a conflict of interest which arose during evaluation will now have a launch opportunity in 2013.

ExoMars

NASA has selected two instrument proposals from the science community for technology development studies. These instruments are for potential inclusion in the European mission ExoMars, scheduled for launch in 2013. In 2008 NASA will make the decision whether to proceed to full development.

Mars Next Decade

The Mars Exploration Program plans future missions to Mars that build on scientific discoveries from past missions and incorporate the lessons learned from previous mission successes and failures. Missions in planning include a Mars mission in 2016 and Mars Sample Return.

Mars Technology

The Mars Technology Program is responsible for technology-development plans that are consistent with NASA's Mars Exploration vision, and implementing and infusing those technologies into future missions. Future missions will demand new technologies to provide better landing accuracy, access to high-priority sites, increased mobility, longer-lived, more robust and higher-output energy systems, and access to the subsurface for sample acquisition and in situ analysis.

Mars Research & Analysis

NASA invests in research and analysis of Mars mission data in order to understand how geologic, climatic, and other processes have worked to shape Mars and its environment over time, as well as how they interact today.

Mars Program Management

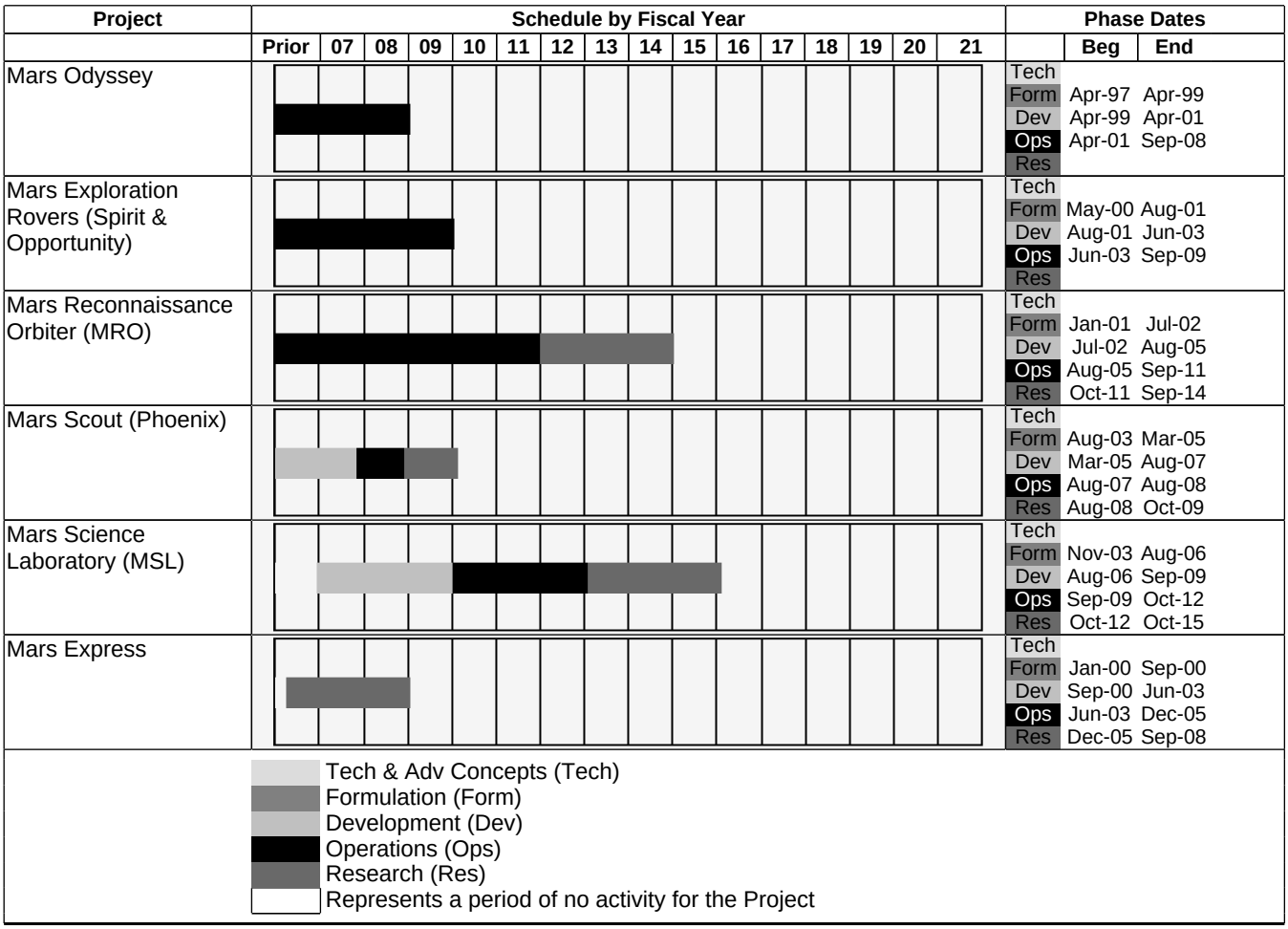
The Jet Propulsion Laboratory is responsible for implementing the Mars Exploration Program, and fulfills its managerial responsibilities within this budget. This includes the allocation, on an as-needed basis, of program reserve funds.

Program Commitments

Commitment/Output FY 2009	Program/Project	Changes from FY 2008 PB Request
MEP will provide continual operational presence on Mars	Mars Exploration	None
At least one Mars mission will be launched at every opportunity (every 26 months)	Mars Exploration	No planned NASA launch to Mars in 2011

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Mars Exploration

Implementation Schedule



Program Management

The Jet Propulsion Laboratory has responsibility for implementation of the Mars Exploration Program. The Director of Planetary Science is the responsible official for this program.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
Mars Exploration Rovers	NASA HQ	JPL	None
MRO	NASA HQ	JPL	None
Phoenix	NASA HQ, JPL	University of Arizona	None
MSL	NASA HQ	JPL	Department of Energy; International partners include Canada, Spain, and Russia.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Mars Exploration

Acquisition Strategy

The Mars Exploration Program (MEP) has set a goal of open competition for all missions. All major acquisitions for MRO, Phoenix, and MSL are in place; Ball Aerospace developed the primary optical instrument for MRO, while Lockheed Martin was the spacecraft design/systems integrator. Lockheed Martin Aerospace and Boeing are providing support for Phoenix. Malin Space Systems and Honeybee Robotics are providing support for MSL.

A major competitive acquisition for the second Mars Scout is underway. All research and technology is procured through the ROSES announcement and a competitive, peer-review selection process.

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	IPAO	10/2006	A Program Implementation Review was conducted in late FY 2006. Review determined the Mars program was functioning well and continuing to make important contributions to science and the Vision, but was short on reserve funding.	10/2008
Performance	IPAO	06/2007	MSL Critical Design Review determined that MSL design would meet mission goals.	02/2008

Program Risk Management

Title	Risk Statement	Risk Management Approach and Plan
Program flexibility	Flight windows for Mars missions occur approximately once every 26 months. As a result, schedule delays can result in missing the launch opportunity altogether.	Schedule and budget reserves are evaluated for their adequacy before a mission proceeds into implementation. Program-level reserves are also held and may be used to mitigate schedule risks.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Mars Exploration
Project In Development:	2009 Mars Science Lab

FY 2009 Budget Request

Budget Authority ($ millions)	Prior	FY 2007 Actual	FY 2008 Enacted	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	BTC	LCC TOTAL
FY 2009 President's Budget Request	**553.0**	**416.8**	**305.5**	**223.3**	**69.0**	**54.6**	**37.6**	**--**	**--**	**1,659.8**
Formulation	515.6	--	--	--	--	--	--	--	--	515.6
Development / Implementation	37.4	416.8	305.5	220.0	5.4	--	--	--	--	985.1
Operations / Close-out	--	--	--	3.3	63.6	54.6	37.6	--	--	159.1
Other	--	0.0	0.0	0.0	0.0	0.0	0.0	--	--	0.0
FY 2008 President's Budget Request	**552.4**	**378.4**	**345.0**	**238.2**	**73.6**	**58.2**	**40.1**	**--**	**--**	**1,686.0**
Formulation	515.1	--	--	--	--	--	--	--	--	515.1
Development / Implementation	37.3	342.6	311.0	211.1	5.4	--	--	--	--	907.4
Operations / Close-out	--	--	--	3.0	63.5	54.5	37.5	--	--	158.5
Other	0.0	35.8	34.0	24.1	4.7	3.7	2.6	--	--	105.0
Changes from FY 2008 Request	**0.6**	**38.4**	**-39.5**	**-14.9**	**-4.6**	**-3.7**	**-2.5**	**--**	**--**	**-26.2**
Formulation	0.5	--	--	--	--	--	--	--	--	0.5
Development / Implementation	0.1	74.2	-5.5	8.9	--	--	--	--	--	77.7
Operations / Close-out	--	--	--	0.3	0.1	0.1	0.1	--	--	0.6
Other	0.0	-35.8	-34.0	-24.1	-4.7	-3.8	-2.6	--	--	-105.0

Note: FY 2009 P.B.R. is in direct dollars (although some indirect funding remains in the Prior Year totals) and represents the July 2007 Operating Plan for the 2007 actual, the 2008 Omnibus Appropriations Act (P.L. 110-161) for the FY 2008 enacted, and the five-year Proposed Budget Estimates for 2009 through 2013. FY 2008 P.B.R. is in Full Cost and represents the as-delivered February 5, 2007 Budget Estimate Book, the "Other" line captures indirect costs as budgeted for in FY 2008.

Explanation of Project Changes

Since preparing the FY 2008 budget, Mars Science Laboratory has encountered cost and schedule difficulties, requiring additional funds to be added in FY 2008 and FY 2009.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Mars Exploration
Project In Development:	2009 Mars Science Lab

Project Purpose

The Mars Science Laboratory (MSL) Project will make detailed measurements of element composition, elemental isotopes and abundance, mineralogy, and organic compounds to determine if Mars has, or ever had, an environment capable of supporting life within the regions it will explore.

MSL has four science objectives: assess the biological potential of at least one selected site on Mars; characterize the geology and geochemistry of the landing region at all appropriate spatial scales; identify planetary processes relevant to past habitability; and characterize the broad spectrum of the Martian surface radiation environment.

For more information, see the MSL homepage at http://marsprogram.jpl.nasa.gov/missions/future/msl.html.

Project Parameters

The MSL is a surface rover which will collect Martian soil and rock samples and analyze them for organic compounds and environmental conditions that could have supported microbial life now or in the past. MSL will be a long-duration (two years) roving science laboratory that will be twice as long and three times as heavy (800-850 kilograms) as the Mars Exploration Rovers, Spirit and Opportunity.

Key technologies developed for MSL include: throttle-controlled, high-thrust engines, required during Martian entry, descent, and landing (EDL); sample acquisition and processing equipment used to acquire and distribute samples to the analytic instrument suite; and long-life, high-reliability, thermal-cycle-resistant electronics for use in the rover.

The EDL system will accommodate a wide range of possible latitude and altitude locations on Mars in order to be discovery-responsive and to have the capability to reach very promising, but difficult-to-reach scientific sites. MSL will also carry a sample cache which will hold as many as 10 samples. Once filled, the cache may be later collected by a Mars Sample Return mission.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Mars Exploration
Project In Development:	2009 Mars Science Lab

Project Commitments

The Mars Science Laboratory (MSL) will be ready to launch in September 2009 and will arrive at Mars after 12 months of flight time. MSL will operate for two Earth years on the surface of Mars and will travel approximately 20 kilometers.

Project Element	Provider	Description	FY 2008 PB Request	FY 2009 PB Request
Rover	JPL	Travel 20 kilometers over the Martian surface.	Same	Same
Stereoscopic and microscopic cameras	Malin Space Systems	Acquire color, stereo images with resolutions up to 0.2 mm/pixel at 2 m range.	Same	Deleted descent imager and camera zoom
Robotic arm tools	Honeybee Robotics	Acquire, process and deliver 75 rock and soil samples to analytic instruments.	Same	Changed the rock grinder to a brush, sample quantity unchanged
Chemistry camera (ChemCam)	Department of Energy/Los Alamos National Laboratory; France	Remotely measure elemental composition of rocks and soil up to 9m from rover.	Same	Same
Alpha Particle X-ray Spectrometer	JPL	Measure with high precision the elemental composition of in situ rocks and soil.	Same	Same
Rover Environmental Monitoring System (REMS)	JPL	Monitor key atmospheric measurements including temperature, pressure, wind speed/direction and humidity.	Same	Same
Dynamic Albedo of Neutrons (DAN)	JPL	Measure hydrogen content in subsurface deposits.	Same	Same
Cruise stage and entry system	Lockheed Martin	Transport rover to Martian surface and land with impact speed below 1 m/s	Same	Same
Mission operations and data archive	JPL	Conduct one-year cruise and two-year rover primary mission with remotely located science team.	Same	Same
Sample Analysis at Mars (SAM)	NASA/GSFC	Analysis of elemental and isotopic composition of Mars samples	Same	Same
Chemistry & Mineralogy Instrument (CheMin)	NASA/ARC	Analysis of mineral and chemical content of Mars samples	Same	Same
Sample cache	ARC	Hockey puck-sized container will collect sample of Martian soil for possible later collection by a Mars Sample Return mission	None	New Commitment

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Mars Exploration
Project In Development:	2009 Mars Science Lab

Schedule Commitments

The Mars Science Laboratory Project entered formulation in November 2004 and proceeded into the development phase in August 2006.

Milestone Name	Confirmation Baseline	FY 2008 PB Request	FY 2009 PB Request
Development			
Critical Design Review	June 2007	No change	No change
System Integration Review (formerly ATLO)	February 2008	No change	No change
Launch Readiness Review	September 2009	No change	No change

Development Cost and Schedule Summary

The Base Year Development Cost Estimate for MSL of $1068.5 million has been adjusted in the following two tables to reflect the change in this document to Direct Dollars for Fiscal Year 2007 forward in order to provide an accurate comparison to the Current Year Development Cost Estimate. The Current Year Development Cost Estimate may differ from the Budget Request table, since these estimates were developed prior to passage of the 2008 Omnibus Appropriations Act.

Project	Base Year	Base Year Develop-ment Cost Estimate ($M)	Current Year	Current Year Develop-ment Cost Estimate ($M)	Cost Change (%)	Key Milestone	Base Year Milestone Date	Current Year Milestone Date	Milestone Change (months)
2009 Mars Science Lab	2007	968.6	2008	1,035.0	7	Launch Readiness	9/30/2009	9/30/2009	0

Development Cost Details

The increased development cost was approved by SMD in September 2007 as a result of technical and schedule difficulties encountered during 2007.

Element	Base Year Development Cost Estimate ($M)	Current Year Development Cost Estimate ($M)	Delta
Total:	**968.6**	**1,035.0**	**66.4**
Spacecraft	424.8	490.8	66.0
Payloads	64.9	89.1	24.2
Systems I&T	46.5	49.8	3.3
Launch Vehicle/Services	182.6	177.5	-5.1
Ground Systems	45.5	46.4	0.9
Science/Technology	11.4	11.5	0.1
Other direct project cost	192.9	169.9	-23.0

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Mars Exploration
Project In Development:	2009 Mars Science Lab

Project Management

2009 Mars Science Laboratory is a JPL-managed project. Instrument implementation has been assigned to JPL. The responsible official for this project is the Planetary Science Division Director.

Project Element	Project Management Responsibility	NASA Center Performers	Cost-Sharing Partners
Rover	JPL	JPL	None
Stereoscopic and microscopic cameras	JPL	None	None
Robotic arm tools	JPL	JPL	None
Chemistry camera (ChemCam)	JPL	None	Department of Energy and France
Alpha Particle X-ray Spectrometer	JPL	None	Canada
Rover Environmental Monitoring System (REMS)	JPL	None	Spain
Dynamic Albedo of Neutrons (DAN)	JPL	None	Russia
Cruise stage and entry system	JPL	JPL, AMES, LaRC	None
Spacecraft	JPL	JPL	None
Sample Analysis at Mars (SAM)	JPL	GSFC	CNES (France)
Chemistry & Mineralogy Instrument (CheMin)	JPL	ARC	None

Acquisition Strategy

All major acquisitions are in place. All major instruments were competitively selected.

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	IPAO/IRT	06/2007	Assess maturity of MSL design. Design was deemed adequate to achieve mission science goals.	02/2008

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Mars Exploration
Project In Development:	2009 Mars Science Lab

Project Risk Management

Title	Risk Statement	Risk Management Approach and Plan
Heatshield development	Uncertain performance of heatshield material (SLA-561) for MSL entry conditions threatens the safety of the spacecraft during entry to Mars.	MSL has concluded that SLA-561 is not viable and has changed heatshield material (will now use PICA).
MSL mass margins	Significant additional mass growth has occurred during development. Increased rover mass results in the need for increased terminal descent propellant, and risks exceeding launch vehicle mass limit.	A complete review of rover mass has been conducted to validate changes and identify mass reduction opportunities. Mass changes are diminishing, and mass will be well understood as hardware deliveries are weighed.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Outer Planets

FY 2009 Budget Request

Budget Authority ($ millions)	FY 2007 Actual	FY 2008 Enacted	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
FY 2009 President's Budget Request	**79.0**	**81.9**	**101.1**	**216.7**	**279.4**	**230.6**	**362.0**
Outer Planets	**79.0**	**81.9**	**101.1**	**216.7**	**279.4**	**230.6**	**362.0**
FY 2008 President's Budget Request	**94.7**	**97.2**	**95.8**	**95.3**	**81.6**	**47.3**	**0**
Operating Missions and Analysis	**94.7**	**97.2**	**95.8**	**95.3**	**81.6**	**47.3**	**0**
Changes from FY 2008 Request	**-15.6**	**-15.2**	**5.3**	**121.4**	**197.7**	**183.2**	**362.0**

Note: In addition to programmatic changes which resulted in budget changes, the Agency's decision to reallocate institutional overhead (Corporate G&A, CM&O, and Institutional Investments) also impacted budgets for FY 2009 through FY 2013. Therefore, the changes shown in the above budget tables consist of both programmatic and institutional adjustments.

Program Overview

The Outer Planets Program consists of two strategic missions, Cassini and a new Outer Planets Flagship mission. These missions conduct science investigations across a broader array of disciplines and in more detail than competed missions. The science discoveries made by these missions are not expected to be easily displaced with time and are expected to overthrow previous paradigms and create new ones in their place.

Program Relevance

Supports NASA's Mission "To pioneer the future in space exploration, scientific discovery, and aeronautics research," by enhancing our understanding of the solar system as it is today and of solar system's formation and evolution, and by protecting the public, our workforce, and our environment while achieving our science.

Supports NASA Strategic Goal 3: "Develop a balanced overall program of science, exploration, and aeronautics consistent with the redirection of the human spaceflight program to focus on exploration," by providing frequent flight opportunities for high-quality, high-value scientific investigations that can be accomplished under a not-to-exceed cost cap. More specifically, the program contributes to Outcomes through 3C.3.

Plans For FY 2009

The Cassini prime science mission ends in July 2008 and starts the extend mission. Cassini FY 2009 major targets include several close flybys of Saturn's moon, Enceladus, as well as over a dozen flybys of the moon Titan. Cassini will also continue studies of Saturn and its rings.

SMD will select the destination for the Outer Planets Flagship in FY 2008 and begin Phase A formulation in FY 2009. Major FY 2009 milestones include release of the Announcement of Opportunity for the mission payload, conclusion of concept and technology definition, and completion of the mission definition review.

The 10 kilogram Pu-238 to be purchased (with funds to be released to Department of Energy in FY 2008 and FY 2009) will provide sufficient Pu238 to enable an Outer Planets Flagship Mission (OPF).

Project Descriptions and Explanation of Changes

Cassini

Cassini-Huygens is an Outer Planets Flagship mission to Saturn that is profoundly altering our understanding of that planet, its famous rings, magnetosphere, icy satellites, and particularly the moon Titan. Cassini-Huygens is an international collaborative effort, with a four year orbiter prime mission. Cassini is the first spacecraft to explore the Saturn system, including all its rings and moons. A major focus is Saturn's largest moon, Titan, with its dense atmosphere, methane-based meteorology, and geologically active surface. Launched in October 1997, Cassini arrived at Saturn in July 2004, and will continue to investigate Saturn and Titan through at least September 2012. The Huygens probe mission was completed successfully in January 2005.

Outer Planets Flagship Mission

The next Outer Planets Flagship mission will consist of a multi-national effort to explore Europa, the Jupiter system, or Titan. SMD plans to downselect to a single mission destination around October 2008. The mission will launch in 2016-2017, arrive at its destination in about 2021-2022, and spend at least three years conducting its primary mission.

Outer Planets Research Project

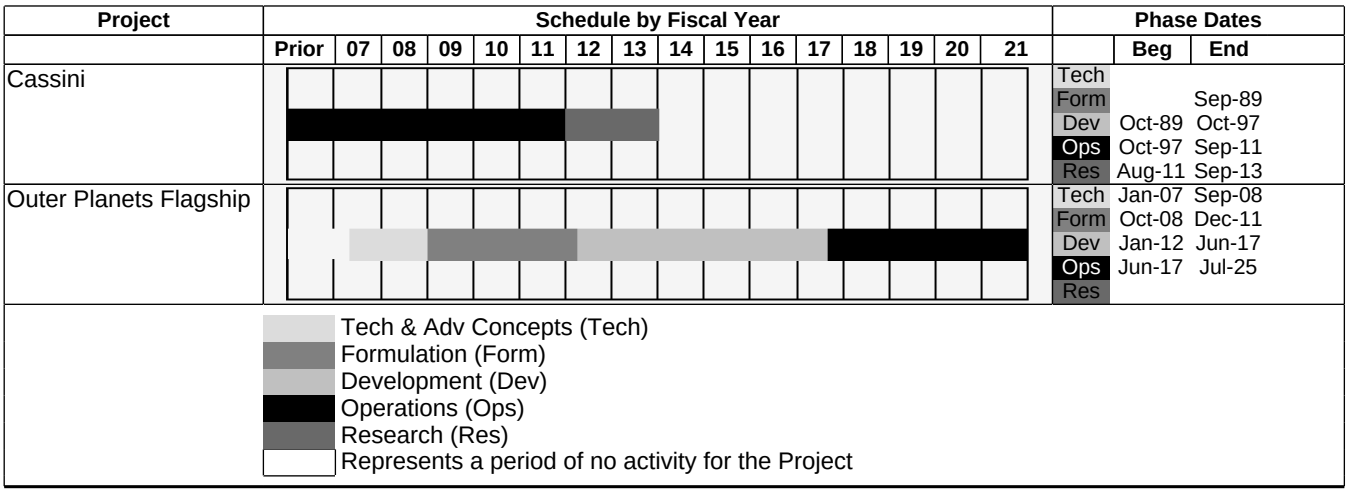
The Outer Planets Research Project provides for the Cassini Data Analysis Project (CDAP), which broadens the science community participation in the analysis of mission data, and allows scientists outside the selected flight team to look at the data from the mission, do research, and publish their findings. Without CDAP, the findings and publications would not come out until years after the mission, since the Cassini mission team members are very busy while the spacecraft is flying. The Cassini Announcement of Opportunity (AO) came out in 1989 and selection of the teams was in 1990. Without CDAP, researchers who were not selected 17 years ago would have little or no chance to participate. Furthermore, the CDAP project facilitates new ideas and approaches, getting young people started in science, and broadening participation to get a critical mass of scientific talent working on mission data at the critical time.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Outer Planets

Program Commitments

Commitment/Output FY 2009	Program/Project	Changes from FY 2008 PB Request
Deliver science data to Planetary Data Systems (PDS) consistent with science archive plan (in increments within 6 -9 months)	Cassini	Same - no changes
Deliver science data to PDS consistent with science objectives to be defined in the AO	Outer Planets Flagship	New

Implementation Schedule



Program Management

Program management responsibility for both the Outer Planets Flagship Program and Cassini programs resides at JPL. Scientific mission priorities for OPF reside with SMD. The Planetary Science Director is the responsible official for this program.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
Cassini	JPL	JPL	The Italian Space Agency provided Cassini's high-gain communication antenna and the Huygens probe was built by the European Space Agency (ESA).
Outer Planets Flagship	JPL	JPL	Potential Partners: ESA and JAXA

Acquisition Strategy

All major acquisitions contracts for Cassini are in place. The acquisition strategy for the Outer Planets Flagship mission is expected to be similar to Cassini. The science payload will be competitively selected, and the nuclear power system will be provided by DOE.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Outer Planets

Independent Reviews

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Quality	Senior Review Panel	02/2007	Cassini senior review for an extended mission recommended approval of the extended mission science.	09/2012
Performance	Indepen TMC and Science Panels	11/2008	Independent science, technical, management, and cost review of concept studies. Results pending.	11/2009

Program Risk Management

Title	Risk Statement	Risk Management Approach and Plan
Plutonium availability	If the supply of plutonium remains limited, then the number and type of RPS available will be reduced, and enough units to meet the needs of the mission may not be available.	Reduce mission power requirements through descope of operational capabilities, mission redesign, or use of higher efficiency power system such as the Advanced Stirling Radioisotope Generator being developed by NASA.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Technology

FY 2009 Budget Request

Budget Authority ($ millions)	FY 2007 Actual	FY 2008 Enacted	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
FY 2009 President's Budget Request	**84.8**	**84.8**	**64.9**	**69.3**	**69.6**	**71.3**	**73.0**
Technology	**84.8**	**84.8**	**64.9**	**69.3**	**69.6**	**71.3**	**73.0**
FY 2008 President's Budget Request	**103.1**	**96.8**	**93.0**	**95.1**	**93.9**	**96.2**	**0**
Technology	**73.4**	**67.6**	**62.6**	**63.9**	**62.7**	**64.2**	**0**
Advanced Multi-Mission Operation System	**29.7**	**29.2**	**30.4**	**31.3**	**31.3**	**32.0**	**0**
Changes from FY 2008 Request	**-18.3**	**-12.0**	**-28.1**	**-25.8**	**-24.3**	**-24.9**	**73.0**

Note: In addition to programmatic changes which resulted in budget changes, the Agency's decision to reallocate institutional overhead (Corporate G&A, CM&O, and Institutional Investments) also impacted budgets for FY 2009 through FY 2013. Therefore, the changes shown in the above budget tables consist of both programmatic and institutional adjustments.

Program Overview

Planetary Science is a challenging endeavor. Future Planetary Science missions will demand advances in both power and propulsion systems to enable successful trips to harsh environments, far from the Sun, with highly challenging trajectories. To meet these needs, the Planetary Science Technology Program includes the Radioisotope Power Systems (RPS), In-Space Propulsion (ISP), and Advanced Multi-Mission Operations System (AMMOS) Projects.

The ISP Project develops in-space propulsion technologies that can enable or benefit near- and mid-term NASA missions. These technologies will enhance the performance of planetary science missions by allowing increased science payload mass, minimized launch cost and decreased mission trip times. Furthermore, ISP will enable access to more challenging and interesting science destinations. The ISP Project is completing development in several propulsion technologies in support of future Flagship, Discovery, and New Frontiers missions. The high-temperature chemical thruster development task will be complete in FY 2008 and high-priority aerocapture ground activities will be completed by FY 2009. Electric propulsion development efforts for NASA's Evolutionary Xenon Thruster (NEXT) ion system development in FY 2008, and Hall thruster development and NEXT thruster wear testing are to continue through the planned project close-out in FY 2010.

The Radioisotope Power System (RPS) Project advances the capabilities of spacecraft power systems, thereby making it possible for missions to travel to more distant destinations. RPS activities focus on a technology portfolio that produces a proto-flight Advanced Stirling Radioisotope Generator (ASRG) by the 2012 to 2013 time frame and continues low-level investments in advanced thermoelectric conversion and thermal photovoltaic technologies as seeds to meet future needs late in the next decades. Funds will be needed to procure nuclear material to support missions in formulation.

The AMMOS Project provides planetary science missions with a set of navigation and design software tools and services for flight mission training, space communications resources allocation, and improved communication and navigation.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Technology

Program Relevance

The Planetary Science Technology Program is designed to support the Outcomes 3C.1 to 3C.4.

Plans For FY 2009

The In-Space Propulsion (ISP) project will:
- Continue electric propulsion life validation testing and analysis of NASA's Evolutionary Xenon Thruster (NEXT);
- Complete high priority technology development activities (large scale aeroshell manufacturing, Guidance Navigation and Control system testing, and space environmental effects testing) for aerocapture; and
- Continue electric propulsion Hall thruster development task towards Technology Readiness Level 6 (TRL6).

Radioisotope Power Systems (RPS) Project will:
- Integrate the first-generation Stirling converters into an engineering model generator assembly, which will then undergo life-testing to provide reliability data;
- Demonstrate 1500-hour lifetime Radioisotope Thermoelectric Generator couples and validate four-couple module power output; and
- Begin development of one Advanced Stirling Radioisotope Generator (ASRG) proto-flight unit for delivery by the 2012 to 2013 time frame.

Advanced Multi-Mission Operations System (AMMOS) will continue to develop multi-mission software tools for spacecraft navigation and mission planning, efficient spacecraft communication, and data handling.

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Technology

Project Descriptions and Explanation of Changes

In-Space Propulsion (ISP)

The In-Space Propulsion (ISP) portfolio invests in high-priority technology areas such as Electric Propulsion (Next-Generation Electric Propulsion), Aerocapture Technology, and Advanced Chemical propulsion.

Radioisotope Power Systems (RPS)

The Radioisotope Power Systems (RPS) Project works toward the demonstration of an Advanced Stirling Radioisotope Generator (ASRG) and supports flight application of the Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) system. System and mission trade studies are performed to evaluate the benefits of advanced RPS technologies for future science missions and to define technology needs.

Technology Planning

Investments in technology planning allow for strategic studies of focused technology areas that are necessary for the achievement of Planetary Science Theme missions.

Advanced Multi-Mission Operations System (AMMOS)

Returning to Planetary Science in FY 2009 from the Heliophysics Deep Space Mission Systems (DSMS) Program, the AMMOS Project provides multi-mission navigation, design, and training tools to flight missions, and undertakes technology investments for improved communications and navigation technologies.

Program Commitments

Commitment/Output FY 2009	Program/Project	Changes from FY 2008 PB Request
Next Generation Ion Thruster will demonstrate a >4,000-second specific impulse xenon thruster.	ISP	Completed in FY08
NEXT thruster long duration testing achieves greater than 80% of required qual-level throughput.	ISP	None
2.65m high temp aeroshell with ablative TPS will be fabricated.	ISP	None
Advanced Stirling convertor will work towards a qualified engineering model.	RPS	None
Radioisotope Thermoelectric Generator (RTG) will demonstrate an 8 Watts (electric)/kg system.	RPS	No longer supported
Provide standard interfaces in order to enable interoperability among missions.	AMMOS	None

Mission Directorate:	Science
Theme:	Planetary Science
Program:	Technology

Program Management

SMD provides overall oversight of the technology program. GRC is responsible for the ISP and RPS projects. JPL is responsible for the AMMOS project. The Planetary Science Division Director is the responsible official for this program.

Project	Management Responsibility	NASA Center Performers	Cost-Sharing Partners
ISP	GRC	GRC	None
RPS	Science Mission Directorate	JPL, GRC	Department of Energy
AMMOS	Science Mission Directorate	JPL	None

Acquisition Strategy

Technology activities are solicited using the NASA Research Opportunities in Space and Earth Sciences (ROSES) announcement, and selections are made using a competitive, peer-reviewed process. Lockheed Martin and Sunpower are providing support for the RPS Project.