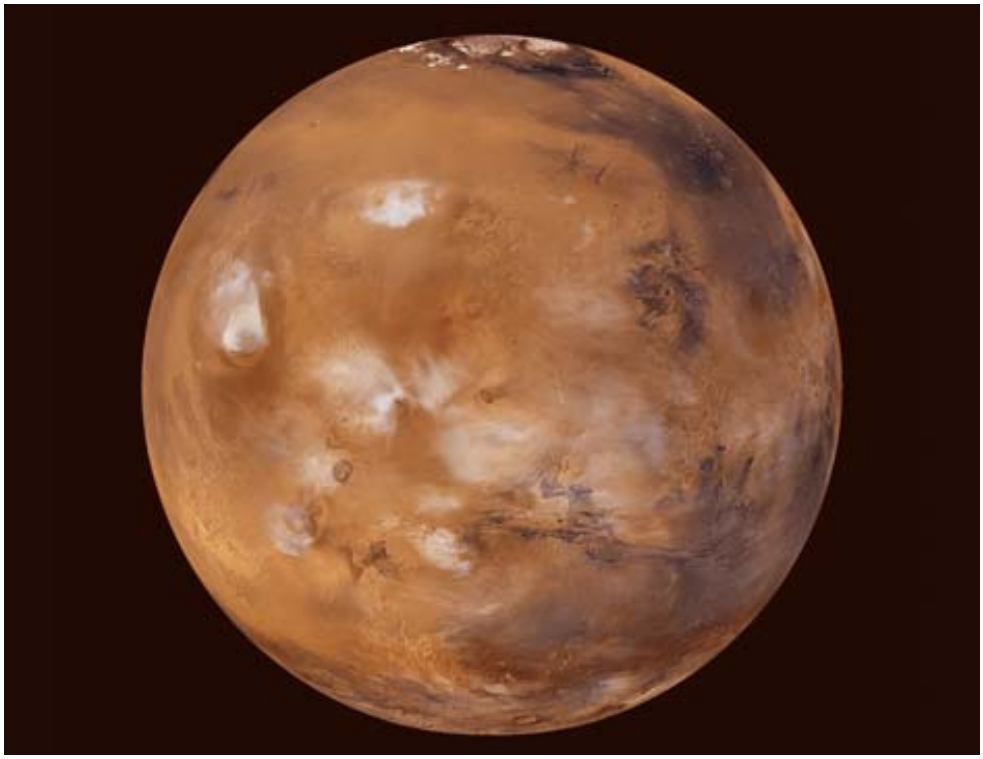
Theme: Mars Exploration



Mars is the target of NASA's most intensive scientific exploration of another planetary body since the Apollo Program, and the first waypoint in the search for extraterrestrial life. The Mars Exploration Program is designed to build on the success of the Mars Global Surveyor and Mars Odyssey missions, as well as that of the Mars Exploration Rovers. The first of the twin robotic geologists landed safely on Mars on January 3, 2004, and has begun to explore Gusev Crater, a site where liquid water may once have been present. More information can be found at "http://marsprogram.jpl.nasa.gov/index.html".

Mars Exploration

Major Events in FY 2005

- The Mars Reconnaissance Orbiter (MRO) will launch in August 2005. MRO will observe the atmosphere, surface, and subsurface of Mars in unprecedented detail.
- Development of the 2007 Mars Scout mission will continue. This mission, the first in the competitively selected Mars Scout Program, is called Phoenix, and will land in and explore the ice-rich terrain of the high northern latitudes of Mars.

Theme: Mars Exploration

OVERVIEW

The Mars Exploration program is a science- and exploration-driven effort to understand and characterize Mars as a dynamic system, including its past and present geology, interior, climate, environment, and its biological potential. The program seeks to characterize the habitability of Mars and determine whether it was ever or still is inhabited by forms of life. The discoveries made by the Mars Exploration effort will help pave the way for eventual human missions to the Red Planet.

NASA is aggressively pursuing the search for water and life at Mars using robotic explorers. The Spirit and Opportunity rovers are the newest in a series of research missions planned to explore Mars through 2010. By the end of this decade, three rovers, a lander, and two orbiters will have visited the planet. NASA will augment this program and prepare for the next decade of Mars research missions by investing in key capabilities to enable advanced robotic missions, such as returning geological samples from Mars or drilling under the surface of Mars. This suite of technologies will enable NASA to rapidly respond to discoveries this decade and pursue the search for water and life at Mars wherever it may lead next decade.

Starting in 2011, NASA will also launch the first in a series of human precursor missions to Mars. These robotic testbeds will demonstrate technologies such as improved aerodynamic entry, Mars orbital rendezvous and docking, high precision landing, and resource extraction and utilization, that can greatly enhance future robotic capabilities and are key to enabling future human Mars missions. These missions will also obtain critical data for future human missions on chemical hazards, resource locations, and research sites and may prepare resources and sites in anticipation of human landings.

The FY 2005 budget request will enable NASA to operate existing assets at Mars (Mars Global Surveyor and Mars Odyssey); to provide science and operational support for the Mars Express and ASPERA-3 projects; to continue the development of the 2005 Mars Reconnaissance Orbiter mission; to initiate the development of the Phoenix Scout mission (2007 launch); and to continue the invest in Education and Public Outreach (E&PO), technology, research and analysis, and advanced studies for future missions.

Missions	Goals supported by this Theme	Objectives supporting these Goals
To Explore the Universe and Search for Life	5. Explore the solar system and the universe beyond, understand the origin and evolution of life, and search for evidence of life elsewhere.	5.3 Understand the current state and evolution of the atmosphere, surface, and interior of Mars.
		5.4 Determine if life exists or has ever existed on Mars.
		5.5 Develop an understanding of Mars in support of future human exploration.

RELEVANCE

The Mars Exploration program will characterize another silicate planet, which, like Earth, bears an atmosphere, and will investigate the variability of its climate in the context of understanding habitability. This work will provide a quantitative basis for interplanetary comparative climatology.

Mars Exploration seeks to understand the "habitability of a silicate planet" and to develop predictive models that pertain to sustainability and habitats. Current scientific knowledge suggests that the conditions for the onset of terrestrial life existed in the early history of Mars (as on Earth), and subsequently planetary evolution caused a divergence. Preserved climatological and geological records on Mars may be relevant to the earliest history and origin of life on Earth. The program will integrate investigations of climate, geology, and global thermal evolution to focus the search for evidence of life in accessible places on Mars. The investigation into whether Mars ever harbored any kind of life contributes to NASA's overall efforts to explore the universe and search for life. By careful study of the planet, we may generate a level of understanding that will enable us to better and predict the environmental evolution and habitability of planet Earth.

NASA's Mars Exploration program is the world's only comprehensive program designed to collect and interpret such a broad panoply of scientific knowledge concerning another planet, while setting the context to answer whether life exists other than on Earth. Mars, by its visible presence, appeals to the imagination, and its regular close proximity to the Earth (every 26 months) makes it a unique frontier than can be explored by robots, and eventually by humans. The program represents one of the U.S. government's strongest efforts to inspire future generations of scientists, engineers, and explorers.

Education and Public Benefits
Public benefits from the Mars Exploration program include understanding another world whose evolution is likely to have been similar to Earth's (where all records of the first 1 billion years have been eradicated). Developing technologies and know-how to enable a comprehensive physics- and chemistry-based search for evidence of life, including non-terrestrial varieties, is of intrinsic value. Discovering that life exists any place other than Earth would be a profound revelation of historic importance, altering humanity's perception of its place in the universe. A scientific understanding of the potential evolution (and potential demise) of life on Mars is directly relevant to the habitability of Earth. Mars exploration technology is also applicable to other solar system missions, to Earth observation, and potentially to biological research on Earth, including mechanisms for detection and mitigation of bioterrorism.

Theme: Mars Exploration

IMPLEMENTATION

The Mars Exploration program is composed of many elements that work together to achieve the program's goals and objectives. Repeated management and scientific peer reviews ensure that each mission provides data in a cost-effective manner. In many cases, the data obtained from different missions are complementary, and are combined in cross-disciplinary studies by members of the scientific community.

Theme responsibility is in the NASA HQ Office of Space Science. The Enterprise official is Dr. Edward Weiler, Associate Administrator for Space Science. The Theme Director and Point of Contact is Mr. Orlando Figueroa, director of the Mars Exploration program at HQ. This theme is in full compliance with NPG7120.5B.

IMPLEMENTATION SCHEDULE

Theme Element	Schedule by Fiscal Year 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10	Purpose
Mars Global Surveyor (MGS)		Provide global visible, topographic and thermal emission spectroscopy data of Mars
2001 Mars Odyssey		Study mineralogic, elemental, chemical, thermal hot spots, and near environment radiation measurements at global scales
2003 Mars Exploration Rovers (MER)		Determine the aqueous, climatic, and geologic history of 2 sites on Mars
Mars Express		Search for evidence of water in the subsurface layers and as surface deposits
2005 Mars Reconnaissance Orbiter (MRO)		Search for local evidence of water at globally targeted sites, and monitor climate
2007 Mars Scout (Phoenix)		Openly competed mission flight opportunity for the science community
2009 Mars Science Laboratory		Nuclear powered mobile analytical laboratory at high priority site
2009 Mars Telesat Orbiter		High data rate telecomm capability to support Mars missions

No exceptions to NPG 7120.5B have been taken.

STATUS

The Mars Exploration program accomplished the following this past year: - Mars Global Surveyor continues its second science mission extension; - Odyssey continues to collect data, with all instruments fully operational; - 2003 Mars Exploration Rovers were successfully launched, Spirit on 10 June and Opportunity on 7 July of 2003; - Delivered to ESA the Mars Express instruments (Radar Sounder [MARSIS] Antenna and Transmitter and RF subsystems), launched successfully in June 2003; - Mars Reconnaissance Orbiter completed its formulation phase successfully; - Selected the 2007 Mars Scout Mission (Phoenix) from 4 selected for definition study phase; - Released Mars Instrument Development Program (MIDP) NRA; selection in late September 2003 for award; and - Released Mars Fundamental Research Program NRA.

By February of 2004, the Mars Exploration program will have: - Landed one rover on Mars (this was accomplished on January 3, 2004, with the successful landing of the Spirit rover); - Selected a Phase A design concept for the 2009 MSL; - Selected a baseline concept design for the Optical Communication Technology demonstration.

The program received an EFFECTIVE rating using the 2003 Performance Assessment Rating Tool (PART).

Theme: Mars Exploration

PERFORMANCE MEASURES

Outcomes/Annual Performance Goals (APGs)	
Outcome 5.3.1	*Characterize the present climate of Mars and determine how it has evolved over time.*
5MEP5	Successfully complete the Mission Concept Review and PMSR for the 2009 Mars Telesat Orbiter (NOTE: this APG supports all MEP research focus areas).
5MEP7	Successfully demonstrate progress in characterizing the present climate of Mars and determine how it has evolved over time. Progress towards achieving outcomes will be validated by external review.
Outcome 5.3.2	*Understand the history and behavior of water and other volatiles on Mars.*
5MEP1	Successfully complete Assembly, Test, and Launch Operations (ATLO) for the Mars Reconnaissance Orbiter mission.
5MEP2	Successfully launch the Mars Reconnaissance Orbiter.
5MEP8	Successfully demonstrate progress in investigating the history and behavior of water and other volatiles on Mars. Progress towards achieving outcomes will be validated by external review.
Outcome 5.3.3	*Understand the chemistry, mineralogy, and chronology of Martian materials.*
5MEP9	Successfully demonstrate progress in studying the chemistry, mineralogy, and chronology of Martian materials. Progress towards achieving outcomes will be validated by external review.
Outcome 5.3.4	*Determine the characteristics and dynamics of the interior of Mars.*
5MEP10	Successfully demonstrate progress in determining the characteristics and dynamics of the interior of Mars. Progress towards achieving outcomes will be validated by external review.
Outcome 5.4.1	*Understand the character and extent of prebiotic chemistry on Mars.*
5MEP4	Successfully complete the Preliminary Mission System Review (PMSR) for the 2009 Mars Science Laboratory (MSL) Mission.
5MEP6	Successfully complete Preliminary Design Review (PDR) for Laser Communication Demonstration (NOTE: this APG supports all MEP research focus areas).
5MEP11	Successfully demonstrate progress in investigating the character and extent of prebiotic chemistry on Mars. Progress towards achieving outcomes will be validated by external review.
Outcome 5.4.2	*Search for chemical and biological signatures of past and present life on Mars.*
5MEP3	Complete science instrument selections for the 2009 Mars Science Laboratory (MSL).
5MEP12	Successfully demonstrate progress in searching for chemical and biological signatures of past and present life on Mars. Progress towards achieving outcomes will be validated by external review.
Outcome 5.5.1	*Identify and understand the hazards that the Martian environment will present to human explorers.*
5MEP13	Successfully demonstrate progress in identifying and studying the hazards that the Martian environment will present to human explorers. Progress towards achieving outcomes will be validated by external review.
Outcome 5.5.2	*Inventory and characterize Martian resources of potential benefit to human exploration of Mars.*
5MEP14	Successfully demonstrate progress in inventorying and characterizing Martian resources of potential benefit to human exploration of Mars. Progress towards achieving outcomes will be validated by external review.
Uniform Measures	
5MEP15	Complete all development projects within 110% of the cost and schedule baseline.
5MEP16	Deliver at least 90% of scheduled operating hours for all operations and research facilities.
5MEP17	At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
MPIAT Report	Mars Program Independent Assessment Team	3/00		Analyze successes and failures of recent Mars and deep space missions.
Program Advisory Group (MEPAG)	Peer Review	9/03	6/04	Refine and evaluate the scientific objectives and research focus areas.
Solar System Roadmap	National Academy of Sciences	7/03	12/06	Assess effectiveness of program goals and implementation strategy.
Space Science Strategic Plan	National Academy of Sciences	7/03	12/06	Assess effectiveness of program goals and implementation strategy.

Theme: Mars Exploration

BUDGET

Budget Authority ($ millions)	FY 2003	FY 2004	Change	FY 2005	Comments
Mars Exploration	**500.4**	**595.1**	**+95.8**	**690.9**	
Development	303.5	182.4	-78.2	104.2	
2003 Mars Exploration Rovers	151.5				
2005 Mars Reconnaissance Orbiter (MRO)	146.9	182.4	-78.2	104.2	
Small Development Projects	5.2				
Operations	26.2	44.5	-34.6	9.9	
Research	27.7	63.5	-2.3	61.2	
Technology	142.9	304.7	+210.9	515.6	Supports new space exploration vision

Indicates changes since the previous year's President's Budget Submit

Indicates budget numbers in full cost.

Theme: Mars Exploration
Development: 2005 Mars Reconnaissance Orbiter (MRO)

PURPOSE

Objectives	Performance Measures
5.3	5MEP1-2,8,15

The goal of the Mars Reconnaissance Orbiter (MRO) is to understand the history of water on Mars by observing the planet's atmosphere, surface, and subsurface in unprecedented detail. This mission will identify the best sites for a new generation of landed vehicles to explore, by virtue of its ability to find local evidence of the chemical and geological "fingerprints" of water and other critical processes. MRO will explore from orbit hundreds of locations on the surface of Mars, observing details that were previously only visible to landers. MRO will focus on locations identified as most promising by Mars Global Surveyor and Odyssey, searching for the presence of surface materials conducive to biological activity or having the potential for preserving biogenic materials.

OVERVIEW

The MRO will be launched in August 2005 by an intermediate-class expendable launch vehicle from Cape Canaveral Air Station, and will enter Mars orbit in 2006. The MRO mission will use its science payload and engineering systems to acquire global mapping, regional survey, and globally distributed targeted observations from a low-altitude, near-polar, mid-afternoon (dayside) Mars primary science orbit (PSO). Currently, the goal is to achieve a near-polar 255x320 km PSO with closest approach to Mars over the planet's south pole. The MRO will observe the planet's surface and atmosphere and explore its upper crust from the PSO during a primary science phase, lasting one Martian year (687 Earth days).

http://mars.jpl.nasa.gov/missions/future/2005-plus.html

PROGRAM MANAGEMENT

The Mars Reconnaissance Orbiter (MRO) project is organized and managed as a project within the Mars Exploration program at the Jet Propulsion Lab (JPL). The Agency Program Management Council (PMC) has MRO governing responsibility. The Enterprise official is Dr. Edward Weiler, Associate Administrator for Space Science at HQ. The Theme Director and the Point of Contact is Mr. Orlando Figueroa, Director of the Mars Exploration Program at HQ. This project is in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

Baseline Commitment as of 7/02, as established in the program-level requirements for the Mars Reconnaissance Orbiter-2005 (MRO) project.

Technical Specifications	FY 2005 President's Budget	Change from Baseline
End of Nominal Life	5.4 years after launch; December 31, 2010	--
Primary Science Phase	Dec. 2006 thru Dec. 2008	--
Mass	2,000 kg	--
Power	5 kW at beginning of mission	--
Raw Data Volume	26 Tbits	--
Mapping Targeted Imaging	30cm/pixel ground sampling monochromatic imaging; < 40m/pixel ground sampling for mineralogical mapping	--
Imaging Capability	<7.5 m/pixel ground sampling context imaging from 300 km altitude.	--
Primary science orbit (PSO)	255 X 320 km	--

Schedule	FY 2005 President's Budget	Change from Baseline
Instruments selection	Nov-01	--
Mission Preliminary Design Review	Jul-02	--
NAR	Jul-02	--
Mission Critical Design Review	3Q/FY03	--
Start spacecraft-level integration and testing	3Q/FY04	--
Launch	4Q/FY05	--
Ship to launch site	3Q/FY05	--

Theme: Mars Exploration
Development: 2005 Mars Reconnaissance Orbiter (MRO)

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Lockheed Martin Astronautics (LMA) has been selected to build the spacecraft. The orbiter system contract with LMA for Phase C/D is implemented in the cost plus fixed/incentive fee contract. Launch vehicle procured via a competitive Launch Services Task Order (LSTO) on the NASA Launch Services (NLS) contract. All science investigations and instruments for the MRO mission were competitively selected under a NASA Announcement of Opportunity (AO). In FY 2003, direct procurement represented 100% of budget authority. Changes since FY 2004 President's Budget: None.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	84%	Industry	54%
Cost Reimbursable	99%	Sole Source	16%	Government	0%
Fixed Price	1%		100%	NASA Intramural	0%
Grants	0%			University	46%
Other	0%	Sci Peer Review	34%	Non Profit	0%
* as of FY03 direct procurement	100%	* as of FY03 direct procurement		* as of FY03 direct procurement	100%

Future Acquisition - Major	Selection	Goals
None - all major acquisitions are in place.		

AGREEMENTS

Internal: Program is not dependent on other NASA activities outside of the control of the Associate Administrator of Space Science. External: The Agenzia Spaziale Italiana (ASI) will provide the Shallow Radar (SHARAD) radar for this mission. Changes since FY 2004 President's Budget: None.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Independent Annual Review	IPAO	7/03	7/03	Evaluates project readiness for implementation.
Project ATLO Readiness Review	IPAO & JPL		4/04	Assess readiness of major systems (Science, Flight, Mission Ops) to enter ATLO.
Mission Readiness Review	IPAO & JPL		7/05	Assess the readiness of the project for launch.

Theme: Mars Exploration
Development: 2005 Mars Reconnaissance Orbiter (MRO)

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	Prior	FY03	FY04	FY05	FY06	FY07	FY08	FY09	BTC	Total	Comments
FY2005 PRESBUD	70.0	146.9	182.4	109.9	46.4	47.6	38.9	23.9	11.8	677.8	
Development	70.0	146.9	182.4	104.2						503.5	
Operations				4.2	24.1	23.7	17.8	11.6	11.8	93.2	
Data Analysis				1.5	22.3	23.9	21.1	12.3		81.1	
Changes since 2004 PRESBUD		+3.4	-1.1	+0.8	+12.7	+9.8	+7.8	+23.9	-26.4	+30.9	
Development		+3.4	-1.1	+0.7						+3.0	JPL burden increased (FY03) and full cost adiustments
Operations				+0.1	+1.5	+3.3	+1.7	+11.6	-18.8	-0.6	Full cost adjustments; MO&DA realignment
Data Analysis				+0.1	+11.2	+6.5	+6.1	+12.3		+28.5	Increased to reflect grass-root estimate and Independent team recommendation
FY2004 PRESBUD	70.0	143.5	183.5	109.1	33.7	37.8	31.1		38.2	646.9	
Development	70.0	143.5	183.5	103.5						500.5	
Operations				4.1	22.6	20.4	16.1		30.6	93.8	
Data Analysis				1.4	11.1	17.4	15.0		7.6	52.6	
Initial Baseline	70.0	147.8	175.4	103.4	32.8	36.7	30.3		36.1	632.5	
Pre-Dev	70.0									70.0	
Development		147.8	175.4	98.0						421.2	
Operations				4.0	22.0	19.8	15.7		28.5	90.0	
Data Analysis				1.4	10.8	16.9	14.6		7.6	51.3	

Indicates changes since the previous year's President's Budget Submit
Indicates budget numbers in full cost.

Theme: Mars Exploration
Development: Small Development Projects

PURPOSE

Objectives	Performance Measures
5.3	5MEP7-8,15

The Red Planet is a source of intrigue and fascination, currently the only other planet where a strong possibility of finding life exists--past or present. NASA is part of the European Space Agency (ESA) Mars Express mission. The objective of the Mars Express mission is to understand the fate of the Martian water supply; understanding this objective is crucial in resolving the mystery of whether life ever existed on Mars.

OVERVIEW

NASA is participating in a mission managed by the European Space Agency (ESA) and Agenzia Spaziale Italiana (ASI) called Mars Express, which is exploring the atmosphere and surface from polar orbit. The spacecraft will carry a science payload with some heritage from European instruments lost on the ill-fated Russian Mars 96 mission, as well as a communications relay to support lander missions. NASA's involvement with the mission includes a joint development of the radar instrument with ASI; support to U.S. science co-investigators; coordination of radio relay systems ensuring various spacecraft operate with each other; a hardware contribution to the energetic neutral atoms analyzer instrument; and the provision of backup tracking support during critical mission phases by NASA's Deep Space Network. NASA's contributions also include the development and data analysis for the Swedish ASPERA-3 experiment, which will study the interaction between solar wind and the Martian atmosphere. ASPERA-3 was selected and is funded as a Discovery Program Mission of Opportunity.

Link to Jet Propulsion Laboratory Mars website: http://marsprogram.jpl.nasa.gov/.

PROGRAM MANAGEMENT

The Mars Express and ASPERA-3 projects are delegated to the Jet Propulsion Laboratory (JPL). The Agency Program Management Council (PMC) has Mars Express and ASPERA-3 governing responsibility. The Enterprise official is Dr. Edward Weiler, Associate Administrator for Space Science at HQ. The Theme Director and the Point of Contact is Mr. Orlando Figueroa, Director of the Mars Exploration Program at HQ. These projects are in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

The baseline for Mars Express is based on the Mars Exploration program's Program Commitment Agreement (PCA); baseline for ASPERA-3 is based on the Discovery PCA.

Technical Specifications	FY 2005 President's Budget	Change from Baseline
Mars Express & ASPERA-3 Launch	June 2003	--
Mars Express & ASPERA-3 Launch Vehicle	Soyuz Fregat Launcher, from Baikonur in Kazakhstan	--
Mars Express & ASPERA-3 Mission Life	One Martian year (687 Earth days)	--

Schedule	FY 2005 President's Budget	Change from Baseline
Mars Express & ASPERA-3 launch	Jun-03	--
Mars Express & ASPERA-3 Mars orbit insertion	Dec-03	--

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Mars Express is European Space Agency (ESA) mission; ESA has overall responsibility. ASPERA-3 is a joint NASA-Agenzia Spaziale Italiana (ASI) instrument development. University of Iowa is responsible for the Mars Express radio frequency system. ASI is responsible for the digital electronic subsystem, subsystem integration, and delivery. The Principal Investigator for ASPERA-3 is at Southwest Research Institute (SwRI), and is responsible for the development and operation. In FY 2003, direct procurement represented 100% of budget authority. Changes since FY 2004 President's Budget: Deleted NetLander (U.S.-provided experiment package was selected under full and open competition as Mission of Opportunity under Discovery Program).

Theme: Mars Exploration
Development: Small Development Projects

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	83%	Industry	11%
Cost Reimbursable	48%	Sole Source	17%	Government	0%
Fixed Price	52%		100%	NASA Intramural	1%
Grants	0%			University	86%
Other	0%	Sci Peer Review	39%	Non Profit	2%
*As of FY03 direct procurement	100%	*As of FY03 direct procurement		*As of FY03 direct procurement	100%

Future Acquisition - Major	Selection	Goals
None - all major acquisitions are in place.		

AGREEMENTS

Internal: Program is not dependent on activities outside the control of the Space Science Associate Administrator. External: ESA has overall Mars Express mission program management. Changes since FY 2004 President's Budget: Cancelled and deleted funding for the U.S.-provided experiment package on NetLander, CNES 2007 Premier Mission.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Mars Express - Project Confirmation	JPL	9/00		Phase C/D Development
Mars Express - MARSIS Peer Review/	JPL	2/02		Flight Hardware delivery
Mars Express - Critical Design Review	ESA	4/02		Transition from design to build

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	Prior	FY03	FY04	FY05	FY06	FY07	FY08	FY09	BTC	Total	Comments
FY2005 PRESBUD	23.3	5.2								28.5	
Mars Express	17.3	3.0								20.3	
ASPERA-3	3.6	0.5								4.1	
NetLander	2.4	1.7								4.2	
Changes since 2004 PRESBUD	-0.1	-3.9	-10.3	-8.1	-4.4	-2.3	-2.5			-31.6	
Mars Express		-0.4								-0.4	Underrun
NetLander		-3.5	-10.3	-8.1	-4.4	-2.3	-2.5			-31.1	Mission cancelled due to CNES cancellation of the 2007 Mars Premier mission
FY2004 PRESBUD	23.4	9.1	10.3	8.1	4.4	2.3	2.5			60.1	
Mars Express	17.3	3.4								20.7	
ASPERA-3	3.6	0.5								4.1	
NetLander	2.5	5.2	10.3	8.1	4.4	2.3	2.5			35.3	
Initial Baseline	16.3	5.2	8.3	5.3	4.6	0.3				40.0	
Mars Express	12.8	4.6	7.6	4.5	3.9					33.4	Lifecycle; 9/00
ASPERA-3	3.5	0.6	0.7	0.8	0.7	0.3				6.6	Lifecycle; 11/99

Indicates changes since the previous year's President's Budget Submit
Indicates budget numbers in full cost.

Theme: Mars Exploration
Operations

PURPOSE

Objectives	Performance Measures
5.3, 5.4, 5.5	5MEP7-14,16

Maximize the scientific return from NASA's investment in spacecraft and other data collection sources by efficiently and reliably operating the data-collecting hardware that enables scientific discoveries.

OVERVIEW

MGS was launched in November 1996 and began mapping operations in March 1999. MGS carries five instruments and is orbiting Mars, mapping the atmosphere, surface, and magnetic field. MGS has provided measurement of potential Mars Exploration Rovers (MER) landing sites, and will support UHF relay of engineering data during MER descent and landing. - The 2001 Mars Odyssey mission, launched in April 2001, consists of an orbiter to map surface mineralogy, elemental composition, and the radiation environment. Its objective is to determine the elemental and chemical composition and map the mineralogy and morphology of the surface, and measure the radiation environment around Mars. - The science goal of the 2003 Mars Exploration Rovers (Spirit and Opportunity), launched on June 10 and July 7, 2003, respectively, is to learn the history of ancient water and its role in the geology and climate of Mars. Each of the rovers will act as a robotic field geologist, equipped to read the geologic record at its landing site and learn what the conditions were when the rocks and soils were formed. Each rover can travel up to 1 km across the Martian landscape measuring the chemical character of the soils, rocks, and previously inaccessible interiors of rocks where unaltered materials may lie. - Mars Multi-Mission Operations (MMO) supports the development and operations for all Mars projects. MMO's goal is to provide an effective and efficient mission operations system for each project with commonality across projects where feasible, while recognizing that each project is an independent entity and has unique requirements.

PROGRAM MANAGEMENT

The MEP mission operations responsibility is delegated to JPL. The Program Management Council (PMC) has MEP governing responsibility. The Enterprise official is Dr. Edward Weiler, Associate Administrator for Space Science at HQ. The Theme Director and the Point of Contact is Mr. Orlando Figueroa, Director of the Mars Exploration Program at HQ. This program is in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

The baseline is based on the MEP Program Commitment Agreement (PCA).

Technical Specifications	FY 2005 President's Budget	Change from Baseline
Mars Global Surveyor (MGS) Extended Science (E2)	Continue through 9/04 (3rd extension through 2006)	Additive to the original baseline
2001 Mars Odyssey Primary Science (E1)	917 Days (E1 through 9/06)	Addition to the original baseline
2001 Mars Odyssey Prime Mission - Relay Support	2/02 through 8/04	--
2003 Mars Exploration Rovers (MER) - Mission Life	90 sols (Martian days) for each rover	--
2003 Mars Exploration Rovers (MER) - Rover Traverse Capability	Up to 1 km from landing site	--
Mars Multi-Mission Operations	Continue to provide tools and training to the Mars mission for efficient operations support	--
MRO end of nominal life	December 31, 2010	--

Mission	Launch Date	Comments
Mars Global Surveyor	Nov. 1996	Mission Extended.
Mars Odyssey	April 2001	Prime mission through Sept. 2004.
Mars Express	June 2003	Prime mission through Sept. 2005.
ASPERA-3	June 2003	Prime mission through Sept. 2006.
Mars Exploration Rover – Spirit	June 2003	Prime mission through April 2004.
Mars Exploration Rover - Opportunity	July 2003	Prime mission through April 2004.
Mars Reconnaissance Orbiter	Aug. 2005	Prime mission through Sept. 2009.
Mars Multi-Mission Operations	Ongoing	Ongoing.

Theme: Mars Exploration
Operations

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

The MER project is being implemented in an "in-house" mode at JPL. Approximately 49% of the budget allocated for the project goes out of house. The rover science instruments, which were selected and procured following an open Announcement of Opportunity (AO), were integrated onto the rovers at JPL. Both the Mars Global Surveyor (MGS) and the 2001 Mars Odyssey are JPL in-house missions, where JPL is responsible for project management, mission design and operation for both missions. Lockheed Martin provides operations support for the orbiter/spacecraft under a cost plus fixed and incentive award fee contract. In FY 2003, direct procurement represented 100% of budget authority. Changes since FY 2004 President's Budget: None.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	65%	Industry	3%
Cost Reimbursable	100%	Sole Source	35%	Government	0%
Fixed Price	0%			NASA Intramural	0%
Grants	0%		100%	University	97%
Other	0%			Non Profit	0%
*As of FY03 direct procurement	100%	*As of FY03 direct procurement		*As of FY03 direct procurement	100%

Future Acquisition	Selection	Goals
All major acquisitions are in place.		

AGREEMENTS

Internal: Program is not dependent on activities outside of the control of the Space Science Associate Administrator. External: Mars Express & ASPERA-3 (both in Data Analysis) involve agreements with the European Space Agency (ESA) and the Italian Space Agency (ASI). Changes since FY 2004 President's Budget: None.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Senior Review (MGS)	HQ	1/99	1/04	Determine the feasibility of MGS science.
Mars Odyssey- Red Team Review (Odyssey)	JPL	1/00		Assess mission design and launch readiness.
Mars Odyssey- Odyssey High Gain Antenna	JPL	1/02		Assess readiness for antenna deployment.

Theme: Mars Exploration
Operations

BUDGET

Budget Authority ($ millions)	FY 2003	FY 2004	FY 2005	Comments
FY2005 PRESBUD	26.2	44.5	9.9	
Mars Global Surveyor	6.0	4.4		
2001 Mars Odyssey	10.5	9.9		
2003 Mars Exploration Rovers (MER)	5.9	26.4	1.6	
2005 Mars Reconnaissance Orbiter (MRO)			4.2	
Mars Multi-Mission Operations	3.9	3.8	4.1	
Changes since 2004 PRESBUD	+0.2	-0.3		
2001 Mars Odyssey	-0.1	-0.1		Full cost adjustments
2003 Mars Exploration Rovers (MER)		-0.1		Full cost adjustments; MO&DA realignment
Mars Multi-Mission Operations	+0.4			Full cost adjustments
FY2004 PRESBUD	26.0	44.8		
Mars Global Surveyor	6.0	4.4		
2001 Mars Odyssey	10.6	10.0		
2003 Mars Exploration Rovers (MER)	5.9	26.5		
Mars Multi-Mission Operations	3.5	3.8		

Indicates changes since the previous year's President's Budget Submit
Indicates budget numbers in full cost.

Theme: Mars Exploration
Research

PURPOSE

Objectives	Performance Measures
5.3, 5.4, 5.5	5MEP7-14,16-17

The objectives of the Mars research program, which includes Research & Analysis (R&A) and Data Analysis (DA), are to utilize flight mission data to develop a predictive understanding of Mars as a system, and to foster new investigations that treat the fundamental physics and chemistry of Mars.

OVERVIEW

Research & Analysis: Mars Data Analysis (MDAP) and Mars Characterization support a large group of scientific investigators (largely at universities) whose research is based upon flight mission data. Mars Fundamental Research program supports competitively-selected researchers investigating the basic physics and chemistry of Mars as a system.

The Mars Global Surveyor (MGS) has been conducting science mapping operations around Mars since March 1999. The spacecraft, now in its second extended mission, has served as a communications relay satellite during the entry, descent, and landing phase of the Mars Exploration Rovers (MER). MGS has discovered evidence of a water cycle on Mars in the form of mid-latitude gully systems, as well as the former presence of an Earth-magnitude magnetic field whose record is frozen into the crustal rocks.

The Mars Odyssey orbiter has already discovered high (80% by volume) concentrations of water ice in the first few feet of the Martian surface in the high latitudes, possibly indicating a massive ground ice "reservoir" on Mars. In addition, one of its instruments has observed mineralogical diversity at sub-km scales, suggesting greater compositional heterogeneity than previously thought.

The science goal of the 2003 Mars Exploration Rovers (Spirit and Opportunity), launched on June 10 and July 7, 2003, respectively, is to learn the history of ancient water and its role in the geology and climate of Mars.

Data Analysis: This program currently includes ASPERA-3 and Mars Express, part of a European Space Agency (ESA)/Italian Space Agency mission launched in June 2003.

PROGRAM MANAGEMENT

NASA HQ has responsibility for the Mars research program. The Program Management Council (PMC) has governing responsibility. The Enterprise official is Dr. Edward Weiler, Associate Administrator for Space Science at HQ. The Theme Director and the Point of Contact is Mr. Orlando Figueroa, Director of the Mars Exploration Program at HQ. This program is in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

The baseline is based on the Mars Exploration program's Program Commitment Agreement (PCA).

Technical Specifications	FY 2005 President's Budget	Change from Baseline
		None

The Mars research and analysis program solicits investigations using competitive, peer review, and is guided by priorities developed by groups which include the NRC's Space Studies Board COMPLEX, the Mars Exploration Program Analysis Group, and the Solar System Decadal Survey (NRC). All science data will be archived in the Planetary Data System (PDS) following a short period (no greater than 6 months) for verification, calibration and validation. There shall be no proprietary data rights.

Schedule	FY 2005 President's Budget	Baseline	Change from Baseline
Mars Fundamental Sci.	Proposal Mar-2003, panel Jun-2003, award Sep-2003	--	--
Mars Data Analysis	Proposal Aug-2003, panel Nov-2003, award Dec-2003	--	--
ROSS NRA	An announcement is released annually via the Research Opportunities in Space Science (ROSS) NRA.	Jan-03	Release annually

Theme: Mars Exploration
Research

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

The Research and Analysis (R&A) and Data Analysis (DA) programs make awards following peer-reviewed competitions under NASA Research Announcements (NRAs), Announcements of Opportunity (AOs) and Cooperative Agreement Notices (CANs). In FY 2002, direct procurement represented 100% of budget authority. Changes since FY 2004 President's Budget: None.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	3%	Full & Open Competition	100%	Industry	6%
Cost Reimbursable	63%	Sole Source	0%	Government	7%
Fixed Price	1%			NASA Intramural	2%
Grants	24%		100%	University	79%
Other	9%			Non Profit	6%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition	Selection	Goals
Annual R&A research announcement	late 2003	100% Science Peer Review

AGREEMENTS

Internal: The program is not dependent on activities outside of the control of the Space Science Associate Administrator. External: Mars Express and ASPERA-3 involve agreements with the European Space Agency (ESA) and the Italian Space Agency (ASI). Changes since FY 2004 President's Budget: None.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
MO&DA Senior Review	Sr. Review committee		7/04	To review extending mission beyond its primary science phase.
R&A peer review	peer review committee	7/03	7/04	Review Mars proposals in response to R&A announcement.

Theme: Mars Exploration
Research

BUDGET

Budget Authority ($ millions)	FY 2003	FY 2004	FY 2005	Comments
FY2005 PRESBUD	27.7	63.5	61.2	
Mars Global Surveyor (MGS)	4.9	2.4		
2001 Mars Odyssey	10.7	10.9	4.2	
2003 Mars Exploration Rovers (MER)	3.6	25.1	10.3	
Mars Express	1.0	4.6	4.3	
ASPERA-3		0.8	0.8	
2005 Mars Reconnaissance Orbiter (MRO)			1.5	
Future Mars Data Analysis	7.6	12.1	32.4	
Mars Exploration Program Research and Analysis		7.6	7.7	
Changes since 2004 PRESBUD	+2.3	+7.3		
2001 Mars Odyssey	+0.9	-0.1		Full cost adjustments
2003 Mars Exploration Rovers (MER)	+1.3	-0.1		Full cost adjustments; MO& DA realignment
Mars Express	+0.2			Full cost adjustments
Future Mars Data Analysis	-0.1	-0.1		Full cost adjustments; added funds for Odyssey science ext (FY05)
Mars Exploration Program Research and Analysis		+7.6		Transferred from SSE theme
FY2004 PRESBUD	25.5	56.2		
Mars Global Surveyor (MGS)	4.9	2.4		
2001 Mars Odyssey	9.8	11.0		
2003 Mars Exploration Rovers (MER)	2.3	25.2		
Mars Express	0.8	4.6		
ASPERA-3		0.8		
Future Mars Data Analysis	7.7	12.2		

Indicates changes since the previous year's President's Budget Submit
Indicates budget numbers in full cost.

Theme: Mars Exploration
Technology and Advanced Concepts

PURPOSE

Objectives	Performance Measures
5.3, 5.4, 5.5	5MEP3-14

The Mars Exploration Program (MEP) Technology and Advanced Concepts effort includes future missions still in the formulation phase and the development of advanced technologies needed for future investigations. This process begins with mission studies as the first phase of the flight program development process. In this phase, scientists work collaboratively with technologists and mission designers to develop the most effective alignment of technology development programs with future mission requirements. This collaboration enables intelligent technology investment decisions through detailed analysis of the trade-offs among design considerations, risk, and cost. In MEP, future missions will focus on targeted, in situ, regional, and sample return investigations. Examples of types of technologies critical to the success of these missions include instrumentation, mobility, autonomy, communications, planetary protection, and sample returns.

OVERVIEW

The 2007 opportunity includes a competitively selected PI-led mission (Mars Scouts) patterned after the Discovery program, and similarly capped at $325M (FY 2003 dollars). In August 2003 the first Scout mission called Phoenix was selected for launch in 2007 to land in the ice rich terrains of the high northern latitudes. The 2009 opportunity will include a roving long-range, long-duration science laboratory, with unprecedented instrument capability for surface analysis to measure geochemistry and biological processes of materials potentially linked with ancient life and climate. The roving science laboratory will also demonstrate precision landing, operational autonomy, and innovative approaches to deliver increased mass to the surface. The 2009 Mars Telecommunications Satellite will be multi-band (X, Ka, UHF) and will be located at an optimal orbit to maximize coverage of orbital, sub-orbital, and surface assets on Mars. The telesat will also include an operational demonstration of optical telecommunications technologies, which will significantly increase the communication data rate and improve the cost per bite of data returned. The Technology program consists of two principal elements: The focused technology program (targeting near-term missions) and base technology program (targeting mid- and far-term missions). Currently, the emphasis is on the technologies required to implement the Mars Science Laboratory (MSL) mission in 2009. The critical technologies for this mission are Entry, Descent, and Landing (EDL), long-life, autonomy, sample acquisition, handling and processing, and Mars proximity telecommunications. The base technology program addresses those technologies that are applicable for mid- and far-term missions (i.e., missions starting more than five years from now) and that are applicable to multiple missions. Base technologies also address longer-term, higher-risk, high-payoff technologies that may enable new types of missions. NASA will augment this program and prepare for the next decade of Mars research missions by investing in key capabilities to enable advanced robotic missions, such as returning geological samples from Mars or drilling under the surface of Mars. This suite of technologies will enable NASA to rapidly respond to discoveries this decade and pursue the search for water and life at Mars wherever it may lead next decade.

Starting in 2011, NASA will also launch the first in a series of human precursor missions to Mars. These robotic testbeds will demonstrate technologies such as improved aerodynamic entry, Mars orbital rendezvous and docking, high precision landing, and resource extraction and utilization, that can greatly enhance future robotic capabilities and are key to enabling future human Mars missions. These missions will also obtain critical data for future human missions on chemical hazards, resource locations, and research sites and may prepare resources and sites in anticipation of human landings.

http://mars.jpl.nasa.gov/missions/future/2003.html

PROGRAM MANAGEMENT

The program responsibility has been delegated to JPL. The Program Management Council (PMC) has governing responsibility. Each MEP mission will execute the NASA formulation sub-process per NPG 7120.5B to provide high confidence that it will be ready to proceed into implementation. The Enterprise official is Dr. Edward Weiler, Associate Administrator for Space Science at HQ. The Theme Director and the Point of Contact is Mr. Orlando Figueroa, Director of the Mars Exploration Program at HQ.

TECHNICAL COMMITMENT

The baseline is outlined in the 2002 Mars Exploration program plan. If approved after the Preliminary Design Review, a Program Commitment Agreement for will be developed and used as the baseline.

Schedule/Mission	FY 2005 President's Budget	Change from Baseline
2007 Phoenix	Mars Scout mission; will land in ice-rich terrain in high northern latitudes.	New selection in 2003.
2009 Mars Science Laboratory	12 months flight time; 5-6 course corrections; lander performs direct entry with altimetry performed in terminal descent; 450-600 kg rover; 500 sol lifetime; 10km mobility.	n/a; no established baseline until confirmation
2009 U.S. Telecom Orbiter	1-year cruise; 6 years on orbit; Electra UHF and X-band link and gimbaled camera.	n/a; no established baseline until confirmation

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

NASA has set a goal of openly competing from 65-75% of budgeted dollars in the Mars Exploration program, depending on whether a given mission is performed in-house at a NASA Center or out-of-house at a contractor facility. Specific acquisition plans include: - 2007 Mars Scout - Full mission competed through Announcements of Opportunity following a process similar to that of the Discovery program, with a life cycle cost cap at $325M, FY 2003 dollars. - 2009 Mars Science Laboratory - Hybrid JPL in-house and industry. - 2009 U.S. Telecom mission - fully competed. Will include Government Furnished Equipment (GFE) developed under other contracts/tasks managed by JPL. - Optical Communication Technology Demonstration will be led by the Goddard Space Flight Center (GSFC) with the Jet Propulsion Lab and MIT Lincoln Lab as partnhers. In FY 2003, direct procurement represented 100% of budget authority. Changes since FY 2004 President's Budget: Includes Optical Communication Technology Demonstration, transferred from the Solar System Theme.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	52%	Industry	11%
Cost Reimbursable	48%	Sole Source	48%	Government	1%
Fixed Price	52%		100%	NASA Intramural	0%
Grants	0%			University	86%
Other	0%			Non Profit	2%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition	Selection	Goals
1. Scout mission	Fall 03	100% Full & Open Competition, 100% Science Peer Review.
2. Technology NRA - released annually	Annually	100% Full and Open Competition, with 100% Peer Review.
3. Pu 238 for Mars Science Laboratory	1QTR/FY03	Contract through DOE via sole source International Agreement.

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator for Space Science. External: Department of Energy for Multi-Mission Radioisotope Thermoelectric Generators (MMRTG). Changes since FY 2004 President's Budget: Deleted U.S. contribution toward 2007 Centre National d'Etudes Spatiales Orbiter; deleted 2007 Agenzia Spaziale Italiana (ASI) Orbiter and 2009 ASI/Synthetic Aperture Radar; added 2009 U.S. Telecom.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
2007 Mars Scout Non-Advocate Review	IPAO		7/04	Assess readiness for implementation.
2009 MSL Non-Advocate Review	IPAO		6/05	Assess readiness for implementation.
2009 U.S. Telecom Non-Advocate Review	IPAO		1/06	Assess readiness for implementation.
Scout Step 1 Proposal Review	LaRC/TMCO		9/03	Select 3-4 mission concepts.
Scout Step 2 Concept Study Review	LaRC/TMCO		3/03	Select Scout flight mission.
Technology 3-year review	External Review Board	9/02	10/03	Assess content, quality and relevance of technology investments.

Theme: Mars Exploration
Technology and Advanced Concepts

BUDGET

Budget Authority ($ millions)	FY 2003	FY 2004	FY 2005	Comments
FY2005 PRESBUD	142.9	304.7	515.6	
Optical Comm		31.0	55.8	
2007 Scout Mission	8.8	28.9	102.8	
2009 MSL	60.6	117.3	174.6	
2009 US Telesat	4.2	9.2	25.1	
Mars Technology	28.7	36.1	20.2	
JPL Discrete CoF	1.4	15.5	11.5	
Mars Program Plans & Architecture and Other	39.1	66.7	125.6	Supports new exploration vision
Changes since 2004 PRESBUD	-34.6	+29.3		
Optical Comm		+31.0		Transferred from SSE Theme
2007 Scout Mission	+1.7	-0.2		Deleted Mission of Opportunity (MoO)
2009 MSL	+39.0	-0.7		Increased MMRTG budget consistent with contract award
2009 US Telesat	+4.2	-0.1		Rephased funding profile
Mars Technology	-21.3	-0.2		
JPL Discrete CoF	-15.1	-0.1		Deferred Flt Project Building to 2005
Mars Program Plans & Architecture and Other	+39.1	+66.7		
2007 CNES Orbiter	-19.4	-14.1		
FY2004 PRESBUD	177.5	275.4		
2007 CNES Orbiter	19.4	14.1		
2007 Scout Mission	7.1	29.1		
2009 MSL	21.6	118.0		
2009 US Telesat		9.3		
Mars Technology	50.0	36.3		
JPL Discrete CoF	16.5	15.6		
2007 Scout Mission	62.9	52.9		

Indicates changes since the previous year's President's Budget Submit
Indicates budget numbers in full cost.