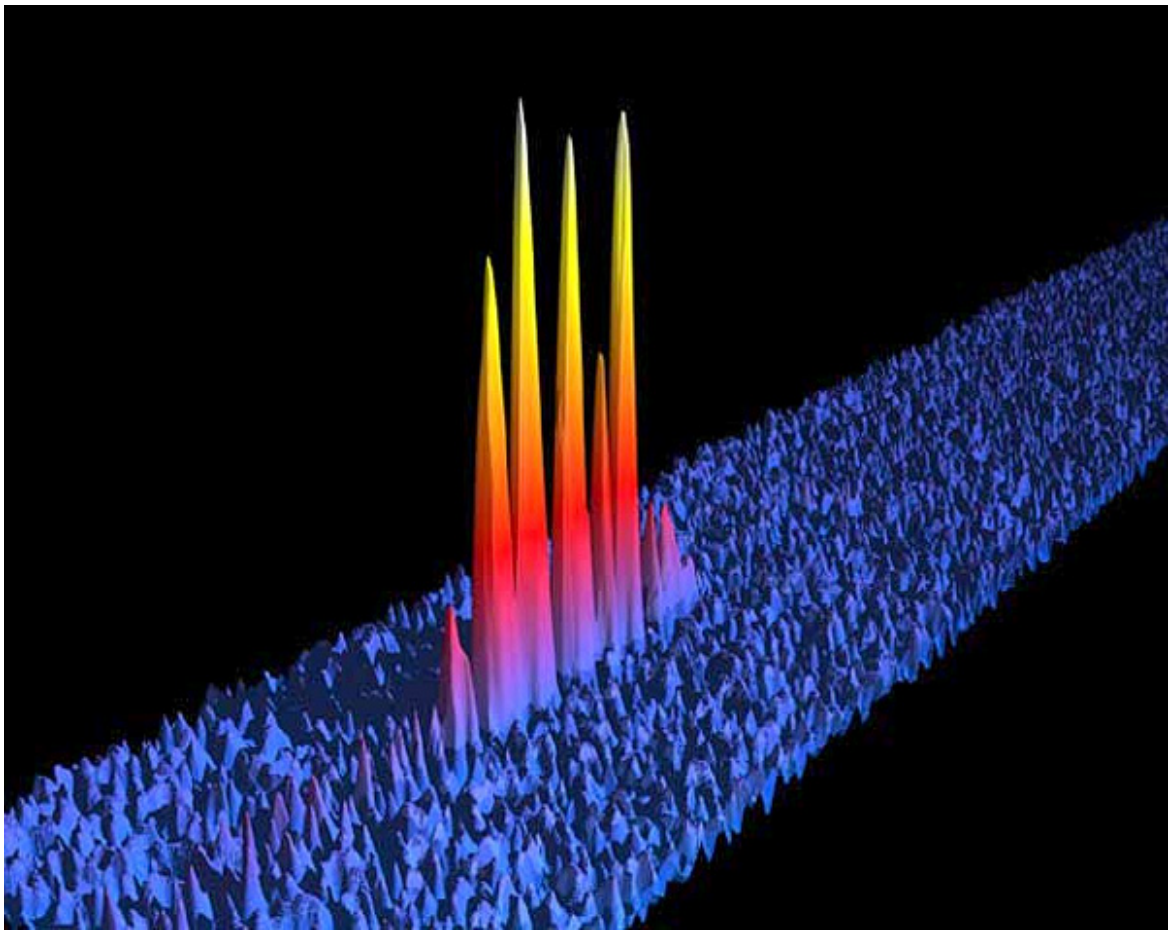
THEME: Physical Sciences Research



NASA-funded physicists at Rice University discovered ultra cold atoms forming bright solitons, localized bundles of waves that maintain a constant shape as they propagate. The researchers observed atomic soliton trains, groups of as many as 15 solitons. These solitons propagated without spreading for several seconds—an eternity for a localized wave bundle. This fundamental research may lead to technical innovations such as atom lasers that could eventually be used to predict volcanic eruptions on Earth and map a probable subsurface ocean on Jupiter's moon, Europa.

PHYSICAL SCIENCES RESEARCH

MAJOR EVENTS IN FY 2004

- 6 physical sciences flight experiments scheduled to be conducted on the Space Shuttle and Space Station.
- Delivery of the first major PSR research facility rack to the International Space Station, the Combustion Integrated Rack (CIR) on ULF-2. Beginning of prime research facility operations on the ISS, a new phase of Space Station utilization.
- Fluids Integrated Rack (FIR) flight hardware available by August 2004.

THEME: Physical Sciences Research (PSR)

OVERVIEW

The Office of Biological and Physical Research (OBPR) Physical Sciences Research (PSR) theme carries out basic and applied scientific investigations to lay the foundation for understanding the details of physical and chemical processes involved in developing the capabilities to deploy spacecraft, to generate resources, and to maintain life support sub-systems for in-space and planetary applications. By using the unique environment afforded by space platforms, the program also tackles fundamental unsolved scientific problems and pursues a better understanding of processes sensitive to the effects of gravity and relevant to industrial and technological applications on Earth. This theme relies on a talented and diverse academic research community to carry out many of its research activities, and strives to involve the next generation of scientists and engineers in space-based, as well as Earth-based, theoretical and experimental research, and to communicate the excitement and share the rewards of new discoveries.

Missions	Goals supported by this theme	Objectives supporting those goals — Reference 2003 Strategic Plan
Understand and Protect our Home Planet	3. Create a more secure world and improve the quality of life by investing in technologies and collaborating with other agencies, industry, and academia.	3.5 Use the unique low-gravity environment of space to resolve scientific issues impacting Earth-based technological and industrial applications
Explore the Universe and Search for Life	4. Explore the fundamental principles of physics, chemistry, and biology through research in the unique natural laboratory of space.	4.2 Using the unique low-gravity environment in space, explore the fundamental organizing principles of nature and understand how they give rise to structure and complexity in matter.
Inspire the Next Generation of Explorers	6. Inspire and motivate students to pursue careers in science, technology, engineering and mathematics.	6.1 Improve student proficiency in science, technology, engineering and mathematics by creating a culture of achievement using educational programs, products and services based on NASA's unique missions, discoveries and innovations. 6.3 Enhance science, technology, and mathematics instruction with unique teaching tools and experiences that are compelling to educators and students only NASA can provide.
	7. Engage the public in shaping and sharing the experience of exploration and discovery	7.2 Engage the public in NASA missions and discoveries, and their benefits, through such avenues as public programs, community outreach, mass media, and the internet.
Space Flight Capabilities	9. Extend the duration and boundaries of human space flight to create new opportunities for exploration and discovery	9.3 Create a research database that resolve fundamental low-gravity issues affecting technologies for human space travel beyond low-Earth orbit (LEO).

RELEVANCE

The PSR theme addresses high priority research as identified by the science community. This research will improve Earth-based technologies and industrial applications by: 1) Improving the understanding of processes for combustion-based energy production and pollutant emission, focusing on issues in materials manufacturing such as the synthesis and processing of complex composite materials, and exploring natural self-assembly processes for advanced materials development; 2) Integrating physical sciences tools to understand complex biological systems impacting health research such as the functional basis of human physiology in space through the application of biological fluid modeling, the use of space to contribute to major problems in structural biology through advances in protein crystallography, mammalian tissue engineering using low gravity to control mechanical stresses, and use of laser tweezers for DNA characterization; 3) Developing quantum technologies, such as the atom laser and quantum data storage and computing, by using the ability to better manipulate atoms and molecules as Bose-Einstein condensates in a low-gravity environment.

THEME: Physical Sciences Research (PSR)

Space exploration offers a unique opportunity to advance our understanding of the fundamental nature of matter and of the some of the key phenomena that give rise to order, structure, and complexity throughout the physical universe. The PSR program will enhance fundamental knowledge of the universe by: 1) Conducting pioneering experiments to advance understanding of model systems of complexity, focusing on a field of condensed matter physics known as "soft matter:" colloids, foams, liquid crystals, and granular systems, and biological system engineering; 2) Sharpening the experimental resolution of studies in condensed matter physics, leading to ultra-precise clocks to probe Einstein's General Relativity theory at an unrivaled level; and 3) Using the space environment to conduct unique experiments in materials science, challenging basic tenets of existing theories of how matter undergoes transformation from one form to another.

The PSR theme will improve the design and operation of space-based infrastructure such as spacecraft power and propulsion sub-systems, life support and resource creation and management systems, and innovative fabrication methods for space exploration purposes either in-space or on extra-terrestrial locations. Data from PSR projects will enable new technologies or improve existing designs in: 1) Efficient technologies for thermal management relying on boiling (an apparently simple technology not now available to designers because boiling in low gravity is not well-understood) two-phase flows in low-gravity in order to improve heat rejection capacity and reliability while decreasing mass and volume requirements; 2) Materials flammability assessment, combustion detection sensors, and fire extinguishment methodologies development in low and partial gravity; 3). Novel approaches for in-space fabrication methods using limited resources, under varying gravity levels, pressures and temperatures; and 4) Assessment and analysis of the effects of radiation on structural, electronic, and life support materials, and the development of radiation protection structure technology.

Education and Public Benefits
Public benefits are derived from the accumulation of new knowledge on a variety of physical and chemical phenomena that cannot be understood, or even observed, by earth-based experiments because of the effects of gravity. A better understanding of how combustion, free convection and other phenomena will lead to better manufacturing processes and improved products. With consistent improvements and a continued understanding of theses effects, there positive impacts to our quality of life is evident. The broadly-based nurturing of academic peer-reviewed research through undergraduate, graduate, and post-doctoral students support in a wide variety of scientific and engineering disciplines will contribute to sustain the supply of the skilled technical workforce of tomorrow. New observations and understanding of nature revealed by unfamiliar phenomena by scientific research in space will enhance the appeal of a technical education. They will provide the renewed excitement and motivation to acquire understanding and to make new discoveries through actual hands-on involvement in flight-based research and space exploration.

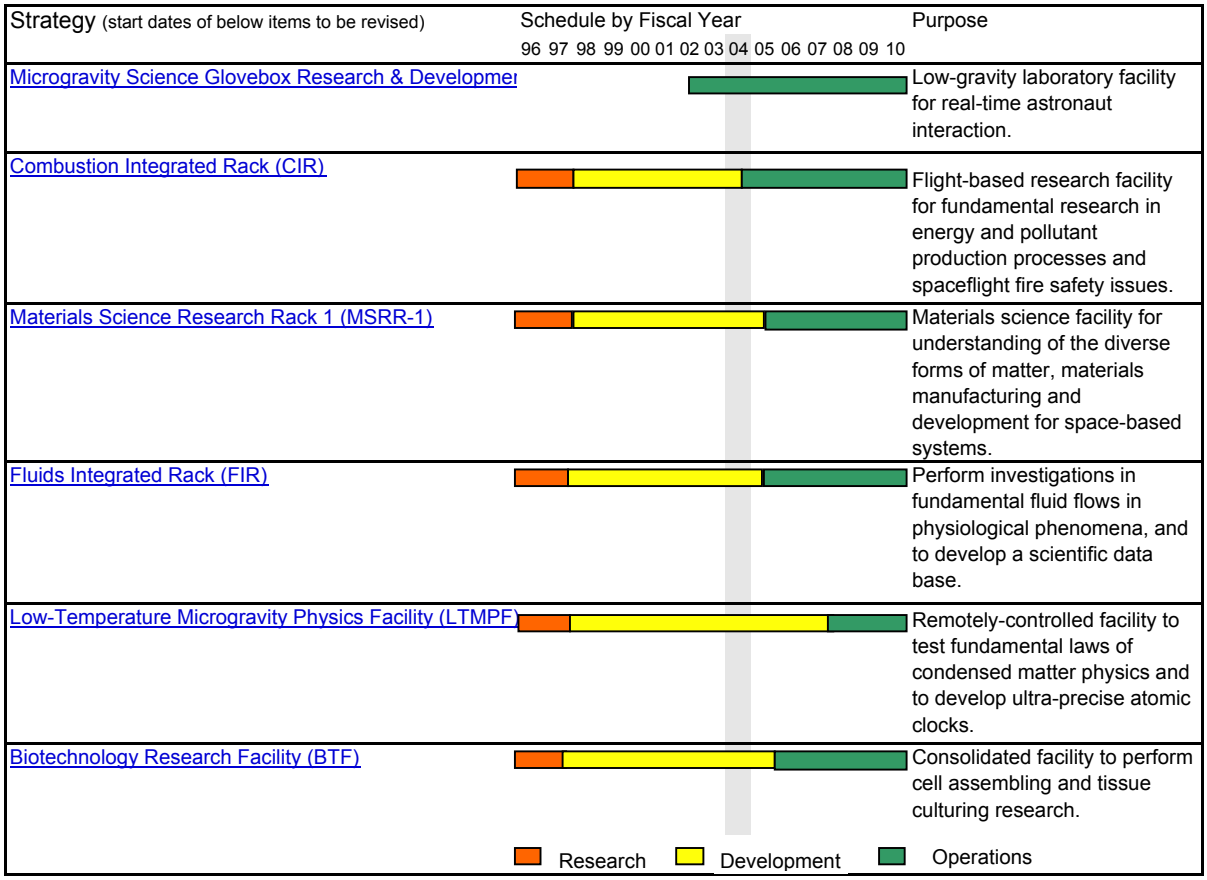
IMPLEMENTATION

This theme is composed of a set of integrated elements working together to achieve the aforementioned goals and objectives. Those elements support five scientific and engineering disciplines contributing their expertise to the accomplishment of the specified goals and objectives. These disciplines are: Cellular and Macromolecular Biotechnology, Combustion Science, Fluid Physics and Transport Phenomena, Materials Science, and Fundamental Physics. Each of these disciplines involve the related scientific communities in academia, government, and the private sector who compete for peer-reviewed research grants to carry out earth and space-based research. The flight-based research is carried out through the development, on-orbit deployment, and operations of a set of cross-disciplinary and/or specialized facilities. The output of the earth and space-based research takes the form of peer-reviewed archival publications, patents, students master and doctoral theses, co-operative agreements with the private sector for collaborative research or for product development, and transferred technology through a technical database.

THEME: Physical Sciences Research (PSR)

IMPLEMENTATION (continued)

The elements of the program include a Research component that selects and administers peer reviewed research grants and contracts, and a flight research element that controls ISS (and STS) development and operations activities. The ISS flight program is developing the following set of specialized and cross-disciplinary research facilities: The Biotechnology Facility (BTF) that will be housed in multi-purpose Express racks, the Fluids and Combustion Facility (FCF - currently composed of the Fluids Integrated Rack (FIR) and Combustion Integrated Rack (CIR)), the Materials Science Research Rack (MSRF - currently composed of MSRR-1), the Low Temperature Microgravity Physics Facility (LTMPF) on the external payload facilities, and a series of pressurized environment sub-rack apparatuses (eg; Physics of Colloids in Space (PCS)). PSR is a multiple-project and single-program theme with program responsibility in the Office of Biological and Physical Research at NASA HQ. The theme director is Dr. Eugene Trinh in the Physical Sciences Research Division at NASA HQ.



STATUS

The PSR theme prepared and carried out an ISS research investigation on colloidal physics, protein crystallization and three-dimensional tissue culture. They initiated the definition of a Bio-science and Engineering program to drive novel concepts for space-based investigations in biomedical systems. Other achievements were: Investigated fundamental and unresolved issues in condensed matter physics and atomic physics, and carried out atomic clock development for space-based utilization; Produced scientific discoveries in atomic and condensed matter physics, and published in mainstream peer-reviewed archival journals; Designed and developed flight experiment apparatus for low-temperature physics, laser cooling, and atomic physics investigations on the ISS; Completed the preparation and carried out ISS investigations in fundamental materials science to be carried out in the Microgravity Science Glovebox; 30 ground research proposals were selected in CY 2002.

Please follow this link for additional data: http://spaceresearch.nasa.gov

THEME: Physical Sciences Research (PSR)

PERFORMANCE MEASURES

Annual Performance Goals	
OUTCOME: 3.5.1	Use the unique low-gravity environment to resolve scientific issues that impact Earth-based technological and industrial applications.
4PSR1	Improve understanding of the detailed physical and chemical processes associated with combustion, the efficiency of combustion, and how soot is produced in flames; the properties and behavior of granular materials such as soils and powders; growing crystals of large molecules for applications in drug development and biomedical research; and growing tissues outside the body (cellular assembling processes in tissue cultures) for research and medical treatments. Progress toward accomplishing this Performance Goal will be assessed by an advisory committee.
OUTCOME: 4.2.1	Advance the scientific understanding of complex biological and physical systems.
4PSR2	Use research in the low gravity environment of space to advance the scientific understanding of complex biological and physical systems. FY 04 accomplishments will include maintaining an open, competitive, and productive research community, and carrying out and analyzing results of ISS experiments in colloidal physics. Progress toward accomplishing this performance goal will be assessed by an advisory committee.
OUTCOME: 4.2.2	Advance understanding of fundamental issues in condensed matter physics and atomic physics.
4PSR3	Investigate fundamental and unresolved issues in condensed matter physics and atomic physics. FY 04 activities will include maintaining an open, competitive and productive research program in condensed matter physics, Bose-Einstein condensation, and atomic clocks development for space-based utilization. Progress toward accomplishing this performance goal will be assessed by an advisory committee.
OUTCOME: 6.1.1	Kindergarten through graduate students will be more proficient in science, technology, engineering and mathematics (STEM).
4PSR4	Engage students in inquiry-based learning experiences through development and distribution of classroom activities that simulate biological and physical sciences space research investigations. These activities will align with standards-based curriculum.
OUTCOME: 6.3.1	Improve quality of STEM instruction.
4PSR5	Develop collaborations with Professional Education Associations directed to enhancement of educator proficiency in use of space research content and classroom, educational hardware focused on standards-based curriculum.
4PSR6	Develop and train facilitators for dissemination of 3 comprehensive Educator Professional Development Seminar packages focused on biological and physical sciences research that coordinates with standard's based science, math, and technology concepts.
OUTCOME: 7.2.4	Broaden OBPR research information to diverse audiences.
4PSR7	In FY 04 increase mailing list of Space Research newsletter by 5,000 over FY 03 mailing list.
4PSR8	Through collaboration with PAO, establish and sustain a series of media presentations of OBPR research highlights. There will be a series of presentations to the media of research results; this campaign of media presentations will be ongoing and will be increased in FY 04 over the initial series that will take place in FY 03.
4PSR9	OBPR will expand its involvement in reaching minority and under-represented sectors of the public, through participation in conferences and community events that reflect cultural awareness and outreach. There will be at least one new venue more associated with a minority and/or under-represented community, then outreach efforts taking place in FY 03.
OUTCOME: 9.3.1	Increase research database with results from radiation measurements, microgravity combustion and heat transport investigations.
4PSR10	Extend the available database on radiation effects in materials using the newly commissioned Booster Application Facility at Brookhaven. Progress will be reviewed by an advisory committee.
4PSR11	Analyze results of ISS and Space Shuttle (STS 107) investigations on fire safety and microgravity combustion. Progress will be reviewed by an Advisory Committee.
4PSR12	Prepare for and carry out microgravity heat exchange investigation on ISS. Progress will be reviewed by an advisory committee.

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
Indep Annual Review	ReMaP	1-Sep-02	None Planned	Research Prioritization
Indep Peer Reviews	IDI	20-Nov-02	3-Dec-02	NRA Announcement Panel Rev.
National Research Council Committees	NAS/NRC	1-Jun-02	None Planned	NAS research progress/quality
External Advisory Committees	NASA	27-Aug-02	Annual	Advisory Committees Research

THEME: Physical Sciences Research (PSR)

BUDGET

Budget Authority ($millions)	FY02	FY03	Change	FY04	Comments
Physical Science Research	**227.4**	**247.1**	**+106.1**	**353.2**	
Development	40.8	29.9	+18.0	47.9	Changes in PSR programs due to full cost, ReMaP decisions, and addition of Human Research Initiative.
Fluids and Combustion Facility	22.3	12.0	+10.9	22.9	
Low Tempature Microgravity Physics Facility	13.9	12.9	-3.0	9.9	
Materials Science Research Rack-1	4.6	5.0	+10.1	15.1	
Operations	66.7	83.1	+76.7	159.8	
ISSRC Physical Science Research	66.7	83.1	+76.7	159.8	
Research	119.9	134.1	+11.4	145.5	
Physical Science Research (Strategic and Fundamental)	119.9	134.1	+11.4	145.5	

Note: For all formats, the FY 02 column reflects the FY 2002 Congressional Operating Plan letter dated 9/30/02. The FY 03 column reflects the FY 2003 Presidents Budget Submit (PBS) as Amended. The Change column includes both programmatic and full cost adjustments. FY 2004 column is in full cost.

Indicates budget numbers in Full Cost.
Indicates changes since the FY 2003 Presidents Budget Submit.
FY 2002 and FY 2003 are not in full cost.

THEME:	Physical Sciences Research (PSR)
DEVELOPMENT:	Fluids and Combustion Facility (FCF)

PURPOSE

Objectives	Reference 2003 Strategic Plan	Performance Measures
3.5; 4.2; 9.3		4PSR1, 4PSR2, 4PSR3, 4PSR10, 4PSR11, 4PSR12

The primary purpose of the Fluids and Combustion Facility (FCF) is to use the space environment as a laboratory to test the fundamental principles of physics, chemistry, and biology and to generate the required scientific microgravity database to enable the development of technologies for human space exploration beyond LEO.

OVERVIEW

The Fluids Integrated Rack (FIR) is an ISS science rack designed to study the properties of simple and complex fluids in various forms (i.e. liquid, gas, multi-phase mixture) in an orbital microgravity environment. The objective is to remove the effects of sedimentation, buoyancy, and convection in order to investigate natural phenomena and industrial processes and systems that are greatly affected by gravitational forces. The FIR provides the laboratory infrastructure to carry out detailed observations and accurate measurements by implementing an ingenious and award-winning rotatable optical bench that allows the quick removal and installation of experiment containers and various diagnostic instrumentation such as imaging, confocal microscopy, environment control, and automation. The Combustion Integrated Rack (CIR) provides similar research capability for investigations requiring insight into the behavior of laminar flames, turbulent droplet and spray combustion, and flame spread over fuel surfaces when the influence of gravity is greatly reduced. Both racks allow the implementation of many different investigations because of their modular design that is conducive to the use of a variety of experimental inserts to accommodate a wide range of research topics.

Please follow this link for additional data: http://fcf.grc.nasa.gov

PROGRAM MANAGEMENT

Enterprise official is Mary Kicza, Associate Administrator for Biological and Physical Research at HQ. Theme Director is Gene Trinh, Director for Physical Sciences Research at HQ. The FCF program responsibility is delegated to the Glenn Research Center. Project Manager is Robert Zurawskil at the Glenn Research Center. Full compliance with NPG 7120.5B will be achieved in FY 03 for the relevant portions.

TECHNICAL COMMITMENT

Baseline Commitment as of OBPR Basis of Estimates (BOE) dated 1/22/02

Technical Specifications	FY04 President's Budget	Change from Baseline
Launch Vehicle:	Shuttle	--
Fluids and Combustion Facitliy:	1 FIR / 1 CIR	--
Power to Payloads:	3 kW rack power	--
Facility operational lifetime:	10 years	
Operational capability:	Provides gas mixing, thermal control, data storage, power conditioning and digital imaging	
Science Instruments:	Gas Chromatograph, Infrared Imaging, Fiber Illumination, Optics Bench and a High-Pressured Containment Vessel	

Schedule	FY04 President's Budget	Change from Baseline
CIR Critical Design Review (CDR)	May-02	2 months
CIR Flight Hardware Available (FHA)	Jan-04	BOE contained TBD
FIR Critical Design Review (CDR)	Dec-02	2 month
FIR Flight Hardware Available (FHA)	Aug-04	--

THEME: Physical Sciences Research (PSR)

DEVELOPMENT: Fluids and Combustion Facility (FCF)

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Data current as of 1/18/2003

Major acquisitions for FCF are: Power Supply, Avionics/control, Common illumination, PI Integration optics bench, Fluid diagnostics, Environmental Control, Imaging and frame capture, Combustion Diagnostics, Combustion Chamber with Northop Grumman as the prime contractor. **Changes since FY03 Pres. Budget: Combustion Integrated Rack added for FY03 - FY08**

Current Acquisitions	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreements	0%	Full & Open Competition	90%	Industry	89%
Cost Reimbursable	0%	Sole Source	10%	Government	4%
Fixed Price	42%		100%	NASA Intramural	6%
Grants	0%			University	1%
Other (Cost +)	58%	Science Peer Review	0%	Non Profit	0%
	100%	*% based on FY 02 direct proc.			100%

Future Acquisitions - Major	Selection	Goals
Change to Cost Plus	Fall 03	100% Full & Open Competition, 10% SB, 100% Cost Plus

AGREEMENTS

Data current as of 1/18/2003

Internal: None.
External: None.
Changes since FY03 Presidents Budget: None.

INDEPENDENT REVIEWS

Data current as of 1/18/2003

Types of Review	Performer	Last Review	Next Review	Purpose
Critical Design Reviews	Indep. Panel	5/28-31/2002	9-13 Dec. 2002	NASA technical and programmatic assessment.

BUDGET / LIFE CYCLE COST

Total budget authority represents a ROM Life Cycle Cost (LCC) for the development of this facility.

Budget Authority ($ in millions)	Prior	FY02	FY03	FY04	FY05	FY06	FY07	FY08	BTC	Total	Comments
FY 2004 President's Budget (LCC)	107.5	22.3	12.0	22.9	12.5	4.9	0.0	0.0	0.0	182.2	
Development	107.5	22.3	12.0	22.9	12.5	4.9				182.2	
Changes since FY 03 Pres. Budget	-0.4	+0.0	+0.0	+15.0	+7.3	+4.9	+0.0	+0.0		+26.8	**Reason for Change:**
Development	-0.4	+0.0	+0.0	+15.0	+7.3	+4.9				+26.8	Add back of the CIR and full cost.
FY 2003 President's Budget (LCC)	108.0	22.3	12.0	7.9	5.2	0.0	0.0	0.0		155.4	
Development (Mar 02)	108.0	22.3	12.0	7.9	5.2	0.0				155.4	
Basis of Estimate (BOE)	108.0	20.1	11.8	7.4	1.9	0.0	0.0	0.0		149.1	
Development (Mar 02)	108.0	20.1	11.8	7.4	1.9	0.0				149.1	Baseline Mar 2002

Indicates budget numbers in Full Cost.
Indicates changes since the FY 2003 Presidents Budget Submit.
FY 2002, FY 2003, Prior and BTC are not in full cost.

THEME:	Physical Sciences Research (PSR)
DEVELOPMENT:	Low Temperature Microgravity Physics Facility (LTMPF)

PURPOSE

Objectives (Reference 2003 Strategic Plan)	Performance Measures
3.5; 4.2; 9.3	4PSR1, 4PSR2, 4PSR3, 4PSR10, 4PSR11, 4PSR12

The Low Temperature Microgravity Physics Facility (LTMPF) will use the space environment as a laboratory to test the fundamental principles of physics, chemistry, and biology. LTMPF will allow the scientific community to carry out definitive experiments in condensed matter physics and critical phenomena. The currently selected space-based investigations are considered capstone research, offering groundbreaking opportunities not before available.

OVERVIEW

The Low Temperature Microgravity Physics Facility (LTMPF) is an external unpressurized payload. The LTMPF is designed for long-duration science investigations whose objectives can only be achieved in a microgravity environment and at ultra-low temperatures provided by a space-qualified cryogenic dewar system. The facility will allow automated and remotely-commanded of unique experimental apparatuses operated at near absolute zero temperature and implementing stable high resolution thermometry. The combination of low-gravity and the use of this high-precision instrumentation will allow the accurate measurement of fundamental parameters such as the heat capacity and compressibility in the critical region of superfluid helium. Such measurements are required to verify fundamental theoretical predictions, but are impossible to carry out on earth. LTMPF will also lead to the development of on-orbit super-stable microwave cavity and to the implementation of a novel Laser Cooling and Atomic Physics facility for the development of ultra-precise atomic clocks.

PROGRAM MANAGEMENT

Enterprise official is Mary Kicza, Associate Administrator for Biological and Physical Research at HQ. Theme Director is Gene Trinh, Director for Physical Sciences Research at HQ. The LTMPF Project program responsibility is delegated to the Jet Propulsion Laboratory. Project Manager is John Pensinger at the Jet Propulsion Laboratory. Full compliance with NPG 7120.5B will be achieved in FY 03 for the relevant portions.

TECHNICAL COMMITMENT

Baseline Commitment as of OBPR Basis of Estimates (BOE) dated 2/26/02.

Technical Specifications	FY04 President's Budget	Change from Baseline
Launch Vehicle	Shuttle	--
External attached payload	Attached payload located on Japanese Module	--
Power to Payloads	300 W power	--
Facility operational lifetime	10 years (5 missions of 6 months each, every 22 months)	--
Operational capability: 5-6 months of Helium and 4.5 months Data Acquition per mission		--
Science Instruments: MISTE/COEX and DYNAMX/CQ		

Schedule	FY04 President's Budget	Change from Baseline
LTMPF Critical Design Review (CDR)	Sep-03	3 months
LTMPF Final Assembly and Test (FAT)	May-06	--
LTMPF Flight Hardware Available (FHA)	Aug-07	18 months

THEME: Physical Sciences Research (PSR)

DEVELOPMENT: Low Temperature Microgravity Physics Facility (LTMPF)

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Major acquisitions for LTMPF are: Facility (includes dewar, enclosure, common electronics & software), Dewar (provides cryostat) and Probe (houses two ISP's). Ball Aerospace and Technology Corporation (BATC) selected in 1995 as prime contractor. In 2001 BATC's content was descoped to only provide the Dewar and Enclosure Subsystem (DES) and Deign_Net Engineering was selected to provide Electronics and Software Subsystem (ESS). **Changes since FY03 Pres. Budget: Two-year delay due to JEM-EF slip.**

Current Acquisitions	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreements	0%	Full & Open Competition	100%	Industry	100%
Cost Reimbursable	0%	Sole Source	0%	Government	0%
Fixed Price	0%		100%	NASA Intramural	0%
Grants	0%			University	0%
Other (Cost + Award Fee)	100%	Sci Peer Review	0%	Non Profit	0%
	100%	*% based on FY 02 direct proc.			100%

Future Acquisitions - Major	Selection	Goals
Cost + Award Fee	Fall 03	100% Full & Open Competition, 10% SB, 100% Cost Plus Award Fee

AGREEMENTS

Internal: None

External: Payload Interface Unit (PIU), Flight Releasable Attachment Mechanism (FRAM), Flight Releasable Grapple Fixture (FRGF) and H Fixture from NASA JSC and SAMS accelerometer from NASA GRC.

Changes since FY03 Pres. Budget: TBD.

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
Independent Assessment	MSFC CFO	26-Jul-01	3-Mar-03	Cost and schedule assessment.

BUDGET / LIFE CYCLE COST

Total budget authority represents a ROM Life Cycle Cost (LCC) for the development of this facility.

Budget Authority ($ in millions)	Prior	FY02	FY03	FY04	FY05	FY06	FY07	FY08	BTC	Total	Comments
FY 2004 President's Budget (LCC)	14.5	13.9	12.9	9.9	6.4	1.3	0.0	0.0	0.0	58.9	
Development	14.5	13.9	12.9	9.9	6.4	1.3				58.9	
Changes since FY 03 Pres. Budget	0.0	0.0	+0.8	-0.6	+0.0	+0.3	+0.0	+0.0		+0.5	***Reason for Change:***
Development	0.0	0.0	+0.8	-0.6	+0.0	+0.3				+0.5	Appropriation increase and full cost adjustments.
FY 2003 President's Budget (LCC)	14.5	13.9	12.1	10.5	6.4	1.0	0.0	0.0		58.4	
Development	14.5	13.9	12.1	10.5	6.4	1.0	0.0			58.4	
Basis of Estimate (BOE)	14.5	9.2	12.1	9.5	6.3	1.2	0.0	0.0		52.8	
Development (Mar 02)	14.5	9.2	12.1	9.5	6.3	1.2	0.0			52.8	Baseline Mar 2002

Indicates budget numbers in Full Cost.

Indicates changes since the FY 2003 Presidents Budget Submit.

FY 2002, FY 2003, Prior and BTC are not in full cost.

THEME:	Physical Sciences Research (PSR)
DEVELOPMENT:	Materials Science Research Rack- 1 (MSRR-1)

PURPOSE

Objectives	Reference 2003 Strategic Plan	Performance Measures
3.5; 4.2; 9.3		4PSR1, 4PSR2, 4PSR3, 4PSR10, 4PSR11, 4PSR12

The strategic objective of the Materials Science Research Rack-1 is to use the space environment as a laboratory to test the fundamental principles of physics, chemistry, and biology. The fundamental purpose of the MSRR-1 will be to evaluate the reactions of various materials to a low gravity environment while contained in a specialized compartment.

OVERVIEW

The MSRR-1 is a modular autonomous rack that implements a set of furnace modules and diagnostic instrumentation for the study of a variety of materials such as glass, ceramics, metals and alloys, electronic materials, and composites in a low gravity environment. The MSRR-1 includes subsystems that provide basic resources, and experiment modules and module inserts, which contain the scientific experiments. An Active Rack Isolation System (ARIS) is provided for vibration isolation. The MSRR-1 accommodates the Materials Science Laboratory through a cooperative project with the European Space Agency. A second experiment module is provided through the Space Products Development program.

Please follow this link for additional data: http://msrf.msfc.nasa.gov/index.html

PROGRAM MANAGEMENT

Enterprise official is Mary Kicza, Associate Administrator for Biological and Physical Research at HQ. Theme Director is Gene Trinh, Director for Physical Sciences Research at HQ. The MSRR - 1 program responsibility is delegated to the Marshall Space Flight Center. Project Manager is Charles Darby at the Marshall Space Flight Center. Full compliance with NPG 7120.5B will be achieved in FY 03 for the relevant portions.

TECHNICAL COMMITMENT

Baseline Commitment as of OBPR Basis of Estimates (BOE) dated 1/22/02.

Technical Specifications	FY04 President's Budget	Change from Baseline
Launch Vehicle	Shuttle	--
MSRR-1	1 MSRR rack, 1 Quench Module Insert (QMI) insert, and 1 SPD furnace module accommodation	--
Power to Payloads	3 kW rack power	--
Operational capability:	Provides support for 2 Experiment Modules Processing parameters can be updated or changed through telescience control of the payload. Sample exchange is manual.	
ARIS equipped ISPR	Major support subsystems: Master Controller, Solid State Power Control Module, Thermal and Environmental Control System, Vacuum Access System, Support Structure, Experiment Modules and Module Inserts.	
Science Instruments:		
Materials Science Laboratory EM	Support precise temperature stability and control, high resolution temperature resolution and measurement, furnace translation capability, mass spectrometer failure detection system, rotating magnetic field, current pulsing capability for sample interface demarcation, and shear cell motor drive capability. Module Inserts Quench Module Insert(QMI) Large Gradient Furnace (LGF) & Solidification Quench Furnace (SQF) are exchangeable on-orbit for tailored experiment conditions including high temperature processing with high and low temperature gradients, rapid heat extraction through quenching, and isothermal heated regions.	
Space Product Development EM	Supports on-orbit exchange of transparent and opaque furnace inserts for vapor crystal growth and processing of glass performs. Samples are exchanged with furnace inserts. Provides temperature control and telescience monitoring and control of processing parameters.	

Schedule	FY04 President's Budget	Change from Baseline
MSRR - 1 Flight Hardware Available (FHA)	Jan-05	6 months
Integrated Payload CDR	Complete 5/02	--
QMI Flight Hardware Available (FHA)	Jan-05	Not in baseline BOE
Payload Safety Review	Oct-03	--

THEME: Physical Sciences Research (PSR)

DEVELOPMENT: Materials Science Research Rack- 1 (MSRR-1)

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Data current as of 1/18/2003

Major acquisitions for MSRR - 1 are: Solid State Power Control Module (SSPCM), Active Rack Isolation System (ARIS), and International Standard Payload Rack (ISPR). The Quench Module Insert (QMI) and additional Rack Support Systems (RSS) which consisting of Master Controller (MC), Thermal & Environment Control System, Vacuum Access System and Support Structure are developed and acquired through the in house effort. The Materials Science Laboratory Experiment Module (MSL-EM), Space Product Development - Experiment Module (SPD-EM) are acquire through other agreements. **Changes since FY03 Pres. Budget: Selection of Prime Contractor with tasks transferred from in-house effort starting in FY03.**

Current Acquisitions	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreements	0%	Full & Open Competition	100%	Industry	30%
Cost Reimbursable	0%	Sole Source	0%	Government	0%
Fixed Price	30%		100%	NASA Intramural	70%
Grants	0%			University	0%
Othe (In House)	70%	Sci Peer Review	0%	Non Profit	0%
	100%	*% based on FY 02 direct proc.			100%

Future Acquisitions - Major	Selection	Goals
Change to On-Site Contractors	Fall 03	100% Full & Open Competition

AGREEMENTS

Data current as of 1/18/2003

Internal: None

External: Interagency Bilateral Cooperative Research Agreement (dated August 1999), as authorized by the early Station Utilization Memorandum of Understanding (MOU) between NASA and ESA. **Changes since FY03 Pres. Budget: None.**

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
Independent Annual Review	MSFC/SMO	20-Jul-02	1-Jul-03	Independent Audit

BUDGET / LIFE CYCLE COST

Total budget authority represents a ROM Life Cycle Cost (LCC) for the development of this facility.

Budget Authority ($ in millions)	Prior	FY02	FY03	FY04	FY05	FY06	FY07	FY08	BTC	Total	Comments
FY 2004 President's Budget (LCC)	35.1	4.6	5.0	15.1	1.5	0.0	0.0	0.0	0.0	61.3	
Development	35.1	4.6	5.0	15.1	1.5	0.0	0.0			61.3	
Changes since FY 03 Pres. Budget	-27.2	+0.0	+0.0	+8.7	-1.4	-1.7	-1.7	+0.0		-23.2	***Reason for Change:***
Development	-27.2	+0.0	+0.0	+8.7	-1.4	-1.7	-1.7			-23.2	Facility only adjustments and full cost.
FY 2003 President's Budget (LCC)	62.3	4.6	5.0	6.4	2.9	1.7	1.7	0.0		84.5	
Development (Mar 02)	62.3	4.6	5.0	6.4	2.9	1.7	1.7			84.5	
Basis of Estimate (BOE)	62.3	7.4	7.7	4.7	0.8	0.0	0.0	0.0		82.8	
Development (Mar 02)	62.3	7.4	7.7	4.7	0.8	0.0	0.0			82.8	Baseline Mar 2002.

Indicates budget numbers in Full Cost.

Indicates changes since the FY 2003 Presidents Budget Submit.

FY 2002, FY 2003, Prior and BTC are not in full cost.

THEME:	Physical Sciences Research (PSR)
OPERATIONS:	Physical Sciences Research (PSR)

PURPOSE

Objectives (Reference 2003 Strategic Plan)	Performance Measures
3.5; 4.2; 9.3	4PSR1, 4PSR2, 4PSR3, 4PSR10, 4PSR11, 4PSR12

The Physical Sciences Research (PSR) Program will combine unique experimental facilities with long-duration access to Low-Earth Orbit and beyond to enable new scientific discoveries and the development of technologies for the benefit of space exploration and Earth-based applications.

OVERVIEW

The Physical Sciences Research Program will continue fabrication of ISS research racks and experiment inserts for the CIR, FIR, and MSRR-1. PSR plans to carry out manifested ISS research investigations in the first discipline focused racks (CIR) as well as in EXPRESS Racks and the Microgravity Science Glovebox in order to process the already selected flight investigations in the queue. The program will also initiate the newly validated and prioritized research program content and continue ground-based and flight research in the validated and prioritized research areas. PSR has a current roster of 85 flight investigations to be implemented between 2004 and 2008. PSR will also collaborate with the International Partners (ESA, DLR, CNES, NASDA) in order to plan the efficient utilization of all available ISS experiment facilities. Starting in FY 2004 OBPR will begin the Human Reserach Inititative. This will accelerate the acquisition of knowledge and technology needed for decisions on human exploration beyond low-Earth-orbit.

Please follow this link for additional data: http://spaceresearch.nasa.gov/

PROGRAM MANAGEMENT

Enterprise official is Mary Kicza, Associate Administrator for Biological & Physical Sciences at HQ Theme Director and Point of Contact is Dr. Eugene Trinh, Director for Physical Sciences Research at HQ. The PSR program responsibility is delegated to the Glenn Research Center, Jet Propulsion Laboratory, Johnson Space Center and Marshall Space Flight Center. Full compliance with NPG 7120.5B will be achieved in FY 03 for the relevant portions.

TECHNICAL COMMITMENT

The definition of the baseline is the Basis of Estimate (BOE)

Technical Specifications	FY04 President's Budget	Change from Baseline
Combustion Integrated Rack	Provide laboratory capability for combustion research	--
Fluids Integrated Rack	Implement cross disciplinary research	--
Materials Science Research Rack-1	Provides materials science research platform	--
Physics of Colliods in Space + (PCS+)	Implements fundamental research in complex systems	--
Low Temp Microgravity Physics Facility	Implements fundamental physics external platform	--
Space Acceleration Measurement System	Implements environmental acceleration measurements	--
Protein Crystal Growth	Implements structural biology research in Express racks	--
BSTC/BTR	Implements cell biotechnology research	--
Microgravity Science Glovebox	Provides a cross-disciplinary hands-on research platform	--

Schedule	FY04 President's Budget	Change from Baseline
Combustion Integrated Rack	Launch on ULF-2	--
Fluids Integrated Rack	Launch on UF-5	--
Materials Science Research Rack-1	Launch on UF-5	--
Physics of Colliods in Space + (PCS+)	FHA in '03	--
Low TemP Microgravity Physics Facility	Launch is TBD	--
Space Acceleration Measurement System	Operations in US Lab	--
Protein Crystal Growth	Operations in US Lab	--
BSTC/BTR	Operations in US Lab	--
Microgravity Science Glovebox	Operations in US Lab	--

THEME: Physical Sciences Research (PSR)

OPERATIONS: Physical Sciences Research (PSR)

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Data current as of 1/18/2003

The major prime contractors for PSR inserts or hardware are: Northrup-Grumman, Boeing and in-house civil service. Contracts typically cover 4 - 5 years of operation build time. Other activities include; integration and ops, utilization and institutional requirements. **Changes since FY03 Pres. Budget: None.**

Current Acquisitions	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreements	0%	Full & Open Competition	90%	Industry	60%
Cost Reimbursable	65%	Sole Source	10%	Government	0%
Fixed Price	5%		100%	NASA Intramural	35%
Grants	0%			University	5%
Other (Cost +)	30%	Sci Peer Review	0%	Non Profit	0%
	100%	*% based on FY 02 direct proc.			100%

Future Acquisitions - Major	Selection	Goals
Change to Cost Plus	Fall 03	100% Full & Open Competition, 5% SB, 100% Cost Plus

AGREEMENTS

Data current as of 1/18/2003

Internal: None.

External: None.

Changes since FY03 Pres. Budget: None.

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
Independent Annual Review	ReMaP	1-Sep-02	N/A	Science Reprioritization
National Academy	NRC/SSB	1-Jun-02	None Planned	Independent science assessment

BUDGET

Budget Authority ($ in millions)	FY02	FY03	FY04	Comments
FY 2004 President's Budget	66.7	83.1	159.8	
ISSRC Physical Sciences Research (Operations)	66.7	83.1	159.8	
Changes since FY 03 President's Budget	+2.4	+62.7	+67.8	***Reason for Change:***
	+2.4	+62.7	+67.8	Full cost accounting, project changes, and addition of the Human Research Initiative (HRI).

Indicates budget numbers in Full Cost.

Indicates changes since the FY 2003 Presidents Budget Submit.

FY 2002 and FY 2003 are not in full cost.

THEME:	Physical Sciences Research (PSR)
RESEARCH:	Physical Sciences Research (PSR)

PURPOSE

Objectives	Reference 2003 Strategic Plan	Performance Measures
3.5; 4.2; 6.1, 6.3, 7.2, 9.3		4PSR1- 4PSR12

The strategic objective of the Physical Sciences Research thrust area is twofold: Strategic Research and Fundamental Research. The Strategic Research area emphasizes the basic and applied research that the Agency relies uniquely upon OBPR to conduct to enable NASA's mission to explore the Universe and search for life. The Fundamental Research area emphasizes the basic and applied research to address the role of gravity in biological and physical processes of inherent scientific interest and of potential technological applications on Earth.

OVERVIEW

The Physical Sciences Research (PSR) Program sponsors peer-reviewed, interdisciplinary ground-based and flight research focusing on most recent and exciting areas of atomic and biomolecular physics and chemistry, groundbreaking research in biotechnology, and significant new developments in materials science, fluid physics, and combustion research. A unique component of the program is the cross-disciplinary research in the microgravity environment of space to increase understanding of those physical and chemical phenomena affecting biological systems that are masked by the effects of gravity on Earth. The PSR research program is divided into two thrust areas: strategic research and fundamental microgravity research. The key difference between the two thrust areas is the strategic research focus on developing advanced technology for both robotic and human deep space flight. Fundamental microgravity research will focus on tackling both challenging basic scientific issues as well as addressing technical challenges relevant to earth-based applications. The PSR program is unique within NASA due to its constituency in academia, government, and the private sector that can be leveraged through joint endeavors with other federal research funding agencies. The program is reviewed by the external research community through the National Research Council (National Academy of Sciences), NASA-convened external Advisory Committees, and NASA-convened ad-hoc Review Committees. Standing Discipline Working Groups review the progress of the detailed research activities. Starting in FY 2004 OBPR will begin the Human Reserach Inititative. This will accelerate the acquisition of knowledge and technology needed for decisions on human exploration beyond low-Earth-orbit.
Please follow this link for additional data: http://spaceresearch.nasa.gov

PROGRAM MANAGEMENT

Enterprise official is Mary Kicza, Associate Administrator for Biological & Physical Sciences at HQ. Theme Director and Point of Contact is Dr. Eugene Trinh, Director for Physical Sciences Research at HQ. The PSR research program has program responsibility delegated to the Glenn Research Center, Ames Research Center, Jet Propulsion Laboratory, Johnson Space Center and Marshall Space Flight Center. Full compliance with NPG 7120.5B will be achieved in FY 03 for the relevant portions.

TECHNICAL COMMITMENT

The definition of the baseline is the Basis of Estimate (BOE) as of March 2002

Technical Specifications		FY04 President's Budget	Change from Baseline
R & T	NRA commitments	Conduct productive and innovative ground and flight peer-reviewed research using a broad scientific and technological community.	--
R & T	NASA Center Support	Provide research and development support to the PSR investigator communities.	--
R & T	Science Disciplines	The relevant science disciplines are: Biotechnology, Bio-engineering, Combustion, Fluid Physics, Fundamental Physics, Materials Science.	--

Schedule	FY04 President's Budget	Change from Baseline
Research Announcements Release	3YR PERIOD 03 NRA - 12/03 04 NRA - 12/04	--
Research Awards	3YR PERIOD Award 3/03 Award 3/04 Award 2/05	--

THEME: Physical Sciences Research (PSR)

RESEARCH: Physical Sciences Research (PSR)

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

The initial NASA Research Announcements (NRA) was first issued in 1988. Research is selected by competitive sourcing through these annual NRAs by disciplines in area research emphasis. Grants typically are for 2 - 4 year inccrements. In FY02, direct NRA Grant procurement represented 75% of budget authority. Changes since FY03 Pres. Budget: None.

Current Acquisitions	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreements	0%	Full & Open Competition	100%	Industry	25%
Cost Reimbursable	0%	Sole Source	0%	Government	0%
Fixed Price	0%		100%	NASA Intramural	15%
Grants	75%			University	60%
Other	25%	Sci Peer Review	75%	Non Profit	0%
	100%	*% based on FY 02 direct proc.			100%

Future Acquisitions - Major	Selection	Goals
Annual research announcements	Winter 03	100% Sci Peer Review, 100% Grants

AGREEMENTS

Internal: None

External: MOUs with NIH and DOE for ground-based and flight research.

Changes since FY03 Pres. Budget: None.

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
National Research Council Committee	NAS/NRC	1-Jun-02	None Planned	NAS research progress & quality evaluation
External Advisory Committees	NASA	27-Aug-02	Annual	Advisory Committees Research progress reviews

LIFE CYCLE COST

Budget Authority ($ in millions)	FY02	FY03	FY04	Comments
FY 2004 President's Budget	119.9	134.1	145.4	
Physical Science Research (Strategic/Fundamental)	119.9	134.1	145.4	
Changes since FY 03 President's Budget	-0.1	-17.1	-20.7	***Reason for Change:***
	-0.1	-17.1	-20.7	FY02 recission, Enterprise reprioritization, full cost accounting, and addition of HRI.

Indicates budget numbers in Full Cost.

Indicates changes since the FY 2003 Presidents Budget Submit.

FY 2002 and FY 2003 are not in full cost.