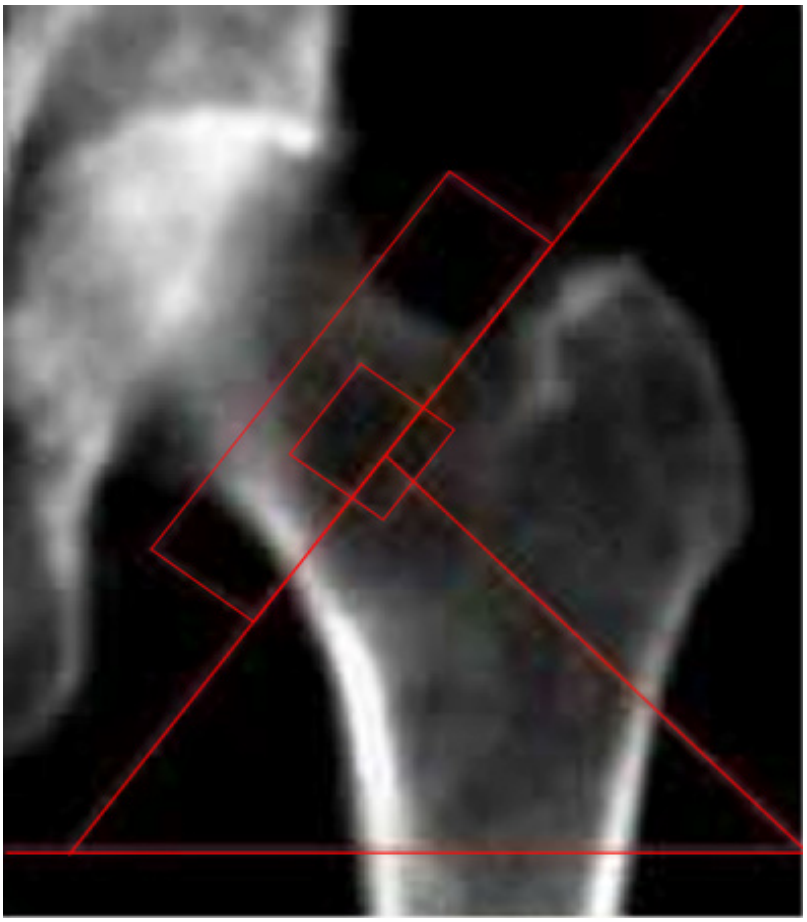
THEME: Biological Sciences Research



People lose bone mass when they spend time in space, but not evenly. Weight bearing bone tends to lose more mass. NASA is studying the specific locations in the skeleton that are most severely affected. Preliminary findings indicate that loss of bone in the hip is three times greater than the average value for the spine. This research helps to identify the risk of bone fractures that astronauts face and may contribute to understanding of mechanisms and potential treatments for bone loss among aging populations on Earth.

BIOLOGICAL SCIENCES RESEARCH

MAJOR EVENTS IN FY 2004

- 25 biological sciences flight experiments scheduled to be conducted on the Space Shuttle and Space Station.
- Habitat Holding Rack flight hardware available by September 2004.

THEME: Biological Sciences Research

OVERVIEW

Biological Sciences Research includes strategic research that is required to support development of procedures and technologies that ultimately will insure the health, safety and efficient suport of human crews in space; fundamental research that will enable understanding of how animals and plants respond to gravity and its "absence" in space flight; and projects to develop new technologies that will improve space flight life support systems.

Biology research in space gives scientists the capacity to examine the role that gravity and other space environmental factors play in life processes. Just as studying life's interaction with other environmental factors, such as light and oxygen, has given us fundamental insights into life's inner workings, the lack of gravity will also serve as a powerful means of studying the fundamental mechanisms of living processes. To date, we have only limited understanding of how gravity interacts with life processes at the molecular, cellular, systems or behavioral levels. Space provides a unique environment to probe the last frontier of how the physical environment has shaped life on Earth.

Missions	Goals supported by this theme	Objectives supporting those goals Reference 2003 Strategic Plan
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.	4.1 Understand how life responds to the space environment and the role of gravity in the processes of life.
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 as 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.	9.1 Understand and control the human health risks of space flight. 9.2 Develop knowledge and technologies to make life support systems self sufficient and improve human performance in space.

RELEVANCE

Access to space affords researchers an exciting opportunity for conducting unique biological research at all levels of biological complexity. Studies of the response and adaptation of cells and organisms (e.g., bacteria, insects, plants, and animals) to space will result in new insights into the effects of gravity and other space environment characteristics on biological processes. This knowledge will directly contribute to many aspects of NASA's strategic goal of exploration by providing critical knowledge about the biological mechanisms underlying the human health risks associated with space flight. In addition, novel information about general principles that regulate biological systems in space will provide fundamental knowledge regarding general biological processes with many applications on Earth. Beyond the response and adaptation of individual organisms to space, long duration exposures to space provide the first opportunity to study how organisms respond to this new environment through complete life cycles and over multiple generations. This research will begin to unravel the intriguing question: What is the capacity of life to adapt and thrive as it ventures off the home planet for more extended periods of time?

THEME: Biological Sciences Research

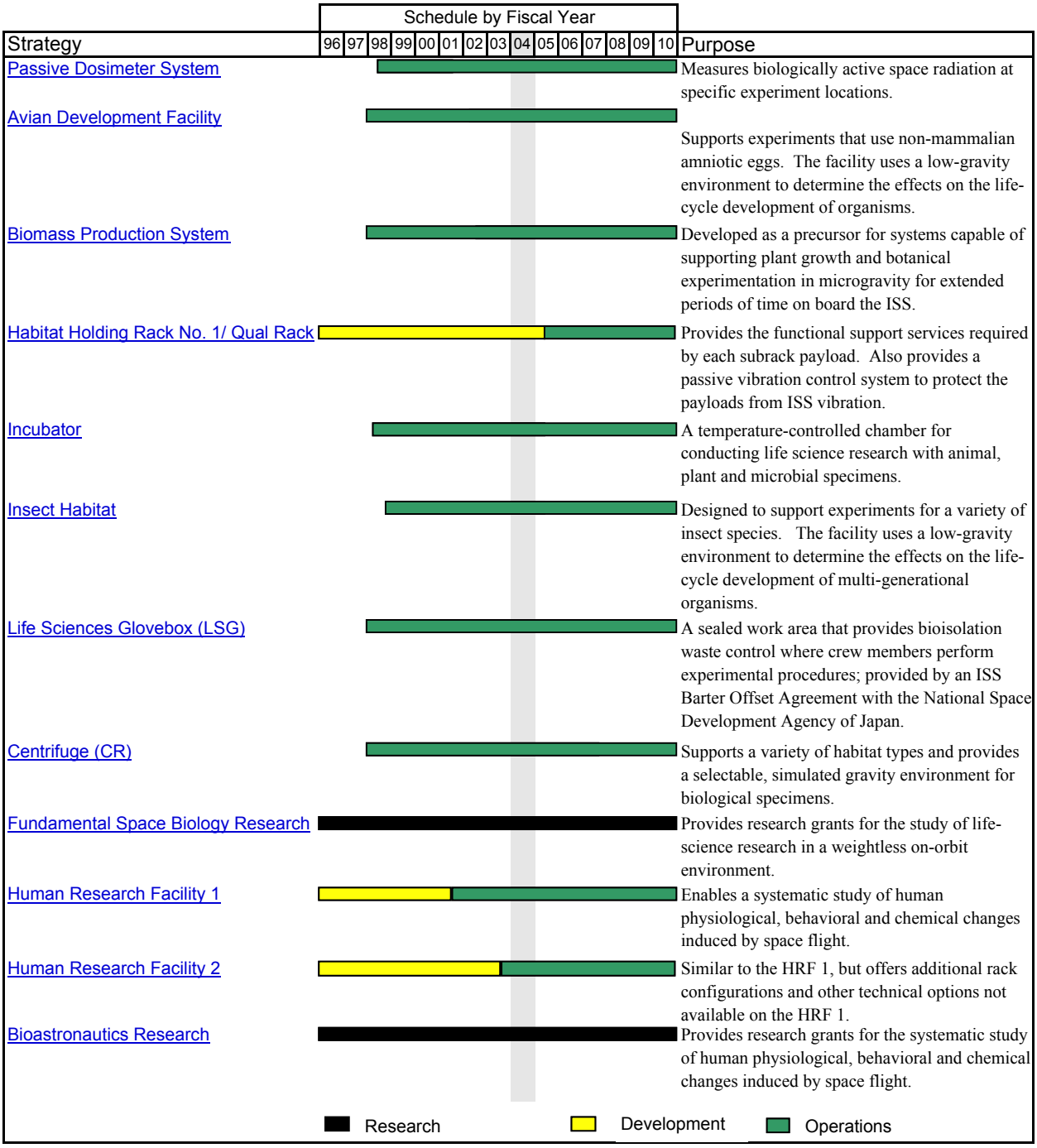
Human space flight is inherently risky. Crew health drives the ability to maintain the International Space Station and to perform experiments on the ISS and beyond. A key element of our strategic research is specifically established to focus on applied biomedical and human support research to reduce risk and improve safety through developing countermeasures. This includes integrating science and medical research to generate the knowledge required to enable flight crews to leave Earth, and eventually low-Earth orbit, perform their assigned tasks, and return to Earth with their health intact. This also includes sponsoring research to develop therapeutics, procedures, techniques, and equipment needed to address flight medical, safety, and performance issues.

Education and Public Benefits
Biological sciences research generates knowledge that promotes understanding of basic biological principles leading to advances in avoiding or eradicating debilitating diseases and physical conditions. Public benefits are gained from development of health-related technologies and processes never before possible. Biological sciences research promotes academic excellence by engaging teachers and students in challenging, relevant space research experiences that provide practice and application of standards-based science, math, and technology concepts. Educational benefits include improvement in science proficiency of educators, availability of unique, space research-related teaching tools and techniques, and increased numbers of students selecting math, science, and technology courses and careers.

THEME: Biological Sciences Research

IMPLEMENTATION

The Enterprise Official for the Biological Sciences Research Theme is Mary Kicza, Associate Administrator for Biological & Physical Research. The HQ Acting Division Director for Fundamental Space Biology is David Liskowsky. The Fundamental Space Biology (FSB) Program is managed and implemented by the Ames Research Center (ARC) under the authority of the ARC Fundamental Biology Program Office. The Center Responsible Officials at ARC are Mel Averner and Gary Jahns. The HQ Acting Division Director for Bioastronautics Research is Guy Fogleman. The Bioastronautics Research (BR) Program coordination responsibility is assigned to the Johnson Space Center (JSC), under the supervision of Dr. John Rummel, Chief, Office of Bioastronautics. The Center Responsible Officials at JSC are Cindy Haven, Bill Paloski, and David Russo.



THEME: Biological Sciences Research

STATUS

During FY 2002, the Fundamental Space Biology (FSB) Program supported 158 investigations; released a solicitation for ground based research resulting in the selection of 22 proposals for funding; proceeded with the initial planning for early ISS utilization; selected and developed for flight a study which will investigate the skeletal system in space and development of countermeasures to bone loss in space flight crews, and a series of experiments which will study genomic changes associated with space flight.

During FY 2002, the Bioastronautics Research (BR) Program conducted protocols for flight testing countermeasures to reduce kidney stone risk; developed an investigation of crew nutritional needs and metabolism status; prepared in-flight validation of cardiovascular countermeasures; evaluated and provided annual report of the progress in reducing medical risk factors; selected 5 ground based experiments and 3 flight based experiments related to the reduction of medical risk factors. The program was part of an independent review by the Research Maximization and Prioritization (ReMaP) Task Force. The efforts offered NASA a stronger understanding of what research portfolios offered the highest potential scientific return.

Go to: http://spaceresearch.nasa.gov/research_projects/FSB.html
http://spaceresearch.nasa.gov/research_projects/biomedical.html
http://spaceresearch.nasa.gov/research_projects/ahst.html

THEME: Biological Sciences Research

PERFORMANCE MEASURES

Annual Performance Goals

Outcome 4.1.1: Describe and determine the ability of life to adapt and thrive in the space environment.

4BSR1: Advance understanding of the role of gravity in biological processes at all levels of biological complexity. FY 04 activities will include soliciting ground-based research in all Fundamental Biology disciplines, planning for increased early ISS utilization for basic biology research in the 2005 and beyond time frame, and maintaining an open, competitive program in fundamental space biology.

Outcome 6.1.1: Kindergarten through graduate students will be more proficient in science, technology, engineering and mathematics (STEM).

4BSR2: 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.

4BSR3: Develop collaborations with Professional Education Associations directed to enhance of educator proficiency in use of space research content and classroom educational hardware focused on standards-based curriculum.

4BSR4: Develop and train facilitators for dissemination of 3 comprehensive Educator Professional Development Seminar packages focused on biological and physical sciences research that coordinates with standards based science, math, and technology concepts.

Outcome 7.2.4: Broaden OBPR research information to diverse audiences.

4BSR5: In FY04, increase mailing list of Space Research newsletter by 5,000 over FY03 mailing list. Space Research is a significant tool used by OBPR to establish and maintain contact with wide audiences through the quarterly newsletter.

4BSR6: 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 FY03.

4BSR7: 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 associated with a minority and/or under-represented community over outreach efforts taking place in FY 03.

Outcome 9.1.1: Identify and test biomedical countermeasures that will make space flight safer for humans.

4BSR8: Use ground-based and space-based research to address risk areas related to long duration phenomena such as bone loss, psychological adaptation to isolation and confinement, and the biological effects of radiation as described in the Critical Path Roadmap. Progress toward accomplishing this performance goal will be reviewed by an advisory committee.

4BSR9: Publish results of Bioastronautics experiments conducted during early ISS Increments (1 through 8) and preliminary results from Increments 9 and 10. Progress toward accomplishing this performance goal will be reviewed by an advisory committee.

4BSR10: Maintain productive peer-reviewed research program in Biomedical Research and Countermeasures including a National Space Biomedical Research Institute that will perform team-based, focused countermeasure-development research. Progress toward accomplishing this performance goal will be reviewed by an advisory committee.

Outcome 9.1.2: Acquire physics and biology data base required to predict radiation risk in space with accuracy sufficient to enable astronauts to accomplish three 180-day missions on ISS without exceeding career radiation limits, at a 95% confidence level.

4BSR11: Expand the space radiation research science community to involve cutting edge researchers in related disciplines by soliciting, selecting, and funding high quality research.

4BSR12: Complete 2 experimental campaigns ("runs") using recently completed Booster Applications Facility (BAF) at Brookhaven National Laboratory (BNL) to measure survival, genetic mutation (mutagenesis), and chromosome aberrations in cells and tissues to improve understanding of the biological effects of the space radiation environment. Progress toward accomplishing this performance goal will be reviewed by an advisory committee.

4BSR13: Evaluate radiation risks to astronauts by continued and careful analysis of past radiation exposures, results of medical follow up, and comparison with appropriately chosen control population not exposed to similar levels of radiation. Make experimental data available for operational use on ISS and other space-related activities where appropriate. Progress toward accomplishing this performance goal will be reviewed by an advisory committee.

Outcome 9.1.3: Advance understanding of the role of gravity in biological processes to support biomedical research

4BSR14: Solicit ground-based research in appropriate Fundamental Biology disciplines to lay the ground work for advanced understanding of the role of gravity in biological processes associated with the human health risks of space flight. Progress toward accomplishing this performance goal will be reviewed by an advisory committee.

4BSR15: Plan for increased early utilization for basic biology research in 2005 to take advantage of evolving ISS capabilities. Progress toward accomplishing this performance goal will be reviewed by an advisory committee.

4BSR16: Maintain a competitive, productive peer-reviewed research program to advance understanding of the role of gravity in biological processes. Progress toward accomplishing this performance goal will be reviewed by an advisory committee.

Outcome: 9.2.1: Identify & test technologies to reduce total mass requirements for Life Support.

4BSR17: Demonstrate, through vigorous research and technology development, a 50% reduction in the projected mass of a life support flight system compared to the system baselined for ISS. Progress toward reducing the mass requirements for life support will be evaluated by an advisory committee.

THEME: Biological Sciences Research

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
Independent Cost Assessment	MSFC CFO	January-02	None	Assess non-recurring SSBRP hardware
COLSA Indep. Assessment	COLSA Corp.	Nov-01	None	Basis for Habitat Holding Rack cost growth and solutions
ReMaP	Indep Committee	September-01	None	Set priorities for ISS research
NASA Advisory Committee	BPRAC	29-30 Aug 02	13-14 Feb 03	Program Review (three times a year)
NASA Advisory Committee	LSAS	28-Aug-02	TBD	Program Review (twice a year)

BUDGET

Budget Authority ($millions)	FY02	FY03	Chng	FY04	Comments
Total Biological Sciences Research	**218.0**	**245.1**	**+113.5**	**358.6**	
Development	16.6	9.0	+1.3	10.4	Changes in BSR programs due to full cost,
Habitat Holding Rack (FSB)	10.0	3.5	+4.7	8.3	ReMaP decisions, and addition of Human
Human Research Facility - 2 (BR)	6.6	5.5	-3.4	2.1	Research Initiative.
Operations	66.9	67.0	+62.4	129.4	
ISSRC Fundamental Space Biology	48.9	38.6	+43.1	81.7	
ISSRC Bioastronautics Research	18.0	28.4	+19.3	47.7	
Research	134.5	169.1	+49.7	218.8	
Fundamental Space Biology	33.3	56.0	+2.8	58.8	
Bioastronautics Research	101.2	113.1	+46.9	160.0	

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: Biological Sciences Research

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THEME:	Biological Sciences Research (Fundamental Space Biology)
DEVELOPMENT:	Habitat Holding Rack (HHR)

PURPOSE

Objectives	Reference 2003 Strategic Plan	Performance Measures
	4.1; 9.1	4BSR1; 15; 16

The Habitat Holding Racks (HHR) provides living quarters for various animals to be used in experiments aboard the ISS. The HHR extends the capability to conduct life sciences research in weightlessness with greatly improved on-orbit facilities. In concert with a large diameter variable gravity centrifuge, the suite of research equipment provided by the Space Station Biological Research Project (SSBRP) provides the life sciences research community the capability to perform research using a wide range of specimen types in controlled environments investigating both fundamental biological processes using gravity as a tool and investigating the effects of weightlessness on living specimens and how to control and mitigate those effects.

OVERVIEW

The Habitat Holding Rack (HHR) is the core element of the Space Station Biological Research Project (SSBRP) which will provide an integrated suite of equipment on the International Space Station (ISS) to perform biological research. The facility will be located in the Centrifuge Accommodation Module (CAM), a module built specifically for the SSBRP facility. The HHR provides a vibration isolated weightless environment for life science experiments. It has common habitat interfaces with the 2.5m Centrifuge and the Life Science Glovebox (LSG). The HHR also provides unique resources necessary for live science research such as cold water cooling, video recording, backup resources for specimens, and crew time saving features. Two Habitat Holding Racks will be located on the International Space Station. The first is planned for January 2005 and will be positioned in the US Lab. Once the Centrifuge Accommodations Module (CAM) is integrated into the Station in mid 2007, both Habitat Holding Racks will be moved to the CAM to be co-located with the LSG and the Centrifuge.

Link to Project Homepage for more information: http://brp.arc.nasa.gov/

PROGRAM MANAGEMENT

The Enterprise Official for the BSR Theme is Mary Kicza, Associate Administrator for Biological & Physical Research. The HQ Acting Division Director for Fundamental Space Biology is David Liskowsky. The SSBRP, which the HHR is a part, is a project managed and implemented by the Ames Research Center (ARC) under the authority of the ARC Fundamental Biology Program Office. The Center Responsible Officials at ARC are Mel Averner and Gary Jahns. The Habitat Holding Rack is developed by Marshall Space Flight Center (MSFC) under the authority of an intercenter agreement. The HHR is manufactured by Boeing for MSFC as part of a contract developing the HRF, EXPRESS and WORF racks. 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 Estimate (BOE) dated 2/28/02.

Technical Specifications	FY04 President's Budget	Change from Baseline
Habitat Holding Rack	Two units on orbit	--
	Accommodates 4 habitats (sub rack payloads designed to accommodate specific science specimens)	--
	Provides Passive vibration isolation for science specimens	--
	Provides cold water cooling to Habitats	--
	International Subrack Interface Standard (ISIS) interfaces to Habitats	--
	Animal well being redundancy	--
	Video recording/compression capability	--
	Compatibility with 2.5m Centrifuge and Life Science glovebox	--
HHR 1 & 2 operational lifetime - 20 years		

Schedule	FY04 President's Budget	Change from Baseline
Qual Rack testing with Qual Habitat complete	June-03	--
Flight Rack #1 stand alone testing complete (DD250)	January-04	--
Flight Rack #2 stand alone testing complete (DD250)	April-04	--
HHR - 1 integration testing with flight Habitats start	May-04	--
HHR-1 with Flight Habitats shipped to KSC	July-04	--
HHR-1 with flight Habitats launched on UF3	January-05	--

THEME: Biological Sciences Research (Fundamental Space Biology)

DEVELOPMENT: Habitat Holding Rack (HHR)

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Data current as of 1/18/03

The HHR development consists of a center agreement between MSFC and ARC and a cost plus contract with Boeing (HHR, combined contract with HRF, EXPRESS, and WORF rack development).

Changes since FY03 Pres. Budget: None.

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

Future Acquisitions - Major	Selection	Goals
None (HHR complete, Boeing contract ends)	N/A	N/A

AGREEMENTS

Internal: None

External: The HHR development supports the National Space Development Agency of Japan (NASDA) development of the 2.5m diameter centrifuge and the Life Science Glovebox (LSG) by providing the design and development of most subsystems and core software used by all three hardware items. The HHR, LSG, and Centrifuge are the three rack level systems which make up the SSBRP, utilizing common spares and interfaces. The LSG and Centrifuge are developed by NASDA for NASA via barter agreement.

Changes since FY03 Pres. Budget: None

INDEPENDENT REVIEWS

Data current as of 1/18/03

Types of Review	Performer	Last Review	Next Review	Purpose
Independent Cost Assessment	MSFC CFO	January-02	None	Assess non-recurring SSBRP hardware development
COLSA Independent Assessment	COLSA Corp.	Nov-01	None	Determine basis for HHR cost growth & recommend cost reductions.

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)	0.0	10.0	3.5	8.3	3.6	0.0	0.0	0.0	0.0	25.4	
HHR Development		10.0	3.5	8.3	3.6					25.4	
Changes since FY 03 Pres. Budget	0.0	0.0	0.0	+6.4	+2.7	-0.5	-0.2	+0.0		+8.5	**Reason for Change:**
HHR Development		0.0	0.0	+6.4	+2.7	-0.5	-0.2			+8.5	Full Cost accounting and design changes
FY 2003 President's Budget (LCC)	0.0	10.0	3.5	1.9	0.9	0.5	0.2	0.0		17.0	
HHR Development		10.0	3.5	1.9	0.9	0.5	0.2			17.0	
Bases of Estimate (BOE)	0.0	16.5	10.5	5.2	2.2	0.0	0.0	0.0		34.4	
HHR Development (Mar 02)		16.5	10.5	5.2	2.2					34.4	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: Biological Sciences Research

DEVELOPMENT: Human Research Facility (HRF) - 2

PURPOSE

Objectives	Reference 2003 Strategic Plan	Performance Measures
9.1; 9.2		4BSR8; 9; 13; 17

The Human Research Facility (HRF) enables a systematic study of human physiological, behavioral and chemical changes induced by space flight. The goal is to accumulate long-term data on adaptation to the space environment. HRF allows high resolution imaging for diagnostics and research applications for human organs. Areas of concern to human well being and performance, such as renal stone risk, bone deterioration and the effects of ionizing radiation, will also be studied.

OVERVIEW

The HRF is a modular International Standard Payload Rack (ISPR) which contains scientific equipment used in Human Research. The HRF rack provides a modular equipment interface for equipment and distributes the utilities of power, data networks, and thermal control. The HRF 2 contains the following subracks: a) the Refrigerated Centrifuge used to separate biological substances of differing densities; b) the Space Linear Acceleration Mass Measuring Device that will provide an accurate means of determining the on-orbit mass of human subjects; c) the Pulmonary Function System that provides the capability to perform pulmonary and cardiovascular measurements; and d) the Rack 2 Workstation which is designed to support human physiological, psychological and cognitive and human factors studies. HRF-1 has been on orbit since March 2001 and has 3 subracks: a) the Ultrasound Imaging System; b) the Gas Analyzer System for Metabolic Analysis Physiology; and c) a computer workstation that allows crew members to command and test the rack's equipment data.

Link to Project Homepage for more information. http://hrf.jsc.nasa.gov

PROGRAM MANAGEMENT

The Enterprise Official for the Biological Sciences Research Theme is Mary Kicza, Associate Administrator for Biological & Physical Research. The HQ Acting Division Director for Bioastronautics Research is Guy Fogleman. The HRF program responsibility is delegated to the Johnson Space Center. The Center Responsible Official at JSC is Ms. Cindy Haven. 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 2/07/02

Technical Specifications	FY04 President's Budget	Change from Baseline
Support Biomedical	2 Racks	--
Power to Payload	3 kW per rack	--
Research & Countermeasure	HRF Rack 2 on schedule for launch on ULF-1 (Mar-03)	
Validation	Science Verification Testing HRF Rack 1; Aug 2000	--
	Science Verification Testing HRF Rack 2; June 2002	--
Science Instruments:	Body Mass Measurement, Pulmonary Function, refrigerated centrifuge, ultrasound imaging	
Facility operational lifetime	10 years	--

Schedule	FY04 President's Budget	Change from Baseline
HRF-Rack 1 on-orbit	Mar-01	--
HRF-Rack 2 on dock at KSC	Aug-02	--

THEME: Biological Sciences Research

DEVELOPMENT: Human Research Facility (HRF) - 2

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Data current as of 1/18/03

HRF development is essentially complete. The balance of the development funds are programmed to cover integration cost of equipment provided by the European Space Agency, including the Muscle Atrophy and Resistive Exercise System (MARES) and the Eye Tracking Device. Integration of these components is under contract to Lockheed-Martin. Also under development is the Urine Monitoring System, being developed by Hamilton-Sundstrand.

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

Future Acquisitions - Major	Selection	Goals
Major acquisitions for HRF were accomplished in prior years. There are no new acquisitions for this development.	N/A	N/A

AGREEMENTS

Internal: None.

External: Provision of the Pulmonary Function Module was dependent on the European Space Agency (ESA), according to NASA/ESA Letter of Agreement signed December 1999.

Changes since FY03 Pres. Budget: None.

INDEPENDENT REVIEWS

Data current as of 1/18/03

Types of Review	Performer	Last Review	Next Review	Purpose
Independent Annual Review	HQ Code M	1-Oct-01	None	No further reviews planned - HRF on-dock at KSC.

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)	0.0	6.6	5.5	2.1	0.0	0.0	0.0	0.0	0.0	14.2	
Development		6.6	5.5	2.1						14.2	
Changes since FY 03 Press Budget	0.0	0.0	+2.0	+0.1	+0.0	+0.0	+0.0	+0.0		+2.1	Reason for Change:
Development		0.0	+2.0	+0.1						+2.1	Full Cost Accounting.
FY 2003 President's Budget (LCC)	0.0	6.6	3.5	2.0	0.0	0.0	0.0	0.0		12.1	
Development		6.6	3.5	2.0						12.1	
Bases of Estimate (BOE)	0.0	6.6	3.5	2.0	0.0	0.0	0.0	0.0		12.1	
Development (Mar 02)		6.6	3.5	2.0						12.1	Baseline Mar 2002

Indicated 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: Biological Sciences Research

OPERATIONS: Fundamental Space Biology (FSB)

PURPOSE

Objectives	Reference 2003 Strategic Plan	Performance Measures
4.1; 9.1		4BSR1; 15; 16

The Fundamental Space Biology (FSB) Space Station Biological Research Project (SSBRP) extends the capability to conduct life sciences research in weightlessness with greatly improved on-orbit facilities. The suite of research equipment provides the life sciences research community the capability to perform research using a wide range of specimen types in controlled environments investigating both fundamental biological processes using gravity as a tool and investigating the effects of weightlessness on living specimens and how to control and mitigate those effects.

OVERVIEW

The Space Station Biological Research Project (SSBRP) will provide an integrated suite of equipment on the International Space Station (ISS) to perform biological research. The facility will be located in the Centrifuge Accommodation Module (CAM), a module built specifically for the SSBRP facility. The suite of equipment include the 2.5m diameter Centrifuge, the Life Sciences Glovebox (LSG), the Habitat Holding Rack (HHR) [data included under "Development" format], the Passive Dosimeter System (PDS), the Avian Development Facility (ADF), the Incubator, the Insect Habitat, the Cell Culture Unit (CCU), the Advanced Animal Habitat (AAH), the Plant Research Unit (PRU), and the Telecommunications Support Center (TSC) located at the Ames Research Center. The Centrifuge provides an artificial gravitational environment, the LSG provides a contained environment for crew performance of science protocols on science specimens, the PDS monitors the radiation environment, the ADF incubates quail eggs, the Incubator provides controlled temperatures for self contained small experiments, the insect habitat provides multiple generation fly experiments, the CCU provides highly automated cell culture experiments, the AAH provides for long duration rat experiments, and the PRU provides for tall plant experiments. The TSC is the ground control facility that electronically links the experiments on ISS with the researcher in their own labs. The CAM, Centrifuge, and LSG are provided by the National Space Development Agency of Japan (NASDA) as part of a barter offset agreement.

Link to Project Homepage for more information. http://brp.arc.nasa.gov

PROGRAM MANAGEMENT

The Enterprise Official for the Biological Sciences Research Theme is Mary Kicza, Associate Administrator for Biological & Physical Research. The HQ Acting Division Director for Fundamental Space Biology is David Liskowsky. The Fundamental Space Biology Program is managed and implemented by the Ames Research Center (ARC) under the authority of the ARC Fundamental Biology Program Office. The Center Responsible Officials at ARC are Mel Averner and Gary Jahns. Full compliance with NPG 7120.5B will be achieved in FY 03.

TECHNICAL COMMITMENT

Baseline is the OBPR Basis of Estimate (BOE) for the Fundamental Space Biology program dated 2/28/02.

Technical Specifications	FY04 President's Budget	Change from Baseline
Centrifuge	2.5 meter diameter, 4 habitats, vibration isolation, 0.01g-2.0g, cold water cooling, International Subrack Standard Interfaces	--
Life Sciences Glovebox	2 operators, 2 habitats, airlock, lab support equipment capability, bioisolation, cleanability, cold water cooling	--
Passive Dosimeter System (PDS)	Nuclear track detectors	--
Avian Development Facility (ADF)	24 quail egg incubator, internal centrifuge	--
Incubator (2 units on orbit)	4°C to 38°C internal temp, data & video capability, 90 day cap	--
Insect Habitat (1 on orbit)	Multiple generation fly experiment capability, 90 day capability	--
Cell Culture Unit (CCU) (2 on orbit)	18 cell culture chambers, 60 auto fixation/sample containers	--
AAH (8 on orbit)	Six rats, environ control, video, 90 day capability	Not included in FY03 PBS
PRU (8 on orbit)	38cm high plants, environ control, video, 90 day capability	Not included in FY03 PBS

Schedule	FY04 President's Budget		Change from Baseline
Phase 2 Incubator, Insect Habitat flight	January-05	UF3	--
Phase 2 Insect Habitat science/validation flight	April-05	UF4	--
Phase 3 LSG flight	January-06	UF6	--
Phase 2 CCU flight	June-06	TBD	--
Phase 3 Centrifuge/CAM flight	April-07	UF7	--
Phase 3 AAH flight (REMAP augmentation, preliminary schedule)	September-07	TBD	--
Phase 3 PRU flight (REMAP augmentation, preliminary schedule)	March-08	TBD	--

THEME: Biological Sciences Research

OPERATIONS: Fundamental Space Biology (FSB)

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Data current as of 1/18/03

FSB Operations is composed of two primary components: Biological Research Projects (BRP) and Utilization. BRP consists of numerous contracts with the following organizations to build equipment: Lockheed Martin (Facility Integration and Incubator), SHOT (ADF), ORBITEC (BPS/PRU), PSI (CCU), STAR (AAH); an international cooperative agreement with the Canadian Space Agency (Insect Habitat) and other international barter agreements for equipment with other partners. Utilization covers all of the expenses associated with integrating the experiments into the flight platform, performing the experiments on-orbit (and related ground control experiments), and post-flight processing of the specimens and data including development of experiment unique hardware, ground operations, flight operations, safety, and quality control.

Changes since FY03 Pres. Budget: None.

Current Acquisitions	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreements	0%	Full & Open Competition	76%	Industry	79%
Cost Reimbursable	70%	Sole Source	24%	Government	21%
Fixed Price	7%		100%	NASA Intramural	0%
Grants	0%			University	0%
Other	23%	Sci Peer Review	0%	Non Profit	0%
	100%	* % based on FY 02 direct proc.			100%

Future Acquisitions - Major	Selection	Goals
Advanced Animal Habitat	Winter 03	100% SBIR Modification, 100% Cost Reimbursable
Plant Research Unit	Winter 03	100% SBIR Modification, 100% Cost Reimbursable

AGREEMENTS

Internal: None

External: An international cooperative agreement with the Hungarian Space Agency (PDS); an international cooperative agreement with the Canadian Space Agency (Insect Habitat); and an ISS barter offset agreement with the National Space Development Agency of Japan (NASDA) for the CAM, Centrifuge, and the LSG.

Changes since FY03 Pres. Budget: None

INDEPENDENT REVIEWS

Data current as of 1/18/03

Types of Review	Performer	Last Review	Next Review	Purpose
Independent Cost Assessment	MSFC CFO	January-02	None	Assess non-recurring SSBRP hardware development costs & perform parametric estimates.
ReMaP	Indep Committee	1-Sep-02	None	Set priorities for ISS research.

BUDGET

Budget Authority ($ in millions)	FY02	FY03	FY04	Comments
FY 2004 President's Budget	48.9	38.6	81.7	
ISSRC Fundamental Space Biology (Operations)	48.9	38.6	81.7	
Changes since FY 03 President's Budget	+0.9	+0.0	+45.0	***Reason for Change:***
	+0.9	+0.0	+45.0	Full cost accounting; addition of Animal & Plant habitats; OBPR shuttle mission to ISS; fund project liens, and ReMaP recommendations.

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:	Biological Sciences Research
OPERATIONS:	Bioastronautics Research (BR)

PURPOSE

Objectives	Reference 2003 Strategic Plan	Performance Measures
9.1; 9.2		4BSR8; 9; 13; 17

Bioastronautics Research performs systematic study of human physiological, behavioral and chemical changes induced by space flight. NASA is accumulating long-term data on adaptation to the space environment. The Human Research Facility (HRF) provides the major on-orbit capability to perform this research. HRF allows high resolution imaging for diagnostics and research applications for body organs. Areas of concern to human well being and performance, such as renal stone risk, bone deterioration and the effects of ionizing radiation, are also being studied.

OVERVIEW

Bioastronautics Research operations include activities required for HRF science development and operations, such as developing experiments and associated flight products: (e.g., operations concepts, flight resource and integration requirements, data management plans, crew procedures and displays, training products for training the crew and ground support personnel). HRF operations include Principal Investigators (PI) hardware development including unique equipment, experiment kits and cables, and integration activities at HRF ground based integration facilities and KSC. HRF operations include sustaining engineering for HRF on-orbit hardware and software. It also includes HRF upgrades and improvements. This task also includes the execution of science performed during research increments, and the operation of the JSC Telescience Support Center and associated hardware and software. 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.

Link to Project Homepage for more information: http://hrf.jsc.nasa.gov

PROGRAM MANAGEMENT

The Enterprise Official for the Biological Sciences Research Theme is Mary Kicza, Associate Administrator for Biological & Physical Research. The HQ Acting Division Director for Bioastronautics Research is Guy Fogleman. The Bioastronautics Research Program coordination responsibility is assigned to the Johnson Space Center (JSC), under the supervision of Dr. John Rummel, Chief, Office of Bioastronautics. The Center Responsible Official at JSC is Ms. Cindy Haven. Full compliance with NPG 7120.5B will be achieved in FY 03 for the relevant portions.

TECHNICAL COMMITMENT

Baseline commitment is as of the OBPR Basis of Estimates (BOE) dated 2/7/2002.

Technical Specifications	FY04 President's Budget	Change from Baseline
Support Biomedical	2 Racks	--
Power to Payload	3 kW per rack	--
Research & Countermeasure	HRF Rack 2 on schedule for launch on ULF-1	
Validation	Science Verification Testing HRF Rack 1 Aug 2000	Not included
	Science Verification Testing HRF Rack 2 June, 2002	Not included
Science Instruments:	Body Mass Measurement, Pulmonary Function, refrigerated centrifuge, ultrasound imaging	

Schedule	FY04 President's Budget

Individual experiments are scheduled for Increments 9 (Sep 2003) & 10 (Feb 2004), currently set for FY 2004. Descriptions of those experiments are available at http://hrf.jsc.nasa.gov/science_summ.html. The following 9 experiments will be conducted using the Human Research Facility on ISS Increments 9 and 10:

1. E039/Badhwar/ Organ Dose Measurement Using Phantom Torso,
2. E057L/Whitson/ Renal Stone Risk During Spaceflight: Assessment and Countermeasure Validation,
3. E096/Kanas/ Crewmember and Crew-Ground Interactions During ISS Missions,
4. E120/Bloomberg/Mobility Promoting Sensorimotor Response Generalizability: A Countermeasure to Mitigate Locomotor Dysfunction after Long-Duration Space Flight,
5. E129/Barrett/ Space Flight-Induced Reactivation of Latent Epstein-Barr Virus,
6. E318/Cavanagh/ Foot/Ground Reaction Forces During Space Flight,
7. E400/Fitts/ Effect of Prolonged Spaceflight on Human Skeletal Muscle,
8. SMO-006/Meck/ Test of Midodrine as a Countermeasure Against Postflight Orthostatic Hypotension, and
9. SMO-008/Meck/ Monitoring of Heart Rate and Blood Pressure During Entry Landing and Egress.

THEME: Biological Sciences Research

OPERATIONS: Bioastronautics Research (BR)

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Data current as of 1/18/03

The prime contractor for the HRF Operations mission is Lockheed Martin under the Science Engineering Analysis and Test (SEAT) contract. The contract covers 5 years of operations, renewable in December 2003. In FY 2002, direct procurement represented about 50% of budget authority. **Changes since FY 2003 President's Budget: none**.

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

Future Acquisitions - Major	Selection	Goals
None	N/A	N/A

AGREEMENTS

Internal: None

External: None

Changes since FY03 Pres. Budget: None.

INDEPENDENT REVIEWS

Data current as of 1/18/03

Types of Review	Performer	Last Review	Next Review	Purpose
ReMaP	Indep Committee	1-Sep-02	None	Set priorities for ISS research.

BUDGET

Budget Authority ($ in millions)	FY02	FY03	FY04	Comments
FY 2004 President's Budget	18.0	28.4	47.7	
ISSRC Bioastronautics Research (Operations)	18.0	28.4	47.7	
Changes since FY 03 President's Budget	-5.6	-2.0	+21.1	***Reason for Change:***
	-5.6	-2.0	+21.1	Changes reflect shift to full cost budgeting, recommendations made by the ReMaP committee, and the addition of the Human Research Initiative.

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:	Biological Sciences Research
RESEARCH:	Fundamental Space Biology (FSB)

PURPOSE

Objectives	Reference 2003 Strategic Plan	Performance Measures
4.1; 6.1; 6.3; 7.6; 9.1		4BSR1; 2-7; 14-16

The Fundamental Space Biology (FSB) Program uses the environment of space to enhance our understanding of biology by providing a continuum of research that investigates the role of gravity and other space flight factors at all levels of biological processes. The understanding, development, and implementation of this research will provide the underpinnings necessary to support long-term human space flight. Additionally, information derived from this research will provide new knowledge about biological processes and their applications on earth.

OVERVIEW

The Fundamental Space Biology Program will: (1) Develop the foundation of fundamental biological knowledge required to enable a long-duration human presence in space; (2) Effectively use microgravity and the other characteristics of the space environment to enhance our understanding of fundamental biological processes; (3) Develop the biological understanding to support other biologically related NASA activities; and (4) Apply this knowledge and technology to improve our nation's competitiveness, education, and the quality of life on Earth. Ground-based and flight research grants are solicited and reviewed via a competitive peer review process.

Link to Project Homepage for more information: http://spaceresearch.nasa.gov/research_projects/FSB.html

PROGRAM MANAGEMENT

The Enterprise Official for the Biological Sciences Research Theme is Mary Kicza, Associate Administrator for Biological & Physical Research. The HQ Acting Division Director for Fundamental Space Biology is David Liskowsky. The Fundamental Space Biology Program is managed and implemented by the Ames Research Center (ARC) under the authority of the ARC Fundamental Biology Program Office. The Center Responsible Officials at ARC are Mel Averner and Gary Jahns. Full compliance with NPG 7120.5B will be achieved in FY 03.

TECHNICAL COMMITMENT

Baseline commitment as of OBPR Basis of Estimate (BOE) dated 2/28/02.

Technical Specifications	FY04 President's Budget	Change from Baseline
The Fundamental Space Biology Program will focus on research in Cell and Molecular Biology, Developmental Biology, and Organismal and Comparative Biology. It includes flight and ground based research designed to understand the effects of the space environment on organisms and their interactions when exposed to space for varying periods of time.		Evolutionary Biology and parts of Gravitational Ecology were given a lower priority by ReMaP, which followed with adjustments to funding levels.

Schedule	FY04 President's Budget	Change from Baseline
Research Announcements	Mar-03 NRA; Jan-04 NRA; Jan-05 NRA; 3YR PERIOD	+3 months
Research Awards	Dec-03 Award; Oct-04 Award; Oct-05 Award; 3YR PERIOD	+3 months

THEME: Biological Sciences Research

RESEARCH: Fundamental Space Biology (FSB)

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Data current as of 1/18/03

Fundamental Space Biology research is performed by Principal Investigators (PI). Most are affiliated with universities. Some are civil servants assigned to NASA Centers and other Federal Agencies such as the National Institutes of Health. Research is solicited and selected for funding through a competitive scientific peer review process. The research program is implemented by the Ames Research Center (ARC) under the authority of the ARC Fundamental Biology Program Office.

Current Acquisitions	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreements	19%	Full & Open Competition	87%	Industry	41%
Cost Reimbursable	36%	Sole Source	13%	Government	0%
Fixed Price	5%		100%	NASA Intramural	2%
Grants	40%			University	44%
Other	0%	Sci Peer Review	39%	Non Profit	13%
	100%	* % based on FY 02 direct proc.			100%

Future Acquisitions - Major	Selection	Goals
Support Services Contract (Lockheed/Martin)	Spring '03	100% Full and Open, Cost Reimbursable
Cooperative Agreements	Spring '03	100% Cooperative Agreements- 100% Sole Source

AGREEMENTS

Internal: None

External: None **Changes since FY03 Pres. Budget: None**

INDEPENDENT REVIEWS

Data current as of 1/18/03

Types of Review	Performer	Last Review	Next Review	Purpose
Independent committee	ReMaP	1-Sep-02	None	Establish research priorities for OBPR.
NASA Advisory Committee	BPRAC	29-30 Aug 02	13-14 Feb 03	Program Review (three times a year).
NASA Advisory Committee	LSAS	28-Aug-02	TBD	Program Review (twice a year).

BUDGET

Budget Authority ($ in millions)	FY02	FY03	FY04	Comments
FY 2004 President's Budget	33.3	56.0	58.8	
Fundamental Space Biology (Research)	33.3	56.0	58.8	
Changes since FY 03 President's Budget	-2.0	0.0	-18.9	***Reason for Change:***
FSB R&T Budget	-2.0	0.0	-18.9	Full cost accounting; Reprioritization of OBPR research and program restructuring

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: Biological Sciences Research

RESEARCH: Bioastronautics Research (BR)

PURPOSE

Objectives	Reference 2003 Strategic Plan	Performance Measures
6.1; 6.3; 7.6; 9.1; 9.2		4BSR2; 3-8; 10-13; 17

The Bioastronautics Research theme seeks to understand physical and psychological adaptation to space flight and return to Earth to develop countermeasures and technologies that reduce risks to the crew. The theme also develops technologies that improve spacecraft habitability, environmental controls, planetary habitability, and space systems. The primary goal of this research is to improve the health and safety of space travelers; however, this research also has the potential to make significant contributions to medical care on Earth.

OVERVIEW

Bioastronautics Research performs research and develops technology for systems that will enable humans to live and work safely and effectively in space. Special emphasis is placed on those technologies that will have a dramatic impact on the reduction of required mass, power, volume, and crew time, and on those that will increase safety and reliability. The program funds technologies that address both the near-, mid-, and long-term needs of space travel, and places a high priority on making NASA technologies available to the private sector for Earth applications. It also performs the scientific research that develops the knowledge base and technologies required to preserve health, morale, performance, and safety in astronaut crews. Program research results are directed to providing a better understanding of physiological, psychological, and behavioral adaptations to space flight that will enable improvements in: predictions of astronaut health and safety risks; diagnostics of health status; management of medical and behavioral problems; establishment of human physiological norms for space flight; protection of humans from the negative physiological and behavioral effects of space flight; and tools available for rehabilitation of crewmembers after space flight.

Link to Project Homepage for more information: http://spaceresearch.nasa.gov/research_projects/biomedical.html

PROGRAM MANAGEMENT

The Enterprise Official for the Biological Sciences Research Theme is Mary Kicza, Associate Administrator for Biological & Physical Research. The Bioastronautics Research Program coordination responsibility is assigned to the Johnson Space Center (JSC), under the supervision of Dr. John Rummel, Chief, Office of Bioastronautics. The Center Responsible Officials at JSC are Bill Paloski for Biomedical Research and Countermeasures, and Dave Russo for Advanced Human Support Technology. Full compliance with NPG 7120.5B will be achieved in FY 2003.

TECHNICAL COMMITMENT

Baseline commitment is as of the OBPR Basis of Estimates (BOE) dated 2/7/2002.

Technical Specifications	FY04 President's Budget	Change from Baseline
Bioastronautics and Countermeasures (BR&C) and Advanced Human Support Technology (AHST). BR&C is further divided into the following research sub disciplines: Radiation Health, Integrated Physiology, Organ System Physiology, Clinical and Operational Medicine, and Behavior and Performance. Sub disciplines of AHST include Environmental Monitoring and Control, Human Factors Eng., Advanced Life Support and Advanced Extravehicular Activity.		Environmental Health and Advanced Extra-Vehicular Activity were given a lower priority by ReMaP, which followed with adjustments to funding

Schedule	FY04 President's Budget	Change from Baseline
Research Announcements	Mar 03, Jan 04, Jan 05	--
Grant Awards	Dec 03, Oct 04, Oct 05	--

THEME: Biological Sciences Research

RESEARCH: Bioastronautics Research (BR)

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Data current as of 1/18/2003

Bioastronautics research is performed by Principal Investigators (PI). Most are affiliated with universities. Some are civil servants assigned to NASA Centers and other Federal agencies such as the National Institutes of Health. A substantial portion of BR's program is executed by the National Space Biomedical Research Institute (NSBRI), a consortium of 12 universities which uses funding provided by NASA and other sources to conduct open competition leading to award of peer-reviewed research grants. NSBRI coordinates its research goals with NASA to minimize duplication and ensure balanced research portfolios.

Current Acquisitions	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreements	31%	Full & Open Competition	100%	Industry	41%
Cost Reimbursable	33%	Sole Source	0%	Government	7%
Fixed Price	0%		100%	NASA Intramural	2%
Grants	36%			University	50%
Other	0%	Sci Peer Review	54%	Non Profit	0%
	100%	* % based on FY 02 direct proc.			100%

Future Acquisitions - Major	Selection	Goals
Annual Research Announcement	N/A	Issue announcement each January; awards in September.
Renew or recompete NSBRI agreement	N/A	Next renewal option due in October 2007.

AGREEMENTS

Internal: None

External: NASA manages an extensive portfolio of interagency agreements with other Federal agencies such as DOD, DOE and NIH to leverage NASA resources and improve the quality of research results.

Changes since FY03 Pres. Budget: None.

INDEPENDENT REVIEWS

Data current as of 1/18/03

Types of Review	Performer	Last Review	Next Review	Purpose
Independent committee	ReMaP	1-Sep-02	None	Establish research priorities for OBPR.
NASA Advisory Committee	BPRAC	29-30 Aug 02	13-14 Feb 03	Program Review (three times a year).
NASA Advisory Committee	LSAS	28-Aug-02	TBD	Program Review (twice a year).

BUDGET

Budget Authority ($ in millions)	FY02	FY03	FY04	Comments
FY 2004 President's Budget (Research)	101.2	113.1	160.0	
Bioastronautics Research (Research)	95.1	113.1	160.0	
Health Research	6.1			In FY 2003 OBPRs portion of Health Research was moved to BR.
Changes since FY 03 President's Budget	-0.6	+0.0	+43.4	***Reason for Change:***
	-0.6	+0.0	+43.4	Full cost accounting and ReMaP.

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.