

HUMAN SPACE FLIGHT
FISCAL YEAR 2003 ESTIMATES
BUDGET SUMMARY

OFFICE OF SPACE FLIGHT

HEDS INVESTMENTS AND SUPPORT

SUMMARY OF RESOURCES REQUIREMENTS

	<u>FY 2001</u> OP PLAN <u>REVISED</u>	<u>FY 2002</u> INITIAL <u>OP PLAN</u>	<u>FY 2003</u> PRES <u>BUDGET</u>	<u>Page</u> <u>Number</u>
(Millions of Dollars)				
OSF Contribution to Academic Programs*	8.1	--	--	
HEDS Technology and Commercialization Initiative**	5.0	--	--	HSF 4-3
Crew Health and Safety	[5.2]	[6.1]	5.8	HSF 4-7
Engineering and Technology Base	73.3	75.2	72.4	HSF 4-10
Rocket Propulsion Test Support	27.9	27.8	27.9	HSF 4-14
Institutional Support	1,133.5	1,111.5	1,072.1	HSF 4-19
 Total	 <u>1,247.8</u>	 <u>1,214.5</u>	 <u>1,178.2</u>	
 <u>Distribution of Program Amount by Installation</u>				
Johnson Space Center	433.0	408.1	422.6	
Kennedy Space Center	299.9	340.4	320.6	
Marshall Space Flight Center	262.2	193.3	195.5	
Stennis Space Center	43.1	45.1	45.4	
Ames Research Center	16.3	11.5	6.0	
Glenn Research Center	43.2	32.4	36.8	
Langley Research Center	9.1	8.2	8.4	
Dryden Flight Research Center	12.9	3.9	3.6	
Goddard Space Flight Center	53.4	53.4	29.0	
Jet Propulsion Laboratory	2.6	2.7	0.4	
NASA Headquarters	72.1	115.5	109.9	
 Total	 <u>1,247.8</u>	 <u>1,214.5</u>	 <u>1,178.2</u>	

** In FY 2002, OSF funding for academic programs is transferred to Academic Programs in SAT as an agency-wide consolidation of funding in academic programs. Detailed information can be found in the Academic Programs section.*

***_The Office of Space Flight cancelled this activity and transferred \$15 million of FY 2001 funding to fund cost growth of the International Space Station, and deleted FY 2002 funding as a result of a Congressional action that directed a general reduction in the HEDS appropriation.*

HEDS Investments linkage to Strategic Plan

The HEDS Investments budget provides resources to support a wide range of activity including: maintenance and modernization of NASA's rocket propulsion test facilities; ensuring the health, safety, and performance of space flight crew members, in training and in flight, for all U.S. Space Shuttle, International Space Station (ISS) and exploration missions; and Engineering and Technical Base (ETB). Agency investments in these strategic areas are essential to ensure maximum return on research investments, thereby reducing operations costs and continuing to implement flight and ground systems improvements, and to support strategic investments in advanced technology needed to meet future requirements and enabling synergistic commercial space development efforts.

BASIS OF FY 2003 FUNDING REQUIREMENT

TECHNOLOGY AND COMMERCIALIZATION

	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>
		(Millions of Dollars)	
HEDS Technology and Commercialization.....	5.0	--	--

DESCRIPTION/JUSTIFICATION

The Human Exploration and Development of Space (HEDS) Technology/Commercialization Initiative (HTCI) supported HEDS analysis and planned for safe, affordable and effective future programs and projects that advanced science and discovery, human exploration, and commercial development of space. Second, the Initiative would have pursued research, development, and validation of breakthrough technologies and highly innovative systems concepts that opened up new and potentially revolutionary system-, infrastructure- and architecture- level options for HEDS. Third, the HTCI would have pursued technologies, systems and infrastructures that enabled synergistic advancement of science-driven integrated human-robotic space exploration, as well as the commercial development of space. Finally, the Initiative would have improved the affordability and the effectiveness with which HEDS would have been able to achieve it's strategic objectives in the future by creating strong partnerships within NASA, with US industry and universities, and with international partners. By achieving these goals, the HEDS Technology/Commercialization Initiative would have supported better informed decisions by policy-makers concerning a) further research and technology development investments, and b) prospective future HEDS exploration initiatives and related capabilities and infrastructures. It would have also made high-leverage, high-risk incremental progress toward innovative systems concepts and breakthrough technologies that could have supported market-driven, private sector decisions concerning commercial development of space.

The strategic approach to accomplish the program goals of the HTCI involved three types of activities. First, HTCI would have conducted systems analysis and advanced concept studies. These activities would have included the formulation and refinement of new approaches (e.g., architectures, technologies, etc.) and the identification/refinement of advanced systems concepts in order to dramatically increase safety while reducing mission risk and cost for future prospective HEDS programs. Second, the Initiative would have undertaken HEDS-enabling advanced research and technology (HART) projects. These would have been competitively selected (with a goal of 50% cost share from Industry, where appropriate), and would have emphasized increases in safety, reduced risks and costs, and enabling new opportunities. Wherever possible, HART Projects would have leveraged other resources (including investments within NASA, other US government, industry, academia, internationally, etc.). Finally, the HTCI would have conducted flight demonstration projects that would have involved "new millennium-type" experiments for small robotic missions, on the International Space Station, or other carriers. This area would have included flight projects that were competitively selected (with a goal of 50% cost share from Industry, where appropriate).

LINKAGES TO STRATEGIC AND PERFORMANCE PLANS

Strategic Plan Goal Supported:

Explore the space frontier

Strategic Plan Objectives Supported:

Invest in the development of high-leverage technologies to enable safe, effective, and affordable human/robotic exploration.

Enable human exploration through collaborative robotic missions.

Define innovative human exploration mission approaches.

Develop exploration/commercial capabilities through private sector and international partnerships.

Performance Plan Metrics Supported:

1H1: Complete testing and delivery for spacecraft integration of experiments for the Mars Surveyor Program 2001 missions.

1H26: Support participation in HEDS research.

1H32: Initiate the HEDS Technology/Commercialization program and establish a synergistic relationship with industry.

<u>FY 2001 Milestones</u>	<u>Plan in FY 2003 Budget</u>	<u>Plan in FY 2002 Budget</u>	<u>Plan in FY 2001 Budget</u>	<u>FY 2002 -FY 2003 Change</u>	<u>Comment</u>
FY 2001 Enabling Advanced Research and Technology (HART) Projects - NASA Research Announcement (NRA)	2 nd Qtr FY 2001	1 st Qtr FY 2001	1 st Qtr FY 2001	1 Qtr later	Initial solicitation of HEDS systems studies and HART technology projects; coordinated with planning for later flight demonstration projects/options. Solicitation was released in February 2001.
FY 2001 (HART) NRA Project Announcements	Cancelled	3 rd Qtr FY 2001	3 rd Qtr FY 2001	Cancelled	Announcement of awards from initial HART NRA. Selection was competed, but announcements were not made due to project cancellation.
FY 2001 HCTI NASA Research Announcement for Flight Demonstration Projects	Cancelled	4 th Qtr FY 2001	4 th Qtr FY 2001	Cancelled	Initial solicitation of HEDS flight demonstration projects, focusing on demonstration project definition studies; coordinated with HCTI studies and HART technology projects. Project was cancelled.

FY 2001 Milestones	Plan in FY 2003 Budget	Plan in FY 2002 Budget	Plan in FY 2001 Budget	FY 2002-FY 2003 Change	Comment
FY 2001 HCTI Competitive Solicitation for Flight Demonstration Project Definition Study Announcement	Cancelled	4 th Qtr FY 2001	4 th Qtr FY 2001	Cancelled	Initial solicitation of HEDS flight demonstration projects, focusing on demonstration project definition studies; coordinated with HCTI studies and HART technology projects. Project was cancelled.
FY 2002 Milestones					
FY 2002 Enabling Research and Technology (HART) NASA Competitive Solicitation	Cancelled	1 st Qtr FY 2002	1 st Qtr FY 2002	Cancelled	Second solicitation of HEDS systems studies and HART technology projects; coordinated with planning for later flight demonstration projects/options.
FY 2002 (HART) Competitive Solicitation Announcements	Cancelled	3 rd Qtr FY 2002	3 rd Qtr FY 2002	Cancelled	Announcement from awards from second HART competitive solicitation.
FY 2002 HCTI Competitive Solicitation for Flight Demonstration Projects	Cancelled	1 st Qtr FY 2002	1 st Qtr FY 2002	Cancelled	Second solicitation of HEDS flight demonstration projects, focusing on demonstration project definition studies; coordinated with HCTI studies and HART technology projects.

FY 2002 HTCI Competitive Solicitation for Flight Demonstration Project Definition Study Announcement	Cancelled	1 st Qtr FY 2002	2 nd Qtr FY 2002	Cancelled	Second solicitation of HEDS flight demonstration projects, focusing on demonstration project definition studies; coordinated with HCTI studies and HART technology projects.
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Lead Center:	Other Centers:	Interdependencies:
NASA Headquarters	Johnson Space Center, Kennedy Space Center, Marshall Space Flight Center, Stennis Space Center, Ames Research Center, Glenn Research Center, Langley Research Center, Goddard Space Flight Center, Jet Propulsion Laboratory	

PROGRAM STATUS/NOTIFICATIONS/PLANS THROUGH 2002

During FY 2001 the Office of Space Flight (OSF) Advanced Programs Office (APO) implemented the first year of the HEDS Technology/Commercialization Initiative (HTCI). The solicitation was successful and significant cost sharing was identified, but the projects were not implemented due to the program being cancelled. The Office of Space Flight cancelled this activity and transferred \$15 million of FY 2001 funding to the International Space Station. This project was cancelled not due to lack of performance. It was cancelled because of the large cost growth experienced in International Space Station development and operations.

BASIS OF FY 2003 FUNDING REQUIREMENT

CREW HEALTH & SAFETY

	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>
		(Millions of Dollars)	
Crew Health and Safety*	[5.2]	[6.1]	5.8

**Note - FY 2001 and FY 2002 data in this section are for comparison purposes only. See Biological and Physical Research section for more details.*

DESCRIPTION/JUSTIFICATION

Crew Health and Safety ensures the health, safety, and performance of space flight crew members, in training and in flight, for all U.S. Space Shuttle, International Space Station (ISS) and exploration missions. This goal encompasses: (1) flight crew health and safety including medical operations; (2) development, integration and configuration management of research requirements for human health, countermeasures and environment systems support; (3) interface to life support technology development; (4) crew health care delivery and crew protection; (5) interface to National Space Biomedical Research Institute (NSBRI) through JSC for operational near-term crew health and safety support.

Within Crew Health and Safety there are five primary elements: (1) medical mission support for the Space Shuttle and ISS programs; (2) astronaut health care; (3) epidemiology (longitudinal studies of astronaut health); (4) Crew Health Monitoring and Risk Mitigation (CHMRM); and (5) Clinical Care Capability Development Program (CCCDP). Crew Health and Safety functions include responsibility for oversight and approval of policies and requirements developed to maintain and provide medical support to optimize the health, safety, and productivity of our astronauts in space. This also includes technology and applications developments. Crew Health and Safety funding provides medical operational support for human space flight and astronaut health care. Crew Health and Safety’s scope ranges from the development of astronaut health policies, standards, and requirements for medical operations and medical research, as well as implementation of these requirements, through operational medical support for all human space flight programs.

JSC is the lead center for Crew Health and Safety. JSC manages the clinical medical and psychological support for the astronauts throughout all phases of space flight missions as well as throughout their careers. They also manage medical informatics and health care systems development efforts in support of medical operations activities for the Human Space Flight (HSF) Program. The majority of the participation by academic institutions are Wright State University School of Medicine, Medical College of Virginia at the Virginia Commonwealth University, and the University of Texas Medical Branch at Galveston.

LINKAGES TO STRATEGIC AND PERFORMANCE PLANS

Strategic Plan Goal Supported: Enable Humans to Live and Work Permanently in Space

Strategic Plan Objectives Supported:

1. Provide and make use of safe, affordable, and improved access to space.
2. Ensure the health, safety, and performance of humans living and working in space.

Performance Plan Metrics Supported: Crew Health and Safety plays a small, but important role in supporting these metrics:

2H01: Begin the development of high leverage technologies to enable safe, effective and affordable human/robotic exploration missions beyond LEO

2H04: Identify and evaluate candidate approaches for 100 to 1000 day human missions capable of a 5 to 10 fold cost reduction while increasing safety and effectiveness (compared to 1990s projections)

2H07: Safely meet the FY 2002 manifest and flight rate commitment.

2H09: Have in place a Shuttle safety investment program that ensures the availability of a safe and reliable Shuttle system for International Space Station assembly and operations

<u>Milestones</u>	<u>Plan in FY 2003 Budget</u>	<u>Plan in FY 2002 Budget</u>	<u>FY 2002- FY 2003 Change</u>	<u>Comment</u>
Prepare and support training and medical hardware for FY 2002 Shuttle missions	7	7		
Support FY 2002 ISS Expeditions	3	3		
Prepare and support training and medical hardware for FY 2003 Shuttle missions	5	5		
Support FY 2003 ISS Expeditions	3	3		

Lead Center: Johnson Space Center	Other Centers: None
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PROGRAM STATUS/NOTIFICATIONS/PLANS THROUGH 2002

During FY 2002, Crew Health and Safety continues to provide operational support to ISS Expeditions 4, 5, and 6 and to Shuttle Missions (STS 108, 109, 110, 111, 107, 112, and 113) from the Blue Flight Control Room (FCR) and Biomedical Multipurpose Support Room (MPSR). Crew Health Monitoring and Risk Mitigation (CHMRM) continued to support pre-and post-flight crew certifications for ISS and Shuttle missions with key support to the extravehicular activity (EVA), crew countermeasures, pharmacotherapeutics, environmental monitoring, and nutrition Integrated Product Team (IPT) expert teams during real-time operational activities. The Clinical Care Capability Development Program (CCCDP) continued to develop the Patient Condition Database for identifying alternate treatment options and prioritization of resource allocation, to develop prototype Electro-Cardiogram (ECG) Orbital Bioinstrumentation Simulator Systems for EVA and vacuum chamber and to develop the following needed medical devices: ultrasound, ventilator, critical care monitors, medical vacuum, and on-orbit IVF (intravenous fluid) generation. Crew Health and Safety in addition developed a Database Preservation and Disaster Recovery plan based on preliminary evaluation of critical, one-of-a-kind clinical data. Epidemiological efforts continued to develop centralized index among the multiple medical databases and to implement SNOMED (Systemized Nomenclature of Medicine) coding in Longitudinal Studies of Astronaut Health (LSAH) for enhanced data mining and analysis.

PROGRAM PLANS FOR FY 2003

During FY 2003, Crew Health and Safety will continue its support of the needs of the space medicine community for space flight missions including operational medical support for the Space Shuttle and ISS. CHMRM funding will assist in the development, monitoring, and interpretations of operational health-related data from space flight including: support of the implementation and interpretation of Medical Requirements (MRs) for Space Shuttle and ISS, support of rapid responses to clinical questions relative to space medicine issues. Clinical Care Capability Development Program (CCCDP) funding will support the ongoing evolution of space medicine research requirements, procedures and technologies. Epidemiological efforts will continue to evaluate the growing body of astronaut health data to better define the medical risks associated with space flight using an evidenced-based systematic approach. Special emphasis will be placed on clinical medical research, radiation, risk assessment, and psychological/human factors.

BASIS OF FY 2003 FUNDING REQUIREMENT

ENGINEERING AND TECHNICAL BASE

	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>
		(Millions of Dollars)	
Engineering and Technical Base	73.3	75.2	72.4

DESCRIPTION/JUSTIFICATION

The focus of the Engineering and Technical Base (ETB) is to support the institutional capability in the operation of space flight laboratories, technical facilities, and testbeds; to conduct independent safety, and reliability assessments; and to stimulate science and technical competence in the United States. ETB activities are carried out at the Johnson Space Center (JSC) including White Sands Test Facility (WSTF), Kennedy Space Center (KSC), and Marshall Space Flight Center (MSFC). Since FY 2000, Rocket Propulsion Test Support has funded these activities at Stennis Space Center. ETB funds are used to maintain the Centers' technical competence, critical skills and unique technical infrastructure. Efforts include system and mission analysis, integrated HSF Research and Technology (R&T) requirements definition and integration, modest R&T investments in an EVA technology demonstration project and investments in R&T supporting the integrated Office of Space Science/HEDS robotic efforts. ETB also provides for applied technology demonstrations and/or technology proof of concepts to improve launch and payload processing operations and for critical, high value, and unique multi program laboratories, test beds, and equipment.

The complex and technically challenging programs managed by OSF are most effectively carried out by sustaining a NASA "core" institutional technical base. It is vital to preserve essential competency and excellence as well as foster innovative technology applications within the ongoing OSF Programs. Since FY 1994, the OSF centers have consolidated activities and have identified ways to economize the resources committed to ETB while maintaining ETB's benefits to the nation's human space flight program. Over the next few years, this consolidation will continue to generate savings through improved information resources management and contract streamlining. A prioritized core capability will include multi-program labs and test facilities, associated systems, equipment, and a full range of skills capable of meeting research, testing and simulation demands.

As the ETB budget remains at steady state level, several activities will continue to refine current business practices. Mandatory equipment repair and replacement will be reassessed. Software applications for multi-program analytical tools will be implemented. The strategy to better manage the NASA investment in information processing resources includes aggressive actions to integrate and consolidate more of these operations. The in-house engineering expertise and technical support is augmented through this program. . A key challenge of the ETB strategy will be to provide a core capability for future human space flight endeavors with fewer resources. Adoption of new innovative processes to meet critical ETB core requirements and streamlining or eliminating non-critical capabilities will be employed to strive for future savings.

LINKAGES TO STRATEGIC AND PERFORMANCE PLANS

Strategic Plan Goal Supported: Explore the Space Frontier (HEDS); Advance Space Transportation (AST)

Strategic Plan Objectives Supported:

Conduct engineering research on the International Space Station to enable exploration beyond Earth orbit (HEDS), define innovative human exploration mission approaches (HEDS), Mission Affordability (AST).

<u>Milestones</u>	<u>Plan in FY 2003 Budget</u>	<u>Plan in FY 2002 Budget</u>	<u>Plan in FY 2001 Budget</u>	<u>FY 2002- FY 2003 Change</u>	<u>Comment</u>
Maintain science and engineering laboratories at KSC	34	34	34	--	Supports 31 agency programs. The FY 2002 number displayed is an increase over the 11 labs shown in last year's budget, but this is a result of a change in how KSC counts labs, rather than the addition of any new labs.
Maintain science and engineering laboratories at JSC	156	156	156	--	Supports 52 agency programs
Maintain science and engineering laboratories and facilities at MSFC	123	123	123	--	Supports 42 agency programs

Lead Center:

None

Other Centers:

Johnson Space Center, Kennedy Space Center, Marshall Space Flight Center

PROGRAM STATUS/NOTIFICATIONS/PLANS THROUGH 2002

In FY 2002 the ETB budget will continue to provide science and engineering lab support to human space flight programs, streamlined technical operations, and additional ADP consolidation activities. This will require that all Centers continue to assess their range of workforce skills, analytical tools and facilities dedicated to ensure their ability to provide space flight institutional engineering support for future human space flight programs and the existing customer base. Center assessments will focus on maintaining core support for design, development, test and evaluations, independent assessments, simulation, operations support, real time anomaly resolution, and systems engineering activities. ETB also works with the programs and the Systems Management Offices to conduct risk management and cost estimating

In FY 2002, MSFC will maintain ETB's institutional base requirements funding; maintain highly skilled Safety and Mission Assurance contractor workforce to conduct assessment of conformance to reliability and quality standards; maintain technical core capability to provide in-depth technical support for research, design, development, mission operations, and evaluation.

In FY 2002, JSC's efforts will continue to focus on maintaining the multi-program use science and engineering laboratories and facilities operational readiness. This effort will include performing scheduled facility infrastructure sustaining maintenance, maintaining analytical tools readiness, and performing the necessary repairs, modifications, and replacements to the facilities infrastructure to accommodate the changes needed to support program commitments. FY 2002 contains many critical programmatic milestones that will require extensive use of our laboratories and facilities. NASA will continue to perform critical studies, test, and analyses for many activities. These include: monitoring human life support and crew health as crews continue to inhabit ISS, ensuring the Shuttle can safely operate and transport Station hardware and astronaut personnel, and ensuring smooth and safe operations of personnel and equipment during the Station assembly EVAs. ETB will also keep the laboratories and facilities operational to perform exploration and development studies.

In FY 2002, KSC Spaceport Engineering Laboratories and Testbeds will continue to provide development, analysis, test and technology demonstrations in support of Shuttle, Space Station, Reusable Launch Vehicles, Expendable Launch Vehicles, Payloads and Life Sciences programs. KSC technical infrastructure sustained through ETB funding will continue to support non-routine real-time problem resolution during Shuttle Launch processing, Space Station processing and Payload Ground Operations. KSC's ETB continues to support unique Center failure analysis capabilities. The labs supporting these capabilities provide independent and objective test and analysis support to NASA Programs, Contractors and customers for highly complex physical anomalies. ETB at KSC also directly supports Shuttle, Station, ELV, and P/L routine operations in the areas of sampling and analysis, non-destructive evaluation, and calibration and standards. ETB indirect support to NASA Programs will continue at KSC through research and development of projects targeted at raising the Technology Readiness Level of high potential technologies for safer, more reliable and cost effective Spaceport operations.

PROGRAM PLANS FOR FY 2003

In FY 2003, MSFC ETB activities will include test area support to MSFC programs and projects that include 2nd Generation RLV and in-house research projects; engineering, science and technical services for core capability tool development and maintenance support to Shuttle, 2nd Generation RLV, and CAD/CAM applications and hardware support to Shuttle, Station, Advanced Space Transportation, Science and in-house projects.

In FY 2003, JSC's efforts will continue to focus on maintaining the multi-program use science and engineering laboratories and facilities operational readiness. NASA will continue to perform critical studies, test, and analyses for many activities. These include: monitoring human life support and crew health as crews continue to inhabit ISS, ensuring the Shuttle can safely operate and transport Station hardware and astronaut personnel, and ensuring smooth and safe operations of personnel and equipment during the Station assembly EVAs. ETB will also keep the laboratories and facilities operational to perform exploration and development studies.

In FY 2003, KSC Spaceport Engineering Laboratories and Testbeds will continue to provide development, analysis, test and technology demonstrations in support of Shuttle, Space Station, Reusable Launch Vehicles, Expendable Launch Vehicles, Payloads and Life Sciences programs. KSC technical infrastructure sustained through ETB funding will continue to support non-routine real-time problem resolution during Shuttle Launch processing, Space Station processing and Payload Ground Operations. KSC's ETB will continue to support unique Center failure analysis capabilities. The labs supporting these capabilities provide independent and objective test and analysis support to NASA Programs, Contractors and customers for highly complex physical anomalies. ETB direct support to Shuttle, Station, ELV, and P/L routine operations in the areas of sampling and analysis, non-destructive evaluation, and calibration and standards will continue. Indirect support to NASA Programs will continue at KSC through research and development of projects targeted at raising the Technology Readiness Level of high potential technologies for safer, more reliable and cost effective Spaceport operations.

BASIS OF FY 2003 FUNDING REQUIREMENT

ROCKET PROPULSION TEST SUPPORT

	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>
		(Millions of Dollars)	
Rocket Propulsion Test Support	27.9	27.8	27.9

DESCRIPTION/JUSTIFICATION

The Stennis Space Center (SSC) is the Lead Center for Rocket Propulsion Testing Support to manage this initiative, which includes making test assignments and approval of test facility investments. Funding for this program provides:

- 1) Sustaining support for propulsion test facilities which include test positions and related infrastructure at SSC, JSC-WSTF, GRC-PB and MSFC;
- 2) Modernization/upgrades of existing facilities to ensure their capabilities are adequate to meet the demands of our future customers and to optimize their operating efficiency;
- 3) Administrative/technical support to SSC for scheduling and management of propulsion testing across the agency and coordination of these activities with DoD and commercial customers; and
- 4) Development of test technologies to improve analytical capabilities, hardware health monitoring, and operational safety and achieve cost savings through enhanced operational efficiencies.

NASA has established a Rocket Propulsion Test Management Board (RPTMB) under Stennis Space Center’s purview, which is NASA’s Lead Center for Rocket Propulsion Testing. The RPTMB is composed of representatives from all four NASA rocket test centers (SSC, MSFC, JSC-White Sands and GRC-Plum Brook) and is chaired by SSC. The RPTMB has established baseline test roles for each center, resulting in the consolidation of test capabilities and the elimination of redundant facilities and related infrastructure. The roles are tailored to take advantage of existing unique capabilities at each site and to consolidate capabilities where appropriate. The RPTMB makes test assignments, controls investments, and manages personnel and equipment sharing among NASA’s test sites.

In addition, NASA has been key to the formation and development of the National Rocket Propulsion Test Alliance (NRPTA). NASA and DoD test sites are cooperating to share people and equipment, review/track investments, and make interagency test assignments that will improve test support and avoid redundant investments in federally owned and operated test facilities. The NRPTA maintains an integrated national rocket test facility schedule and utilization rate, along with detailed data on NASA/DoD test facility capabilities.

LINKAGES TO STRATEGIC AND PERFORMANCE PLANS

Strategic Plan Goal Supported: Enable the Commercial Development of Space (HEDS); Advance Space Transportation (AST)

Strategic Plan Objectives Supported:

Advance the scientific, technological, and academic achievement of the Nation by sharing our knowledge, capabilities, and assets (HEDS), Mission Affordability (AST).

<u>Milestones</u>	<u>Plan in FY 2003 Budget</u>	<u>Plan in FY 2002 Budget</u>	<u>Plan in FY 2001 Budget</u>	<u>FY 2002- FY 2003 Change</u>	<u>Comment</u>
Liquid Nitrogen (N2) system upgrades	3rd Qtr FY 2003	4 th Qtr FY 2001	4 th Qtr FY 2001	7 Qtrs later	Complete Liquid Nitrogen (N2) system upgrades for Propulsion Test Area at White Sands Test Facility (WSTF). Project delayed due to contractor default; awaiting selection of new contractor pending closeout of existing contract.
Test Stand 4670 repair and activation	3rd ^t Qtr FY 2002	1 st Qtr FY 2002	1 st Qtr FY 2002	2 Qtrs later	Initiate repair and activation of Test Stand 4670 at MSFC. Delay in staffing being made available from other center projects.
Mothball Test Facilities at MSFC	2 nd Qtr FY 2002	3 rd Qtr FY 2000	3 rd Qtr FY 2000	7 Qtrs later	De-activation of the Building-4670 and 302 test facilities at MSFC due to insufficient test requirements planned in the near future.
Install diagnostics systems in E Complex at SSC	2 nd Qtr FY 2002	4 th Qtr FY 2001	4 th Qtr FY 2001	2 Qtrs later	Field-test & install wireless miniature accelerometer and fiber-optic strain measurement systems in E Complex at SSC. Successfully developed wireless sensor design, architecture in FY 2001; first unit diverted to safety-critical monitoring of Hydrogen Peroxide propellant drum temperatures (instead of vibration); more units being built. Completed lab evaluation of fiber-optic strain sensors.
Validate field prediction models	3 rd Qtr FY 2002	3 rd Qtr FY 2002	3 rd Qtr FY 2002		Validate acoustic field prediction model for E Complex test cells at SSC. Supporting model development effort by MSFC.

<u>Milestones</u>	<u>Plan in FY 2003 Budget</u>	<u>Plan in FY 2002 Budget</u>	<u>Plan in FY 2001 Budget</u>	<u>FY 2002- FY 2003 Change</u>	<u>Comment</u>
Install advanced test sensors	3 rd Qtr FY 2002	3 rd Qtr FY 2002	3 rd Qtr FY 2002		Install advanced test sensors (e.g. accelerometers, flow meters, etc.) in E complex test cells at SSC. Wireless acceleration, acoustic, strain sensors in work for FY 2002. Identify newly developed sensors at other NASA sites for trials at SSC. Attempt plume signature of Hydrocarbon plumes.
Validate high pressure propellant flow models	4 th Qtr FY 2002	4 th Qtr FY 2002	4 th Qtr FY 2002		Achieve highly accurate characterization of ultra high-pressure cryogenic propellant flows. Began modeling effort in late FY 2001; continuing throughout FY 2002
Complete Steam line replacement	4 th Qtr FY 2002	4 th Qtr FY 2002	4 th Qtr FY 2002		Replace aging Steam lines in Propulsion Test Area at WSTF. Project study completed 4 th Qtr 2001; project design is in work. Shuttle Infrastructure funding remaining project activities. Plan completion date still good.
Establish test equipment database	4 th Qtr FY 2002	4 th Qtr FY 2001	4 th Qtr FY 2001	1 year delay	Establish detailed test equipment database to support future development of improved scheduling/integration tools. Development of database required extensive effort; competing priorities resulted in delay of planned completion until the latter part of FY 2002.
Enhanced diagnostic tools	3 rd Qtr FY 2003				Implement upgrades of plume effects simulation tools (hardware and software) at SSC. Demonstrate enhanced capabilities for signatures of Hydrocarbon rocket plumes.
Test Area Communication replacement	4 th Qtr FY 2003				Complete replacement/upgrade to Test Area Communication Systems at WSTF
Repair Helium Systems	4 th Qtr FY 2003				Initiate repair to test facility Helium system at WSTF

<u>Milestones</u>	<u>Plan in FY 2003 Budget</u>	<u>Plan in FY 2002 Budget</u>	<u>Plan in FY 2001 Budget</u>	<u>FY 2002- FY 2003 Change</u>	<u>Comment</u>
Steam Boiler Replacement	4 th Qtr FY 2003				Initiate replacement of steam boilers for altitude exhaust system in Building 2 at Glenn Research Center/PlumBrook.
UHP GN Vessels Procurement	4 th Qtr FY 2003				Initiate the procurement process of 2 Ultra High Pressure Gaseous Nitrogen bottles for SSC
Spares Procurement	4 th Qtr FY 2003				Initiate procurement for spare high pressure valves for SSC E-complex
New Data Acquisition System	4 th Qtr FY 2003				Upgrade the test facility Data Acquisition system at MSFC

Lead Center: Stennis Space Center	Other Centers: Johnson Space Center/White Sands Test Facility, Marshall Space Flight Center, Glenn Research Center	Interdependencies: Department of Defense
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PROGRAM STATUS/NOTIFICATIONS/PLANS THROUGH 2002

Over the last several years, actions taken by NASA's Rocket Propulsion Test Management Board (RPTMB) have resulted in an estimated total savings of approximately \$70 million, while actions taken by the National Rocket Propulsion Test Alliance (NRPTA) have contributed an estimated \$2 million in savings. To date, the RPTMB has made 27 propulsion test assignments within NASA, across other agencies, and to industry facilities.

During FY 2002, the RPTMB will continue to implement critical facility upgrades to ensure existing test assets are truly "world-class", thus providing flexible and robust testing capabilities operated by a highly experienced and trained cadre of test personnel. Test facility maintenance activities are ongoing in support of Space Shuttle, Space Launch Initiative (SLI), DoD and commercial test projects. The RPTMB will continue to make test assignments that optimize utilization of existing test facilities across the agency and achieve further cost savings. Efforts will also continue to assess test facilities for possible closure and activate other test facilities currently being modified in preparation for planned testing in FY 2002 and beyond. Additional investments in new test technologies will continue to enhance our ability to monitor the status of hardware during testing and increase operational safety.

Investments will continue to be made in the development of improved scheduling tools, test technologies and modularization of test support hardware to reduce turnaround times, improve test management capabilities and improve operational efficiencies. Plans are also under consideration to establish a single Test Operations Contractor for the 4 NASA centers under RPTMB control. We will also continue to work with DoD through the NRPTA in consolidation of national test capabilities, test assignments, test facility utilization and modernization.

PROGRAM PLANS FOR FY 2003

During FY 2003, the RPTMB will continue critical facility upgrades to ensure existing test assets are truly “world-class. Test facility maintenance activities are ongoing in support of Space Shuttle, Space Launch Initiative (SLI), DoD and commercial test projects. Efforts will also continue to assess test facilities for possible closure and activate other test facilities currently being modified in preparation for planned testing in FY 2002 and beyond. Additional investments in new test technologies will continue to enhance our ability to monitor the status of hardware during testing and increase operational safety.

Investments will continue to be made in the development of improved tools, technologies and modularization of test support hardware to improve operational efficiencies. We will also continue to work with DoD through the NRPTA in consolidation of national test capabilities, test assignments, test facility utilization and modernization.

BASIS OF FY 2003 FUNDING REQUIREMENT

HEDS INSTITUTIONAL SUPPORT

	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>
		(Millions of Dollars)	
Institutional Support to HEDS Enterprise.....	1,133.5	1,111.5	1,072.1
<u>Research and Program Management</u>	<u>1,014.6</u>	<u>1,038.2</u>	<u>997.2</u>
Personnel and Related Costs.....	805.0	739.3	763.0
Travel	24.7	22.8	23.1
Research Operations Support (ROS).....	184.9	276.1	211.1
<u>Construction of Facilities</u>	<u>118.9</u>	<u>73.3</u>	<u>74.9</u>
Environmental	26.8	21.8	26.1
Construction of Facilities.....	92.1	51.5	48.8
Full-Time Equivalent (FTE) Workyears	7,839	7,090	6,786

Note - Includes budget augmentation for Security Allocation under ROS in FY 2002 (\$76m)

Note - FY 2001 data in this section is for comparison purposes only. Reductions shown are primarily due to transfer of program content from HEDS to other enterprises. See Mission Support sections for more details.

DESCRIPTION/JUSTIFICATION

The two primary goals of this budget segment are to:

- 1.) Acquire and maintain a civil service workforce that reflects the cultural diversity of the Nation and, along with the infrastructure, is sized and skilled consistent with accomplishing NASA’s research, development, and operational missions with innovation, excellence, and efficiency for the Human Exploration and Development of Space (HEDS) Enterprise.
- 2.) Ensure that the facilities critical to achieving the HEDS Enterprise are constructed and continue to function effectively, efficiently, and safely, and that NASA installations conform to requirements and initiatives for the protection of the environment and human health.

Research and Program Management (R&PM)

R&PM provides the salaries, other personnel and related costs, travel and the necessary support for all administrative functions and other basic services in support of research and development activities at NASA installations. The salaries, benefits, and supporting costs of this workforce comprise approximately 76% of the requested funding. Administrative and other support is approximately 21% [of the requests. The remaining 2% of the request are required to fund travel necessary to manage NASA and its programs.

Research Operations Support provides three major services: facilities services, technical services and management and operations. Facility services provide security, fire protection, and other custodial services. It also provides maintenance of roads and grounds and of all administrative buildings and facilities. Finally, it provides rental of administrative buildings and all utility costs of administrative buildings. Technical Services provides the Administrative Automatic Data Processing capability that supports Accounting, Payroll, Budgeting, Procurement, and Personnel as well as all the other Administrative functions. It also funds the Graphics and Photographic support to these functions. Finally, it funds the Installation-wide safety and public information programs. Management and Operations funds the telephone, mail, and logistics systems, the administrative equipment and supplies, and the transportation system including the general purpose motor pools and the program support aircraft. It also funds the basic medical and environmental health programs. Finally, it funds the System Management Office, printing and reproduction and all other support, such as small contract and purchases for the Center Directors staff and the Administrative functions.

The Systems Management Office (SMO) provides support and independent evaluations of projects and programs for compliance with the implementation of NPG 7120.5A, NASA Program and Project Management Processes and Requirements and, as appropriate, the Marshall Quality Manual. The SMO determines consistency across product lines for Center systems engineering functions related to space systems programs and projects, including requirements development and requirements flowdown, program verification, and cost projections. The SMO provides leadership, consultation services, and technical expertise on systems engineering processes.

Construction of Facilities (CofF)

This budget line item provides for discrete projects required for components of the basic infrastructure and institutional facilities. Almost all of these projects are for capital repair. NASA has conducted a thorough review of its facilities infrastructure finding that the deteriorating plant condition warrants an increased repair and renovation rate to avoid safety hazards to personnel, facilities, and mission; and that some dilapidated facilities need to be replaced. Investment in facility revitalization is needed to maintain a facility infrastructure that is safe and capable of supporting NASA's missions.

Detailed cost estimates for HSF R&PM are shown as part of the total agency R&PM budget (see R&PM narratives) to provide a complete picture of NASA's budget requirements for personnel and administrative support. The descriptions and cost estimates are shown as part of the Construction of Facilities program (see Construction of Facilities narratives) to provide a complete picture of NASA's budget requirement for facilities. Extensive detail as to how this funding is utilized by HSF is located under the Two-Appropriation/Mission Support portion of the budget.

ROLES AND MISSIONS

The detail provided here is for the support of HEDS Enterprise programs at the following institutions - Johnson Space Center, Kennedy Space Center, Marshall Space Flight Center, Stennis Space Center, Ames Research Center, Dryden Flight Research Center, Glenn Research Center, Langley Research Center, Jet Propulsion Laboratory, and Goddard Space Flight Center.

Johnson Space Center (JSC)

The Human Exploration and Development of Space Enterprise funds approximately 90% of JSC's Institution cost in FY 2003.

Institutional support funding at the Johnson Space Center (JSC) supports personnel carrying out the lead center management responsibility for the International Space Station program. In addition, specific JSC technical responsibilities include development of a set of facilities and systems to conduct the operations of the Space Station including on-orbit control of the Space Station. JSC also provides institutional personnel as well as engineering and testbed support to the Space Station program. This includes test capabilities, the provision of Government Furnished Equipment (GFE), and engineering analysis support for the work of the prime contractor, its major subcontractors, and NASA system engineering and integration efforts.

JSC also has lead center management responsibility for the Space Shuttle. In addition, JSC personnel will provide development, integration, and operations support for the Mission Control Center (MCC), the Shuttle Mission Simulator (SMS), and other ground facilities needed for Space Shuttle Operations. JSC workers will provide Space Shuttle operational flight program management including system integration, crew equipment modification and processing, crew training, flight mission planning and operations, and procurement of Orbiter hardware.

In the Payload and ELV support program, JSC personnel provide support to payload operations and support equipment.

JSC will also conduct concept studies and development on flight systems and options for human transportation. JSC provides support to the engineering and technical and technology program support.

Space Operations Management Office (SOMO) personnel at JSC manage the telecommunication, data processing, mission operation, and mission planning services needed to ensure that the goals of NASA's exploration, science, and research and development programs are met in an integrated and cost-effective manner. SOMO also provides the administration and management of the Consolidated Space Operations Contract (CSOC).

Kennedy Space Center (KSC)

The Human Exploration and Development of Space Enterprise funds approximately 97% of KSC's Institution cost in FY 2003.

The Kennedy Space Center (KSC) is a supporting center for the Space Station Program. KSC personnel have developed a set of facilities, systems, and capabilities to conduct the operations of the Space Station. KSC develops launch site operations

capabilities for conducting pre-launch and post-landing ground operations including integrated testing, interface verification, servicing, launch activities, and experiment-to rack physical integration. The KSC workforce provides launch site logistics support, resupply and customer utilization. KSC serves as the primary agent for management and integration of ground processes for all U.S. launched International Space Station (ISS) elements from manufacture and assembly through verification and launch. KSC develops and maintains ISS flight systems expertise to support the ISS on-orbit mission and retains technical and operational experience within NASA and KSC for ground processing and verification of space flight hardware.

KSC workers will also provide Space Shuttle launch preparation, including orbiter processing, Ground Support Equipment (GSE) logistics; operation and maintenance of GSE; and launch and landing operations.

KSC is the Lead Center for the Payload Carriers and Support Program. KSC personnel provide technical expertise, facilities and capabilities to perform payload buildup, test and checkout, integration and servicing of multiple payloads. They also support development, operation, logistics and maintenance of Ground Support Equipment; transportation of payloads and supporting equipment to the Space Shuttle; and integration and installation of the payloads into the Space Shuttle. KSC workers develop, activate, operate and maintain the Payload Carrier facility system, GSE, and processes to enable efficient launch site processing of carriers and payloads.

KSC personnel will provide government insight/oversight of all launch vehicle and payload processing and checkout activities for all NASA contracted expendable launch vehicle and upper stage launch services both at KSC and the Vandenberg Air Force Base.

Marshall Space Flight Center (MSFC)

The Human Exploration and Development of Space Enterprise funds approximately 41% of MSFC's Institution cost in FY 2003. This is down from 61% in last year's Budget request, due to the transfer of the International Space Station research from the HEDS enterprise to the Biological and Physical Research Enterprise, along with an increase in funding from the Aerospace Technology Enterprise for pace Launch Initiative activities.

Marshall Space Flight Center (MSFC) will provide engineering support to the ISS program including engineering analysis in support of the International Space Station (ISS) system engineering and integration effort. The Center also has oversight responsibility for the development of the Nodes 1 & 2, and the Multi Purpose Logistics Module. MSFC personnel carry out design integration of cargo elements for flight on the MSFC provided unpressurized logistics carrier to support ISS mission-build and logistics supply flights. MSFC also has responsibility for developing payload utilization capabilities and planning and executing payload integration and operations activities. This includes the development and operation of the EXPRESS Rack payload carrier, ISS Payload Data Services System and the ISS Payload Planning System.

The Institutional Support in the Space Shuttle Projects Office (SSPO) at MSFC is responsible for executing the Space Shuttle Program role assigned to the Center. These responsibilities include activities associated with the Space Shuttle Main Engine (SSME), External Tank (ET), Solid Rocket Booster (SRB), and Reusable Solid Rocket Motor (RSRM). The SSPO is responsible for these propulsion hardware elements and associated systems, test and flight operations, and facilities.

MSFC manages and maintains the NASA Integrated Services Network (NISN) - NISN services provide communications hardware, software, and transmission medium that inter-connects NASA Headquarters, installations, universities, and major contractor locations for the transfer of data, voice, and video.

Stennis Space Center (SSC)

The Human Exploration and Development of Space Enterprise funds approximately 43% of SSC's Institution cost in FY 2003. This is down from 58% in last year's Budget request, as a result of correcting the allocation of indirect support among the HEDS, Earth Science and Aerospace Technology Enterprises.

The Stennis Space Center will provide, maintain and manage the facilities and the related capabilities required for the continued development and acceptance testing of the Space Shuttle Main Engines.

As the Lead Center for Propulsion Testing, SSC will operate, maintain, and manage a propulsion test capability that includes test facilities at JSC/WSTF, MSFC and GRC/Plum Brook and related systems for development, certification, and acceptance of rocket propulsion systems and components. SSC will also maintain and support the Center's technical core laboratory and operations to enable SSC to conduct advanced propulsion test technology research and development for government and commercial propulsion programs.

Ames Research Center (ARC)

The Human Exploration and Development of Space Enterprise funds approximately 3% of ARC's Institution cost in FY 2003. This is down from 8% last year due to transfer of the International Space Station research from the HEDS enterprise to the Biological and Physical Research Enterprise. Ames Research Center has the agency lead role in Gravitational Biology and Ecology programs. These synergistic programs examine the adaptation of life forms to reduced gravity.

Dryden Flight Research Center (DFRC)

The Human Exploration and Development of Space Enterprise funds approximately 5% of DFRC's Institution cost in FY 2003. This is down from 22% last year due to transfer of the management of the Western Aeronautical Test Range from the HEDS enterprise to Aerospace Technology Enterprise as a part of the decentralization of the Space Communications and Data Systems program. DFRC conducts technology development and flight test of the X-38 vehicle. They also provide operational and technical support for the conduct of Space Shuttle missions, including on-orbit tracking and communications and, as needed, landing support for the orbiter, crew, and science requirements.

Glenn Research Center (GRC)

The Human Exploration and Development of Space Enterprise funds approximately 12% of GRC's Institution cost in FY 2003. This is down from 23% last year due to increased funding from the Space Science Enterprise. GRC support to the space station program includes technical and management support in the areas of power and on-board propulsion components and system, engineering and analysis, technical expertise, and testing for components and systems. This includes use of facilities and testbeds and construction of flight hardware as required. GRC also develops and demonstrates communications and network technologies in relevant environments to enhance the performance of existing mission services or enable new services. These people identify and infuse new capabilities at higher frequencies (Ka-band and above) into the next generation of spacecraft and communications satellites, to enable seamless interoperability between NASA assets and commercial space and ground networks. The Center's personnel also ensure timely and high-quality availability of radio frequency spectrum to enable the realization of NASA goals.

Langley Research Center (LaRC)

The Human Exploration and Development of Space Enterprise funds approximately 3% of LaRC's Institution cost in FY 2003. LaRC supports the HEDS Enterprise through systems analyses of potential Space Station evolution as well as future human exploration missions in space.

Jet Propulsion Laboratory (JPL)

The Human Exploration and Development of Space Enterprise funds approximately 2% of JPL's Institution cost in FY 2003 in the areas of other than direct Research Operations Support and Construction of Facilities funding. This is down from 35% last year due to the transfer of management of the Deep Space Network from the HEDS Enterprise to the Space Science Enterprise.

Goddard Space Flight Center (GSFC)

The Human Exploration and Development of Space Enterprise funds approximately 7% of GSFC's Institution cost in FY 2003. This is down from 14% last year due to transfer of management of the Ground Networks from the HEDS Enterprise to the Earth Science Enterprise. GSFC manages flights of the Hitchhiker, a reusable carrier system that provides increased flight opportunities with reduced lead-time while maximizing Space Shuttle load factors and minimizing spaceflight costs. GSFC personnel also manage and coordinate the Agency's Get Away Special (GAS) program.

Research and technology activities at GSFC involve the investigation and development of advanced systems and techniques for spacecraft communications and tracking, command and control, and data acquisition and processing. The primary objectives are to apply technology and develop advanced capabilities to meet the tracking and data processing requirements of new missions and to improve the cost effectiveness and reliability of flight mission support.

GSFC personnel also manage a number of critical program elements in the Space Communications and Data Systems program including operation of the Tracking and Data Relay Satellite System (TDRSS) and development of the replenishment TDRSS spacecraft.

Headquarters (HQ)

The Human Exploration and Development of Space Enterprise funds approximately 28% of HQ's Institution cost in FY 2003. This is down from 35% last year due to reallocation of funding headquarters activities between the Enterprises. The Enterprise's Institutional Support figure includes an allocation for funding Headquarters activities based on the relative distribution of direct FTE's across the agency. A more complete description can be found in the Mission Support/Two Appropriation budget section.

PROGRAM STATUS/NOTIFICATIONS/PLANS THROUGH 2002

The FY 2002 funding estimate for Research Operations Support includes \$76.0M provided in the Emergency Supplemental to enhance NASA's security and counter-terrorism capabilities.

PROGRAM PLANS FOR FY 2003

The FY 2003 funding estimate for Research Operations Support includes \$24.0M provided in the Emergency Supplemental to enhance NASA's security and counter-terrorism capabilities.