

HUMAN SPACE FLIGHT
FISCAL YEAR 2002 ESTIMATES
BUDGET SUMMARY

OFFICE OF SPACE FLIGHT

INVESTMENTS AND SUPPORT

SUMMARY OF RESOURCES REQUIREMENTS

	<u>FY 2000</u> OPLAN <u>REVISED</u>	<u>FY 2001</u> OPLAN <u>REVISED</u>	<u>FY 2002</u> PRES <u>BUDGET</u>	Page <u>Number</u>
		(Thousands of Dollars)		
Rocket Propulsion Test Support.....		27,938	27,800	HSF 5-3
OSF Contributions to Academic Programs		7,982	--	HSF 5-9
Technology and Commercialization		19,956	19,000	HSF 5-11
Engineering and Technical Base		73,338	75,200	HSF 5-14
HEDS Institutional Support		--	<u>1,181,500</u>	HSF 5-17
Total.....		<u>129,214</u>	<u>1,303,500</u>	
 <u>Distribution of Program Amount by Installation</u>				
Johnson Space Center		33,170	408,306	
Kennedy Space Center		11,750	279,055	
Marshall Space Flight Center		38,438	259,627	
Stennis Space Center		20,101	52,742	
Ames Research Center		100	16,846	
Dryden Flight Research Center			13,865	
Glenn Research Center		1,800	55,742	
Langley Research Center		650	10,520	
Goddard Space Flight Center.....		3,005	57,430	
Jet Propulsion Laboratory		850	11,357	
Headquarters		<u>19,350</u>	<u>138,010</u>	
Total.....		<u>129,214</u>	<u>1,303,500</u>	

PROGRAM GOALS

The Investments and Support budget provides resources to support a wide range of activity including the maintenance and modernization of NASA's rocket propulsion test facilities, support for NASA's academic programs, research investments in the Human Exploration and Development of Space (HEDS) enterprise through the HEDS Technology and Commercialization Initiative, 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.

STRATEGY FOR ACHIEVING GOALS

The Investments and Support budget reflects a commitment to meet a wide array of programs. The principal areas of activity in the Investments and Support program are:

- 1) To provide leadership in the area of rocket propulsion testing;
- 2) To develop technologies to enable future space exploration activities and promote space commercialization and technology transfer; and
- 3) To empower a core workforce to operate Human Space Flight laboratories, technical facilities, and test beds, and stimulate science and technical competence in the United States.

The Investments and Support budget was a new budget line item established in the FY 2001 budget. Funding for this budget line, with the exception of the HEDS Technology and Commercialization program, was established from programs previously funded in the Human Space Flight and Mission Support Appropriations. Specifically, the Engineering and Technical Base was previously funded from the Payload Utilization and Operations budget line item in FY 1999 and FY 2000. The Enterprise Contribution to Academic Programs was previously funded from both Space Shuttle and Payload Utilization and Operations. The Rocket Propulsion Test Program was previously funded in the following BLIs: Space Shuttle, Engineering and Technical Base, Space Station and Research and Program Management (R&PM). Beginning in FY 2002, the budget for additional support to NASA's academic programs was transferred to the Academic programs to centralize agency funding for this activity.

BASIS OF FY 2002 FUNDING REQUIREMENT

ROCKET PROPULSION TEST SUPPORT

	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
		(Thousands of Dollars)	
Rocket Propulsion Test Support.....	[24,500]	27,938	27,800

PROGRAM GOALS

A new Budget Line Item (BLI) was established in FY 2001 to ensure NASA's rocket propulsion test capabilities are properly managed and maintained in world class condition. The Rocket Propulsion Test Support Program is a consolidation of ongoing activities to achieve a more effective test program. The Rocket Propulsion Test Support Program was previously funded in FY 2000 and prior years in the following BLIs: Space Shuttle, Engineering and Technical Base (ETB) and Research and Program Management (R&PM). This consolidation has significantly enhanced NASA's ability to properly manage rocket testing activities and infrastructure.

STRATEGY FOR ACHIEVING GOALS

The Stennis Space Center (SSC) has been appointed as Lead Center for Propulsion Testing 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.

SCHEDULE AND OUTPUTS

Improve test capabilities and increase safety through modernization/upgrades of test facilities at all NASA test centers

Improve altitude system capability and efficiency
Plan: 4th Qtr FY 2000
Actual: 4th Qtr FY 2000

Improve altitude system capability and efficiency at JSC-WSTF and GRC-PB. Installed vacuum isolation valves and high speed safety valves at JSC-WSTF and completed refurbishment of cooling water system for B-2 test stand at Glenn research Center - Plumbrook Complex (GRC-PB)

High-pressure spares and equipment upgrades
Plan: 3rd Qtr FY 2000
Actual: 3rd Qtr FY 2000

Provide critical high-pressure spares and equipment upgrades for E Complex at Stennis Space Center (SSC). Spare hardware procurements implemented in FY 00; additional acquisitions/upgrades planned in FY 2001-2002

Data Acquisition and Control Systems (DACS) and video systems upgrades
Plan: 3rd Qtr FY 2001

Install Data Acquisition and Control Systems (DACS) and video systems upgrades at E3 test facility at SSC.

Refurbish spray chamber water system
Plan: 4th Qtr FY 2001

Refurbish spray chamber water system for B-2 test stand at GRC/PB

Liquid Nitrogen (N2) system upgrades
Plan: 4th Qtr FY 2001

Complete Liquid Nitrogen (N2) system upgrades for Propulsion Test Area at White Sands Test Facility (WSTF)

Repair structural support systems
Plan: 4th Qtr FY 2001

Repair structural support systems/install enhanced N2 storage capability at Test Stand 115 at Marshall Space Flight Center (MSFC)

Activate new Data Acquisition and Control System Lab (DACS) Complete activation and operational deployment of new DACS lab in Bldg. 4010 at SSC.

Plan: 1st Qtr FY 2002

Initiate replacement of steam boilers Initiate replacement of steam boilers for alt exhaust system in B2 at GRC/PB.

Plan: 1st Qtr FY 2002

Initiate repair and activation of TS 4670 Initiate repair and activation of Test Stand 4670 at MSFC.

Plan: 1st Qtr FY 2002

Complete Steam line replacement Complete Steam line replacement for Propulsion Test Area at WSTF.

Plan: 4th Qtr FY 2002

Improve NASA test capabilities and achieve cost savings by implementation of planned facility readiness/closure plans

Initiate Commercial Test Operations on B-1 Test Stand Complete integration of commercial operations on test stand B-1 at SSC. B-1 test stand successfully transitioned to Boeing in 2nd Qtr FY 00; RS68 engine test operations now underway.

Plan: 2nd Qtr FY 2000

Actual: 2nd Qtr FY 2000

Activate cells 2 and 3 of E-1 Test Facility at SSC Cell 3 activation completed 1st Qtr FY 2001; now supporting IPD LOX turbopump testing. Cell 2 activation approximately 90% complete;

Plan: 4th Qtr FY 2000

Revised: 4th Qtr FY 2001

Mothball test stand 4670 at MSFC Mothball test stand 4670 at Marshall Space Flight Center. TS4670 remains in inactive status pending final determination of 2nd Generation RLV testing requirements.

Plan: 3rd Qtr FY 2000

Actual: 3rd Qtr FY 2000

Initiate Commercial Development/test operations on H-1 test facility Turn over H-1 test facility to commercial development/test customer in support of Space Based Laser Program (SSC)

Plan: 3rd Qtr FY 2001

Enhance test diagnostics capabilities and increase operational efficiencies through implementation of new test technologies

Development of H2 Leak
Detection System

Plan: 4th Qtr FY 2000

Actual: 4th Qtr FY 2000

Develop improved H2 Leak Detection System for A/B test stand at Stennis Space Center. Fiber optics detection system design completed in FY 00; prototype hardware testing currently underway

Development of plume
diagnostics

Plan: 4th Qtr FY 2000

Actual: 4th Qtr FY 2000

Complete development of plume diagnostics research activities to detect metals in exhaust plumes. Developed real-time video capability for plume observations; new plume video image analysis techniques using visible or spectrally filtered video data; and continued development of atomic absorption technique for engine health monitoring;

Modular test hardware

Plan: 4th Qtr FY 2000

Revised: Under review

Initiate development of modular test hardware prototype at Stennis Space Center. Project postponed due to funding priorities and conflicts with test support activities

Advanced data acquisition
and controls development
laboratory

Plan: 4th Qtr FY 2000

Actual: 4th Qtr FY 2000

Complete advanced data acquisition and controls development laboratory at Stennis Space Center. Initial installation of laboratory equipment completed in FY 00; system operations underway

Provide analysis support for
testing at B-1 Test Stand

Plan: 2nd Qtr FY 2001

Initiate emissions spectroscopy analysis of RS68 engine exhaust plume at B-1 test stand at SSC.

Install additional systems at
E Complex at SSC

Plan: 4th Qtr FY 2001

Field-test & install wireless miniature accelerometer and optic strain measurement systems at E Complex at SSC

Validate field prediction
models

Plan: 3rd Qtr FY 2002

Validate acoustic field prediction model for E Complex test cells at SSC

Install advanced test sensors

Plan: 3rd Qtr FY 2002

Install advanced test sensors (e.g. accelerometers, flow meters, etc.) in E complex test cells at SSC.

Validate high pressure propellant flow models
Plan: 4th Qtr FY 2002

Achieve highly accurate characterization of ultra high-pressure cryogenic propellant flows

Improve coordination/management of propulsion testing between NASA and DoD via efforts by the Rocket Propulsion Test Management Board (RPTMB)

Improve Scheduling/integration tools and processes

Plan: 4th Qtr FY 2000
Actual: 4th Qtr FY 2000

Develop improved scheduling/integration tools and processes. Task accomplished; integrated test utilization planning for NASA and DoD test facilities now operational

Conduct NASA/DoD cross-agency test assignments

Plan: 4th Qtr FY 2000
Actual: 4th Qtr FY 2000

Achieve six NASA/DoD cross-agency test assignments. Accomplished five NASA/DoD test assignments in FY 2000 -

Establish integration and assignment process in conjunction with DoD

Plan: 4th Qtr FY 2000
Actual: 4th Qtr FY 2000

Establish test integration and assignment process in conjunction with DoD. Software tools/processes established; ongoing test assignment activities conducted via RPTMB and NRPTA

Increase the number of Air Force test personnel

Plan: 4th Qtr FY 2000
Actual: 4th Qtr FY 2000

Increase the number of Air Force test personnel at SSC from 1 to 3. Transitioned 1 USAF civil servant to NASA/SSC

Establish test equipment database

Plan: 4th Qtr FY 2001

Establish detailed test equipment database to support future development of improved scheduling/integration tools

ACCOMPLISHMENTS AND PLANS

Over the last three years, decisions made and actions taken by NASA's Rocket Propulsion Test Management Board (RPTMB) has resulted in an estimated total savings of approximately \$52 million, while the National Rocket Propulsion Test Alliance (NRPTA) has contributed another \$2 million. To date, the RPTMB has made 23 propulsion test assignments within NASA, across other agencies, and to industry facilities where it was in the best interest of NASA.

During FY 2001, the RPTMB orchestrated test assignments in response to the agency's NASA Research Announcement (NRA8-30) for the Space Launch Initiative. This activity encompassed over 50 test projects, including backup options. Efforts of the NRPTA assisted in the collaboration of NASA and DoD on the RBCC program by identifying existing facility options, developing test assignments and determining appropriate facility investments. Further collaboration with DoD and commercial test customers at SSC has also resulted in the planned turnover of the H-1 test facility to Lockheed Martin for development of a facility to support the DoD's Space Based Laser program.

During FY 2002, the agency 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. 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 in the upcoming fiscal year to execute planned facility closures and activate 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 also continue to be made in the development of improved scheduling tools, test technology, and modularization of test support hardware to reduce turnaround times, improve test management capabilities and improve overall operational efficiencies.

BASIS OF FY 2002 FUNDING REQUIREMENT

OSF CONTRIBUTION TO ACADEMIC PROGRAMS

	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002*</u>
	(Thousands of Dollars)		
OSF Contribution to Academic Programs	[3,100]	8,000	
Education Programs.		[2,500]	
Minority University Research and Education Programs		[5,500]	

* 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 FY 2002 information can be found in the Academic Programs section.

PROGRAM GOALS

The goal of the Office of Space Flight (OSF) Contribution to Academic Programs is to provide additional funding to support NASA direction for academic programs as set forth in the NASA Strategic Plan as one of the Agency's five contribution to the Nation's science and technology goals and priorities.

STRATEGY FOR ACHIEVING GOALS

In carrying out its Education Program, NASA is particularly cognizant of the powerful attraction the Human Exploration and Development of Space (HEDS) mission holds for students and educators. The unique character of the Human Exploration and Development of Space (HEDS) Strategic Enterprise's exploration, scientific, and technical activities has the ability to captivate the imagination and excitement of students, teachers, and faculty, and channel this into an investment which support NASA's Education Program.

In fulfilling its role to support excellence in education as set forth in the NASA Strategic Plan, the NASA Education Program brings students and educators into its missions and its research as participants and partners. NASA provides the opportunity for educators and students to experience first hand involvement with the Human Exploration and Development of Space (HEDS) Enterprise scientists and engineers, facilities, and research and development activities. Examples of such opportunities include the Learning Technologies Program, a new Undergraduate Internship Program, and the Graduate Student Researchers Program. The participants benefit from the opportunity to become involved in research and development endeavors, gain an understanding of the breadth of HEDS activities, and return to the classroom with enhanced knowledge and skills to share with the entire education community. Detail as to how this funding is utilized is located under the NASA Education portion of the budget.

The Human Exploration and Development of Space (HEDS) Strategic Enterprise investments in higher education institutions include Federally mandated outreach to the Nation's Historically Black Colleges and Universities (HBCUs) and Other Minority

Universities (OMUs), including Hispanic-Serving Institution and Tribal Colleges and Universities. This outreach is achieved through a comprehensive and complementary array of strategies developed in collaboration with the Office of Equal Opportunity Programs. These strategies are designed to create a broad-based, competitive aerospace research capability within Minority Institutions (MI's). This capability fosters new aerospace science and technology concepts by integrating HEDS Enterprise-related cutting-edge science and technology concepts, practices, and teaching strategies into MI's academic, scientific and technology infrastructure. As result, increasing the production of more competitive trained U.S. students underrepresented in NASA-related fields who, because of their research training and exposure to cutting-edge technologies, are better prepared to enter graduate programs or the workplace. Other initiatives are focused on enhancing diversity in the HEDS Strategic Enterprise's programs and activities. This includes exposing faculty and students from HBCUs and OMUs, and students from under-served schools, with significant enrollments of minority students, to the Enterprise's research efforts and outcomes, educational programs, and activities. To support the accomplishment of the Enterprise's mission, these programs are implemented through NASA Centers and JPL. The Centers and JPL support the MUREP through use of their unique facilities, program management and grant administration, and commitment of their personnel to provide technical assistance and assist in other facets of program implementation. Extensive detail as to how this funding is utilized is located under the MUREP portion of the budget.

SCHEDULE AND OUTPUTS

Extensive detail as to how this funding is utilized is located under the Academic Programs portion of the budget.

ACCOMPLISHMENTS AND PLANS

Beginning in FY 2002, the funding for the OSF Contribution to Academic Programs was transferred to the Academic Programs portion of the budget. Details on FY 2001 and FY 2002 activity can be found in that section.

BASIS OF FY 2002 FUNDING REQUIREMENT

TECHNOLOGY AND COMMERCIALIZATION

	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
		(Thousands of Dollars)	
HEDS Technology and Commercialization.....	--	19,956	19,000

PROGRAM GOALS

The goals of the Human Exploration and Development of Space (HEDS) Technology/Commercialization Initiative (HTCI) are four-fold. First, the HTCI will support HEDS analysis and planning for safe, affordable and effective future programs and projects that advance science and discovery, human exploration, and commercial development of space. Second, the Initiative will pursue research, development, and validation of breakthrough technologies and highly innovative systems concepts that open up new and potentially revolutionary system-, infrastructure- and architecture- level options for HEDS. Third, the HTCI will pursue technologies, systems and infrastructures that enable synergistic advancement of science-driven integrated human-robotic space exploration, as well as the commercial development of space. Finally, the Initiative will improve the affordability and the effectiveness with which HEDS will be able to achieve its 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 will support 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 will also make high-leverage, high-risk incremental progress toward innovative systems concepts and breakthrough technologies that could support market-driven, private sector decisions concerning commercial development of space.

STRATEGY FOR ACHIEVING GOALS

The strategic approach to accomplish the program goals of the HTCI involves three types of activities. First, HTCI will conduct systems analysis and advanced concept studies. These activities will include 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 will undertake HEDS-enabling advanced research and technology (HART) projects. These will be competitively selected (with a goal of 50% cost share from Industry, where appropriate), and will emphasize increases in safety, reduced risks and costs, and enabling new opportunities. Wherever possible, HART Projects will leverage other resources (including investments within NASA, other US government, industry, academia, internationally, etc.). Finally, the HTCI will conduct flight demonstration projects (including small missions, if funding permits). These flight projects will involve “new millennium-type” experiments for small robotic missions, on the International Space Station, or other carriers. This area will include flight projects that will be competitively selected (with a goal of 50% cost share from Industry, where appropriate).

SCHEDULE AND OUTPUTS

Systems Analysis and Advanced Concepts Studies - Activities supporting System Analysis and Advanced Concepts Studies will be integrated with the NASA Research Announcements (NRAs) supporting HEDS-enabling Advanced Research and Technology (HART) projects, as summarized below.

HEDS-enabling Advanced Research and Technology (HART) Projects

'01HEDS-enabling Research and Technology (HART) NASA Research Announcement
Plan: 1st Qtr FY 2001

Initial solicitation of HEDS systems studies and HART technology projects; coordinated with planning for later flight demonstration projects/options.

'01HEDS-enabling Research and Technology (HART) NRA Project Announcements
Plan: 3rd Qtr FY 2001

Announcement of awards from initial HART NRA.

'02HEDS-enabling Research and Technology (HART) NASA Competitive Solicitation
Plan: 1st Qtr FY 2002

Second solicitation of HEDS systems studies and HART technology projects; coordinated with planning for later flight demonstration projects/options.

'02HEDS-enabling Research and Technology (HART) Competitive Solicitation Announcements
Plan: 3rd Qtr FY 2002

Announcement of awards from second HART Competitive Solicitation.

Flight Demonstration Projects

'01HEDS Technology/Commercialization Initiative NASA Research Announcement for Flight Demonstration Projects
Plan: 4th Qtr FY 2001

Initial solicitation of HEDS flight demonstration projects, focusing on demonstration project definition studies; coordinated with HCTI studies and HART technology projects.

'02HEDS Technology/
Commercialization Initiative
Competitive Solicitation for
Flight Demonstration Projects
Plan: 1st Qtr FY 2002

Second solicitation of HEDS flight demonstration projects, focusing on demonstration project definition studies; coordinated with HCTI studies and HART technology projects.

'01HEDS Technology/
Commercialization Initiative
Competitive Solicitation for
Flight Demonstration Project
Definition Study Announcement
Plan: 2nd Qtr FY 2002
Revised: 1st Qtr FY 2002

Second solicitation of HEDS flight demonstration projects, focusing on demonstration project definition studies; coordinated with HCTI studies and HART technology projects.

ACCOMPLISHMENTS AND PLANS

During FY 2001 the Office of Space Flight (OSF) Advanced Programs Office (APO) implemented the first year of the HEDS Technology/Commercialization Initiative (HTCI), including competitively selected activities and specific in-house activities. Preliminary validation of technologies at the component level is underway, as well as planning for potential future investment options. Flight Demonstration Project options will be defined, as appropriate.

During FY 2002, the APO will continue the implementation of HTCI projects that are competitively selected in FY2001, as well as initiating, as resources permit, a second competitive solicitation for additional projects. NASA will also continue the process of strategic road map refinement and in-house studies, research and technology development, and flight experiment definition.

BASIS OF FY 2002 FUNDING REQUIREMENT

ENGINEERING AND TECHNICAL BASE

	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
		(Thousands of Dollars)	
Engineering and technical base	[85,200]	73,338	75,200

Note - FY 2000 is for comparison purposes only. See Payload Utilization and Operations section for more information.

PROGRAM GOALS

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), Marshall Space Flight Center (MSFC), and Stennis Space Center (SSC). ETB funds are used to: maintain the Centers' technical competence and ability to perform research; analysis and testing tasks; to solve present problems; and to reduce costs in developing programs, technologies, and materials. 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 required supporting the integrated Office of Space Science/HEDS robotic efforts.

STRATEGY FOR ACHIEVING GOALS

The complex and technically challenging programs managed by the Office of Space Flight (OSF), now and in the future, are most effectively carried out by sustaining a NASA "core" institutional technical base. It is vital to preserve essential competency and excellence. 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 ADP operations. ETB will ensure synergism among major NASA engineering programs. 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 enable future savings.

In FY 2001, funding for Engineering and Technical Base was moved from the Payload Utilization and Operations budget line item to a new budget line item, Investments and Support.

SCHEDULE AND OUTPUTS

Laboratories & facilities supported (KSC)	Maintains 11 science and engineering laboratories in support of 6 agency programs
Laboratories & facilities supported (JSC)	Maintains 156 science and engineering laboratories in support of 52 agency programs
Laboratories & facilities supported (MSFC)	Maintains 123 science and engineering laboratories and facilities in support of 42 agency programs
Laboratories & facilities supported (SSC)	Maintains 3 science and engineering laboratories in support of 2 agency programs
NASA Minority University Research and Education Program at JSC, KSC, MSFC & SSC	Award education and research grants

ACCOMPLISHMENTS AND PLANS

FY 2000 Accomplishments can be found in the *Payload and Utilization Operations* section.

In FY 2001 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, anomaly resolution, and systems engineering activities.

In FY 2001, a new budget line item was established for Rocket Propulsion Testing by transferring the portion of ETB budget supporting propulsion testing.

In FY 2001 MSFC will maintain ETB's institutional base requirements funding; award education and research grants to Historically Black Colleges and Universities (HBCU) to promote science and technology; 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; and ETB funding for Propulsion Testing will transfer from MSFC to SSC.

In FY 2001, 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. FY2001 contains many critical programmatic milestones that will require extensive use of our laboratories and facilities. NASA will continue to need 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 2001, KSC Materials Science Laboratory will continue providing analysis and test support to Shuttle, Space Station, Reusable Launch Vehicles, Payloads and Life Sciences programs. In the area of technology development, the KSC Materials Science Laboratory will establish Electrostatic Discharge and Corrosion Engineering Testbeds.

In FY 2002, 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 2002, KSC Materials Science Laboratory will continue providing analysis and test support to Shuttle, Space Station, Reusable Launch Vehicles, Payloads and Biological and Physical Research programs. In the area of technology development, the KSC Materials Science Laboratory will continue Electrostatic Discharge and Corrosion Engineering Testbeds.

In FY2002, MSFC ETB activities will include test area support to MSFC programs and projects that include 2nd Gen and in-house research projects; engineering, science and technical services for core capability tool development and maintenance support to Shuttle, 2nd Gen RLV, and the Propulsion Research Center; and CAD/CAM applications and hardware support to Shuttle, Station, Advanced Space Transportation, Science and in-house projects.

BASIS OF FY 2002 FUNDING REQUIREMENT

HEDS INSTITUTIONAL SUPPORT

	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
		(Thousands of Dollars)	
Institutional Support to HEDS Enterprise.....	[1,027,000]	[1,143,300]	1,181,500
<u>Research and Program Management</u>	<u>[947,600]</u>	<u>[1,001,500]</u>	<u>1,083,088</u>
Personnel and Related Costs.....	[701,700]	[765,500]	831,521
Travel	[22,400]	[25,700]	25,159
Research Operations Support.....	[223,500]	[210,300]	226,408
<u>Construction of Facilities</u>	<u>[79,400]</u>	<u>[141,800]</u>	<u>98,412</u>
Full-Time Equivalent (FTE) Workyears	<u>[7,416]</u>	<u>[7,779]</u>	<u>8,092</u>

Note - FY 2000 and FY 2001 data in this section are for comparison purposes only. See *Mission Support* sections for more details.

PROGRAM GOALS

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 79% of the requested funding. Administrative and other support is approximately 19% of the requests. The remaining 2% of the request are required to fund travel necessary to manage NASA and its programs.

Construction of Facilities (CoF)

This budget line item provides for discrete projects required for components of the basic infrastructure and institutional facilities and almost all are for capital repair. NASA facilities are critical for the HEDS Enterprise, to sustaining the future of aeronautics and advanced space transportation, which both support critical national capabilities that are used not only for NASA, but for military and private industry users as well. 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.

SCHEDULE AND OUTPUTS

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. Similarly, 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 93% of JSC's Institution cost in FY 2002.

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 94% of KSC's Institution cost in FY 2002.

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 61% of MSFC's Institution cost in FY 2002.

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, Multi Purpose Logistics Module and Interim Control 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, the Payload Operations Integration Center, ISS Payload Data Services System and the ISS Payload Planning System. MSFC's Lead Center Microgravity Research responsibilities include managing the development of major facilities to be permanently housed on the ISS.

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 58% of SSC's Institution cost in FY 2002.

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 8% of ARC's Institution cost in FY 2002. 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 22% of DFRC's Institution cost in FY 2002. 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, landing support of crew and science requirements.

Glenn Research Center (GRC)

The Human Exploration and Development of Space Enterprise funds approximately 23% of GRC's Institution cost in FY 2002. 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 2002. 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 35% of JPL's Institution cost in FY 2002 in the areas of other than direct Research Operations Support and Construction of Facilities funding. JPL manages NASA's Deep Space Network (DSN) communication complexes for the Johnson Space Center, the Space Operations Lead Center, a critical program element of Space Operations. DSN communications complexes are strategically placed on three continents - in California's Mojave

Desert, in Australia, and in Spain. The DSN provides the two-way communications link that guides and controls spacecraft and brings back images and other scientific data. The DSN, the largest and most sensitive scientific telecommunications system in the world, also performs radio and radar astronomy observations for the exploration of the solar system and the universe.

Goddard Space Flight Center (GSFC)

The Human Exploration and Development of Space Enterprise funds approximately 14% of GSFC's Institution cost in FY 2002.

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.

Although the Johnson Space Center is designated as the Space Operations Lead Center, GSFC personnel manage a number of critical program elements, including: operation of the Tracking and Data Relay Satellite System (TDRSS); the development of the replenishment TDRSS spacecraft; mission control, data processing, and orbit/attitude computation support; operating the Space Tracking and Data Network (STDN), the NASA Communications (NASCOM) Network, and the Aeronautics, Balloons and Sounding Rocket Program. The NASCOM Network links the stations of the Deep Space Network (DSN), STDN, TDRSS, and other tracking and data acquisition elements with control centers and data processing and computation centers.

Headquarters (HQ)

The Human Exploration and Development of Space Enterprise funds approximately 35% of HQ's Institution cost in FY 2002. 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.