Marshall Space Flight Center FY 2000 Implementation Plan

October 1999

The NASA Vision

**NASA is an investment in America's future.
As explorers, pioneers, and innovators, we boldly expand frontiers in air and space to inspire and serve America and to benefit the quality of life on Earth.**

The NASA Strategic Enterprise Goals

Human Exploration and Development of Space

- Expand the space frontier.
- Expand scientific knowledge.
- Enable and establish a permanent and productive human presence in Earth orbit.
- Expand the commercial development of space.
- Share the experience and discovery of human space flight.

Aero-Space Technology

- Enable U.S. leadership in global civil aviation through safer, cleaner, quieter, and more affordable air travel.
- Revolutionize air travel and the way in which aircraft are designed, built, and operated.
- Enable the full commercial potential of space and expansion of space and exploration.
- Enable and provide world-class Research and Development services including facilities and expertise, and proactively transfer technologies in support of industry and U.S. Government Research and Development.

Space Science

- Establish a virtual presence throughout the solar system, and probe deeper into the mysteries of the Universe and life on Earth and beyond—a goal focused on the fundamental science we will pursue.
- Pursue space science programs that enable and are enabled by future human exploration beyond low-Earth orbit—a goal exploiting the synergy with the human exploration of space.
- Develop and utilize revolutionary technologies for missions impossible in prior decades—a goal recognizing the enabling character of technology.
- Contribute measurably to achieving the science, mathematics, and technology education goals of our Nation, and share widely the excitement and inspiration of our missions and discoveries—a goal reflecting our commitment to education and public outreach.

Earth Science

- Expand scientific knowledge of the Earth system using NASA's unique capabilities from the vantage points of space, aircraft, and in situ platforms.
- Disseminate information about the Earth systems.
- Enable productive use of Mission To Planet Earth science and technology in the public and private sectors.

Director's Message

The Marshall Space Flight Center is pleased to present its FY 2000 Implementation Plan. The plan outlines Marshall's roles and responsibilities, defines metrics to implement Agency and Enterprise goals and objectives, and identifies the future direction of the Center. As indicated by the plan, we are focused on enabling the success of the Agency's mission through our role as Center of Excellence for Space Propulsion and our assigned mission areas in Space Transportation Systems Development, Microgravity, and Space Optics Manufacturing Technology.

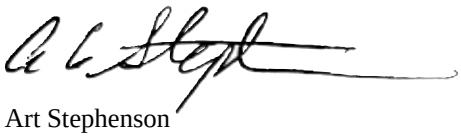
Our first commitment is to safety and mission success. We are dedicated to promoting safety in all we do. Whether it is the reliability of the Space Shuttle or *International Space Station* assembly and operation, ensuring a safe work environment, or making a safe commute to and from work, our goal is to prevent human injury and loss of property and to ensure the safety of all operations and products.

The programs we implement through this plan will be crucial to the future of Marshall and the Nation's space program. The Center will support the Human Exploration and Development of Space Enterprise by continuing to oversee and upgrade Shuttle propulsion elements and by continuing our roles in supporting the construction and operations of the *International Space Station*. We will also pursue microgravity research and space product development initiatives. In support of the Aero-Space Enterprise, we will demonstrate reusable launch vehicle technologies that will increase reliability and decrease the cost of access to space. This includes the flight-tests of the X–34, X–33, X–37, and other Pathfinder programs. Technology development in diffractive optics and coatings applications will continue to support the Space Science Enterprise. The Center will also continue to manage operations for Chandra, the world's most powerful x-ray observatory. Our Global Hydrology and Climate Center will continue to support the Earth Science Enterprise. These are only a few of the many efforts that we will pursue in fiscal year 2000.

The plan also presents our core values, which serve as guiding principles in our decision making, influencing not only our behaviors but our thought processes. We realize that our employees are our most important resource, that we are accountable to our customers and their satisfaction, that excellence must be ingrained in all we do, that we must work as a team, and that creativity and innovation are required to make a significant difference. Our success is dependant upon our adherence to these values and standards.

To be successful in meeting NASA's vision, our teamwork extends to all NASA centers, other government agencies, academia and industry. We depend on our partners' diverse, highly skilled and talented workforce and unique capabilities to meet the challenges of the future.

In order to meet our metrics for fiscal year 2000, we will strive to improve every day. I know that we will meet these challenges with the dedicated support of the Marshall team, our NASA and industry partners, and our contractors. Every challenging journey requires a roadmap. The Fiscal Year 2000 Implementation Plan is the Marshall roadmap to an exciting future. I encourage every member of the Marshall team to read this plan and understand their contribution to the success of Marshall and NASA.



Art Stephenson
Center Director

Marshall Space Flight Center

Mission

Bringing people to space; bringing space to people.
We are world leaders in access to space and the use of space for research and development to benefit humanity.

Goals

- Establish MSFC as number one in safety within NASA.
- Develop and maintain the NASA preeminence in space propulsion to enable the exploration and development of space.
- Lead the research and development of space transportation technologies and systems that support our customers' needs.
- Lead NASA's Microgravity Research and Space Product Development Programs, and develop and maintain capabilities required to meet national research objectives.
- Lead the Agency in the development of lightweight, large-aperture space optics manufacturing technology for use in achieving the mission goals of NASA's strategic enterprises.
- Enhance and sustain a highly skilled, diverse, and motivated workforce committed to safety while working in a creative and productive environment in support of cutting-edge systems and technology development.

Center of Excellence

- Space Propulsion

Mission Areas

- Space Transportation Systems Development
- Microgravity
- Space Optics Manufacturing Technology

Commitment to Safety and Mission Success

Our goal: Establish MSFC as number one in safety within NASA.

MSFC's Safety Policy

MSFC will strive to prevent human injury and occupational illnesses and ensure safety of all operations and products.

MSFC Safety Principles

- Unsafe conditions are correctable.
- All mishaps can be prevented.
- Management is responsible and accountable for prevention of on-the-job mishaps (incidents, close calls, etc.).
- All mishaps must be reported, investigated, and the causes rectified.
- Management is responsible for training employees to work safely.
- Each employee is responsible for safety.
- Off-duty safety is an important part of MSFC's safety success.
- A comprehensive safety and risk management program increases the probability of mission success.

Safety Management Programs and Techniques

MSFC has implemented unique and innovative management techniques to improve safety of the public, the astronauts and pilots, the NASA workforce, and high-value equipment and property.

Current Safety Processes

- Safety and Mission Assurance (S&MA) is organized to effectively support the MSFC organizational structure while maintaining collocation in major project offices and contractor plants.
- Senior management safety review process for all payloads involves most senior managers.
- S&MA internet web pages contain pertinent employee safety information and are frequently enhanced.
- The Safety Concerns Reporting System has been improved and is used frequently by employees to report concerns.
- Risk Management planning, consulting and training are available to support project risk management and development.
- All MSFC managers and supervisors have been trained in MSFC's new occupational safety and health philosophy and process.
- All MSFC Safety and Quality Management System documentation is contained in a single Integrated Document Library.
- MSFC implemented an occupational safety, health and environmental committee structure to facilitate a total MSFC safety program.
- All major management meetings include a safety discussion.
- Managers and supervisors conduct monthly workplace occupational safety and health audits with employees and ensure employees have appropriate safety training.
- Occupational safety and health information is widely disseminated using multiple media.

FY 2000 Safety Initiatives

Use the Agency Safety Initiative Model to reinvigorate the MSFC Safety Program. Implement the Voluntary Protection Program (VPP) and complete OSHA's VPP Star Certification.

Management Commitment and Employee Involvement

- Make worksite safety documentation user friendly
- Implement employee involvement activities
- Include safety performance in job descriptions and performance evaluation plans
- Ensure public safety during X–33 and X–34 flight testing

System and Worksite Hazard Analysis

- Perform job hazard analyses
- Improve communications of lessons learned from mishaps and close calls

Hazard Prevention and Control

- Train supervisors to perform job safety analyses
- Develop contractor safety performance evaluation methods

Safety and Health Training

- Provide all employees with safety training
- Benchmark the safety programs at other NASA Centers and contractors to improve MSFC safety programs

Safety and Mission Success Metrics

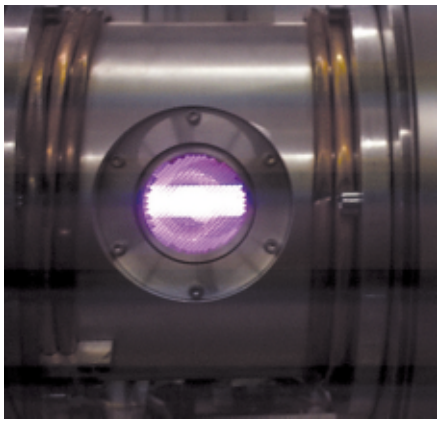
- Achieve a 60-percent increase in predicted reliability of the Space Shuttle over the 1995 baseline
- Reduce lost time mishap rate by 20-percent per year compared to the FY98 baseline of 0.16 over 5 years and better the NASA goal each year
- Complete incorporation of safety into the MSFC Integrated Document Library system by the end of FY 2000
- Complete the OSHA Voluntary Protection Program Star certification by the end of FY 2000
- All MSFC projects successfully complete their safety reviews on time

Center of Excellence:
Space Propulsion

Our goal: Develop and maintain the NASA preeminence in space propulsion to enable the exploration and development of space.

We support—

- Human Exploration and Development of Space Enterprise
- Aero-Space Technology Enterprise
- Space Science Enterprise
- Industry and Commercial Needs
- Other Federal Agencies



Gas Dynamic Mirror Fusion Propulsion Experiment.

Test of the low-cost Fastrac rocket engine.

As the NASA Center of Excellence for Space Propulsion, Marshall is leading the development of advanced Earth-to-orbit and in-space propulsion systems and technologies.

NASA engineers are working to enable significantly lower cost propulsion systems with higher performance and aircraft-like reliability. Technologies will be developed and demonstrated at several levels including component, subsystem, and system in both ground and flight test, where appropriate.

Marshall provides space propulsion services to all enterprises and provides critical leadership for efforts among NASA field centers, industry, academia, and other Government agencies.

The world-class capability of skilled personnel, processes, and facilities will be maintained and enhanced to develop new and innovative space propulsion technologies, to report these technology advances in a timely manner, and to assist in their transfer into commercial ventures that augment America's industrial growth and benefit the quality of life on Earth.

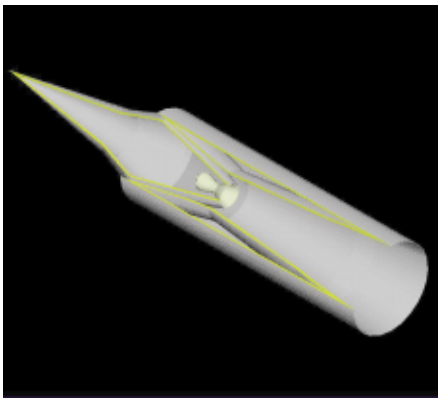
Earth-to-Orbit Propulsion

A critical element to increasing safety and lowering the cost of space access is increasing the performance margin of Earth-to-orbit propulsion systems while lowering the operations, development, and manufacturing costs.

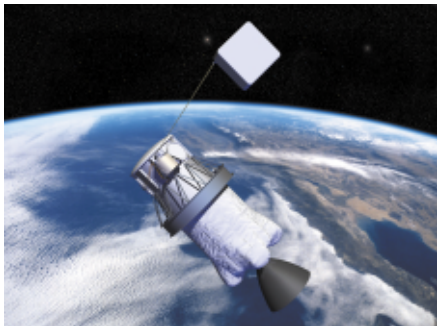
Near-term activities are focused on enabling a long life, high thrust-to-weight rocket-based reusable launch vehicle around the end of the decade. These technologies include advanced altitude compensating nozzle concepts such as aerospike, lightweight composite thrusters, composite lines and ducts, ceramic turbines, composite housings, and other low-cost components.

Building on near-term developments, mid-term technology activities are centered around enabling air-breathing combined cycle rocket engines. Building on synergy between space and aeronautics activities, Marshall has initiated flowpath demonstrations of these bold, new concepts. Mid-term efforts also include evaluation of new engine cycles like pulse detonation concepts and use of high-energy density fuels. Efforts will continue to further increase life and thrust-to-weight of rocket engines.

Long-term technologies include revolutionary off-board energy sources, such as magnetic launch assist, ground-based laser propelled systems, and nonchemical rocket/air-breathing combined cycle engines.



Combined Cycle Engines for increased mission specific impulse.



Propulsive Small Expendable Deployer System (ProSEDS).

Space Propulsion Metrics

- Deliver Fit Check Fastrac engine to X–34 project in first quarter of FY00 and certify in third quarter of FY00
- Fly ProSEDS Tether propulsion flight experiment at first opportunity after August 2000
- Complete design and demonstration of a portable antiproton trap in FY00
- Demonstrate RLV propulsion technologies including:
  - Lightweight long-life thrust cells
  - Polymer matrix lines, valves, and ducts
  - Advanced unshrouded impeller design
  - Advanced high-efficiency turbine design.
- Define combined cycle flight demonstration in FY00
- Complete *ISS* Propulsion Module CDR in FY 2000
- Complete X–33 XRS–2200 linear aerospike hot fire at SSC
- Continue to upgrade facilities and maintain safe, cost-effective state-of-the-art test capabilities
- Prepare *ISS* Interim Control Module for late FY00 availability.

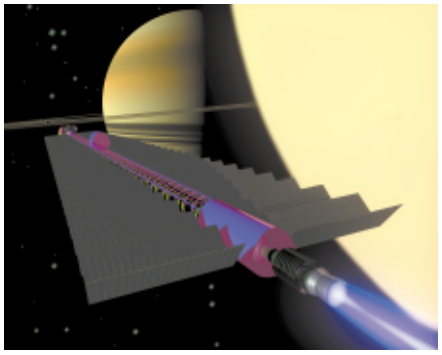
In-Space Propulsion

Over 70 percent of all payloads need transportation beyond low-Earth orbit. A primary driver to enabling these systems is increasing the efficiency while decreasing the mass of the propulsion system.

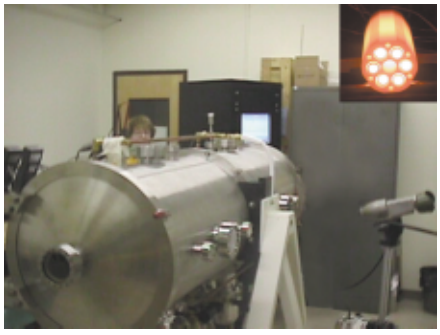
Marshall is pursuing technologies to enable Earth-orbital and planetary transportation that include advanced chemical engines, solar thermal and solar electric propulsion systems, and electrodynamic tethers.

Ambitious missions to destinations within the solar system will require significant improvements in propulsive capability. This is especially true for human exploration which will require dramatic reductions in trip time with the assurance of safe and reliable mission operations. The technologies being researched include propulsion concepts based on fission and fusion energy sources.

Eventual missions to near-interstellar space and eventually the stars will require performance well beyond the capabilities envisioned for interplanetary space flight. Marshall's Propulsion Research Center (PRC) is meeting the challenge through its research activities in beamed energy sails, advanced fusion systems, matter/antimatter annihilation, and speculative motive physics.



The use of fusion for propulsion has the potential to open the entire solar system for exploration.



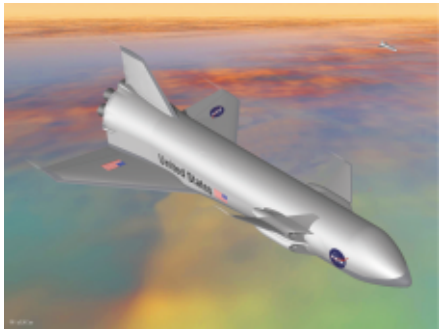
Heatpipe Bimodal Reactor Module Test.

Mission:
Space Transportation Systems Development

Our goal: Lead the research and development of space transportation technologies and systems that support our customers' needs.

We support—

- Human Exploration and Development of Space Enterprise
- Aero-Space Technology Enterprise
- Space Science Enterprise
- Earth Science Enterprise
- Industry and Commercial Needs
- Other Federal Agencies



Reusable First Stage (RFS) in flight.

MSFC has responsibility for research, technology maturation, design, development, and integration of space transportation and propulsion systems. This includes both reusable space transportation systems for Earth-to-orbit applications, as well as vehicles for orbital transfer and deep space transportation.

Space Shuttle Elements

MSFC's Space Shuttle projects manage safe, continuous, robust, and cost-effective operations for the Space Shuttle propulsion elements: External tank, solid rocket booster, reusable solid rocket motor, and Space Shuttle main engine. MSFC will continue to streamline operations and aggressively develop and implement significant upgrades to enhance safety, meet the manifest, improve mission supportability, and improve the system to sustain the Space Shuttle for its lifetime.

MSFC is responsible for evaluation and potential implementation of significant (Phase IV) Shuttle upgrades including a new liquid propulsion reusable first stage (RFS) as well as other upgrade options.

Space Shuttle Metrics

- Maintain less than one in-flight anomaly (IFA) per mission
- Streamline operations
  - Continue the transition of routine operations from a government role of oversight to insight.
  - Transition Shuttle prime contracts to the Space Flight Operations Contract, based on project maturity and stability.
- Achieve a 60-percent increase in predicted reliability of the Space Shuttle over the 1995 baseline
  - Projections based on the Quantitative Risk Assessment indicate a 95-percent improvement (48-percent risk reduction) for ascent upon incorporation of Space Shuttle main engine upgrades:
    – Block II: Fourth Quarter FY 2000.
- Evaluate improvements in Shuttle systems safety, operability and cost by incorporating upgrades such as:
  - Upgraded solid rocket motors or new liquid propulsion reusable first stages
  - ET friction stir weld and repair processes.

Shuttle Atlantis.

The X–34 demonstrates technologies for the Reusable Launch Vehicle Program.

Advanced Space Transportation Technology

MSFC's Space Transportation Directorate will significantly increase safety while reducing the cost of future space transportation systems. MSFC, in partnership with the space launch industry and other NASA centers, is dedicated to developing advanced technologies and systems to enable new civil, commercial, and military mission capabilities; and encouraging commercial investment in, and operation of, space transportation systems.

MSFC leads the Nation in space transportation by combining the development of ground-based state-of-the-art technologies with the validation of key technology products in a series of flight demonstrations (X–33, and Pathfinder Programs/Projects). MSFC efforts are focused on substantially reducing the risk associated with developing a full-scale operational second generation reusable launch vehicle (RLV) early in the next decade while setting the stage for hundredfold reductions in the cost of third-generation space transportation systems in 25 years.

The Advanced Space Transportation Program (ASTP) will pursue the development of revolutionary advancements in space access with the potential to increase safety by a factor of 10,000 and reduce costs to hundreds of dollars per pound of payload versus the thousands of dollars measured today. In-space focused technologies will demonstrate performance improvements to reduce trip time and mass by a factor of 2 to 3 and reduce cost by a factor of 10 in 15 years. ASTP will provide the basic building blocks of propulsion, airframe, operating and range, and vehicle systems technologies to support flight demonstration projects, while focusing on future breakthrough technologies beyond the next generation.

Advanced Concepts

The Advanced Concepts Group (ACG) envisions and creates new space transportation concepts and preliminary designs that enable low-cost space access, exploration, space development, and science.

X–33.

The ACG indentifies new technologies and innovative concepts to meet space program goals and evaluates their technical feasibility. The ACG conducts advanced mission studies; conceptualizes designs that meet stringent safety, quality, and life cycle cost requirements; develops analytical tools; and supports technology demonstrations.

X–33 Program

The X–33 Program will demonstrate the key design and operational aspects of a single stage to orbit (SSTO) RLV rocket system. It will accomplish this through suborbital vehicle flight tests from the Launch Operation Center at Dryden Flight Research Center. The primary objectives of the X–33 Program are technology demonstrations (flight and ground) to reduce the business and technical risk to enable privately financed development and operation of a next generation reusable space transportation system; design and test of the X–33 flight system, subsystems, and major components to ensure their traceability and scaleability to a full-scale SSTO rocket system; improved mass fraction for vehicle structures and improved thrust to weight for rocket propulsion systems; and demonstration of key "aircraft-like" operational attributes required for a cost-effective SSTO rocket system including operability, reusability, affordability, and safe abort.

X–37.

Rocket-Based Combined Cycle and magnetic sled advanced technology demonstrator concept.

Key to accomplishment of these objectives is the contribution of all NASA Centers. Through partnerships with industry, significant contributions have been made by the Ames and Langley Research Centers in the aero-thermal/Thermal Protection System (TPS) technologies development arena. Another major activity is housed at the Stennis Space Center, where the XRS2200 linear aerospike engine is being tested.

Pathfinder Programs

The Pathfinder Program develops for flight, and flight demonstrations, advanced space transportation technologies through the use of experimental vehicles and flight experiments. The X–34 is the first of the Pathfinder experimental vehicles. It is a Rocket Plane Demonstrator Technology Test-Bed powered by the MSFC-developed Fastrac engine and is capable of speeds up to Mach 8. Unpowered flight tests begin in mid FY 2000 and powered flight tests begin in late FY 2000.

The X–37 is a Space Plane Orbital Flight Demonstrator Technology Testbed which advances the state-of-the-art technology readiness level of approximately 41 technologies (embedded and carry-on experiments) through flight demonstration. The first unpowered flight of the X–37 is scheduled for early CY 2002 and the first orbital flight is scheduled for late CY 2002 from the Shuttle payload bay.

Several NASA Centers play vital roles in the X–37 Project including Langley where the wind tunnel testing; aerodynamics analysis; aero-heating analysis; and design, analysis and testing of the Ceramic Matrix Composite (CMC) ruddervators and flaperons are performed.

Pathfinder flight experiments demonstrate a number of advanced launch vehicle and spacecraft technologies such as nontraditional propulsion systems, improvements and innovations to conventional propulsion systems, safe abort capability, vehicle health management systems, composite structures, and new thermal protection systems. These experiments will be flown on a variety of platforms including the Pathfinder demonstration vehicles, satellites, the Space Shuttle, reentry vehicles, and other appropriate systems. Two of these experiments are the ProSEDS and the Hall Effect Thruster. The ProSEDS flight experiment will demonstrate the electrodynamic tether propulsion concept and the T–160E Hall Effect Thruster System will demonstrate the Hall Solar Electric Propulsion concept. Glenn Research Center is the designated lead for electric propulsion and utilizes the expertise of the Jet Propulsion Laboratory and MSFC in this technology area.

Advanced Transportation Technology Metrics

- Begin flight tests of the X–33 and demonstrate key technologies in CY00
- Complete X–34 captive carry test in FY00
- Initiate flight of the X–34 and demonstrate key technologies in CY00
- Complete Spaceliner 100 technology roadmap in FY00
- Demonstrate 2nd generation RLV technologies by the end of calendar year 2000 including:
  - Non-autoclave processing and lox compatible composite structures
  - Composite joining
  - Integrated structure and TPS
  - Hot structures and TPS.
- Complete 250k hybrid testing in the first quarter of FY00
- Complete ground demonstration of 100 percent design life on the NSTAR ion engine in FY00
- Complete combined cycle propulsion flight demonstrator definition in the second quarter of FY00
- Complete 500-hour test of 10 kW Hall Electric Thruster in FY00
- Conduct X–40A approach and landing test
- Launch SHARP–B2 flight experiment
- Complete proof and structural load tests of X–33 composite LH_2 tank
- Build and deliver X–38 deorbit propulsion stage for integration into the flight demonstrator in late FY00
- Complete Rocket-Based Combined Cycle flowpath testing in FY00
- Complete X–37 design in FY00.

Mission:
Microgravity

Our goal: Lead NASA's Microgravity Research and Space Product Development Programs, and develop and maintain capabilities required to meet National research objectives.

We support—

- Human Exploration and Development of Space Enterprise
- NASA-Approved Principal Investigators
- National Scientific Community
  - Academia
  - Industry
  - Government
- Commercial Space Centers and Industry Partners
- American Companies/Industries

Dendrites, which are materials microstructures, are frequent objects of study in microgravity.

Payload specialist Dr. Roger Crouch conducting research in a microgravity glovebox.

MSFC's Microgravity Research Program Office (MRPO) is responsible for implementing the Agency's microgravity initiatives. MSFC's efforts enable scientific and commercial researchers the unique opportunity to use the low-gravity environment of space as a catalyst to generate new knowledge, products, and services that improve the quality of life on Earth.

MRPO accomplishes this mission by providing program management of research and associated instrumentation, apparatus and facilities sponsored by the Human Exploration and Development of Space Enterprise (HEDS). Resources are provided by the Office of Life and Microgravity Sciences and Applications through both its Microgravity Research and its Commercial Research and Space Product Development Divisions, and the Office of Space Flight through its International Space Station Payloads Office.

The MRPO implements MSFC's Microgravity Lead Center assignments by administering and managing grants, cooperative agreements and contracts; managing the development of specialized instrumentation, flight hardware and multi-user research facilities; and manifesting flight opportunities on parabolic aircraft, suborbital rockets, free-flyers, the Space Shuttle, and the *International Space Station* (ISS). MRPO provides research support through gloveboxes, accelerometers and vibration isolation opportunities; conducts advanced and focused technology development programs; and provides education and outreach to the research community, industry, and the public. MRPO delegates technical management of individual science disciplines to supporting field centers. Supporting Centers include the Jet Propulsion Laboratory (Fundamental Physics), the Glenn Research Center (Combustion Science and Fluid Physics and Transport Phenomena), and the Marshall Space Flight Center (Biotechnology and Materials Science). The Johnson Space Center supports the Biotechnology subdiscipline of Cellular Science. Program Management oversight and control are accomplished by MRPO with direct involvement of the supporting field centers through the Microgravity Research Team. The MRPO also collaborates with other programs within the Agency and the HEDS Enterprise, and implements international agreements and collaborations with international partners. Current Agency collaborations include participation in the Decadal Planning Team, membership on the In-Situ Resource Utilization Steering Committee, participation in the development of radiation shielding strategies and diagnostics, Cross-Enterprise Technology Development collaborations, and membership on the *ISS* Preplanned Program Improvement initiative. In addition, as a member in the joint efforts of the Advanced Project Division of the Office of Space Flight and the Office of Life and Microgravity Sciences and Applications, Agency activities to promote the commercial development of space have been initiated.

Microgravity Research Program

The mission of the Microgravity Research Program is to use the environment of space to obtain new knowledge and increase the understanding of natural phenomena in biological, chemical and physical systems, especially with regard to the effects of gravity which may be obscured on Earth. The Microgravity Research Program also facilitates the application of such knowledge to commercially viable products, processes and services.

Microgravity researchers are provided the unique opportunity to study natural processes and phenomena in the near absence of gravity. Comparison between ground- and space-based research data allows scientists to accurately understand the role gravity plays in everyday life. Low-gravity research also allows scientists the opportunity to explore phenomena normally obscured by the effects of gravity. Scientists selected into the program perform peer-reviewed investigations in the research areas of biotechnology, combustion science, fluid physics, fundamental physics, and materials science. MSFC manages the implementation of the program, including the development of major facilities to be permanently housed on the *International Space Station* and available to the science community for unique low-gravity research opportunities.

Microgravity Research Metrics

- Support at least 425 research investigations
- Support at least 12 Science Concept Reviews (SCR) and 20 Requirements Definition Reviews (RDR)
- Conduct research on at least 7 parabolic aircraft flight campaigns for selected science and engineering data, and 2 suborbital rocket flights
- Conduct radiation shielding workshop to evaluate and prioritize materials candidates based on established performance criteria
- Launch one Spread Across Liquids (SAL) campaign and one Extensional Rheology Experiment (ERE)
- Conduct an In-Situ Resource Utilization Workshop to evaluate and prioritize processing issues to be resolved by materials science research based on established performance criteria
- Conduct requirements definition for granular flows, fluids, and dust management experiment
- Issue STS-95 Mission Report.

The Forced Flow Flame-Spreading Test was designed to study flame spreading over solid fuels when air is flowing at a low speed in the same direction as the flame spread.

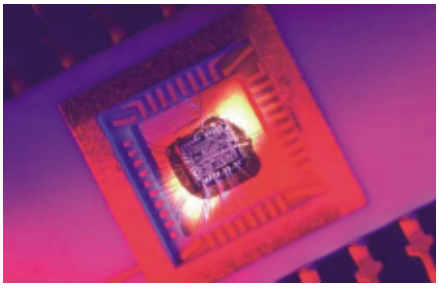
Microgravity Science and Applications

MSFC is responsible for implementing the Materials Science and Biotechnology Science disciplines and the Glovebox Program within the Microgravity Research Program. To implement the program, MSFC has a unique team of scientists, engineers and managers teamed with industry, academia, and international individuals and organizations to establish and maintain world-class research in those fields. MSFC also is responsible for providing glovebox facilities on the Shuttle and *ISS* for the purpose of supporting low-cost and fast-track investigations from all disciplines of the Microgravity Program.

MSFC is responsible for the financial and managerial administration of all selected investigations, assistance in the definition of focused science objectives, access to ground and flight facilities and carriers, definition and development of new enabling research technology, definition and development of scientific apparatus and facilities, mission operations support, and transfer of the accumulated microgravity database.

Microgravity Science and Application Metrics

- Perform verification testing and conduct acceptance reviews on microgravity science glovebox in preparation for turnover to *ISS* for integration
- Initiate flight and ground investigation grants for 98 Materials Science NASA Research Announcements.



The Space Vacuum Epitaxy Center has assisted advances in electronics, including a semiconductor IR laser and the commercial development of thin film solar cells.

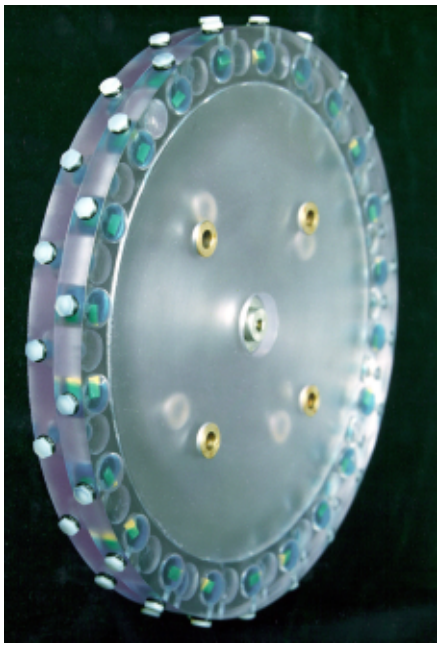
Commercial microgravity research is available to help industry study and improve on procedures, protocols, and drugs.

Space Product Development Program

The mission of the Space Product Development (SPD) Program is to encourage and facilitate the use of space for the development of commercial products and services. In fulfilling this responsibility to encourage the fullest commercial use of space, the SPD program is managing an organization of Commercial Space Centers (CSC's) that have successfully employed methods for encouraging private industry to exploit the benefits of microgravity research. The unique opportunities of this environment are being made available to private industry in an effort to develop new competitive products, create jobs, and enhance the quality of life. The success of the CSC's research is evidenced by the increasing amount of industrial participation in commercial microgravity research and the potential products nearing marketability.

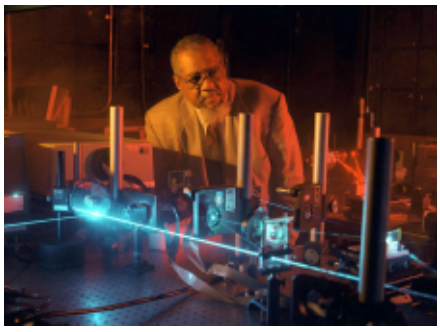
Space Product Development Metrics

- Provide an augmentation to the cooperative agreement with the Center for Macromolecular Crystallography for an Infectious Disease Initiative
- Fund development and advocate accomodations for at least three commercial payloads.



The ADvanced SEParation (ADSEP) commercial payload is making use of major advances in separation technology.

NASA Administrator Dan Goldin (left), during a visit at Children's Hospital of Wisconsin in Milwaukee, Wisconsin, discussed how NASA's special lighting technology may soon be applied to, and studied for, the treatment of specific cancer tumors.



Dr. Donald Frazier pursues optical computing through research in nonlinear optics.

Mission:
Space Optics Manufacturing Technology

Our goal: Lead the agency in the development of lightweight, large-aperture Space Optics Manufacturing Technology for use in achieving the mission goals of NASA's strategic enterprises.

We support—

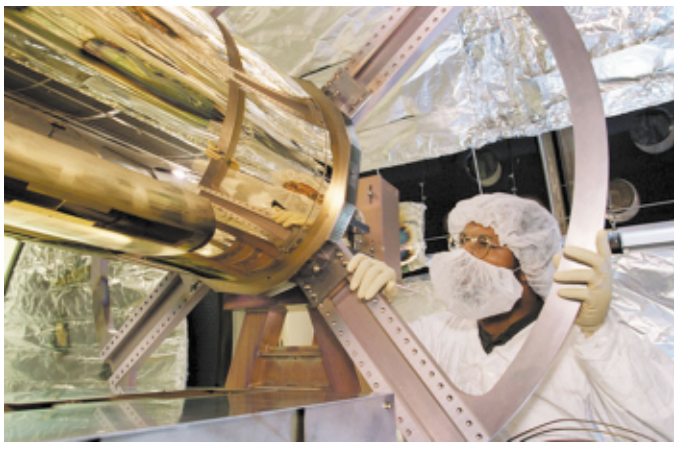
- HEDS Enterprise
- Space Science Enterprise
- Earth Science Enterprise
- Aero-Space Technology Enterprise
- Industry and Commercial Needs
- Other Federal Agencies

X-ray Calibration Facility Test Chamber.

The development of lightweight space optical systems is of vital importance to NASA's continued exploration of the universe. Lightweight optics and optical systems are essential components of NASA's commitment to reducing launch costs while increasing payload utility.

The MSFC Space Optics Manufacturing Technology Center (SOMTC) is actively developing new enabling techniques for the manufacture of low-mass, large-aperture space optical systems, while also managing technology development for potential use in space observatories such as the Next Generation Space Telescope and the Constellation X-ray missions.

SOMTC is a national resource providing numerous unique capabilities and facilities in support of NASA-wide efforts including space science and Earth science imaging systems, advanced propulsion systems, and Human Exploration and Development of Space.



Precision coating of 05-m Constellation X-ray mandrel in Large Coating Chamber.

SOMTC's capabilities and facilities have been organized into four areas: The Advanced Optical Systems Development Group; the Diffractive Optics Coatings, and Surface Morphology Development Group; the Optical Design, Analysis, and Fabrication Group; and the Optical Test Group.

Advanced Optical Systems are being developed to include ultra-lightweight optical technologies (e.g., replicated optics, adaptive optics, ultra-lightweight thin membrane optics, and advanced solar power systems). Replication techniques will be applied to enable laser propulsion craft studies and the manufacture and development of lightweight normal incidence mirrors and other lightweight optical subsystem components and optical instruments to support the imaging needs of NASA as well as other government agencies. Advanced telescope concepts and technologies are being developed to support extrasolar planet detection, space-based interferometry, x-ray telescopes and interferometry, ground-based large-aperture telescopes and low-cost, disposable space telescopes.

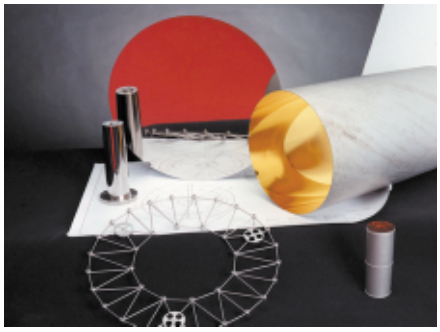
Diffractive Optics, Coatings, and Surface Morphology is developing advanced optical manufacturing technologies in support of key NASA enterprise needs. Research and development activities are currently underway for technologies supporting advanced solar power, laser propulsion, spacecraft formation flying, cosmic ray detection, and LIDAR scanning.

Optical Design, Analysis, and Fabrication provides the capability and facilities required to develop, fabricate, measure, and coat prototype and flight demonstration optics. These capabilities include optical design and analysis, opto-mechanical design, machine shop, diamond turning, grinding and polishing, metrology, and optical coatings. Optical components up to 6 feet in diameter can be diamond turned to near net shapes. The Metrology Lab has capabilities for the measurement of surface finish and figure to determine compliance to optical specifications during fabrication and performance predictions of completed optics. Metallic and multilayer dielectrics, as well as metal dielectric coatings, can be applied to various optical surfaces in the Coatings Lab.

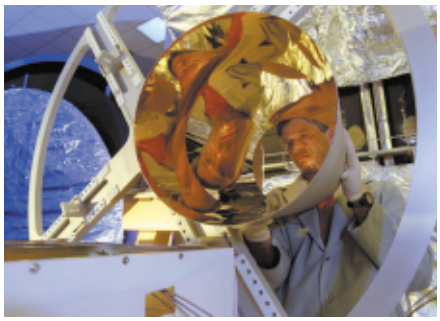
Optical Test provides state-of-the-art testing for a variety of space optical systems. The group provides testing at the MSFC X-ray Calibration Facility and the Stray Light Facility. These facilities support optical testing in highly variable thermal environments for x-ray through infrared wavelengths. The facilities also support the evaluation of advanced optical manufacturing technologies for the Space Science Enterprise and the Next Generation Space Telescope (NGST) as well as providing x-ray testing for the Solar X-Ray Imager Telescope. New metrology techniques are being developed to ensure the success of large-aperture space optical systems.

Space Optics Manufacturing Technology Metrics

- Conduct research and analysis in diffractive optics and coatings applications
  - Advance the TRL one level in optical beam-steering
  - Demonstrate fabrication of 8" diameter diffractive optics
  - Demonstrate imaging performance of .37 m fresnel lens
  - Produce solar concentrators with 50 percent higher flux levels to enable solar power systems with efficiencies > 40 percent
  - Investigate one new coating for x-ray mirror replication technology.
- Upon delivery, test the two NGST demonstration mirrors at cryogenic temperatures
- Produce a 0.2-m diameter diffractive scanner with 80 percent efficiency for a 30-degree scan angle
- Implement processes at the X-Ray Calibration Facility to reduce the cost of optical systems testing by 10 percent
- Establish a customer satisfaction tracking program
- For Constellation-X, demonstrate resolution <= 10 arc seconds in replicated x-ray optics weighing <=1/3 the weight of XMM optics
- Produce 0.5-m diameter normal incidence replicated optic with thickness variation less than 5 percent over the mirror surface
- Deploy and test an inductive edge sensor mirror alignment technology in a ground-based observatory
- Identify concepts and materials for .1 kg/m2 ultra-lightweight optical substrates
- Establish test-bed for image-based wavefront sensing and control system.



Advanced Replicated Optics manufactured at the SOMTC.



Advanced lightweight electroformed nickel mirror for the Constellation-X.

Precision polishing of 0.5 m Constellation X-ray mandrel.

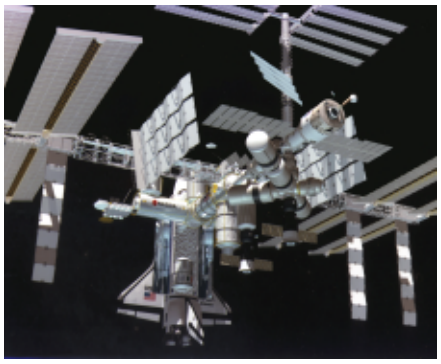
Other Programmatic Assignments

The following is a brief summary of program related assignments being implemented by MSFC for the NASA Enterprises and other Lead Centers.

International Space Station

We support—

- Human Exploration and Development of Space Enterprise



International Space Station.

Multi-Purpose Logistics Module (MPLM) in Alenia Clean Room.

The *International Space Station* is a U.S.-led, international partnership program to build and operate a unique, world-class orbiting laboratory, free from the effects of gravity. Long-term scientific and technology development will be conducted for the benefit of life on Earth.

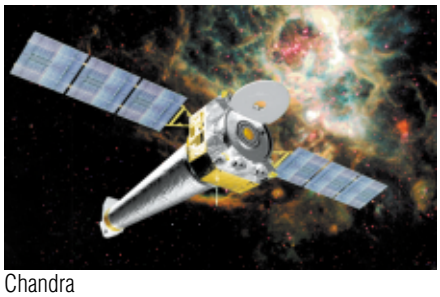
MSFC supports the ISS Program through task agreements with the ISS Program Office at the Johnson Space Center (JSC). MSFC plays a vital role in building, operating, and utilizing the ISS for NASA through the performance of these tasks. Specifically, MSFC is responsible for development of the regenerative life support systems for ISS's crew and research animals; management oversight of two node elements and the Multipurpose Logistics Module being built by the Italian Space Agency, the Interim Control Module being built by the Naval Research Laboratory, and the propulsion module being built by the Boeing Company; development of research facilities including the EXPRESS rack and other payload support equipment; integration support of Spacelab pallets and support equipment for ISS assembly; and environmental qualification testing of major ISS elements and systems.

MSFC is also responsible for the management, integration, and execution of payload operations and utilization activities on board the ISS. The Payload Operations Integration Center, located at MSFC, is the ISS Program focal point for payload operations. MSFC controllers staff the facility and interact with the worldwide scientific research community to plan and conduct payload operations on board the ISS. Payload operations training is a joint effort between MSFC and JSC.

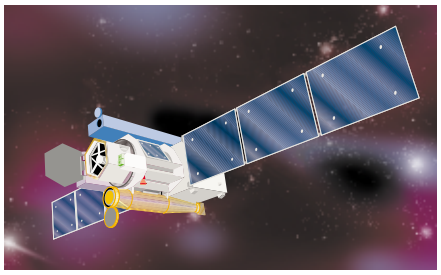
International Space Station Metrics

- Provide carrier integration on schedule for *ISS* Flight 3A in 1st quarter of FY00
- Provide carrier integration on schedule for *ISS* Flight 6A in 4th quarter of FY00
- Integrate the first MPLM in preparation for flight 5A.1, 3rd quarter of FY00
- Conduct integrated payload operations on *ISS* beginning with Flight 4A in FY00
- Conduct operational readiness reviews in FY00
- Complete development and integration of EXPRESS racks in accordance with flight schedules beginning in FY00
- Complete preparations for launch of the first rack of the Human Research Facility on Flight 5A.1
- Demonstrate the capability for principal investigators to conduct remote operations support of ISS payloads in FY00
- Complete *ISS* Propulsion Module CDR in FY00
- Prepare *ISS* Interim Control Module for late FY00 availability.

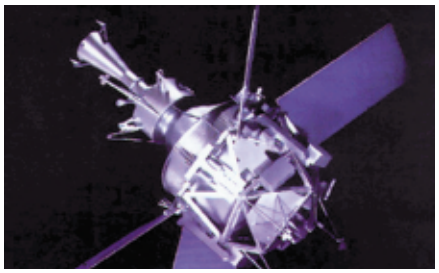
Payload Operations Integration Center.



Chandra



Solar-B.



Gravity Probe-B.

Chandra

We support—

- Space Science Enterprise

MSFC is responsible for managing the Chandra X-Ray Observatory (CXO). This responsibility includes the overall design, development, integration, and testing of the CXO. MSFC continues to manage the operations of the CXO through the Operations Control Center (OCC) and the Chandra X-Ray Center (CXC) at the Smithsonian Astrophysical Observatory in Cambridge, MA. The program's goals are to determine the nature of celestial objects from normal stars to quasars, understand the nature of physical processes that take place in and between astronomical objects, and understand the history and evolution of the universe. These goals will be accomplished by extending the range of astrophysical observations significantly beyond that of previous x-ray observatories through increases in sensitivity and resolution. Images taken will be 10 times sharper than those from previously flown x-ray telescopes.

Chandra Metrics

- Fully acceptable performance is defined as instruments meeting nominal performance expectations, completing 80 percent of preplanned and commanded observations with 95 percent of science data recovered on the ground. Minimum acceptable performance is defined as the loss of one or both gratings, and/or loss of an entire focal plane instrument, and/or partial loss of the second focal plane instrument, as long as imaging capability is available. Complete 40 percent of preplanned observations with 75 percent of science data recovered on the ground.

Scientific Payloads and Research

We support—

- Space Science Enterprise

MSFC manages the Solar X-Ray Imager, Solar-B scientific payloads and conducts fundamental research in six disciplines—cosmic-ray physics, gamma-ray astronomy, x-ray astronomy, solar physics, space plasma physics and astrobiology. In the cosmic-ray field, MSFC scientists are developing and testing particle calorimeters for the Advanced Cosmic Ray Experiment on Space Station (ACCESS). ACCESS will increase the energy range over which the composition and energy spectra of cosmic rays can be measured. In gamma-ray astronomy, MSFC scientists will continue to support operations, distribution and analysis of data from the Burst and Transient Source Experiment (BATSE) of the Compton Gamma-Ray Observatory. Discoveries of new gamma-ray bursters, pulsars and black hole candidates will be made. A prototype of the Gamma-ray Large Area Space Telescope (GLAST), using scintillating fiber technology will be used to demonstrate achievement of the mission angular resolution and energy range requirements. In x-ray astronomy a balloon payload will be flown to demonstrate a new replicated optics technology being developed for the Constellation-X mission. In solar physics, analysis of MSFC's vector magnetic field measurements in conjunction with data from several U.S. and international space missions will continue. The development of the technology for demonstrating an ultraviolet vector magnetograph has begun. In space plasma physics, data from the TIDE and UVI instruments are being acquired and analyzed as part of the ISTP program. Data from the IMAGE spacecraft will be acquired, reduced, distributed and analyzed. In astrobiology, MSFC scientists are studying organisms that survive in extreme (cold) conditions to determine which characteristics can serve as biomarkers for probing extraterrestrial samples.

MSFC is also responsible for managing the overall design, development integration, test, and flight operations of the Gravity Probe–B (GP–B) flight experiment. The GP–B objective is to test two extraordinary, unverified predictions of Einstein's Theory of General Relativity, namely "geodetic precession" and "frame dragging," both of which describe distortions in the space time continuum. In order to test these subtle effects, GP–B will fly ultra-precise, tiny gyroscopes aboard a drag-free spacecraft containing the world's largest space-qualified cryogenic system.

In an effort to communicate new science and technology information to the public, MSFC's science communications process works to develop between three and five new WWW headlines per week that draw from the entire NASA research portfolio.

Scientific Payloads and Research Metrics

- Gravity Probe-B
  - Complete final integration and test of the Gravity Probe-B science payload
  - Mission lifetime of 16 months
  - Measurement accuracy for relativistic drift of 0.5 milliarcsecond/year
- Solar-B
  - Mission lifetime of 3 years
  - Engineering models by February 2001
  - Focal plane instrument to ISAS by October 2002
  - 0.5-Meter Optical Telescope resolution of 0.25 arcseconds
- Solar X-Ray Imager
  - Launch on GOES-M October 2000
  - Mission lifetime of 3 years
  - Full-disk soft x-ray imaging of the Sun, including solar flares and coronal holes.

Climate studies and lightning observations.

The ER2 flies most of the sensors for land and severe storm research.

Global Hydrology and Climate Center

We support—

- Earth Science Enterprise (ESE)
- National Oceanographic and Atmospheric Administration (NOAA)

Through the Global Hydrology and Climate Center (GHCC), a joint venture with academia, MSFC engages in research, education, and the development of Earth science applications. The GHCC focuses on using advanced technology to observe and understand the global climate system, and applies this knowledge to agriculture, urban planning, water resource management, and operational meteorology. Areas of emphasis include observations of lightning, winds, and the use of other measurements for the study of Earth's global hydrologic and energy cycles.

FY 2000 GHCC Activities

The GHCC will perform global water cycle research emphasizing the use of advanced satellite measurements for determining fundamental atmospheric water variables, their phase, and their three-dimensional transports, translating findings into improved climate prediction models. To emphasize increased accuracy in surface hydrology and dispersion of chemical pollutants, the GHCC will use advanced satellite data assimilation techniques in regional weather prediction models.

A major focus in FY 2000 is strengthening the atmospheric lightning program through continuing research and acquisition of global lightning data from Optical Transient Detector and Lighting Imaging Sensor (LIS), understanding the relationship between lightning flash rate and severe storm onset, and establishing a collaborative program with NOAA for acquisition of lightning data from geosynchronous orbit to improve severe storm prediction.

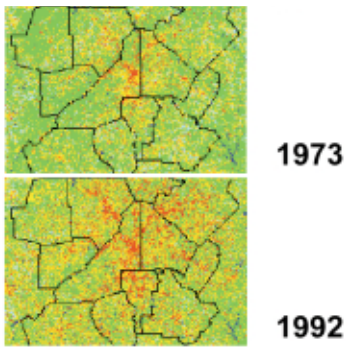
To support archaeological studies and contribute to ESE global land use classification, land use change research in Central America will be performed. In addition, the GHCC will evaluate the interannual climate variability of the southeast U.S. and determine implications on key economic sectors and increase the understanding of sources and sinks for tropospheric ozone and its transport.

Restructure of the coherent wind lidar technology demonstration program includes ground-based technology development, and design planning for future flight opportunities. Other activities include developing improved satellite retrieval techniques to measure and monitor atmospheric aerosol concentration, its transport, and its influence on radiative properties of clouds.

Research results from urban heat island studies will be provided to state and local governments for utilization, and the Global Hydrology Resource Center (GHRC) will continue developing its capabilities through component data information systems for LIS, MSU, AMSU, and SSM/I measurements; its ESIP for AMSR data processing; and its efficient accessibility by science community.

Global Hydrology and Climate Center Metrics

- Provide two demonstrations of improvements to climate modeling based upon utilization of operational satellite data in FY00
- Establish a partnership with the NOAA forecast office for use of advanced satellite data to improve operational forecast models on a regional scale in FY00
- Publish three scientific papers on the relationship between lightning and severe storms; establish an agreement with NOAA for flight of a lightning imaging sensor in geosynchronous orbit in FY00
- Complete mosaic of Central America from the Japanese Earth Resources Satellite (JERS–1), provide initial training of Central American participants, and complete two site intensive field campaigns within the region in FY00
- Complete regional assessment of Southeast U.S. and integrate into national assessment process in FY00
- Restructure wind remote sensing program in collaboration with GSFC and complete ground validation of key coherent lidar subsystems in FY00
- Complete baseline thermal characteristics of five major U.S. cities in collaboration with state and local government in FY00
- Process, validate, archive, and provide accessibility to continuing data sets from OTD, LIS, and AMSU in FY00.



Land use change in the Atlanta, GA, area where red indicates urban area development.

Agency Support Activities

A broad range of personnel, facility, and operational support services is required to support NASA's mission. NASA Headquarters has assigned the following Agency support activities to MSFC.

Principal Center Support Activities

- **Communications Architecture and Providing Agencywide Area Network (WAN) Services**
  Provide an Agencywide communications architecture to support NASA's Enterprises that incorporates flexibility of technologies, efficiency in sustaining costs, and standards ensuring full interoperability.
- **NASA Automated Data Processing Consolidation Center**
  Centrally locate, operate, and manage non-Mission Critical mainframe computers and mid-range systems required to support the Agency's Strategic Enterprises.
- **NASA Digital Television Transition**
  Provide policy dissemination, planning, and implementation guidelines to efficiently transition from NASA's current analog television and video systems architecture to the U.S. digital standard.
- **Earned-Value Management (EVM)**
  Establish an effective, value-added NASA EVM program and provide the oversight and guidance for the implementation of EVM policy throughout the Agency.
- **NASA Preferred Technical Standards**
  Serves as the NASA lead in providing an integrated system of NASA-wide preferred technical standards, guidelines, specifications, and handbooks.
- **Space Environments and Effects**
  Serve as NASA's lead for identifying, developing, and maintaining the technologies required to mitigate effects of hazardous space environments on spacecraft required for future missions.
- **IFMP Training Activity**
  As Principal Center, MSFC has assumed responsibility for the Integrated Financial Management Program (IFMP) Training Program activities and will carry out the role from an Agency perspective. MSFC will provide general day-to-day management, oversite, and coordination of Agencywide IFMP training initiatives.
- **NASA Operational Environment Team (NOET)**
  Provide a continuing capability to support and facilitate activities related to achieving environmental compliance in the design, development, test, use and production of aerospace hardware.
- **NASA Acquisition Internet Service (NAIS)**
  Provide the leadership for the Agency's on-line acquisition service and technical support for all operational systems and the primary technical expertise for several developmental projects, including the Virtual Procurement Office (VPO). Responsible for management of Agencywide team activities.
- **NASA Integrated Services Network (NISN)**
  The NISN Project Office provides voice, video, data, and messaging services to Agency customers, including mission, center, programmatic, administrative, and scientific communities.
- **Defense Contract Administrative Service Financial Management Support**
  Responsible for Agency-level accounting associated with the Contract Administration and Audit Services provided to NASA.
- **National Center for Advanced Manufacturing (NCAM)**
  Enables advanced manufacturing research and technology development and incorporates the use of Intelligent Synthesis Environment into manufacturing to improve the competitiveness of the U.S. aerospace industry.
- **NASA Engineering Excellence Initiative**
  Lead a NASA-wide effort to define, measure, and improve engineering excellence across the Agency, with focus on people, processes, facilities, and tools.

Other Support Activities

- **Spacelink**
  NASA Spacelink is an electronic aeronautics and space resource that places NASA educational materials, news, and reference data at the fingertips of teachers and students around the world.
- **Electronic Meeting System**
  Provide leadership in implementing and sustaining a collaborative performance improvement tool across the Agency.
- **Human Resource and Payroll Information Systems**
  Provide leadership in implementing and sustaining an Agency human resource and payroll system that provides the necessary automated tools to professionals that support the NASA workforce. Provides NASA payroll production and customer support for the Agency.
- **Integrated Financial Management Program (IFMP)**
  Provide leadership in the IFMP arena, and along with DFRC, be the first Centers to implement IFMP. Agency operations, the test facility, and development of Agencywide legacy system interfaces are performed by MSFC.
- **Logistics Business Systems Operations and Maintenance**
  Provide responsive and cost- effective logistics business systems to all NASA Strategic Enterprises, business partners, and logistics business process customers.
- **Environmental Assessments Impact Statements**
  Provide leadership in implementing the National Environmental Policy Act for all new MSFC programs such as X–33, Future X Pathfinders, and Space Solar Power.
- **AdminSTAR**
  Provide leadership in implementing and sustaining a training administration business system across the Agency.

Institutional Functions and Capabilities

Our goal: Enhance and sustain a highly skilled, diverse, and motivated workforce committed to safety while working in a creative and productive environment in support of cutting-edge systems and technology development.

Functions	Goals	Metrics
Safety and Mission Assurance	Enhance MSFC's effectiveness in roles supporting NASA's Strategic Enterprises by ensuring that safety, reliability, maintainability, and quality assurance are integrated early into and throughout the life cycle of all programs and projects.	• Maintain Centerwide Safety and Mission Assurance initiatives to support all MSFC programs and projects in accordance with the defined S&MA metrics in this plan.
Center Operations	Enhance customer satisfaction by simplifying processes and reducing costs associated with providing and delivering quality support services, protecting and preserving physical assets, providing a safe and healthy environment for the MSFC workforce, and promoting harmonious industrial labor relations. • Environmental Engineering Department • Facilities Engineering Department • Information Services Department • Logistics Services Department • Protective Services Department	• Ninety percent customer satisfaction by FY 2000 • Ninety percent services provided at competitive rates by FY 2000 • Eighty percent of processes simplified through integrated support services by FY 2000 • Perform annual building inspections and special inspections to ensure a healthy work environment for all employees. • Make available to all employees physical examinations, special screenings, immunizations, first aid and emergency assistance.
Customer and Employee Relations	Facilitate and coordinate the MSFC strategic and implementation planning process and communicate, internally and externally, clear, consistent messages that are traceable to the MSFC Implementation Plan. Partner with other Center organizations to increase collaboration or renew beneficial agreements with government agencies at all levels. Promote alliances with academia, industry, and national and regional associations to utilize ongoing research and technologies developed at the Center. Involve the educational community in our endeavors to inspire students, create learning opportunities, and enlighten inquisitive minds. Ensure an effective workforce that enables MSFC to succeed in a dynamic external environment, and provide quality products and services to our customers. • Education Programs • Employee and Organizational Development • Government and Community Relations • Human Resources • Internal Relations and Communications • Media Relations • Technology Transfer	• Implement IFMP Performance Series Training 3 months prior to IFMP implementation • Reduce the MSFC civil servants' FTE while maintaining a diverse workforce • Enhance public knowledge of MSFC programs and activities by conducting a national media campaign monthly • Increase the number of NASA Educator Resource Centers to seven in our six-state geographical region • Increase the employee and organizational development opportunities by 15 percent over the FY99 baseline • Implement summer program for college undergraduates and first year graduate students • Establish 10 new partnerships that compliment Marshall's primary mission areas; negotiate 3 new licensing agreements that provide monetary value to the Center; and release 10 new success stories that highlight the technologies of MSFC • Increase by 50 percent the number of key stakeholders briefed on MSFC's roles and missions with a focus to members of Congress on NASA oversight committees • Increase by 50 percent the number of speaking opportunities for the Marshall Director and other Center employees at the local, regional, and national level. With other CaER organizations, develop key center messages on MSFC roles and missions for speakers to convey • Incorporate exhibits and interactive displays at the Space Station bus tour stop about Marshall product lines by December 1999. • Develop new methods of directing web surfing educators and students to NASA sites containing popular content sought by the educational community.

Equal Opportunity

Promote and strive for equal opportunity; equity and diversity in all occupational groups, grade levels, organizational units; MSFC programs and activities; and fully accessible facilities. Conduct educational programs with historically black and other minority universities.

- Increase workforce representation by 5 percent in underrepresented categories as defined in the Center's current Affirmative Employment Plan
- Improve the accessability features in five of the Center's buildings and public access areas
- Increase research participation with historically black and other minority universities by 5 percent.

Financial Management

As stewards of government resources, we will develop and maintain processes and systems that ensure accurate financial control across the Center.

- Obligate 95 percent of authorized funding for the current Program Year
- Ensure that the IFMP Phase 1 systems and processes are successfully implemented 8 months after the successful test of the Core Financial Module
- Cost 70 percent or more of the resources authority available to cost within the fiscal year.

Legal Support

Support MSFC's assigned roles and missions by providing sound, understandable, timely legal counsel and representation of the highest quality to all MSFC organizational elements. Administer the ethics program and patent prosecution for MSFC.

- Ensure that all court-imposed filing dates are met
- Review financial disclosure forms within 60 days of submission.

Procurement

Improve effectiveness and efficiency of Center acquisitions through increased use of techniques and management tools that enhance contractor innovations and performance.

- Increase obligated funds available for performance-based contracts to 80 percent
- MSFC will award 20 percent of its dollars available for contracting to Small Business concerns in FY00
- MSFC will award 8 percent of its dollars available for contracting to Small Disadvantaged Businesses in FY00.

Systems Management Office

The Systems Management Office (SMO) was created as the pathfinder for a NASA initiative during the MSFC reorganization in May 1999, to provide a focal point for systems management, including systems engineering and cost and economic analysis, for MSFC programs and projects. The Systems Management Office provides systems management consulting support throughout the product life cycle; ensures that appropriately tailored systems management processes are designed in the formulation of programs/projects; provides independent evaluations of MSFC projects and programs for compliance with and implementation of NASA and MSFC project and program management guidelines and manuals; provides leadership, consultation services, and technical expertise and determines consistency across product lines for Center systems engineering and cost and economic analysis functions; ensures that MSFC program/project personnel receive appropriate training and mentoring in systems engineering and cost and economic analysis best practices; and supports external organizations in reviews and analysis of NASA programs and projects.

- Establish collaboratively with other MSFC and NASA organizations the expected mode(s) of interaction (e.g., customer, provider, peer) and document these in SMO processes in FY00
- Establish criteria in early FY00 for MSFC projects and programs to achieve focus status, a subset which receives the highest level of SMO support; and establish baseline Organizational Issuances through the MSFC ISO–9000 management system that define SMO processes by January 1, 2000
- Plan, conduct and support Independent Assessments and Independent Annual and Non-Advocate Reviews, as appropriate (30 planned); implement periodic independent evaluation to the MSFC Director (30 planned); and recommend project unique tailoring of 7120.5A processes
- Provide program and project planning consultation to projects in formulation to ensure NPG 7120.5A compliance (12 planned)
- Support MSFC implementation of the NASA Engineering Excellence Initiative, leading formulation of systems engineering training plans by September 30, 2000; and develop and implement process for mentoring of systems and cost engineers at MSFC by September 30, 2000
- Implement prototype capability for ISE Reusable Space Transportation System application.

Engineering Directorate

MSFC's Engineering Directorate provides highly skilled crosscutting engineering services for the MSFC product line directorates and offices, and provides Agency leadership of select crosscutting engineering functions.

The Engineering Directorate's mission is to provide state-of-the art engineering services for MSFC's products, and enables safe and affordable access to space, advanced tools and hardware for space utilization, and the creation of new knowledge of our Earth and universe through support of scientific investigations. The directorate also leads the development of some Agencywide crosscutting engineering technologies, and participates in the transfer of these technologies into the private sector.

The directorate's capabilities include mechanical design; avionics systems; structural systems; and thermal systems design, analysis, and test; materials and manufacturing process development; and crosscutting systems engineering services. The directorate also does research, technology and development for the engineering tools and facilities in the areas of our crosscutting engineering disciplines.

The directorate accomplishes its objectives through highly trained and motivated personnel located in four departments and three offices described below:

Avionics Department: Plans, performs, and directs R&D in engineering and analysis of electrical systems, guidance and control systems, instrumentation systems, radio frequency systems, computer and data systems, software and avionics simulation systems related to space vehicles, payloads, and support equipment.

Structures, Mechanical, and Thermal Department: Plans, conducts, and directs R&D in structural, mechanical, and thermal systems for the analysis, design, and/or qualification testing of space and launch vehicles, payloads, and systems.

Materials, Processes, and Manufacturing Department: Provides science, technology, and engineering design, development and test of materials, processes and products to be used in space vehicle applications, including related ground facilities, test articles, and support equipment.

Engineering Systems Department: Plans and performs systems related crosscutting engineering services and support encompassing NASA standards, mass properties, kinematics, supportability and logistics, modeling and simulation, human engineering, configuration and data management, and environments (EMI/EMC, space and terrestrials).

Engineering Technology Development Office: Integrates technology development for the directorate and leads the Space Environments and Effects program for the Agency.

Chandra Chief Engineers Office: Provides system engineering support for the Chandra Observatory program.

Business Management Office: Integrates business management for the directorate and supports Center and Agencywide initiatives in improving NASA business practices.

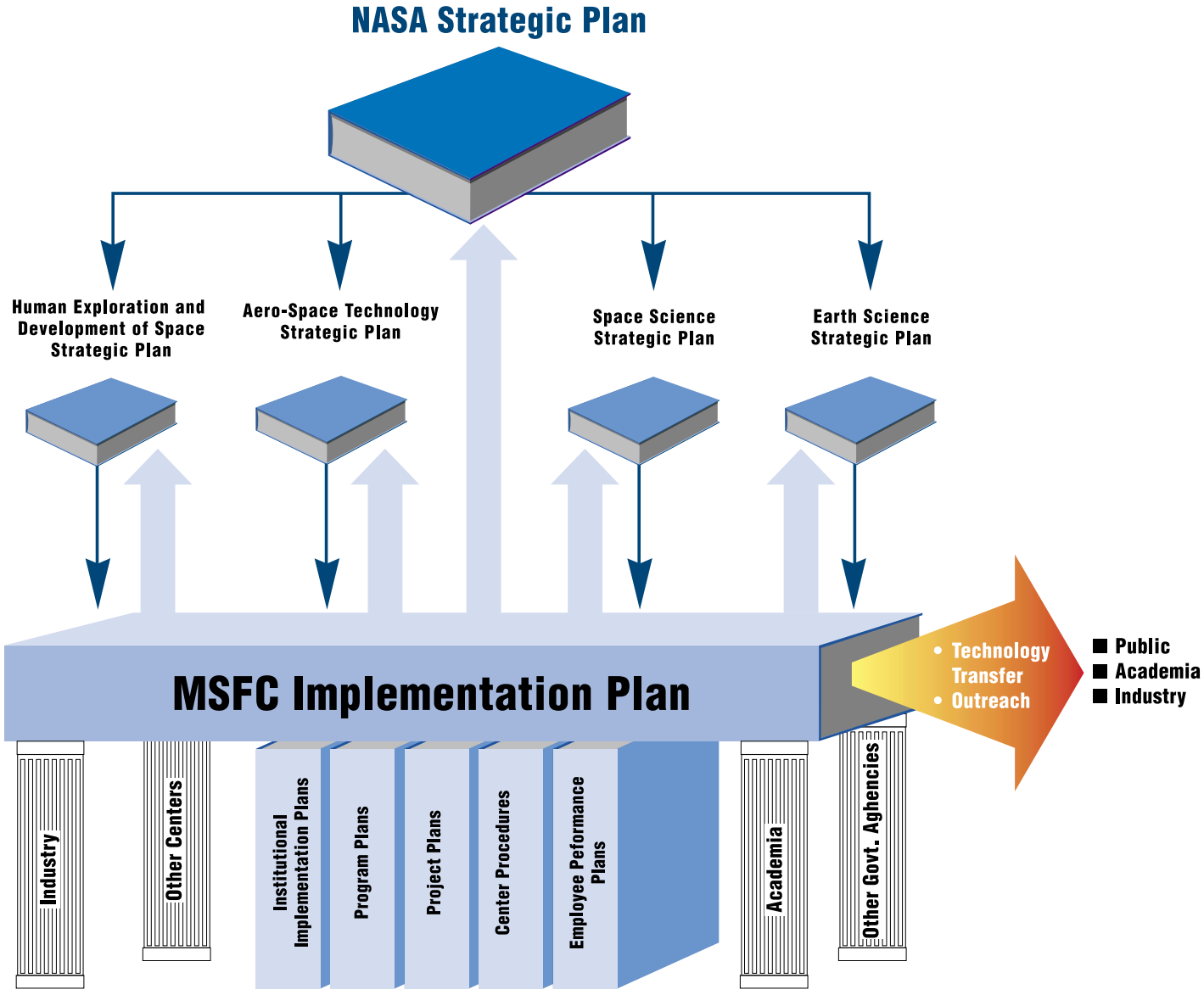
Engineering Metrics

- Reduce relative lost time injuries by 50 percent as compared to FY99 baseline
- Increase the relative amount of training by 10 percent compared to the FY99 baseline
- Initiate at least one new means of communicating directorate information to ED personnel
- Achieve 90 percent customer satisfaction as determined by ED customer surveys of MSFC product line directorates and offices
- Initiate at least one new means of obtaining customer feedback to ED from the product line directorates and offices
- Complete benchmarking of engineering capabilities and identify areas for improvement
- Increase the relative number of ED technical memoranda, conference papers, journal papers as well as ED membership in technical commities by 10 percent as compared to the FY99 baseline
- Implement the NASA Engineering Excellence Initiative through responsibilities as Principal Center
- Establish at least three new teaming arrangements with another NASA Center(s) to support MSFC product line directorates and offices
- Establish at least three new teaming arrangements with an industry and/or a university partner to bid on a NASA MSFC activity or NASA NRA's
- Initiate and/or propose at least one new national or international activity for ED to lead the Agency in a crosscutting engineering function
- Increase the relative number of ED patent disclosures by 20 percent as compared to the FY99 baseline
- Participate in the transfer of at least two new technologies into the private sector.

MSFC's Link to the Future

The *NASA Strategic Plan* defines the Agency's vision, mission, and fundamental questions of science and research that provide the foundation for our goals. The four Strategic Enterprises identify their objectives to meet the Agency's goals in their individual Strategic Plans.

The *MSFC FY 2000 Implementation Plan* provides the link for the Center Program Plans, Project Plans, Institutional Implementation Plans, Center Procedures, and Employee Performance Plans to the Agency and Enterprise Strategic Plans. Our implementation is supported by industry, other Centers, other Federal agencies, and academia. The Implementation Plan reflects MSFC's dedication to NASA's goals and communicates to the Strategic Enterprises, our employees, and our partners and customers the implementation of our roles and missions through metrics tied to the Agency budget.



Points of Contact

For further information regarding the *Marshall Space Flight Center FY 2000 Implementation Plan*, please contact the following individuals.

Center of Excellence for Space Propulsion

Space Transportation Directorate—http://photo3.msfc.nasa.gov/propulsion.html	TD01	John Rogacki	256–544–3551
Propulsion Research Center	TD40	George Schmidt	256–544–6055

Human Exploration and Development of Space

Microgravity Research—http://microgravity.msfc.nasa.gov/	SD10	Robin Henderson	256–544–1738
Flight Projects Directorate—http://www1.msfc.nasa.gov/FD/	FD01	Axel Roth	256–544–0451
Space Shuttle—http://liftoff.msfc.nasa.gov/	MP01	Alex McCool	256–544–0718
ISS Propulsion Module Project Office	TD11	Steve Richards	256–544–7053
Development Projects Office	TD12	Bob Hughes	256–544–6624

Aero-Space Technology

Space Transportation Systems Development—http://stp.msfc.nasa.gov/	TD01	John Rogacki	256–544–3551
Advanced Space Transportation Program—http://astp.msfc.nasa.gov/	TD15	Garry Lyles	256–544–9203
X–33 Program—http://rlv.msfc.nasa.gov/	TD13	Robert Austin	805–572–2134
Pathfinder Program—http://rlv.msfc.nasa.gov/	TD14	John London	256–544–0454
Vehicle and Systems Development Department	TD50	Helen McConnaughey	256–544–1165
Technology Evaluation Department	TD70	Jerry Smelser	256–544–4082

Space Science Enterprise

Science Directorate—http://science.nasa.gov	SD01	Frank Rose	256–544–7721
Space Optics Manufacturing Technology	SD70	Scott Smith	256–544–5175
Chandra X-ray Observatory Program Office (CXO)—http://Chandra.nasa.gov/	XP01	Fred Wojtalik	256–544–0647
Gravity Probe–B	SD30	Rex Geveden	256–544–9335

Earth Science Enterprise

Global Hydrology and Climate Center (GHCC)—http://www.ghcc.msfc.nasa.gov/ghcc_home.html	SD60	Ray Arnold	256–922–5861

Principal Center and Agency Support Activities

NASA Payroll Operations Consolidation	RS10	John Alexander	256–544–7290
Integrated Financial Management Program Implementation	AD33	Jonathan Pettus	256–544–9271
Communications Architecture and Providing Agency WAN Services	AD33	Terry Luttrell	256–544–0130
NASA Automated Data Processing Consolidation Center	AD31	Portia Dischinger	256–544–8650
Earned Value Performance Management	RS40	Jeff Saxon	256–544–0109
NASA Prefered Technical Standards	ED40	Gabe Wallace	256–544–4359
Space Environments and Effects	ED03	Steven Pearson	256–544–2350
NASA Digital Television Transition	AD32	Rodney Grubbs	256–544–4582
Sustaining Engineering Support for Agencywide Administrative Systems	AD33	Sheila Fogle	256–544–5638
Logistics Business Systems Operations and Maintenance	AD40	Nikita Zurkin	256–544–6326
IFMP Training	CD03	Tricia Kennedy	256–544–7532
AdminSTAR and Electronic Meeting System	CD20	Greg Walker	256–544–7558
Engineering Excellence Initiative	ED41	Joseph Hale	256–544–2193
NASA Operational Environment Team	ED30	Ann Whitaker	256–544–2481
Defense Contract Administrative Service Financial Management Support	RS21	Tonia Martin	256–544–6506
NASA Integrated Service Network	AD30	Rick Helmick	256–544–3460
National Center for Advanced Manufacturing	ED30	Ann Whitaker	256–544–2481
Spacelink—http://spacelink.nasa.gov	CD60	Jim Pruitt	256–544–0213

MSFC Institutional Functions and Capabilities—http://www.msfc.nasa.gov/

Engineering Directorate	ED01	Jim Kennedy	256–544–1000
Chief Counsel	LS01	Bill Hicks	256–544–0010
Educational Programs	CD60	Jim Pruitt	256–544–0213
Equal Opportunity	OS01	Charles Scales	256–544–4927
Financial Management	RS01	David Bates	256–544–0092
Human Resources	CD10	Danny Hightower	256–544–7496
Internal Relations & Communications	CD40	Norman Brown	256–544–0505
Government & Community Relations	CD50	Shar Hendrick	256–544–5549
Employee and Organizational Development	CD20	Greg Walker	256–544–7558
Information Services	AD30	Charles Houston	256–544–5772
Facilities Engineering	AD20	Peter Allen	256–544–7909
Environmental Engineering	AD10	Rebecca McCaleb	256–544–4367
Logistics Services	AD40	Roy Malone	256–544–0506
Procurement	PS01	Steve Beale	256–544–0257
Safety & Mission Assurance	QS01	Amanda Goodson	256–544–0043
Technology Transfer	CD30	Sally Little	256–544–4266
Protective Services	AD50	Bradley Waits	256–544–4534
Media Relations	CD70	Dom Amatore	256–544–0031
Systems Management Office	VS01	J.W. Kilpatrick	256–544–2051
Occupational Safety	QS10	Herb Shivers	256–544–8903
Occupational Health	AD02M	William Dye	256–544–2390

Marshall Space Flight Center Implementation Plan Linkage to the FY 2000 NASA Performance Plan

Human Exploration and Development of Space Enterprise

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2000 MSFC Metrics
Expand the frontier	Invest in enabling high-leverage exploration technologies	In coordination with other Enterprises, develop and implement tests and demonstrations of capabilities for future human exploration in the areas of advanced space power, advanced space transportation, information and automation systems, and sensors and instruments	Manage the Space Solar Power (SSP) Exploratory Research and Technology (SERT) study. Activities include analysis of system concepts to identify viable approaches to SSP for planetary surface and space applications. Products will enable NASA management to make informed decisions on a portfolio of SSP technology investments.	Publish a final report on the SERT study. Material within the report will include concept analysis, technology roadmaps and recommendations on near-term technology development and demonstrations. Demonstrate SSP technologies in solar power generation (SPG), power management and distribution (PMAD), and wireless power transmission (WPT).
	Enable human exploration through collaborative robotic missions	Complete the Radiation Research Instrument for the Mars 01 missions to study transit, orbital, and surface radiation effects, and conduct three workshops to define and prioritize research tasks in subjects such as radiation shielding materials, in situ resource utilization, and fluids management and heat transfer technology. Complete the science definition of granular flows, fluids, and dust management experiments to begin gathering research data to alleviate critical problems of dust buildup, habitat foundation engineering, and rover performance during planetary exploration	Initiate planning in combustion research safety issues, conduct workshop on radiation shielding, conduct ISRU workshop on materials, complete requirements definition of dust management and granular flows	Conduct one workshop on radiation and In Situ Resource Utilization. Conduct requirements definition for granular flows, fluids, and dust management experiment
	Define innovative, safe and affordable human exploration mission architectures	Complete the development and initiate the implementation of a comprehensive technology investment strategy to support future human exploration that includes capability development for increasing self-sustainability, decreasing transit times, developing commercial opportunities, reducing cost and risk, and increasing knowledge and operational safety	Participate in HEDS Integrated Technology Planning	Publish technology planning for Microgravity Research and Space Product Development in the HEDS Research and Technology Plan
Expand Scientific Knowledge	In partnership with the scientific community, use the space environment to explore chemical, biological, and physical systems	Support an expanded research program of approximately 935 investigations, an increase of ~17% over FY99. Publish 100% of science research progress in the annual OLMSA Life Sciences and Microgravity Research Program Task Bibliographies and make this available on the internet	Hold pre-NRA conferences, release NRA's in three research disciplines. Science data to be returned to investigators in a timely manner to aid in meeting publication schedules. Bibliography to be updated and maintained in internet continuously.	Support at least 425 research investigations. Support at least 12 Science Concept Reviews and 20 Requirements Definition Reviews. Prepare and release three NRA's. Maintain science bibliography on the internet. Conduct research on at least 7 parabolic aircraft flight campaigns and 2 suborbital rocket flights
				Initiate flight and ground investigation grants for 98 Materials Science NASA Research Announcements
		Using suborbital rockets, complete one combustion experiment on the flame spread of liquid fuels to better control Earth-/space-based fire hazards, and conduct an investigation to test theories of fundamental physics properties and physical laws of fluids to provide key data for Earth and space-based processing materials; report the results	Communicate requirements to providers to ensure availability of suborbital rockets, launch one SAL campaign and one fluids investigation. Data to be returned to investigators in timely manner for publication.	Launch one SAL campaign and one Extensional Rheology Experiment (ERE)
		Complete data reduction from the STS–95 Research Module mission. Begin to explore new cooperative efforts with the NIH in the area of aging and transfer space-driven research data for industry development of a new drug to treat Chagas' disease	Cooperative efforts with NIH and other non-NASA agencies to be investigated during planing conferences with science and discipline meetings.	Issue mission report on STS-95

Human Exploration and Development of Space Enterprise (continued)

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2000 MSFC Metrics
Enable and establish a permanent and productive human presence in Earth orbit	Provide safe and affordable access to space	Have in place an aggressive Shuttle program that ensures the availability of a safe and reliable Shuttle system through the *ISS* era	Space Shuttle Projects Office	Achieve a 60% increase in predicted reliability of the Space Shuttle over the 1995 baseline
		Achieve seven or fewer flight anomalies per mission		Maintain less than one in-flight anomaly (IFA) per mission for Marshall-related propulsion elements
	Deploy and operate the *ISS* to advance scientific, exploration, engineering, and commercial objectives	Deploy and activate the Canadian-built Space Station Remote Manipulator System to provide an *ISS*-based remote manipulating capability for maintenance and assembly	Provide launch carrier system and on-orbit deployment support	Provide carrier integration on schedule for Flight 6A in 4th quarter of FY00
		Deploy and activate the airlock to provide an *ISS*-based EVA capability	Provide launch carrier and support on-orbit deployment	Provide carrier integration on schedule for *ISS* Flight 3A in 1st quarter of FY00
		Deliver to orbit the first of three Italian-built Multi-Purpose Logistics Modules (MPLM's) to provide a reusable capability for delivering payload and systems racks to orbit	Provide engineering oversight of the design, development, and manufacturing of the three MPLM's	Integrate the first MPLM in preparation for flight 5A.1, 3rd quarter of FY00
		Conduct operations with a three-person human presence on the *ISS*	Certify cadre for integrated payload operations and deliver associated flight products	Conduct integrated payload operations on *ISS* beginning with Flight 4A in FY00
			Deliver ground support systems for payload operations	Conduct operational readiness reviews in FY00
		Complete preparations for the initial *ISS* research capability through the integration of the first rack of the Human Research Facility (HRF–1), five EXPRESS racks with small payload research, and the Microgravity Science Glovebox	Develop the EXPRESS rack for integration of science payloads	Management of *ISS* Propulsion Module
			Complete preparations for the initial *ISS* research capability	Complete development and integration of EXPRESS racks in accordance with flight schedules beginning in FY00
			Microgravity Science and Applications	Complete preparations for launch of the first rack of the Human Research Facility on Flight 5A.1
				Perform verification testing and conduct acceptance reviews on MSG in preparation for turnover to *ISS* for integration
			Perform verification testing and conduct acceptance reviews on MSG on preparation for turnovers to *ISS* for integration. Provide at least three small research payloads compatible with EXPRESS racks	Complete acceptance review for MSG
		Develop, build, and deliver a U.S. Propulsion Module before the end of 2002	Management of *ISS* Propulsion Module	Complete *ISS* Propulsion Module CDR in FY 2000
		Build and deliver ICM to support CY00 utilization	Management of ICM Module	Prepare *ISS* Interim Control Module for late FY00 availability
	Ensure and enhance the health, safety, and performance of humans in space	Provide training to the appropriate NASA supervisors with specific emphasis on actions to prevent injury and illness on the job. Increase employee participation in the wellness program by at least 25% over the FY97 baseline. In coordination with the Office of Safety and Mission Assurance, achieve a 10% reduction in workers' compensation claims over the FY98 baseline.	Use the Agency Safety Initiative model to reinvigorate the MSFC Safety Program	Reduce lost time mishap rate by 20% per year compared to the FY98 baseline of 0.16 over 5 years and better the goal each year
				Complete the OSHA VPP Star Certification by the end of FY00
			Space Shuttle Projects Office	Maintain less than one in-flight anomaly per mission
Expand the commercial development of space	Foster commercial participation on the *International Space Station*	Utilize at least 30% of Space Shuttle and *ISS* FY00 capabilities for commercial investigations, per the U.S. Partner Utilization Plan	Fund payload development for Space Shuttle and *ISS*. Advocate commercial payload accommodations in the Partner Utilization Plan	Fund developments and advocate accommodations for at least three commercial payloads
			Begin establishing an Infectious Disease Initiative with the Center for Macromolecular Crystallography	Provide an augmentation to the Cooperative Agreement with the Center for Macromolecular Crystallography for an Infectious Disease Initiative

Aero- Space Technology Enterprise

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2000 MSFC Metrics
Space Transportation-enable the full commercial potential of space and expansion of space research and exploration	Revolutionize space launch capabilities	Conduct the flight testing of the X–33 vehicle	Management of the X–33 Program	Begin flight test of the X–33 and demonstrate key technologies in CY00 Complete X–33 XRS–2200 linear aerospike hot fire at SSC Complete proof and structural load tests of X–33 composite LH_2 tank
		Complete vehicle assembly and begin the flight test of the second X–34 vehicle	Management of the Pathfinder Program	Initiate flight test of the X–34 and demonstrate key technologies in CY00 Complete X–34 captive carry test in FY00 Complete X–37 design in FY00 Conduct X–40A approach and landing test Deliver Fitcheck Fastrac engine to X–34 project in first quarter of FY00 and certify in third quarter of FY00 Launch SHARP–B2 flight experiment
		Complete small payload-focused technologies and select concepts for flight demonstration of a reusable first stage (Bantam)	Management of ASTP	Demonstrate densified liquid oxygen and hydrogen for RLV application Complete Rocket-Based Combined Cycle flowpath testing in FY00 Complete 250k hybrid testing in the first quarter of FY00 Complete design and demonstration of a portable antiproton trap in FY00 Demonstrate RLV propulsion technologies including: – Lightweight long-life thrust cells – Polymer matrics lines, valves, and ducts – Advanced unshrouded impeller design – Advanced high efficiency tubine design. Define combined cycle flight demonstration in FY00 Fly ProSEDS tether propulsion flight experiment at first opportunity after August 2000
		None listed	Space Propulsion	Complete Spaceliner 100 technology roadmap in FY00 Continue to upgrade facilities and maintain safe, cost-effective state-of-the art test capabilities Build and deliver X–38 Deorbit Propulsion Stage for integration into the flight demonstrator in late FY00 Complete ground demonstration of 100% design life on the NSTAR ion engine in FY00 Complete combined cycle propulsion flight demonstrator definition in the second quarter of FY00 Complete 500-hour test of 10kW Hall Electric Thruster in FY00

Aero- Space Technology Enterprise (continued)

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2000 MSFC Metrics
				Demonstrate 2nd generation RLV technologies by the end of calendar year 2000 including: – Nonautoclave processing and lox compatible composite structures – Composite joining – Integrated structure and TPS – Hot structures and TPS
			Space Transportation Directorate	Study improvements in Shuttle systems safety, operability and cost by evaluating upgraded solid rocket motors or new liquid propulsion reusable first stages and the ET friction stir weld and repair processes
				Streamline operations by continuing the transition of routine operations from a government role of oversight to insight and the transition of Shuttle prime contracts to the Space Flight Operations Contract, based on project maturity and stability

Space Science Enterprise

Chart the evolution of the universe, from origins to destiny, and understand its galaxies, stars, planets, and life	Solve mysteries of the universe	The Chandra X-Ray Observatory will meet nominal performance expectations, with 80% of preplanned and commanded observations with at least 95% of science data recovered on the ground	Management of the Chandra program	Fully acceptable performance is defined as instruments meeting nominal performance expectations, completing 80% of preplanned and commanded observations with 95% of science data recovered on the ground. Minimum acceptable performance is defined as the loss of one or both gratings, and/or loss of an entire focal plane instrument, and/or partial loss of the second focal plane instrument, as long as imaging capability is available. Complete 40% of preplanned observations with 75% of science data recovered on the ground.
		Complete the final integration and test of the GP–B science payload with the spacecraft in August 2000	Manage the development of Gravity Probe-B	Complete final integration and test of the Gravity Probe-B science payload
		Complete and deliver for testing Solar B's four electrical engineering models in September 2000	Manage the development of Solar-B	Complete Phase A and requirements review
				Begin Phase B
			Support integration and test of Solar X-Ray Imager	Complete integration and test for planned launch (October 2000)
				Full-disk soft x-ray imaging of the Sun, including solar flares and coronal holes
		In FY00, continue to operate instruments not dependent on expended consumables (OSSE,BATSE,COMPTEL) at an average efficiency of at least 60%	Support to the Burst and Transient Source Experiment (BATSE)	MSFC scientists will support operations, distribution and analysis of data from the Burst and Transient Source Experiment (BATSE) of the Compton Gamma-Ray Observatory
		The prototype primary instrument for GLAST will demonstrate achievement of the established instrument performance level	Support to the Gamma-Ray Large Area Space Telescope (GLAST)	A prototype of the GLAST, using scintillating fiber technology, will be used to demonstrate achievement of the mission angular resolution and energy range requirements
		Based on an overall goal of conducting 26 worldwide science and technology demonstration balloon missions, at least 23 campaigns shall successfully achieve altitude and distance, and investigators' instrumentation shall function as planned for at least 19 missions	Conduct fundamental research	A balloon payload will be flown to demonstrate the new replicated optics technology being developed for the Constellation X mission

Space Science Enterprise (continued)

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2000 MSFC Metrics
	Explore the solar system	Acquire calibrated observational data from the Japanese Yohkoh high-energy solar physics mission for at least 75% of the time permitted by tracking coverage. Collect pixel-limited images in all Transition Region and Coronal Explorer (TRACE), wavelength bands. Capture at least 90% of available Ulysses science data.	Conduct fundamental research	In solar physics MSFC will continue analysis of data from the Japanese/U.S. Yohkoh mission, the Transition Region and Coronal Explorer (TRACE), the Solar Heliospheric Observatory and the Ulysses missions in conjunction with vector magnetic field measurements obtained at MSFC
Develop new critical technologies to enable innovative and less costly mission and research concepts	Develop innovative technologies for enterprise missions and external customers	None listed	World-class leadership in space optics manufacturing technology	Conduct Research and Analysis in Diffractive Optics and Coatings applications Advance the TRL one level in optical beam steering Demonstrate fabrication of 8" diameter diffractive optics Demonstrate imaging performance of .37-m fresnel lens Produce solar concentrators with 50% higher flux levels to enable solar power systems with efficiencies > 40% Investigate one new coating for x-ray mirror replication technology Upon delivery, test the two NGST demonstration mirrors at cryogenic temperatures For Constellation X, demonstrate resolution <= 10 arc seconds in replicated x-ray optics weighing <=1/3 the weight of XMM optics Produce 0.5 m diameter normal incidence replicated optics with thickness variation less than 5% over the mirror surface Identify concepts and materials for .1 Kg/m2 ultra-lightweight optical substrates Deploy and test an inductive edge sensor mirror alignment technology in a ground-based observatory Establish test-bed for image-based wavefront sensing and control system Establish a customer satisfaction tracking program Produce a 0.2-m diameter diffractive scanner with 80% efficiency for a 30-degree scan angle
Support all goals	Support all objectives	Conduct research and analysis	Conduct fundamental research	The MSFC Space Science Department will conduct fundamental research in five disciplines: Cosmic-ray physics, high-energy astrophysics, solar physics, low-energy space plasma physics and astrobiology.

Earth Space Enterprise

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2000 MSFC Metrics
Expand scientific knowledge by characterizing the Earth system	Detect long-term climate change, causes and impacts	Continue to improve the design and sophistication of a global climate system model, including use of higher resolution, to make it a state-of-the-art climate system model for projecting the climate consequences at the regional level.	Perform global water cycle research emphasizing use of advanced satellite measurements for determining fundamental atmospheric water variables, their phase, and their three-dimensional transports, translating findings to improved climate prediction models	Provide two demonstrations of improvements to climate modeling based upon utilization of operational satellite data
	Predict seasonal to interannual climate variations	Establish a benchmark for global and regional rainfall measurements by combining TRMM measurements with measurements from other sources	Advance satellite data assimilation techniques in regional weather prediction models, emphasizing increased accuracy in surface hydrology and dispersion of chemical pollutants	Establish a partnership with the NOAA forecast office for use of advanced satellite data to improve operational forecast models on a regional scale
			Strengthen atmospheric lightning program through continuing research and acquisition of global lightning data from OTD and LIS, understand relationship between lightning flash rate and severe storm onset, and establish collaborative program with NOAA for acquisition of lightning data from geosynchronous orbit to improve severe storm prediction	Publish three scientific papers on the relationship between lightning and severe storms, and establish an agreement with NOAA for flight of a lightning imaging sensor in geosynchronous orbit
			Restructure coherent wind lidar technology demonstration program including ground-based technology development, and design planning for future flight opportunities	Restructure wind remote sensing program in collaboration with GSFC and complete ground validation of key coherent lidar subsystems
	Understand the causes and consequences of land-cover/land-use change	Continue the development of global land-cover/use change data set based on Landsat and EOS instrument, at seasonal refresh rate	Perform land use change research in Central America for archaeological studies and contribution to ESE global land use classification	Complete mosaic of Central America from the Japanese Earth Resources Satellite (JERS-1), provide initial training of Central American participants, and complete two site intensive field campaigns within the region
Enable the productive use of Earth science and technology in the public and private sectors	Make major scientific contributions to national and international environmental assessments	Complete the contribution to the First National Assessment of the Potential Consequences of Climate Variability and Change: Provide climate scenario information, support the national synthesis, conduct several regional U.S. analyses, and provide supporting research for sector analyses	Evaluate interannual climate variability of southeast U.S. and determine implications on key economic sectors	Complete regional assessment of Southeast U.S. and integrate into national assessment process
	Extend the use of Earth science research for national, state, and local applications	Implement at least five joint applications research projects/partnerships with state and local governments in remote sensing applications	Increase collaboration with state and local government for utilization of research results from urban heat island studies.	Complete baseline thermal characteristics of five major U.S. cities in collaboration with state and local governments
Disseminate information about the Earth system	Implement open, distributed, and responsive system architectures	EOSDIS will make available data on prediction, land surface, and climate to users within 5 days	Continue developing capabilities of Global Hydrology Resource Center through its component data information systems for LIS, MSU, AMSU, and SSM/I measurements, its ESIP for AMSR data processing, and its efficient accessibility by science community	Process, validate, archive, and provide accessibility to continuing data sets from OTD, LIS, and AMSU

Manage Strategically

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2000 MSFC Metrics
Provide a basis for the Agency to carry out its responsibilities effectively and safely and enable management to make critical decisions regarding implementation activities and resource allocations that are consistent with the goals, objectives, and strategies contained in NASA's Strategic, Implementation, and Performance Plans	Optimize investment strategies and systems to align human, physical, and financial resources with customer requirements, while ensuring compliance with applicable statues and regulations	Reduce the civil service workforce level to below 18,200. Maintain a diverse NASA workforce throughout the downsizing efforts.	Human Resources Department	Reduce the MSFC civil servants FTE while maintaining a diverse workforce
			Equal Opportunity Office	Increase workforce representation by 5% in underrepresented categories
				Improve the accessibility features in 5 of the Center's buildings and public access areas
				Increase research participation with historically black and other minority universities by 5%
		Reduce the number of Agency lost workdays (from occupational injury or illness) by 3% from the FY94–96 3-year average	Safety and Mission Assurance Office	Reduce lost-time mishap rate by 20% per year over 5 years and better the NASA goal each year
				Complete the OSHA Voluntary Protection Program Star certification by the end of FY 2000
				Complete incorporation of safety into the MSFC Integrated Document Library by the end of FY 2000
		Cost 70% or more of available resources	Office of Chief Financial Officer	Cost 70% or more of the resources authority available to cost within the fiscal year
				Obligate 95 percent of authorized funding for the current program year
		Begin the implementation at NASA installations of the Integrated Financial Management System following completion of system testing	Office of Chief Financial Officer	Ensure that the IFMP Phase 1 systems and processes are successfully implemented 8 months after the successful test of the core financial module
			IFMP Training Program Office	Implement IFMP Performance Series Training 3 months prior to IFMP implementation at MSFC
		None listed	Systems Management Office	Establish collaboratively with other MSFC and NASA organizations the expected mode(s) of interaction (e.g., customer, provider, peer) and document these in SMO processes
				Establish criteria for MSFC projects and programs to achieve focus status, a subset which receives the highest level of SMO support, and establish baseline Organizational Issuances through the MSFC ISO–9000 management system that define SMO processes
				Plan, conduct and support Independent Assessments and Independent Annual and Non-Advocate Reviews as appropriate, implement periodic independent evaluation to the MSFC Director, and recommend project unique tailoring of 7120.5A processes
				Provide program and project planning consultation to projects in formulation to ensure NPG 7120.5A compliance
				Support MSFC implementation of the NASA Engineering Excellence Initiative, leading formulation of systems engineering training plans, and develop and implement process for mentoring of systems and cost engineers at MSFC
				Implement prototype for ISE RSTS applications
	Improve the effectiveness and efficiency of Agency acquisitions through the increased use of techniques and management that enhance contractor innovations and performance	Of funds available for PBC, maintain PBC obligations at 80%	Procurement Office	Maintain obligated funds available for performance-based contracts at 80%
		Achieve at least the congressionally mandated 8% goal for annual funding to small disadvantaged businesses.		MSFC will award 8% of its dollars available for contracting to SDB concerns in FY 2000
		None listed	Center Operations Directorate	Ninety percent customer satisfaction by FY 2000.
				Ninety percent services provided at competitive rates by FY 2000

Manage Strategically (Continued)

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2000 MSFC Metrics
			Center Operations Directorate	Perform annual building inspections and special inspections to ensure a healthy work environment Make available to all employees physical examinations, special screenings, immunizations, first aid, and emergency assistance

Provide Aero-Space Products and Capabilities

Enable NASA's Strategic Enterprises and their Centers to deliver products and services to customers more effectively and efficiently while extending the technology, research, and science benefits broadly to the public and commercial sectors	Reduce the cost and development time to deliver products and operational services	Meet schedule and cost commitments by keeping the development and upgrade of major scientific facilities and capital assets within 110% of cost and schedule estimates, on average	Space Optics Technology Manufacturing Center	Implement processes at the X-Ray Calibration Facility to reduce the cost of optical systems testing by 10%
	Improve and maintain NASA's engineering capability	None listed	Engineering Directorate	Increase the relative amount of training by 10% compared to the FY99 baseline Increase the relative number of ED technical memoranda, conference papers, journal papers as well as ED membership and technical commities by 10% as compared to the FY99 baseline Implement the NASA Engineering Excellence Initiative through responsibilities as Principal Center Initiate and/or propose at least one new national or international activity for ED to lead the Agency in a crosscutting engineering function Participate in the transfer of at least two new technologies into the private sector

Generate Knowledge

Extend the boundaries of knowledge of science and engineering, capture new knowledge in useful and transferable media, and share new knowledge with customers	Select and fund/conduct research and analysis programs	For selecting, and funding/conducting R&A and core technology projects, the Space Science Enterprise, OLMSA, and the ESE will use broad Agency announcements (AO, NRA, and CAN solicitations) to competitively award 80% or more of resources in these programs based on peer review	Microgravity research	Issue discipline research NRA's for microgravity research
	Conduct further research	None listed	Engineering Directorate	Increase the relative number of ED technical memoranda, conference papers, and journal papers as compared to the FY99 baseline Establish at least three new teaming arrangements with another NASA Center(s) to support MSFC product line directorates and offices. Establish at least three new teaming arrangements with an industry and/or a university partner to bid on a NASA MSFC product line activity or NASA NRA Initiate and/or propose at least one new national or international activity for ED to lead the Agency in a crosscutting engineering function Increase the relative number of ED patent disclosures by 20% as compared to the FY99 baseline Complete benchmarking of engineering capabilities and identify areas for improvement

Communicate Knowledge

NASA Near-Term Goals	NASA Objectives	NASA Performance Targets	MSFC Implementation	FY 2000 MSFC Metrics
Ensure that NASA's customers receive the information derived from NASA's research efforts that they want, in the format they want, for as long as they want it	Highlight existing and identify new opportunities for NASA's customers, including the public, the academic community, and the nation's students, to participate directly in space research and discovery	Increase new opportunities to transfer technology to private industry from 19,600 to 19,800. These opportunities will be made available to the public through the Tech Tracs database and will be measured by monitoring a controlled data field that indicates the number of new technologies communicated to the public	MSFC Technology Transfer Department	Establish 10 new partnerships that compliment Marshall's primary mission areas, negotiate 3 new licensing agreements that provide monetary value to the Center, and release 10 new success stories that highlight the technologies of MSFC
		Seek to maintain a level of participation involvement of approximately 3 million with the education commuity, including teachers, faculty, and students	MSFC Education Programs	Increase the number of NASA Educator Resource Centers in our six-state geographical service region to seven Implement a summer program for college undergraduates and first year graduate students
	Improve the external constituent communities' knowledge, understanding, and use of results and opportunities associated with NASA's programs	Provide the public with internal access to listings of existing and upcoming communications events, activities, and products and best communications practices within NASA	MSFC Media Relations Department	Enhance public knowledge of MSFC programs and activities by conducting a national media campaign each month
		None listed	Government and Community Relations Department	Increase by 50% the number of key stakeholders briefed on MSFC's roles and missions with a focus to members of Congress on NASA oversight committees Increase by 50% the number of speaking opportunities for the Marshall director and other Center employees at the local, regional, and national level. With other CaER organizations, develop key center messages on MSFC roles and missions for speakers to convey. Incorporate exhibits and interactive displays at the Space Station bus tour stop about propulsion, microgravity, space transportation, space sciences, and optics by December 1999.
		Increase the number of searched pages in NASA web space by 5% per year, relative to the FY99 baseline	MSFC's science communications process	Develop between three and five new WWW headlines per week that draw from the entire NASA research portfolio
			MSFC Education Programs	Develop new methods of directing web surfing educators and students to NASA sites containing popular content sought by the educational community.

MARSHALL VALUES

The Marshall Space Flight Center team is committed to these core values.

People

• We recognize that the people who work here are "most important"—and are our greatest strength. • We create a safe and healthy environment.• We encourage balance between personal and professional life. • We enable personal and professional growth.• We commit ourselves to the highest standards of integrity and ethical behavior.• We reward and celebrate our accomplishments.• We recognize individual and cultural differences and treat each other with dignity and respect.

Customers

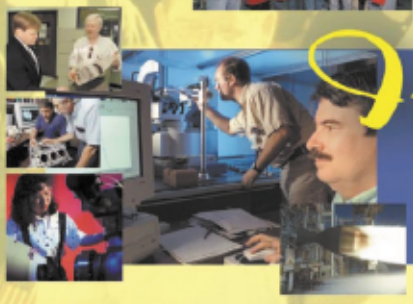
• We are accountable to our customers and are committed to their satisfaction.
• Our customers can depend on us to deliver quality products and services.

Excellence

• We pursue excellence in our people and in everything we do.
• We promote continual learning and improvement.
• We hold one another accountable for doing what we commit to do.

Teamwork

• We are a unified and interdependent team.
• We cooperate, communicate openly and share ideas with each other for the common good.
• We seek and enable partnerships with other NASA Centers, other agencies, academia, industry and our local and global communities.



Innovation

• We promote innovation and creativity.
• We seek different ideas and perspectives.
• We are committed to making a significant difference.
• We are willing to accept well-assessed, selected risks in the pursuit of our goals—but never at the expense of safety.

These values serve as the principles that guide our decisions and behaviors.

SAFETY IS A FRAME OF MIND.

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