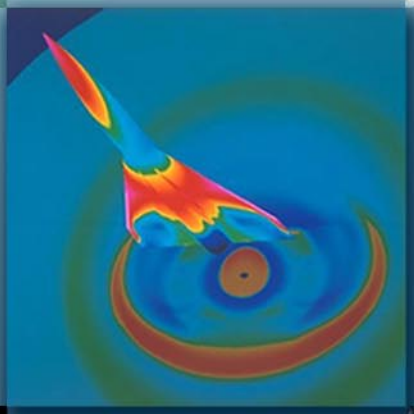
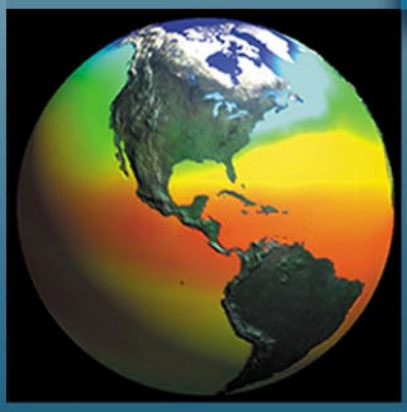
NASA Glenn Research Center





Strategic Implementation Plan

Fiscal Year 2003

National Aeronautics and
Space Administration

John H. Glenn Research Center at Lewis Field
Cleveland, Ohio

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Center Director's Message

This Glenn Research Center Strategic Implementation Plan summarizes the Center's key processes, activities, metrics, and milestones for fiscal year 2003.

This plan addresses the needs of GRC's primary customers, who are our Nation's businesses, academia, the Department of Defense, and the Federal Aviation Administration. This plan addresses the needs of GRC's primary stakeholders, who are Congress, the Administration, state and local government entities in Ohio and the Great Lakes region, and, of course, NASA Headquarters and the other NASA centers—all of whom are also GRC's customers.

To successfully satisfy customer and stakeholder needs, we at GRC must not only commit ourselves to implementing this plan but also to practicing the key values of quality, openness, diversity, and integrity. We must commit ourselves to innovation and continuous improvement so that we will always provide quality products and excellent services for safe and reliable aeronautics, aerospace, and space applications. These commitments will benefit our Center, NASA, our Nation, and the world.

Donald J. Campbell
Director

Julian M. Earls
Deputy Director

Marvin E. Goldstein
Chief Scientist

John W. Gaff
Assistant Deputy Director for Policy

J. William Silvera
Chief Counsel

Gary T. Seng
Director, Aeropropulsion Research Program Office

Olga D. Gonzalez-Sanabria
Director, Systems Management Office

Robert Romero
Chief, Office of Equal Opportunity Programs

Robert E. Fails
Chief Financial Officer

Robyn N. Gordon
Chief, Office of Human Resources

Arun K. Sehra
Director of Aeronautics

Woodrow Whitlow, Jr.
Director of Research and Technology

Gerald R. Barna
Director of Space

Randall B. Furnas
Director of Engineering and Technical Services

Sasi K. Pillay
Chief Information Officer

Vernon W. Wessel
Director of Safety and Assurance Technologies

John M. Hairston, Jr.
Director of External Programs

Introduction

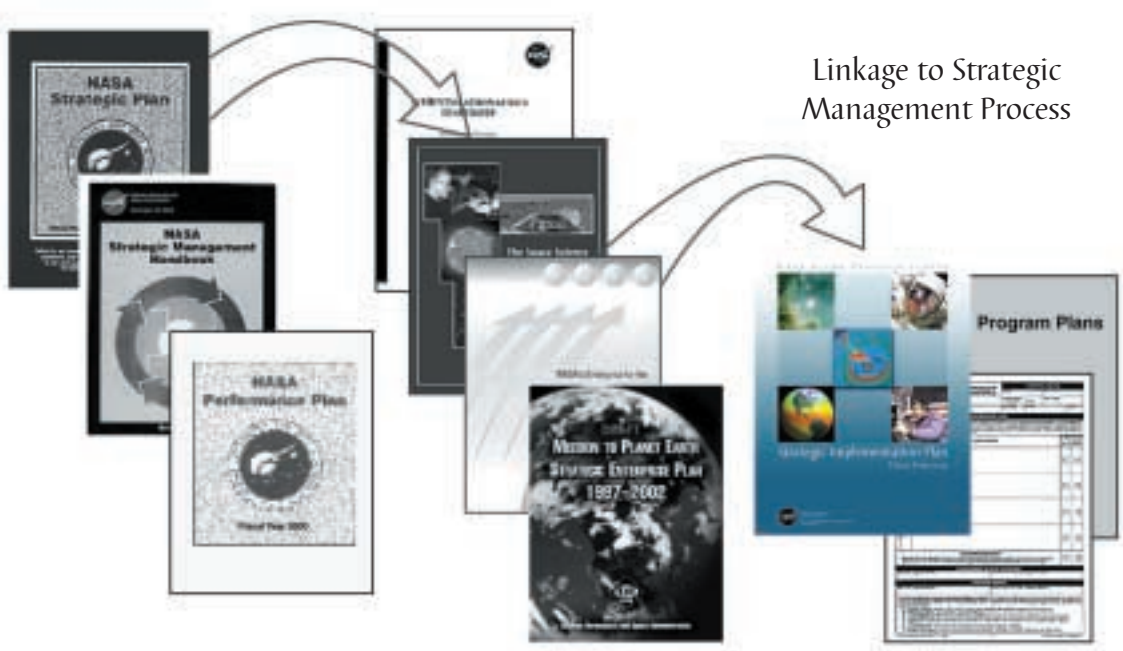
The Purposes of This Plan

The Government Performance and Results Act of 1993 requires agencies to conduct long-term strategic planning, measure program outcomes, and be accountable for achieving program results. Accordingly, NASA has developed a Strategic Plan that articulates its activities, goals, customers, and methods for successfully accomplishing its mission.

The Glenn Research Center (GRC) Strategic Implementation Plan (SIP) is designed to

- Delineate GRC's fiscal year objectives and milestones to support NASA's Strategic Plan and Annual Performance Plan
- Communicate to GRC employees their expected contributions to the Agency and the Center
- Assure GRC customers and stakeholders that their needs are being met
- Provide performance measures and indicators for GRC

The diagram below shows that the elements of the NASA Strategic Plan and Annual Performance Plan cascade to the NASA GRC SIP and subsequently to program plans and individual employee performance plans.



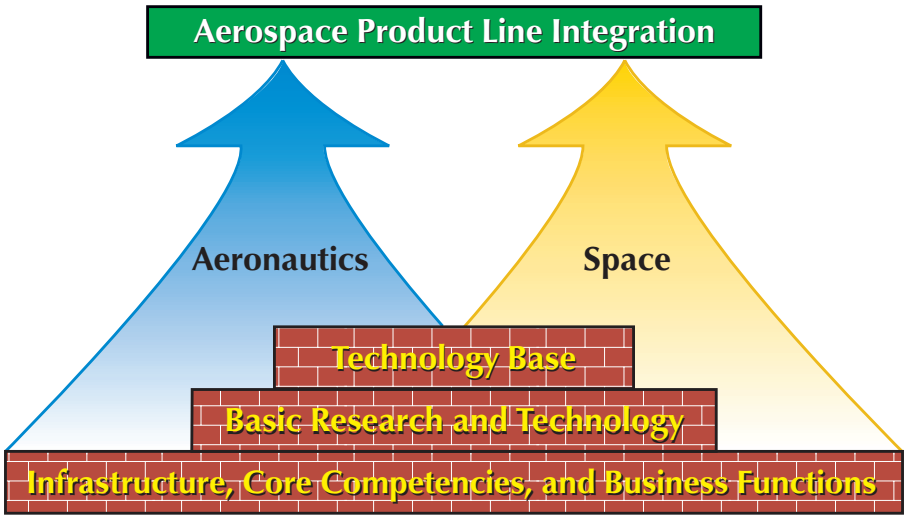
Linkage to Strategic Management Process

The NASA Mission

To understand and protect our home planet
To explore the Universe and search for life
To inspire the next generation of explorers
. . . as only NASA can

The GRC Mission

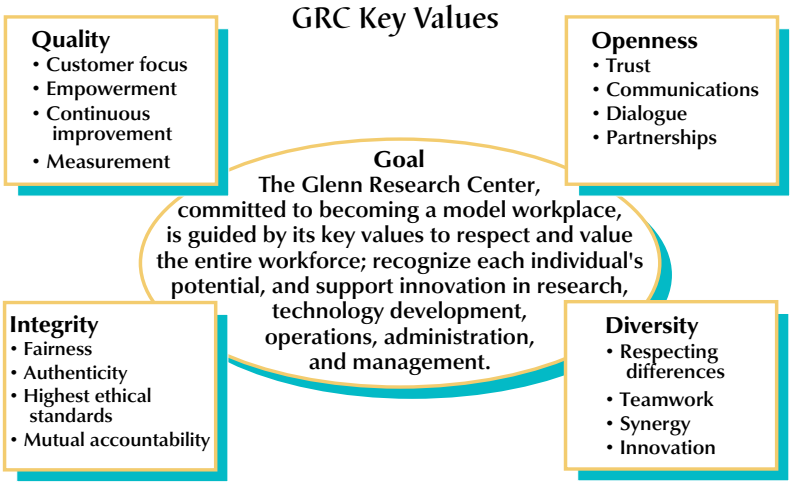
As a diverse team working in partnership with government, industry, and academia to increase national wealth, safety, and security, protect the environment, and explore the universe, we develop and transfer critical technologies that address national priorities through research, technology development, and systems development for safe and reliable aeronautics, aerospace, and space applications.



The GRC Mission and its foundations.

Model Workplace Goal

The model workplace represents the goal state where the full integration of Glenn's key values (diversity, quality, openness, and integrity) is adequately demonstrated. It is the type of workplace where all people at Glenn feel valued for their contributions to the Center's goals and are rewarded fairly for their achievements; where work is an energizing and motivating experience free from racism, sexism, and other "isms" that divide and denigrate groups and individuals; where all persons enjoy personal fulfillment in their careers; where Glenn is frequently visited for benchmarking by other U.S. organizations because of the excellence of its culturally diverse staff and management; where customers, stakeholders, and staff recognize the benefits of its culturally diverse workforce.



Agency Safety Initiative

The NASA Agency Safety Initiative is a cornerstone element for all programmatic and institutional activities at GRC. The overall goal of this policy is "Making NASA the Nation's leader in the safety and occupational health of its workforce and in the safety of the products and services it provides." In response to this goal, GRC has initiated comprehensive efforts to implement an effective safety and health program, which includes provisions for the systematic identification, evaluation, and prevention or control of hazards—general and specific—arising from foreseeable conditions in the workplace.

Four NASA core process requirements vital to the success of the Agency Safety Initiative are

- Management commitment and employee involvement
- Worksite hazard analysis
- Hazard prevention and control
- Safety and health training

In response to these requirements, the GRC program stresses enhanced safety practices in the workplace and improved safety awareness by management and staff. A systematic approach to safety and health risk identification has been introduced and is being applied to all systems, equipment, and facilities. Program and project managers now include the prevention and control of safety and health hazards as essential elements of their risk strategies, and GRC's industrial and academic partners have also been recruited in the pursuit of these goals. Comprehensive training helps managers and staff to recognize and control workplace hazards and hazardous situations. This coordinated effort will enable GRC to meet the NASA Administrator's goals in this most important element of the NASA mission.

GRC Core Competencies

GRC implements Agency goals and strategies by building and maintaining critical skills, capabilities, and business functions to support technology development, resulting in four technology core competencies. GRC also builds and maintains critical skills, capabilities, and business functions to support scientific research, resulting in three science core competencies. Finally, the Center's continuing significant role in improving scientific and mathematical education in our Nation draws upon competency in education.

Listed below are the Center's core competencies and their corresponding strategic thrusts:

Technology Core Competencies

Aeropropulsion Systems

Applied research to

- Improve turbomachinery components and propulsion systems
- Develop improved aero-, thermo-, structural, and mission analysis modeling and simulation tools for aeropropulsion systems
- Develop improved materials and structural concepts for aeropropulsion systems
- Reduce propulsion system noise and emissions
- Increase propulsion system efficiency
- Advance harsh environment instrumentation and sensors
- Develop propulsion control and engine health management technologies

Aerospace Power and Electric Propulsion

Applied research to

- Enhance ability to propel spacecraft on science and exploration missions
- Provide transit and surface power to NASA missions
- Create technology in power and electric propulsion to enhance and enable NASA missions
- Provide system analysis, modeling and simulation, and mission analysis to guide technology in end-to-end power and electric propulsion developments

Aerospace Communications

Applied research to

- Provide end-to-end system analyses, modeling, simulation, and demonstrations
- Advance frequency spectrum utilization and signal propagation analyses
- Advance multigigabit processing communication payloads, Internet protocols, Internet-protocol-compliant aircraft and spacecraft, data distribution networks, and satellite constellation networks
- Advance space Internet protocols and technologies for space and terrestrial interoperability
- Advance communications, navigation, and surveillance (CNS); aviation security technologies; and sensors, local area networks (LAN), wide-area networks (WAN), and data distribution
- Develop communication device and component specialties, including high-power electronic and monolithic microwave integrated-circuit (MMIC) devices, phased-array antennas, and processing electronics

Fluids and Combustion

Basic and applied aeronautical and propulsion-related research to

- Understand and improve combustion processes
- Improve fire safety and fire prevention, detection, and suppression
- Develop computational fluid dynamics tools for turbulent reacting flows
- Determine fluid and thermal physics of ice growth processes
- Determine effects of ice accretion on vehicle performance
- Develop icing-tolerant designs and ice avoidance systems
- Develop fluid management and cryogenic fluids technologies

Science Core Competencies

Fluid Physics

Basic and applied research in a microgravity environment to

- Enhance basic understanding of fluid phase processes, from molecular to large-scale phenomena
- Improve control and utilization of fluids in space-based systems (e.g., propellant management, life support, and thermal control systems)
- Exploit the knowledge-transfer potential for Earth-based environmental and industrial processes

Combustion Science

Basic and applied research in a microgravity environment to

- Enhance basic understanding of combustion processes involving a wide combination of fuel, oxidizer, and ignition conditions
- Improve fire safety practices and technologies for space-based systems (e.g., spacecraft fire safety flammability standards, detection systems, and suppression systems)
- Exploit the knowledge-transfer potential for Earth-based processes to improve fuel efficiency, reduce pollution, and control unwanted fires and explosions

Bioscience and Engineering

Basic and applied research to

- Stimulate increased productive, cross-disciplinary, collaborative research involving the physical science and engineering and biological science communities
- Adapt and apply research, knowledge, and technology of fluids, sensors, instrumentation, and imaging to improve biotechnology and biomedical research

Education

Educational services to

- Inspire students to pursue careers in science, technology, engineering, and mathematics, especially through the Lewis Educational, Research, and Collaborative Internship Program, precollege student involvement programs unique to GRC, and by use of GRC's student database for assessment and tracking

- Increase minority educator and student participation in the GRC-developed, Nationwide Science, Engineering, and Mathematics Aerospace Academy and NASA's National Explorer Academies

- Share advanced educational technology through educator and student participation in GRC 2003 Centennial of Flight and For Inspiration and Recognition of Science and Technology activities

- Improve K–12 education through regional educational partnerships such as the Science and Mathematics Achievement Required for Tomorrow consortium, the Regional Alliance for Informal Science Education, and Ohio Aerospace Institute (OAI)

- Provide educators in the Great Lakes Region with teaching tools and experiences through onsite and classroom involvement with GRC resources and people

- Improve K–16 education through participation on the Code R Aerospace Education Coordinating Committee and the GRC Aerospace Education Coordinating Committee

- Support Agency education initiatives, including engaging the public at science centers, museums, air shows, conferences, education exhibits, and similar venues

GRC Mission Areas

GRC Mission Area: Aeropropulsion

Vision

NASA continues to be the world leader in aeropropulsion research and technology. This leadership will foster a series of technological revolutions early in the 21st century, to produce propulsion systems that are intelligent, whisper quiet, clean and lean with near-zero emissions, and structurally integral to the vehicle. These revolutionary propulsion systems will be based upon breakthroughs in new technologies such as high-temperature nanomaterials, nanodevices, and computational intelligence. They will enable 21st-century vehicle systems to blend into the environment, inspiring new pioneers in the field of air and air-to-space travel.

Mission

Develop, verify, and transfer air-breathing propulsion technology for subsonic, supersonic, hypersonic, general aviation, and high-performance aircraft and rotorcraft. Relative to this mission, GRC conducts fundamental research in propulsion-related materials, structures, internal fluid mechanics, instrumentation, controls, and systems. Aeropropulsion encompasses turbine engines, all varieties of intermittent combustion engines, electric engines, hybrid engines, and all other types of engines applicable to next-generation and future air and space vehicle systems.

Ultraclean, quiet, intelligent engine.

GRC Mission Area: Space Propulsion

Vision

GRC develops space propulsion system technology breakthroughs that expand NASA's horizon of discovery. GRC space propulsion technology provides critical advanced concepts that are finding wider applications in more of NASA's near-Earth-orbit and deep space missions. More efficient, more powerful technology could allow a reduction in spacecraft and mission costs, increased mission and science capabilities, or revolutionary spacecraft and mission concepts.

Mission

Develop propulsion technologies to enable future NASA missions. Stimulate industry with new concepts that will be applicable to Earth-centered projects like communications and weather satellites. Enable long-term, long-distance missions with durable, reliable, efficient, powerful deep space propulsion systems.

Spacecraft propelled by advanced ion or Hall thrusters.

GRC Mission Area: Aerospace Power

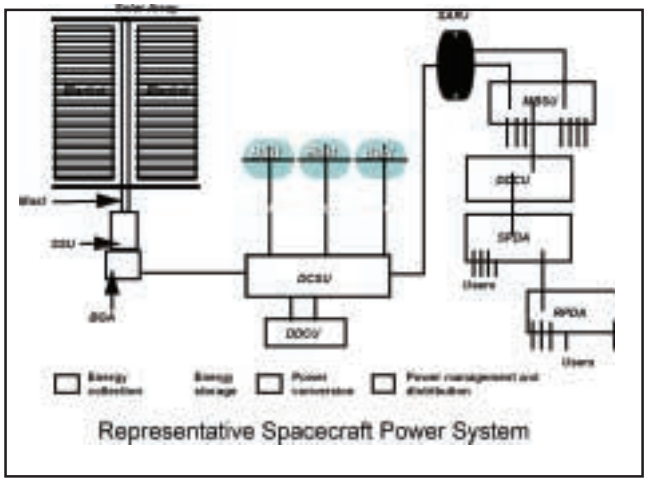
Vision

GRC provides critical advanced aerospace power technology to meet the needs of the NASA Enterprises and Strategic Technology areas and help to revolutionize the aerospace industry. Aerospace power needs are growing and will continue to grow and change in the future. GRC will meet these changing requirements with research that will provide ever more sophisticated power concepts. These new technology advancements will be mission enabling for future NASA projects.

Mission

Develop aerospace power technologies that enable future NASA missions and transfer these technologies to industry.

This mission is accomplished by a well-balanced combination of in-house research, design, testing, and evaluation, as well as through key partnerships and cooperation with other NASA centers, other government agencies, universities, and industry. GRC efforts are planned and implemented in close concert with the requirements of the Enterprises and mission centers to ensure that the technologies developed will meet future Agency mission needs.



GRC Mission Area: Aerospace Communications

Vision

GRC's vision for aerospace communications in the 21st century is to enable the interconnection of aircraft and spacecraft with the seamless ease that is observed today on the terrestrial Internet.

Mission

GRC's mission for aerospace communications is to lead the Agency in the development, verification, and transfer of systems and technologies to revolutionize the national airspace and enable future space visitors.

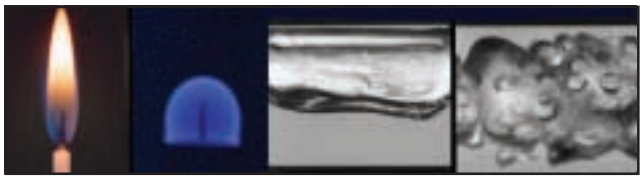
GRC Mission Area: Microgravity

Vision

GRC microgravity research is recognized worldwide for inspiring and enabling a growing array of high-value scientific and technological advancements through the use of GRC's unique capabilities in reduced-gravity and interdisciplinary research. GRC microgravity-enabled research will be critical to the achievements of a broad-based spectrum of international scientists, technologists, and educators from academia, industry, and government; GRC-supported microgravity research will be pivotal to the development of advanced technology needed to enable future space missions; and research supported or conducted by GRC will be sought by industry to provide new products and services that benefit the American public and others worldwide.

Mission

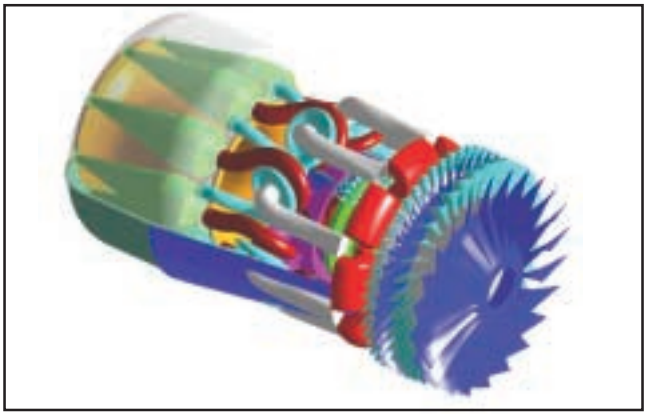
Promote and enable use of the microgravity environment for the advancement of scientific and technological knowledge, and expand the application of that knowledge to derive the greatest possible benefits, both in future space missions and in increased national health, wealth, safety, and security. Engage the national research community by fostering synergistic and creative microgravity research proposals by academic, governmental, and industrial researchers and technologists. Develop ground-based and flight facilities and diagnostic capabilities to support peer-reviewed and selected investigations.



Propulsion and Power Research and Technology

The Propulsion and Power Program is a basic research and technology program of NASA's Aerospace Technology Enterprise (ASTE). It focuses on maintaining U.S. superiority in engine technology and ensuring the long-term environmental compatibility, safety, and efficiency of propulsion systems. The program addresses critical propulsion technology needs across a broad range of investment areas, including revolutionary advances in conventional aeropropulsion, unconventional combustion-based propulsion, and electric/hybrid propulsion and power systems technologies.

High-risk, high-potential research investments include fuel-cell-based propulsion and power systems, high-temperature nanotechnology including silicon carbide nanotubes, self-adapting, highly efficient gas turbine components to enable highly intelligent engines, and pulse-detonation engine technologies. These technologies are developed through proof-of-component and/or concept testing (Technology Readiness Level 3). Especially promising technologies will be recommended to technology maturation programs for possible breadboard testing in relevant environments (Technology Readiness Level (TRL) 5).



Pratt & Whitney concept for pulse detonation engine (PDE) hybrid with reverse flow combustors.

Ultra-Efficient Engine Technology

GRC has responsibility for the Ultra-Efficient Engine Technology (UEET) project, which is a key project within the Vehicle Systems Program. UEET will develop, validate, and hand off revolutionary propulsion technologies to enable future generations of aerospace vehicles. These technologies will be applicable across the speed range from subsonic to hypersonic, with the emphasis on turbine-based systems. The project will address local air quality concerns, long-term aviation growth, and impact on the world climate by providing technology to dramatically increase fuel efficiency while reducing carbon dioxide (CO_2) and oxides of nitrogen (NOx) emissions. UEET will also develop technology to avoid impacting the ozone layer during aircraft cruise operation. This research will lead to other focused projects, including engine system test demonstrators accomplished in partnership with other government agencies and industry.

Technologies developed by the UEET project will likely be transferred to other programs and projects, such as ASTP and QAT. Emerging technologies from the Aerospace Propulsion and Power R&T project and other projects will be incorporated into UEET.

Weather Safety Technology

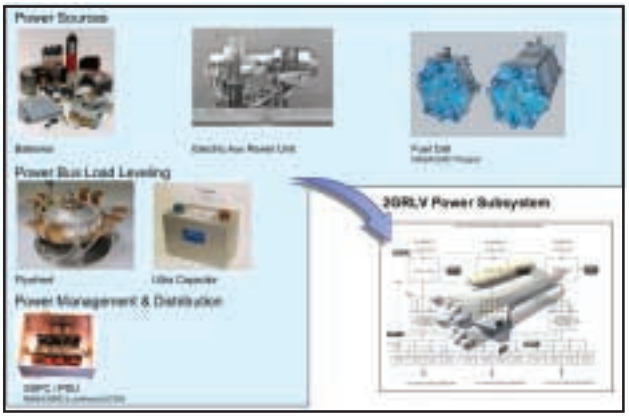
The Weather Safety Technology project is under the Aviation Safety Program. The overall project objective is to reduce the incidence of aircraft accidents related to icing, turbulence, and other adverse weather-related conditions. These can be mitigated by the availability of timely, intuitive weather information in the cockpit, mitigation technologies and

analysis tools, and appropriate education and training. The technologies arising from this Project will reduce the role of atmospheric conditions in aviation fatal accidents, incidents, and injuries.

This project will develop aviation weather information and digital communications systems; turbulence detection systems; tools for design, certification, and qualification of aircraft systems in icing; icing detection and protection systems; icing educational and training aids; and atmospheric hazard avoidance and mitigation methods.

Second-Generation Reusable Launch—Vehicle Subsystems

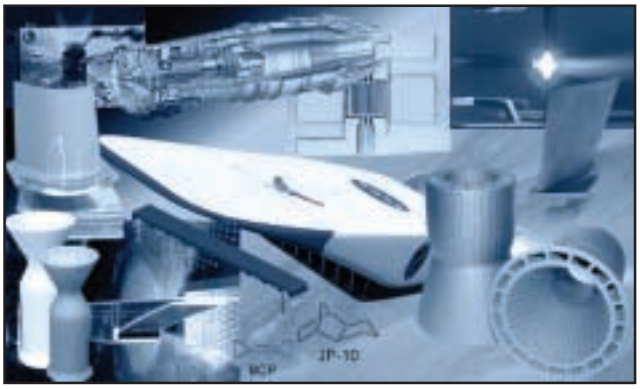
The Vehicle Subsystems (VSS) project is part of the Space Launch Initiative. It is implemented with participation from industry, academia, the Department of Defense (DOD), and several NASA centers. The project provides technical and programmatic leadership for all technology development and demonstrations of vehicle subsystems. It addresses technology advancement and risk reduction in advanced avionics, power, and actuation.



The power element is developing risk-reduction technology for advanced power generation, energy storage, and power distribution and management systems. Advanced electromechanical and electrohydrostatic actuators are being developed in the actuator element of the VSS project, along with peak power storage and/or load-leveling devices to enhance actuator operations. These actuator technologies eliminate the centralized hydraulic actuation system, decreasing maintenance requirements and thereby decreasing vehicle operating costs. The avionics element includes advanced development of avionics for vehicle management, data acquisition, telemetry and/or recording, guidance, navigation, and control. Redundancy management techniques will be integrated to increase safety.

Space Transfer and Launch Technology—Propulsion Research and Technology

Propulsion Research and Technology (PR&T) is a project within the ASTP Hypersonics Investment Area. PR&T is developing critical advanced component technologies for both turbine-based combined-cycle (TBCC) and rocket-based combined-cycle (RBCC) propulsion systems, and the engineering capabilities to successfully design, build, and test hypersonic propulsion systems. The project will also host the two University Research and Engineering Technology Institutes (URETIs) in hypersonics.



Key PR&T challenges include the extreme environments generated by hypersonic flight; the wide operating ranges needed in components, and the performance and life requirements (greater than 500 missions, which is unprecedented for access-to-space propulsion); and the orders-of-magnitude improvements required in reliability and safety. PR&T will use many methods of technology maturation for hypersonic propulsion system components, including developing test articles to be integrated in ground-based propulsion testbeds being developed by the Revolutionary Turbine Accelerator (RTA) and RBCC projects.

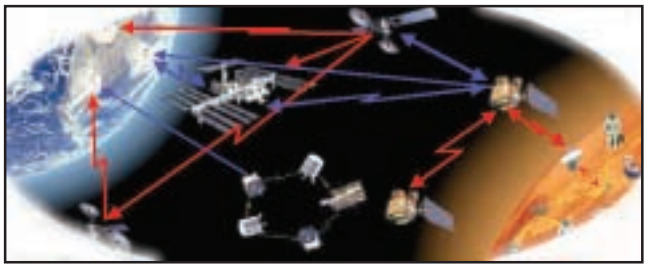
Turbine-Based Combined-Cycle Propulsion Revolutionary Turbine Accelerator

The TBCC RTA is a project within the ASTP Hypersonics Investment Area. With participation from industry, academia, DOD, and several NASA centers, the RTA project will develop and demonstrate TBCC and high-Mach turbine propulsion for space access. The project is developing critical component and subsystem technologies to improve thrust-to-weight ratio and reliability, and reduce the maintenance requirements for high-Mach turbine propulsion systems.

The RTA project consists of the development and testing of a ground-based turbine accelerator demonstrator engine; concept definition of a subscale TBCC propulsion system (turbine accelerator with dual mode scramjet for a X43–B flight test); and concept definition and analysis of vision turbine-based propulsion systems. Development of the ground-based demonstrator engine is aimed at identifying and rectifying issues for the development of large turbine accelerators. The near-term focus of the RTA project is on turbine accelerator concepts that will reach at least Mach 4 and provide increased operability and durability compared with the current state of the art.

Space Communications

Space Communications (SC) is a project within the Computer Information Communications Technology Program in ASTE. The project aims to enable both widespread coverage and continuous presence for the delivery of high-rate data from aero-based, Earth-based, and space-based assets. New communication and information technology breakthroughs will soon establish our virtual presence throughout the solar system, allowing us to obtain information from throughout the universe and distribute it directly to the user.



The SC project has two technical objectives: to develop and demonstrate innovative technology products for space data delivery, enabling high data rates, broad coverage, and Internetlike data access that will vastly expand the reach of space and Earth science; and to develop distributed communication architectures, networks, and technologies to provide broad coverage and intelligence-based, real-time data delivery from air, Earth, and space.

Energetics

The GRC Energetics Project is conducted under the Enabling Concepts and Technology (ECT) Program in Aerospace Technology. The ECT Program explores revolutionary concepts for aerospace systems, and performs fundamental research and development of high-payoff technologies. The Energetics Project develops advanced power and propulsion technologies. GRC has a long and productive history in meeting unique NASA space power and propulsion needs, which typically are not addressed through commercial industry. Meeting these needs allows the Agency to perform its mission with increased capability at reduced cost.

By acting as a foundation for a broad range of innovative technologies and steady influx of new concepts, this project will enable NASA's mission developers in all five Enterprises to expand their affordable options. Technology development includes solar power generation, energy storage and conversion, power management and distribution, and advanced electrical and chemical propulsion.

NASA Evolutionary Xenon Thruster

GRC has been selected to develop the NASA Evolutionary Xenon Thruster (NEXT) under the In-Space Propulsion Program. The NEXT Project will develop and verify an advanced ion propulsion system consisting of thruster, power processing, and xenon-feed-system elements. Technologies developed under NEXT (at the component and system level) are expected to reach a TRL of 5, with significant progress made toward a TRL of 6 in the 2005 timeframe, to support future implementation by solar system exploration mission users.

Characterization of system performance, lifetime issues, critical interfaces, optimal operation, and integration of ion propulsion elements are key objectives of the project.

Quiet Aircraft Technology

The Quiet Aircraft Technology (QAT) project, operated under ASTE, will develop technology to directly improve the quality of life of U.S. citizens by reducing the public's exposure to aircraft noise. The QAT Engine System Noise Reduction project will provide the advanced analytical tools to predict engine noise and the technologies to reduce it.

The goals of the Engine System Noise Reduction project are based on NASA's ASTE goals. The 10-year Enterprise goal is to deliver a technology that will enable a 50-percent reduction in the perceived noise levels of future aircraft, relative to the best of the fleet in 1997. This would require reductions of 4 dB in engine fan and jet noise relative to the current state-of-the-art engine noise-reduction technologies. The primary goal of the Engine System Noise Reduction project is therefore to develop technologies to reduce both fan and jet noise by 4 dB, and to demonstrate these technologies in laboratory-scale rig tests by 2005.

Nuclear Systems Initiative

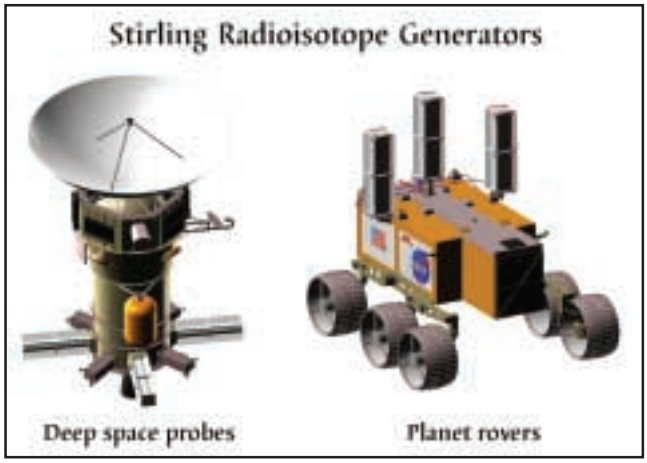
The Nuclear Systems Initiative will develop enabling power and propulsion technologies to dramatically increase potential scientific return for future NASA space science missions to the outer planets. NASA GRC will be a main contributor to the Nuclear Systems Initiative technology and management efforts in the areas of electric propulsion and power systems.

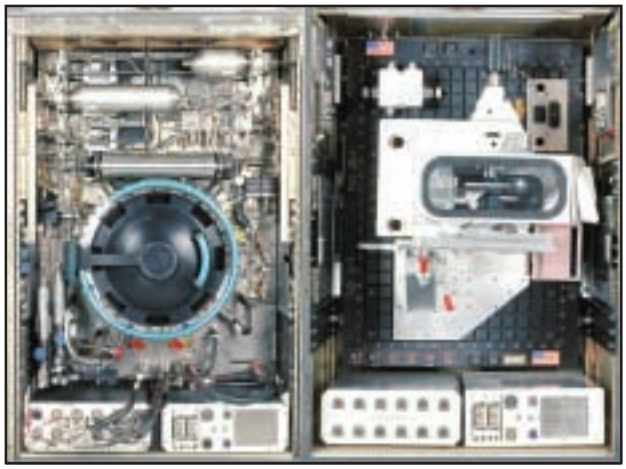
GRC is the premier developer of electric propulsion and power systems and has built, flown, and operated several spacecraft. The electric propulsion technologies that GRC is developing are significantly enhanced by the increased electrical power provided by the proposed nuclear-driven power systems. The added propulsion capabilities will enable missions to be flown that are beyond the performance capabilities of current chemical propulsion systems. The dynamic power conversion technologies GRC has expertise in are leading candidates for the generation of electrical power from the thermal energy of a nuclear source.

Fluids and Combustion Facility

The Fluids and Combustion Facility (FCF) is a key project enabling NASA's Biological and Physical Research Enterprise to conduct scientific investigations on the International Space Station (ISS). The FCF will be deployed on ISS in 2004 and 2005 and will mark a new era in the quality and quantity of research capabilities in combustion science, fluid physics, and other disciplines.

The FCF is a system of on-orbit and ground hardware and software, including two powered racks for combustion and fluid physics research. FCF will provide advanced telescience capabilities to allow researchers to operate their experiments interactively, as though working in their own distant laboratory. Each investigation can be customized with a small amount of equipment that can be easily installed by the ISS crew. FCF is adaptable and modular so that it can be upgraded as needed. The facility will accommodate 10 to 30 combustion and fluid physics experiments each year of its 10-year lifetime.

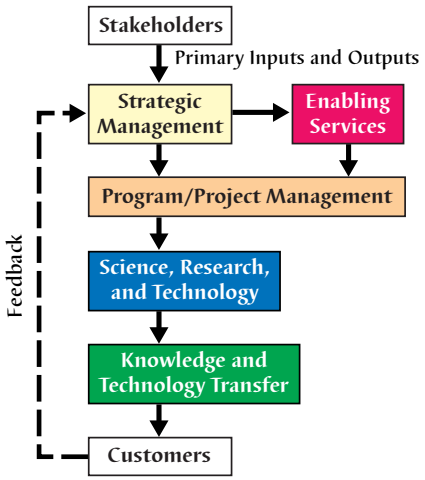




Alignment of NASA's Cross-Cutting Processes to New GRC Key Processes and the President's Management Agenda

GRC Key Processes

In FY03, GRC will begin to manage in accordance with five new Key Processes (Strategic Management (SM); Enabling Services (ES); Program and Project Management (PPM); Science, Research, and Technology (SRT); and Knowledge and Technology Transfer (KTT)). These key processes cut across organizations. They provide a basis for improving the efficiency as well as the effectiveness of the Center. A simplified chart showing GRC's Key Processes and primary input and output flows is provided below.



NASA plans in FY03 to phase out the use of and reference to the four Cross-Cutting Processes (Manage Strategically, Provide Aerospace Products and Capabilities, Generate Knowledge, and Communicate Knowledge) and phase in the President's Management Agenda (PMA) performance areas (Integrating Budget and Performance, Human Capital, Competitive Sourcing, Improved Financial Management, and E-Government). To reduce some of the confusion arising from this transition and overlap, a summary is given below of how the four Cross-Cutting Processes generally align with the new management categories.

NASA Cross-Cutting Process	President's Management Agenda Performance Area	New GRC Key Process
Manage Strategically	Integrating Budget and Performance	Strategic Management
	Human Capital	Enabling Services (Human Resources)
	Competitive Sourcing	Enabling Services (Procurement)
	Improved Financial Management	Enabling Services (Finance)
	E-Government	Enabling Services (Information Technology)
Provide Aerospace Products and Capabilities	—	Program and Project Management
Generate Knowledge	—	Science, Research, and Technology
Communicate Knowledge	—	Knowledge and Technology Transfer

GRC Performance Measurement

GRC uses milestones and metrics to assess and document the effectiveness and efficiency of its processes. Any level of GRC process can be measured by milestones, metrics, or both. However, GRC Key Processes are measured by both milestones and metrics.

Milestones

Milestones are discrete events that are important to the accomplishment or progress of a NASA or GRC mission, program, project, or process, such as delivery of a product, provision of a service, or development of a specific technology. Because milestones typically occur only once, they generally cannot be trended except in an aggregate sense. Program and project milestones can often be evaluated for technical, schedule, and cost performance, but most other milestones can only be assessed using "yes/no" criteria.

All Level-1 and most Level-2 GRC program milestones will be given in this SIP. Other nonprogram milestones (and a few project milestones) of significance to the Center will also be identified in this Plan.

Metrics

Metrics come in many forms and are direct or indirect measures or indicators of performance that are quantifiable, have specific goals or targets (ideally, with "goodness" readily apparent), and can be trended. Metrics like input, activity, output, and outcome are the most common. They may measure or indicate effectiveness (by measuring something like customer satisfaction) or efficiency (by measuring the economics of performing an activity). Both effectiveness and efficiency metrics are important to understanding and improving the health of the organization.

Strategic Management

Key Process Objective
Direct and allocate resources, and evaluate performance for the Center.

Strategic Management Metrics (Goals)
Director's Action Item Responsiveness: Complete 80 percent of the actions on or before due date.

New Business: *No goals set yet. See Milestone 03SM1.1.*

Revenues: Increase revenues over FY02.

Center Obligations and Costing: Stay within 5 percent of the plan; cost at least 75 percent of all resources available to cost.

Customer Satisfaction: Increase customer satisfaction, measured once every 2 years.

Employee Satisfaction: Increase employee satisfaction, measured once every year.

Major Milestone Performance: Complete 85 percent of all SIP milestones.

Strategic Implementation Plan Timeliness: Submit the draft SIP to NASA Headquarters by October 1.

Strategic Management Milestones
Shown below are GRC's FY03 SM milestones, and how they relate to Agency goals and objectives (primarily the Cross-Cutting Process, Manage Strategically) and PMA goals and guidance.

Agency Goals and Objectives:	GRC Milestones Supporting These Goals and Objectives:
MS Goal 1: Enable the Agency to carry out its responsibilities effectively, efficiently, and safely through sound management decisions and practices.	**03SM1.1: New Business Registry** Implement the New Business Registry Centerwide. (4Q; 0170/O. Gonzalez-Sanabria)
PMA—**General Guidance**: Focus on activities that can produce the highest rate of return.	**03SM1.2: External Customer Survey** Complete the second biannual GRC external customer survey. (4Q; 0170/O. Gonzalez-Sanabria)
PMA—**Integrating Budget and Performance:** Consult with external parties on performance metrics for research programs.	**03SM1.3: ISO Registration** Maintain registration to the ISO 9001:2000 standard by successfully completing registrar surveillance audits. (4Q; 0170/O. Gonzalez-Sanabria)
	03SM1.4: GRC Process Model Define and develop process maps for the second level of processes in the GRC Process Model. (4Q; 0170/O. Gonzalez-Sanabria)
	03SM1.5: Center Roles, Missions, and Core Competencies PMA Action: Provide a clear definition of Center roles, missions, and core competencies. (3Q; 0170/O. Gonzalez-Sanabria)

Enabling Services

Key Process Objective

Provide institutional resources, services, and facilities that satisfy customer needs.

Enabling Services Metrics

There are no process-level metrics for Enabling Services. However, each of the following service areas have metrics, most of which are reported at Management Information Meetings (MIMs). A complete listing of these metrics and their goals can be found in the GRC Business Management Systems Manual.

Facilities

Financial Management

Procurement

Information Technology Services

Security

Environmental Services

Publishing and Imaging Services

Safety

Media and Outreach

Human Resources

Equal Opportunity

Flight Operations Management

Enabling Services Milestones

GRC's FY03 Enabling Services milestones, and how they relate to Agency goals and objectives (primarily Manage Strategically, and Provide Aerospace Products and Capabilities, the NASA Cross-Cutting Processes), are given below.

Agency Goals and Objectives:

MS Goal 1: *Enable the Agency to carry out its responsibilities effectively, efficiently, and safely through sound management decisions and practices.*

MS Objective 1: *Protect the safety of our people and facilities and the health of our workforce.*

MS Performance Goal 3MS1: *NASA will increase the safety of its infrastructure and the health of its workforce through facility safety improvements, reduced environmental hazards, increased physical security, enhanced safety and health awareness, and appropriate tools and procedures for health enhancement.*

GRC Milestones Supporting These Goals and Objectives:

03ES1.1: Plum Brook Reactor Decommissioning
Remove completely the reactor tank internals. (4Q; 8010/T. Polich)

03ES1.2: Facility Security Enhancement
Complete FY03 facility security enhancement designs. (4Q; 8500/D. Ornick)

03ES1.3: Incident Reporting Information System
Implement the Incident Reporting Information System throughout the Agency. (4Q; 8300/M. Dominguez)

Agency Goals and Objectives:

MS Objective 2: *Achieve the most productive application of Federal acquisition policies.*

MS Performance Goal 3MS2: *Continue to take advantage of opportunities for improved contract management by maintaining a high proportion of performance-based contracts.*

MS Performance Goal 3MS9: *Continue integrating small, small disadvantaged, and women-owned businesses together with minority universities into the competitive base from which NASA can purchase goods and services.*

PMA—**Competitive Sourcing:**
Update the Federal Activities Inventory Reform (FAIR) Act inventory to recharacterize the NASA workforce.
Develop and implement a plan to convert and/or compete at least 50 percent of "commercial" positions.
Implement appropriate Strategic Resources Review recommendations.

MS Objective 3: *Manage our fiscal and physical resources optimally.*

PMA—**Financial Management:** Implement the Integrated Financial Management Program (IFMP).

Plum Brook reactor.

GRC Milestones Supporting These Goals and Objectives:

03ES2.1: Workforce Rebalancing
PMA Action: Commence efforts to achieve workforce reductions in the 300 series moving toward reduction in that series by FY07. (2Q; 7000/R. Furnas, 6400/R. Gordon)

03ES2.2: Outsourcing Strategy
PMA Action: Develop a long-range (5-year), competitive outsourcing strategy for rebalancing in-house and out-of-house work. (3Q; 0200/R. Fails, 0610/B. Baker)

03ES2.3: Facility Outsourcing Strategy
PMA Action: Commence planning and steps to convert five major GRC test facilities to contractor operation and maintenance and to have a consolidated test facility O&M contract in place by September 2005. (1Q; 7500/J. Haas)

03ES2.4: Long-Range Facility Strategy
PMA Action: Develop a long-range facility action plan, addressing the linkage to program requirements and institutional and/or infrastructure savings initiatives. (4Q; 7000/R. Furnas)

03ES3.1: Integrated Financial Management Program Core Financial Module Training
Complete training of Wave 1 users in the IFMP Core Financial Module. (1Q; 220/C. Root)

03ES3.2: Integrated Financial Management Program Core Financial Module Implementation
Successfully go live for Wave 1 of the IFMP Core Financial Module. (1Q; 220/C. Root)

03ES3.3: Integrated Financial Management Program Budget Formulation Module
Successfully complete Phase 1 of the IFMP Budget Formulation Module. (4Q; 210/K. Gornick)

03ES3.4: Supply System Strategy
PMA Action: Complete a GRC supply system strategy. (1Q; 0620/C. Kennedy)

Agency Goals and Objectives:

MS Objective 4: *Enhance the security, efficiency, and support provided by our information technology resources.*

MS Performance Goal 3MS4: *Improve IT infrastructure service delivery by providing increased capability and efficiency while maintaining a customer rating of satisfactory.*

MS Performance Goal 3MS5: *Enhance IT security by meeting established performance indicators in three critical areas.*

MS Performance Goal 3MS6: *Enhance mission success through seamless, community-focused electronic service delivery.*

PMA—E-Government:
Move to management of NASA's IT infrastructure as a NASA-wide strategic asset.
Move from distributed business processes to federated, shared services.

GRC Milestones Supporting These Goals and Objectives:

03ES4.1: PACE Contract Competition
Using the 8(a)/SDB process, implement a contract to provide cost-effective, consolidated administrative and scientific computing support. (3Q; 7100/W. Naiman)

03ES4.2: Information Technology Security Plan
Ensure that all GRC information technology systems have an IT Security Plan. (4Q; 7100/P. Kotlenz)

03ES4.3: (Deleted prior to publication)

03ES4.4: (Deleted prior to publication)

03ES4.5: Collaborative Tools Pilot
As lead of an eNASA pilot sponsored by the NASA chief information officer, procure and deploy collaborative tools to 35 Agency teams and provide training and support to ensure effective use of those tools. (4Q; 7105/S. Prahst)

Agency Goals and Objectives:

MS Objective 5: *Invest wisely in our use of human capital, developing and drawing upon the talents of all our people.*

MS Performance Goal 3MS7: *Align management of human resources to best achieve Agency strategic goals and objectives.*

MS Performance Goal 3MS8: *Attract and retain a workforce that is representative at all levels of America's diversity, and maximize individual performance through training and development experiences.*

GRC Milestones Supporting These Goals and Objectives:

03ES5.1: Early-Out and Buy-Out Actions
PMA Action: Commence planning and actions to implement early-out and buy-out authority for FY03, FY04, and FY07 to reduce civil service staffing in various technical service functions to address possible budgetary issues. (TBD; 0400/R. Gordon)

03ES5.2: Strategic Management of Human Capital Plan
PMA Action: Develop a human capital plan to address skill mix rebalancing and core competencies. (4Q; 0400/R. Gordon)

03ES5.3: Affirmative Employment Program
Complete the Center FY02 Affirmative Employment Program (AEP) accomplishment report and FY03 AEP plan update. (2Q; 0180/R. Romero)

PMA—**Human Capital:**
Improve use of existing flexibilities (targeted recruitment bonuses and retention allowances).
Reestablish recruitment networks (co-op, PMI).
Implement a paperless hiring and promotion system.
Develop further program management training, incorporating lessons learned.
Facilitate efforts to maintain a future talent pool and develop connections between NASA pipeline and hiring efforts.

03ES5.4: Directorate and Staff Office Equal Opportunity Metrics
Develop directorate and staff office metrics for measuring equal opportunity progress on hires, promotions, losses, awards, and training to be presented at quarterly Management Information Meetings. (3Q; 0180/R. Romero, 6000/R. Saldana)

Agency Goals and Objectives:

PAPAC Goal 1: *Enable NASA's strategic Enterprises and their Centers to deliver products and services more effectively and efficiently.*

PAPAC Objective 1: *Enhance program safety and mission success in the delivery of products and operational services.*

PAPAC Performance Goal 3P1: *Meet schedule and cost commitments by keeping development and upgrade of major scientific facilities and capital assets within 110 percent of cost and schedule estimates, on average.*

PAPAC Performance Goal 3P2: *Track the availability of NASA's spacecraft and major ground facilities by keeping the operating time lost due to unscheduled downtime to less than 10 percent of scheduled operating time.*

CK Objective 1: *Share with the public the knowledge and excitement of NASA's programs in a form that is readily understandable.*

GRC Milestones Supporting These Goals and Objectives:

03ES6.1: Continuous Risk Management Implementation
Facilitate the GRC Continuous Risk Management implementation process for an additional 12 GRC projects. (4Q; 8100/F. Robinson)

03ES6.2: Process Based Mission Assurance
Prototype program assist wizards, bring the Process Based Mission Assurance (PBMA) servers online at GRC, and establish communities of practice mapping of the knowledge experts. (4Q; 8100/L. Scaglione)

03ES7.1: Centennial of Flight Celebration
Implement the exhibit fabrication and management plan developed in 2002 for participation by the Center and the Agency in the 2003 Centennial of Flight celebration. (4Q; 9300/L. Campbell)

03ES7.2: Media Day
Plan and implement a media day at Glenn to showcase the Center's role in the Centennial of Flight celebration, Plum Brook's reactor decommissioning, and other significant research activities. (4Q; 9300/L. Campbell)

Program and Project Management

Key Process Objective

Ensure that GRC programs and projects meet their technical objectives on schedule and within budget.

Program and Project Management Metrics (Goals)

Major Program and Project Milestone Technical Performance: Achieve all technical milestones.

Major Program and Project Milestone Schedule Performance: Achieve 85 percent of all milestones on schedule.

Major Program and Project Milestone Budget Performance: Achieve obligations and costing within 5 percent of plan.

Program and Project Milestones

GRC's FY03 generic program and project milestones, and how they relate to Agency goals and objectives, are given below. Specific program and project milestones are arranged under their sponsoring NASA Enterprise on subsequent pages. All program and project milestones come under the rubric of the new PPM key process.

Agency Goals and Objectives:	GRC Milestones Supporting These Goals and Objectives:
PAPAC Objective 3: Capture and preserve engineering and technological best practices and process knowledge to continuously improve NASA's PPM.	03PPM1.1: Program Performance Evaluation PMA Action: Provide Program Performance Evaluations on all major programs and projects managed by GRC. (4Q; 0200/R. Fails)

GRC Milestones Supporting the Aerospace Technology Enterprise

To maintain U.S. preeminence in aerospace research and technology, ASTE has developed the following goals and objectives that GRC supports.

ASTE Goal 1—Revolutionize Aviation: Enable the safe, environmentally friendly expansion of aviation.

Agency Goals and Objectives:

ASTE Objective 1: Increase Safety—Make a safe air transportation system even safer by reducing the aircraft accident rate by a factor of 5 by 2007 and by a factor of 10 by 2022.

Agency Performance Goal 3R1: Demonstrate progress in maturing, through flight tests and/or simulations, the critical technologies that will be necessary to meet the aviation safety objective. These tests and simulations are critical steps in the development of a suite of technologies that, when completely developed and implemented by the customer, will provide a minimum of 50-percent reduction in fatal accident rate.

GRC Milestones Supporting These Goals and Objectives:

Note: An asterisk (*) indicates a Government Performance and Results Act milestone.

***03A1.1: Smart Icing System Concept Demonstration**
Demonstrate through simulation (using icing flight test database) a concept design of an ice management system that, when fully implemented, would sense the presence of ice accretion on an aircraft, automatically activate and manage the ice protection systems, and provide the pilot with feedback, including the effect of the icing on measured aircraft performance, stability, and control. (3Q; 2500/M. Wadel, 5800/T. Bond)

***03A1.2: Cockpit Weather Information Technologies**
Complete initial evaluation of next-generation cockpit weather information and digital datalink technologies. (3Q; 2500/K. Martzaklis, 6100/M. Jarrell)

***03A1.3: Superalloy Engine Components**
Develop reliable life prediction concepts for advanced nickel-based turbine disk superalloys. (4Q; 0140/G. Seng, 2600/S. Johnson, 5120/M. Nathal)

Agency Goals and Objectives:

ASTE Objective 2: Reduce Emissions—Protect local air quality and our global climate by reducing NOx emissions of future aircraft by 70 percent by 2007 and by 80 percent by 2022 (baseline: 1996 International Civil Aviation Organization (ICAO) standard) and reducing CO_2 emissions of future aircraft by 25 percent by 2007 and by 50 percent by 2022.

Agency Performance Goal 3R2: Complete combustor sector tests for concepts capable of achieving the 705 NOx goal by

GRC Milestones Supporting These Goals and Objectives:

***02A2.1 (Carryover from prior fiscal year): Aspirating Seal Demonstration**
Demonstrate engine aspirating seal technology in partnership with industry. (2Q; 2100/R. Shaw, 2600/M.J. Long-Davis)

03A2.1: Deleted prior to publication

***03A2.2: Ceramic Matrix Composite Turbine Vane**
Develop a long-life, cooled ceramic matrix composite (CMC)

2007, and select the most promising approaches to full annular rig testing for large and regional engine applications. Complete an interim technology assessment of the aggregate potential benefits from engine and airframe technologies to reduce environmental impact. The results from this analysis will provide a benchmark for measuring overall progress and guide future investment decisions.

turbine vane system with an environmental barrier coating system. (1Q; 2600/J. Rohde, 5100/J. DiCarlo)

***03A2.3: Ceramic Matrix Composite Rig Test**
Demonstrate durability of a CMC combustor liner subcomponent sector in rig tests and utilize probabilistic methods analysis. (1Q; 2600/R. Draper, 5100/D. Brewer)

***03A2.4: Large Engine Annular Combustor**
Down-select a large engine contractor to do full annular combustor testing to attain a TRL of 5, based upon a level of emission reduction to be demonstrated and the cost to NASA criteria. (4Q; 2600/J. Rohde, 5800/C. Lee)

***03A2.5: Regional Engine Annular Combustor**
Down-select a regional engine contractor to do full annular combustor testing to attain a TRL of 5, based upon a level of emission reduction to be demonstrated and the cost to NASA criteria. (4Q; 2600/J. Rohde, 5800/C. Lee)

***03A2.6: NOx Reduction Combustor Sector Tests**
In combustor sector tests, demonstrate at least a 70-percent reduction in NOx production relative to 1996 ICAO standards for landing and takeoff conditions in a simulated subsonic engine. (4Q; 2600/J. Rohde, 5800/C. Lee)

***03A2.7: Ultra-Efficient Engine Technology Benefit Assessment**
Perform an interim technology benefit assessment of UEET technologies and their impact on meeting program goals. (4Q; 2600/W. Plencner, 2400/W. Haller)

***03A2.8: Oil-Free Engine Core**
Complete oil-free FJX–2 core testing. (4Q; 0140/G. Seng, 2600/R. Corrigan, 5000/C. Dellacorte)

***03A2.9: Polymer Matrix Composite Engine Component Test**
Test a polymer matrix composite (PMC) component in a realistic engine environment. (4Q; 0140/G. Seng, 2600/C. Ginty, 5150/J. Sutter)

Agency Goals and Objectives:

ASTE Objective 3: Reduce Noise—Benefit airport neighbors, the aviation industry, and travelers by reducing the perceived noise of future aircraft by a factor of 2 (10 dB) by 2007 and by a factor of 4 (20 dB) by 2022 (using 1997 subsonic aircraft technology as a baseline), thereby confining noise to within the airport boundary.

Agency Performance Goal 3R3: Complete development of initial physics-based prediction models to enable discovery of potential noise reduction concepts. Complete an interim technology assessment of the aggregate potential benefits

GRC Milestones Supporting These Goals and Objectives:

02A3.1 (Carryover from prior fiscal year): Fan Noise Tests and Code Development
Conduct fan tests in the 9- by 15-Foot Low-Speed Wind Tunnel to determine rotor contributions to total fan noise for two fans with different loading distributions, and develop advanced measurement methods to support computational aeroacoustics code development. (2Q; 2200/J. Grady)

02A3.2 (Carryover from prior fiscal year): Jet Noise Reduction Concept Assessment
Evaluate the noise reduction benefits of chevron nozzles and

for these concepts to reduce noise emissions. The results from this analysis will provide a benchmark for measuring overall progress and guide future investment decisions.

nozzle lip treatment concepts using the Small Hot Jet Acoustic Rig. (1Q; 2100/J. Grady)

***03A3.1: Physics-Based Noise Prediction Models**
Develop initial physics-based noise prediction models. (4Q; 2600/J. Grady, 5940/E. Envia)

03A3.2: Advanced Mixer Nozzle Tests
Conduct acoustic and flow diagnostic measurements of an advanced mixer nozzle concept using the refurbished Nozzle Acoustic Test Rig in the GRC Aeroacoustic Propulsion Laboratory. (3Q; 2600/J. Grady, 5940/E. Envia)

03A3.3: Fan and Stator System Noise Tests
Complete source diagnostics tests in the GRC 9- by 15-Foot Low-Speed Wind Tunnel to determine rotor and stator contributions to total fan system noise for two fans and three stator designs, and develop advanced flow measurement methods for code validation. (4Q; 2600/J. Grady, 5940/E. Envia)

Agency Goals and Objectives:

ASTE Objective 4: Increase Capacity—Enable the movement of more air passengers with fewer delays by doubling the capacity of the aviation system within 10 years and tripling it within 25 years, based on 1997 levels.

ASTE Objective 5: Increase Mobility—Enable people to travel faster and farther, anywhere, anytime, by reducing the time for intercity door-to-door transportation by half by 2007 and by two-thirds by 2022, and reducing long-haul transcontinental travel time by half by 2022.

GRC Milestones Supporting These Goals and Objectives:
None for FY03

ASTE Goal 2—Advance Space Transportation: Create a safe, affordable highway through the air and into space.

Agency Goals and Objectives:

ASTE Objective 6: Mission Safety—Radically improve the safety and reliability of space launch systems by reducing the incidence of crew loss for a second-generation reusable launch vehicle (RLV) to 1 in 10,000 missions (a factor of 40) by 2010 and to less than 1 in 1 million missions (an additional factor of 100) for a third-generation RLV by 2025.

Agency Performance Goal 3R6: Down-select to a minimum of two launch architectures for detailed development based on their ability to meet safety and affordability goals. This selection will determine what launch architectures and critical technology developments will be continued through FY06.

Agency Performance Goal 3R7: Complete the independent evaluation of three revolutionary hypersonic propulsion technology systems demonstrations and associated ground technologies. This independent evaluation will validate the ability of each propulsion system—a rocket-based combined-cycle engine, a turbine-based combined-cycle engine, and a scramjet engine—to achieve the strategic objectives within cost and schedule.

GRC Milestones Supporting These Goals and Objectives:

***03A6.1: High-Temperature Polymer Matrix Composite**
Demonstrate resin transfer molded PMC with 550 °F use temperature. (4Q; 6500/P. Dasgupta, 5150/M. Meador)

03A6.2: Propulsion System Evaluation
Provide data to support the independent evaluation of a turbine-based combined-cycle engine and rocket-based combined-cycle engine. (2Q; 6500/P. Senick, 5920/P. Bartolotta)

03A6.3: Multiple-Specie Chemical Sensor
Test a first-generation fuel-oxygen safety sensor with multiple-specie (hydrogen, hydrocarbon, and oxygen) sensors in an array for the second-generation RLV. (4Q; 6500/M. Tuma, 5510/G. Hunter)

Agency Goals and Objectives:

ASTE Objective 7: Mission affordability—Create an affordable highway to space by reducing the cost of delivering a payload to low Earth orbit to $1,000 per pound (a factor of 10) by 2010 and to $100 per pound (an additional factor of 10) by 2025 and reducing the cost of interorbital transfer by a factor of 10 within 15 years and by an additional factor of 10 by 2025.

Agency Performance Goal 3R8: See 3R6

Agency Performance Goal 3R9: See 3R7

ASTE Objective 8: Mission Reach—Extend our reach in space with faster travel times by reducing the time for planetary missions by a factor of 2 by 2015 and by a factor of 10 by 2025.

Agency Performance Goal 3R10: Complete initial component tests to provide data for evaluating feasibility of key concepts.

GRC Milestones Supporting These Goals and Objectives:

03A7.1: Polymer-Exchange Membrane Fuel Cell Breadboard Hardware
Deliver to Johnson Space Center (JSC) a polymer-exchange membrane (PEM) fuel-cell breadboard hardware developed by the second-generation RLV subsystems project. (4Q; 6500/N. Pham)

03A7.2: Power and Actuator Preliminary Design
Complete preliminary design of power and actuator hardware for integrated ground testing. (4Q; 6500/J. Free)

03A7.3: Flyback Booster Jet Propulsion Risk Assessment
Complete first-phase analysis of the second-generation flyback booster risk assessment study with General Electric Aircraft Engines and Pratt & Whitney. (2Q; 6500/G. Sadler)

03A7.4: Advanced Control Surface Seals Test Rig
Complete installation of the hot seal scrub test fixture required for the third-generation airframe project's advanced control surface seals task. (4Q; 6500/P. Dasgupta, 5950/P. Dunlap)

03A7.5: Cooled Ceramic Matrix Composite Panel
Design and fabricate a large-scale (6- by 30-in.) cooled CMC

panel for scramjet testing in support of the third-generation RLV initiative. (4Q; 6500/W. Taylor, 5130/M. Jaskowiak)

03A7.6: Hypersonic Propulsion Research and Technology Project Competitive Sourcing
Release the initial competitive solicitation for the FY04 content of the HPR&T project. (2Q; 6500/M. Klem, 6500/C. McLeod)

03A7.7: Revolutionary Turbine Accelerator Project Readiness Review
Conduct an independent Project Readiness Review of the RTA technical approach. (3Q; 6500/P. Bartolotta)

03A7.8: Revolutionary Turbine Accelerator Ground-Based Testbed Concept Design Review
Conduct an independent Concept Design Review of the RTA ground-based testbed. (4Q; 6500/P. Bartolotta)

03A7.9: Integrated System Test of an Air-breathing Rocket Ground Test Engine Concept
Complete RBCC ground test engine conceptual design. (4Q; 6500/P. Senick)

ASTE Goal 3—Pioneer Technology Innovation: Enable a revolution in aerospace systems.

Agency Goals and Objectives:

ASTE Objective 9: Engineering Innovation—Enable rapid, high-confidence, and cost-efficient design of revolutionary systems by enabling the capability to predict and alleviate with 95-percent confidence, during mission design, all probable threats to mission success by 2012. By 2022, enable the capability to methodically design missions with safety, cost, technical performance, and life defined with 95-percent confidence.

Agency Performance Goal 3R11: Complete development of an organizational risk model and establish initial high dependability computing testbeds and tools.

ASTE Objective 10: Technology Innovation—Enable fundamentally new aerospace system capabilities and missions by enabling a 500-percent increase in useful new science information acquired from NASA science missions, data sources, and science system simulations, as compared to FY00–02 science programs by 2012, and by 2022, a 1000-percent increase.
—Enable heretofore-impractical or unaffordable mission classes by improving, by a factor of 3 in 2012 and 10 in 2020 (over comparable systems and concepts designed using FY00–02 flight-ready technology), flight resources, including payload mass, volume, and power.

GRC Milestones Supporting These Goals and Objectives:

***03A10.1: Ion Optics**
Validate ion optics for a twofold increase in life relative to Deep Space 1. (4Q; 6900/J. Nainiger, 5430/M. Patterson)

***03A10.2: Hall Thruster Life and Operations**
Complete Hall thruster life and operating point correlations. (3Q; 6900/J. Nainiger, 5430/D. Jacobson)

***03A10.3: Hall Thruster Modeling**
Complete Hall thruster modeling. (4Q; 6900/J. Nainiger, 5430/D. Jacobson)

***03A10.4: Multijunction Solar Cell**
Demonstrate the feasibility of a high-efficiency multijunction solar cell on a silicon substrate by completing a laboratory demonstration of a two-junction cell on a lattice mismatched silicon substrate. (4Q; 6900/J. Nainiger, 5410/R. Hakimzadeh)

***03A10.5: Advanced Flywheels**
Demonstrate single-axis integrated momentum and power control with flywheels as a step toward future integrated attitude control and energy storage systems for spacecraft. (4Q; 6900/J. Nainiger, 5450/J. Soeder)

Agency Goals and Objectives:

ASTE Objective 10: By 2012, enable mission systems that can operate safely and successfully with less than 10 percent of the human participation required for FY00–02 designs, and by FY20 enable missions that can analyze unexpected events, adjust plans, and adapt systems accordingly, with no human participation.

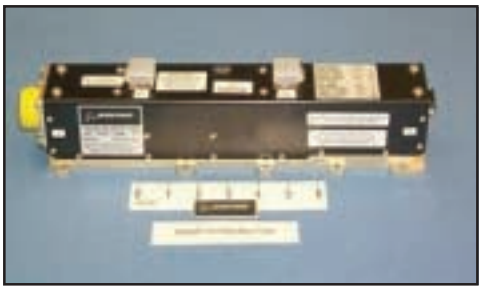
Agency Performance Goal 3R12: Advance the state of the art in automated data analysis, mission command and communications, and science sensors and detectors that are potentially beneficial for future NASA missions.

Agency Performance Goal 3R13: Advance the state of the art in power and propulsion systems, spacecraft systems, and large or distributed space systems, and our knowledge of space environmental effects that are required to support future NASA missions.

Agency Performance Goal 3R14: Demonstrate progress toward the achievement of systems, and systems of systems, that can think, reason, make decisions, adapt to change, and cooperate among themselves and with humans to provide safe and successful aerospace processes and mission functions with greatly reduced human participation by successfully demonstrating individual autonomy components.

GRC Milestones Supporting These Goals and Objectives:

03A10.6: Miniaturized Traveling Wave Tube
Complete optimized design and fabrication of a miniaturized high-efficiency 32-GHz traveling wave tube for high-performance transmitters. (4Q; 6100/K. Bhasin, 5620/R. Simons)



High-power 32-GHz traveling wave tube.

03A10.7: 100-W Traveling Wave Tube Prototype
Demonstrate a 100-W traveling wave tube with an efficiency of at least 55 percent operating at 32 GHz for high-data-rate applications. (4Q; 6100/K. Bhasin, 5620/R. Simons)

03A10.8 Space Communication Project NASA Research Announcement
Issue a NASA Research Announcement (NRA) for the Space Communication Project. (2Q; 6100/K. Bhasin, 5620/R. Simons)

03A10.9 Spacecraft Network Devices
Develop prototype network devices based on terrestrial open system network standards for direct instrument control of manned and unmanned spacecraft. (4Q; 6100/K. Bhasin, 5650/G. Fujikawa)

GRC Milestones Supporting the Human Exploration and Development of Space Enterprise

The mission of the Human Exploration and Development of Space (HEDS) Enterprise is to expand the frontier of space and knowledge by exploring, using, and enabling the development of space for human enterprise. GRC supports the HEDS Enterprise by providing expertise in several areas: research, development, operations planning, and technology demonstration for the ISS; power system technology development for Space Shuttle Upgrades; and research in space power, onboard propulsion, space communications, and space transportation.

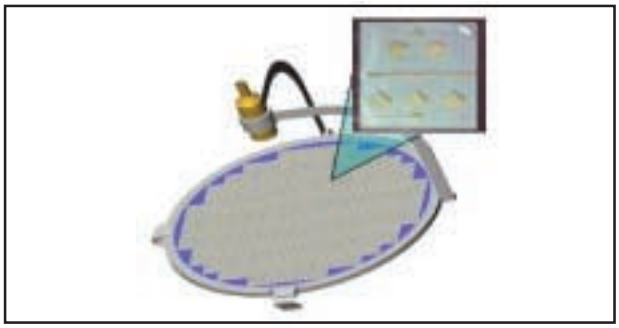
HEDS Goal 1—Explore the space frontier.

Agency Goals and Objectives:

HEDS Objectives:
- **1A:** Invest in the development of high-leverage technologies to enable safe, effective, and affordable human and/or robotic exploration
- **1B:** Conduct engineering research on the ISS to enable exploration beyond Earth orbit.
- **1C:** Enable human exploration through collaborative robotic missions.
- **1D:** Define innovative human exploration mission approaches.
- **1E:** Develop exploration and commercial capabilities through private sector and international partnerships.

GRC Milestones Supporting These Goals and Objectives:

03H1.1: Transmit Reflectarray Antenna Phase Shifter
Complete the design, fabrication, and demonstration of a 26.5-GHz ferroelectric phase shifter for a transmit reflectarray antenna. (2Q; 6100/J. Budinger, 5640/F. Miranda)



26.5-GHz phase shifter layout for ferroelectric reflectarray antenna.

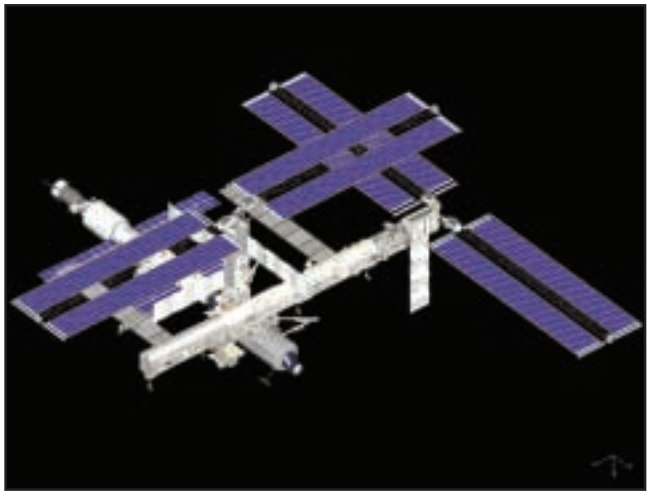
HEDS Goal 2—Enable humans to live and work permanently in space.

Agency Goals and Objectives:

HEDS Objectives:
- **2A:** Provide and make use of safe, affordable, and improved access to space.
- **2B:** Operate the ISS to advance science, exploration, engineering, and commerce.
- **2C:** Ensure the health, safety, and performance of humans living and working in space.
- **2D:** Meet sustained space operations needs while reducing costs.

GRC Milestones Supporting These Goals and Objectives:

03H2.1: Electric Power System Verification
Complete the electric power system verification analysis for flight 12a. (3Q; 6900/T. Tyburski)



HEDS Goal 3—Enable the commercial development of space.

Agency Goals and Objectives:

HEDS Objectives:

- **3A:** Improve the accessibility of space to meet the needs of commercial research and development.
- **3B:** Foster commercial endeavors with the ISS and other assets.
- **3C:** Develop new capabilities for human space flight and commercial applications through partnerships with the private sector.

GRC Milestones Supporting These Goals and Objectives:

03H3.1: World Radiocommunication Conference Preparatory Meeting
Present U.S. and NASA issues at the Conference Preparatory Meeting for WRC–2003. (1Q; 6140/W. Whyte)

03H3.2: 2003 World Radiocommunication Conference
Present U.S. and NASA issues at the 2003 World Radiocommunication Conference. (3Q; 6140/W. Whyte)

HEDS Goal 4—Share the experience and benefits of discovery.

Agency Goals and Objectives:

HEDS Objectives:

- **4A:** Engage and involve the public in the excitement and the benefits of—and in setting the goals for—the exploration and development of space.
- **4B:** Provide significantly more value to significantly more people through exploration and space development efforts.
- **4C:** Advance the scientific, technological, and academic achievement of the Nation by sharing our knowledge, capabilities, and assets.

GRC Milestones Supporting These Goals and Objectives:

03H4.1: Ka-Band Propagation
Complete 1-year measurement and analysis of Ka-band propagation data in a tropical zone. (2Q; 6100/J. Budinger)

GRC Milestones Supporting the Space Science Enterprise

The mission of the Space Science Enterprise (SSE) is to explore the solar system; chart the evolution of the universe and understand its galaxies, stars, planets, and life; discover planets around other stars; and search for life beyond Earth. GRC supports this Enterprise mission by providing advanced power, in-space propulsion, and space communication technologies—all of which will lower mission costs and enable new capabilities. In addition, GRC plays a major role in the crosscutting technology program that supports all the space Enterprises and makes specific contributions to space science mission-focused efforts.

SSE Goal 1—Science: Chart the evolution of the universe, from origins to destiny, and understand its galaxies, stars, planets, and life.

Agency Goals and Objectives:

SSE Objectives:

- **1A:** Understand the structure of the universe, from its earliest beginnings to its ultimate fate.
- **1B:** Explore the ultimate limits of gravity and energy in the universe.
- **1C:** Learn how galaxies, stars, and planets form, interact, and evolve.
- **1D:** Look for signs of life in other planetary systems.
- **1E:** Understand the formation and evolution of the solar system and the Earth within it.
- **1F:** Probe the origin and evolution of life on Earth, and determine if life exists elsewhere in our solar system.
- **1G:** Understand our changing Sun and its effects throughout the solar system.
- **1H:** Chart our destiny in the solar system.
- **1I:** Support the Strategic Plan science objectives: development and near-term future investments

GRC Milestones Supporting These Goals and Objectives:

None for FY03

SSE Goal 2—Technology/Long-Term Future Investments: Develop new technologies to enable innovative and less expensive research and flight missions.

Agency Goals and Objectives:

SSE Objectives:

- **2A:** Acquire new technical approaches and capabilities.
- **2B:** Validate new technologies in space.
- **2C:** Apply and transfer technology.

GRC Milestones Supporting These Goals and Objectives:

03S2.1: NASA Evolutionary Xenon Thruster Breadboard Integration Testing
Complete initial breadboard integration testing of the NASA Evolutionary Xenon Thruster (NEXT) ion propulsion system (4Q; 6900/S. Benson, 5430/M. Patterson)

SSE Goal 3—Education and Public Outreach: Share the excitement and knowledge generated by scientific discovery and improve science education.

Agency Goals and Objectives:

SSE Objectives:

- **3A:** Share the excitement of space science discoveries with the public.
- **3B:** Enhance the quality of science, mathematics, and technology education, particularly at the precollege level.
- **3C:** Help create our 21st-century scientific and technical workforce.

GRC Milestones Supporting These Goals and Objectives:

None for FY03

GRC Milestones Supporting the Earth Science Enterprise

The Earth Science Enterprise (ESE) mission is to develop a scientific understanding of the Earth system and its response to natural and human-induced changes to improve prediction of climate, weather, and natural hazards for present and future generations. Advanced spacecraft technology being developed by GRC provides capabilities that will significantly enhance current Earth Science missions or enable new missions. GRC's contributions are in advanced power, in-space propulsion, and space communications technology. The majority of the GRC crosscutting technology efforts (conducted under the auspices of the Space Science Enterprise) are applicable to Earth Science missions. In addition, GRC is developing technology to meet specific Earth science mission requirements.

ESE Goal 1—Observe, understand, and model the Earth system to learn how it is changing, and the consequences for life on Earth.

Agency Goals and Objectives:

ESE Objectives:
- **1A:** Discern and describe how the Earth is changing.
- **1B:** Identify and measure the primary causes of change (forcings) in the Earth system.
- **1C:** Determine how the Earth system responds to natural and human-induced changes.
- **1D:** Identify the consequences of change in the Earth system for human civilization.
- **1E:** Enable the prediction of future changes in the Earth system.

GRC Milestones Supporting These Goals and Objectives:
None for FY03

ESE Goal 2—Expand and accelerate the realization of economic and societal benefits from Earth science, information, and technology.

Agency Goals and Objectives:

ESE Objectives:
- **2A:** Demonstrate scientific and technical capabilities to enable the development of practical tools for public- and private-sector decisionmakers.
- **2B:** Stimulate public interest in and understanding of Earth system science and encourage young scholars to consider careers in science and technology.

GRC Milestones Supporting These Goals and Objectives:
None for FY03

ESE Goal 3—Develop and adopt advanced technologies to enable mission success and serve national priorities.

Agency Goals and Objectives:

ESE Objectives:
- **3A:** Develop advanced technologies to reduce the cost and expand the capability for scientific Earth observation.
- **3B:** Develop advanced information technologies for processing, archiving, accessing, visualizing, and communicating Earth science data.
- **3C:** Partner with other domestic and international agencies to develop and implement better methods for using remotely sensed observations in Earth system monitoring and prediction.

GRC Milestones Supporting These Goals and Objectives:

03E3.1: Fault-Tolerant Field Programmable Gate Arrays
Complete development and radiation testing of fault-tolerant field programmable gate arrays (FPGAs) for a radiation-hardened low-power transceiver. (4Q; 6160/P. Paulsen)

GRC Milestones Supporting the Biological and Physical Research Enterprise

The Biological and Physical Research Enterprise (BPR) seeks to understand and enable the human experience in space, and to use space to better understand the laws of nature and the evolution of life. GRC supports BPR by developing and transferring basic knowledge and technologies related to fluid physics, combustion sciences, acceleration measurement, and bioscience and engineering.

BPR Goal 1—Conduct research to enable safe and productive human habitation of space.

Agency Goals and Objectives:

BPR Objectives:
- **1A:** Conduct research to ensure the health, safety, and performance of humans living and working in space.
- **1B:** Conduct research on biological and physical processes to enable future missions of exploration.

GRC Milestones Supporting These Goals and Objectives:

03B1.1 Spacecraft Fire Safety
Conduct a workshop to define methods, databases, and validating tests for material flammability characterization, hazard reduction, and fire detection and suppression strategies for spacecraft and extraterrestrial habitats. (3Q; 6711/G. Ruff)

BPR Goal 2—Use the space environment as a laboratory to test the fundamental principles of physics, chemistry, and biology.

Agency Goals and Objectives:

BPR Objectives:
- **2A:** Investigate chemical, biological, and physical processes in the space environment, in partnership with the scientific community.
- **2B:** Develop strategies to maximize scientific research output on the ISS and other space research platforms.

GRC Milestones Supporting These Goals and Objectives:

02B2.2 (Carryover from prior fiscal year): Coarsening in Solid-Liquid Mixtures-2 Experiment
Provide for the deployment Coarsening in Solid-Liquid Mixtures-2 Experiment, integrate it into the ISS Microgravity Science Glovebox, and initiate experiment operations. (2Q; 6700/F. Kohl)

02B2.4 (Carryover from prior fiscal year): Critical Viscosity of Xenon-2
Complete the Critical Viscosity of Xenon-2 (CVX–2) Experiment on STS–107. (2Q; 6728/S. Motil)

02B2.6 (Carryover from prior fiscal year): Combustion Module-2 Experiments
Complete project investigations for Laminar Soot Processes (LSP), Structure of Flameballs at Low Lewis Number (SOFBALL), and the Water Mist Fire Suppression Experiment (Mist) on the STS–107 mission. (2Q; 6729/A. Over)

02B2.8 (Carryover from prior fiscal year): Microgravity Acceleration Environment
Measure and report the acceleration environment during the microgravity experiment operations on STS–107. (2Q; 6727/B. Foster)

02B2.11 (Carryover from prior fiscal year): Fluids Integrated Rack Critical Design Review

Complete the Fluids Integrated Rack (FIR) critical design review (CDR). (2Q; 6700/R. Zurawski)

03B2.1: Combustion Integrated Rack Software Critical Design Review
Complete the Combustion Integrated Rack (CIR) Delta and software CDR. (2Q; 6700/R. Zurawski)

03B2.2: Fluids and Combustion Facility Combustion Integrated Rack Engineering Development Unit
Complete FCF CIR Engineering Development Unit (EDU) and deliver to JSC for crew training. (4Q; 6700/R. Zurawski)

03B2.3: Multiuser Droplet Combustion Apparatus Critical Design Review
Complete the Multiuser Droplet Combustion Apparatus (MDCA) CDR. (2Q; 6729/C. Myhre)

03B2.4: Fiber Supported Droplet Combustion-3 Flight Hardware
Complete flight hardware development and availability of the Fiber Supported Droplet Combustion-3 (FSDC–3) experiment. (2Q; 6727/D. Truong)

03B2.5: Smoke Point in Coflow Flight Hardware
Complete flight hardware development and availability of the Smoke Point in Coflow Experiment (SPICE). (3Q; 6727/D. Truong)

03B2.6: Candle Flames in Microgravity-2 Flight Hardware
Complete flight hardware development and availability of the Candle Flames in Microgravity-2 (CFM–2) experiment. (4Q; 6727/D. Truong)

3B2.7: Physics of Colloids in Space Flight Hardware
Complete refurbishment of the Physics of Colloids in Space (PCS) hardware and complete flight hardware availability for PCS+. (3Q; 6728/M. Doherty)

3B2.8: Light Microscopy Module Critical Design Review
Complete the Light Microscopy Module CDR. (4Q; 6728/S. Motil)

03B2.9: Coarsening in Solid Liquid Mixtures–2 Operations
Complete runs on the first set of Coarsening in Solid Liquid Mixtures–2 (CSLM-2) samples in the ISS Microgravity Science Glovebox. (4Q; 6720/M. Hickman)

03B2.10: Operations for Investigating the Structure of Paramagnetic Aggregates from Colloidal Emulsions Experiment
Complete the data collection for Investigating the Structure of Paramagnetic Aggregates from Colloidal Emulsions (InSPACE) in the ISS Microgravity Science Glovebox. (4Q; 6727/J. Lekan)

03B2.11: Microgravity Environment Report
Measure the ISS acceleration environment and publish the FY04 ISS Microgravity Environment Report. (3Q; 6727/B. Foster)

03B2.12: Bioscience and Bioengineering Plan
Develop a GRC bioscience and bioengineering tactical implementation plan. (2Q; 6700/M. Nall)

03B2.13: Flight Project Requirements Definition Reviews
Advance at least seven flight projects to their implementation phase by completing their Requirements Definition Reviews. (3Q; 6700/S. Simons)

03B2.14: Shear History Extensional Rheology Experiment
Complete flight hardware development and availability for the Shear History Extensional Rheology Experiment (SHERE). (4Q; 6728/K. Logsdon)

BPR Goal 3—Enable and promote commercial research in space.

Agency Goals and Objectives:

BPR Objectives:
- **3A:** Provide technical support for companies to begin space research.
- **3B:** Foster commercial research endeavors with the ISS and other assets.
- **3C:** Systematically provide basic research knowledge to industry.

GRC Milestones Supporting These Goals and Objectives:
None for FY03

BPR Goal 4—Use space research opportunities to improve academic achievement and the quality of life.

Agency Goals and Objectives:

BPR Objectives:
- **4A:** Advance the scientific, technological, and academic achievement of the Nation by sharing our knowledge, capabilities, and assets.
- **4B:** Engage and involve the public in research in space.

GRC Milestones Supporting These Goals and Objectives:

03B4.1: Dropping in Microgravity Environment Competition
Expand the Dropping in Microgravity Environment (DIME) high school competition for nationwide participation. (3Q; 6727/R. DeLombard)

03B4.2: Girl Scout Aerospace Merit Badge
Complete the resource kit for earning a NASA Girl Scout Aerospace Merit Badge. (2Q; 6701/I. Kiryk)

Science, Research, and Technology

Key Process Objective

Conduct aerospace research and development that advance science and technology for NASA missions and satisfy customer requirements.

Science, Research, and Technology Process Metrics

New Technology Disclosures: Provide 180 new technology disclosures per year.

Patent Applications: Submit at least 20 patent applications per year.

Major Award Applications: Submit 20 major award applications per year.

ISI Journal Articles and Conference Proceedings: 371 were published in CY01; increase publications every year.

Internal Customer Agreement (ICA) Performance: Establish a system in FY03 for evaluating ICA performance.

Science, Research, and Technology (SRT) External Customer Agreements: Begin tracking SRT ECA's in FY03.

Science, Research, and Technology Milestones

Program and project milestones are managed within the PPM process but are performed within the SRT process. They appear in the preceding PPM milestone section to avoid unnecessary duplication. All milestones unique to the SRT process are given below.

Agency Goals and Objectives:

PAPAC Objective 2: Improve NASA's engineering capability to remain as a premier engineering research and development organization.

GRC Milestones Supporting These Goals and Objectives:

03SRT1.1: New University Partnership Initiative
PMA Action: Implement the John H. Glenn Biomedical Engineering Consortium and begin reporting its status. (1Q; 6700/J. Salzman)

03SRT1.2: Multiuser Silicon Carbide Fabrication Process
Demonstrate the multiuser silicon carbide (MUSiC) fabrication process for producing microelectromechanical (MEMS) devices for harsh environments. (4Q; 5500/M. Zeller)

03SRT1.3: Supplemental Multilayer Insulation Research Facility Operations
Restore facility operations for the Supplemental Multilayer Insulation Research Facility (SMIRF) after airport relocation efforts are completed. (4Q; 7300/J. Morris)

Knowledge and Technology Transfer

Key Process Objective

Communicate knowledge to (the) educational community and transfer technology to commercial partners.

Knowledge and Technology Transfer Metrics (Goals)

Patents Awarded: Obtain at least 12 new patents per year.

Patent License Royalties: Increase patent license royalty income from previous year.

Small Disadvantaged Businesses in the Lewis Incubator for Technology (LIFT), the Garrett Morgan Commercialization Initiative (GMCI), and Small Business Innovation Research (SBIR) Programs: Bring in at least 30 new participants per year.

Major Awards: *Goal to be determined in FY03.*

New Technologies Marketed: Market at least 10 new technologies per year.

Success Stories: Produce at least 20 success stories per year.

Partnership Contributions: *Goal to be determined in FY03.*

Office of Educational Programs (OEP) Target Populations: Track this number each year.

OEP Teacher and Student Event: Produce at least one teacher and student event per year.

OEP Webcasts: Produce at least two Webcasts per year.

OEP Out-of-State Videoconferences: Produce at least two videoconferences per year.

Knowledge and Technology Transfer Milestones

GRC's FY03 KTT milestones, and how they relate to Agency goals and objectives (primarily the NASA Cross-Cutting Processes entitled Provide Aerospace Products and Capabilities and Communicate Knowledge) are given below.

Agency Goals and Objectives:	GRC Milestones Supporting These Goals and Objectives:
PAPAC Objective 4: *Facilitate technology insertion and transfer, and utilize commercialization partnerships in research and development to the maximum extent practicable.*	**03KTT1.1: Commercial Technology Office Annual Report** Publish the Commercial Technology Office (CTO) annual report, informing internal and external constituents about the CTO's primary products. (4Q; 9400/L. Viterna)
PAPAC Performance Goal 3P6: *Dedicate 10 to 20 percent of the Agency's research and development budget to commercial partnerships.*	**03KTT1.2: Commercial Technology Office Web Site** Develop and market in Northeast Ohio a new CTO Web site. (4Q; 9400/L. Viterna)
CK Objective 2: *Disseminate scientific information generated by NASA programs to our customers.*	**03KTT1.3: Space Act Agreement Maker Transfer** Transfer the Space Act Agreement Maker (SAAM) to at least two other NASA centers. (4Q; 9400/L. Viterna)
CK Objective 3: *Transfer NASA technologies and innovations to private industry and the public sector.*	

Agency Goals and Objectives:

CK Objective 4: Support the Nation's education goals.

CK Performance Goal 3CK4: Using NASA's unique resources (missions, people, and facilities) to support educational excellence for all, NASA will meet three of the following four indicators:

- **4A:** Provide excellent and valuable educational programs and services, maintaining an excellent customer service rating ranging between 4.3 and 5 (on a five-point scale) 90 percent of the time.
- **4B:** NASA will involve the educational community in its endeavors, maintaining a level of involvement of approximately 3 million participants, including teachers, faculty, and students.
- **4C:** Increase the amount of funding for and participation of minority universities.
- **4D:** Increase the number of refereed publications by investigators and the number of research papers and presentations by students at minority universities, using FY02 as a baseline.

GRC Milestones Supporting These Goals and Objectives:

03KTT4.1: Educator Workshop
Conduct an educator workshop based on State initiatives to enhance teacher preparation and skill. (4Q; 9200/J. Charleston)

03KTT4.2: Underrepresented and Underserved Student Participation
Increase the number of underrepresented minority and underserved students participating in NASA student programs. (4Q; 9200/J. Charleston)

03KTT4.3: Centennial Anniversary Flight Simulations
Develop online educational software simulations to support the centennial anniversary of powered flight. (4Q; 9200/J. Charleston)

03KTT4.4: Centennial Anniversary Education Lead Center
Serve as the educational lead Center for ASTE to coordinate the celebration of the centennial anniversary of powered flight. (4Q; 9200/J. Charleston)

03KTT4.5: Webcast Participation
Utilize Webcast technologies to increase the number of students and teachers participating in educational programs to highlight NASA GRC programs. (4Q; 9200/J. Charleston)

03KTT4.6: Interactive K–12 Web Site
Develop an online interactive educational aeronautics Web site for grades K–12. (4A; 9200/J. Charleston)

03KTT4.7: Videoconferencing Technologies
Increase the number of ways to use technology to reach students and teachers by investigating the use of emerging high-level videoconferencing technologies with at least one out-of-state school. (4Q; 9200/J. Charleston)

03KTT4.8: Science, Engineering, Mathematics, and Aerospace Academy Sites
Integrate three new Science, Engineering, Mathematics, and Aerospace Academy (SEMAA) sites into the National SEMAA Program. (4A; 9200/J. Charleston)

03KTT4.9: Science, Engineering, Mathematics, and Aerospace Academy Next Generation Plan
Develop an implementation plan for SEMAA: Next Generation (NG). (4A; 9200/J. Charleston)

03KTT4.10 Education Outreach Metrics
Continue to work with GRC Aerospace Enterprise Project Offices to develop education outreach metrics. (4A; 9200/J. Charleston)

Appendix A
GRC Program Points of Contact

Agency Safety Initiative
Manuel B. Dominguez 216–433–6735

Aerospace Technology Enterprise
Propulsion and Power Research and Technology
Gary T. Seng 216–433–3732
Ultra-Efficient Engine Technology
Robert Shaw 216–977–7135
Aviation Systems Project Office
Jaiwon Shin 216–433–8714
HPCC and Information Technology R&T (Aerospace Propulsion Design Tools)
John Lytle 216–433–3213
Flight Research R&T (ERAST Sensors)
David Bents 216–433–6135
Airframe Systems R&T (21st Century Aircraft Propulsion)
Leo Burkardt 216–433-7021
Airframe Systems R&T (System Study and Analysis)
Timothy Wickenheiser 216–977–7111
Advanced Space Transportation Technology
Harry Cikanek 216–433–6196
Aeronautical Communications
Jaiwon Shin 216–433–8714
Space Communications
Kul Bhasin 216–433–3676
Advanced Power and On-Board Propulsion
Joseph Nainiger 216–977–7103
Quiet Aircraft Technology
Anita Liang 216–977–7439

Human Exploration and Development of Space Enterprise
International Space Station (ISS) Assembly Support and Technology Demonstrations
Timothy Tyburski 216–433–8616
Space Communications and Data Systems
Pete Vrotsos 216–433–3560
Shuttle Upgrades
William Taylor 216–433–6568
Exploration Initiatives
Power
Steven D. Johnson 216–433–5370
Advanced Space Transportation
Stanley Borowski 216–977–7091

Biological and Physical Research Enterprise
Microgravity Science Program
Jack Salzman 216–433–2868
Fluid Physics
Fred Kohl 216–433–2866
Combustion Science
Thomas Sutliff 216–433–3887
Acceleration Measurement
David Francisco 216–433–2653
ISS: Fluid and Combustion Research Facility Development and Utilization
Thomas St. Onge 216–433–3557

Space Science and Earth Science Enterprises
Power
Raymond Burns 216–433–5360
In-Space Propulsion
John Dunning 216–433–5298
Earth Science Technology Program
Phillip Paulsen 216–433–6507

On Behalf of All NASA
Spectrum Management
Wayne Whyte 216–433–3482
Workgroup Hardware and Software
William Naiman 216–433–9330
Aeronautics Exhibits
David DeFelice 216–433–5538
Environmental Information Systems
Mike Blotzer 216–433–8159
Information Technology Security Awareness Training
Richard Clapper 216–433–2890
Engineering for Complex Systems
Gary T. Seng 216–433–3732

Appendix B
GRC Organizational Points of Contact

Office of the Director
Director
Donald J. Campbell 216-433-2929
Deputy Director
Julian M. Earls 216-433-3014
Deputy Director for Operations
Julian M. Earls (Acting) 216-433-3014
Chief Scientist
Marvin E. Goldstein 216-433-5825
Assistant Deputy Director for Policy
John W. Gaff 216-433-2940

Office of the Chief Counsel
William Sikora 216-433-2318

Aeropropulsion Research Program Office
Gary T. Seng 216-433-3732

NASA Office of Inspector General
Chester A. Sipsock 216-433-8960

Systems Management Office
Olga Gonzalez-Sanabria 216-433-5252

Office of Equal Opportunity
Robert Romero 216-433-5538

Office of the Chief Financial Officer
Robert E. Fails 216-433-2977

Office of Human Resources
Robyn N. Gordon 216-433-2515

Office of Acquisition
Procurement
Bradley J. Baker 216-433-2800
Logistics and Technical Information
Christopher Kennedy 216-433-5980

Aeronautics Directorate
Director
Arun K. Sehra 216-433-3397
Deputy Director
Jaiwon Shin 216-433-8714

Research and Technology Directorate
Director
Woodrow Whitlow, Jr. 216-433-3193
Deputy Director
Lawrence J. Bober 216-433-3944

Space Directorate
Director
Gerald J. Barna 216-433-2970
Deputy Director
Rudolph L. Saldana 216-433-2970

Engineering and Technical Services Directorate
Director
Randall B. Furnas 216-433-2321
Deputy Director
Jose M. Vega 216-433-5453
Plum Brook Facility Manager
Robert P. Kozar 419-294-3236
Chief Information Officer
Sasi K. Pillay 216-433-9300

Safety and Assurance Technologies Directorate
Director
Vernon W. Wessel 216-433-2350

External Programs Directorate
Director
John M. Hairston, Jr. 216-433-8686
Educational Programs
Jo Ann Charleston 216-433-2957
Community and Media Relations
Linda Dukes-Campbell 216-433-8920
Commercial Technology
Larry Viterna 216-433-2966

For more information about this Plan,

Contact GRC Systems Management Office

Telephone: 216–433–8567
E-mail: implement@grc.nasa.gov

or

Visit the Glenn Web site at

http://www.grc.nasa.gov/www/Strategic_Implementation/