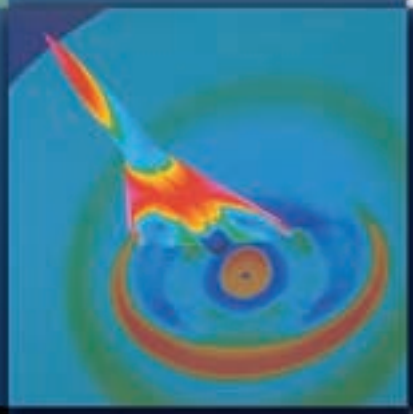
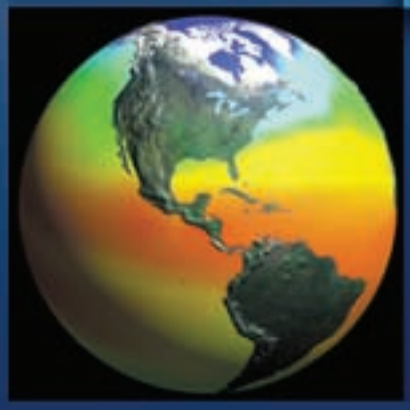
NASA GLENN RESEARCH CENTER




Strategic Implementation Plan

Fiscal Year 2002

National Aeronautics and
Space Administration

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

Center Director's Message

The Glenn Research Center (GRC) Strategic Implementation Plan summarizes the Center's primary objectives and milestones supporting NASA's Enterprises and Crosscutting Processes in fiscal year 2002.

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. It 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 these 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.

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Chief Information Officer

John M. Hairston, Jr.
Director of External Programs

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Introduction

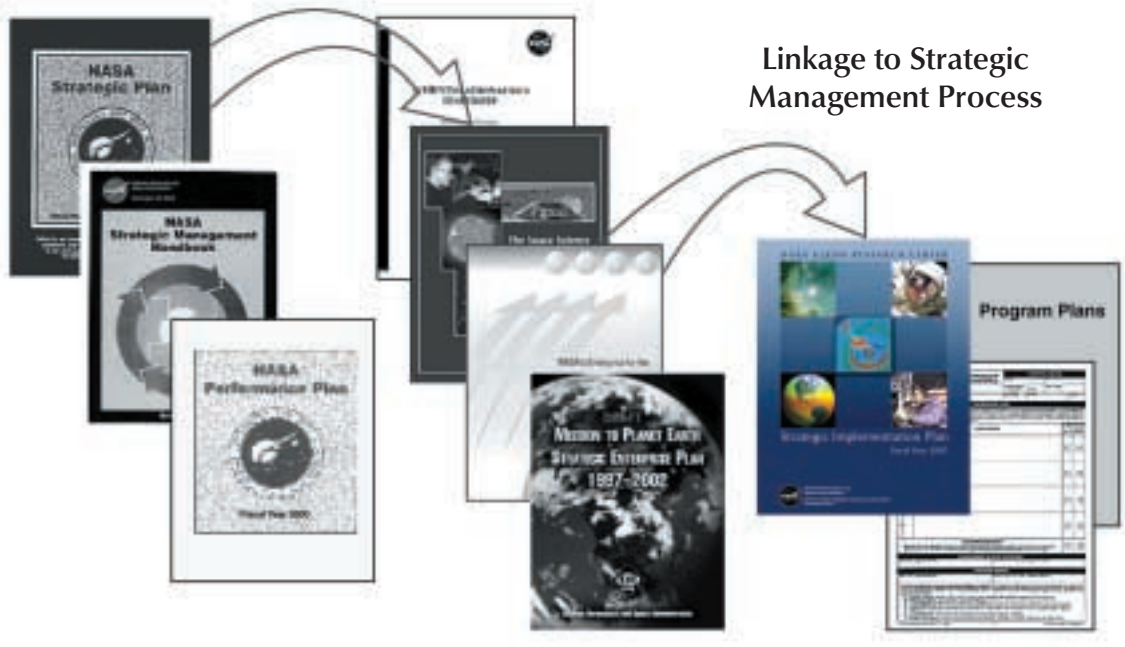
The Purposes of This Plan

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 purposes of the GRC Strategic Implementation Plan are 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's 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 Strategic Implementation Plan and subsequently to program plans and individual employee performance plans.



The NASA Vision

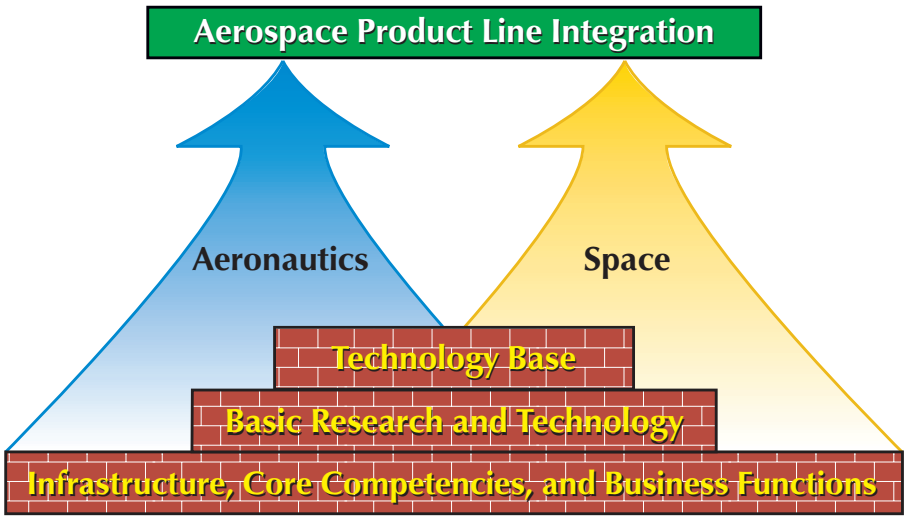
NASA is an investment in America's future. As explorers, pioneers, and innovators, we boldly expand frontiers in air and space to inspire and serve America and to benefit the quality of life on Earth.

The NASA Mission

- To advance and communicate scientific knowledge and understanding of Earth, the solar system, and the universe
- To advance human exploration, use, and development of space
- To research, develop, verify, and transfer advanced aeronautics, space, and related technologies

The GRC Mission

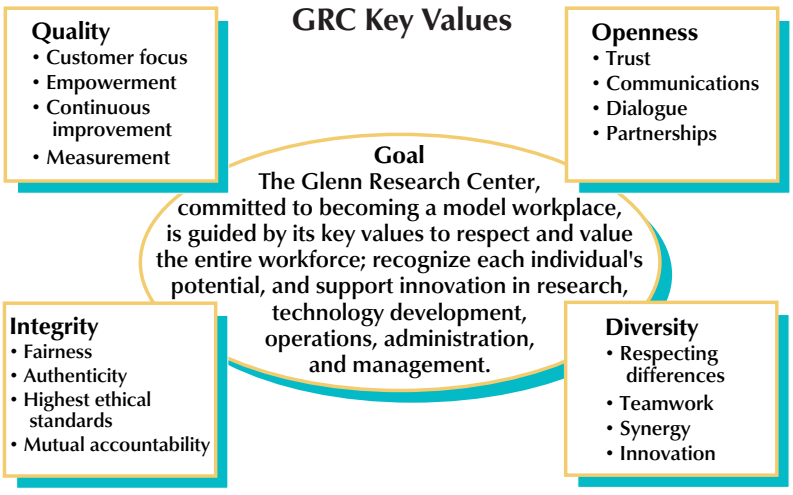
As a diverse team working in partnership with government, industry, and academia to increase national wealth, safety, and security, protect the environment, and explore the universe, we develop and transfer critical technologies that address national priorities through research, technology development,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



GRC's 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 of managers and staff has begun to better 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 basic research and technology development. Although there are many overarching competencies that are critical to the success of the Center, GRC previously focused on four technology core competencies. However, in concert with recent Agency initiatives and in recognition of the creation of NASA's new Biological and Physical Research Enterprise, GRC has widened its focus to include three new science core competencies. These three science core competencies, based on the Center's unique expertise and contributions to scientific research, combine with the four technology core competencies to enable GRC to fully support all five NASA Enterprises.

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

Technology Core Competencies

Aeropropulsion Systems

- Improve turbomachinery components and propulsion systems
- Develop improved aerodynamics and mission analysis tools
- Develop improved materials and structural concepts
- Reduce propulsion system noise and emissions
- Increase propulsion system efficiency
- Advance harsh environment instrumentation and sensors
- Advance propulsion control and engine health management technologies

Aerospace Power and Electric Propulsion

- 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

- Provide end-to-end system analyses, modeling, simulation, and demonstrations
- Advance frequency spectrum utilization and signal propagation analyses
- Promote multigigabit processing communication payloads, Internet protocol (IP)-compliant aircraft and spacecraft, data distribution networks, and satellite constellation networks
- Promote 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
- Advance 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

- 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 fluid mechanics, heat and mass transport, and other physical principles governing the behavior and dynamics of fluid processes

- Provide scientific leadership for the Microgravity Fluid Physics Discipline, including ground-based and space-based research
- 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 combustion processes involved with rapid, self-sustaining chemical reactions that release significant amounts of heat

- Provide scientific leadership for the Microgravity Combustion Science Discipline including ground-based and space-based research
- 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

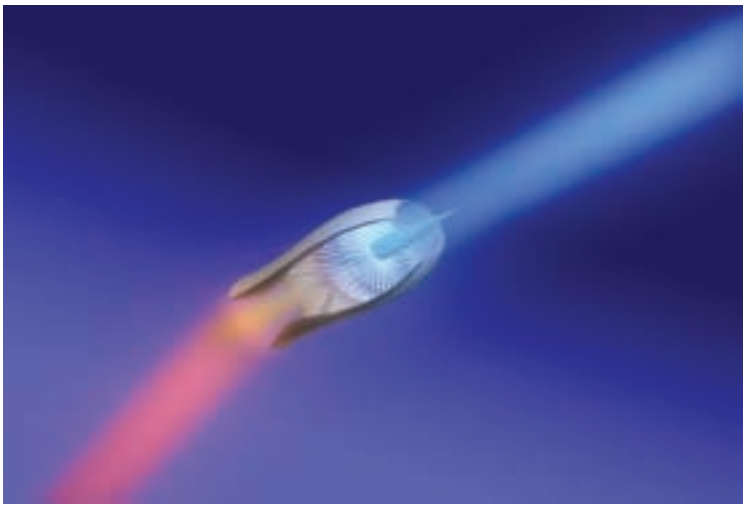
Bioscience and Engineering

Cutting-edge physical science and engineering knowledge to enable advances in the fields of biotechnology and biomedical research and applications

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

Agency-Specific Mission: Aeropropulsion

A major GRC Agency-specific mission is to develop, verify, and transfer air-breathing propulsion technology for subsonic, supersonic, hypersonic, general aviation, and high-performance aircraft. Relative to this mission, GRC also conducts fundamental research in propulsion-related materials, structures, internal fluid mechanics, instrumentation, controls, and systems. Aeropropulsion encompasses turbine engines, intermittent-combustion engines (especially Stirling-cycle engines), electric engines, hybrid propulsion systems, combined-cycle engines, ramjets, detonation-wave engines, and all other types of engines that are or could be used on aircraft and air-breathing space access vehicles.



Vectored engine.

Agency-Specific Mission: Aerospace Power Systems Research and Technology

The NASA Administrator has designated GRC to have the Agency's lead role for the mission area of aerospace power systems research and technology. This role is crucial to future NASA missions and potential new initiatives. GRC aerospace power systems research and technology will benefit aeronautics and space in support of all NASA Enterprises. Responsibilities include the leadership and management of advanced power systems research and technology development and, where appropriate, support of NASA's power system development.

GRC-developed solar arrays on the International Space Station.

Center of Excellence: Turbomachinery

GRC has Agencywide responsibility for technologies directly applicable to fans, pumps, compressors, turbines, and other rotating components. Turbomachinery technologies are critical to air-breathing propulsion and power systems as well as to space and terrestrial propulsion and power conversion applications. Associated turbomachinery components include fans, cases, combustors, bearings, seals, gears, inlets, nozzles, sensors, and actuators. Disciplines critical to leadership in turbomachinery include materials, structures, lubrication, acoustics, aerodynamics, heat transfer, computational fluid dynamics, combustion, icing, instrumentation, and controls. GRC's primary objective in this area is to increase turbomachinery safety, durability, reliability, performance, efficiency, affordability, and environmental compatibility to improve U.S. industrial competitiveness and national security.

Turbomachinery visualization.

Program Responsibility: Aerospace Propulsion and Power Research and Technology

GRC has responsibility for NASA's Aerospace Propulsion and Power Research and Technology (R&T) Program in the Aerospace Technology Enterprise. This program focuses on maintaining U.S. superiority in engine development and ensuring the long-term environmental compatibility, safety, and efficiency of propulsion systems. It addresses critical propulsion technology needs across a broad range of investment areas, including revolutionary advances in conventional aeropropulsion and unconventional propulsion technologies. Additionally, this program develops technology that supports the goals and objectives of other NASA Enterprises, and supports and transfers applicable technologies to the Agency's other programs, including Ultra-Efficient Engine Technology (UEET), Aviation Safety (AvSP), Advanced Space Transportation (ASTP), and Quiet Aircraft Technology (QAT).

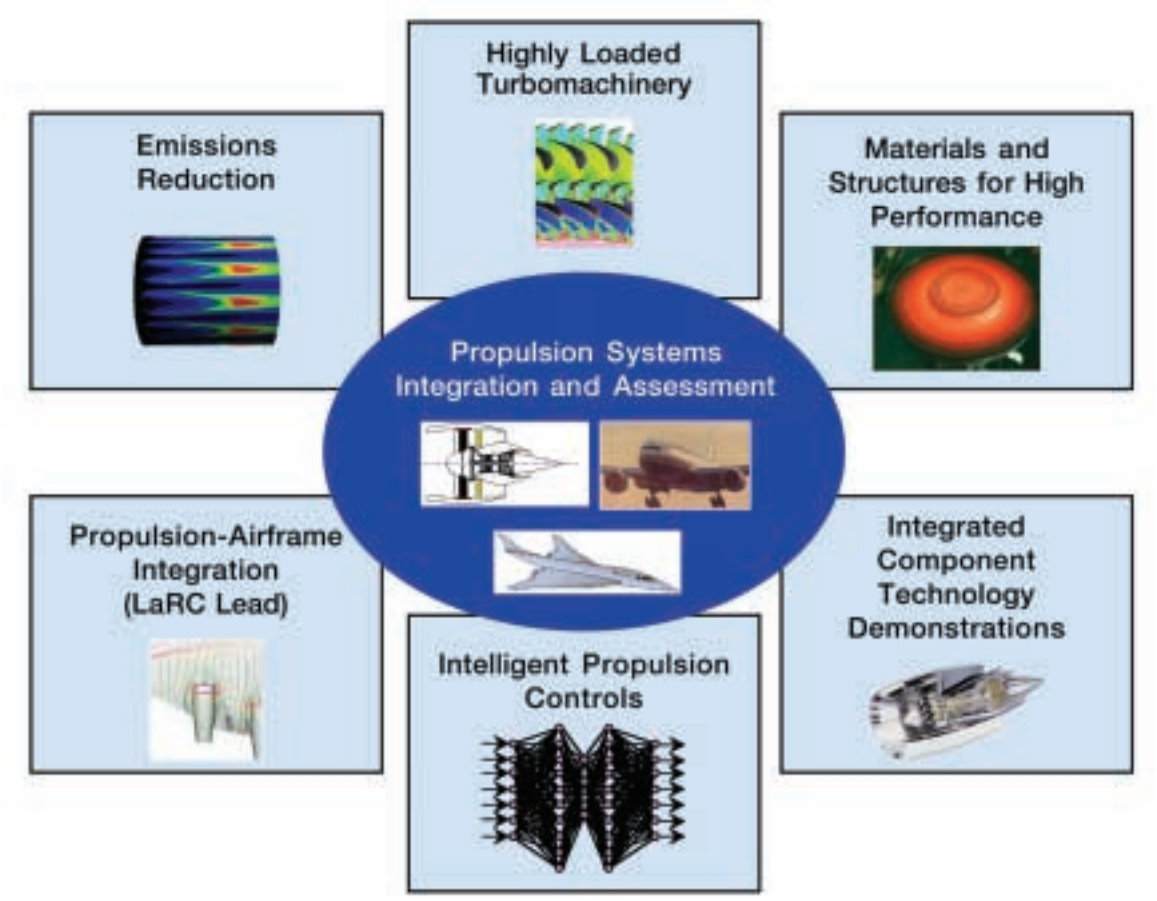
(a)

(b)

Two Mars aircraft concepts. (a) Entomopter (flapping wing vehicle). (b) Solar sailer.

Program Responsibility: Ultra-Efficient Engine Technology

GRC has responsibility for the UEET Program. The vision of the program is to develop and validate revolutionary propulsion technologies that will enable future generations of aerospace vehicles. Emerging technologies from the Aerospace Propulsion and Power R&T Program and other technologies will be incorporated into the UEET Program. The technologies developed and demonstrated will be applicable across the speed range from subsonic to hypersonic, with the emphasis on turbine-based systems. The UEET Program will lead to other focused programs, including engine system test demonstrators accomplished in partnership with other government agencies and industry. Technologies developed in the UEET Program are also likely to be transferred to other programs, such as ASTP and QAT.



UEET Program projects.

GRC Support to NASA Enterprises

Mission Areas	Aeropropulsion Aerospace Power				
Center of Excellence	Turbomachinery				
Program Responsibility	Aerospace Propulsion and Power Research and Technology (R&T) Ultra-Efficient Engine Technology				
Enterprises	Aerospace Technology	Human Exploration and Development of Space	Space Science	Earth Science	Biological and Physical Research Enterprise
Programs Supported by the Glenn Research Center	• Aviation Safety -Accident mitigation -Weather-related accident prevention: aviation weather information, advanced data link • Aviation System Capacity: advanced communications for air traffic management • Advanced Space Transportation Technology: propulsion R&T, turbine-based combined-cycle • Quiet Aircraft Technology • Computing Information Communication Technology: propulsion simulation, controls and instrumentation, software integrity, high-rate data delivery • Aerospace Flight Research R&T: Environmental Research Aircraft and Sensor Technology • Aerospace Vehicle Systems R&T: system study and turbulence analysis • Airspace operations systems R&T: icing • Small Aircraft Transportation System • Second-Generation Reusable Launch Vehicle systems, propulsion, systems engineering	• International Space Station -Electrical power -Communications enhancement • Communications and space Internet technologies • Exploration initiatives -Power -In-space propulsion -Advanced space transportation propulsion concepts • Shuttle Upgrades: materials, propulsion and power	• Power • In-space propulsion technologies • Communications and space Internet technologies New Millennium		• Microgravity research -Fluid physics -Combustion science -Acceleration measurement -Bioscience and engineering • International Space Station Microgravity -Fluid and combustion research facility -Experiment payloads -Multiuser hardware and support
Agencywide	• Spectrum Management • Small business technology transfer and research contracting • Small business innovation research contracting • Space Operations Management Office liaison for commercial communications • Environmental information systems • Principal Center for Workgroup Hardware and Software and aeronautics exhibits				

GRC Contributions to the Aerospace Technology Enterprise

To sustain global U.S. leadership in civil aeronautics and space transportation, the Aerospace Technology Enterprise (ASTE) has developed the following goals and objectives that GRC supports.

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

ASTE Objective 1: Increase Safety—Make a safe air transportation system even safer.

ASTE Performance Goal 2R1: Complete the interim progress assessment utilizing the technology products of the Aviation Safety program as well as the Aerospace Base R&T efforts and transfer to industry an icing CD-ROM, conduct at least one demonstration of an aviation safety-related subsystem, and develop at least two-thirds of the planned models and simulations.

GRC Objective A1.0: Reduce aircraft accidents related to icing, weather, poor visibility, and engine problems; develop technology to prevent and suppress aircraft fires.

GRC Milestones supporting these Goals and Objectives:*

***02A1.1: National Aviation Weather Information Network (AWIN)**
Demonstrate AWIN digital data link capability for graphical display of weather information. [4Q; 2500/K.Martzaklis]

Prototype AWIN ground station.

***02A1.2: CD-ROM Icing Training Module For Pilots**
Develop and distribute a CD-ROM self-paced icing training module for pilots. [3Q; 0140/G.Seng, 2500/M.Wadel]

02A1.3: LEWICE Version 2.2
Release computational 2-D ice accretion code Lewice V2.2. [3Q; 0140/G.Seng, 2500/M.Wadel]

02A1.4: UltraSafe Propulsion Technologies
Conduct spin and burst tests to evaluate the effect of dual mode heat treatment (DMHT) processing technology on disk life. [4Q; 0140/G.Seng, 2200/S.Johnson]

*All Government Performance and Results Act (GPRA) milestones are highlighted in blue and asterisked. The estimated milestone completion quarter and GRC point(s) of contact are bracketed.

ASTE Objective 2: Reduce Emissions—Protect local air quality and our global climate.

ASTE Performance Goal 2R2: NASA's research stresses engine technology to reduce the emissions of oxides of nitrogen (NO_x) and carbon dioxide (CO_2). The annual performance goal is to complete sector testing of a low-NO_x combustor concept capable of a 70-percent reduction in NO_x from the 1996 (International Civil Aviation Organization (ICAO)) baseline, and demonstrate at least one additional concept for the reduction of other emissions.

GRC Objective A2.0: Reduce NO_x emissions of future aircraft by 70 percent in 10 years and by 80 percent within 25 years (using the 1996 ICAO standard for NO_x as the baseline). Reduce CO_2 emissions of future aircraft by 25 percent and 50 percent in the same timeframe (using 1997 subsonic aircraft technology as the baseline).

GRC Milestones supporting these Goals and Objectives:

***01A2.4 (Carryover from prior fiscal year): Active Controls**
Investigate active control of high-frequency instabilities in combustion flows. [3Q; 0140/G.Seng, 2200/R.Corrigan]

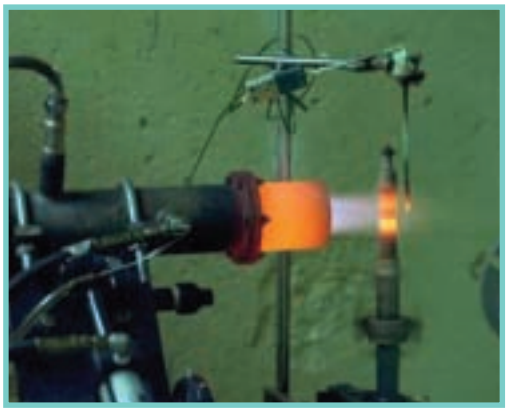
***01A2.6 (Carryover from prior fiscal year): CMC Combustor Liner**
Demonstrate the durability of 2200 °F ceramic matrix combustor liners in engine tests. [2Q; 2100/R.J.Shaw; 2300/M.J.Long-Davis]

***02A2.1: Aspirating Seal Demonstration**
Demonstrate engine aspirating seal technology in partnership with industry. [2Q; 2100/R.J.Shaw; 2300/M.J.Long-Davis]

***02A2.2: Controls Architecture Payoff Studies**
Complete benefits studies of intelligent propulsion controls for small-thrust class engines (less than 20,000 lb thrust). [3Q; 2100/R.J.Shaw, 2200/D.Sokolowski]

***02A2.3: Integrated Component Technology Demonstration Plan for Small-Thrust Class Engines**
Develop an Integrated Component Technology Demonstration Plan for collaborative tests of engine demonstrators incorporating UEET technologies for small-thrust class engines (less than 20,000 lb thrust). [3Q; 2100/R.J.Shaw, 2300/M.J.Long-Davis]

***02A2.4: Integrated Component Technology Demonstration Plan for Access-to-Space Engines**
Develop an Integrated Component Technology Demonstration Plan for collaborative tests of engine demonstrators incorporating UEET technologies for access-to-space engines. [3Q; 2100/R.J.Shaw, 2300/M.J.Long-Davis]



Thermal Barrier Coating Test Rig.

***02A2.5: Initial Low NO_x Reduction Demonstration in a Combustor Sector for Subsonic Engines**
In combustor sector tests, demonstrate a 65-percent reduction in the production of nitrogen oxides (NO_x) relative to the 1996 International Civil Aviation (ICAO) standards for landing and take-off conditions in a simulated subsonic engine. [4Q; 2100/R.J.Shaw, 2200/J.Rohde]

***02A2.6: Ceramic Thermal Barrier Coating System**
Select low-conductive ceramic thermal barrier coating to achieve a significant increase in temperature capability. [4Q; 2100/R.J.Shaw, 2300/R.Draper]

02A2.7: Microelectromechanical Systems Engine Emissions Sensors
Demonstrate microelectromechanical systems (MEMS) high-temperature emission sensors in an engine. [4Q; 5500/M.Zeller, 5510/G.Hunter]

***02A2.8: Hybrid Fuel Cell and Liquid-Hydrogen-Fueled Optimized Turbofan Concepts**
Assessment of hybrid fuel cell and liquid-hydrogen-fueled optimized turbofan concepts. [4Q; 0140/G.Seng, 2200/D.Ercegovic]

02A2.9: Emission Flame Tube Tests
Demonstrate concepts for reduction in gaseous, particulate, and aerosol emissions. [4Q; 0140/G.Seng, 2200/R.Corrigan]

***02A2.10: Revolutionary Aeropropulsion Concepts**
Revolutionary aerospace propulsion concepts identified and preliminary performance assessed. [4Q; 0140/G.Seng, 2200/D.Ercegovic]

02A2.11: PMC Inlet Guide Vane Test
Engine-test coated polymer-matrix-composite inlet guide vane. [4Q; 140/G.Seng, 2200/C.Ginty]

ASTE Objective 3: Reduce Noise—Reduce aircraft noise to benefit airport neighbors, the aviation industry, and travelers.

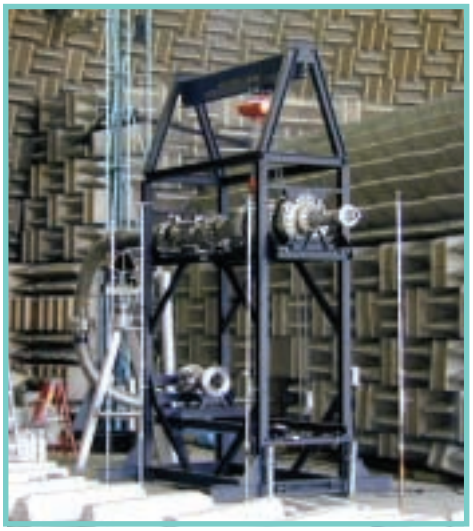
GRC Objective A3.0: Reduce the perceived noise of future subsonic aircraft engines based on pre-1997 engine designs by a factor of 2 by 2007 and by a factor of 4 by 2022.

GRC Milestones supporting these Goals and Objectives:

02A3.1: 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. [4Q; 2200/J.Grady]

ASTE Performance Goal 2R3: NASA's research stresses reducing noise in the areas of engines, nacelles, engine-airframe integration, aircraft interiors, and flight procedures. The annual performance goal is to assess and establish the strongest candidate technologies to meet a 10-decibel reduction in community noise.

02A3.2: Jet Noise Reduction Concept Assessment
Evaluate the noise reduction benefits of chevron nozzles and nozzle lip treatment concepts using the Small Hot Jet Acoustic Rig. [4Q; 2200/J.Grady]



Small Hot Jet Acoustic Rig.

ASTE Objective 4: Increase Capacity—Enable the movement of more air passengers with fewer delays.

ASTE Performance Goal 2R4: NASA's research stresses operations systems for safe, efficient air traffic management and new aircraft configurations for high-productivity utilization of existing runways. The annual performance goal is to develop a decision support tool and define concepts for future aviation systems.

GRC Objective A4.0: Develop and demonstrate enhanced aviation system throughput by an improved airspace communications infrastructure to support free-flight air traffic management concepts.

GRC Milestones supporting these Goals and Objectives:
None for FY02

ASTE Objective 5: Increase Mobility—Enable people to travel faster and farther, anywhere, anytime.

ASTE Performance Goal 2R5: NASA's research stresses aircraft technologies that enable the use of existing small community and

GRC Objective A5.0: Develop low-cost intermittent-combustion and turbine engines and single-lever engine controls for general aviation aircraft.

GRC Milestones supporting these Goals and Objectives:
None for FY02

neighborhood airports, without requiring control towers, radar installations, and more land use for added runway protection zones. The annual performance goal is to baseline, in partnership with the Federal Aviation Administration, the system engineering documents for the Small Aircraft Transportation System concept.

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

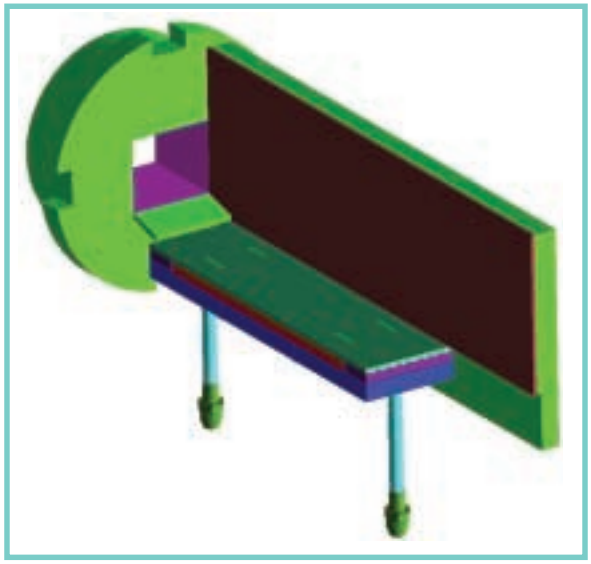
ASTE Objective 6: Mission Safety—Radically improve the safety and reliability of space launch systems.

ASTE Performance Goal 2R6: Complete risk-reduction and architecture reviews to support design and demonstration decisions.

GRC Objective A6.0: Improve the safety and reliability of access-to-space propulsion systems by developing new materials and health-monitoring techniques to improve their life and operability.

GRC Milestones supporting these Goals and Objectives:

02A6.1: Cooled Panel Testing
Hot-fire-test 2.5- by 10-in. water-cooled ceramic-matrix-composite panels in Cell 22 of the Research Combustion Laboratory. [3Q; 6500/M.Klem]



Cooled panel concept.

02A6.2: NITEX Software Demonstration
Port the NITEX diagnostic technologies and integrated vehicle health management (IVHM) architecture to flightlike hardware and test them against nominal and off-nominal main propulsion system data sets. [4Q; 6500/M.Klem]

ASTE Objective 7: Mission Affordability—Create an affordable highway to space.

ASTE Performance Goal 2R7: Complete risk reduction and architecture reviews and initial hardware demonstrations to support design and demonstration decisions.

02A6.3: Life Prediction Techniques for Metal Matrix Composites
Release an enhanced version of Micromechanics Analysis Code/ Generalized Method of Cells (MAC/GMG) software (version 4.0), incorporating both deformation and damage models and a new high-fidelity micromechanics formulation. [4Q; 6500/M.Klem]

GRC Objective A7.0: Reduce the cost contribution of access-to-space propulsion systems and subsystems while improving their performance, life, function, and operability.

GRC Milestones supporting these Goals and Objectives:

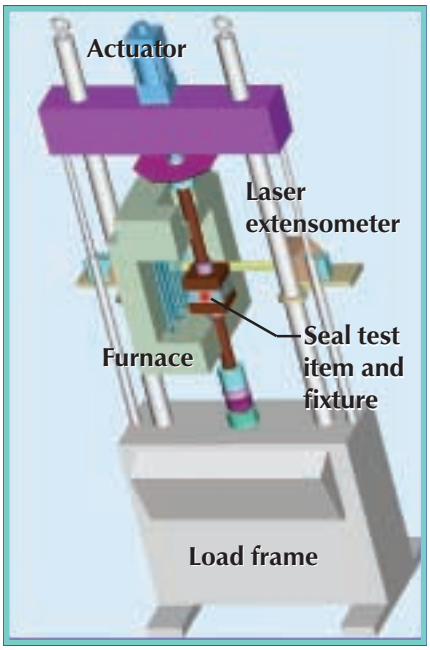
***01A7.1 (Carryover from prior fiscal year): Pulse Detonation Engine**
Complete assessment and conceptual design of pulse-detonation-engine-based hybrid-cycle and combined-cycle propulsion systems. [3Q, 0140/G.Seng, 0142/D.Perkins]

02A7.1: Power and Actuator Technology Risk Reduction
Complete power and actuator requirements definition for second general risk-reduction base period. [4Q; 6500/N.Pham]

02A7.2: Proton-Exchange-Membrane Fuel Cell Powerplant
Award the Phase I contract for proton-exchange-membrane (PEM) fuel cell powerplant development. [2Q; 6500/N.Pham]

02A7.3: *Deleted prior to publication*

02A7.4: Hot Seal Compression Test Rig
Complete installation of high-temperature seal compression test fixture. [4Q; 6500/P.Dasgupta]



Hot Seal Compression Test Rig.

ASTE Objective 8: Mission Reach—Extend our reach in space with faster travel times.

ASTE Performance Goal 2R8: Conduct a test of an advanced ion propulsion engine.

GRC Objective A8.0: Enable faster travel times by developing propulsion systems that are lighter, more efficient, and capable of long-duration thrust.

GRC Milestones supporting these Goals and Objectives:

***02A8.1: 75-cm Ion Engine**
Demonstrate at least 10-kW operation of the 75-cm, high-ISP ion engine. [4Q; 6900/J.Dunning]

02A8.2 Ion Engine Fundamentals
Complete internal probe diagnostics of the discharge plasma in a 30-cm ion engine. [4Q; 6900/J.Dunning]

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

ASTE Objective 9: Engineering Innovation—Enable rapid, high-confidence, cost-efficient design of revolutionary systems.

ASTE Performance Goal 2R9: Conduct at least five demonstrations of revolutionary aerospace subsystems.

GRC Objective 9.0: Develop computing and testing tools to reduce aircraft engine design and development time.

GRC Milestones supporting these Goals and Objectives:

01A6.1 (Carryover from prior fiscal year): Turbofan Flow Path Simulation
Demonstrate full primary flow path simulation of a two-spool turbofan engine in less than 15 hr of central processing unit time. This Navier-Stokes simulation will be run to numerical convergence and torque balance. The turbomachinery simulation will use the Average Passage NASA (APNASA) flow code, and the combustor simulation will use the National Combustion Code. Validation of the simulation will be performed using a GE90 engine. [4Q; 0140/G.Seng, 2900/J.Veres]

Advanced turbofan concept.

Milestones 02A9.1–02A9.4: *Deleted prior to publication*

02A9.5: Alloy Design Workbench
Demonstrate a new software tool that can run on a personal computer to design alloys for specific engineering requirements with a high degree of confidence using only bulk properties, thereby significantly reducing development time. [4Q; 0140/G.Seng, 2200/C.Ginty]

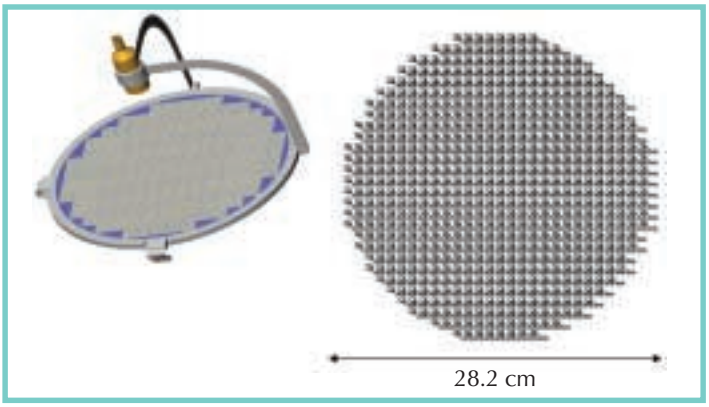
ASTE Objective 10: Technology Innovation—Enable fundamentally new aerospace system capabilities and missions

ASTE Performance Goal 2R10: Develop at least two new materials concepts and demonstrate the feasibility of at least two nanotechnology concepts and two other concepts, including demonstration of space communication link technology operating at 622 megabits per second for direct data distribution users.

GRC Objective A10.0:
Same as ASTE Objective

GRC Milestones supporting these Goals and Objectives:

02A10.1: Ferroelectric Reflectarray Antenna
Demonstrate proof of concept for a Ka-band ferroelectric reflectarray antenna. [4Q; 6100/P.Vrotsos, 5610/D.Foltz]



Prototype ferroelectric reflectarray antenna.

02A10.2: High-rpm Flywheel
Complete modification and upgrade of the technology development flywheel module for continued component and system controls development in the GRC flywheel testbed at speeds up to 60,000 rpm. [4Q; 6900/J.Nainiger]

02A10.3: Silicon Substrate
Demonstrate the feasibility of replacing the germanium substrate in high-efficiency, multiband-gap solar cells with silicon to enable lighter, lower cost, and significantly more robust solar cells. [3Q; 6900/J.Nainiger]

ASTE Goal 4—Commercialize Technology: Extend the commercial application of NASA technology for economic benefit and improved quality of life.

ASTE Objective 11: Commercialization—Facilitate the greatest practical utilization of NASA know-how and physical assets by U.S. industry.

GRC Objective A11.0:
Same as ASTE Objective

GRC Milestones supporting these Goals and Objectives:

02A11.1: Lewis Incubator for Technology Tenants
Increase the number of tenants in the Lewis Incubator for Technology (LIFT) to 14, of which at least 50 percent will be minority or women-owned companies. [4Q; 9400/L.Viterna]

ASTE Performance Goal 2R11: Continue the solicitation of customer feedback on the services, facilities, and expertise provided by the Aerospace Technology Enterprise.

- **11A:** Achieve a facility utilization customer satisfaction rating on a 10-point scale of 5 or better 95 percent of the time, and 8 or better 80 percent of the time, based on exit interviews.
- **11B:** Transfer at least 12 new technologies and processes to industry and other government agencies.

02A11.2: Commercial Technology Fund
Demonstrate application of engineering and technology insertion into the products of at least five different companies through the Commercial Technology Fund. [4Q; 9400/L.Viterna]

02A11.3: GRC Biomedical Technology Applications
Collaborate with at least four separate partners within the Great Lakes region on biomedical applications of GRC technology. [4Q; 9400/L.Viterna]

02A11.4: Focused Marketing Plans
Establish and implement at least two focused marketing plans for GRC technologies with high commercialization potential. [4Q; 9400/L.Viterna]

02A11.5: MEMS Technology Transfer
Transfer harsh-environment MEMS technologies to Glennan Microsystems Initiative partners for product development. [4Q; 5500/M.Zeller, 5510/L.Matus]

ASTE Performance Goal 2R12: Continue the implementation of current education outreach activities and establish new plans for all new program activities initiated in FY02.

GRC Objective A12.0: Implement ASTE education outreach plans, particularly for the Aerospace Propulsion and Power (APP) and UEET programs, using the Glenn Aerospace Education Coordinating Committee and other outreach organizations and processes.

GRC Milestones supporting these Goals and Objectives: See Milestone C4.10

ASTE Goal 5—Space Transportation Management: Provide commercial industry with the opportunity to meet NASA's future launch needs, including human access to space, with new launch vehicles that promise to radically reduce cost and improve safety and reliability.

ASTE Objective 13: Utilize NASA's Space Transportation Council (STC) in combination with an External Independent Review Team (EIRT) to ensure Agency-level integration of near and far-term space transportation investments.

GRC Objective A13.0:
Same as ASTE Objective

GRC Contributions to the Human Exploration and Development of Space Enterprise

The mission of the Human Exploration and Development of Space (HEDS) Enterprise is to bring the frontier of space fully within the sphere of human activity to build a better future for all humans. GRC supports the HEDS Enterprise by providing expertise in several areas: research, development, operations planning, and technology demonstration for the International Space Station (ISS); power system technology development for space shuttle upgrades; and research in space power, onboard propulsion, space communications, and space transportation.

HEDS Goal 1—Expand the space frontier.

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 Objective H1.0: Develop power, communications, and in-space propulsion systems and advance the state of knowledge of reduced-gravity effects to enable human and robotic missions of exploration.

GRC Milestones supporting this Goal and these Objectives:
None

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

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 Objective H2.0:
Same as HEDS Objectives

GRC Milestones supporting this Goal and these Objectives:

02H2.1: ISS Power System Verification
Complete ISS power system verification analysis cycle for Flight 8A. [2Q; 6900/T.Tyburski]

HEDS Goal 3—Enable the commercial development of space.

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 Objective H3.0: Enable the commercialization of space communication, power, in-space propulsion, and other aerospace technologies.

GRC Milestones supporting this Goal and these Objectives:

01H4.1 (Carryover from prior fiscal year): Advanced Communications Technology Satellite Experiment Results
Complete final dissemination of results from NASA's experiments programs on the Advanced Communications Technology Satellite (ACTS). [3Q; 6100/P.Vrotsos, 6160/R.Bauer]

02H3.1: International Telecommunications Union Delegation
Develop, present, and lead the NASA and U.S. technical constituents in International Telecommunications Union (ITU) Working Parties 7B and 7C. [2Q; 6100/P.Vrotsos, 6140/W.Whyte]

02H3.2: Conference Preparatory Text for World Radiocommunications Conference
Lead the U.S. Working Party 7E in completing the Conference Preparatory text for the World Radiocommunications Conference WRC–2003. [3Q; 6100/P.Vrotsos, 6140/W.Whyte]

02H3.3: World Radiocommunications Conferences WRC–2003 Proposals
Complete U.S. proposals of interest to NASA for the World Radiocommunications Conference WRC–2003. [4Q; 6100/P.Vrotsos, 6140/W.Whyte]

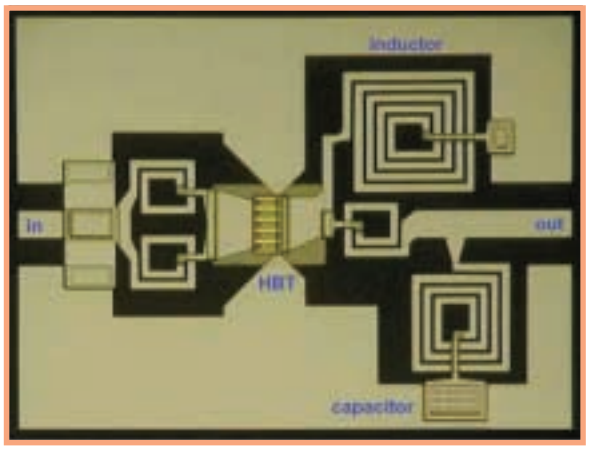
02H3.4: Space Frequency Meeting
Develop and present NASA and U.S. positions to the Space Frequency Coordination Group meeting. [4Q; 6100/P.Vrotsos, 6140/W.Whyte]

02H3.5: Space Internet Testbed
Demonstrate space Internet testbed capability to verify NASA's use of commercial protocols and network technologies. [3Q; 6100/P.Vrotsos, 6160/P.Paulsen]

Electrically steered phased-array antenna components.

02H3.6: Phased-Array Antenna System
Characterize the performance of an electrically steered phased-array antenna with high-rate modulated data. [4Q; 6100/P.Vrotsos, 6160/R.Reinhart]

02H3.7: Silicon-Germanium-Based Power Amplifier
Contingent on execution of a Space Act Agreement with Boeing, develop a Ku-band silicon-germanium-based power amplifier MMIC design for a phased-array antenna transmit module. [4Q; 6100/P.Vrotsos, 6160/R.Reinhart]



Silicon-germanium power amplifier design.

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

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 Objective H4.0:
Same as HEDS Objectives

GRC Milestones supporting this Goal and these Objectives:
None for FY02

GRC Contributions to 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, and life.

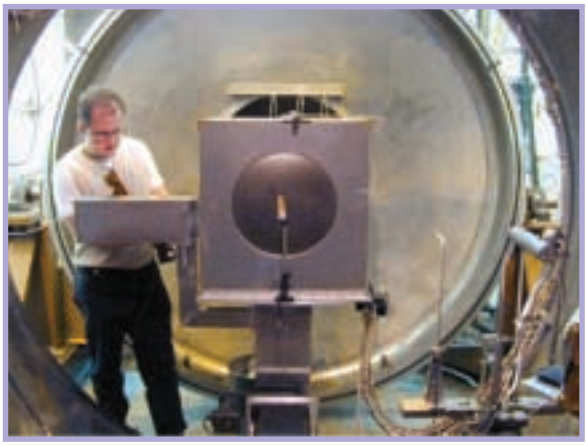
SSE Objectives:

- **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 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 of development and/or near-term future investments.

GRC Objective S1.0: Develop in-space propulsion, power, communication, and other advanced spacecraft technologies for application to Space Science research.

GRC Milestones supporting this Goal and these Objectives:

02S1.1: Next-Generation Ion Propulsion System
Submit a proposal in response to an upcoming NASA Research Announcement for a next-generation ion propulsion system. [2Q; 6500/W.Taylor, 6900/S.Benson]



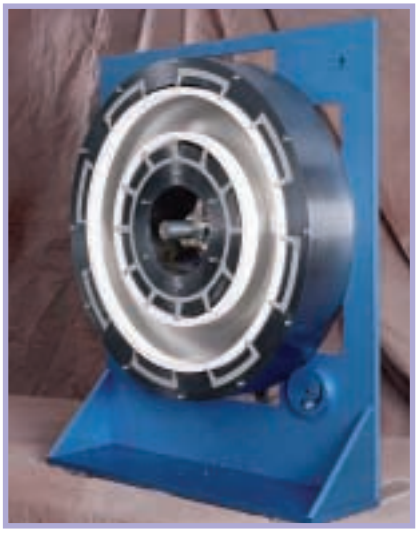
Ion engine prototype.

02S1.2: *Deleted prior to publication*

02S1.3: Core and Emerging Technology
Submit proposals in response to an upcoming NASA Research Announcement for core and emerging technology investment. [3Q; 6500/W.Taylor]

02S1.4: Ion Engine Fundamentals
Complete engine probe diagnostics of the discharge plasma in a 30-cm ion engine. [4Q; 6900/J.Dunning]

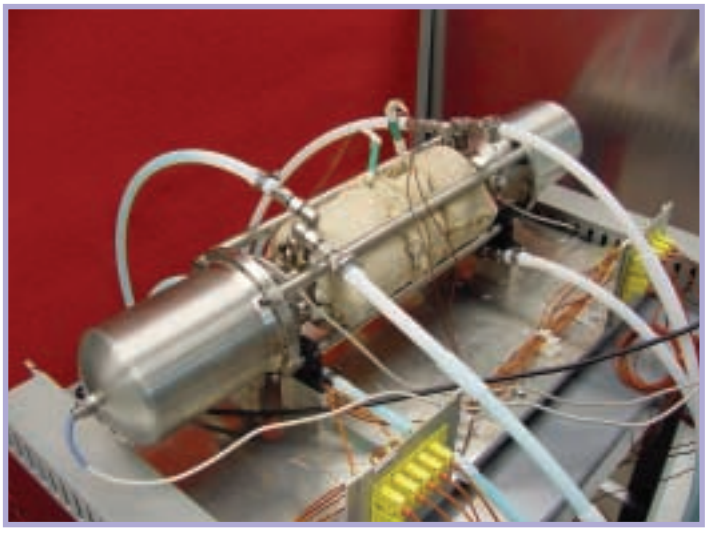
02S1.5: 50-kW Hall Thruster
Conduct initial testing of the first U.S. prototype 50-kW Hall thruster. [3Q; 6900/J.Dunning]



Hall thruster.

02S1.6: *Changed to 02A10.2 prior to publication*

02S1.7: Stirling Convertor Code
Make operational a multidimensional computational fluid dynamics Stirling convertor performance computer code by building on existing models, to support ongoing GRC Stirling convertor technology development. [4Q; 6900/J.Nainiger]



GRC-designed Stirling convertor.

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

SSE Objectives:

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

GRC Objective S2.0:
Same as SSE Objectives

GRC Milestones supporting this Goal and these Objectives:
None for FY02

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

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 pre-college level.
- **3C:** Help create our 21st-century scientific and technical workforce.

GRC Objective S3.0:
Same as SSE Objectives

GRC Milestones supporting this Goal and these Objectives:
None for FY02

GRC Contributions to 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 missions or enable new Earth Science missions. GRC's contributions are in advanced power, in-space propulsion, and space communications technology. Most 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.

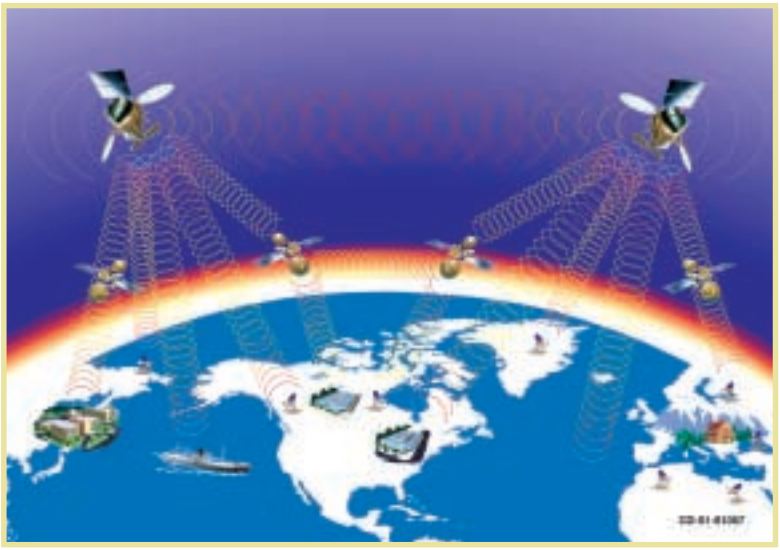
ESE Goal 1—Observe, understand, and model the Earth system to learn how it is changing, and the consequences for life on Earth.

ESE Objectives:

- **1A:** Discern and describe how the Earth is changing.
- **1B:** Identify and measure the primary causes of change 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 Objective E1.0: Develop power, in-space propulsion, communication, and other advanced spacecraft technologies for application to Earth science-related research.

GRC Milestones supporting this Goal and these Objectives:
None for FY02



Developing future communications architectures for Earth observing.

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

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 Objective E2.0:
Same as ESE Objectives

GRC Milestones supporting this Goal and these Objectives:
None for FY02

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

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 agencies to develop and implement better methods for using remotely sensed observations in Earth system monitoring and prediction.

GRC Objective E3.0:
Same as ESE Objectives

GRC Milestones supporting this Goal and these Objectives:
None for FY02

GRC Contributions to the Biological and Physical Research Enterprise

The Biological and Physical Research Enterprise (BPR) conducts interdisciplinary fundamental and applied research to pursue answers to the basic questions underlying human space flight:

- How can human existence expand beyond the home planet to achieve maximum benefits from space?
- How do fundamental laws of nature share 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.

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 Objective B1.0: Facilitate and enable the conduct of research to improve spacecraft fire and safety and to improve countermeasures for long-term exposure to the microgravity environment of space.

GRC Milestones supporting this Goal and these Objectives:

02B1.1: Interdisciplinary Fluid Physics, Biotechnology, and Biomedicine
Publish a white paper describing the benefits of interdisciplinary fluid physics, biotechnology, and biomedical research. [1Q; 6700/F.Kohl]

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

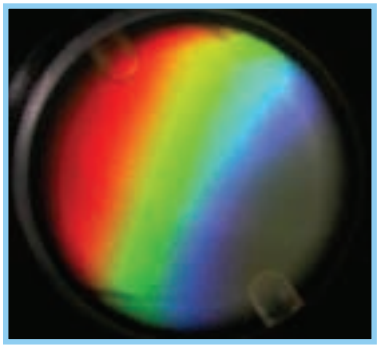
BPR Objectives:

- **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 Objective B2.0: Enable the research community to use gravity as an experimental variable in the combustion science and fluid physics disciplines.

GRC Milestones supporting this Goal and these Objectives:

02B2.1: Physics of Colloids in Space Experiment
Successfully complete Experiment of Physics of Colloids in Space (EXPPCS) on the ISS. [4Q; 6700/F.Kohl]



Colloid visualization on the International Space Station.

02B2.2: Coarsening in Solid-Liquid Mixtures-2 Experiment
Provide for the deployment of Coarsening in Solid-Liquid Mixtures-2 experiment, integrate it in the ISS Microgravity Science Glovebox, and initiate experiment operations. [4Q; 6700/F.Kohl]

02B2.3: InSPACE Experiment
Provide for the deployment of Investigating the Structures of Paramagnetic Aggregates of Colloid Emulsions (InSPACE) experiment in the ISS Microgravity Science Glovebox. [3Q; 6700/F.Kohl]

02B2.4: Critical Viscosity of Xenon-2 Experiment
Successfully complete Critical Viscosity of Xenon-2 experiment (CVX–2) on STS–107. [4Q; 6700/F.Kohl]

02B2.5: Microgravity Combustion Smoldering Experiment
Successfully complete Microgravity Smoldering Combustion (MSC) experiment on STS–108. [1Q; 6700/T.Sutliff]

02B2.6: Combustion Module-2 Experiments
Successfully complete the Laminar Soot Processes (LSP), Structure of Flame Balls at Low Lewis-number (SOFBALL), and Mist experiments on STS–107 using the Combustion Module-2 facility. [4Q; 6700/T.Sutliff]

02B2.7: Collisions Into Dust Experiment-2
Successfully complete Collisions Into Dust Experiment-2 (COLLIDE–2) on STS–108. [6700/F.Kohl]

02B2.8: Microgravity Acceleration Environment
Measure and report the acceleration environment during microgravity experiment operations on STS–107. [4Q; D.Francisco]

02B2.9: ISS Acceleration Environment
Measure the ISS acceleration environment and publish increment reports for ISS increments 3 and 4. [4Q; 6727/D.Francisco]

02B2.10: ISS Acceleration Environment Neural Network
Complete implementation of a neural network-fuzzy logic system

to assess and monitor the ISS acceleration environment. [2Q; 6727/D.Francisco]

02B2.11: ISS Fluids and Combustion Facility
Complete the Critical Design Review of the Fluids Integrated Rack. [4Q; 6700/R.Zurawski]

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

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 Objective B3.0:
Same as BPR Objectives

GRC Milestones supporting this Goal and these Objectives:
None for FY02

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

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 Objective B4.0: Provide information and educational materials, programs, and training about BPR-related subjects to U.S. teachers.

GRC Milestones supporting this Goal and these Objectives:

02B4.1: Microgravity Education Outreach
Expand Dropping in a Microgravity Environment (DIME) high school competition to the local six-state region (Illinois, Indiana, Michigan, Minnesota, Wisconsin, and Ohio). [3Q; 6727/R.DeLombard]

DIME team in front of their Cotton Combustion Experiment.

GRC Crosscutting Process Objectives

The NASA Strategic Plan outlines the following crosscutting processes:

- Manage strategically
- Provide aerospace products and capabilities
- Generate knowledge
- Communicate knowledge

This section identifies specific GRC implementing activities related to these crosscutting processes. These activities are enabling functions that support GRC's mission.

Manage Strategically (MS)

Effective and sound management of the unique combination of physical resources and human talents at NASA is critical to achieving NASA's goals and objectives. Strategic management ensures that the public's investment in NASA is well served and that the Agency's initiatives and achievements benefit the quality of life on Earth for all humankind.

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 2MS1: 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 Objective M1.0: Implement a comprehensive program of institutional safety initiatives and risk assessments identifying hazards associated with GRC's research facilities and workplace and implement mitigation initiatives for those hazards that measurably improve the safety of GRC's infrastructure and workforce.

GRC Milestones supporting these Goals and Objectives:

02M1.1: Support the Agency goal to reduce the overall occurrence of injuries (due to occupational injury or illness) by 3 percent per year from the FY1997 baseline, to 1.15 occurrences per 100 workers (0.98). [4Q; 0500/W.Wessel]

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

MS Performance Goal 2MS2: Continue to take advantage of opportunities for improved contract management by maintaining a high proportion of performance-based contracts.
MS Performance Goal 2MS9: Continue integrating small, small disadvantaged, and women-

GRC Objective M2.0: Maximize the percentage of GRC contract dollars directed to performance-based contracts and to small, small disadvantaged, and women-owned businesses.

GRC Milestones supporting these Goals and Objectives:

02M2.1: Performance-Based Contracting
Obligate at least 80 percent of all procurement dollars to performance-based contracts. [4Q; 0600/B.Baker]

02M2.2: Socioeconomic Procurement Goals
Achieve the small, small disadvantaged, and women-owned business goals assigned to the Center and improve the FY01 percentage and contract dollars obligated to Hub Zone firms, historically black

owned businesses together with minority universities into the competitive base from which NASA can purchase goods and services.

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

MS Performance Goal 2MS3: Revitalize Agency facilities and reduce environmental liability.

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

colleges and universities, other minority educational institutions, and service-disabled veterans. [4Q; 0600/B.Baker]

GRC Objective M3.0: Effectively and economically manage GRC's financial and human resources. This includes implementing the Agency's Integrated Financial Management System, maintaining an ISO 9000-certified Business Management System, taking steps to have a workforce representative of America's diversity, and reducing equal employment opportunity complaints through use of the informal Alternative Dispute Resolution process.

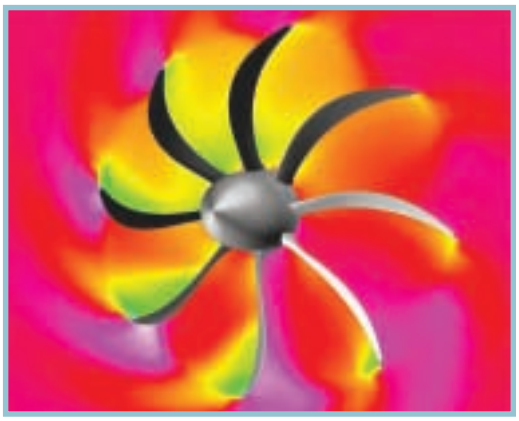
GRC Milestones supporting these Goals and Objectives:

01M1.2 (Carryover from prior fiscal year): Plum Brook Reactor Decommissioning
Obtain Nuclear Regulatory Commission approval of the Plum Brook Nuclear Reactor Facility Decommissioning Plan. [2Q; 0500/S.Hardy]

02M3.1: Costing
Cost at least 75 percent of the resources authority available to cost during the fiscal year. [4Q; 0200/R.Fails]

02M3.2: *Deleted prior to publication*

02M3.3: Environmental Management System
Maintain an ISO 14001-registered Environmental Management System. [4Q; 0500/W.Wessel]



Propfan simulation.

GRC Objective M4.0: Ensure that GRC IT provides an open yet secure exchange of information, is consistent with Agency technical architectures and standards, demonstrates a projected return on investment, reduces risk, and directly contributes to mission success.

GRC Milestones supporting these Goals and Objectives:

02M4.1: Information Technology Inventory Obsolescence Process
Facilitate and coordinate the IT obsolescence process so that the

MS Performance Goal 2MS4: Improve IT infrastructure service delivery by providing increased capability and efficiency while maintaining a customer rating of satisfactory.

MS Performance Goal 2MS5: Enhance IT security by meeting established performance indicators in three critical areas: vulnerabilities detected, training, and IT security plans.

MS Performance Goal 2MS6: Enhance mission success through seamless, community-focused electronic service delivery.

average age of GRC interoperable or networked computer systems does not exceed 3 years and that no GRC IT equipment is older than 7 years. [4Q; 7100/J.Oprea]

02M4.2: Outsourcing Desktop Initiative Customer Satisfaction
Fully satisfy (obtain a rating of at least 4 on a 5-point scale) at least 95 percent of all GRC IT users who respond to the Outsourcing Desktop Initiative for NASA (ODIN) customer survey. [4Q; 7100/D.Sosoka]

02M4.3: IT Security Plan
Ensure that all GRC IT systems have an IT security plan. [4Q; 7100/P.Kotlenz]

02M4.4: External Services Network
Implement the necessary infrastructure such that all publicly available Web and file transfer protocol (FTP) servers can be migrated to the External Services Network. [2Q; 7100/D.Sosoka]

***02M4.5: Basic IT Security Awareness Training**
Ensure that 90 percent of all GRC civil servants and contractors successfully complete the basic IT Security Awareness Training course. [3Q; 7100/K.Langenwalter]

***02M4.6: Manager IT Security Training**
Ensure that the GRC Chief Information Officer (CIO) and IT Security Manager, and 95 percent of all GRC civil servant and contractor managers complete the IT Security for Managers 2002 SOLAR training. Ensure that 95 percent of all personnel who authorize Special Management Attention (SMA) systems, systems processing Mission (MSN), or Business and Restricted Technology (BRT) information successfully complete the Manager Responsibilities for ITS Risk Management SOLAR training. [3Q; 7100/K.Langenwalter]

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

MS Performance Goal 2MS7: Align management of human resources to best achieve Agency strategic goals and objectives.

MS Performance Goal 2MS8: Attract and retain a workforce that is representative at all levels of America's diversity.

GRC Objective M5.0: Effectively and economically manage GRC's human resources. This includes taking steps to have a workforce representative of America's diversity, and reducing Equal Employment Opportunity complaints through use of the informal Alternative Dispute Resolution process.

GRC Milestones supporting these Goals and Objectives:

02M5.1: Understanding and Meeting Office of Human Resources Customer Needs
Establish a baseline and cycletime for processes and services provided by the GRC Office of Human Resources. [2Q; 0400/R.Bailer]

02M5.2: Workforce Diversity
Maintain a diverse workforce where women, minorities, individuals with disabilities, and disabled veterans are represented at all levels.

Targets are to increase the representation of minorities by at least 0.6 percent, of women by at least 0.4 percent, and of individuals with disabilities and disabled veterans by at least 0.85 percent. [4Q; 0180/R.Romero]

02M5.3a: Hiring Within Underrepresented Groups
Ensure that progress in hiring women, minorities, individuals with disabilities, and disabled veterans has been made at GRC compared with FY01. [4Q; 0180/R.Romero]

02M5.3b: Promoting Within Underrepresented Groups
Ensure that progress in promoting women, minorities, individuals with disabilities, and disabled veterans has been made at GRC compared with the 5-year average from FY97 to FY01. [4Q; 0180/R.Romero]

02M5.4: ADR Process
Ensure that at least 85 percent of all informal Equal Opportunity complaints are resolved using the Alternative Disputes Resolution process, which includes counseling and mediation, based on the 5-year average from FY97 to FY01. [4Q; 0180/R.Romero]

Provide Aerospace Products and Capabilities (PAPAC)

NASA's Strategic Enterprises and their centers use the PAPAC process to deliver systems (ground, aeronautics, space), technologies, data, and operational services to NASA customers. Through the use of Agency facilities, customers can conduct research, explore and develop space, and improve life on Earth.

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 2P1: 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.

GRC Objective P1.0: Develop and maintain a comprehensive R&D risk-management methodology. Ensure that GRC's risk-management methodology and all program and/or project risk-management plans comply with NASA Policy Directive 7120.4 and NASA Procedures and Guidelines 7120.5 and that they address safety, environmental compatibility, and security. Utilize the Mission Assurance Program to improve the quality, timeliness, and cost-effectiveness of the development and acquisition of research products and services by making risk-management training, orientation, and implementation support available to all GRC program and project personnel.

GRC Milestones supporting these Goals and Objectives:

02P1.1: CRM Implementation
Implement the GRC Continuous Risk Management implementation plan for at least 12 GRC programs or projects. [4Q; 0500/W.Wessel]

02P1.2: Mission Assurance Tools
Complete the development of the Process Based Mission

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

PAPAC Objective 3: Capture and preserve engineering and technological best practice to continuously improve NASA's program and project management.

PAPAC Objective 4: Facilitate technology insertion and transfer, and utilize commercial partnerships in research and development to the maximum extent practicable.

PAPAC Performance Goal 2P6: Dedicate 10 to 20 percent of the Agency's R&D budget to commercial partnerships.

Assurance tools and techniques, incorporate them with Agencywide examples and lessons learned in a Web-based tool kit, and complete GRC implementation visits associated with these tools and techniques. [4Q; 0500/W.Wessel]

GRC Objective P2.0: Enhance GRC's critical research capabilities.

GRC Milestones supporting these Goals and Objectives:
None for FY02

GRC Objective P3.0:
Same as PAPAC Objective

GRC Milestone supporting these Goals and Objectives:
None for FY02

GRC Objective P4.0: Form alliances and partnerships with other NASA centers; Federal, state, and local agencies; and academia and industry.

GRC Milestones supporting these Goals and Objectives:

***02P4.1: GRC Partnerships**
Dedicate 10 to 20 percent of GRC's research and development budget to partnerships with commercial potential. [4Q; 9400/L.Viterna]

02P4.2: Garrett Morgan Commercialization Initiative
Transfer at least three GRC technologies to small minority or women-owned businesses through the Garrett Morgan Commercialization Initiative. [4Q; 9400/L.Viterna]

02P4.3: NASA Illinois Commercialization Center
Transfer at least five GRC technologies through the NASA Illinois Commercialization Center. [4Q; 9400/L.Viterna]

NASA Illinois
Commercialization Center

02P4.4: SBIR/STTR Programs
Manage at least 10 percent of the Agency's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) funding. [4Q; 9400/L.Viterna]

Generate Knowledge (GK)

The primary purpose of this crosscutting process is to extend the boundaries of knowledge of science and engineering through high-quality research. (There are no Agencywide goals, objectives, or performance goals for this crosscutting process. Accordingly, this year GRC also has no objectives or milestones in this category.)

Communicate Knowledge (CK)

The Communicate Knowledge process facilitates the distribution of information on NASA's missions and discoveries. It provides information to NASA's customers around the world, including scientists, technologists, companies, innovators, educators, publishers, museums, the media, and every citizen.

CK Goal 1—Ensure that NASA's customers receive information from the Agency's efforts in a timely and useful form.

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

CK Performance Goal 2CK1: Share the experience of expanding the frontiers of air and space with the public and other stakeholders by meeting four of the following five indicators:

- **1A:** More Americans can visit a NASA exhibit, through a minimum of 350 events per year.
- **1B:** Public attendance and participation in the NASA Art Program will increase, through exhibitions in 15 additional states.
- **1C:** Agency officials and astronauts will convey clear information on NASA activities though the most-used medium in America—television— through no less than 20 live shots per month on average.
- **1D:** NASA's activities and achievements will be chronicled and put into perspective for the American

GRC Objective C1.0: Ensure widespread recognition of GRC's capabilities and technologies; enhance the Center's image by communicating its expertise internally and externally; and increase public awareness of GRC contributions.

GRC Milestones supporting these Goals and Objectives:

02C1.1: Centennial of Flight Exhibit
Develop an exhibit fabrication and management plan for the participation of the Center and the Agency in the 2003 centennial of flight celebration. [2Q; 9300/L.D.Campbell]

GRC's new Wonders of Flight exhibit.
(David H. Polcyn/News Journal, Mansfield, Ohio, used with permission.)

public, through 10 new historical publications.

- **1E:** Documents significant in the Agency's history will be made available to a larger audience by producing one new electronic document, a CD-ROM.

CK Objective 2: Disseminate scientific information generated by NASA programs to our customers.

02C1.2: Center Director Forums
Develop and implement expanded manager and employee forums with the Center Director. [4Q; 5000/J.Giomini]

02C1.3: News Release Imagery
Increase efforts in the area of visual imagery to identify still photographs and video to the media and place on the Web. [4Q; 9300/L.D.Campbell]

GRC Objective C2.0: Disseminate scientific and technical information generated by GRC activities to GRC customers and beneficiaries.

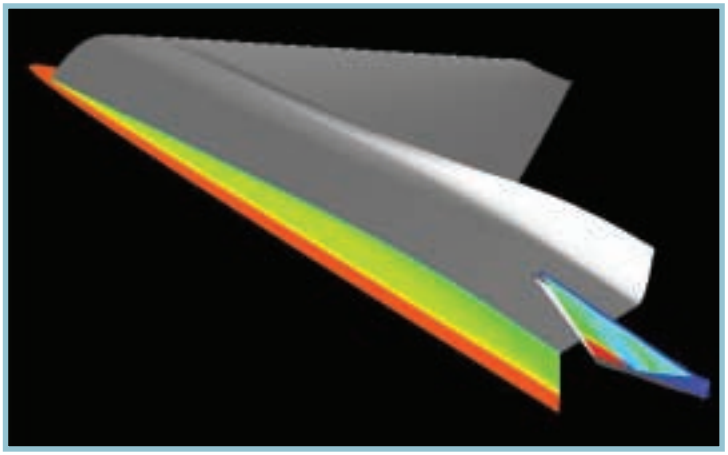
GRC Milestones supporting these Goals and Objectives:

***02C2.1: Technologies Released to the Public**
Document 160 disclosures of new technology from GRC internally and externally funded R&D. [4Q; 9400/L.Viterna]

02C2.2: Technology Opportunity Sheets
Generate at least eight Technology Opportunity Sheets (TOPS) to market GRC capabilities, facilities, and technologies. [4Q; 9400/L.Viterna]

02C2.3: Success Stories
Research and release to the public at least 20 stories of successful technology transfer. [4Q; 9400/L.Viterna]

02C2.4: Technology Commercialization Articles
Publish at least 30 articles relating to technology commercialization activities in publications such as NASA Aerospace Technology Innovation and Spinoff. [4Q; 9400/L.Viterna]



Integrated system test of an air-breathing rocket (ISTAR) inlet simulation.

CK Objective 3: Transfer NASA technologies and innovations to private industry and the public sector.

CK Performance Goal 2CK3: Ensure consistent, high-quality external communication by meeting three of the following four indicators:

- **3A:** Effectively communicate technologies available for commercial use and technologies that have been commercialized by industry through specific publications.
- **3B:** Publish at least one industry-specific, special edition of Aerospace Technology Innovation to attract new readership and encourage partnerships with targeted industry sectors.
- **3C:** Carry out effective NASA technology transfer market outreach to the medical device industry.
- **3D:** The NASA Technology Tracking System (TechTracS) data base, accessible through the Internet, will list at least 18,000 NASA technologies that are considered to be of benefit to U.S. industry and the public.

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

GRC Objective C3.0: Support the Agency's efforts to improve technology transfer by ensuring that GRC's best practices are communicated to other NASA centers.

GRC Milestones supporting these Goals and Objectives:

02C3.1: Space Act Agreement and Software Release Processes
Work with at least six NASA centers to streamline the Agency's Space Act Agreement documentation and Software Release processes. [4Q; 9400/L.Viterna]

GRC Objective C4.0: Expand and enhance GRC science, mathematics, and engineering educational programs and public outreach. To accomplish this, GRC will align its educational programs with the framework described in the NASA Implementation Plan for Education 1999–2003.

CK Performance Goal 2CK4:
Using NASA's unique resources (mission, 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 5-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:** Through partnerships, NASA will increase the amount of total funding obligations from the FY00 baseline for historically black colleges and universities and other minority universities.
- **4D:** NASA will establish an undergraduate scholarship program.

GRC Milestones supporting these Goals and Objectives:

02C4.1: Teacher Preparation and Skill Enhancement
Conduct an event that will systemically link teachers, students, and parents in an ongoing educational program. [4Q; 9200/J.Charleston]

02C4.2: Student Support
Increase the number of underrepresented minority and underserved students participating in NASA student programs. [4Q; 9200/J.Charleston]

02C4.3: Curriculum Support
Develop instructional materials to support the celebration of the 100th anniversary of powered flight. [4Q; 9200/J.Charleston]

02C4.4: Education Technology 1
Serve as the educational lead center for the Aerospace Technology Enterprise to coordinate the celebration of the 100th anniversary of powered flight. [4Q; 9200/J.Charleston]

02C4.5: Education Technology 2
Utilize webcast technologies to increase the number of students and teachers participating in educational programs to highlight NASA GRC programs. [4Q; 9200/J.Charleston]

02C4.6: Education Technology 3
Increase the number of ways that technology can be used to reach students and teachers by investigating the use of emerging high-level video-conferencing technologies with at least one out-of-state school. [4Q; 9200/J.Charleston]

02C4.7: Systemic Improvement 1
Integrate five new Science, Engineering, Mathematics, and Aerospace Academy (SEMAA) sites into the national SEMAA program. [4Q; 9200/J.Charleston]

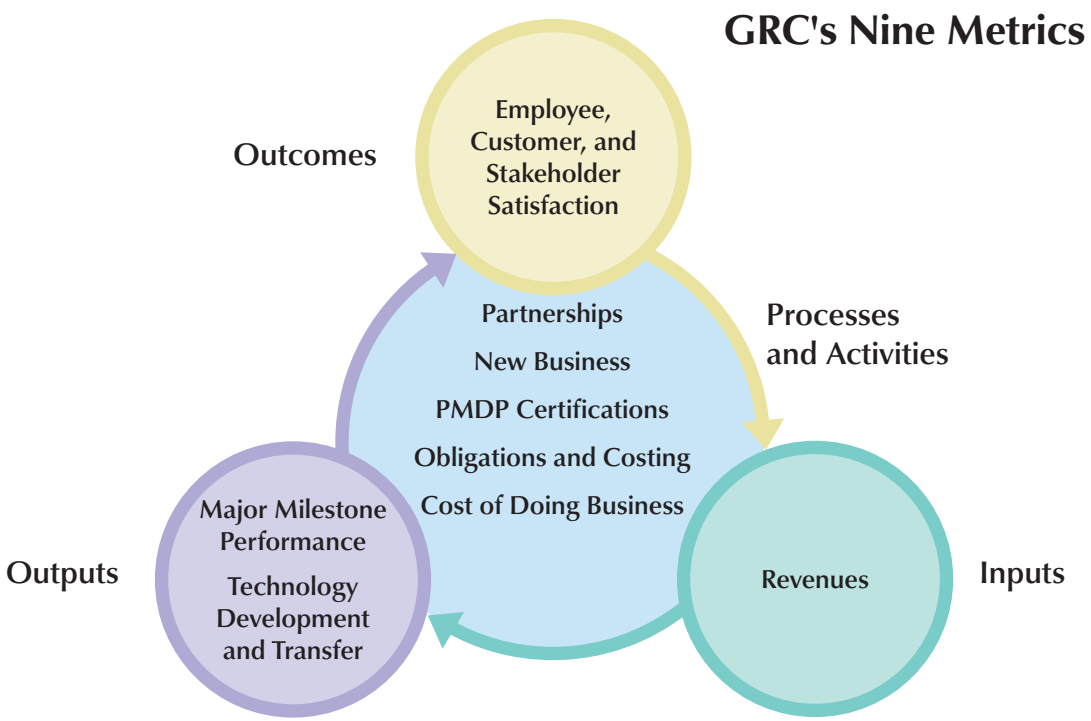
02C4.8: Systemic Improvement 2
Upgrade and install new microgravity curricula in NASA's 22 Aerospace Education Laboratories. [4Q; 9200/J.Charleston]

02C4.9: Systemic Improvement 3
Conduct phase II of the Aerospace Education Center feasibility study. [4Q; 9200/J.Charleston]

02C4.10: Educational Program Management
Work with GRC Aerospace Technology Enterprise project offices to develop education outreach metrics. [4Q; 9200/J.Charleston]

GRC Center-Level Metrics

GRC has nine metrics to monitor the overall health of the Center. These metrics are reviewed by GRC management on a quarterly basis and also during the annual Center Performance Review.



Revenues—Tracks the balance of the Center's revenue portfolio and the distribution of funding received from NASA Enterprises, other government agencies, and non-Federal entities.

Partnerships—Counts the number of partnerships GRC has established with businesses, educational and nonprofit organizations, and non-Federal entities.

New Business—Tracks the new opportunities being pursued by GRC, the cost to GRC of pursuing them, and the value of the new business captured.

Program Management Development Program (PMDP) Certifications—Counts the number of GRC employees who have achieved PMDP certification at the four designated levels. Each GRC directorate has established certification goals to meet anticipated program management needs.

Obligations and Costing—Measures GRC obligations and costing, both planned and actual. GRC's goal is to be within 2 percent of the plan for each area monitored and for all areas in aggregate.

Cost of Doing Business—Compares the percentage of funds GRC spends for direct costs, service pool costs, and general and administrative costs.

Major Milestone Performance—Measures the cost, schedule, and technical performance of all milestones in the GRC Strategic Implementation Plan. GRC's goal is to complete at least 85 percent of all milestones on schedule and within budget while accomplishing the designated technical objectives.

Technology Development and Transfer—Counts the number of GRC new technology disclosures, refereed journal articles, patents, patent licenses, and major awards.

Employee, Customer, and Stakeholder Satisfaction—Measures GRC's overall success in meeting the needs of these three key groups. This is GRC's keystone metric.

Appendix A
GRC Program Points of Contact

NASA Safety Initiative

Manuel B. Dominguez 216–433–6735

Aerospace Technology Enterprise

Aerospace Propulsion and Power Program Research and Technology
Gary T. Seng 216–433–3732

CICT Research and Technology
Gary T. Seng 216–433-3732

Ultra-Efficient Engine Technology
Robert Shaw 216–977–7135

Aviation Safety 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 Program
Harry Cikanek 216–433–6196

Breakthrough Propulsion Physics Project
Marc Millis 216–977–7535

Aeronautical Communications
Denise Ponchak 216–433–3465

CICT Space Project
Kul Bhasin 216–433–3676

Advanced Power and On-Board Propulsion Project
Joseph Nainiger 216–977–7103

Human Exploration and Development of Space Enterprise

International Space Station (ISS) Assembly Support and Technology Demonstrations
Timothy Tyburski 216–433–8616

Space Operations Program
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
Robert Bauer 216–433-3431

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 216–433–6186

Environmental Information Systems
Daniel White 216–433–3103

Information Technology Security Awareness Training
Richard Clapper 216–433–2890

Appendix B
GRC Organizational Points of Contact

Office of the Director
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Chief Scientist
Marvin E. Goldstein 216–433–5825
Assistant Deputy Director for Policy
John W. Gaff 216–433–2940

Chief Counsel
William Sikora 216–433–2318

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

Inspector General
Chester A. Sipsock 216–433–8960

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

Equal Opportunity
Robert Romero 216–433–5538

Chief Financial Officer
Robert E. Fails 216–433–2977

Office of Human Resources
Rick J. Bailer 216–433–2481

Safety and Assurance Technologies
Vernon W. Wessel 216–433–2350

Environmental Management Office
Michael Blotzer 216–433–8159

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Bradley J. Baker 216–433–2800

Aeronautics Directorate
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Arun K. Sehra 216–433–3397

Research and Technology Directorate
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Woodrow Whitlow, Jr. 216–433–3193
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Randall B. Furnas 216–433–2321
Deputy Director
Jose M. Vega 216–433–5453

Plum Brook Management
Robert P. Kozar 419–294–3205

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Sasi K. Pillay 216–433–9300

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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 216–433–3484

For more information about this Plan,

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E-mail: implement@grc.nasa.gov

or

Visit the Glenn web site at

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