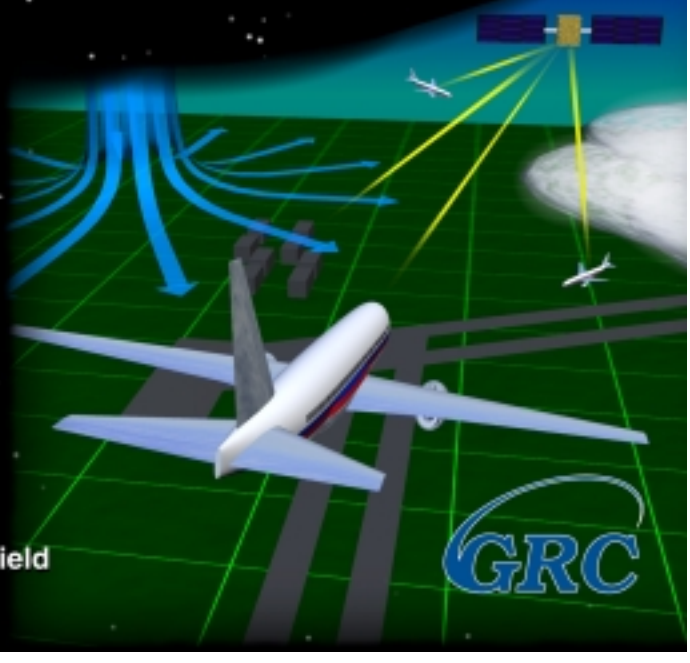
The NASA Glenn Research Center Strategic Implementation Plan

Fiscal Year 2000



National Aeronautics and Space Administration

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

GRC

Center Director's Message

The Glenn Research Center (GRC) Strategic Implementation Plan provides an overarching summary of our Center's objectives supporting NASA's goals and objectives and a detailed description of all of GRC's planned major contributions to NASA's Enterprises and Crosscutting Processes in Fiscal Year 2000.

This Plan addresses the needs of GRC's customers, stakeholders, and beneficiaries. The primary customers of GRC technology, products, and services are our Nation's businesses, academia, the Department of Defense, and the Federal Aviation Administration. GRC's primary stakeholders are Congress, the Administration, Ohio's key government officials, and, of course, NASA Headquarters and the other NASA Centers (who often are also GRC's internal customers and partners). GRC's primary beneficiaries are all Americans.

To successfully satisfy these groups' needs, we at GRC must not only commit ourselves to implement this Plan but also to practice the key values of quality, openness, diversity, and integrity. We also must commit ourselves to innovation and continuous improvement so that we may 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

Gerald J. Barna
Acting Deputy Director

Julian M. Earls
Deputy Director for Operations

John W. Gaff
Assistant Deputy Director for Policy

Carol J. Russo
Director of Aeronautics

Woodrow Whitlow
Director of Research and Technology

John M. Hairston, Jr.
Director of External Programs

Maury L. Blanton
Chief, Office of Human Resources

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Chief Counsel

Robert Romero
Chief, Office of Equal Opportunity Programs

Olga D. Gonzalez-Sanabria
Chief, Plans and Programs

Robert E. Fails
Chief Financial Officer

Rudolph L. Saldana
Acting Director of Space

Randall B. Furnas
Director of Engineering and Technical Services

Marvin E. Goldstein
Chief Scientist

Vernon W. Wessel
Director of Safety and Assurance Technologies

Peter W. McCallum
Acting Chief, Aeropropulsion Research Program Office

Phillip R. Walker
Director of Diversity

Sasi K. Pillay
Chief Information Officer

Table of Contents

Front Cover:
Upper Right: Mars 2001 Mission; represents Glenn contributions to Space Science

Upper Left: International Space Station (ISS) and Space Shuttle; represents Glenn contributions to Human Exploration and Development of Space

Lower Left: Terra Satellite; represents Glenn contributions to Earth Science

Lower Right: Aviation System Diagram; represents Glenn contributions to Aero-Space Technology

Foreground: GRC concept for rocket-based combined-cycle hypersonic vehicle; represents synergy in aeronautics and space and Glenn's pioneering spirit

Introduction

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 this Strategic Implementation Plan are to

- Delineate the means by which Glenn Research Center (GRC) will achieve the goals and objectives set forth in the NASA Strategic Plan
- Communicate to GRC employees their expected contributions to the Agency and the Center
- Assure GRC's customers, stakeholders, and beneficiaries that their needs are being addressed
- Provide the major FY2000 milestones that will be evaluated as part of the overall Agency Performance Plan

The diagram below shows that the elements of the NASA Strategic Plan cascade to the NASA GRC Strategic Implementation Plan and subsequently to Program Plans and individual employee Performance Plans.

The NASA Vision

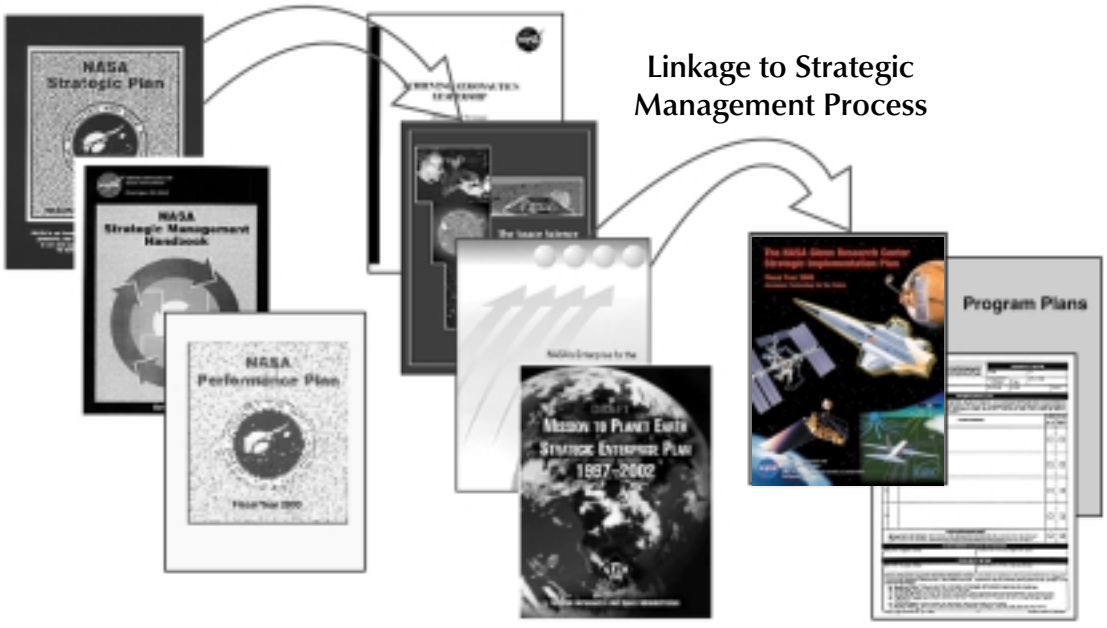
NASA is an investment in America's future. As explorers, pioneers, and innovators, we boldly expand frontiers in air and space to inspire and serve America and to benefit the quality of life on Earth.

The NASA Mission

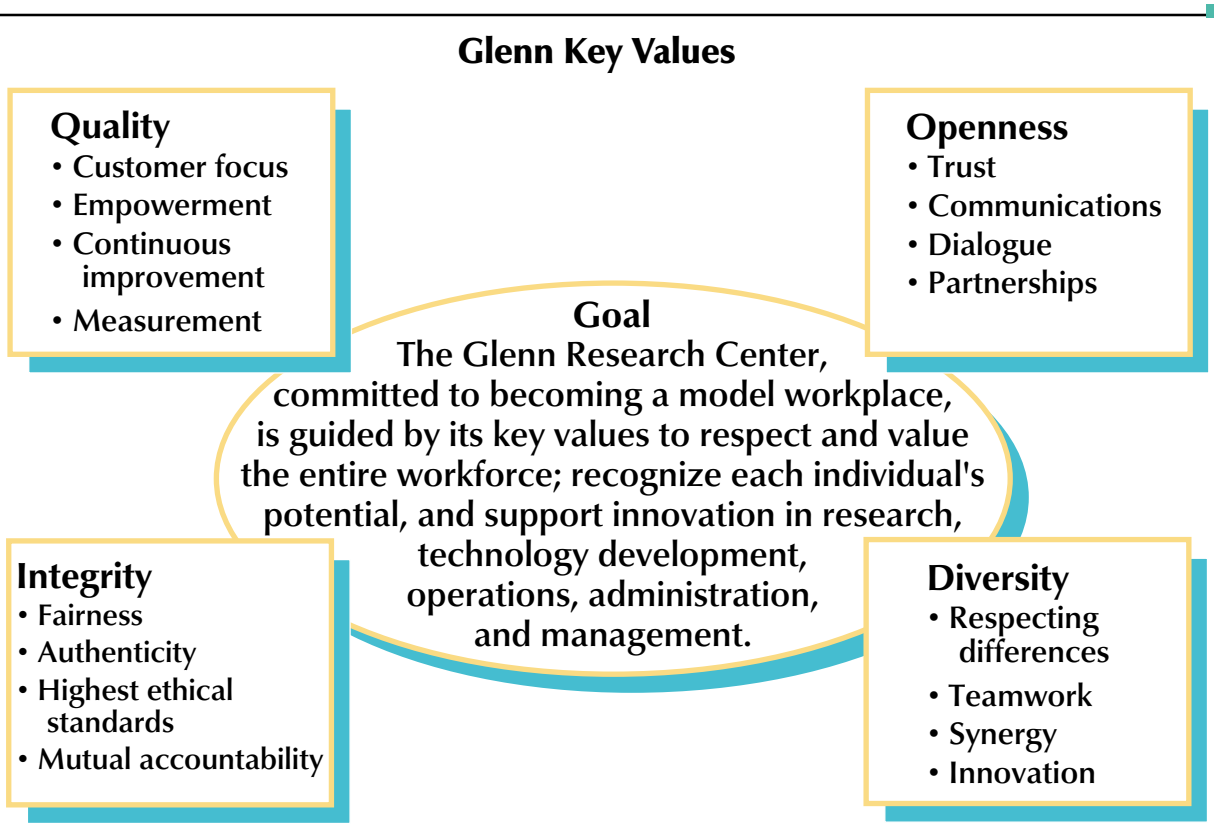
- To advance and communicate scientific knowledge and understanding of Earth, the solar system, and the universe and use the environment of space for research
- To advance human exploration, use and development of space
- To research, develop, verify and transfer advanced aeronautics, space and related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



Linkage to Strategic Management Process



Model Workplace Goal

The model workplace represents the goal state where 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.

GRC Implementation of the Agency Safety Initiative

The NASA Agency Safety Initiative (ASI) 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 ASI are

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

In response to these requirements, the Glenn Research Center program stresses enhanced safety practices in the workplace and an improved safety awareness by management and staff. A systematic approach to safety and health risk identification has been introduced and will be 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. More 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

The Glenn Research Center implements Agency goals and strategies by building upon a set of critical skills, capabilities, and business functions to support basic research and technology development. These efforts lead to a broad technology base that through advanced development is transferred to our customers for product development and operations. The Glenn Research Center's strategy integrates aeronautics and space capabilities with an aerospace product line. Some competencies have been defined as core to our mission, but there also are many critical enabling skills that support these core functions, without which our mission could not be performed. Listed below are the Center's core competencies and corresponding capability areas where our skills and expertise support the implementation of NASA goals:

Air-Breathing Propulsion Systems
- Air-breathing propulsion systems
- Hybrid propulsion systems
- Propulsion system components
- Propulsion system materials and structures

Space Technology
- Aerospace power and in-space propulsion
- Aerospace communications

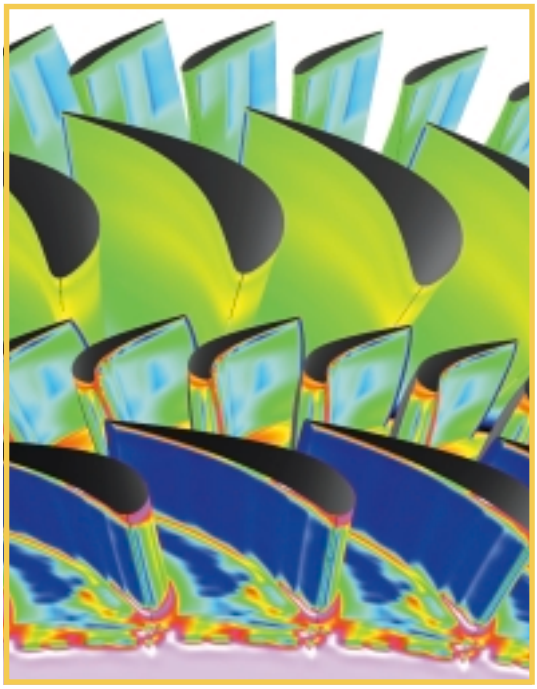
Fundamental and Applied Science
- Fluid and gas dynamics
- Combustion science
- Aerospace environments
- Extreme environment instrumentation

Aerospace Systems
- Mission analysis support
- System engineering and integration
- Systems analysis
- Test support
- Manufacturing engineering
- Facility systems engineering
- Simulation and modeling
- Software engineering

Program and Project Management

GRC Center of Excellence: Turbomachinery

The Glenn Research Center 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 fan containment, 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, and controls. GRC's primary objective in this area is to increase turbomachinery safety, durability, reliability, performance, efficiency, affordability, and environmental compatibility in order to improve U.S. industrial competitiveness and national security.



Turbine flow-field visualization through computational fluid dynamics (CFD).

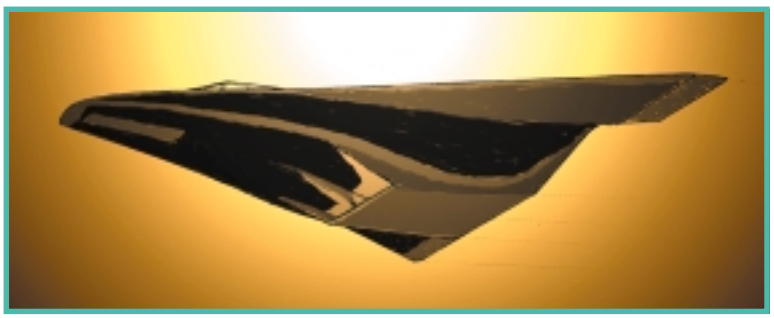
GRC Systems Management

To improve NASA's program and project management process, the Administrator has directed all Centers to create a Systems Management Office (SMO). The GRC SMO will promote excellence in Center programs and projects by supporting their formulation activities, by assuring that requirements be clearly defined and flow down through the various project levels, and by providing independent assessments that include cost estimates and analyses as requested by the Center Program Management Council. The SMO will assure that Glenn programs and projects be formulated and executed in compliance with NPG 7120.5A.

The GRC SMO will report to the Center Director and will also support the development of Center strategic processes, implementation planning, metrics process planning, and guidelines leading toward a comprehensive and synergistic program for aeronautics and space.

GRC Agency-Specific Mission: Aeropropulsion

The Glenn Research Center's Agency-specific mission is to 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 also 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 (compression and spark-ignited), electric engines, and all other types of engines used on aircraft.



Conceptual Mach 5, turbine-based, combined-cycle, hypersonic vehicle.

GRC Agency-Specific Mission: Aerospace Power Systems Research and Technology

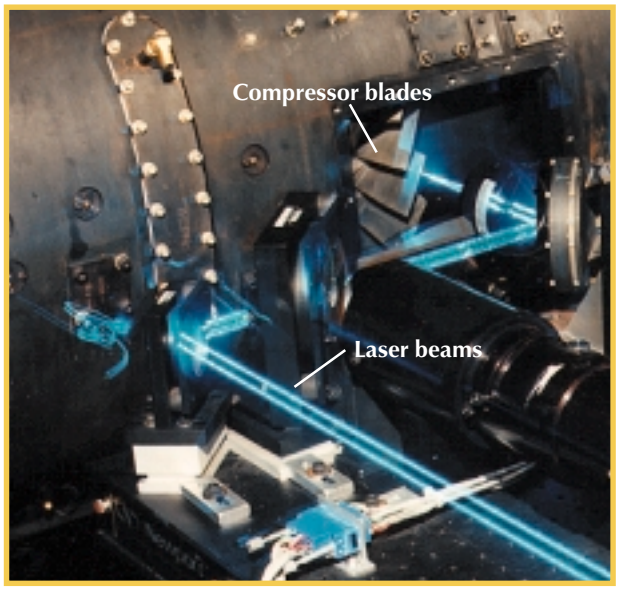
The NASA Administrator has designated GRC to be the Agency's Lead Center for Aerospace Power Systems Research and Technology. This area is crucial to future NASA missions and potential new initiatives and will benefit aeronautics and space in support of all NASA enterprises. Responsibilities include the leadership and management of advanced power systems research and technology development and, where appropriate, support to NASA's power system development.

GRC solar concentrator array with refractive linear element technology (SCARLET) used on Deep Space–1 spacecraft (inset).

GRC Program Responsibility: Aerospace Propulsion and Power Research and Technology

Glenn has lead center management responsibility for NASA's Propulsion and Power Research and Technology (R&T) Program, one of seven Base R&T programs in the Aero-Space 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. The program addresses critical propulsion technology needs across a broad range of investment areas, including revolutionary advances in conventional aeropropulsion, unconventional propulsion technologies, and air-breathing aerospace propulsion.

This program develops technology that supports the three pillars and eleven goals of the Aero-Space Technology Enterprise.



Use of laser technology to measure engine compressor flow field.

GRC Program Responsibility: Ultra-Efficient Engine Technology

GRC has lead center program management responsibility for the Ultra-Efficient Engine Technology (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 together with other technologies will be incorporated in 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.

Advanced subsonic turbine engine fan.

GRC Support to NASA'S Enterprises

Mission Areas	Aeropropulsion Aerospace power			
Center of Excellence	Turbomachinery			
Lead Center Programs	• Aerospace Propulsion and Power Research and Technology • Ultra-Efficient Engine Technology (UEET)			
Cross-Enterprise Support	• Intelligent Synthesis Environment • Cross-Enterprise Technology Development Program Thrust Area Management - Advanced power and onboard propulsion - High-rate data delivery			
Agencywide Support	Principal Center for - Environmental Information Systems - Workgroup Hardware and Software - Information Technology Security/ Awareness Training Expert Center		Lead for - Spectrum Management - Aeronautics Exhibits	
Enterprises	Aero-Space Technology (AT)	Human Exploration and Development of Space (HEDS)	Space Science (SS)	Earth Science (ES)
Programs Supported by the Glenn Research Center	• Aviation Safety - Accident mitigation - Weather-related accident prevention • Aviation System Capacity • Future-X (Pathfinders) • X-33 Advanced Technology Demonstration • High-Performance Computing and Communications • Advanced Space Transportation - Power - In-space propulsion - Air-breathing propulsion • Base R&T Programs - Flight research - Airframe systems - Rotorcraft - Information systems - Aviation operations	• International Space Station - Electrical power - Fluid and combustion research facility - Communications enhancement • Microgravity Research - Fluid physics - Combustion science - Acceleration measurement • Space Operations • Shuttle Upgrades • Exploration Initiative Studies	• Technology Development - Power - In-space propulsion - Communications	

GRC Contributions to the Aero-Space Technology (AT) Enterprise

To sustain global U.S. leadership in civil aeronautics and space transportation, the Aero-Space Technology Enterprise developed a set of bold objectives presented in the 1997 brochure *Aeronautics & Space Transportation Technology: Three Pillars for Success*. The three pillars—Global Civil Aviation, Revolutionary Technology Leaps, and Access to Space—encompass 10 enabling technology objectives to revolutionize air and space technology. An additional overarching goal relating to the provision of world-class aerospace facilities and expertise was added in 1999.

Pillar One: Global Civil Aviation

***AT Goal**—Enable the development of an environmentally friendly global air transportation system for the next century of unquestioned safety that improves the Nation's mobility.*

***AT Technology Objective 1:** Reduce the aircraft accident rate by a factor of five by within 10 years (by 2007) and by a factor of 10 within 25 years (by 2022).*

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

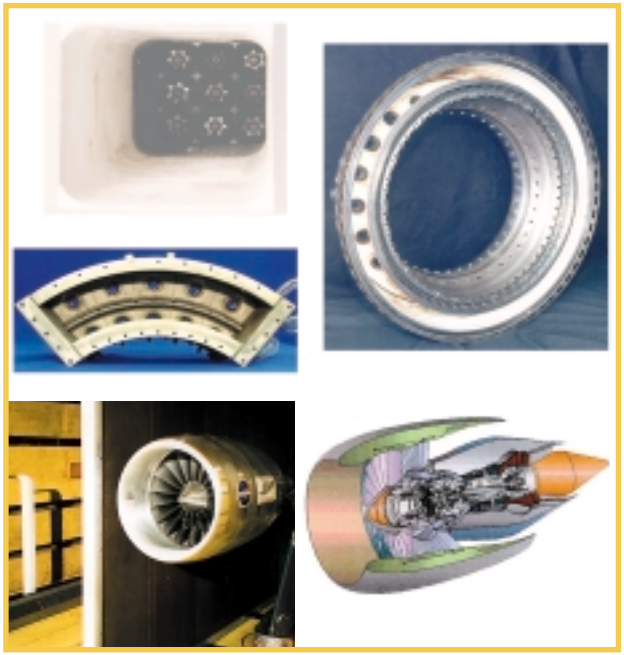
GRC FY2000 Milestones

A1.1: Complete and publish three-dimensional design guidelines for the control of gear crack paths and the prediction of crack growth rates in ultrasafe gears.

A1.2: Complete a report detailing the data link and communications requirements of current and future weather products and tools.

A1.3: Develop candidate next-generation communication system architectures addressing the timely and accurate dissemination of high-quality graphical weather information.

AT Technology Objective 2: Reduce emissions of future aircraft by a factor of three within 10 years and by a factor of five within 25 years.



Aircraft engine noise and emissions research.

GRC Objective A2.0: Reduce the emissions of aircraft engines designed after 1997 by a factor of three by the year 2007 and by a factor of five by the year 2022.

GRC FY2000 Milestones

A2.1: Demonstrate "smart" turbomachinery concepts to minimize pollutants throughout the mission cycle.

A2.2: Complete flametube evaluation of 70-percent landing and takeoff (LTO) nitrogen oxide (NOx) reduction concepts. (This milestone supports NASA FY2000 Performance Target 0R1.)

A2.3: Complete selections of turbomachinery flow-control concepts for fans and compressors that offer promise for use in future propulsion systems for improved performance across the mission cycle and reduced pollutants.

A2.4: Complete selection of ceramic thermal barrier coating concepts that will be developed as part of a turbine material system development, capable of sustained performance at a 3100 °F turbine rotor inlet temperature.

A2.5: Complete preliminary technology benefits assessment of candidate technologies for contributions to achievement of overall

Ultra-Efficient Engine Technology (UEET) Program goals for increased performance and reduced emissions.

AT Technology Objective 3: Reduce the perceived noise levels of future aircraft by a factor of two from today's subsonic aircraft within 10 years and by a factor of four within 25 years.

GRC Objective A3.0: Reduce the perceived noise of future subsonic aircraft engines, which are based on pre-1997 engine designs, by a factor of two by the year 2007 and by a factor of four by the year 2022.

GRC FY2000 Milestone

A3.1: Validate technology that reduces the community noise impact by 10 decibels (dB) relative to 1992 technology; that is, the engine source noise contribution is at least 6 dB. (This milestone supports NASA FY2000 Performance Target 0R2.)

AT Technology Objective 4: While maintaining safety, triple the aviation system throughput, in all weather conditions, within 10 years.

GRC Objective A4.0: Develop and demonstrate enhanced aviation system throughput by propulsion system enhancements for rotorcraft and an improved airspace communications infrastructure to support free flight.

GRC FY2000 Milestone

A4.1: Complete development of a Ku-band aeronautical communications terminal.

AT Technology Objective 5: Reduce the cost of air travel by 25 percent within 10 years and by 50 percent within 25 years.

GRC Objective A5.0: Reduce aircraft engine design, development, acquisition, and maintenance costs to help achieve a 25-percent reduction in 1997 air travel cost by the year 2007 and a 50-percent reduction by the year 2022.

GRC FY2000 Milestone

A5.1: Demonstrate a 900 °F silicon carbide (SiC) pressure sensor on an engine.

Pillar Two: Revolutionary Technology Leaps

AT Goal—Revolutionize air travel and the way in which air and space vehicles are designed, built and operated.

AT Technology Objective 6: Reduce the travel time to the Far East and Europe by 50 percent within 25 years, and do so at today's subsonic ticket prices.

GRC Objective A6.0: Effectively and efficiently close out GRC activities under NASA's High Speed Research Program, which terminates in FY2000.

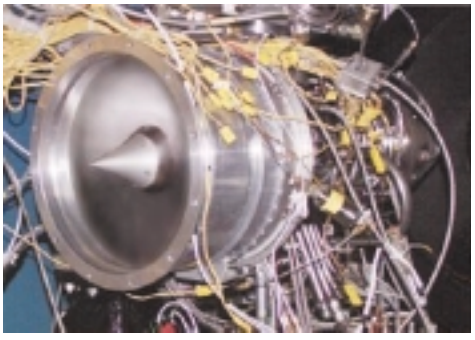
AT Technology Objective 7: Invigorate the general aviation industry, delivering 10,000 aircraft annually within 10 years and 20,000 aircraft annually within 25 years.

GRC Objective A7.0: Develop low-cost intermittent combustion and turbine engines and single-lever engine controls for General Aviation aircraft.

GRC FY2000 Milestone

A7.1: Perform flight demonstrations of advanced General Aviation piston and turbine engines at the annual Oshkosh Air Show. (This milestone is the same as NASA FY2000 Performance Target 0R7.)

Test of intermittent combustion engine built by Teledyne Continental Motors.



Test of turbine engine built by Williams International.

AT Technology Objective 8: Provide next-generation design tools and experimental aircraft to increase design confidence, and cut the development cycle time for aircraft in half.

GRC Objective A8.0: Develop computing and testing tools to reduce aircraft engine design and development time.

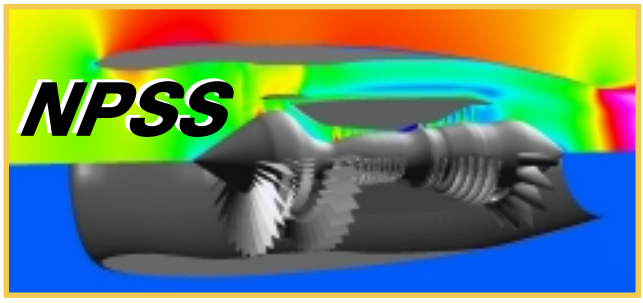
GRC FY2000 Milestones

A8.1: Develop ground and flight-demonstration capabilities and methodologies for integrated air-breathing propulsion systems for experimental hypersonic vehicles and access to space.

A8.2: Demonstrate real-time, on-demand, off-body instrumentation systems suitable for use in high-productivity wind tunnels and aeropropulsion facilities.

A8.3: Release Numerical Propulsion System Simulation (NPSS) Version 1 to industry.

A8.4: Complete overnight core engine simulation using three-dimensional Navier-Stokes codes, APNASA, and the National Combustion Code.



Numerical propulsion system simulation.

Pillar Three: Access to Space

AT Goal—Achieve the full potential of space for all human endeavor through affordable space transportation.

AT Technology Objective 9: Reduce the payload cost to low Earth orbit by an order of magnitude, from $10,000 to $1,000 per pound, within 10 years and by an additional order of magnitude, from $1,000's to $100's per pound, within 25 years.

GRC Objective A9.0: Reduce the cost contribution of access-to-space propulsion systems and associated subsystems while improving their performance, life, function, and operability.

Propellant densification system at GRC.

GRC FY2000 Milestones

A9.1: Develop and demonstrate X–33-scale advanced propellant densification technology.

A9.2: Develop and demonstrate the application of the health management posttest diagnostic system for reusable launch vehicles and the X–33.

A9.3: Develop and demonstrate advanced structural concepts and materials for reusable propulsion system components, such as gas generator combustors and thrust cell liners.

A9.4: Complete a high-voltage modular switch breadboard and select the most promising candidates for further development.

A9.5: Complete flow-path definition and testing for the first flight demonstrator.

A9.6: Complete rocket-based, combined-cycle (RBCC) propulsion inlet, mixer-combustor, and integrated propulsion pod component validation for semiaxisymmetric vertical takeoff systems.

A9.7: Complete definition of rocket-based, combined-cycle (RBCC) propulsion integration technology applications concept to semiaxisymmetric vertical takeoff systems.

AT Technology Objective 10: Reduce the cost of interorbital transfer by an order of magnitude within 15 years, and reduce travel time for planetary missions by a factor of two within 15 years and by an order of magnitude within 25 years.

GRC Objective A10.0: Develop Advanced in-space propulsion technology.

GRC FY2000 Milestones

A10.1: Complete a 500-hour test of a 10-kilowatt Hall electric thruster in support of the Advanced Space Transportation Program.

A10.2: In partnership with Russia, flight-demonstrate Hall Effect thruster technology on EXPRESS.

GRC Ongoing Activity

A10.A: Investigate breakthrough propulsion physics.

Additional Goal

AT Goal—Enable, as appropriate, on a national basis, world-class aerospace R&D services, including facilities and expertise, and proactively transfer cutting-edge technology in support of industry and Government R&D.

AT Technology Objective 11: Provide world-class aerospace research and development services, facilities, and expertise.

GRC Objective A11.0: Complete 90 percent of all AT Enterprise-controlled milestones within 3 months of their scheduled completion. (This milestone supports NASA FY2000 Performance Target 0R13.)

GRC Contributions to the Human Exploration and Development of Space (HEDS) Enterprise

The mission of the HEDS Enterprise is to bring the frontier of space fully within the sphere of human activity to build a better future for everyone. The Glenn Research Center 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; technology development for human missions of exploration; and research in microgravity science, space power, onboard propulsion, space communications, and space transportation.

Installation of GRC Laminar Soot Processes Experiment on Space Shuttle Mission MSL–1.

***HEDS Goal 1**—Explore the space frontier*

- *Invest in the development of high-leverage technologies to enable safe, effective, and affordable human/robotic exploration*
- *Conduct engineering and human health research on the International Space Station to enable exploration beyond Earth orbit*
- *Enable human exploration through collaborative robotic missions*
- *Define innovative human exploration mission approaches*
- *Develop exploration/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 missions of exploration.

GRC FY2000 Milestones

H1.1: Deliver the Mars Array Technology Experiment (MATE) and Dust Accumulation and Removal Experiment (DART) flight experiments for the Mars 2001 mission.

H1.2: Develop an advanced power converter using digital control and demonstrate output impedance tailoring (also Milestone E1.1).

H1.3: Receive the phased-array antenna flight unit from Raytheon for the Direct Data Distribution experiment and commence test and integration.

H1.4: Develop a miniature internet router breadboard for 2- to 4-megabit-per-second mobile applications.

H1.5: Support World Radiocommunications Conference 2000, including all preparatory meetings.

H1.6: Support the Inter-American Telecomm Commission Radiocommunications Committee.

GRC Ongoing Activities

H1.A: Develop methods, data bases, and validating tests for material flammability characterization.

H1.B: Advance the state of reduced-gravity fluid physics knowledge to allow the development of reliable and efficient heat transfer technology for space and extraterrestrial operations.

H1.C: Advance the state of reduced-gravity fluid physics knowledge to allow the development of effective fuel management technology for space, extraterrestrial, and industrial operations.

H1.D: Advance the state of reduced-gravity fluid physics knowledge to enable dust control technologies and bulk materials handling for extraterrestrial habitats and in situ resource utilization.

H1.E: Develop and demonstrate advanced power generation, storage, and distribution technologies that will impact ISS, Space Shuttle, and space exploration activities.

HEDS Goal 2—Expand scientific knowledge

- *Investigate chemical, biological, and physical systems in the space environment in partnership with the scientific community.*
- *Expand collaborative research on the International Space Station that will further human exploration of the solar system.*
- *Extend significantly scientific discovery on missions of exploration through the integrated use of human and machine capabilities.*

GRC Objective H2.0: For the combustion science and fluid physics disciplines, enable the research community to use gravity as an experimental variable.

GRC FY2000 Milestones

H2.1: Complete development, testing, and delivery of the Combustion Module 2 (CM–2), along with one commercial and two scientific experiments, and prepare it for operation on STS–107.

Sounding rocket flights for SAL and ERE experiments.

H2.2: Complete one Spread Across Liquid (SAL) sounding rocket flight and one Extensional Rheometry Experiment (ERE) sounding rocket flight.

H2.3: Support an expanded microgravity research program of 200 investigations in the combustion science and fluid physics disciplines. (This milestone supports NASA FY2000 Performance Target 0H1.)

GRC Ongoing Activities

H2.A: Enable increased combustion efficiency, reduced pollution, and mitigation of fire risks through insights gained and data uniquely obtained from microgravity experiments.

H2.B: Conduct ground-breaking basic research in reduced-gravity fluid physics and transport phenomena to provide a fundamental understanding of the natural phenomena affected by gravity, which increases the efficiency and effectiveness of space-based and industrial processes by providing support to 54 principal investigators.

***HEDS Goal 3**—Enable humans to live and work permanently in space*

- *Provide safe, affordable, and improved access to space*
- *Operate the International Space Station to advance scientific, exploration, engineering, and commercial objectives*
- *Ensure the health, safety, and performance of humans living and working in space*
- *Meet sustained space operations needs while reducing costs*

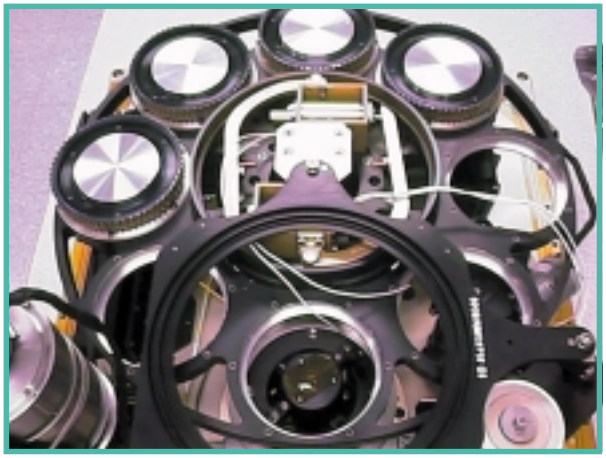
GRC Objective H3: Support the design, development, deployment, and operation of the ISS and develop and demonstrate technologies for nontoxic Space Shuttle upgrades that require less maintenance and hazardous ground processing than current hypergolic propulsion systems.

GRC FY2000 Milestones

H3.1: Deliver more efficient dc-to-dc converters and more efficient and flexible remote power switches for the ISS and continue the development of advanced power system components to reduce ISS electric power system requirements.

H3.2: Design, develop, build, and deliver a safety-critical manual switch for the ISS power system.

H3.3: Provide for deployment on UF–1 the Physics of Colloids in Space experiment, integrate it in the ISS EXPRESS rack, and initiate experiment operations following system checkout.



Cell carousel assembly for Physics of Colloids in Space Experiment.

H3.4: Complete delivery of all Space Acceleration Measurement System (SAMS–II) equipment needed to support UF–1.

H3.5: Complete safety and abuse testing of lithium ion cells for an electric auxiliary power unit for the Space Shuttle.

GRC Ongoing Activities

H3.A: Provide power system and hardware expertise to support the development, verification, acceptance, sustaining engineering, and operations of the ISS.

H3.B: Analyze the ISS power system to determine end-to-end performance in stage- and orientation-specific cases to support design analysis and verification analysis cycles; provide analyses of power system performance during ISS operations to validate system and component performance.

H3.C: Analyze and interpret accelerometer data to characterize the microgravity environment of the ISS for the microgravity science principal investigations.

H3.D: Perform anomaly resolution using the Glenn power system testbed.

***HEDS Goal 4**—Enable the commercial development of space*

- *Improve the accessibility of space to meet the needs of commercial research and development*
- *Foster commercial endeavors with the International Space Station and other assets*
- *Develop new capabilities for human space flight and commercial applications through partnerships with the private sector*

GRC Objective H4.0: Enable the commercialization of space communication, power, in-space propulsion, and other aerospace technologies.

GRC FY2000 Milestones

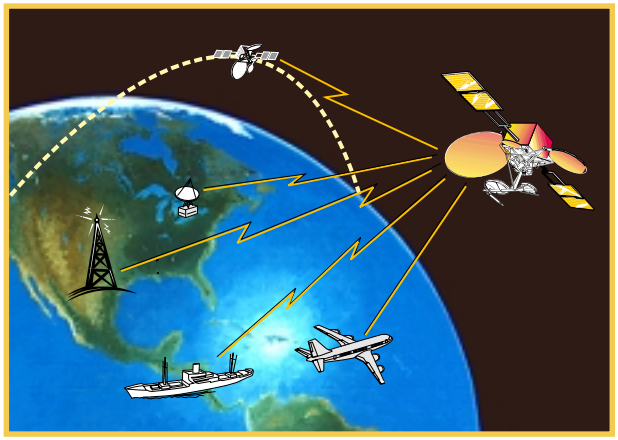
H4.1: Complete a Space Act Agreement with Lockheed Martin Corporation and establish an Advanced Communications Technology Satellite (ACTS) high-data-rate experiment capability at the Consolidated Space Operations Contract facilities in Houston to

enable integrated operations architecture experiments and service demonstrations.

H4.2: Complete the Space Internet Communications and Network Technology Assessment.

H4.3: Conduct a final ACTS conference to close out the ACTS experiments program, share recent results, and commemorate NASA's accomplishments.

H4.4: Shut down the ACTS communications payload, super-orbit the spacecraft, and terminate spacecraft operations.



Advanced communications network.

***HEDS Goal 5**—Share the experience and benefits of discovery*

- *Engage and involve the public in the excitement in and the benefits of—and setting the goals for—the exploration and development of space*
- *Provide significant value to people globally through exploration and space development efforts*
- *Advance the scientific, technological, and academic achievement of the Nation by sharing our knowledge, capabilities, and assets*

GRC Objective H5.0: GRC will share its experiences and discoveries as set forth under the Crosscutting Process Objective entitled "Communicate Knowledge."

GRC Contributions to the Space Science (SS) Enterprise

The mission of the Space Science Enterprise is to explore the solar system: chart the evolution of the universe to understand its galaxies, stars, planets, and life; discover planets around other stars; and search for life beyond Earth. The Glenn Research Center 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, Glenn 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.

Space Science Goals—

- *Establish a virtual presence throughout the solar system, and probe deeper into the mysteries of the universe and life on Earth and beyond*
- *Pursue space science programs that enable and are enabled by future human exploration beyond low Earth orbit*
- *Develop and utilize revolutionary technologies for missions impossible in prior decades*
- *Contribute measurably to achieving the science, mathematics, and technology education goals of our Nation, and share widely the excitement and inspiration of our missions and discoveries*

GRC Objective S1.0: Develop power, in-space propulsion, communication, and other advanced spacecraft technologies.

GRC FY2000 Milestones

S1.1: Demonstrate a 10-gigabyte-per-second fast packet switch.

S1.2: Complete K-band monolithic microwave, integrated-circuit-based, phased-array development and testing for use in Direct Data Distribution experiments.

S1.3: Complete the investigation of reliable transport protocols over dynamically delay-varying links.

Prototype lithium ion battery selected for NASA'S Mars 2001 mission.

S1.4: Provide lithium ion battery technology, in partnership with the NASA/Air Force Lithium Ion Battery Consortium, for NASA's Mars 2001 mission.

S1.5: Complete the evaluation of UV durability of New Generation Space Telescope sunshield materials.

GRC Contributions to the Earth Science (ES) Enterprise

The Earth Science Enterprise is dedicated to understanding the total Earth system and the effects of natural and human-induced changes on the global environment. Advanced spacecraft technology being developed by GRC is providing capabilities that will significantly enhance current or enable new Earth Science missions. Glenn'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.

Earth Science Goals—

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

GRC Objective E1.0: Develop power, in-space propulsion, communication, and other advanced spacecraft technologies.

GRC FY2000 Milestone

E1.1: Develop an advanced power converter using digital control and demonstrate output impedance tailoring (also Milestone H1.2).

GRC Ongoing Activity

E1.A: Work with the Earth Science Technology Office to develop a Platform Technologies Program that incorporates advanced power, propulsion, and communications technologies.

GRC advanced digital control technology for electric propulsion power processing.

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

GRC's ISO/BMS logo.

Strategic Management (SM)

NASA Objective 1: Optimize investment strategies and systems to align human, physical, and financial resources with customer requirements while ensuring compliance with applicable statutes and regulations.

GRC Objective M1.0: Optimize GRC investments and align its resources to customer requirements.

GRC FY2000 Milestones

M1.1: Reduce GRC's civil service workforce from 1993 to 1983 FTE's. (This milestone supports NASA FY2000 Performance Target 0MS1.)

M1.2: Reduce the GRC personnel occupational injury or illness lost-time rate to 0.20 hour per 200,000 hours worked. (This milestone supports NASA FY2000 Performance Target 0MS3.)

M1.3: Cost 70 percent or more of the resources authority available to cost within the fiscal year. (This milestone supports NASA FY2000 Performance Target 0MS4.)

M1.4: Obtain ISO 9001 registration.

M1.5: Complete Business Management System implementation.

M1.6: Complete first ISO 9001 surveillance audit.

GRC Ongoing Activities

M1.A: Create and maintain a work environment free of discrimination, ensuring equal opportunity for all.

M1.B: Achieve a workforce representative of America's diversity. (This activity supports NASA FY2000 Performance Target 0MS2.)

M1.C: Eliminate EEO complaints by addressing issues and concerns through the Alternative Dispute Resolution process.

M1.D: Maintain ISO 9001 compliance and re-registration thereafter.

M1.E: Meet all NASA Integrated Financial Management System milestones applicable to GRC. (This activity supports NASA FY2000 Performance Target 0MS11.)

NASA Objective 2: Improve the effectiveness and efficiency of Agency acquisitions through the increased use of techniques and management that enhance contractor innovations and performance.

GRC Objective M2.0: Increase performance-based contracting.

GRC FY2000 Milestone

M2.1: Obligate at least 80 percent of all procurement dollars to performance-based contracts. (This milestone supports NASA FY2000 Performance Target 0MS5.)

M2.2: Obligate at least 35 percent of all procurement dollars to small disadvantaged businesses. (This milestone supports NASA FY2000 performance Target 0MS8.)

GRC Ongoing Activities

M2.A: Increase microprocurement contracting by GRC user activities to 75 percent of all actions.

M2.B: Increase efforts to identify eligible businesses to support set-aside decisions by participating in at least one forum each year to identify new small disadvantaged businesses and women-owned businesses. (This activity supports NASA FY2000 Performance Target 0MS8.)

NASA Objective 3: Ensure that information technology provides an open and 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 Objective M3.0: Ensure that GRC information technology provides an open and 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 FY2000 Milestones

M3.1: Conduct a readiness review to ensure GRC preparedness for Y2K.

M3.2: Conduct zero day and leap year awareness and preparedness activities to ensure seamless transition at GRC.

M3.3: Develop a final version of the GRC Business Contingency and Continuity Plan.

M3.4: Ensure that the Code R Office Desktop Initiative for NASA (ODIN) selection process has been completed so that GRC may fully transition to the selected ODIN vendor.

M3.5: Complete the transition to the desktop seat management environment with all phases of the effort implemented, which includes full metric adherence and technology refreshment.

M3.6: Implement a technology obsolescence plan.

M3.7: Publish Glenn Policy Directive 2810, GRC Information Technology (IT) Program Policy and Glenn Procedures Guideline 2810, Information Technology Security Management.

M3.8: Establish and publish a GRC Computer Security Incident Response and Reporting Policy.

M3.9: Complete an Information Technology security risk assessment for the Telescience Center.

M3.10: Publish a GRC Information Security Training and Awareness Plan.

GRC Ongoing Activities

M3.A: Ensure that under ODIN, desktop, telecommunication, and networking systems will be comparable to or better than current systems with regard to response time, downtime, and other key performance measures. (This activity supports NASA FT2000 Performance Target 0MS10.)

M3.B: Ensure that under ODIN, desktop, telecommunication, and networking costs will be no greater than the current full cost for the current system. (This activity supports NASA FT2000 Performance Target 0MS10.)

M3.C: Ensure that Information Security Plans are implemented for all GRC IT systems.

M3.D: Ensure that robust network boundary controls are in place and maintained to protect mission data.

M3.E: Periodically conduct vulnerability scans and penetration tests on all mission-critical GRC systems.

Provide Aerospace Products and Capabilities (PAPAC)

NASA Objective 1: Reduce the cost and development time to deliver products and operational service.

GRC Objective P1.0: Improve the effectiveness and usage of GRC test and computational facilities.

GRC FY2000 Milestone

P1.1: On a scale from 0 to 10, ensure that at least 95 percent of all GRC facility users rate their satisfaction with GRC facilities at 6 or above (Satisfied) and that at least 80 percent

rate their satisfaction at 8 or above (Highly Satisfied). (This milestone supports NASA FY2000 Performance Target 0R14.)

P1.2: By the end of the first quarter, complete a decommissioning plan for the Plum Brook nuclear reactor facility and submit the plan to the Nuclear Regulatory Commission for review and approval.

GRC Ongoing Activity

P1.A: Each year, invest 15 percent of research facility funding into research technology improvements. (This activity supports NASA FY2000 Performance Target 0P1.)

NASA Objective 2: Improve and maintain NASA's engineering capability.

GRC Objective P2.0: Significantly enhance and expand GRC's critical technical capabilities.

GRC Ongoing Activities

P2.A: Develop and implement a critical technologies and a core competencies plan.

P2.B: Maintain a high-quality, dual-career-ladder promotion process.

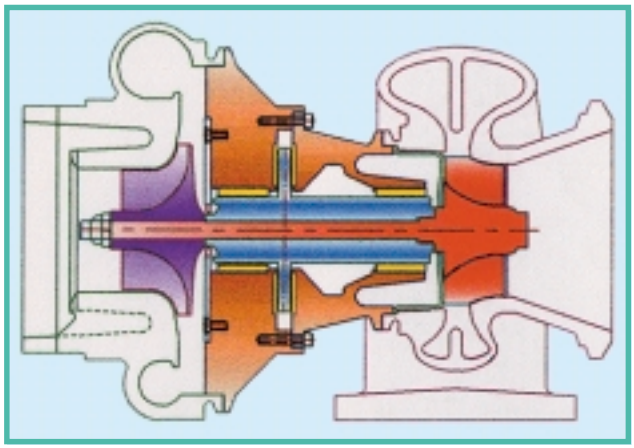
P2.C: Optimize the R&T skill mix to meet the needs of program and project offices.

P2.D: Maintain a high-quality Strategic Research Fund (SRF) to support breakthrough research in new areas and provide opportunities for GRC researchers to develop new ideas.

P2.E: Coordinate the SRF and GRC's Small Business Innovation Research and Small Business Technology Transfer Research activities.

P2F: Enhance the GRC technical skills that contribute to the Turbomachinery Center of Excellence.

NASA Objective 3: Capture and preserve engineering and technological best practices and process knowledge to continuously improve NASA's program and project management.



Oil-free turbocharger in development at GRC.

GRC Objective 3.0: Develop and maintain a comprehensive R&D risk management methodology. (This objective supports NASA FT2000 Performance Target 0P5.)

GRC Ongoing Activities

P3.A: Ensure that GRC's risk management methodology and all risk management plans comply with NPD 7120.4 and NPG 7120.5 and that they address safety, environmental compatibility, and security.

P3.B: Utilize the Mission Assurance Program to improve the quality, timeliness, and cost-effectiveness of research products and services.

NASA Objective 4: Focus on integrated technology planning and technology development in cooperation with commercial industry and other NASA partners and customers.

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

GRC FY2000 Milestones

P4.1: Establish and maintain the North American Icing Alliance.

P4.2: Support 30 women-owned and minority-owned small businesses under the Garrett Morgan Commercialization Initiative. (This milestone supports NASA FY2000 Performance Target 0MS8.)

P4.3: Increase the number of tenants in the Lewis Incubator for Technology (LIFT) to 12, including 4 women-owned and minority-owned small businesses. (This milestone supports NASA FY2000 Performance Target 0MS8.)

GRC Ongoing Activities

P4.A: Coordinate space technology development programs between NASA, DOD, and the National Reconnaissance Office (NRO) through the newly formed Space Technology Alliance and identify opportunities for leveraging funds to enhance support for NASA missions. (This activity supports NASA FY2000 Performance Target 0P7.)

P4.B: Through participation in and leadership of NASA-wide joint planning teams, ensure that GRC space technology programs are coordinated with other NASA technology development programs and that they enable revolutionary exploration missions by NASA.

P4.C: Provide leadership and technical support to the Interagency Power Group, which fosters the exchange and transfer of information regarding the development of advanced space power systems and has representation from all relevant U.S. Government agencies.

P4.D: Implement a government-led communication alliance with academia and industry to create roadmaps and develop precompetitive technologies.

P4.E: Increase the value returned from U.S. investment in microgravity research by managing the National Center for Microgravity Research on Fluids and Combustion to provide a focal point for the external academic and private sectors.

P4.F: Provide leadership and technical support to the Glennan Microsystems Initiative, a collaboration with regional industrial and academic partners, to foster innovations in microelectronic, sensor, actuator, system, and control technologies for harsh environments.

P4.G: Provide leadership and technical support to the Propulsion Instrumentation Working Group, an industrial alliance fostering technical exchanges among aerospace engine manufacturers, DOD, and NASA.

Generate Knowledge (GK)

NASA Objectives:

1. *Acquire advice*
2. *Plan and set priorities*
3. *Select and fund/conduct research and analysis programs*
4. *Select and implement flight missions*
5. *Analyze data*
6. *Publish and disseminate results*
7. *Create archives*
8. *Conduct further research*

GRC Objective G1.0: Generate aerospace knowledge safely, efficiently, effectively, and economically.

Payload retrieval in GRC's Zero-Gravity Research Facility.

Communicate Knowledge (CK)

NASA Objective 1: *Highlight existing and identify new opportunities for NASA's customers, including the public, the academic community, and the Nation's students, to participate directly in space research and discovery.*

GRC Objective C1.0: Expand and enhance science, math, and engineering educational programs and public outreach. To accomplish this,

GRC student workshop.

GRC will align its educational programs with the framework described in the NASA Implementation Plan for Education. (This objective supports NASA FY2000 Performance Target 0R16.)

GRC FY2000 Milestones

C1.1: Teacher preparation and enhancement: utilize two or more dissemination vehicles of other organizations to publicize onsite workshops to teachers in Northeast Ohio to increase participation from schools with under-represented student populations and to reduce mailing costs.

C1.2: Teacher preparation and enhancement: deliver onsite educational workshops to 250 teachers.

C1.3: Student support: increase the number of students served over FY99, resources permitting, by expanding involvement with existing national programs, enhancing attendance in current programs, or seeking new initiatives with internal and external partners.

C1.4: Curriculum support: depending on funding, bring in one or two primary teachers to develop aerospace curriculum materials suitable for grades K to 3.

C1.5: Support of systemic change: conduct a needs assessment of parental involvement in OEP programs.

C1.6: Education technology: complete EngineSim and distribute it to at least 1000 teachers and students over the Internet and through CD–ROM's.

C1.7: Education technology: provide videoconferencing workshops to at least 1500 students.

NASA Objective 2: *Improve the external constituent communities' knowledge, understanding, and use of the results and opportunities associated with NASA's programs.*

GRC Objective C2.0: In the community and in media relations, increase and enhance publicity on GRC capabilities, accomplishments, and contributions. With respect to technology transfer, increase and enhance the productive use of GRC-generated and GRC-sponsored science and technology in the public and private sectors.

GRC FY2000 Milestones

C2.1: Establish a Community Relations Plan for the decommissioning of the Plum Brook nuclear reactor.

C2.2: Conduct a summit with industry to focus on microsystems technology.

GRC Ongoing Activities

C2.A: Increase GRC's presence at regional air shows and community events.

C2.B: Increase GRC's presence in local and regional media.

C2.C: Enhance the transfer of microgravity research results to industry through participation in a focused outreach program established by the National Center for Microgravity Research on Fluids and Combustion.

C2.D: Invest 10 to 20 percent of the Center's R&D budget in partnerships with U.S. businesses. (This activity supports NASA FY2000 Performance Target 0P6.)

C2.E: Report to another Enterprise program, another NASA Enterprise, a Government agency, or industry the transfer of all significant new technologies and processes developed from programs and projects sponsored by the AeroSpace Technology Enterprise at GRC Program Management Council meetings and through existing program reporting mechanisms. (This activity supports NASA FY2000 Performance Target 0R15.0.)

GRC Center-Level Metrics

This plan documents Glenn Research Center's contributions to the accomplishment of Agency goals and performance targets, which flow from the NASA Strategic Plan and the Government Performance and Results Act and are set forth in the annual NASA Performance Plan. Individuals and organizations must measure their performance using metrics tailored to the Center's unique role and mission. In FY2000, Center management will test 10 Center-level metrics on the basis of their contributions to planning and corrective action decisions to ensure a healthy level of achievement and a balanced portfolio that support the quality policy: "Our commitment to continuous improvement ensures quality products, excellent services and satisfied customers."

Major Milestone Performance

This metric measures the performance of all current year milestones in the GRC Strategic Implementation Plan. Cost, schedule, and technical performance ratings for each milestone will be tracked. Corrective actions will be taken on those milestones not meeting their targets.

Technology Development and Transfer

This metric tracks five indicators that relate to the quality and value of the Center's technology output and transfer:

- New technology disclosures
- Refereed journal articles
- Patents
- Patent licenses
- Major awards

Cost of Doing Business

This metric measures costs by NASA's full-cost management, budgeting, and accounting categories:

- Direct
- Service pool
- General and administrative

Obligation and Costing Performance

This metric measures the effectiveness of the Center's budget resource management.

Revenues

This metric tracks and forecasts the balance of the Center's revenue portfolio and tracks the distribution of resources from the NASA Enterprises, other Government agencies, and non-Federal entities.

Expenditures

This metric tracks and forecasts the distribution of funding in three categories:

- Center operations (short-term focus)
- Research and development (medium-term focus)
- Capital investments (long-term focus)

Program Management Development Process (PMDP) Certifications

This metric counts the number of employees certified at different levels of the Program Management Development Process. This is an indirect indicator of compliance with NPG 7120.5, NASA Program and Project Management Processes and Requirements, readiness for programs and projects, and the overall learning environment.

Partnerships

This metric counts the number of partnerships established with three sectors:

- Business
- Education and/or nonprofit
- Other (includes other NASA centers, Federal agencies, etc.)

New Business

This metric tracks the number of new starts pursued and the number and value of new starts that have commenced.

Employee, Customer, and Stakeholder Satisfaction

This metric is GRC's overarching outcome measure and the underpinning of its quality policy. Data will be obtained from a variety of sources for each group and corrective actions will be implemented, as necessary, to ensure continuous improvement.

Appendix A
Glenn Program Points of Contact

NASA Safety Initiative

Manuel B. Dominguez (216) 433–6735

AT Enterprise

Propulsion Systems Research and Technology
Peter W. McCallum (216) 433–8852

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

Aviation Safety Project Office
Jai-won Shin (216) 433–8714

Rotorcraft R&T (Low-Noise Technology)
Timothy Krantz (216) 433–3580

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 (System Study and Analysis)
Timothy Wickenheiser (216) 977–7111

Advanced Space Transportation Technology
Harry Cikanek (216) 433–6196

Advanced Communications
Konstantinos Martzaklis (216) 433–8966

Intelligent Synthesis Environments
Austin Evans (216) 433–8313

HEDS Enterprise

International Space Station (ISS) Electrical Power
John Dunning (216) 433–5298

ISS: Fluid and Combustion Research Facility Development
Thomas St. Onge (216) 433–3557

SOMO Communications Technology for Space Operations
James Budinger (216) 433–3496

Shuttle Upgrades
William Taylor (216) 433–6568

Exploration Initiatives

Power
Raymond Burns (216) 433–5360

Advanced Space Transportation
Stanley Borowski (216) 977–7091

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

SS and ES Enterprises

Power
Raymond Burns (216) 433–5360

In-Space Propulsion
John Dunning (216) 433–5298

Communications Technology
James Budinger (216) 433–3496

Cross-Enterprise Technology Development Program Thrust Area Management

Advanced Power and Onboard Propulsion
Joseph Nainiger (216) 977–7103

High-Rate Data Delivery
Kul Bhasin (216) 433–3676

On Behalf of all NASA

Lead Center for Spectrum Management
Wayne Whyte (216) 433–3482

Principal Center for Workgroup Hardware and Software
William Naiman (216) 433–9330

Principal Center for Aeronautics Exhibits
Robert Romero (216) 433–5538

Principal Center for Environmental Information Systems
Daniel White (216) 433–3103

Expert Center for Information Technology Security Awareness Training
Richard Clapper (216) 433–2890

Appendix B
Glenn Institutional Points of Contact

Office of the Director
Director
Donald J. Campbell (216) 433–2929

Deputy Director
Gerald J. Barna (Acting) (216) 433–5308

Deputy Director for Operations
Julian M. Earls (216) 433–3014

Chief Scientist
Marvin E. Goldstein (216) 433–5825

Director of Diversity
Phillip R. Walker (216) 433–2486

Assistant Deputy Director for Policy
John W. Gaff (216) 433–2940

Chief Counsel
William Sikora (216) 433–2318

Aeropropulsion Research Program Office
Peter W. McCallum (216) 433–8852

Inspector General
Chester A. Sipsock (216) 433–8960

Systems Management
Olga Gonzalez-Sanabria (Acting) (216) 433–5252

ISO Project Office
Karen M. Meinert (216) 433–2344

Equal Opportunity
Robert Romero (Acting) (216) 433–5538

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

Human Resources
Maury L. Blanton (216) 433–2515

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

Acquisition
Julian M. Earls (Acting) (216) 433–3014

Aeronautics Directorate
Director
Carol J. Russo (216) 433–2965

Deputy Director
Arun K. Sehra (216) 433–3397

Research and Technology Directorate
Director
Woodrow D. Whitlow (216) 433–3193

Deputy Director
Lawrence J. Bober (216) 433–3944

Space Directorate
Director
Rudolph L. Saldana (Acting) (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 Management
Robert P. Kozar (419) 294–3236

Chief Information Officer
Sasi K. Pillay (216) 433–9300

External Programs Directorate
Director
John M. Hairston, Jr. (216) 433–8686

Educational Programs
JoAnn Charleston (216) 433–2957

Community and Media Relations
Linda Dukes-Campbell (216) 433–8920

Commercial Technology
Larry Viterna (216) 433–2966

Appendix C
NASA Performance Targets Supported by GRC

FY2000 NASA Performance Plan Targets	Supporting GRC Objectives/ Milestones/Activities
Aero-Space Technology Enterprise	
0R1: Demonstrate in a laboratory combustion experiment an advanced turbine engine combustor concept that will achieve up to a 70-percent reduction of oxides of nitrogen emissions based on the 1996 International Civil Aviation Organization standard.	**A2.2:** Complete a flametube evaluation of 70-percent landing and takeoff (LTO) nitrogen oxide (NOx) reduction concepts.
0R2: Validate the technologies to reduce noise for large commercial transports by at least 7 decibels (dB) relative to 1992 production technology.	**A3.1:** Validate the technology to reduce community noise impact by 10 dB relative to 1992 technology (engine source noise contribution is at least 6 dB).
0R7: Perform flight demonstrations of advanced general aviation piston and turbine engines at the annual Oshkosh air show.	**A7.1:** Same
0R13: Complete 90 percent of all Enterprise-controlled milestones within 3 months of schedule.	**A11.0:** Complete 90 percent of all AT Enterprise-controlled milestones within 3 months of scheduled completion.
0R14: Achieve a facility utilization customer satisfaction rating of 95 percent of respondents at 5 or better and 80 percent at 8 or better, based on exit interviews.	**P1.1:** On a scale of 0 to 10, ensure that at least 95 percent of all GRC facility users rate their satisfaction with facilities at 6 or above (Satisfied) and at least 80 percent rate their satisfaction at 8 or above (Highly Satisfied).
0R15: Transfer at least 12 new technologies and processes to industry during the fiscal year.	**C2.E:** Report to another Enterprise program, another NASA Enterprise, a Government agency, or industry the transfer of all significant new technologies and processes developed from programs and projects sponsored by the Aero-Space Technology Enterprise at GRC Program Management Council meetings and existing program reporting mechanisms.
0R16: Continue the implementation of current educational outreach plans and establish plans for all new program activities initiated in FY00.	**C1.0:** Expand and enhance GRC science, math, 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.

0H1: Support an expanded research program of approximately 935 investigations, an increase of about 17 percent over FY99. Publish 100 percent of science research progress in the annual OLMSA Life Sciences and Microgravity Research Program Task Bibliographies and make this available on the Internet.

H2.3 Support an expanded microgravity research program of 200 investigations in the combustion science and fluid physics disciplines.

Crosscutting Process: Manage Strategically

0MS1: Reduce the civil service workforce level to below 18,200.

M1.1: Reduce GRC's civil service workforce level from 1993 to 1983 FTE's.

0MS2: Maintain a diverse NASA workforce throughout the downsizing efforts.

M1.B: Achieve a workforce representative of America's diversity.

0MS3: Reduce the number of Agency lost workdays (from occupational injury or illness) by 5 percent from the 3-year average (FY94 to 96).

M1.2: Reduce the GRC personnel occupational injury or illness lost time rate to 0.20 hour per 200,000 hours worked.

0MS4: Cost 70 percent or more of resources available to cost within the fiscal year.

M1.3: Cost 70 percent or more of the resources authority.

0MS5: Of funds available for PBC, maintain performance-based contract obligations at 80 percent (funds available exclude grants, cooperative agreements, actions less than $100,000, small business innovation research, small business technology transfer, federally funded research and development centers, intragovernmental agreements, and contracts with foreign governments or international organizations).

M2.1: Obligate at least 80 percent of all procurement dollars to performance-based contracts.

0MS8: Achieve at least the congressionally mandated 8-percent goal for funding to small disadvantaged businesses (including prime and subcontracts, small disadvantaged businesses, historically black colleges and universities (HBCU), other minority institutions, and women-owned small businesses).

M2.2: Obligate at least 35 percent of all procurement dollars to small disadvantaged businesses.

M2.B: Increase efforts to identify eligible businesses to support set-aside decisions by participating in at least one forum each year to identify new small disadvantaged businesses and women-owned businesses.

P4.2: Support 30 women-owned and minority-owned businesses under the Garrett Morgan Commercialization Initiative.

P4.3: Increase the number of tenants in the Lewis Incubator for Technology (LIFT) to 12, including 4 women-owned and minority-owned small businesses.

0MS10: Improve the information technology infrastructure service delivery to provide increased capability and efficiency while maintaining a customer rating of "satisfactory" and holding costs per resource unit to the FY98 baseline.	**M3.A:** Ensure that under ODIN, desktop, telecommunication, and networking systems will be comparable to or better than current systems with regard to response time, downtime, and other key performance measures. **M3.B:** Ensure that under ODIN, desktop, telecommunication, and networking costs will be no greater than the current full cost for the present system.
0MS11: Begin at NASA installations the implementation of the Integrated Financial Management System following the completion of system testing.	**M1.E:** Meet all NASA Integrated Financial Management System milestones applicable to GRC.

Crosscutting Process: Provide Aerospace Products and Capabilities

0P1: Meet schedule and cost commitments by keeping the development and upgrade of major scientific facilities and capital investments within 110 percent (on average) of cost and schedule estimates.	**P1.A:** Each year invest 15 percent of research facility funding in research technology improvements.
0P5: Capture a set of best practices or lessons learned from each program commensurate with current program status (include at least one from each of the four Provide Aerospace Products and Capabilities subprocesses). Data will be implemented in process improvement and program or project management training.	**P3.0:** Develop and maintain a comprehensive R&D risk management methodology.
0P6: Dedicate to commercial partnerships the percentage of the Agency's R&D budget established in the FY99 process.	**C2.D:** Invest 10 to 20 percent of the Center's R&D budget in partnerships with U.S. businesses.
0P7: Increase the leveraging of the technology budget with the activities of other organizations relative to the FY99 baseline established during the process development.	**P4.A:** Coordinate space technology development programs between NASA, DOD, and the National Reconnaissance Office (NRO) through the newly formed Space Technology Alliance and identify opportunities for leveraging funds to enhance support for NASA missions.

Crosscutting Process: Generate Knowledge

NASA Objectives:

1. *Acquire advice*
2. *Plan and set priorities*
3. *Select and fund/conduct research and analysis programs*
4. *Select and implement flight missions*
5. *Analyze data*
6. *Publish and disseminate results*
7. *Create archives*
8. *Conduct further research*

G1.0: Generate aerospace knowledge safely, efficiently, effectively, and economically.

Crosscutting Process: Communicate Knowledge

0C1: Seek to maintain a participation of approximately three million with the educational community—teachers, faculty, and students.

C1.1: Teacher preparation and enhancement: Utilize two or more dissemination vehicles from other organizations to publicize onsite workshops to northeastern Ohio teachers to increase participation from schools with under-represented student populations and to reduce mailing costs.

C1.2: Teacher preparation and enhancement: Deliver onsite educational workshops to 250 teachers.

C1.3: Student support: Increase the number of students served in FY99, resources permitting, by expanding involvement with existing national programs, enhancing attendance in current programs, or seeking new initiatives with internal and external partners.

C1.4: Curriculum support: Bring in one or two primary teachers to develop aerospace curriculum materials suitable for grades K to 3 (this item is dependent on funding).

C1.5: Systemic change support: Conduct a needs assessment of parental involvement in the Office of Educational Programs.

C1.6: Education technology: Complete EngineSim and distribute it to at least 1000 teachers and students over the Internet and through the distribution of CD-ROM's.

C1.7: Education technology: Provide video-conferencing workshops to at least 1500 students.

For more information about this Plan,

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