NASA Glenn Research Center Strategic Implementation Plan

Fiscal Year 2001

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 2001.

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

To successfully satisfy these customer and stakeholder needs, we at GRC must not only commit ourselves to implementing this Strategic Implementation Plan but also to practicing the key values of quality, openness, diversity, and integrity. We also 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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Acting Deputy Director

Julian M. Earls
Deputy Director for Operations

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Assistant Deputy Director for Policy

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Chief Information Officer

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Director of External Programs

Table of Contents

Front Cover
Lower Left: Concept for a spacecraft traveling through a wormhole; represents possible future GRC contributions to Space Science

Upper Left: The International Space Station; represents GRC contributions to Human Exploration and Development of Space

Upper Right: The V–Jet II aircraft powered by advanced turbine engines; represents GRC contributions to Aerospace Technology

Lower Right: The unmanned Helios prototype aircraft being developed under the Earth Resources and Sensor Technology Program; represents GRC contributions to Earth Science

Introduction

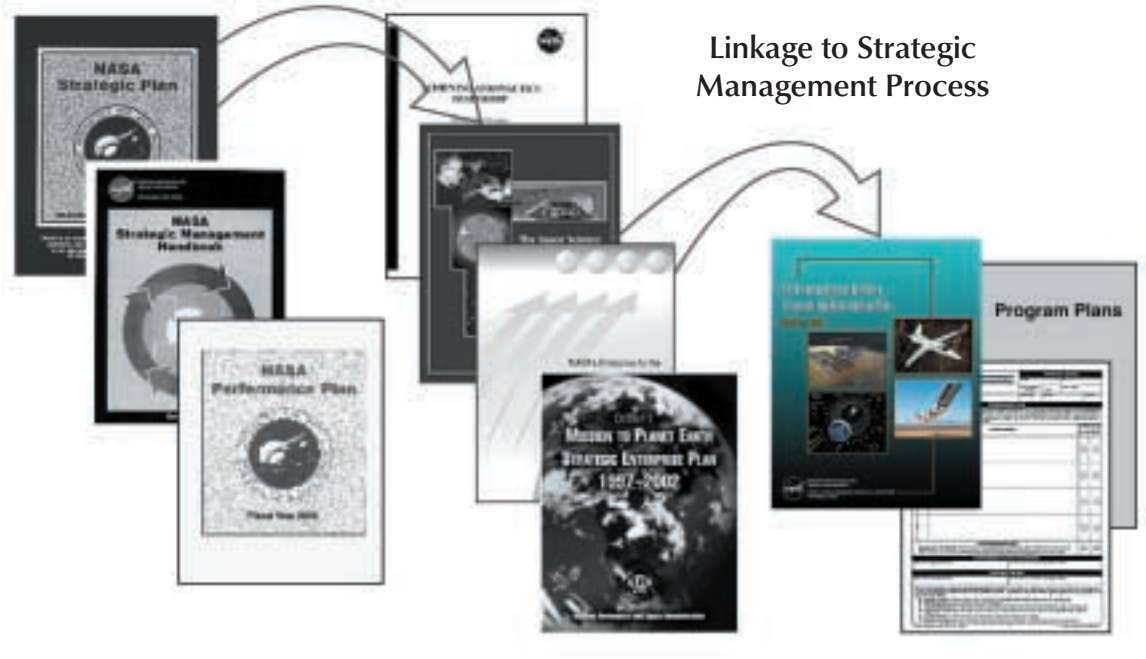
The Purposes of This Plan

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 this Strategic Implementation Plan are to

- Delineate GRC's fiscal year goals and objectives to support NASA's Strategic 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 cascade to the NASA GRC Strategic Implementation Plan and subsequently to program plans and individual employee performance plans.



Linkage to Strategic Management Process

The NASA Vision

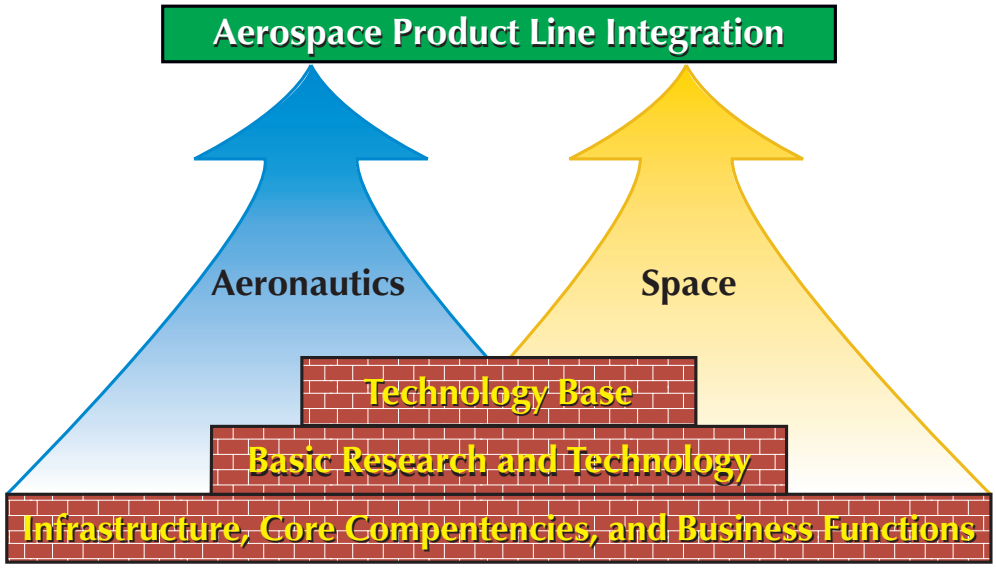
NASA is an investment in America's future. As explorers, pioneers, and innovators, we boldly expand frontiers in air and space to inspire and serve America and to benefit the quality of life on Earth.

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

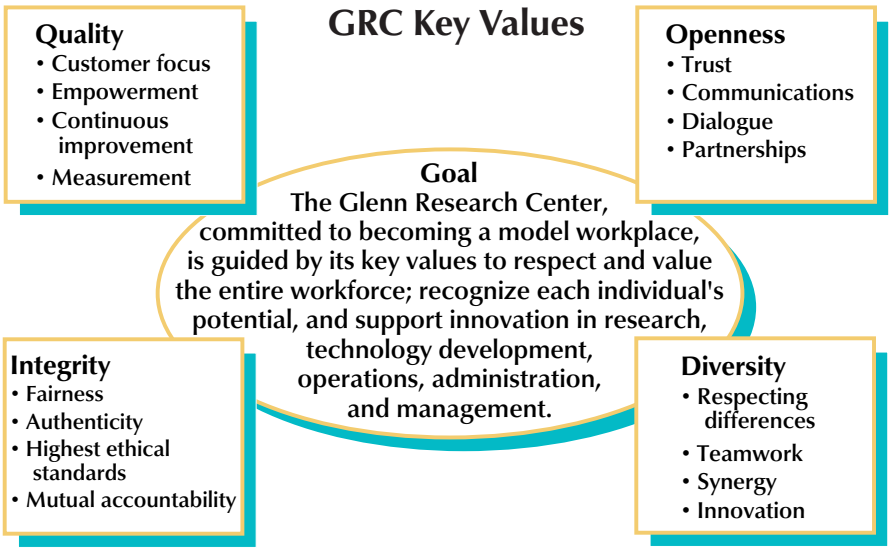
As a diverse team working in partnership with government, industry, and academia to increase national wealth, safety, and security, protect the environment, and explore the universe, we develop and transfer critical technologies that address national priorities through research, technology development,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



Implementation of the 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 Glenn Research Center 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 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.

Systems Management

To improve NASA's program and project management, the Agency has directed each center to create a Systems Management Office (SMO). The GRC SMO will promote excellence in Center programs and projects by

- Supporting their formulation activities
- Assuring that requirements are clearly defined and flow down through the project levels
- Providing independent assessments that include cost estimates and analyses as requested by the Center Program Management Council

The SMO will assure that GRC programs and projects are formulated and executed in compliance with NASA Procedures and Guidelines (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 to a comprehensive and synergistic program for aeronautics and space.

GRC Capabilities and Responsibilities

Core Technical Competencies

The Glenn Research Center 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, in coordination with other Agency efforts, has narrowed the current focus to technical core competencies. The four GRC technical core competencies, which have been identified to support the four NASA

Enterprises, and their relationship to the Center's five overarching competencies (air-breathing propulsion systems, space technology, fundamental and applied science, aerospace systems, and program and project management) are set forth below.

Aeropropulsion Systems

This technical core competency falls under the overarching Center core competency of air-breathing propulsion systems. It relates to the development of critical technologies for aeropropulsion systems that are safe, quiet, highly efficient, long-lived, intelligent, reliable, low-cost, and have minimum environmental impact. These propulsion system technology developments will apply to all aircraft

- Speed regimes and classes (low-speed to hypersonic)
- Types (air-breathing and hybrid/combined cycle)
- Operating environments (low-altitude to transatmospheric)

Aerospace Power and Electric Propulsion

This technical core competency falls under the overarching Center core competency of space technology. It relates to the development of advanced technologies for human and robotic spacecraft, aircraft, and transportation vehicles. This includes

- Technologies and systems that will result in robust, lightweight, ultra-highly efficient, long-lived, low-cost power and electric propulsion systems
- Technologies that will allow effective generation and utilization of power and significant increases in vehicle payload fraction
- Analysis of systems and requirements that will provide tactical and strategic guidance for technology advances

Aerospace Communications

This technical core competency also falls under the overarching Center core competency of space technology. It relates to the development of revolutionary communication and network systems that significantly increase the capacity and connectivity among satellites, spacecraft, aircraft, and ground networks enabling new applications and services. This includes

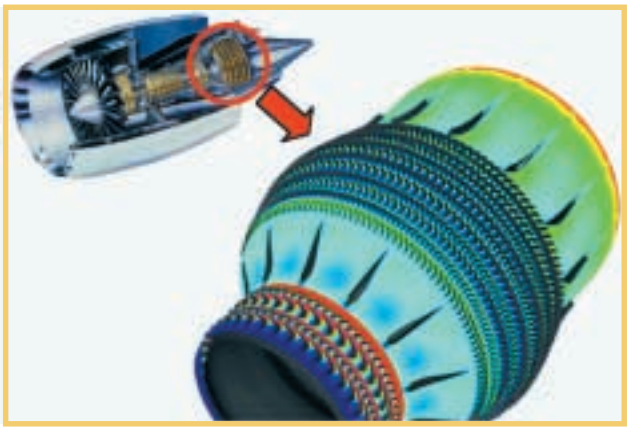
- Technologies that improve the power, bandwidth, and cost efficiency of communications at millimeter wave frequencies and higher and the interoperability, reliability, security, and quality of services of aerospace networks
- The provision of technologies that meet the requirements of future robotic and human space missions, National Airspace capacity, safety, and transportation initiatives, NASA's utilization of emerging commercial communications services, and communications technology applications including telemedicine

Fluids and Combustion

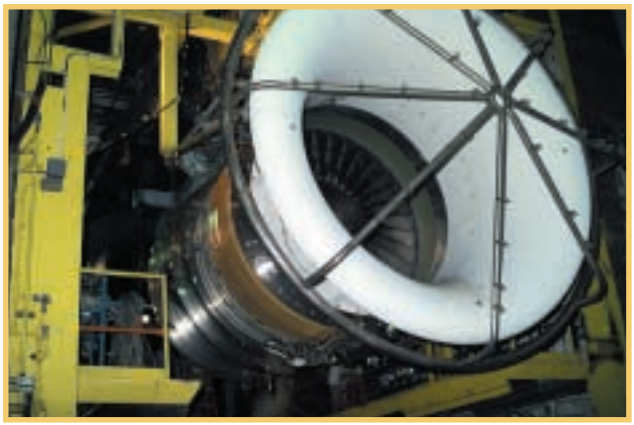
This technical core competency falls under the overarching Center core competency of fundamental and applied science. It relates to the development of advanced technology through innovative, basic and applied, multidisciplinary research in fluid physics and thermal and combustion sciences including gravitational effects on reacting and nonreacting flows, single- and multiphase flows, and phase change. These technologies enable revolutionary advances in systems for NASA's human and robotic space missions, aeronautics applications, and space transportation applications, which include addressing critical safety issues.

Agency-Specific Mission: Aeropropulsion

A major Glenn Research Center 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.



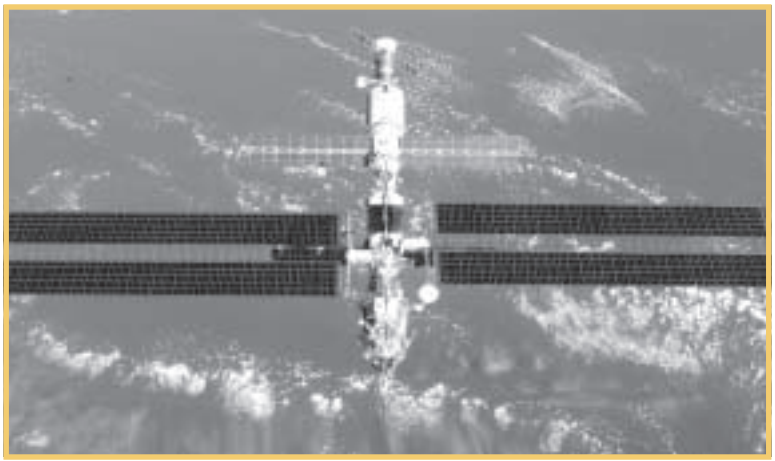
GE90 coupled-flow turbine simulation.



PW4000 low-nitrogen-oxide engine combustor test.

Agency-Specific Mission: Aerospace Power Systems Research and Technology

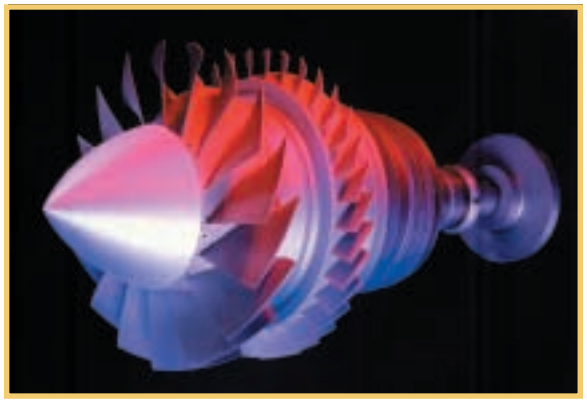
The NASA Administrator has designated GRC to be the Agency's mission provider for aerospace power systems research and technology. This role is crucial to future NASA missions and potential new initiatives and will benefit aeronautics and space in support of all NASA Enterprises. Responsibilities include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



GRC-developed solar array for the International Space Station.

Center of Excellence: Turbomachinery

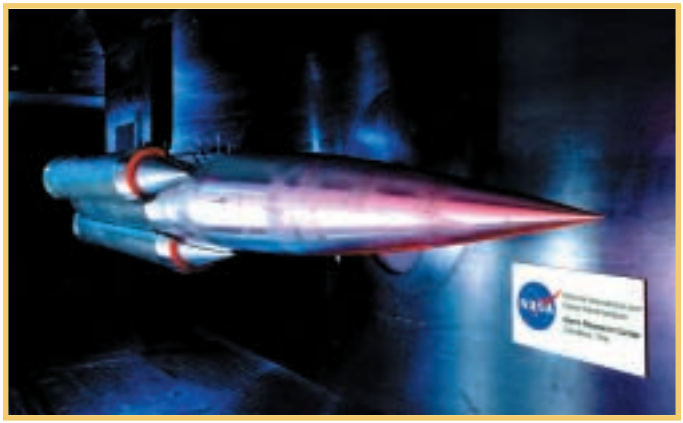
GRC has Agencywide responsibility for technologies directly applicable to fans, pumps, compressors, turbines, and other rotating components. Turbomachinery technologies are critical to air-breathing propulsion and power systems as well as to space and terrestrial propulsion and power conversion applications. Associated turbomachinery components include 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, 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.



Turbofan compressor concept.

Program Responsibility: Aerospace Propulsion and Power Research and Technology

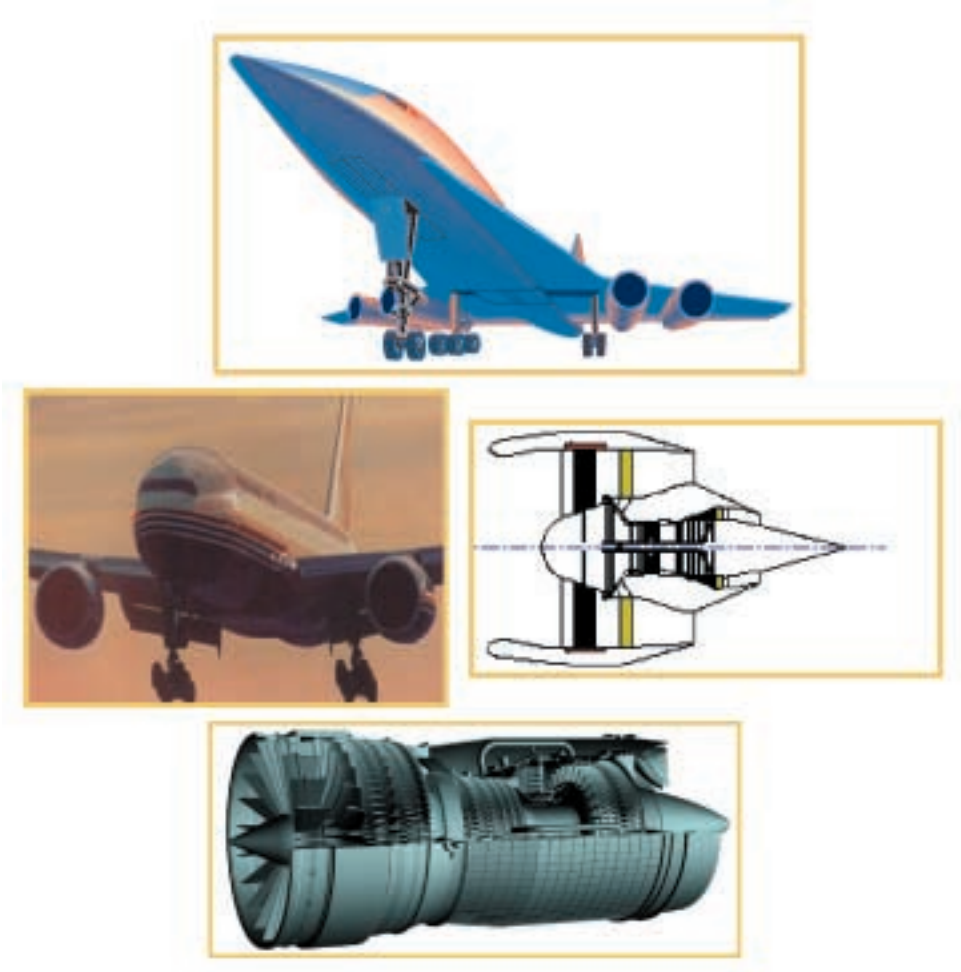
GRC has lead center management responsibility for NASA's Aerospace Propulsion and Power Research and Technology (R&T) Program, one of seven Base R&T programs in the Aerospace Technology Enterprise. This program focuses on maintaining U.S. superiority in engine development and ensuring the long-term environmental compatibility, safety, and efficiency of propulsion systems. 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 4 pillar goals and 10 objectives of the Aerospace Technology Enterprise. In addition, the program supports and transfers applicable technologies to the Agency's programs, including Ultra-Efficient Engine Technology (UEET), Aviation Safety (AvSP), Advanced Space Transportation (ASTP), and Quiet Aircraft Technology (QAT).



GTX model tested in GRC 10- by 10-Foot Supersonic Wind Tunnel.

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 and 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. Technologies developed in the UEET Program will also likely be transferred to other programs, such as the Advanced Space Transportation and the Quiet Aircraft Technology.



UEET concepts and potential applications.

GRC Support to NASA Enterprises

Mission Areas	Aeropropulsion Aerospace Power			
Center of Excellence	Turbomachinery			
Lead Center Programs	Aerospace Propulsion and Power Research and Technology Ultra-Efficient Engine Technology			
Cross-Enterprise Thrust Area Management	Cross-Enterprise Technology Development Program Thrust Area Management -Advanced power and onboard propulsion -High-rate data delivery			
Agencywide Lead	Principal Center for -Spectrum Management -Environmental Information Systems -Information Technology Security -Aeronautics Exhibits -Workgroup Hardware and Software -Awareness Training Expert Center			
Enterprises	Aerospace Technology	Human Exploration and Development of Space	Space Science	Earth Science
Programs Supported by the Glenn Research Center	• Aviation Safety -Accident mitigation -Weather-related accident prevention • Aviation System Capacity • Quiet Aircraft Technology • Small Aircraft Transportation System • Second-Generation Reusable Launch Vehicles • Future–X (Pathfinders) • X–33 Advanced Technology Demonstration • High-Performance Computing and Communications • Advanced Space Transportation -Third-generation reusable launch vehicles -In-space transportation -Space transportation research • Flight research R&T • Rotorcraft R&T • Information technology R&T • Aviation operations R&T • Intelligent synthesis environment R&T • Aerospace vehicle systems technology R&T	• 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 Aerospace Technology Enterprise

To sustain global U.S. leadership in civil aeronautics and space transportation, the Aerospace Technology Enterprise (AT) has developed the following goals and objectives that GRC supports.[1]

AT Goal 1: Global Civil Aviation–Develop an environmentally friendly global air transportation system for the next century of unquestioned safety that improves the Nation's mobility.

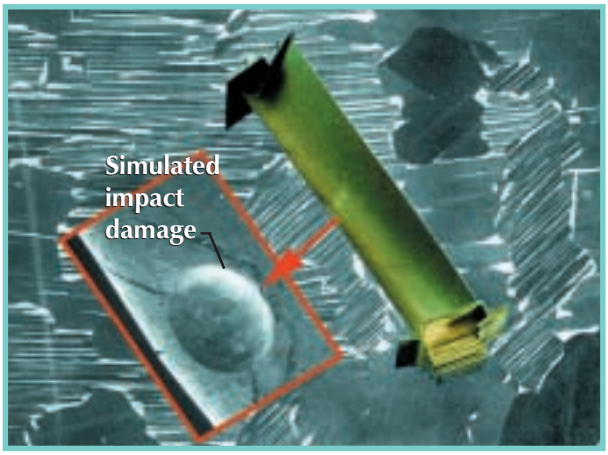
AT Objective 1: Reduce the aircraft accident rate by a factor of 5 within 10 years and by a factor of 10 within 25 years.

AT FY2001 Performance Target 1R1: Complete 75 percent of the conceptual designs of systems for preventing and mitigating accidents and demonstrate tools for accident analysis and risk assessment.

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 FY2001 Milestones:

A1.1: Demonstrate that cast gamma titanium-aluminide has sufficient durability to allow the design of robust low-pressure turbine blades.



GRC simulated titanium-aluminide, low-pressure turbine blade impact event.

A1.2: Down-select ground-based, remote-sensing technologies for a prototype ground-based system to sense icing conditions.

A1.3: Complete and publish three-dimensional design guidelines for the control of gear crack paths and the prediction of crack growth.

[1]The Agency has numbered all fiscal year NASA performance targets, but they are not necessarily in the same order as the Enterprise objectives they support.

AT Objective 2: Reduce emissions of future aircraft by a factor of 3 in 10 years and by 5 within 25 years.

AT FY2001 Performance Target 1R2: Complete one system-level technology benefit assessment, one component concept selection, and one new material system.

GRC Objective A2.0: Reduce the emissions of aircraft engines designed after 1997 by a factor of 3 by the year 2007 and by a factor of 5 by the year 2022.

GRC FY2001 Milestones:

A2.1: Select a candidate *fan* flow control concept for wake control using computational fluid dynamics (CFD) simulation.

A2.2: Select a candidate *turbine* flow control concept for ultrahigh aerodynamic loading.

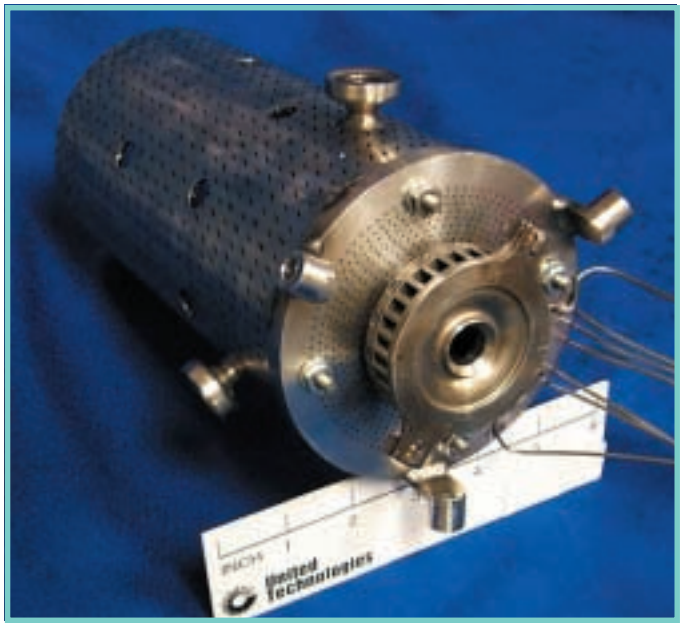
A2.3: Develop an integrated component technology demonstration plan for collaborative tests of engine demonstrators incorporating UEET technologies.

A2.4: Investigate active control of high-frequency instabilities in combustion flows.

A2.5: Demonstrate properties of 1350 °F turbomachinery disk alloy.

A2.6: Demonstrate the durability of 2200 °F ceramic matrix composite combustor liner in engine tests.

A2.7: Based on supporting trade studies, conceptually design optimum propulsion systems.



GRC-developed experimental combustor.

AT Objective 3: Reduce the perceived noise levels of future aircraft by a factor of 2 in 10 years and by a factor of 4 in 25 years.

AT FY2001 Performance Target 1R3: Complete large-scale definition of 2- to 5-decibel (dB) reduction in aircraft noise based on 1997 production technology and initial assessments of concepts offering additional reduction.

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

AT FY2001 Performance Target 1R4: Complete the civil tiltrotor project by validating data bases for contingency power, flight paths and noise reduction, as well as complete at least one demonstration of an airspace management decision support tool.

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 2 by the year 2007 and by a factor of 4 by the year 2022.

GRC FY2001 Milestones:

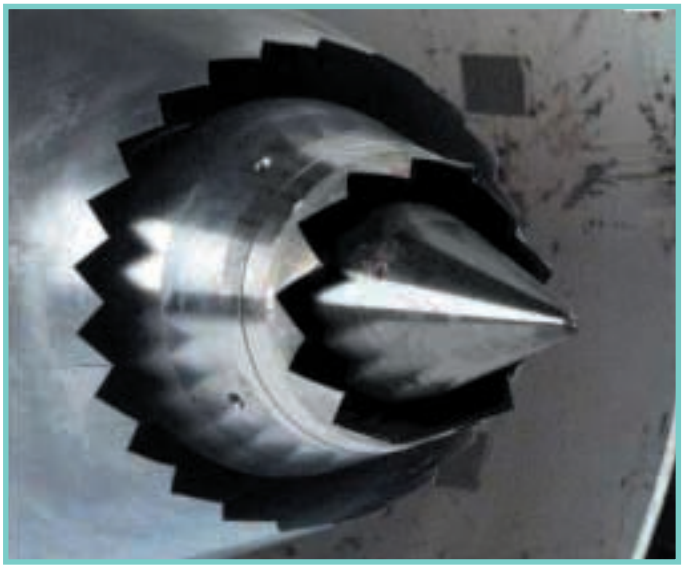
A3.1: Validate noise reduction technology through large-scale component testing (engine tests).

A3.2: Identify advanced concepts for engine noise reduction.

A3.3: Establish a compressor, turbine, and combustor noise data base for modern engines.

A3.4: Validate technology to reduce engine noise by 4 dB.

A3.5: Document propulsion system concepts for 20-dB reduction in aircraft noise.



GRC low-noise turbine engine nozzle.

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 air traffic management concepts.

GRC FY2001 Milestone:

A4.1: Complete communications architecture study to assess technology needs and detailed modeling and simulation requirements.

AT Goal 2: Revolutionary Technology Leaps–Revolutionize air travel and the way in which air and space vehicles are designed, built, and operated.

AT Objective 5: Invigorate the general aviation industry so it can deliver 10,000 aircraft annually within 10 years and 20,000 aircraft annually within 20 years.

AT FY2001 Performance Target 1R7: Complete the Advanced General Aviation Transport Experiments project by validating transportation system concepts through flight test and publish design guidelines; establish at least one partnership agreement on the Small Aircraft Transportation System program.

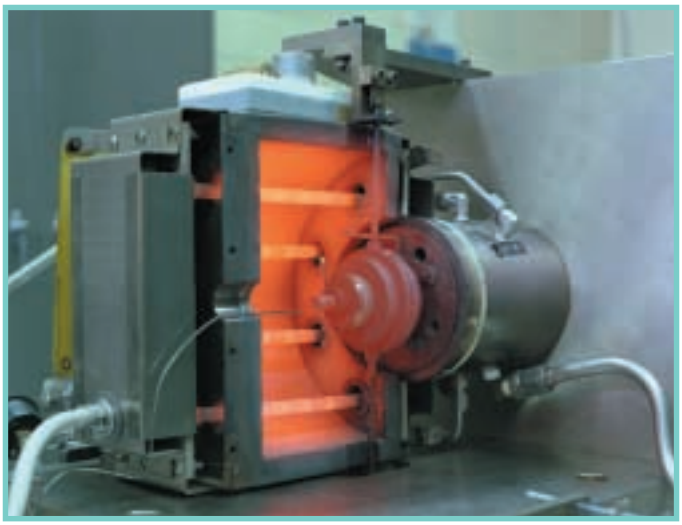
AT Objective 6: Provide next-generation design tools to increase design confidence and cut the development cycle time for aircraft in half within 10 years.

AT FY2001 Performance Target 1R8: Develop at least three new design tools and accomplish at least four demonstrations of advances in computation and communications.

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

GRC FY2001 Milestone:

A5.1: Complete core hot-section radial foil bearing rig testing.



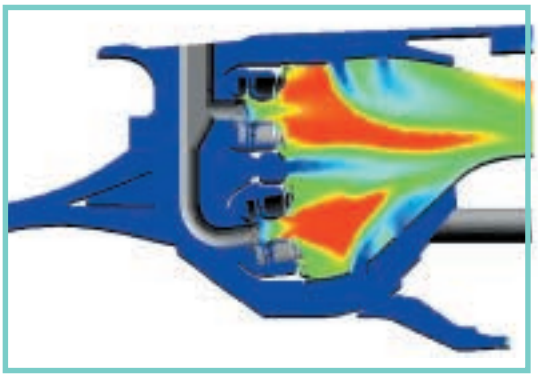
GRC foil air bearing being tested at 1400 °F.

GRC Objective A6.0: Develop computing and testing tools to reduce aircraft engine design and development time.

GRC FY2001 Milestones:

A6.1: Demonstrate a three-dimensional, steady-state simulation of an aircraft engine's primary flow path overnight.

A6.2: Complete combustor and compressor simulations in 3 hours or less.



GRC computer visualization of pressure distribu-tion in turbine combustor.

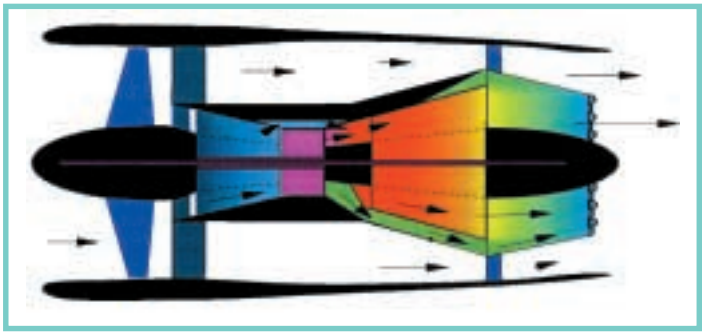
AT Objective 7: Provide next-generation experimental aircraft to increase design confidence and cut the development cycle time for aircraft in half within 10 years.

AT FY2001 Performance Target 1R9: Demonstrate two new concepts in flight and identify five new concepts for further examination.

GRC Objective 7.0: Provide propulsion concepts for next-generation experimental aircraft to increase design confidence and cut the development cycle time for aircraft propulsion systems in half within 10 years.

GRC FY2001 Milestone:

A7.1: Complete assessment and conceptual design of pulse-detonation-engine-based hybrid cycle and combined-cycle propulsion systems.



GRC concept for pulse-detonation engine.

AT Goal 3: Space Transportation–Achieve the full potential of space for all human endeavor through affordable space transportation.

AT Objective 8: 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 within 25 years.

GRC Objective A8.0: Reduce the cost contribution of access-to-space propulsion systems and associated subsystems while improving their performance, life, function, and operability.

GRC FY2001 Milestones:

A8.1: Complete rocket-based, combined cycle (RBCC) propulsion inlet, mixer-combustor, and integrated propulsion pod component validation for semiaxisymmetric vertical takeoff systems.

A8.2: Complete initial flow-path definition for the RBCC demonstrator.

A8.3: Define preprototype proton-exchange-membrane fuel cell powerplant requirements for second-generation reusable launch vehicles.

A8.4: Complete testing of an 8-lb/sec liquid hydrogen densification system.

A8.5: Complete screening study of ultra-high-temperature polymer matrix composites with optimized three-dimensional fiber architecture.

A8.6: Complete modifications of the Numerical Propulsion System Simulation to allow analysis of rocket cycle propulsion systems.

AT Objective 9: Reduce the cost of interorbital transfer by an order of magnitude and travel time by a factor of 2 within 15 years.

GRC Objective A9.0: Develop advanced in-space propulsion technology.

GRC FY2001 Milestones:

A9.1: Complete the procurement for a 50-kilowatt-class Hall thruster design.

GRC Hall thruster test.

A9.2: Complete screen characterization testing with liquid hydrogen for the development of advanced cryogenic liquid acquisition devices.

GRC propellant densification test site.

A9.3: Fabricate candidate nuclear thermal propulsion fuel samples and establish a detailed fuels development plan in cooperation with the Department of Energy.

A9.4: Present Breakthrough Propulsion Physics Project first year's research results at 2001 Joint Propulsion Conference.

AT Goal 4: Research and Development Services–Enable and, as appropriate, provide on a national basis world-class aerospace R&D services, including facilities and expertise.

AT Objective 10: Provide world-class aerospace research and development services, facilities, and expertise.

GRC Objective 10: Provide world-class aerospace research and development services, facilities, and expertise.

AT 2001 Performance Target 1R12: Continue the solicitation of customer feedback on the services, facilities, and expertise provided by the Aerospace Technology Enterprise.

GRC FY2001 Milestone:

Continue the solicitation of customer feedback on the services, facilities, and expertise provided by the Aerospace Technology Enterprise.

AT FY2001 Performance Target 1R13: Continue the implementation of current education outreach plans and establish new plans for all new program activities initiated in FY01.

GRC FY2001 Milestone:

Continue the implementation of current education outreach plans and establish new plans for all new program activities initiated in FY01.

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. 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.

HEDS Goal 1: Expand the space frontier.

HEDS Objective: Expand human exploration through collaborative robotic missions.

HEDS Objective: Define innovative human exploration mission approaches.

HEDS Objective: Invest in enabling high-leverage technologies.

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 FY2001 Milestones:

H1.1: Demonstrate secure Internet-based operations in space (NASA Johnson Space Center Inspection 2000).

H1.2: Conduct a preliminary design review for the K-band Direct Data Distribution (D^3) flight and ground segments.

Hitchhiker design for D^3 flight payload.

H1.3: Demonstrate a prototype stacked, integrated, thin-film solar cell/thin-film lithium polymer battery supply with an open-circuit voltage greater than 4 volts and a current density capability of 5mA/cm^2 for low-Earth-orbit illumination cycles.

H1.4: Complete the characterization of initial novel polymer electrolyte candidates for the polymer energy rechargeable system.

H1.5: Demonstrate a modular dc-to-dc converter for space application that maintains high efficiency over a wide range of power levels with a peak efficiency exceeding 95 percent.

H1.6: Develop and/or present NASA/U.S. positions to the Space Frequency Coordination Group meeting.

H1.7: Contingent upon execution of a Cooperative Agreement with Raytheon, complete testing of a K-band phased-array antenna.

HEDS Goal 2: Expand scientific knowledge.

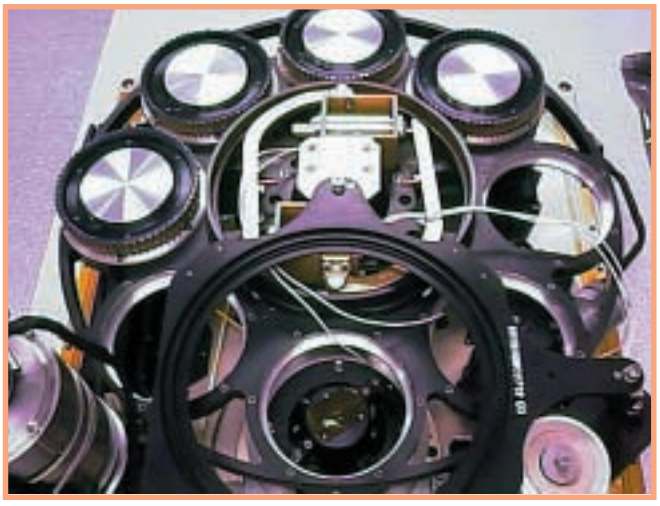
HEDS Objective: In partnership with the scientific community, use the space environment to investigate chemical, biological, and physical systems.

HEDS FY2001 Performance Target 1H5: Begin research on the International Space Station.

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

GRC FY2001 Milestones:

H2.1: Successfully complete the Laminar Soot Processes (LSP), Structure of Flame Balls at Low Lewis numbers (SOFBALL), and the Mist experiments on STS−107 using the CM−2 facility.



Cell carousel assembly for Physics of Colloids in Space Experiment.

H2.2: Complete one Spread Across Liquid (SAL) sounding rocket experiment.

H2.3: Provide for deployment on Flight 6A the Physics of Colloids in Space (PCS) experiment, integrate it in the ISS EXPRESS rack, and initiate experiment operations following system checkout.

HEDS Goal 3: Enable and establish a permanent and productive human presence in Earth orbit.

HEDS Objective: Provide safe, affordable, and improved access to space.

HEDS Objective: Deploy and use the International Space Station to advance scientific, exploration, engineering, and commercial objectives.

HEDS Objective: Ensure the health, safety, and performance of humans living and working in space.

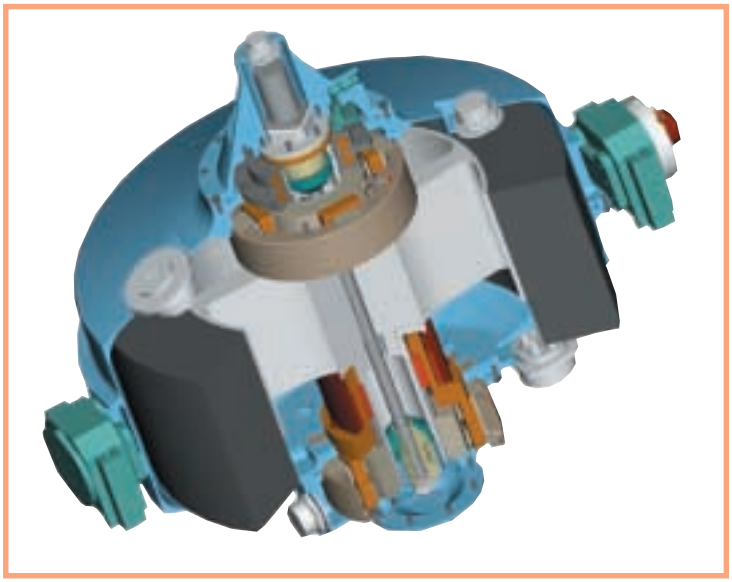
HEDS Objective: Meet sustained space operations needs while reducing costs.

HEDS FY2001 Performance Target 1H13: Successfully complete the majority of the planned research activities in support of the initiation of on-orbit research opportunities (on the International Space Station).

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 FY2001 Milestones:

H3.1: Conduct a critical design review of the prototype flywheel energy storage system replacement for nickel-hydrogen batteries on the ISS.



GRC design for prototype flywheel energy storage system.

H3.2: Complete power system verification analysis for ISS assembly flights.

H3.3: Measure the ISS acceleration environment, develop models to characterize the effects of that environment on ISS research, and disseminate those results to the ISS investigator community.

HEDS Goal 4: Expand the commercial development of space.

HEDS Objective: Facilitate access to space for commercial researchers.

HEDS Objective: Foster commercial participation in the International Space Station

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

GRC FY2001 Milestones:

H4.1: Complete final dissemination of results from NASA's experiments program on the Advanced Communications Technology Satellite (ACTS).

H4.2: Investigate the development of transferring ACTS operations to a university-based consortium and implement if appropriate.

H4.3: Complete installation of Ka- and V-band propagation terminals for collection of data from the Stentor satellite.

Ka-band prototype propagation terminal.

HEDS Goal 5: Share the experience and benefits of discovery of human space flight.

HEDS Objective: Increase the scientific, technological, and academic achievements of the Nation by sharing our knowledge, capabilities, and assets.

GRC Objective H5.0: Increase the scientific, technological, and academic achievements of the Nation by sharing our knowledge, capabilities, and assets.

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. 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, 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: Chart the evolution of the universe from origins to destiny and understand its galaxies, stars, and life.

SSE Objectives:

- Solve the mysteries of the universe.
- Explore the solar system.
- Discover planets around other stars.
- Search for life beyond Earth.

SSE Goal: Contribute measurably to achieving the science, mathematics, and technology education goals of our Nation.

SSE Objective: Make education and enhanced public understanding of science an integral part of our missions and research.

SSE Goal: Support human exploration through robotic missions.

SSE Objective: Investigate the composition, evolution, and resources of Mars, the Moon and small bodies.

SSE Objective: Develop the knowledge to improve the reliability of space weather forecasting.

SSE Goal: Develop new technologies needed to carry out innovative and less-costly mission and research concepts.

SSE Objective and FY2001 Performance Target 1S12: Plan, develop, and validate new technologies needed to enable future research and flight missions by achieving performance objectives in the Space Science core technology programs and by making progress as planned in the flight validation program.

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

GRC FY2001 Milestones:

S1.1: Complete development of a 155-megasymbol-per-second, radiation-tolerant, modulator/encoder application-specific integrated circuit, including constrained envelope modulation.

S1.2: Complete the K-band phased-array antenna provided under a Cooperative Agreement with Raytheon.

S1.3: Test Stirling converters mounted in a prototypical structure under launch load conditions.

GRC-designed Stirling converter.

S1.4: Demonstrate the validity of an electrostatic micro-ion (about 10 watts) concept.

[See Milestones H1.3, H1.4, and H1.5, which also support the Space Science Enterprise.]

GRC Contributions to the Earth Science Enterprise

The Earth Science Enterprise (ESE) 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 provides capabilities that will significantly enhance current or enable new Earth Science missions. GRC's contributions are in advanced power, in-space propulsion, and space communications technology. The majority of the GRC crosscutting technology efforts (conducted under the auspices of the Space Science Enterprise) are applicable to Earth Science missions. In addition, GRC is developing technology to meet specific Earth Science mission requirements.

ESE Goal: Expand scientific knowledge by characterizing the Earth system.

ESE Objectives:

- Successfully launch spacecraft.
- Understand the causes and consequences of land-cover/land-use change.
- Predict seasonal-to-interannual climate variation.
- Detect long-term climate change, causes, and impacts.
- Understand the causes of variation in atmospheric ozone concentration and distribution.
- Identify natural hazards, processes, and mitigation strategies.

Developing future communications architectures for Earth observing.

ESE Goal: Disseminate information about the Earth system.

ESE Objective: Implement open, distributed, and responsive data system architecture.

ESE Goal: Enable the productive use of ESE science and technology in the public and private sectors.

ESE Objectives:

- Develop and transfer advanced remote-sensing technologies.
- Extend the use of Earth Science research to national, state, and local applications.
- Support the development of a robust commercial remote-sensing industry.
- Increase public understanding of Earth system through education and outreach.
- Make major scientific contributions to national and international environmental assessments.

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

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)

MS Goal 1: Ensure that the Agency meets its responsibilities safely and effectively as it allocates its resources to support NASA's strategic, implementation, and performance plans.

MS Objective 1: Assess, document, communicate, and mitigate the programmatic and technical risks associated with NASA programs and projects; focus special attention toward addressing and mitigating safety and health risks presented by our work environment and our projects.

MS FY2001 Performance Target 1MS1: Increase the safety of NASA's infrastructure and workforce with facilities safety improvements, reduced environmental hazards, increased physical security, and enhanced safety awareness among its employees.

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 FY2001 Milestones:

M1.1: Achieve a Centerwide personnel occupational injury and illness lost time rate per 200,000 hours worked of 0.14 or less.

M1.2: Obtain Nuclear Regulatory Commission approval of the Plum Brook Nuclear Reactor Facility Decommissioning Plan.

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

MS FY2001 Performance Target 1MS2: Continue to take advantage of opportunities for improved contract management by maintaining a high proportion of performance-based contracts and maintain significant contractor involvement in NASA programs for small businesses, minority institutions, and minority and women-owned businesses.

MS Objective 3: Optimize Agency investment strategies and systems to align human, physical, and financial resources with customer requirements while ensuring compliance with applicable statutes and regulations.

MS FY2001 Performance Target 1MS3: Renew the Agency's management systems, facilities, and human resources through updated use of automated systems, facilities, and revitalization and personnel training.

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

GRC FY2001 Milestones:

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

M2.2: Achieve the annual small, disadvantaged, women-owned business and other socioeconomic procurement goals negotiated on behalf of GRC by NASA Headquarters with the Small Business Administration.

GRC Objective M3.0: Effectively and economically manage GRC's financial, physical, 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 FY2001 Milestones:

M3.1: Cost at least 75 percent of the resources authority available to cost during the fiscal year.

M3.2: Ensure that at least 15 percent of all training is accomplished using technology-based methods.

M3.3: Complete an implementation plan for the new ISO 9001 standard.

MS Objective 4: 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.

MS FY2001 Performance Target 1MS4: Improve information technology (IT) infrastructure service delivery to provide increased capability and efficiency while maintaining a customer rating of "satisfactory" and enhance IT security through a reduction of system vulnerabilities across all NASA centers, emphasizing IT security awareness training for all NASA personnel.

M3.4: Ensure that at least 85 percent of all informal Equal Employment Opportunity complaints are resolved using the Informal Alternative Disputes Resolution Process.

M3.5: Ensure that progress in hiring and promoting women, minorities, individuals with disabilities, and disabled veterans has been made at GRC compared with FY2000.

M3.6: 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 and women by at least 1 percent per year and individuals with disabilities and disabled veterans by at least 0.5 percent per year.

GRC Objective M4.0: Ensure that GRC information technology 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 FY2001 Milestones:

M4.1: Complete GRC's transition to an outsourced desktop seat management environment.

M4.2: Plan and implement the necessary infrastructure such that all publicly available Web and FTP servers can be migrated to the External Services Network.

M4.3: Complete required actions to comply with the annual Agency CIO-defined metrics for a ratio of 0.10 for the top 50 IT security vulnerabilities.

M4.4: Complete the NASA implementation plan for integrating a standard project management tool in the current Agency architecture.

GRC Aeroshark Pentium II cluster.

M4.5: Develop and report recommendations on NASA collaborative IT tool standards and strategy.

M4.6: Document a NASA Enterprisewide IT architecture.

M4.7: Ensure that at least half of all GRC IT systems have an IT security plan.

M4.8: Facilitate and coordinate the IT obsolescence process such that the average age of the GRC inventory of the interoperable/networked computer systems does not exceed 3 years and no IT equipment is older than 7 years.

M4.9: Fully satisfy (obtain a rating of at least 4 on a 5-point scale) at least 95 percent of all IT users who respond to the Outsourcing Desktop Initiative customer survey.

Provide Aerospace Products and Capabilities (PAPAC)

PAPAC Goal: Enable NASA's strategic Enterprises and their centers to deliver products and services more effectively and efficiently while extending the technology, research, and science benefits broadly to the public and commercial sectors.

PAPAC Objective 1: Meet schedule and cost commitments.

PAPAC FY2001 Performance Target 1P1: Meet schedule and cost commitments by keeping development and upgrade of major scientific facilities and capital assets within 110 percent of cost and schedule estimates, on average.

PAPAC Objectives 2, 3: Improve and maintain NASA's engineering capability.

PAPAC FY2001 Performance Target 1P3: Ensure the availability of NASA's spacecraft and facilities by decreasing operating time lost to unscheduled downtime.

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

GRC FY2001 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).

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

GRC FY2001 Milestone:

P2.1: Ensure that unscheduled downtime in GRC's primary wind tunnels (Icing Research, 8- by 6-Foot/9- by 15-Foot, and 10- by 10-Foot) and the Propulsion Systems Laboratory is not more than 10 percent of their scheduled operating time.

PAPAC Objective 4: Capture and preserve engineering and technological best practice to continuously improve NASA's program and project management.

PAPAC FY2001 Performance Target 1P4: Capture a set of best practices and/or lessons learned from each program, to include at least one from each of the four PAPAC subprocesses documented in NPG 7120.5, commensurate with current program status. Data will be implemented in PAPAC process improvement and in program and/or project management training.

PAPAC Objectives 5, 6: Facilitate the insertion of technology into all programs and proactively transfer technology from commercialization partnerships and integrate all innovative approaches to strengthen U.S. competitiveness.

PAPAC FY2001 Performance Target 1P5: Dedicate 10 to 20 percent of the Agency's research and development budget to commercial partnerships.

GRC Objective P4.0: 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 FY2000 Milestones:

P4.1: Complete the GRC Continuous Risk Management Implementation Plan and all corresponding changes to applicable Business Management System and web-site documents.

P4.2: Complete development of risk-based acquisition management tools and techniques, incorporate them with Agencywide examples and lessons learned in a web-based toolkit and complete GRC implementation visits associated with these tools and techniques.

GRC Objective P5.0: Form alliances and partnerships with other NASA centers, federal, state, and local agencies, academia, and industry.

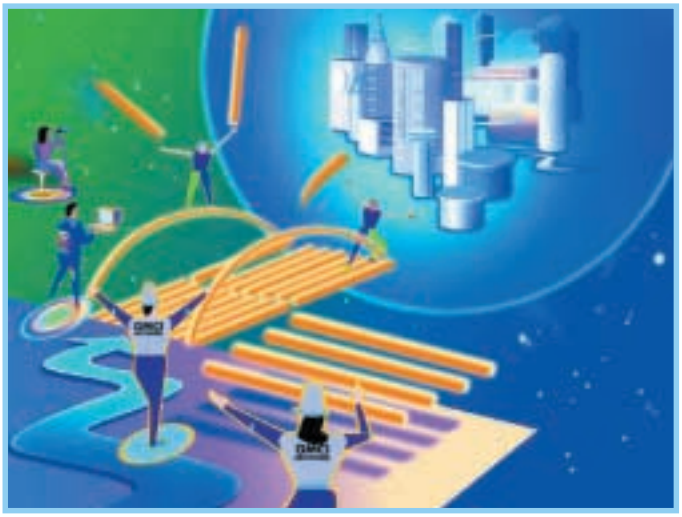
GRC FY2001 Milestone:

P5.1: Dedicate 10 to 20 percent of GRC's research and development budget to partnerships with commercial potential.

PAPAC FY2001 Performance Target 1P6: Dedicate the percent of technology budget that was reported in the FY2000 Performance Report toward leveraging with activities of other organizations.

GRC FY2001 Milestones:

P5.2: Expand the transfer of technologies to small, minority, and women-owned businesses into Illinois, Indiana, Michigan, and Wisconsin through the Garrett Morgan Commercialization Initiative.



Garrett Morgan Commercialization Initiative: a bridge between research and technology utilization.

P5.3: Upgrade network wiring on the first floor of Building 501 and restructure the Lewis Incubator for Technology Smart Efficient Components network support service delivery process.

P5.4: Transfer product development responsibility in at least two technologies to commercial partners through the Commercial Technology Office fund.

Generate Knowledge (GK)

GK Goal: Extend the boundaries of knowledge of science and engineering to capture new knowledge in useful and transferable media and to share new knowledge with customers.

GK Objective 1: Acquire advice from diverse communities.

GK FY2001 Performance Target 1G1: The Space Science, Earth Science, and Office of Life and Microgravity Sciences and Applications/ Human Exploration and Development of Space Enterprises will obtain scientific guidance from their investigator communities. Each Enterprise will have at least one advisory committee and receive at least seven letters of advice from them.

GK Objective 2: Plan and set research priorities.

GK Objective 3: Select, fund, and conduct research programs.

GK FY2001 Performance Target 1G3: The Space Science, Earth Science, and Office of Life and Microgravity Sciences and Applications/ Human Exploration and Development of Space Enterprises will use competitive merit review whenever possible to select performers for science and basic technology research. They will use Announcements

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

GRC FY2001 Milestone:

G1.1: Conduct a workshop to define methods, data bases, and validating tests for material flammability characterization, hazard reduction, and fire detection/suppression strategies for spacecraft and extraterrestrial habitats.

GRC microgravity research: flame at normal gravity (1g) and at microgravity (µg).

of Opportunity, NASA Research Announcements, and Cooperative Agreement Notices to award 80 percent of their science and basic research funds.

GK Objectives 4, 5: Archive data and publish, patent, and share results.

GK Objectives 6, 7: Collaborate with old and new partners.

GK FY2001 Performance Target 1G6: Work with other federal agencies and U.S. industry to complement and support our activities. Establish Memorandums of Understanding and Memorandums of Agreement.

GK FY2001 Performance Target 1G7: Pursue mutually beneficial cooperative activities in aeronautics and space with other nations. Use Memorandums of Understanding and Letter Agreements.

Communicate Knowledge (CK)

CK Goal: Ensure that NASA's customers receive the information derived from the Agency's research and development efforts that they want, when they want it, and for as long as they want it.

CK 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 experience.

CK FY2001 Performance Target 1CK4: Support educational excellence and reach out to the underserved and underrepresented minority community.

GRC Objective C1.0: 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 to 2003.

GRC FY2001 Milestones:

C1.1: Teacher preparation and skill enhancement and student support: conduct a pilot project or event that will systemically link teachers, students, and parents in an ongoing educational program.

C1.2: Curriculum support: review educator resource center network sites in the region, establish new Space Act Agreements, and host a national conference.

C1.3: Education technology: develop additional aeronautics education laboratories.

C1.4: Educational program management: establish mechanisms for joining Office of Educational Programs with NASA Enterprise education and outreach plans, starting with the Advanced Subsonic Technology (AST) Enterprise Ultra-Efficient Engine Technology and Aerospace Propulsion and Power programs.

C1.5: Increase the number of methods 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.

Very Special Arts 2000 event in GRC hangar.

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

CK FY2001 Performance Target 1CK1: Convey to the public information about and knowledge generated by NASA's programs.

GRC Objective C2.0: Ensure widespread recognition of GRC's capabilities and technologies; enhance GRC's image by communicating its expertise internally and externally; and increase public awareness of GRC's contributions.

GRC FY2001 Milestones:

C2.1: Publish abstracts and reports of progress for at least 90 percent of the FY2000 microgravity program research investigations (tasks) and make this information available on the Internet.

C2.2: Update and enhance the GRC Visitor Center by installing new interactive exhibits and galleries that focus on aeronautics, microgravity, and robotics.

New Aero Adventure Gallery in the GRC Visitor Center.

C2.3: Develop a benchmark communication team and a process for enhancing internal communications.

GRC Objective C3.0: Increase and enhance the productive use of GRC-generated and GRC-sponsored science and technology in the public and private sectors though technology transfer and

CK FY2001 Performance Target 1CK3: Facilitate the transfer of NASA-generated technology and innovations to private industry.

commercialization.

GRC Milestones:

C3.1: Provide at least 60 new NASA TechTracS technology records that will be publicly accessible via the Internet.

C3.2: Provide GRC input for publication of Technology Opportunity sheets, success stories, sites on the Web, NASA Spinoff, Tech Briefs, R&T Report, Innovation, and other technical publications.

C3.3: Meet NASA Enterprise deadlines for formulating Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) program topics and subtopics.

GRC Center-Level Metrics

GRC has 10 metrics to monitor the overall health and level of achievement at the Center. Six of these metrics are defined and are currently in use. Four are under development. Progress under all 10 metrics is reviewed by GRC senior management on a quarterly basis and also at the annual GRC Performance Review. The description, implementation status, fiscal year goals, and future plans for each metric are set forth below.

Metrics in Use

Major Milestone Performance

This metric measures the cost, schedule, and technical performance of all milestones in the GRC Strategic Implementation Plan. GRC's FY01 goal is to complete 85 percent of all milestones on schedule and within budget while accomplishing the milestone technical objectives.

Technology Development and Transfer

This metric tracks the number of GRC technology disclosures, refereed journal articles, patents, patent licenses, and major awards. These five indicators are used to evaluate the quality and value of the Center's technology output and transfer. Fiscal year goals for these indicators will be set when more data for them are obtained and analyzed.

Partnerships

This metric counts the number of partnerships GRC has established in three sectors: businesses; educational and nonprofit organizations; and other government organizations. During FY01, goals for each of these partnership categories will be established.

Program Management Development Program (PMDP) Certifications

This PMDP metric tracks the number of Glenn employees who have achieved PMDP certification at the four designated levels. Each Center directorate has established certification goals to meet future anticipated program and project management needs.

Obligation and Costing Performance

This metric measures GRC obligation and cost performance, both planned and actual. GRC's FY01 goal is to be within 2 percent of the plan for each area monitored and for all areas in aggregate.

Cost of Doing Business

This metric compares the funds GRC has spent in three high-level cost categories: direct costs, service pool costs, and general and administrative costs. Data are being collected to establish past year trends so that a goal for each category may be set in FY01.

Metrics Under Development

New Business

This metric will track the new opportunities being pursued by GRC, the cost to GRC of pursuing them, and the number and value of the new business captured. The final format of this metric will be determined early in FY01.

Revenues

This metric will track and forecast the balance of the Center's revenue portfolio and the distribution of resources from NASA Enterprises, other government agencies, and non-Federal entities. The Center is currently collecting the data for this metric so those goals for them may be established in FY01.

Expenditures

This metric will monitor GRC's distribution of funds in three areas: Center operations (short-term focus), research and development (medium-term focus), and capital investments (long-term focus). The intent of this metric is to insure balanced investment in all Glenn's asset areas. This metric will be finalized in FY01.

Employee, Customer, and Stakeholder Satisfaction

This metric will measure GRC's overall success in meeting the needs of its employees, customers, and stakeholders. During FY01, the first employee satisfaction survey will be completed, and the methodology for collecting customer and stakeholder data will be established and data collected.

Appendix A
GRC Program Points of Contact

NASA Safety Initiative

Manuel B. Dominguez (216) 433–6735

AT Enterprise

Propulsion Systems Research and Technology
Peter W. McCallum (Acting) (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 Program
Harry Cikanek (216) 433–6196

Breakthrough Propulsion Physics Project
Marc Millis (216) 977–7535

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

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

Shuttle Upgrades
William Taylor (216) 433–6568

Exploration Initiatives

Power
Steven D. Johnson (216) 433–5370

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

SS Communications Technology
Kul Bhasin (216) 433–3676

ES Communications Technology
Robert Bauer (216) 433–3431

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

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
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

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 (Acting) (216) 433–8852

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

Systems Management Office
Olga D. Gonzalez-Sanabria (216) 433–5252

Equal Opportunity
Robert Romero (216) 433–5538

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

Human Resources
Leroy McCreary (Acting) (216) 433–2489

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

Environmental Management Office
Michael Blotzer (216) 433–8159

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

Aeronautics Directorate

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

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

Research and Technology Directorate
Director
Woodrow 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

B–0952
Feb 01

For more information about this Plan,

Contact

Glenn Plans and Programs Office

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

or

Visit the Glenn Website at

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