FULL COST BUDGETING

In the FY 2004 budget request, NASA introduced a new full cost budgeting approach. "Full cost" means that each program and project budget estimate includes all of the program or project's direct and indirect costs, including all civil service salaries and other infrastructure costs. Full cost budgeting directly links each program and project with the infrastructure it uses. Before full cost, only the project unique procurement costs for a given program or project were included in that program's or project's budget.

On October 1, 2003, NASA implemented its full cost initiative, of which full cost budgeting was the first step. NASA is now for the first time operating in a total full cost environment: managing programs and projects in terms of their total costs; accounting for all costs as either direct or as General and Administrative (G&A); and budgeting for a program or project's full costs.

Implementing full cost has been crucial to NASA's success to integrate budget and performance as called for in the President's Management Agenda (PMA). NASA is the first agency to receive the coveted "green" rating. An account of this achievement and NASA's overall PMA progress is provided in the "PMA Update" section of this document.

HOW FULL COST WORKS – THE BASICS

In full cost, each program and project budget includes three types of costs: Direct Costs, Center G&A Costs, and Corporate G&A Costs. The full cost of a program/project is the sum of these costs. Exhibit 1 depicts in detail the cost components for each NASA full cost program/project.

Direct Costs

(1) Direct costs are related to a project at the time the costs are incurred. They include purchased goods and services, contracted support, and direct civil service salaries/benefits/travel; and

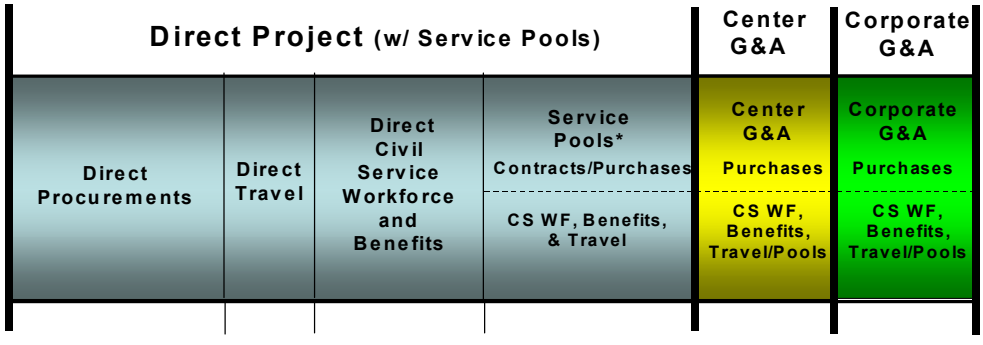
(2) Service pool costs are infrastructure capabilities supporting multiple programs and projects at NASA Centers. They are services whose costs can be linked to specific programs and projects based on usage. There are six standard service pools established for use by NASA Centers: Facilities and Related Services; Information Technology; Science and Engineering; Fabrication; Test Services; and Wind Tunnel Services. During budget formulation, the Center's total demand for a service (based on projected usage by programs) and the pool's funding requirements are identified through negotiations with program and project managers and service providers. The total full cost budget request for each program and project includes its projected service pool bill.

Center G&A Costs

These are Center costs that cannot be accurately allocated to specific programs and projects based on usage. These costs are instead allocated to each Center program and project based on how many civil servants and on-site contractors work on the given program or project.

Each Center develops the total budget request for the center's G&A costs based on Agency guidance and with NASA Agency-level approval. Center G&A costs include the salaries and benefits of Center civil servants in G&A functions, their travel, Center training and awards, security, grounds maintenance, pavement and roads, fire protection, libraries, business computing, public affairs, non-program construction of facilities (CoF), transportation services, legal, human resources services, procurement support, budgeting, accounting, equal opportunity, educational outreach, medical services, and logistics services.

Exhibit 1: Full Cost Components

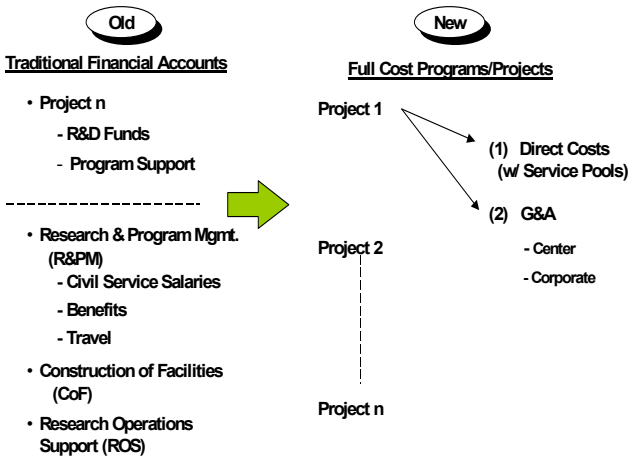


* - Costs of services provided to projects based on on use/ consumption

Corporate G&A Costs

These include two types of costs: NASA Headquarters operating costs and Agency-wide G&A costs (including costs of Corporate G&A functions performed at NASA Centers on behalf of the Agency). Examples of activities covered are the NASA Administrator's office, Enterprise management, Headquarters operations, and the functional offices that govern Agency-wide matters, such as public affairs and procurement and human resources policy and practice. Corporate G&A costs are allocated to all NASA programs and projects based on their share of NASA's total direct cost (including service pool costs).

Exhibit 2: Traditional vs. Full Cost Budgets



TRADITIONAL VS. FULL COST BUDGETING

Exhibit 2 compares NASA's traditional budget structure (used for FY 2003 and prior) with the full cost structure (started in FY 2004). Before full cost, Agency program and project budget estimates included only the Direct Research and Development (R&D) Costs. Direct R&D Costs consisted primarily of contract costs plus certain supporting costs labeled Program Support. They did not include civil service workforce costs or travel dollars; these were instead budgeted under Research and Program Management (R&PM). Other institutional infrastructure costs, such as Research Operations Support (ROS) (business management functions and basic center operations), were similarly separate from program and project costs.

Full cost, by contrast, allocates the entire Agency budget among programs and projects. Program and project managers now have visibility over and manage all program and project resources. Their budgets reflect the full cost of a given program or project effort.

BENEFITS OF FULL COST

Full cost budgets allow more informed decisions on the most optimal use of all resources (dollars, workforce, and facilities). Full cost facilitates full disclosure of Agency costs, enables linkage of resources to results, and supports accountability to taxpayers. Full cost practices promote efficient, optimal use of institutional resources. Specifically, full cost:

- Allows justification of the entire budget on a program and project basis;
- Allocates the civil service workforce by program/project need;
- Bases institutional resources on program and project requirements;
- Eliminates "free" infrastructure resources for program managers, and gives managers more insight and role in defining institutional capabilities;.
- Links services with customers, basing service pool funding on user demand, not a parametric formula;
- Sharpens management focus (at NASA Headquarters Enterprise, Center, and program levels) on G&A infrastructure and sources of support capabilities, revealing underutilized institutional resources and cost-effective alternatives;
- Encourages competitively selecting support capabilities, benchmarking NASA services against non-NASA services, and reducing unneeded government infrastructure;
- Strengthens ties among mission components, among programs and projects, and among parts of the budget request; and
- Motivates and helps program and project managers be more efficient in managing their programs and optimizing the use of their budgeted resources (both dollars and workforce).

PERFORMANCE EVALUATION OF SELECT PROGRAMS

In 2003, OMB reviewed seven NASA Themes for performance effectiveness using the Performance Assessment Rating Tool (PART). The results are summarized in the following table. For details on performance assessments of the Themes listed here, see www.whitehouse.gov/OMB/ budget. PART recommendations are also discussed in individual Theme summary pages in this document.

The PART is an evaluation tool developed by the White House Office of Management and Budget (OMB) to assess the effectiveness of Federal programs. It will be phased in across all Federal Agencies. In its first year of use, Federal Agencies and Departments were asked to apply the PART to 20% of all programs (NASA Themes) to determine how well it assesses program effectiveness and management performance. As a result, three NASA Themes were reviewed in 2002. For 2003, the percent to be reviewed increased to 40%, so seven NASA Themes were reviewed.

The PART will be applied to an additional 20% of Federal Programs each year until the tool is used as a standard assessment for all Programs. The PART identifies the program management changes needed to improve a program's effectiveness. Programs previously assessed using the PART will be reassessed and their scores raised or lowered depending on changes in performance

Program (Theme)	Rating	Explanation	Recommendation
Mars Exploration	Effective	The program is well-defined and well-managed and is making excellent progress towards achieving its science goals.	Augment the program to accelerate the search for life on Mars and prepare for future human exploration.
Solar System Exploration	Effective	Well-defined and well-managed, the program has a clear purpose and ties directly to NASA's mission.	Continue to support a diverse mission portfolio, including missions to search for habitable environments and life.
Mission and Science Measurement Technology	Moderately Effective	Responsiveness to external review and effective management has resulted in an improved program.	Leverage the program as a foundation for a new exploration technology program.
Biological Sciences Research	Results Not Demonstrated	The selection and prioritization of scientific research has improved; however, additional work is needed to develop suitable performance goals and demonstrate results.	Refocus the program to support the new exploration vision.
Earth Science Applications	Results Not Demonstrated	The program has taken the right steps to establish a viable strategy but will require additional time to demonstrate results.	Continue to focus on implementation and fully develop products and partnerships.
Space Shuttle	Results Not Demonstrated	The program lacks good performance measures. The hiatus that has followed the *Columbia* tragedy has prevented the program from achieving results.	Increase return-to-flight funding to improve results in future years. Plan to retire the Shuttle by the end of the decade, once its role in Station assembly is complete.
Space Station	Results Not Demonstrated	The program lacks good long-term performance measures and has been unable to achieve goals due to Shuttle unavailability.	Reduce dependence on problematic crew and cargo transfer systems. Redirect the program to bring it into alignment with the new exploration vision.

Management and Performance: President's Management Agenda Update

UPDATE ON THE PRESIDENT'S MANAGEMENT AGENDA (PMA)

NASA has made significant progress in improving the quality of our management by implementing the President's Management Agenda. This is a government-wide effort to improve the way that Government manages in five key areas: Human Capital, Financial Management, E-Government, Competitive Procurement, and Integrated Budget and Performance. The Office of Management and Budget (OMB) uses a red/yellow/green 'stoplight' rating system to rate for agency status and progress; green indicates success. The discussion below describes our progress in 'getting to green' in all five areas.

The President's Management Agenda provides the central focus for all management reform efforts across the Agency, including our Freedom to Manage initiatives. NASA has established a highly integrated, disciplined process for 'getting to green' with weekly status reports to the Administrator by each of our five President's Management Agenda (PMA) area champions. Since last year, NASA has improved in 4 out of our 5 initiatives, getting to green in both Human Capital and Budget and Performance Integration, and yellow in both Competitive Sourcing and E-Government.

Last year, NASA implemented our first human capital plan, established an accountability system to track the associated results, and demonstrated our ability to make distinctions in employee performance using a comprehensive awards system. NASA used performance information and full-cost considerations to develop our budget requests and to inform our management decisions. NASA has a competitive sourcing plan and has announced two standard competitions involving more than 230 positions. NASA has an information technology architecture in place to guide our investments and strengthen our IT security. All NASA IT systems are now operating within 10% of planned budget and schedule. NASA has taken significant steps toward resolving inconsistencies in financial reporting and issues relating to valuation of contractor-held property by implementing the Core Financial Module of the Integrated Financial Management Program. Data reconciliation issues due to the conversion from the old to the new systems, however, have presented us with challenges in preparing our 2003 financial statements

	Human Capital	Competitive Sourcing	Financial Performance	E-Government	Budget and Performance Integration
Status					
Progress					

FY 2004 Performance Plan Update

INTRODUCTION

This is a revision of NASA's Fiscal Year 2004 (FY 2004) Performance Plan, originally published as part of the NASA Integrated Budget and Performance Document, titled *FY 2004 Budget Estimates* and subsequently updated on September 30, 2004. NASA has made several strategic changes in the FY 2005 President's Budget submittal. Some of these changes will be implemented immediately, and thus impact the FY 2004 Performance Plan.

Mission I: To Understand and Protect our Home Planet

Goal 1: Understand the Earth system and apply Earth system science to improve prediction of climate, weather, and natural hazards.

Objective 1.1 Understand how the Earth is changing, better predict change and understand the consequences for life on Earth.

Outcome 1.1.1 *Enable prediction of polar and global stratospheric ozone recovery (amount and timing) to within 25% by 2014.*

Outcome 1.1.2 *Predict the global distribution of tropospheric ozone and the background concentration in continental near-surface air to within 25% by 2014.*

Outcome 1.1.3 *Enable extension of air quality forecasts for ozone and aerosols from 24 to 72 hours by 2010.*

APG 4ESS7 Atmospheric Composition - Integrate high latitude satellite, suborbital, and ground based observations, coupled with laboratory studies and model calculations to assess the potential for future ozone depletion in the arctic, and characterize the properties and distributions of various types of clouds and aerosols as they relate to the extinction of solar radiation in the atmosphere. Progress toward achieving outcomes will be validated by external review. (Outcome 1.1.1, 1.1.2, 1.1.3)

Outcome 1.1.4 *Use satellite data to help enable decreased hurricane landfall uncertainty from +/- 400 km to +/- 100 km in the three-day forecasts by 2010.*

Outcome 1.1.5 *Use satellite data to help extend more accurate regional weather forecasting from 3 days to 5 days by 2010.*

APG 4ESS8 Weather - Improve predictive capabilities of regional models using satellite-derived localized temperature and moisture profiles and ensemble modeling. Progress toward achieving outcomes will be validated by external review. (Outcome 1.1.4, 1.1.5)

Outcome 1.1.6 *Develop projections of future atmospheric concentrations of carbon dioxide and methane for 10-100 years into the future with improvements in confidence of >50% by 2014.*

Outcome 1.1.7 *By 2014, develop in partnership with other agencies, credible ecological forecasts that project the sensitivities of terrestrial and aquatic ecosystems to global environmental changes for resource management and policy-related decision-making.*

Outcome 1.1.8 *Report changes in global land cover, productivity, and carbon inventories with accuracies sufficient for use in the food industry, in evaluating resource management activities, and in verifying inventories of carbon emissions and storage.*

APG 4ESS9 Carbon Cycles, Ecosystems, and Biogeochemistry - Reduce land cover errors in ecosystem and carbon cycle models, and quantify global terrestrial and marine primary productivity and its interannual variability. Progress toward achieving outcomes will be validated by external review. (Outcome 1.1.6, 1.1.7, 1.1.8)

Outcome 1.1.9 *Enable development of seasonal precipitation forecasts with > 75% accuracy by 2014.*

Outcome 1.1.10 *Improve estimates of the global water and energy cycles by 2012 to enable balancing of the global and regional water and energy budgets to within 10%.*

APG 4ESS10 Water and Energy Cycle - Enhance land surface modeling efforts, which will lead to improved estimates of soil moisture and run-off. Progress toward achieving outcomes will be validated by external review. (Outcome 1.1.9, 1.1.10)

Outcome 1.1.11 *Reduce uncertainty in global sea level change projections by 50% by the year 2014, and include regional estimates of deviation from global mean.*

Outcome 1.1.12 *Enable 10-year or longer climate forecasts by the year 2014 with a national climate modeling framework capable of supporting policy decision-making at regional levels.*

APG 4ESS11 Climate, Variability and Change - Assimilate satellite and in situ observations into a variety of ocean, atmosphere, and ice models for purposes of state estimation; provide experimental predictions on a variety of climatological timescales; and determine the plausibility of these predictions using validation strategies. Progress toward achieving outcomes will be validated by external review. (Outcome 1.1.11, 1.1.12)

Outcome 1.1.13 *Enable 30-day volcanic eruption forecasts with > 50% confidence by 2014.*

Outcome 1.1.14 *Enable estimation of earthquake likelihood in North American plate boundaries with > 50% confidence by 2014.*

APG 4ESS12 Earth Surface and Interior Structure - Advance understanding of surface change through improved geodetic reference frame, estimates of mass flux from satellite observations of Earth's gravitational and magnetic fields, and airborne and spaceborne observations of surface height and deformation. Progress toward achieving outcomes will be validated by external review. (Outcome 1.1.13, 1.1.14)

Objective 1.2 Expand and accelerate the realization of economic and societal benefits from Earth science, information, and technology.

Outcome 1.2.1 *By 2012, benchmark the assimilation of observations (geophysical parameters, climate data records) provided from 20 of the 80 remote sensing systems deployed on the flotilla of 18-22 NASA Earth observation research satellites.*

Outcome 1.2.2 *By 2012, benchmark the assimilation of 5 specific types of predictions resulting from Earth Science Model Framework (ESMF) of 22 NASA Earth system science models.*

Outcome 1.2.3 *By 2012, benchmark the assimilation of observations and predictions resulting from NASA Earth Science research in 8-10 decision support systems serving national priorities and the missions of federal agencies.*

APG 4ESA1 National applications: Benchmark measurable enhancements to at least 2 national decision support systems using NASA results, including the use of optical depth derived from MODIS data into the Air Quality Index provided by EPA and the use of ocean height Derived from Topex and Jason missions into reservoir monitoring tools with USDA. (Outcome 1.2.1, 1.2.3)

APG 4ESA2 Cross Cutting Solutions: Expand DEVELOP (Digital Earth Virtual Environment and Learning Outreach Project) workforce development program to 2-4 additional states and benchmark the use of NASA research results for water and energy decision support tools. (Outcome 1.2.1, 1.2.2, 1.2.3)

APG 4ESA3 Cross Cutting Solutions: Competitively select at least 5 solutions projects for the Research, Education, Applications solutions Network (REASoN) program to serve national applications through projects that support agriculture, public health and water quality decision support tools. (Outcome 1.2.1, 1.2.2, 1.2.3)

APG 4ESA4 Cross Cut Solutions: Verify and validate at least two commercial remote sensing sources/products for Earth science research including DigitalGlobe Quicksat and OrbImage Overview-3 high resolutions optical imagery. (Outcome 1.2.1)

Objective 1.3 Understand the origins and societal impacts of variability in the Sun-Earth connection.

Outcome 1.3.1 *Develop the capability to predict solar activity and the evolution of solar disturbances as they propagate in the heliosphere and affect the Earth.*

APG 4SEC8 Successfully demonstrate progress in developing the capability to predict solar activity and the evolution of solar disturbances as they propagate in the heliosphere and affect the Earth. Progress towards achieving outcomes will be validated by external review.

Outcome 1.3.2 *Specify and enable prediction of changes to the Earth's radiation environment, ionosphere, and upper atmosphere.*

APG 4SEC9 Successfully demonstrate progress in specifying and enabling prediction of changes to the Earth's radiation environment, ionosphere, and upper atmosphere. Progress towards achieving outcomes will be validated by external review.

Outcome 1.3.3 *Understand the role of solar variability in driving space climate and global change in the Earth's atmosphere.*

APG 4SEC10 Successfully demonstrate progress in understanding the role of solar variability in driving space climate and global change in the Earth's atmosphere. Progress towards achieving outcomes will be validated by external review.

Objective 1.4 Catalog and understand potential impact hazards to Earth from space.

Outcome 1.4.1 *By 2008, inventory at least 90 percent of asteroids and comets larger than 1 km in diameter that could come near Earth.*

APG 4SSE10 Successfully demonstrate progress in determining the inventory and dynamics of bodies that may pose an impact hazard to Earth. Progress towards achieving outcomes will be validated by external review.

Outcome 1.4.2 *Determine the physical characteristics of comets and asteroids relevant to any threat they may pose to Earth.*

APG 4SSE11 Successfully demonstrate progress in determining the physical characteristics of comets and asteroids relevant to any threat they may pose to Earth. Progress towards achieving outcomes will be validated by external review.

Goal 2: Enable a safer, more secure, efficient, and environmentally friendly air transportation system.

Objective 2.1 Decrease the aircraft fatal accident rate, reduce the vulnerability of the air transportation system to hostile threats, and mitigate the consequences of accidents and hostile acts.

Outcome 2.1.1 *By 2005, research, develop, and transfer technologies that will enable the reduction of the aviation fatal accident rate by 50% from the FY 1991-1996 average.*

APG 4AT4 Utilizing results of component testing, simulations, and analyses, complete an integrated program assessment of the suite of aviation safety technologies to determine their synergistic effect on reducing the fatal accident rate.

APG 4AT5 Propulsion system malfunctions are cited in 25% of fatal accidents, with disk and/or fan blade component failures being attributed to about 15% of these malfunctions. In FY 2004 NASA will develop prototype disks and engine containment materials with inherent failure resistant characteristics that will be ready for full scale testing in FY 2005.

APG 4AT6 Controlled Flight into Terrain (CFIT) accounts for 30% of General Aviation fatal accidents. During FY 2004, NASA will complete the flight evaluation of a synthetic vision system that improves pilot situational awareness by providing a display of "out-the–window" information that is not effected by adverse metrological conditions. This system when fully implemented has the potential to eliminate 90% of CFIT accidents.

Outcome 2.1.2 *By 2009, research, develop & transfer technologies that will reduce the vulnerability exposure of the aircraft, and reduce the vulnerabilities of other components in the air transportation system.*

APG 4AT7 Complete a preliminary demonstration, in a realistic operational environment, of an automated system to provide real-time identification of flight path deviations and a means to alert authorities in a prompt and consistent manner.

Objective 2.2 Protect local and global environmental quality by reducing aircraft noise and emissions.

Outcome 2.2.1 *By 2007, develop, demonstrate and transfer technologies that enable a reduction by half, in community noise due to aircraft, based on the 1997 state of the art.*

APG 4AT8 Validate initial concepts for engine and airframe source noise reduction by 5dB (re: to CY 2001 SOA).

Outcome 2.2.2 *By 2007, develop, demonstrate and transfer technologies for reducing NOx emission by 70% from the 1996 ICAO standard, to reduce smog and lower atmospheric ozone.*

APG 4AT19 Complete detailed design of a low-emission combustor leading to a 2005 test of a full-annular combustor demonstrating a 70% reduction of nitrogen oxides.

Outcome 2.2.3 *By 2007, develop, demonstrate and transfer technologies for reducing the green-house gas, CO_2, emissions by 25% based on the state of the art for airframe and engine component technologies in 2000.*

APG 4AT9 Experimentally demonstrate a 2-stage highly loaded compressor for increasing pressure rise per stage.

Objective 2.3 Enable more people and goods to travel faster and farther, with fewer delays.

Outcome 2.3.1 *By 2004, develop, demonstrate and transfer technologies that enable a 35% increase in aviation system throughput in the terminal area and a 20% increase in aviation system throughput en route based on 1997 NAS capacities.*

APG 4AT10 Complete validation and assessment of the Advanced Air Transportation Technologies products (tools/concepts) through field and laboratory demonstrations, analyses, evaluations, and assessments on a tool-by-tool basis to demonstrate an increase in terminal throughput by 35 percent and an increase in en route throughput by 20 percent.

Outcome 2.3.2 *By 2005, develop, demonstrate and transfer key enabling capabilities for a small aircraft transportation system.*

APG 4AT12 Flight demonstrate the ability to double the operations rate at non-towered, non-radar airports in low-visibility conditions using self-separation and flight-path guidance technologies for general aviation aircraft.

Outcome 2.3.3 *By 2009, develop, demonstrate, and transfer technologies that enable a further 5% increase in throughput in the terminal area and a further 10% increase in en route throughput based on 1997 NAS capacity.*

APG 4AT11 Develop a non-real-time Virtual Airspace Simulation Technology environment that will model the National Airspace System and provide the capability to conduct trade-off analyses amongst concepts and technologies for the future air transportation system.

APG 4AT13 Based on research completed under AATT project and current work under VAMS project, provide preliminary analysis and assessment of distributed air/ground traffic management (DAG/TM) operational concept.

Goal 3: Create a more secure world and improve the quality of life by investing in technologies and collaborating with other agencies, industry, and academia.

Objective 3.1 Enhance the Nation's security through partnerships with DOD, DHS and other U.S. or international government agencies.

Outcome 3.1.3 *By 2012, in partnership with the Department of Homeland Security, the Department of Defense, and the Department of State, deliver 15 observations and 5 model predictions for climate change, weather prediction and natural hazards to national and global organizations and decision-makers to evaluate 5 scenarios and optimize the use of Earth resources (food, water, energy, etc.) for homeland security, environmental security and economic security.*

APG 4ESA5 Benchmark improvements to at least two of the target national applications - air quality and agricultural competitiveness.

Outcome 3.1.4 *Demonstrate effective international collaboration on the International Space Station.*

APG 4ISS1 In concert with the ISS International Partners, extend a continuous two-person (or greater) crew presence on the ISS through the end of FY04.

Outcome 3.1.5 *Transfer technology both to and from the Department of Defense.*

APG 4AT14 Conduct and obtain flight test data of autonomous aerial refueling technologies in support of DoD UCAV Program.

Objective 3.2 Improve the Nation's economic strength and quality of life by facilitating innovative use of NASA technology.

Outcome 3.2.1 *On an annual basis, develop 50 new technology transfer agreements with the Nation's industrial and entrepreneurial sectors.*

APG 4HRT6 Complete 50 transfers of NASA technologies, expertise or facility usage to the U.S. private sector, through hardware licenses, software usage agreements, or Space Act agreements.

Outcome 3.2.2 By 2008, realign commercial product development to focus on NASA needs, while maintaining industrial partnerships.

APG 4RPFS1 Complete realignment plans of SPD.

APG 4RPFS2 Enable industry research in space that allows them to bring one commercial product under investigation to market by FY04.

Outcome 3.2.3 By 2008, develop and test at least two design tools for advanced materials and in-space fabrication, and validate on ISS.

APG 4RPFS3 Complete preparations for launch of a new containerless processing facility for research on synthesis of advanced materials on ISS.

APG 4RPFS4 Continue synthesis of zeolite crystals on ISS.

Outcome 3.2.4 By 2008, working with all OBPR research organizations and other NASA enterprises, identify at least three additional users of Research Partnership Center spaceflight hardware.

APG 4RPFS5 Develop a database of RPC spaceflight hardware showing potential outside users.

APG 4RPFS6 Develop a system for sharing RPC spaceflight hardware with outside users.

Outcome 3.2.5 By 2008, increase by 30% (from the 2003 level) the utilization of NASA/OBPR-derived technologies by other agencies, private sector, and academia to advance basic and applied research goals of practical impact.

APG 4PSR1 Maintain an active research program in collaboration with other agencies in laser light scattering, bioreactor, and containerless technologies.

Objective 3.3 Resolve scientific issues in the low gravity environment of space that enrich life on Earth by leading to better design tools in energy, materials, medical, and communication technologies.

Outcome 3.3.1 By 2008, analyze the impact of the results of the first phase of ISS and ground-based research in Biotechnology, fundamental science, and engineering to demonstrate the introduction of at least two new design tools and/or process improvements to existing technologies and industrial practices.

APG 4PSR2 Demonstrate the productivity of the research program in Combustion, Fluids Physics, Biotechnology, and Materials science and accomplish the milestones of ISS research projects.

Outcome 3.3.2 By 2008, quantitatively assess the impact of space and ground-based research on fire safety hazard prevention and containment and on energy conversion to demonstrate measurable risk reduction and increased efficiency.

APG 4PSR3 Process and analyze existing STS-107 data on fire safety and microgravity combustion research and maintain a productive ground and flight-based research program.

Outcome 3.3.3 By 2008, develop at least three new leveraged research partnerships with industry, academia, and other government agencies that improve NASA spacecraft safety.

APG 4RPFS7 Develop at least one enabling technology to improve the safety of space transportation systems.

Mission II: To Explore the Universe and Search for Life

Goal 4: Explore the fundamental principles of physics, chemistry, and biology through research in the unique natural laboratory of space.

Objective 4.1 Determine how fundamental biological processes of life respond to gravity and space environments.

Outcome 4.1.1 *Use ground-based simulators and ISS to determine gravity responses for at least five model organisms by 2008.*

APG 4BSR1 Solicit ground-based research on two widely studied model organisms.

APG 4BSR2 Produce a road map and strategic goals for plant research ground-based studies and flight opportunities. Solicit flight-based research on at least one model plant species.

Outcome 4.1.2 *Develop predictive models of cellular, pathogenic, and ecological responses to space for at least two organisms by 2008.*

APG 4BSR3 Solicit ground-based research on responses of cells and pathogens to space environments.

APG 4BSR4 Select two model species to support the development of predictive models. Communicate with the research community in workshops and at national and international scientific meetings about the approach.

Outcome 4.1.3 *By 2008, structure the Fundamental Space Biology flight research program to emphasize at least five model organisms and teams of Principal Investigators.*

APG 4BSR5 In coordination with International partners, solicit flight research on two model organisms and establish at least two research teams.

APG 4BSR6 Review and reprioritize Fundamental Space Biology flight experiments with a focus on model specimens.

APG 4BSR7 Reevaluate flight hardware and habitats with respect to research goals and focus resources on select units.

Objective 4.2 Expand understanding of fundamental physical processes and insight into the laws of nature through space-based investigation.

Outcome 4.2.1 *By 2008, complete the first generation of ISS research in colloidal physics and soft condensed matter and demonstrate the ability to control the colloidal engineering of at least two different model structures.*

APG 4PSR4 Demonstrate the productivity of the colloidal physics and soft-condensed matter program and accomplish the planned ISS research projects milestones.

Outcome 4.2.2 *By 2008, complete the design and fabrication of the first ISS fundamental microgravity physics facility to allow the performance of two capstone investigations in dynamical critical phenomena.*

APG 4PSR5 Demonstrate the accomplishments of the ISS fundamental physics facility development milestones and maintain a productive ground and space-based research program in condensed matter physics.

Outcome 4.2.3 *By 2008, complete the design for the ISS laser-cooling laboratory and demonstrate the feasibility to deploy the most accurate atomic clock in space.*

APG 4PSR6 Demonstrate the accomplishments of the ISS laser cooling and atomic physics facility milestones and maintain an innovative and productive ground and space-based research program in atomic and gravitational physics.

Outcome 4.2.4 *By 2008, complete the first phase of the ISS biotechnology facility and demonstrate cellular biotechnology research throughput increase by a factor of two.*

APG 4PSR7 Demonstrate the accomplishments of the ISS Biotechnology research facility development milestones and maintain a productive and innovative ground and space-based research program in cellular biotechnology and tissue engineering.

Goal 5: Explore the solar system and the universe beyond, understand the origin and evolution of life, and search for evidence of life elsewhere.

Objective 5.1 Learn how the solar system originated and evolved to its current diverse state.

Outcome 5.1.1 *Understand the initial stages of planet and satellite formation.*

APG 4SSE12 Successfully demonstrate progress in understanding the initial stages of planet and satellite formation. Progress towards achieving outcomes will be validated by external review.

Outcome 5.1.2 *Understand the processes that determine the characteristics of bodies in our solar system and how these processes operate and interact.*

APG 4SSE13 Successfully demonstrate progress in studying the processes that determine the characteristics of bodies in our solar system and how these processes operate and interact. Progress towards achieving outcomes will be validated by external review.

Outcome 5.1.3 *Understand why the terrestrial planets are so different from one another.*

APG 4SSE14 Successfully demonstrate progress in understanding why the terrestrial planets are so different from one another. Progress towards achieving outcomes will be validated by external review.

Outcome 5.1.4 *Learn what our solar system can tell us about extra-solar planetary systems.*

APG 4SSE15 Successfully demonstrate progress in learning what our solar system can tell us about extra-solar planetary systems. Progress towards achieving outcomes will be validated by external review.

Objective 5.2 Understand how life begins and evolves and determine the characteristics of the solar system that led to the origin of life.

Outcome 5.2.1 *Determine the nature, history, and distribution of volatile and organic compounds in the solar system.*

APG 4SSE16 Successfully demonstrate progress in determining the nature, history, and distribution of volatile and organic compounds in the solar system. Progress towards achieving outcomes will be validated by external review.

Outcome 5.2.2 *Identify the habitable zones in the solar system.*

APG 4SSE17 Successfully demonstrate progress in identifying the habitable zones in the solar system. Progress towards achieving outcomes will be validated by external review.

Outcome 5.2.3 *Identify the sources of simple chemicals that contribute to pre-biotic evolution and the emergence of life.*

APG 4SSE18 Successfully demonstrate progress in identifying the sources of simple chemicals that contribute to prebiotic evolution and the emergence of life. Progress towards achieving outcomes will be validated by external review.

Outcome 5.2.4 *Study Earth's geologic and biologic records to determine the historical relationship between Earth and its biosphere.*

APG 4SSE19 Successfully demonstrate progress in studying Earth's geologic and biologic records to determine the historical relationship between Earth and its biosphere. Progress towards achieving outcomes will be validated by external review.

Objective 5.3 Understand the current state and evolution of the atmosphere, surface, and interior of Mars.

Outcome 5.3.1 *Characterize the present climate of Mars and determine how it has evolved over time.*

APG 4MEP9 Successfully demonstrate progress in characterizing the present climate of Mars and determining how it has evolved over time. Progress towards achieving outcomes will be validated by external review.

Outcome 5.3.2 *Understand the history and behavior of water and other volatiles on Mars.*

APG 4MEP10 Successfully demonstrate progress in investigating the history and behavior of water and other volatiles on Mars. Progress towards achieving outcomes will be validated by external review.

Outcome 5.3.3 *Understand the chemistry, mineralogy, and chronology of Martian materials.*

APG 4MEP11 Successfully demonstrate progress in studying the chemistry, mineralogy, and chronology of Martian materials. Progress towards achieving outcomes will be validated by external review.

Outcome 5.3.4 Determine the characteristics and dynamics of the interior of Mars.

APG 4MEP12 Successfully demonstrate progress in determining the characteristics and dynamics of the interior of Mars. Progress towards achieving outcomes will be validated by external review.

Objective 5.4 Determine if life exists or has ever existed on Mars.

Outcome 5.4.1 Understand the character and extent of prebiotic chemistry on Mars.

APG 4MEP13 Successfully demonstrate progress in investigating the character and extent of prebiotic chemistry on Mars. Progress towards achieving outcomes will be validated by external review.

Outcome 5.4.2 Search for chemical and biological signatures of past and present life on Mars.

APG 4MEP14 Successfully demonstrate progress in searching for chemical and biological signatures of past and present life on Mars. Progress towards achieving outcomes will be validated by external review.

Objective 5.5 Develop an understanding of Mars in support of future human exploration.

Outcome 5.5.1 Identify and understand the hazards that the Martian environment will present to human explorers.

APG 4MEP15 Successfully demonstrate progress in identifying and studying the hazards that the Martian environment will present to human explorers. Progress towards achieving outcomes will be validated by external review.

Outcome 5.5.2 Inventory and characterize Martian resources of potential benefit to human exploration of Mars.

APG 4MEP16 Successfully demonstrate progress in inventorying and characterizing Martian resources of potential benefit to human exploration of Mars. Progress towards achieving outcomes will be validated by external review.

Objective 5.6 Understand the changing flow of energy and matter throughout the Sun, heliosphere, and planetary environments.

Outcome 5.6.1 Understand the structure and dynamics of the Sun and solar wind and the origins of magnetic variability.

APG 4SEC11 Successfully demonstrate progress in understanding the structure and dynamics of the Sun and solar wind and the origins of magnetic variability. Progress towards achieving outcomes will be validated by external review.

Outcome 5.6.2 Determine the evolution of the heliosphere and its interaction with the galaxy.

APG 4SEC12 Successfully demonstrate progress in determining the evolution of the heliosphere and its interaction with the galaxy. Progress towards achieving outcomes will be validated by external review.

Outcome 5.6.3 Understand the response of magnetospheres and atmospheres to external and internal drivers.

APG 4SEC13 Successfully demonstrate progress in understanding the response of magnetospheres and atmospheres to external and internal drivers. Progress towards achieving outcomes will be validated by external review.

Objective 5.7 Understand the fundamental physical processes of space plasma systems.

Outcome 5.7.1 Discover how magnetic fields are created and evolve and how charged particles are accelerated.

APG 4SEC14 Successfully demonstrate progress in discovering how magnetic fields are created and evolve and how charged particles are accelerated. Progress towards achieving outcomes will be validated by external review.

Outcome 5.7.2 Understand coupling across multiple scale lengths and its generality in plasma systems.

APG 4SEC15 Successfully demonstrate progress in understanding coupling across multiple scale lengths and its generality in plasma systems. Progress towards achieving outcomes will be validated by external review.

Objective 5.8 Learn how galaxies, stars, and planetary systems form and evolve.

Outcome 5.8.1 Learn how the cosmic web of matter organized into the first stars and galaxies and how these evolved into the stars and galaxies we see today.

APG 4ASO9 Successfully demonstrate progress in learning how the cosmic web of matter organized into the first stars and galaxies and how these evolved into the stars and galaxies we see today. Progress towards achieving outcomes will be validated by external review.

Outcome 5.8.2 Understand how different galactic ecosystems of stars and gas formed and which ones might support the existence of planets and life.

APG 4ASO10 Successfully demonstrate progress in understanding how different galactic ecosystems of stars and gas formed and which ones might support the existence of planets and life. Progress towards achieving outcomes will be validated by external review.

Outcome 5.8.3 Learn how gas and dust become stars and planets.

APG 4ASO11 Successfully demonstrate progress in learning how gas and dust become stars and planets. Progress towards achieving outcomes will be validated by external review.

Outcome 5.8.4 Observe planetary systems around other stars and compare their architectures and evolution with our own.

APG 4ASO12 Successfully demonstrate progress in observing planetary systems around other stars and comparing their architectures and evolution with our own. Progress towards achieving outcomes will be validated by external review.

Objective 5.9 Understand the diversity of worlds beyond our solar system and search for those that might harbor life.

Outcome 5.9.1 Characterize the giant planets orbiting other stars.

APG 4ASO13 Successfully demonstrate progress in characterizing the giant planets orbiting other stars. Progress towards achieving outcomes will be validated by external review.

Outcome 5.9.2 Find out how common Earth-like planets are and see if any might be habitable.

APG 4ASO14 Successfully demonstrate progress in finding out how common Earth-like planets are and seeing if any might be habitable. Progress towards achieving outcomes will be validated by external review.

Outcome 5.9.3 Trace the chemical pathways by which simple molecules and dust evolve into the organic molecules important for life.

APG 4ASO15 Successfully demonstrate progress in tracing the chemical pathways by which simple molecules and dust evolve into the organic molecules important for life. Progress towards achieving outcomes will be validated by external review.

Outcome 5.9.4 Develop the tools and techniques to search for life on planets beyond our solar system.

APG 4ASO16 Successfully demonstrate progress in developing the tools and techniques to search for life on planets beyond our solar system. Progress towards achieving outcomes will be validated by external review.

Objective 5.10 Discover what powered the Big Bang and the nature of the mysterious dark energy that is pulling the Universe apart.

Outcome 5.10.1 Search for gravitational waves from the earliest moments of the Big Bang.

APG 4SEU9 Successfully demonstrate progress in searching for gravitational waves from the earliest moments of the Big Bang. Progress towards achieving outcomes will be validated by external review.

Outcome 5.10.2 Determine the size, shape, and matter-energy content of the Universe.

APG 4SEU10 Successfully demonstrate progress in determining the size, shape, and matter-energy content of the Universe. Progress towards achieving outcomes will be validated by external review.

Outcome 5.10.3 Measure the cosmic evolution of dark energy.

APG 4SEU11 Successfully demonstrate progress in measuring the cosmic evolution of the dark energy that controls the destiny of the Universe. Progress towards achieving outcomes will be validated by external review.

Objective 5.11 Learn what happens to space, time, and matter at the edge of a black hole.

Outcome 5.11.1 Determine how black holes are formed, where they are, and how they evolve.

APG 4SEU12 Successfully demonstrate progress in determining how black holes are formed, where they are, and how they evolve. Progress towards achieving outcomes will be validated by external review.

Outcome 5.11.2 Test Einstein's theory of gravity and map space-time near event horizons of black holes.

APG 4SEU13 Successfully demonstrate progress in testing Einstein's theory of gravity and mapping space-time near event horizons of black holes. Progress towards achieving outcomes will be validated by external review.

Outcome 5.11.3 Observe stars and other material plunging into black holes.

APG 4SEU14 Successfully demonstrate progress in observing stars and other material plunging into black holes. Progress towards achieving outcomes will be validated by external review.

Objective 5.12 Understand the development of structure and the cycles of matter and energy in the evolving Universe.

Outcome 5.12.1 Determine how, where, and when the chemical elements were made, and trace the flows of energy and magnetic fields that exchange them between stars, dust, and gas.

APG 4SEU15 Successfully demonstrate progress in determining how, where, and when the chemical elements were made, and tracing the flows of energy and magnetic fields that exchange them between stars, dust, and gas. Progress towards achieving outcomes will be validated by external review.

Outcome 5.12.2 Explore the behavior of matter in extreme astrophysical environments, including disks, cosmic jets, and the sources of gamma-ray bursts and cosmic rays.

APG 4SEU16 Successfully demonstrate progress in exploring the behavior of matter in extreme astrophysical environments, including disks, cosmic jets, and the sources of gamma-ray bursts and cosmic rays. Progress towards achieving outcomes will be validated by external review.

Outcome 5.12.3 Discover how the interplay of baryons, dark matter, and gravity shapes galaxies and systems of galaxies.

APG 4SEU17 Successfully demonstrate progress in discovering how the interplay of baryons, dark matter, and gravity shapes galaxies and systems of galaxies. Progress towards achieving outcomes will be validated by external review.

Objective 5.13 Through robotic and human lunar missions, demonstrate capabilities, including use of lunar and other space resources, for safe, affordable, effective and sustainable human-robotic solar system exploration.

Outcome 5.13.1 Develop capability to conduct robotic lunar test bed missions by 2008 and human lunar missions as early as 2015 but no later than 2020 that can demonstrate exploration systems and architectural approaches, including use of lunar resources, to enable human-robotic exploration across the solar system.

4LE1 Identify and analyze past architecture-definition and trade studies with applicability to lunar human-robotic exploration tests.

Outcome 5.13.2 Conduct robotic missions, in lunar orbit and on the lunar surface, to acquire engineering and environmental data by 2015 required to prepare for human-robotic lunar missions.

Outcome 5.13.3 By 2020, establish through lunar surface missions the building block capabilities to support safe, affordable and effective long-duration human presence beyond low Earth orbit (LEO) as a stepping-stone to sustained human-robotic exploration and discovery beyond the Moon.

Outcome 5.13.4 By 2015, demonstrate new human-robotic space operations capabilities employing advanced in-space infrastructures, including space assembly, maintenance and servicing, and logistics concepts.

Mission III: To Inspire the Next Generation of Explorers

Goal 6: Inspire and motivate students to pursue careers in science, technology, engineering, and mathematics.

Objective 6.1 Increase the number of elementary and secondary students and teachers who are involved in NASA-related education opportunities.

Outcome 6.1.1 *By 2008, increase by 20%, student participation in NASA instructional and enrichment activities.*

APG 4ED1 Develop protocols to establish a baseline of NASA student participation.

APG 4ED2 Develop and implement at least one model program, based on best practices, that engages students in NASA science and technology (inclusive of the science and technical Enterprises).

Outcome 6.1.2 *By 2008, increase by 20%, the number of elementary and secondary educators effectively utilizing NASA content-based STEM materials and programs in the classroom.*

APG 4ED3 Develop protocols to establish a baseline of NASA teacher participation.

APG 4ED4 Develop and implement a model program, based on best practices, that engages teachers in NASA science and technology (inclusive of the science and technical Enterprises).

Outcome 6.1.3 *By 2008, increase by 20%, family involvement in NASA-sponsored elementary and secondary education programs.*

APG 4ED5 Establish a baseline of existing NASA sponsored family involvement activities and existing and potential partners.

APG 4ED6 Using an established best-practices model, implement one NASA-sponsored family involvement component/program at each Center.

Outcome 6.1.4 *By 2008, 90% of NASA elementary and secondary programs are aligned with state or local STEM educational objectives.*

APG 4ED7 Establish a baseline to determine the number of states in which NASA state-based programs are being implemented.

Objective 6.2 Support higher education research capability and opportunities that attract and prepare increasing numbers of students and faculty for NASA-related careers.

Outcome 6.2.1 *By 2008, attain a statistically significant increase in the number and diversity of NASA-supported students graduating in NASA-related fields.*

APG 4ED8 Establish a NASA-wide baseline of the number and diversity of NASA-supported students.

Outcome 6.2.2 *By 2008, attain a statistically significant increase in the number of faculty in higher education institutions who are first-time proposers in NASA research and development opportunities.*

APG 4ED9 Develop an inventory identifying the number of first-time proposers and the universe of faculty in higher education institutions involved with NASA research and development opportunities.

Outcome 6.2.3 *By 2008, increase by 20% the number of higher education institutions that align their NASA research and development activities with STEM teacher preparation departments to improve STEM teacher quality.*

APG 4ED10 Develop a model to demonstrate how NASA's investment in higher education institutions can influence the quality of pre-service education in STEM fields.

Outcome 6.2.4 *By 2008, increase by 10% the number and diversity of students conducting NASA-relevant research.*

APG 4ED11 Develop an infrastructure and funding plan that provides Education sponsored flight research opportunities (including STS, ISS, ELV, balloons, and sounding rockets) for graduate, undergraduate, and selected high school students.

Objective 6.3 Increase the number and diversity of students, teachers, faculty and researchers from underrepresented and underserved communities in NASA related STEM fields.

Outcome 6.3.1 *By 2008, increase by 20%, underrepresented/underserved NASA-sponsored students who pursue academic degrees in NASA-related STEM disciplines.*

APG 4ED12 Develop protocols to establish a baseline of NASA underrepresented/underserved student participation.

APG 4ED13 Develop a model undergraduate program, based on best practices, bridging current programs, that engages underrepresented/underserved students.

Outcome 6.3.2 *By 2008, increase by 20%, the number and diversity of teachers and faculty from underrepresented/underserved communities and institutions who participate in NASA-related STEM programs.*

APG 4ED14 Develop protocols to establish a baseline of NASA underrepresented/underserved teacher/faculty participation in NASA STEM related learning environments.

Outcome 6.3.3 *By 2008, increase by 20% the number of underrepresented/underserved researchers and minority serving institutions that compete for NASA research and development opportunities.*

APG 4ED15 Establish a baseline of the numbers of underserved/underrepresented researchers and minority serving institutions competing for NASA research announcements.

APG 4ED16 Conduct 3 technical assistance workshops.

Outcome 6.3.4 *By 2008, increase family involvement in underrepresented/underserved NASA-sponsored student programs.*

APG 4ED17 Using an established best-practices model, pilot a NASA-sponsored family involvement component in one underrepresented/underserved NASA sponsored student program.

Objective 6.4 Increase student, teacher, and public access to NASA education resources via the establishment of e-Education as a principal learning support system.

Outcome 6.4.1 *By 2008, identify and implement 4 new advanced technology applications that will positively impact learning.*

APG 4ED18 Benchmark advanced technology tools/applications under development to determine the 4-6 with the most impact potential for NASA e-learning.

Outcome 6.4.2 *By 2008, demonstrate the effectiveness of NASA digital content materials in targeted learning environments.*

APG 4ED19 Assess at least 25 of the NASA explorer schools, utilizing the School Technology and Readiness (STaR) tool.

Outcome 6.4.3 *By 2008, establish a technology infrastructure that meets citizen demand for NASA learning services.*

APG 4ED20 Perform a NASA learning services technology infrastructure needs assessment.

Goal 7: Engage the public in shaping and sharing the experience of exploration and discovery.

Objective 7.1 Improve public understanding and appreciation of science and technology, including NASA aerospace technology, research, and exploration missions.

Outcome 7.1.1 *By 2008, establish a national program to engage the informal education community with NASA Science and Technology.*

APG 4ED23 Conduct an opinion survey to baseline public attitudes and knowledge of NASA research and exploration.

Outcome 7.1.2 *By 2008 provide instructional materials derived from NASA research and scientific activities that meet the needs of NASA's informal education partners.*

APG 4ED21 Compile an inventory of existing programs and partnerships to establish a baseline to assess and prioritize high-leverage and critical informal education programs and educational family involvement activities.

Outcome 7.1.3 *By 2008 provide professional development for NASA's informal education partners.*

APG 4ED22 Inventory and assess current NASA professional development programs for relevance to the targeted informal learning environments.

Outcome 7.1.4 *Engage the public in NASA missions, discoveries and technology through public programs, community outreach, mass media, and the Internet.*

APG 4SSE20 Through partnerships with major science museums or planetariums, put on display or on tour major exhibitions or planetarium shows based on Theme content.

APG 4SSE21 Provide materials and technical expertise to support the development of exhibits and programs at science museums and planetariums.

APG 4SSE22 Seek out and capitalize on special events and particularly promising opportunities in the Theme science program to bring space science to and involve the public in the process of scientific discovery.

APG 4ESA6 Provide in public venues at least 50 stories on the scientific discoveries, practical benefits, or new technologies sponsored by the Earth Science Enterprise.

APG 4ESS13 Post the most exciting imagery and explanations about Earth science on the Earth observations/ESE website.

APG 4SFS3 Ensure participation of all space flight programs and Centers in increasing by 10% venues that provide "hands-on" opportunities for the public to experience and become more knowledgeable of space flight benefits and contributions, particularly ISS.

APG 4RPFS8 Increase distribution of the Space Research newsletter by 5,000 over FY03 circulation in order to further educate the general public, industry, and academia on space-based research.

APG 4RPFS9 Through collaboration with PAO, establish and sustain a series of media briefings highlighting OBPR research.

APG 4RPFS10 Expand outreach activities that reach minority and under-represented sectors of the public, through increased participation in conferences and community events that reflect cultural awareness and outreach. Each fiscal year, increase the previous year baseline by supporting at least one new venue that focuses on these public sectors.

APG 4AT16 Partner with external organizations to celebrate the centennial of powered flight highlighting NASA's accomplishments & activities in the advancement of flight.

APG 4AT17 Partner with museums & other cultural organizations and institutions to promote NASA achievements to non-traditional audiences, develop and implement a series of traveling exhibitions highlighting NASA activities, develop and distribute informational material related to accomplishments and plans.

APG 4TS4 Space transportation technical exhibits will be sponsored for at least five events reaching over 50,000 participants to improve public appreciation of the ongoing activities and benefits of NASA's space transportation research and technology development efforts.

APG 4HRT11 Publish and distribute program specific publications (Aerospace Innovations, NASA Tech Briefs, Spinoff) including 1 industry targeted edition, in a sector where NASA can promote its technologies available for commercialization.

APG HRT12 Provide public and industry access to the TechTracS database, which features approximately 18,000 updated and evolving new technologies, as well as technical briefs, diagrams, and illustrations.

Exploration Capabilities

Goal 8: Ensure the provision of space access, and improve it by increasing safety, reliability, and affordability.

Objective 8.1 Assure safe, affordable, and reliable crew and cargo access and return from the International Space Station.

Outcome 8.1.1 *Acquire non-Shuttle, crew and cargo access and return capability for the Station by 2010.*

Objective 8.3 Improve the accessibility of space via the Space Shuttle to better meet Space Station assembly, operations, and research requirements.

Outcome 8.3.1 *Assure public, flight crew, and workforce safety for all Space Shuttle operations and safely meet the manifest and flight rate commitment through completion of Space Station aaembly.*

APG 4SSP1 Implement necessary modifications to the Space Shuttle system for return-to-flight in FY04.

APG 4SSP2 Achieve zero Type-A (damage to property at least $1M or death) or Type-B (damage to property at least $250K or permanent disability or hospitalization of 3 or more persons) mishaps in FY2004.

APG 4SSP3 Achieve 100% on-orbit mission success for all Shuttle missions launched in FY04. For this metric, mission success criteria are those provided to the prime contractor (SFOC) for purposes of determining successful accomplishment of the performance incentive fees in the contract.

Objective 8.4 Assure capabilities for world-class research on a laboratory in low Earth orbit.

Outcome 8.4.1 *Provide a safe, reliable, and well-managed on-orbit research facility.*

APG 4ISS2 Achieve zero Type-A (damage to property at least $1M or death) or Type-B (damage to property at least $250K or permanent disability or hospitalization of 3 or more persons) mishaps in FY2004.

APG 4ISS3 Based on the Space Shuttle return-to-flight plan, establish a revised baseline for ISS assembly (through International Core Complete) and research support.

APG 4ISS4 Provide at least 80% of up-mass, volume and crew-time for science as planned at the beginning of FY04.

Outcome 8.4.2 *Expand the ISS crew size to accommodate U.S. and International Partner research requirements.*

APG 4ISS5 Obtain agreement among the International Partners on the final ISS configuration.

Objective 8.5 Provide services for space communications, rocket propulsion testing, and launch in support of NASA, other government agencies and industry.

Outcome 8.5.1 *Provide safe, well-managed and 95% reliable space communications, rocket propulsion testing, and launch services to meet agency requirements.*

APG 4SFS4 Maintain NASA success rate at or above a running average of 95% for missions on the FY04 Expendable Launch Vehicle (ELV) manifest.

APG 4SFS5 Achieve at least 95% of planned data delivery for the International Space Station, each Space Shuttle mission, and low-Earth orbiting missions in FY04.

APG 4SFS6 Achieve zero Type-A (damage to property at least $1M or death) or Type-B (damage to property at least $250K or permanent disability or hospitalization of 3 or more persons) mishaps in FY2004.

APG 4SFS7 Achieve positive feedback from a minimum of 95% of all rocket propulsion test customers.

APG 4SFS8 Establish the Agency wide baseline space communications architecture, including a framework for possible deep space and near Earth laser communications services.

Goal 9: Extend the duration and boundaries of human space flight to create new opportunities for exploration and discovery.

Objective 9.1 Understand human physiological reactions to reduced gravity and develop countermeasures to assure survival of humans traveling far from Earth.

Outcome 9.1.1 By 2008, develop and test candidate countermeasures using ground-based analysis and space flight.

APG 4BSR8 Use ground-based and space-based research to lessen the risks related to long duration phenomena such as bone loss, physiological adaptation to isolation and confinement, and the biological effects of radiation as described in the Bioastronautics Critical Path Roadmap.

APG 4BSR9 Publish results of Bioastronautics experiments conducted during early ISS Increments (1 through 8) and preliminary results from Increments 9 and 10.

APG 4BSR10 Maintain productive peer-reviewed research program in Biomedical Research and Countermeasures including a National Space Biomedical Research Institute that will perform team-based focused countermeasure-development research.

APG 4SFS10 Certify the medical fitness of all crew members before launch.

Outcome 9.1.2 By 2008, reduce uncertainties in estimating radiation risks by one-half.

APG 4BSR11 Expand the space radiation research science community to involve cutting edge researchers in related disciplines by soliciting, selecting, and funding high quality research.

APG 4BSR12 Complete two experimental campaigns ("runs") using recently completed National Space Radiation Laboratory (NSRL) at Brookhaven National Laboratory (BNL) to measure survival, genetic mutation (mutagenesis), and chromosome aberrations in cells and tissues to improve understanding of the biological effects of the space radiation environment.

APG 4BSR13 Evaluate radiation risks to astronauts by continued and careful analysis of past radiation exposures, results of medical follow up, and comparison with appropriately chosen control population not exposed to similar levels of radiation. Make experimental data available for operational use on ISS and other space-related activities where appropriate.

Outcome 9.1.3 Advance understanding of the role of gravity in biological processes to support biomedical research.

APG 4BSR14 Openly solicit ground-based research in appropriate Fundamental Biology disciplines to lay the ground work for advanced understanding of the role of gravity in biological processes associated with the human health risks of space flight.

APG 4BSR15 Plan for increased early utilization for basic biology research in 2005 to take advantage of evolving ISS capabilities.

APG 4BSR16 Maintain a competitive, productive peer-reviewed research program to advance understanding of the role of gravity in biological processes.

Objective 9.2 Develop new human support systems and solutions to low gravity technological challenges to allow the next generation of explorers to go beyond low earth orbit.

Outcome 9.2.1 Identify & test technologies by 2010 to reduce total mass requirements by a factor of three for Life Support using current ISS mass requirement baseline.

APG 4BSR17 Demonstrate, through vigorous research and technology development, a 50% reduction in the projected mass of a life support flight system compared to the system baselined for ISS.

APG 4HRT14 Demonstrate ground test of a Mobile Intelligent Vehicle Health Management (IVHM) system for internal spacecraft operations that will provide environmental sensing capabilities and knowledge management services. The Mobile IVHM will perform independent calibration checks for environmental sensors; autonomously replace or substitute for failed environmental sensors; hunt down and isolate gas leaks and temperature problems; and provide a range of crew personal data assistant functions.

Outcome 9.2.2 By 2008, develop predictive models for prototype two-phase flow and phase change heat transfer systems for low- and fractional gravity with an efficiency improvement of at least a factor of two over 2003 ISS radiative systems, and prepare ISS experiments for validation.

APG 4PSR8 Increase the current strategic ground research in microgravity heat exchange and advance the existing ISS investigations toward flight.

Outcome 9.2.3 By 2008, develop predictive engineering model and prototype systems to demonstrate the feasibility of deploying enhanced space radiation-shielding multi-functional structures with at least a factor of two improvement in shielding efficiency and mass reduction, and prepare a space experiment for validation.

APG 4PSR9 Extend the available database on radiation effects on materials properties using the newly commissioned NASA Space Radiation Laboratory at Brookhaven.

Objective 9.3 Demonstrate the ability to support a permanent human presence in low Earth orbit as a stepping-stone to human presence beyond.

Outcome 9.3.1 Develop experience in working and living in space by continuously supporting a crew on-board the ISS through 2016.

APG 4ISS6 Continuously sustain a crew to conduct research aboard the ISS.

Objective 9.4. Develop technologies to enable safe, affordable, effective and sustainable human-robotic exploration and discovery beyond low Earth orbit (LEO).

Outcome 9.4.1 Identify, develop and validate human-robotic capabilities by 2015 required to support human-robotic lunar missions.

4HRT1 Formulate guidelines for a top-down strategy-to-task (STT) technology R&D planning process that will facilitate the development of human-robotic exploration systems requirement.

4HRT2 Charter an Operational Advisory Group of technologists and operators to prepare for two systems-focused Quality Function Deployment (QFD) exercises that will take place in FY 2005.

4HRT3 Charter a Technology Transition Team that will review candidate human-robotic exploration systems technologies, and provide detailed updates to human-robotic technology roadmaps.

Outcome 9.4.2 Identify and execute a research and development program to develop technologies by 2015 critical to support human-robotic lunar missions.

4HRT4 Conduct an “Industry Day” by mid-FY 2004 to communicate the Exploration Systems Enterprise vision and processes.

Outcome 9.4.3 By 2016, develop and demonstrate in space nuclear fission-based power and propulsion systems that can be integrated into future human and robotic exploration missions.

4HRT5 Review nuclear propulsion and vehicle systems technology roadmap for alignment with exploration priorities, particularly human-related system and safety requirements.

Outcome 9.4.4 Develop and deliver 1 new critical technology every 2 years in at least each of the following disciplines: in-space computing, space communications and networking, sensor technology, modular systems, and engineering risk analysis.

Objective 9.5. Develop crew transportation systems to enable exploration beyond low Earth orbit (LEO).

Outcome 9.5.1 By 2014, develop and flight-demonstrate a human exploration vehicle that supports safe, affordable and effective transportation and life support for human crews traveling from the Earth to destinations beyond LEO.

4TS1 The Demonstration of Autonomous Rendezvous Technology flight article will be certified for flight demonstration, establishing it as a test platform for demonstrating key technologies required to enable an autonomous (no pilot in the loop) approach to the International Space Station.

4TS2 Conduct full reviews of OSP and NGLT programs, identifying acquisitions strategies, technologies, and lessons learned that are applicable to the new CEV program.

Outcome 9.5.2 By 2010, identify and develop concepts and requirements that could support safe, affordable and effective transportation and life support for human crews traveling from the Earth to the vicinity or the surface of Mars.

4TS3 Compile a document that catalogs major architecture and engineering trade studies of space transportation architectures for human Mars exploration.

Goal 10: Enable revolutionary capabilities through new technology.

Objective 10.1 Improve the capability to assess and manage risk in the synthesis of complex engineering systems.

Outcome 10.1.1 *By 2005 demonstrate 2 prototype systems that prove the feasibility of resilient systems to mitigate risks in key NASA mission domains. Feasibility will be demonstrated by reconfigurability of avionics, sensors, and system performance parameters.*

APG 4HRT7 Develop a Prototype Concept Design Risk Workstation that provides the capability to identify, track, and trade-off risk in the conceptual design phase of missions. The workstation will integrate databases, visualization modules, solicitation routines, system simulations, and analysis programs that support an interactive system design process.

Objective 10.3 Leverage partnerships between NASA Enterprises, U.S. industrial firms, and the venture capital community for innovative technology development.

Outcome 10.3.1 *Promote and develop innovative technology partnerships between NASA, venture capital firms and U.S. industry for the benefit of all Enterprise mission needs, initiating three (3) partnerships per year.*

APG 4HRT8 Establish 3 partnerships with U.S. industry and the investment community using the Enterprise Engine concept.

APG 4HRT9 Develop 36 industry partnerships that will add value to NASA Enterprises.

Outcome 10.3.2 *Facilitate on an annual basis the award of venture capital funds or Phase III contracts to no less than two SBIR firms to further develop or produce their technology through industry or government agencies.*

APG 4HRT10 Achieve through NASBO, the award of Phase III contracts or venture capital funds to 2 SBIR firms to further develop or produce their technology through industry or government agencies.

Objective 10.5 Create novel aeronautics concepts and technology to support science missions and terrestrial and space applications.

Outcome 10.5.1 *Develop technologies that will enable solar powered vehicles to serve as sub-orbital satellites for science missions.*

APG 4AT18 Demonstrate the efficient performance of a flight-prototype regenerative energy storage system in an altitude chamber.

Outcome 10.5.2 *By 2008, develop and demonstrate technologies required for routine Unmanned Aerial Vehicle operations in the National Airspace System above 18,000 feet for High-Altitude, Long-Endurance (HALE) UAVs.*

APG 4AT15 Deliver a validated set of requirements for UAV access at and above FL400, and a preliminary set of requirements for access at and above FL180.

Implementing Strategies to Conduct Well-Managed Programs

Solar System Exploration

APG 4SSE1 Complete all development projects within 110% of the cost and schedule baseline.

APG 4SSE2 Each research project will allocate 75% of its funding competitively during FY04.

APG 4SSE3 SSE will complete all of its missions within 10% of their baseline schedules.

Accomplish key development activities in support of Solar System Exploration:

APG 4SSE4 Successfully launch MESSENGER.

APG 4SSE5 Deliver the Deep Impact spacecraft for Environmental Testing.

APG 4SSE6 Successfully complete the New Horizons/Pluto Critical Design Review (CDR).

Accomplish key technology activities in support of Solar System Exploration:

APG 4SSE7 Define the Level One science goals for the Jupiter Icy Moons Orbiter (JIMO) Mission.

APG 4SSE8 Release an NRA for high capability instruments useful on the JIMO Mission and follow-on Project Prometheus payloads.

APG 4SSE9 Release an NRA for the next New Frontiers Mission.

Mars Exploration Program

APG 4MEP1 Complete all development projects within 110% of the cost and schedule baseline.

APG 4MEP2 Each research project will allocate 75% of its funding competitively during FY04.

APG 4MEP3 MEP will complete all of its missions within 10% of their baseline schedules.

Accomplish key development activities in support of Mars Exploration:

APG 4MEP4 Successfully land at least one of the two Mars Exploration Rovers.

APG 4MEP5 Successfully complete the Level One Requirements for the Mars Exploration Rover Mission.

APG 4MEP6 Successfully complete the 2005 Mars Reconnaissance Orbiter (MRO) Assembly, Test, and Launch Operations (ATLO) Readiness Review.

Accomplish key technology activities in support of Mars Exploration:

APG 4MEP7 Complete Laser Communication Demonstration Concept Review.

APG 4MEP8 Release Instrument Announcement of Opportunity (AO) for the 2009 Mars Science Laboratory (MSL).

Astronomical Search for Origins

APG 4ASO1 Complete all development projects within 110% of the cost and schedule baseline.

APG 4ASO2 Each research project will allocate 75% of its funding competitively during FY04.

APG 4ASO3 ASO will complete all of its missions within 10% of their baseline schedules.

Accomplish key development activities in support of the Astronomical Search for Origins:

APG 4ASO4 Successfully complete Hubble Space Telescope (HST) Cosmic Origins Spectrograph (COS) development.

APG 4ASO5 Successfully complete Stratospheric Observatory For Infrared Astronomy (SOFIA) Observatory Flight Test.

APG 4ASO6 Successfully complete Space Infrared Telescope Facility (SIRTF) In-Orbit Checkout (IOC) and Science Verification.

Accomplish key technology activities in support of the Astronomical Search for Origins:

APG 4ASO7 Establish and freeze James Webb Space Telescope (JWST) System-Level Requirements.

APG 4ASO8 Validate Microarcsecond Metrology (MAM-1) Testbed progress toward interferometer sensor performance for Space Interferometry Mission (SIM).

Structure and Evolution of the Universe

APG 4SEU1 Complete all development projects within 110% of the cost and schedule baseline.

APG 4SEU2 Each research project will allocate 75% of its funding competitively during FY04.

APG 4SEU3 SEU will complete all of its missions within 10% of their baseline schedules.

Accomplish key development activities to advance understanding of the Structure and Evolution of the Universe:

APG 4SEU4 Successfully complete the Gamma-ray Large Area Space Telescope (GLAST) Mission Confirmation Design Review (CDR)

APG 4SEU5 Successfully launch Swift.

APG 4SEU6 Successfully complete Pre-Ship Review of Astro-E2 instruments X-ray Spectrometer (XRS) and X-ray Telescope (XRT).

Accomplish key technology activities to advance understanding of the Structure and Evolution of the Universe:

APG 4SEU7 Begin Formulation/Phase A for the Laser Interferometer Space Antenna (LISA) Mission.

APG 4SEU8 Complete Constellation-X (Con-X) design and fabricate the 8x8 Transition Edge Sensor Array for the X-ray Microcalorimeter Spectrometer.

Sun-Earth Connection

APG 4SEC1 Complete all development projects within 110% of the cost and schedule baseline.

APG 4SEC2 Each research project will allocate 75% of its funding competitively during FY04.

APG 4SEC3 SEC will complete all of its missions within 10% of their baseline schedules.

Accomplish key development activities to advance understanding of the Sun-Earth Connection:

APG 4SEC4 Begin Solar Terrestrial Relations Observatory (STEREO) Integration & Testing (I&T).

APG 4SEC5 Begin Solar Dynamics Observatory (SDO) Implementation.

Accomplish key technology activities to advance understanding of the Sun-Earth Connection:

APG 4SEC6 Release Announcement of Opportunity (AO) for Geospace Missions.

APG 4SEC7 Make AO selections for Magnetospheric Multiscale Mission.

Earth System Science

APG 4ESS1 Complete all development projects within 110% of the cost and schedule baseline.

APG 4ESS2 Each research project will allocate 80% of its funding competitively during FY04.

APG 4ESS3 Each project will complete its mission within 10% of its baseline schedules.

APG 4ESS4 Successfully develop and infuse technologies that will enable future science measurements by 1) advancing 25% of funded technology developments one Technology Readiness Level, and 2) maturing 2-3 technologies to the point where they can be demonstrated in space or in an operational environment.

APG 4ESS5 At least 90% of all on-orbit instruments will be operational during their design lifetimes.

APG 4ESS6 Disseminate data that are easy to access to science focus area customers.

Earth Science Applications

APG 4ESA7 Deliver at least 90% of operating hours for all operations and research facilities.

APG 4ESA8 At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

Biological Sciences Research

APG 4BSR18 Complete all development projects within 110% of the cost and schedule baseline.

APG 4BSR19 At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

Physical Sciences Research

APG 4PSR10 Complete all development projects within 110% of the cost and schedule baseline.

APG 4PSR11 At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

Research Partnerships and Flight Support

APG 4RPFS11 Deliver at least 90% of operating hours for all operations and research facilities.

Aeronautics Technology

APG 4AT1 Complete all development projects within 110% of the cost and schedule baseline.

APG 4AT2 The Theme will allocate 75% of its procurement funding competitively during FY04.

APG 4AT3 The Theme will complete 90% of the major milestones planned for FY04.

Education

APG 4ED24 At least 80%, by budget, of research projects will be peer reviewed and competitively awarded.

Transportation Systems

APG 4TS5 The Theme will distribute at least 80% of its allocated procurement funding to competitively awarded contracts.

Human Robotic Technologies

APG 4HRT13 Distribute at least 80% of allocated procurement funding to competitively awarded contracts, including continuing and new contract activities.

FY 2004 Performance Plan Update

International Space Station

APG 4ISS7 Complete all development projects within 110% of the cost and schedule baseline.

APG 4ISS8 The ISS Program will complete all of its missions within 10% of its baseline schedules.

Space Shuttle Program

APG 4SSP5 Complete all development projects within 110% of the cost and schedule baseline.

APG 4SSP6 Space Shuttle Program will execute its program within 10% of its baseline schedules.

Space and Flight Support

APG 4SFS14 Complete all development projects within 110% of the cost and schedule baseline.

APG 4SFS15 Space and Flight Support will execute its programs within 10% of its baseline schedules.

NASA is undergoing extensive internal programmatic reviews to determine how best to implement the new exploration vision. As a result, the specific goals and milestones for FY 2005 are expected to change.

Mission I: To Understand and Protect our Home Planet

Goal 1: Understand the Earth system and apply Earth system science to improve prediction of climate, weather, and natural hazards.

Objective 1.1 Understand how the Earth is changing, better predict change and understand the consequences for life on Earth.

Outcome 1.1.1 *Enable prediction of polar and global stratospheric ozone recovery (amount and timing) to within 25% by 2014.*

5ESS1 Integrate satellite, suborbital, ground based observations, coupled with laboratory studies and model calculations to assess potential for future ozone depletion in the Arctic. Characterize properties and distributions of clouds and aerosols as they relate to the extinction of solar radiation in the atmosphere. Specific output: first release of validated Aura data. Progress toward achieving outcomes will be validated by external review. See Atmospheric Composition Roadmap

Outcome 1.1.2 *Predict the global distribution of tropospheric ozone and the background concentration in continental near-surface air to within 25% by 2014.*

5ESS1 Integrate satellite, suborbital, ground based observations, coupled with laboratory studies and model calculations to assess potential for future ozone depletion in the arctic. Characterize properties and distributions of clouds and aerosols as they relate to the extinction of solar radiation in the atmosphere. Specific output: first release of validated Aura data. Progress toward achieving outcomes will be validated by external review. See Atmospheric Composition Roadmap.

Outcome 1.1.3 *Enable extension of air quality forecasts for ozone and aerosols from 24 to 72 hours by 2010.*

5ESS1 Integrate satellite, suborbital, ground based observations, coupled with laboratory studies and model calculations to assess potential for future ozone depletion in the arctic. Characterize properties and distributions of clouds and aerosols as they relate to the extinction of solar radiation in the atmosphere. Specific Output: first release of validated Aura data. Progress will be validated by external review. See Atmospheric Composition Roadmap.

Outcome 1.1.4 *Use satellite data to help enable decreased hurricane landfall uncertainty from +/- 400 km to +/- 100 km in the three-day forecasts by 2010.*

5ESS2 Improve predictive capabilities of regional models using satellite-derived localized temperature and moisture profiles and ensemble modeling. Progress toward achieving outcomes will be validated by external review. See Weather Roadmap.

Outcome 1.1.5 *Use satellite data to help extend more accurate regional weather forecasting from 3 days to 5 days by 2010.*

5ESS2 Improve predictive capabilities of regional models using satellite-derived localized temperature and moisture profiles and ensemble modeling. Progress toward achieving outcomes will be validated by external review. See Weather Roadmap.

Outcome 1.1.6 *Develop projections of future atmospheric concentrations of carbon dioxide and methane for 10-100 years into the future with improvements in confidence of >50% by 2014.*

5ESS3 Reduce land cover errors in ecosystem and carbon cycle models, and quantify global terrestrial and marine primary productivity and its interannual variability. Specific output: Produce a multi-year global inventory of fire occurrence and extent. Progress toward achieving outcomes will be validated by external review. See Carbon Cycles and Ecosystems Roadmap.

Outcome 1.1.7 *By 2014, develop in partnership with other agencies, credible ecological forecasts that project the sensitivities of terrestrial and aquatic ecosystems to global environmental changes for resource management and policy-related decision-making.*

5ESS4 Reduce land cover errors in ecosystem and carbon cycle models, and quantify global terrestrial and marine primary productivity and its interannual variability. Specific Output: Release first synthesis of results from research on the effects of deforestation and agricultural land use in Amazonia. Progress toward achieving outcomes will be validated by external review. See Carbon Cycle and Ecosystems Roadmap.

Outcome 1.1.8 *Report changes in global land cover, productivity, and carbon inventories with accuracies sufficient for use in the food industry, in evaluating resource management activities, and in verifying inventories of carbon emissions and storage.*

5ESS5 Reduce land cover errors in ecosystem and carbon cycle models, and quantify global terrestrial and marine primary productivity and its interannual variability. Specific output: Improve knowledge of processes affecting carbon flux within the coastal zone, as well as sources and sinks of aquatic carbon, to reduce uncertainty in North American carbon models. Progress toward achieving outcomes will be validated by external review. See Carbon Cycle and Ecosystems Roadmap.

Outcome 1.1.9 *Enable development of seasonal precipitation forecasts with > 75% accuracy by 2014.*

5ESS6 Enhance land surface modeling efforts, which will lead to improved estimates of soil moisture and run-off. Specific output: launch Cloudsat. Progress toward achieving outcomes will be validated by external review. See Water and Energy Cycle Roadmap.

Outcome 1.1.10 *Improve estimates of the global water and energy cycles by 2012 to enable balancing of the global and regional water and energy budgets to within 10%.*

5ESS6 Enhance land surface modeling efforts, which will lead to improved estimates of soil moisture and run-off. Specific output: launch Cloudsat. Progress toward achieving outcomes will be validated by external review. See Water and Energy Cycle Roadmap.

Outcome 1.1.11 *Reduce uncertainty in global sea level change projections by 50% by the year 2014, and include regional estimates of deviation from global mean.*

5ESS7 Assimilate satellite/in situ observations into variety of ocean, atmosphere, and ice models for purposes of state estimation; provide experimental predictions on variety of climatological timescales; determine plausibility of these predictions using validation strategies. Specific output: documented assessment of relative impact of different climate forcings on long-term climate change and climate sensitivities to those various forcings. See Climate, Variability and Change Roadmap.

Outcome 1.1.12 *Enable 10-year or longer climate forecasts by the year 2014 with a national climate modeling framework capable of supporting policy decision-making at regional levels.*

5ESS8 Assimilate satellite/in situ observations into variety of ocean, atmosphere, and ice models for purposes of state estimation; provide experimental predictions on variety of climatological timescales; determine plausibility of these predictions using validation strategies. Specific output: An assimilated product of ocean state on a quarter degree grid. See Climate, Variability and Change roadmap.

Outcome 1.1.13 *Enable 30-day volcanic eruption forecasts with > 50% confidence by 2014.*

5ESS9 Advance understanding of surface change through improved geodetic reference frame, estimates of mass flux from satellite observations of Earth's gravitational and magnetic fields, and airborne and spaceborne observations of surface height and deformation. Progress toward achieving outcomes will be validated by external review. See Earth Surface and Interior Roadmap.

Outcome 1.1.14 *Enable estimation of earthquake likelihood in North American plate boundaries with > 50% confidence by 2014.*

5ESS9 Advance understanding of surface change through improved geodetic reference frame, estimates of mass flux from satellite observations of Earth's gravitational and magnetic fields, and airborne and spaceborne observations of surface height and deformation. Progress toward achieving outcomes will be validated by external review. See Earth Surface and Interior Roadmap.

Objective 1.2 Expand and accelerate the realization of economic and societal benefits from Earth science, information, and technology.

Outcome 1.2.1 *By 2012, benchmark the assimilation of observations (geophysical parameters, climate data records) provided from 20 of the 80 remote sensing systems deployed on the flotilla of 18-22 NASA Earth observation research satellites.*

5ESA1 Crosscutting Solutions: Work within the Joint Agency Committee on Imagery Evaluation and the Commercial Remote Sensing Policy Working Group through partnerships with NIMA, USGS, NOAA, and USDA to verify/validate at least two commercial remote sensing sources/products for Earth science research, specifically with respect to land use/land cover observations for carbon cycle and water cycle research.

5ESA2 National Apps: Benchmark measurable enhancements to at least 2 national decision support systems using NASA results, specifically in the Disaster Management and Air Quality communities. These projects will benchmark the use of observations from 5 sensors from NASA research satellites.

5ESA3 Crosscutting Solutions: Expand DEVELOP (Digital Earth Virtual Environment and Learning Outreach Project) human capital development program to increase the capacity for the Earth science community at a level of 100 program graduates per year and perform significant student-led activities using NASA research results for decision support with representation in 30 states during the fiscal year.

5ESA4 Crosscutting Solutions: Benchmark solutions from at least 5 projects that were selected in FY03 REASoN program to serve national applications through projects that support decision support in areas such as agriculture, public health and water quality. These projects will benchmark use of observations from at least 5 sensors from NASA research satellites.

Outcome 1.2.2 *By 2012, benchmark the assimilation of 5 specific types of predictions resulting from Earth Science Model Framework (ESMF) of 22 NASA Earth system science models.*

5ESA5 The DEVELOP (Digital Earth Virtual Environment and Learning Outreach Project) program will advance the capacity of our future workforce with students from at least 20 states working to develop and deliver benchmark results of at least 4 rapid prototype projects using NASA Earth science research results in decision support tools for state, local and tribal government applications.

5ESA6 Crosscutting Solutions: Benchmark solutions associated with at least 5 decision support systems that assimilate predictions from Earth system science models (e.g. GISS, GFDL, NCEP, SpoRT, and the Earth Science laboratories).

Outcome 1.2.3 *By 2012, benchmark the assimilation of observations and predictions resulting from NASA Earth Science research in 8-10 decision support systems serving national priorities and the missions of federal agencies.*

5ESA7 National applications: Benchmark enhancements to at least 2 national decision support systems using NASA results, specifically in the Disaster Management, Public Health, and Air Quality communities. These projects will benchmark the use of observations from 5 sensors from NASA research satellites.

5ESA8 Crosscutting Solutions: Verify and validate solutions for at least 5 decision support systems in areas of national priority associated with the FY03 selected REASoN projects.

Objective 1.3 Understand the origins and societal impacts of variability in the Sun-Earth connection.

Outcome 1.3.1 *Develop the capability to predict solar activity and the evolution of solar disturbances as they propagate in the heliosphere and affect the Earth.*

5SEC2 Successfully complete Solar Dynamics Observatory (SDO) Critical Design Review (CDR).

5SEC3 Successfully complete THEMIS Critical Design Review (CDR).

5SEC6 Successfully demonstrate progress in developing the capability to predict solar activity and the evolution of solar disturbances as they propagate in the heliosphere and affect the Earth. Progress towards achieving outcomes will be validated by external review.

Outcome 1.3.2 *Specify and enable prediction of changes to the Earth's radiation environment, ionosphere, and upper atmosphere.*

5SEC4 Complete Announcement of Opportunity (AO) Selection for Geospace Missions far ultraviolet Imager

5SEC7 Successfully demonstrate progress in specifying and enabling prediction of changes to the Earth's radiation environment, ionosphere, and upper atmosphere. Progress towards achieving outcomes will be validated by external review.

Outcome 1.3.3 *Understand the role of solar variability in driving space climate and global change in the Earth's atmosphere.*

5SEC8 Successfully demonstrate progress in understanding the role of solar variability in driving space climate and global change in the Earth's atmosphere. Progress towards achieving outcomes will be validated by external review.

Objective 1.4 Catalog and understand potential impact hazards to Earth from space.

Outcome 1.4.1 *By 2008, inventory at least 90 percent of asteroids and comets larger than 1 km in diameter that could come near Earth.*

5SSE5 Successfully demonstrate progress in determining the inventory and dynamics of bodies that may pose an impact hazard to Earth. Progress towards achieving outcomes will be validated by external review.

Outcome 1.4.2 *Determine the physical characteristics of comets and asteroids relevant to any threat they may pose to Earth.*

5SSE1 Successfully launch Deep Impact.

5SSE6 Successfully demonstrate progress in determining the physical characteristics of comets and asteroids relevant to any threat they may pose to Earth. Progress towards achieving outcomes will be validated by external review.

Goal 2: Enable a safer, more secure, efficient, and environmentally friendly air transportation system.

Objective 2.1 Decrease the aircraft fatal accident rate, reduce the vulnerability of the air transportation system to hostile threats, and mitigate the consequences of accidents and hostile acts.

Outcome 2.1.1 *By 2005, research, develop, and transfer technologies that will enable the reduction of the aviation fatal accident rate by 50% from the FY 1991-1996 average.*

5AT1 Evaluate and flight validate selected next generation cockpit weather information, communications, airborne weather reporting, turbulence prediction and warning technologies, Synthetic Vision System and Runway Incursion Prevention System display concepts. The flight demonstration will illustrate the increased safety of integrating selected concepts in support of fleet implementation decisions. (AvSSP)

5AT2 Demonstrate through applications and simulations safety-improvement systems that will illustrate the increased safety of integrating selected concepts in support of fleet implementation decisions. (AvSSP)

Outcome 2.1.2 *By 2009, research, develop & transfer technologies that will reduce the vulnerability exposure of the aircraft, and reduce the vulnerabilities of other components in the air transportation system.*

5AT3 Create and establish a prototype data collection system for confidential, non-punitive reporting on aviation security by functional personnel in the aviation system.

5AT16 Develop a preliminary joint research plan with the Transportation Security Administration (TSA). (AvSSP)

Objective 2.2 Protect local and global environmental quality by reducing aircraft noise and emissions.

Outcome 2.2.1 *By 2007, develop, demonstrate and transfer technologies that enable a reduction by half, in community noise due to aircraft, based on the 1997 state of the art.*

5AT4 Using laboratory data and systems analysis, complete selection of the technologies that show the highest potential for reducing commercial air transportation noise by at least 50%.(Vehicle Systems)

Outcome 2.2.2 *By 2007, develop, demonstrate and transfer technologies for reducing NOx emission by 70% from the 1996 ICAO standard, to reduce smog and lower atmospheric ozone.*

5AT5 Demonstrate 70% reduction NOx emissions in full-annular rig tests of candidate combustor configurations for large subsonic vehicle applications (Vehicle Systems).

Outcome 2.2.3 *By 2007, develop, demonstrate and transfer technologies for reducing the green-house gas, CO2, emissions by 25% based on the state of the art for airframe and engine component technologies in 2000.*

5AT6 Based on laboratory data and systems analysis, select unconventional engine or power systems for technology development that show highest potential for reducing CO2 emissions and/or enabling advanced air vehicles for new scientific missions. (Vehicle Systems)

5AT7 Complete laboratory aerodynamic assessment of low-drag slotted wing concept. (Vehicle Systems)

5AT19 Complete supersonic inlet design requirements study that will identify technology gaps and priorities required for design of future efficient long range supersonic propulsion systems. (Vehicle Systems)

5AT27 Demonstrate through sector testing a full scale CMC turbine vane that will reduce cooling flow requirements and thus fuel burn in future turbine engine system designs. (Vehicle Systems)

Objective 2.3 Enable more people and goods to travel faster and farther, with fewer delays.

Outcome 2.3.2 *By 2005, develop, demonstrate and transfer key enabling capabilities for a small aircraft transportation system.*

5AT10 Complete experimental validation of airborne systems with concept vehicle development

Outcome 2.3.3 *By 2009, develop, demonstrate, and transfer technologies that enable a further 5% increase in throughput in the terminal area and a further 10% increase in en route throughput based on 1997 NAS capacity.*

5AT8 Complete development of WakeVAS concept of operations and downselect WakeVAS architecture.

5AT9 Complete human-in-the-loop concept and technology evaluation of shared separation. (Airspace Systems)

5AT11 Complete analysis of capacity-increasing operational concepts and technology roadmaps with VAST models, simulations, and Common Scenario Set. (Airspace Systems)

5AT12 Develop display guidelines that exploit new understanding of perceptual systems and cognitive and physiological determinants of human performance. (Airspace Systems)

5AT13 Establish the fluid dynamics mechanism for alleviating wake through experimental and computational fluid mechanics studies. (Airspace Systems)

5AT14 Complete System-Wide Evaluation and Planning Tool initial simulation and field demonstration. (Airspace Systems)

5AT15 Complete communications, navigation, and surveillance requirements analysis. (Airspace Systems)

5AT22 Using laboratory data and systems analysis, complete selection of the technologies that show the highest potential for reducing takeoff/landing field length while maintaining cruise Mach, low speed controllability and low noise. (Vehicle Systems)

Goal 3: Create a more secure world and improve the quality of life by investing in technologies and collaborating with other agencies, industry, and academia.

Objective 3.1 Enhance the Nation's security through partnerships with DoD, the Department of Homeland Security and other U.S. or international government agencies.

Outcome 3.1.3 *By 2012, in partnership with the Department of Homeland Security, the Department of Defense, and the Department of State, deliver 15 observations and 5 model predictions for climate change, weather prediction and natural hazards to national and global organizations and decision-makers to evaluate 5 scenarios and optimize the use of Earth resources (food, water, energy, etc.) for homeland security, environmental security and economic security.*

5ESA9 Benchmark the use of predictions from 2 NASA Earth system science models (including the GISS 1200 and NCEP weather prediction) for use in national priorities, such as support for the Climate Change Science Program (CCSP) and Climate Change Technology Program (CCTP) and the NOAA National Weather Service.

5ESA10 Benchmark the use of observations and predictions of Earth science research results in 2 scenarios assessment tools, such as tools used by the Environmental Protection Agency (specifically in the Community Multi-scale and Air Quality (CMAQ) Improvement Program tools) and the Department of Energy.

Outcome 3.1.4 *Demonstrate effective international collaboration on the International Space Station.*

5ISS1 In concert with the ISS International Partners, extend a continuous two-person (or greater) crew presence on the ISS through the end of FY2004.

Outcome 3.1.5 *Transfer technology both to and from the Department of Defense.*

5AT17 Complete NASA / Industry / DoD studies of heavy-lift Vertical Take Off and Landing (VTOL) configurations to provide strategic input for future decisions on commercial / military Runway Independent Vehicles. (Vehicle Systems)

Objective 3.2 Improve the Nation's economic strength and quality of life by facilitating innovative use of NASA technology.

Outcome 3.2.1 *On an annual basis, develop 50 new technology transfer agreements with the Nation's industrial and entrepreneurial sectors.*

5HRT18 Complete 50 technology transfer agreements with the U.S. private sector for the transfer of NASA technologies, through hardware licenses, software usage agreements, facility usage agreements or Space Act Agreements.

Outcome 3.2.2 *By 2008, realign commercial product development to focus on NASA needs, while maintaining industrial partnerships.*

5RPFS1 Implement SPD realignment plan by establishing three partnerships between SPD and other divisions of OBPR.

5RPFS2 Involve RPC industrial partners in at least one new project that directly benefits NASA's mission.

Outcome 3.2.3 *By 2008, develop and test at least two design tools for advanced materials and in-space fabrication, and validate on ISS.*

5RPFS3 Based on present manifest, begin on-orbit containerless processing of new ceramic materials using Space-DRUMS hardware installed on ISS.

Outcome 3.2.4 *By 2008, working with all OBPR research organizations and other NASA enterprises, identify at least three additional users of Research Partnership Center spaceflight hardware.*

5RPFS4 Promote availability of RPC-built spaceflight hardware throughout NASA utilizing the new database.

5RPFS5 Implement hardware sharing system.

5RPFS6 Identify and develop a working relationship with at least one new non-SPD user of RPC-built spaceflight hardware.

Outcome 3.2.5 *By 2008, increase by 30% (from the 2003 level) the utilization of NASA/OBPR-derived technologies by other agencies, private sector, and academia to advance basic and applied research goals of practical impact.*

5PSR1 Develop a multi-agency collaboration for research at the interface between the physical and life sciences, and enhance collaborative efforts with other agencies and the private sector on biotechnology, materials research, and optical diagnostics for health research.

Objective 3.3 Resolve scientific issues in the low gravity environment of space that enrich life on Earth by leading to better design tools in energy, materials, medical, and communication technologies.

Outcome 3.3.1 *By 2008, analyze the impact of the results of the first phase of ISS and ground-based research in Biotechnology, fundamental science, and engineering to demonstrate the introduction of at least two new design tools and/or process improvements to existing technologies and industrial practices.*

5PSR2 Continue a productive ground and flight-based research program in Combustion, Fluid Physics, Biotechnology, and Materials science, and carry out the milestones for all ISS research projects.

Outcome 3.3.2 *By 2008, quantitatively assess the impact of space and ground-based research on fire safety hazard prevention and containment and on energy conversion to demonstrate measurable risk reduction and increased efficiency.*

5PSR3 Publish the results of STS-107 investigations based on available data in microgravity combustion research, and maintain a productive ground and flight-based program in fundamental and strategic combustion and reactive flows research.

Outcome 3.3.3 *By 2008, develop at least three new leveraged research partnerships with industry, academia, and other government agencies that improve NASA spacecraft safety.*

5RPFS7 Develop a prototype system based on one new enabling technology to improve the safety of space transportation systems

Mission II: To Explore the Universe and Search for Life

Goal 4: Explore the fundamental principles of physics, chemistry, and biology through research in the unique natural laboratory of space.

Objective 4.1 Determine how fundamental biological processes of life respond to gravity and space environments.

Outcome 4.1.1 *Use ground-based simulators and ISS to determine gravity responses for at least five model organisms by 2008.*

5BSR1 Solicit ground-based research on three widely studied model organisms.

5BSR2 Implement a tactical plan for plant research and solicit studies appropriate to that plan on at least two model plant species.

Outcome 4.1.2 *Develop predictive models of cellular, pathogenic, and ecological responses to space for at least two organisms by 2008.*

5BSR3 Solicit ground-based research on responses of cells and pathogens to space environments.

5BSR4 Initiate intra- and interagency programs to study microbial ecology and evolution

Outcome 4.1.3 *By 2008, structure the Fundamental Space Biology flight research program to emphasize at least five model organisms and teams of Principal Investigators.*

5BSR5 Develop selected flight research experiments on two model organisms in coordination with research teams for identified flight opportunities.

5BSR6 Align reprioritized fundamental biology flight experiments with available hardware and hardware development.

Objective 4.2 Expand understanding of fundamental physical processes and insight into the laws of nature through space-based investigation.

Outcome 4.2.1 *By 2008, complete the first generation of ISS research in colloidal physics and soft condensed matter and demonstrate the ability to control the colloidal engineering of at least two different model structures.*

5PSR4 Continue flight and ground-based research in colloidal physics and soft-condensed matter, and accomplish the project milestones for the ISS research program in fluid physics.

Outcome 4.2.2 *By 2008, complete the design and fabrication of the first ISS fundamental microgravity physics facility to allow the performance of two capstone investigations in dynamical critical phenomena.*

5PSR5 Continue the development of the ISS fundamental physics facility for low temperature and condensed matter physics, and maintain a productive ground-based research program in condensed matter physics.

Outcome 4.2.3 *By 2008, complete the design for the ISS laser-cooling laboratory and demonstrate the feasibility to deploy the most accurate atomic clock in space.*

5PSR6 Continue the development of the ISS laser cooling and atomic facility by accomplishing the project milestones, and maintain an innovative and outstanding ground research program in atomic and gravitational physics.

Outcome 4.2.4 *By 2008, complete the first phase of the ISS biotechnology facility and demonstrate cellular biotechnology research throughput increase by a factor of two.*

5PSR7 Continue the development of the ISS Biotechnology Facility and maintain a productive and innovative ground and space research program in cellular biotechnology and tissue engineering.

Goal 5: Explore the solar system and the universe beyond, understand the origin and evolution of life, and search for evidence of life elsewhere.

Objective 5.1 Learn how the solar system originated and evolved to its current diverse state.

Outcome 5.1.1 Understand the initial stages of planet and satellite formation.

5SSE2 Complete integration and testing for New Horizons/Pluto.

5SSE4 Release a NASA Research Announcement (NRA) for In Space Power and Propulsion technology development activities (NOTE: this APG could potentially support multiple SSE research focus areas).

5SSE7 Successfully demonstrate progress in understanding the initial stages of planet and satellite formation. Progress towards achieving outcomes will be validated by external review.

Outcome 5.1.2 Understand the processes that determine the characteristics of bodies in our solar system and how these processes operate and interact.

5SSE8 Successfully demonstrate progress in studying the processes that determine the characteristics of bodies in our solar system and how these processes operate and interact. Progress towards achieving outcomes will be validated by external review.

Outcome 5.1.3 Understand why the terrestrial planets are so different from one another.

5SSE9 Successfully demonstrate progress in understanding why the terrestrial planets are so different from one another. Progress towards achieving outcomes will be validated by external review.

Outcome 5.1.4 Learn what our solar system can tell us about extra-solar planetary systems.

5SSE10 Successfully demonstrate progress in learning what our solar system can tell us about extra-solar planetary systems. Progress towards achieving outcomes will be validated by external review.

Objective 5.2 Understand how life begins and evolves and determine the characteristics of the solar system that led to the origin of life.

Outcome 5.2.1 Determine the nature, history, and distribution of volatile and organic compounds in the solar system.

5SSE3 Select the next New Frontiers mission (NOTE: this APG could potentially support multiple SSE research focus areas).

5SSE11 Successfully demonstrate progress in determining the nature, history, and distribution of volatile and organic compounds in the solar system. Progress towards achieving outcomes will be validated by external review.

Outcome 5.2.2 Identify the habitable zones in the solar system.

5SSE12 Successfully demonstrate progress in identifying the habitable zones in the solar system. Progress towards achieving outcomes will be validated by external review.

Outcome 5.2.3 Identify the sources of simple chemicals that contribute to pre-biotic evolution and the emergence of life.

5SSE13 Successfully demonstrate progress in identifying the sources of simple chemicals that contribute to prebiotic evolution and the emergence of life. Progress towards achieving outcomes will be validated by external review.

Outcome 5.2.4 Study Earth's geologic and biologic records to determine the historical relationship between Earth and its biosphere.

5SSE14 Successfully demonstrate progress in studying Earth's geologic and biologic records to determine the historical relationship between Earth and its biosphere. Progress towards achieving outcomes will be validated by external review.

Objective 5.3 Understand the current state and evolution of the atmosphere, surface, and interior of Mars.

Outcome 5.3.1 Characterize the present climate of Mars and determine how it has evolved over time.

5MEP5 Successfully complete the Mission Concept Review and PMSR for the 2009 Mars Telesat Orbiter (NOTE: this APG supports all MEP research focus areas).

5MEP7 Successfully demonstrate progress in characterizing the present climate of Mars and determine how it has evolved over time. Progress towards achieving outcomes will be validated by external review.

Outcome 5.3.2 Understand the history and behavior of water and other volatiles on Mars.

5MEP1 Successfully complete Assembly, Test, and Launch Operations (ATLO) for the Mars Reconnaissance Orbiter mission.

5MEP2 Successfully launch the Mars Reconnaissance Orbiter.

5MEP8 Successfully demonstrate progress in investigating the history and behavior of water and other volatiles on Mars. Progress towards achieving outcomes will be validated by external review.

Outcome 5.3.3 Understand the chemistry, mineralogy, and chronology of Martian materials.

5MEP9 Successfully demonstrate progress in studying the chemistry, mineralogy, and chronology of Martian materials. Progress towards achieving outcomes will be validated by external review.

Outcome 5.3.4 Determine the characteristics and dynamics of the interior of Mars.

5MEP10 Successfully demonstrate progress in determining the characteristics and dynamics of the interior of Mars. Progress towards achieving outcomes will be validated by external review.

Objective 5.4 Determine if life exists or has ever existed on Mars.

Outcome 5.4.1 Understand the character and extent of prebiotic chemistry on Mars.

5MEP4 Successfully complete the Preliminary Mission System Review (PMSR) for the 2009 Mars Science Laboratory (MSL) Mission.

5MEP6 Successfully complete Preliminary Design Review (PDR) for Laser Communication Demonstration (NOTE: this APG supports all MEP research focus areas).

5MEP11 Successfully demonstrate progress in investigating the character and extent of prebiotic chemistry on Mars. Progress towards achieving outcomes will be validated by external review.

Outcome 5.4.2 Search for chemical and biological signatures of past and present life on Mars.

5MEP3 Complete science instrument selections for the 2009 Mars Science Laboratory (MSL).

5MEP12 Successfully demonstrate progress in searching for chemical and biological signatures of past and present life on Mars. Progress towards achieving outcomes will be validated by external review.

Objective 5.5 Develop an understanding of Mars in support of future human exploration.

Outcome 5.5.1 Identify and understand the hazards that the Martian environment will present to human explorers.

5MEP13 Successfully demonstrate progress in identifying and studying the hazards that the Martian environment will present to human explorers. Progress towards achieving outcomes will be validated by external review.

Outcome 5.5.2 Inventory and characterize Martian resources of potential benefit to human exploration of Mars.

5MEP14 Successfully demonstrate progress in inventorying and characterizing Martian resources of potential benefit to human exploration of Mars. Progress towards achieving outcomes will be validated by external review.

Objective 5.6 Understand the changing flow of energy and matter throughout the Sun, heliosphere, and planetary environments.

Outcome 5.6.1 Understand the structure and dynamics of the Sun and solar wind and the origins of magnetic variability.

5SEC1 Complete Solar Terrestrial Relations Observatory (STEREO) instrument integration.

5SEC9 Successfully demonstrate progress in understanding the structure and dynamics of the Sun and solar wind and the origins of magnetic variability. Progress towards achieving outcomes will be validated by external review.

Outcome 5.6.2 Determine the evolution of the heliosphere and its interaction with the galaxy.

5SEC10 Successfully demonstrate progress in determining the evolution of the heliosphere and its interaction with the galaxy. Progress towards achieving outcomes will be validated by external review.

Outcome 5.6.3 Understand the response of magnetospheres and atmospheres to external and internal drivers.

5SEC11 Successfully demonstrate progress in understanding the response of magnetospheres and atmospheres to external and internal drivers. Progress towards achieving outcomes will be validated by external review.

Objective 5.7 Understand the fundamental physical processes of space plasma systems.

Outcome 5.7.1 Discover how magnetic fields are created and evolve and how charged particles are accelerated.

5SEC12 Successfully demonstrate progress in discovering how magnetic fields are created and evolve and how charged particles are accelerated. Progress towards achieving outcomes will be validated by external review

Outcome 5.7.2 Understand coupling across multiple scale lengths and its generality in plasma systems.

5SEC13 Successfully demonstrate progress in understanding coupling across multiple scale lengths and its generality in plasma systems. Progress towards achieving outcomes will be validated by external review

Objective 5.8 Learn how galaxies, stars, and planetary systems form and evolve.

Outcome 5.8.1 Learn how the cosmic web of matter organized into the first stars and galaxies and how these evolved into the stars and galaxies we see today.

5ASO4 Demonstrate James Webb Space Telescope (JWST) primary mirror technology readiness by testing a prototype in a flight-like environment.

5ASO5 Successfully demonstrate progress in learning how the cosmic web of matter organized into the first stars and galaxies and how these evolved into the stars and galaxies we see today. Progress towards achieving outcomes will be validated by external review.

Outcome 5.8.2 Understand how different galactic ecosystems of stars and gas formed and which ones might support the existence of planets and life.

5ASO6 Successfully demonstrate progress in understanding how different galactic ecosystems of stars and gas formed and which ones might support the existence of planets and life. Progress towards achieving outcomes will be validated by external review.

Outcome 5.8.3 Learn how gas and dust become stars and planets.

5ASO7 Successfully demonstrate progress in learning how gas and dust become stars and planets. Progress towards achieving outcomes will be validated by external review.

Outcome 5.8.4 Observe planetary systems around other stars and compare their architectures and evolution with our own.

5ASO3 Demonstrate system-level instrument pointing precision consistent with SIM's flight system basic performance requirements, as specified in program plan.

5ASO8 Successfully demonstrate progress in observing planetary systems around other stars and comparing their architectures and evolution with our own. Progress towards achieving outcomes will be validated by external review.

Objective 5.9 Understand the diversity of worlds beyond our solar system and search for those that might harbor life.

Outcome 5.9.1 Characterize the giant planets orbiting other stars.

5ASO9 Successfully demonstrate progress in characterizing the giant planets orbiting other stars. Progress towards achieving outcomes will be validated by external review.

Outcome 5.9.2 Find out how common Earth-like planets are and see if any might be habitable.

5ASO2 Successfully complete the Kepler mission Preliminary Design Review (PDR).

5ASO10 Successfully demonstrate progress in finding out how common Earth-like planets are and seeing if any might be habitable. Progress towards achieving outcomes will be validated by external review.

Outcome 5.9.3 Trace the chemical pathways by which simple molecules and dust evolve into the organic molecules important for life.

5ASO1 Deliver the SOFIA Airborne Observatory to Ames Research Center for final testing.

5ASO11 Successfully demonstrate progress in tracing the chemical pathways by which simple molecules and dust evolve into the organic molecules important for life. Progress towards achieving outcomes will be validated by external review.

Outcome 5.9.4 Develop the tools and techniques to search for life on planets beyond our solar system.

5ASO12 Successfully demonstrate progress in developing the tools and techniques to search for life on planets beyond our solar system. Progress towards achieving outcomes will be validated by external review.

Objective 5.10 Discover what powered the Big Bang and the nature of the mysterious dark energy that is pulling the Universe apart.

Outcome 5.10.1 Search for gravitational waves from the earliest moments of the Big Bang.

5SEU4 Successfully demonstrate progress in search for gravitational waves from the earliest moments of the Big Bang. Progress towards achieving outcomes will be validated by external review.

Outcome 5.10.2 Determine the size, shape, and matter-energy content of the Universe.

5SEU5 Successfully demonstrate progress in determining the size, shape, and matter-energy content of the universe. Progress towards achieving outcomes will be validated by external review.

Outcome 5.10.3 Measure the cosmic evolution of dark energy.

5SEU6 Successfully demonstrate progress in measuring the cosmic evolution of the dark energy, which controls the destiny of the universe. Progress towards achieving outcomes will be validated by external review

Objective 5.11 Learn what happens to space, time, and matter at the edge of a black hole.

Outcome 5.11.1 Determine how black holes are formed, where they are, and how they evolve.

5SEU7 Successfully demonstrate progress in determining how black holes are formed, where they are, and how they evolve. Progress towards achieving outcomes will be validated by external review.

Outcome 5.11.2 Test Einstein's theory of gravity and map space-time near event horizons of black holes.

5SEU8 Successfully demonstrate progress in testing Einstein's theory of gravity and mapping space-time near event horizons of black holes. Progress towards achieving outcomes will be validated by external review.

Outcome 5.11.3 Observe stars and other material plunging into black holes.

5SEU9 Successfully demonstrate progress in observing stars and other material plunging into black holes. Progress towards achieving outcomes will be validated by external review.

Objective 5.12 Understand the development of structure and the cycles of matter and energy in the evolving Universe.

Outcome 5.12.1 Determine how, where, and when the chemical elements were made, and trace the flows of energy and magnetic fields that exchange them between stars, dust, and gas.

5SEU10 Successfully demonstrate progress in determining how, where, and when the chemical elements were made, and tracing the flows of energy and magnetic fields that exchange them between stars, dust, and gas. Progress towards achieving outcomes will be validated by external review.

Outcome 5.12.2 Explore the behavior of matter in extreme astrophysical environments, including disks, cosmic jets, and the sources of gamma-ray bursts and cosmic rays.

5SEU1 Complete the integration and testing of the Gamma-ray Large Area Space Telescope (GLAST) spacecraft bus.

5SEU11 Successfully demonstrate progress in exploring the behavior of matter in extreme astrophysical environments, including disks, cosmic jets, and the sources of gamma-ray bursts and cosmic rays. Progress towards achieving outcomes will be validated by external review.

Outcome 5.12.3 Discover how the interplay of baryons, dark matter, and gravity shapes galaxies and systems of galaxies.

5SEU12 Successfully demonstrate progress in discovering how the interplay of baryons, dark matter, and gravity shapes galaxies and systems of galaxies. Progress towards achieving outcomes will be validated by external review.

Objective 5.13 Through robotic and human lunar missions, demonstrate capabilities, including use of lunar and other space resources, for safe, affordable, effective and sustainable human-robotic solar system exploration.

Outcome 5.13.1 *Develop capability to conduct robotic lunar test bed missions by 2008 and human lunar missions as early as 2015 but no later than 2020 that can demonstrate exploration systems and architectural approaches, including use of lunar resources, to enable human-robotic exploration across the solar system.*

5LE1 Identify and define preferred human-robotic exploration systems concepts and architectural approaches for validation through lunar missions.

5LE2 Identify candidate architectures and systems approaches that can be developed and demonstrated through lunar missions to enable a safe, affordable and effective campaign of human-robotic Mars exploration.

Outcome 5.13.2 *Conduct robotic missions, in lunar orbit and on the lunar surface, to acquire engineering and environmental data by 2015 required to prepare for human-robotic lunar missions.*

5LE3 Establish a baseline plan and Level 1 requirements to utilize the robotic lunar orbiter(s) and robotic lunar surface mission(s) to collect key engineering data and validate environmental characteristics and effects that might affect later robotics, astronauts and supporting systems.

5LE4 Identify candidate scientific research and discovery opportunities that could be pursued effectively during robotic lunar missions.

Outcome 5.13.3 *By 2020, establish through lunar surface missions the building block capabilities to support safe, affordable and effective long-duration human presence beyond low Earth orbit (LEO) as a stepping-stone to sustained human-robotic exploration and discovery beyond the Moon.*

5LE5 Establish a viable investment portfolio for development of human support systems, including human/machine extravehicular activity (EVA) systems, locally autonomous medical systems and needed improvements in human performance and productivity beyond low Earth orbit (LEO).

Outcome 5.13.4 *By 2015, demonstrate new human-robotic space operations capabilities employing advanced in-space infrastructures, including space assembly, maintenance and servicing, and logistics concepts.*

5LE6 Identify preferred approaches for development and demonstration during lunar missions to enable transformational space operations capabilities.

5LE7 Conduct reviews with international and U.S. government partners, to determine common capability requirements and opportunities for collaboration.

Mission III: To Inspire the Next Generation of Explorers

Goal 6: Inspire and motivate students to pursue careers in science, technology, engineering, and mathematics.

Objective 6.1 Increase the number of elementary and secondary students and teachers who are involved in NASA-related education opportunities.

Outcome 6.1.1 *By 2008, increase by 20%, student participation in NASA instructional and enrichment activities.*

5ED1 Increase NASA student participation by 5% above baseline

Outcome 6.1.2 *By 2008, increase by 20%, the number of elementary and secondary educators effectively utilizing NASA content-based STEM materials and programs in the classroom.*

5ED2 Increase NASA teacher participation by 5% above baseline.

Outcome 6.1.3 *By 2008, increase by 20%, family involvement in NASA-sponsored elementary and secondary education programs.*

5ED3 Increase existing NASA-sponsored family involvement activities and existing and potential partners by 5% over baseline

Outcome 6.1.4 *By 2008, 90% of NASA elementary and secondary programs are aligned with state or local STEM educational objectives.*

5ED4 25% of NASA elementary and secondary programs are aligned with state or local STEM educational objectives.

Objective 6.2 Support higher education research capability and opportunities that attract and prepare increasing numbers of students and faculty for NASA-related careers.

Outcome 6.2.1 *By 2008, attain a statistically significant increase in the number and diversity of NASA-supported students graduating in NASA-related fields.*

5ED5 Establish a NASA-wide baseline of the diversity of NASA-supported students.

Outcome 6.2.2 *By 2008, attain a statistically significant increase in the number of faculty in higher education institutions who are first-time proposers in NASA research and development opportunities.*

5ED6 Use existing higher education programs to assist and encourage first time faculty proposers for NASA research and development opportunities.

Outcome 6.2.3 *By 2008, increase by 20% the number of higher education institutions that align their NASA research and development activities with STEM teacher preparation departments to improve STEM teacher quality.*

5ED7 Establish a baseline of institutions receiving NASA research and development grants and contracts that link their research and development to the institution's school of education.

Outcome 6.2.4 *By 2008, increase by 10% the number and diversity of students conducting NASA-relevant research.*

5ED8 Establish a baseline of the number and diversity of students conducting NASA-relevant research.

Objective 6.3 Increase the number and diversity of students, teachers, faculty and researchers from underrepresented and underserved communities in NASA related STEM fields.

Outcome 6.3.1 *By 2008, increase by 20%, underrepresented/underserved NASA-sponsored students who pursue academic degrees in NASA-related STEM disciplines.*

5ED9 Increase NASA underrepresented/underserved student participation by 5% over baseline.

Outcome 6.3.2 *By 2008, increase by 20%, the number and diversity of teachers and faculty from underrepresented/underserved communities and institutions who participate in NASA-related STEM programs.*

5ED10 Increase NASA underrepresented/underserved teacher/faculty participation in NASA STEM-related learning environments by 5% over baseline.

Outcome 6.3.3 By 2008, increase by 20% the number of underrepresented/underserved researchers and minority serving institutions that compete for NASA research and development opportunities.

5ED11 Increase the numbers of underserved/underrepresented researchers and minority serving institutions competing for NASA research announcements by 5% above baseline.

Outcome 6.3.4 By 2008, increase family involvement in underrepresented/underserved NASA-sponsored student programs.

5ED12 Establish a baseline of family involvement in underrepresented/underserved NASA-sponsored student programs.

Objective 6.4 Increase student, teacher, and public access to NASA education resources via the establishment of e-Education as a principal learning support system.

Outcome 6.4.1 By 2008, identify and implement 4 new advanced technology applications that will positively impact learning.

5ED13 Implement 1 new advanced technology application.

Outcome 6.4.2 By 2008, demonstrate the effectiveness of NASA digital content materials in targeted learning environments.

5ED14 Evaluate the 50 pilot NASA Explorer Schools, utilizing a design experiment approach.

Outcome 6.4.3 By 2008, establish a technology infrastructure that meets citizen demand for NASA learning services.

5ED15 Develop a plan for establishing a technology infrastructure.

Goal 7: Engage the public in shaping and sharing the experience of exploration and discovery.

Objective 7.1 Improve public understanding and appreciation of science and technology, including NASA aerospace technology, research, and exploration missions.

Outcome 7.1.1 By 2008, establish a national program to engage the informal education community with NASA Science and Technology.

5ED16 Implement Phase 1 of a plan to increase appreciation of the relevance and role of NASA science and technology.

Outcome 7.1.2 By 2008 provide instructional materials derived from NASA research and scientific activities that meet the needs of NASA's informal education partners.

5ED17 Develop a plan to assess and prioritize high-leverage and critical informal education programs and educational involvement activities.

Outcome 7.1.3 By 2008 provide professional development for NASA's informal education partners.

5ED18 Develop a plan to assess current NASA professional development programs for relevance to the targeted informal learning environments.

Outcome 7.1.4 Engage the public in NASA missions, discoveries and technology through public programs, community outreach, mass media, and the Internet.

5AT18 Partner with museums and other cultural organizations and institutions to engage non-traditional audiences in NASA missions.

5ESA11 Provide in public venues at least 50 stories on the scientific discoveries, the practical benefits, or new technologies sponsored by the Earth Science Enterprise.

5ESS10 Post the most exciting imagery and explanations about Earth science on the Earth observations/ESE website.

5RPFS8 Through collaboration with PAO, establish and sustain a series of media briefings highlighting OBPR research.

5RPFS9 Expand outreach activities that reach minority and under-represented sectors of the public, through increased participation in conferences and community events that reflect cultural awareness and outreach. Each fiscal year, increase the previous year baseline by supporting at least one new venue that focuses on these public sectors.

Exploration Capabilities

Goal 8: Ensure the provision of space access, and improve it by increasing safety, reliability, and affordability.

Objective 8.1 Assure safe, affordable, and reliable crew and cargo access and return from the International Space Station.

Outcome 8.1.1 *Acquire non-Shuttle, crew and cargo access and return capability for the Station by 2010.*

5ISS7 Baseline a strategy and initiate procurement of cargo delivery service to the ISS.

Objective 8.3 Improve the accessibility of space via the Space Shuttle to better meet Space Station assembly, operations, and research requirements.

Outcome 8.3.1 *Assure public, flight crew, and workforce safety for all Space Shuttle operations and safely meet the manifest and flight rate commitment through completion of Space Station assembly.*

5SSP1 Achieve zero Type-A (damage to property at least $1M or death) or Type-B (damage to property at least $250K or permanent disability or hospitalization of three or more persons) mishaps in FY 2005

5SSP2 Achieve an average of eight or fewer flight anomalies per Space Shuttle mission in FY 2005

5SSP3 Achieve 100 percent on-orbit mission success for all Shuttle missions launched in FY 2005. For this metric, mission success criteria are those provided to the prime contractor (SFOC) for purposes of determining successful accomplishment of the performance incentive fees in the contract.

Objective 8.4 Assure capabilities for world-class research on a laboratory in low Earth orbit.

Outcome 8.4.1 *Provide a safe, reliable, and well-managed on-orbit research facility.*

5ISS2 Achieve zero Type-A (damage to property at least $1M or death) or Type-B (damage to property at least $250K or permanent disability or hospitalization of 3 or more persons) mishaps in FY2004.

5ISS3 Based on the Space Shuttle return-to-flight plan, establish a revised baseline for ISS assembly (through International Core Complete) and research support.

5ISS4 Provide at least 80% of up-mass, volume and crew-time for science as planned at the beginning of FY2004. (Supports Objective 1.1, 3.5, 4.1 and 4.2)

Outcome 8.4.2 *Expand the ISS crew size to accommodate U.S. and International Partner research requirements.*

5ISS5 Obtain agreement among the International Partners on the final ISS configuration.

Objective 8.5 Provide services for space communications, rocket propulsion testing, and launch in support of NASA, other government agencies and industry.

Outcome 8.5.1 *Provide safe, well-managed and 95% reliable space communications, rocket propulsion testing, and launch services to meet agency requirements.*

5SFS8 Establish the Agency-wide baseline space communications architecture, including a framework for possible deep space and near Earth laser communications services.

5SFS15 Maintain NASA success rate at or above a running average of 95% for missions on the FY2004 Expendable Launch Vehicle (ELV) manifest.

5SFS16 Achieve at least 95% of planned data delivery for the International Space Station, each Space Shuttle mission, and low-Earth orbiting missions in FY2004.

5SFS19 Define and provide space transportation requirements for future human and robotic exploration and development of space to all NASA and other government agency programs pursuing improvements in space transportation.

Goal 9: Extend the duration and boundaries of human space flight to create new opportunities for exploration and discovery.

Objective 9.1 Understand human physiological reactions to reduced gravity and develop countermeasures to assure survival of humans traveling far from Earth.

Outcome 9.1.1 By 2008, develop and test candidate countermeasures using ground-based analysis and space flight.

5BSR7 Increase the use of space flight analogs on the ground to better define hypotheses for flight experiments

5BSR8 Publish final results of Bioastronautics experiments conducted during ISS increment 8 and preliminary results from Increments 9 and 10.

5BSR9 Maintain productive peer-reviewed research program in Biomedical Research and Countermeasures including a National Space Biomedical Research Institute that will perform team-based focused countermeasure-development research.

5BSR10 Under the Human Research Initiative (HRI) increase the number of investigations addressing biomedical issues associated with human space exploration.

5BSR11 Conduct scientific workshops to fully engage the scientific community in defining research strategies for addressing and solving NASA's biomedical risks.

5SFS20 Certify the medical fitness of all crew members before launch.

Outcome 9.1.2 By 2008, reduce uncertainties in estimating radiation risks by one-half.

5BSR12 Expand the space radiation research science community to involve cutting edge researchers in related disciplines by soliciting, selecting, and funding high quality research.

5BSR13 Use 1000 hours/yr of beam time at the National Space Radiation Laboratory (NSRL) at Brookhaven National Laboratory (BNL) to measure survival, genetic mutation (mutagenesis) and chromosome aberrations in cells and tissues to improve understanding of the biological effects of the space radiation environment.

5BSR14 Integrate research data collected over the past two years at NSRL, with existing database to develop more accurate predictions resulting in improved biological strategies for radiation risk reduction.

Outcome 9.1.3 Advance understanding of the role of gravity in biological processes to support biomedical research.

5BSR15 Maintain a completed, productive, peer-reviewed ground-based research program in appropriate fundamental biology disciplines to lay the groundwork for advanced understanding of the role of gravity in biological processes associated with the human health risk of space flight.

5BSR16 Initiate a nanosatellite program for in-situ analytical technology for producing the fundamental biological understanding necessary for countermeasure development.

Objective 9.2 Develop new human support systems and solutions to low gravity technological challenges to allow the next generation of explorers to go beyond low earth orbit.

Outcome 9.2.1 Identify & test technologies by 2010 to reduce total mass requirements by a factor of three for Life Support using current ISS mass requirement baseline.

5BSR17 Demonstrate, through vigorous research and technology development, a 55% reduction in the projected mass of a life support flight system compared to the system base-lined for ISS.

Outcome 9.2.2 By 2008, develop predictive models for prototype two-phase flow and phase change heat transfer systems for low- and fractional gravity with an efficiency improvement of at least a factor of two over 2003 ISS radiative systems, and prepare ISS experiments for validation.

5PSR8 Continue Strategic ground-based research in microgravity heat-exchange multi-phase systems and advance existing flight projects toward flight.

Outcome 9.2.3 By 2008, develop predictive engineering model and prototype systems to demonstrate the feasibility of deploying enhanced space radiation-shielding multi-functional structures with at least a factor of two improvement in shielding efficiency and mass reduction, and prepare a space experiment for validation.

5PSR9 Continue accumulating data on radiation effects on materials properties and initiate the assessment of the performance of multifunctional materials.

Objective 9.3. Demonstrate the ability to support a human presence in low Earth orbit as a stepping-stone to human presence beyond.

Outcome 9.3.1 *Develop experience in working and living in space by continuously supporting a crew on-board the ISS through 2016.*

5ISS6 Continuously sustain a crew to conduct research aboard the ISS

Objective 9.4. Develop technologies to enable safe, affordable, effective and sustainable human-robotic exploration and discovery beyond low Earth orbit (LEO).

Outcome 9.4.1 *Identify, develop and validate human-robotic capabilities by 2015 required to support human-robotic lunar missions.*

5HRT1 Establish an integrated, top-down strategy-to-task technology R&D planning process to facilitate the development of human-robotic exploration systems requirements

5HRT2 Execute two systems-focused Quality Function Deployment exercises through an Operational Advisory Group (including both technologists and operators) to better define systems attributes necessary to accomplish human-robotic exploration operational objectives.

5HRT3 Execute selected R&D-focused Quality Function Deployment exercises through an external/internal Technology Transition Team to review candidate human-robotic exploration systems technologies, and provide detailed updates to human-robotic technology road maps.

5HRT4 Test and validate preferred engineering modeling and simulation computational approaches through which viable candidate architectures, systems designs and technologies may be identified and characterized. Select one or more approaches for ongoing use in systems/technology road mapping and planning.

Outcome 9.4.2 *Identify and execute a research and development program to develop technologies by 2015 critical to support human-robotic lunar missions.*

5HRT5 Identify and analyze viable candidates and identify the preferred approach to sustained, integrated human-robotic solar system exploration involving lunar/planetary surfaces and small bodies, and supporting operations. Validate a focused technology R&D portfolio that addresses the needs of these approaches and identifies existing gaps in technological capabilities.

5HRT6 Establish and obtain approval for detailed R&D requirements, roadmaps and program planning in key focused technology development areas, including self-sufficient space systems; space utilities and power; habitation and bioastronautics; space assembly, maintenance and servicing; space transportation; robotic networks; and information technology and communications.

Outcome 9.4.3 *By 2016, develop and demonstrate in space nuclear fission-based power and propulsion systems that can be integrated into future human and robotic exploration missions.*

5HRT7 Develop Level 1/ Level 2 requirements for nuclear power and propulsion systems in support of selected human and robotic exploration architectures and mission concepts.

5HRT8 Complete a validated road map for nuclear power and propulsion R&D, and related vehicle systems technology maturation.

5HRT9 Formulate a demonstration mission plan for Jupiter Icy Moons Orbiter that will test and validate nuclear power and propulsion systems for future human-robotic exploration missions.

Outcome 9.4.4 *Develop and deliver 1 new critical technology every 2 years in at least each of the following disciplines: in-space computing, space communications and networking, sensor technology, modular systems, and engineering risk analysis.*

5HRT15 Complete an Advanced Space Technology Program technology roadmap that interfaces appropriately with the technology planning of NASA's enterprises.

5HRT16 Deliver at least one new critical technology in each key area (including: in-space computing, space communications and networking, sensor technology, modular systems, and engineering risk analysis) to NASA's enterprises, for possible test and demonstration.

5HRT17 Prepare and announce the Centennial Challenge Cycle 2 major award purses, including competition rules, regulations, and judgment criteria.

Objective 9.5. Develop crew transportation systems to enable exploration beyond low Earth orbit (LEO).

Outcome 9.5.1 *By 2014, develop and flight-demonstrate a human exploration vehicle that supports safe, affordable and effective transportation and life support for human crews traveling from the Earth to destinations beyond LEO.*

5TS1 Conduct a detailed review of previous vehicle programs to capture lessons-learned and appropriate technology maturation; incorporate results into the human exploration vehicle requirements definition process.

5TS2 Develop and obtain approval for human exploration vehicle Level 1 and Level 2 Requirements and the resulting Program Plan.

5TS3 Complete preliminary conceptual design(s) for the human exploration vehicle, in conjunction with definition of an integrated exploration systems architecture.

5TS4 Develop launch vehicle Level 1 Requirements for human-robotic exploration within an integrated architecture, and define corresponding programs to assure the timely availability of needed capabilities, including automated rendezvous, proximity operations and docking, modular structure assembly, in space refueling, and launch vehicle modifications and developments.

Outcome 9.5.2 *By 2010, identify and develop concepts and requirements that could support safe, affordable and effective transportation and life support for human crews traveling from the Earth to the vicinity or the surface of Mars.*

5TS5 Conduct a preliminary conceptual design study for a human-robotic Mars exploration vehicle, in conjunction with definition of an integrated exploration systems architecture.

Goal 10: Enable revolutionary capabilities through new technology.

Objective 10.1 Improve the capability to assess and manage risk in the synthesis of complex engineering systems.

Outcome 10.1.1 *By 2005 demonstrate 2 prototype systems that prove the feasibility of resilient systems to mitigate risks in key NASA mission domains. Feasibility will be demonstrated by reconfigurability of avionics, sensors, and system performance parameters.*

5HRT10 Develop prototype design and organizational risk analysis tools to do risk identifications, assessments, mitigation strategies, and key trade-off capabilities not only between risks, but between risks and other mission design criteria.

5HRT11 Develop a robust software tool for accident investigation that can help identify the causes of spacecraft, airplane, and/or other mission hardware accidents.

Objective 10.3 Leverage partnerships between NASA Enterprises, U.S. industrial firms, and the venture capital community for innovative technology development.

Outcome 10.3.1 *Promote and develop innovative technology partnerships between NASA, venture capital firms and U.S. industry for the benefit of all Enterprise mission needs, initiating three partnerships per year.*

5HRT12 Establish three partnerships with U.S. industry and the investment community using the Enterprise Engine concept.

5HRT13 Develop 12 industry partnerships, including the three established using the Enterprise Engine, that will add value to NASA Enterprises.

Outcome 10.3.2 *Facilitate on an annual basis the award of venture capital funds or Phase III contracts to no less than two SBIR firms to further develop or produce their technology through industry or government agencies.*

5HRT14 Achieve through NASBO, the award of Phase III contracts or venture capital funds to no less than two SBIR firms to further develop or produce their technology through industry or government agencies.

Objective 10.5 Create novel aeronautics concepts and technology to support science missions and terrestrial and space applications.

Outcome 10.5.1 *Develop technologies that will enable solar powered vehicles to serve as "sub-orbital satellites" for science missions.*

5AT20 Complete flight demonstration of a second generation damage adaptive flight control system. (Vehicle Systems)

5AT21 Define requirements for a robust, fault-tolerant avionics architecture that supports fully autonomous vehicle concepts. (Vehicle Systems)

5AT24 Complete laboratory aerodynamic assessment of low-drag slotted wing concept. (Vehicle Systems)

5AT25 Based on laboratory data and systems analysis, select unconventional engine or power systems for technology development that show highest potential for reducing CO2 emissions and/or enabling advanced air vehicles for new scientific missions. (Vehicle Systems)

5AT26 Complete initial flight series for validation of improved HALE ROA aero-structural modeling tools used to reduce risk and increase mission success. (Vehicle Systems)

Outcome 10.5.2 By 2008, develop and demonstrate technologies required for routine Unmanned Aerial Vehicle operations in the National Airspace System above 18,000 feet for High-Altitude, Long-Endurance UAVs.

5AT23 Demonstrate integrated technologies and policies for UAV flight operations above FL400.(Vehicle Systems)

Implementing Strategies to Conduct Well-Managed Programs

Solar System Exploration

5SSE15 Complete all development projects within 110% of the cost and schedule baseline.

5SSE16 Deliver at least 90% of scheduled operating hours for all operations and research facilities.

5SSE17 At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

Mars Exploration Program

5MEP15 Complete all development projects within 110% of the cost and schedule baseline.

5MEP16 Deliver at least 90% of scheduled operating hours for all operations and research facilities.

5MEP17 At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

Lunar Exploration Program

5LE8 The Theme will distribute at least 80% of its allocated procurement funding to competitively awarded contracts.

Astronomical Search for Origins

5ASO13 Complete all development projects within 110% of the cost and schedule baseline.

5ASO14 Deliver at least 90% of scheduled operating hours for all operations and research facilities.

5ASO15 At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

Structure and Evolution of the Universe

5SEU13 Complete all development projects within 110% of the cost and schedule baseline.

5SEU14 Deliver at least 90% of scheduled operating hours for all operations and research facilities.

5SEU15 At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

Sun-Earth Connection

5SEC14 Complete all development projects within 110% of the cost and schedule baseline.

5SEC15 Deliver at least 90% of scheduled operating hours for all operations and research facilities.

5SEC16 At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

Earth System Science

5ESS11 Complete all development projects within 110% of the cost and schedule baseline.

5ESS12 Deliver at least 90% of scheduled operating hours for all operations and research facilities.

5ESS13 At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

Earth Science Applications

5ESA12 Deliver at least 90% of scheduled operating hours for all operations and research facilities.

5ESA13 At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

FY 2005 Performance Plan

Biological Sciences Research

5BSR18 Complete all development projects within 110% of the cost and schedule baseline.

5BSR19 Deliver at least 90% of scheduled operating hours for all operations and research facilities.

5BSR20 At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

Physical Sciences Research

5PSR10 Complete all development projects within 110% of the cost and schedule baseline.

5PSR11 Deliver at least 90% of scheduled operating hours for all operations and research facilities.

5PSR12 At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

Research Partnerships and Flight Support

5RPFS10 Deliver at least 90% of scheduled operating hours for all operations and research facilities.

Aeronautics Technology

5AT28 This Theme will complete 90% of the major milestones planned for FY 2005.

Education

5ED19 At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

Human Robotic Technologies

5HRT15 Distribute at least 80% of allocated procurement funding to competitively awarded contracts, including continuing and new contract activities.

Transportation Systems

5TS6 Distribute at least 80% of allocated procurement funding to competitively awarded contracts, including continuing and new contract activities.

International Space Station

5ISS8 Complete all development projects within 110% of the cost and schedule baseline.

5ISS9 Deliver at least 90% of scheduled operating hours for all operations and research facilities.

Space Shuttle Program

5SSP4 Complete all development projects within 110% of the cost and schedule baseline.

5SSP5 Deliver at least 90% of scheduled operating hours for all operations and research facilities.

Space and Flight Support

5SFS21 Complete all development projects within 110% of the cost and schedule baseline.

5SFS22 Deliver at least 90% of scheduled operating hours for all operations and research facilities.