National Aeronautics and Space Administration

Annual Performance Report

FISCAL YEAR 2007

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Management and Performance: FY 2007 PAR Annual Performance Report

NASA's annual Performance and Accountability Report (PAR) meets relevant U.S. government reporting requirements, including the *Government Performance and Results Act* of 1993, the *Chief Financial Officers Act* of 1990, and the *Federal Financial Management Improvement Act* of 1996. The PAR provides a summary of the Agency's financial position and its progress towards achieving NASA's performance measures (i.e., Strategic Goals and Sub-goals, Outcomes, and Annual Performance Goals).

NASA's Participation in the Performance and Accountability Report Pilot Program

For FY 2007, NASA chose to participate in the Office of Management and Budget's (OMB's) PAR pilot program, as described in OMB Circular A-136. This pilot entails producing three reports as an alternative to the consolidated PAR:

- An Agency Financial Report (AFR), which provides NASA's financial statements and accompanying notes, an audit of the financial statements, a summary of materials weaknesses and management challenges, as well as corrective actions, and an overview of the year's performance achievements. NASA issued this report on November 15, 2007.
- An Annual Performance Report (APR), presented here, detailing NASA's performance towards achieving the FY 2007 Performance Plan.
- A Performance Highlights document, which is a public-outreach summary of NASA's performance, financial, and management achievements and challenges. NASA issued this document on February 1, 2008.

The AFR and Performance Highlights document, as well as NASA's FY 2009 Budget Estimates with accompanying APR, are available on the Web at www.nasa.gov/news/budget/index.html.

APR Contents

Strategic Goals, Performance Measures, and Organization

NASA's 2006 Strategic Plan established six Strategic Goals, with six Sub-goals supporting Strategic Goal 3. Progress towards achieving the Strategic Goals are measured using multi-year Outcomes and supporting Annual Performance Goals, as outlined in the Agency's annual Performance Plan.

NASA is organized into four Mission Directorates and an equivalent organization called Cross-Agency Support Programs:

- The **Science Mission Directorate (SMD)** conducts the scientific exploration of Earth, the Sun, the solar system, and the universe. Large, strategic missions are complemented by smaller missions, including ground-, air-, and orbiting space-based observatories, deep-space automated spacecraft, and planetary orbiters, landers, and surface rovers. This Directorate also develops increasingly refined instrumentation, spacecraft, and robotic techniques in pursuit of NASA's science goals.

- The **Aeronautics Research Mission Directorate (ARMD)** conducts fundamental research in aeronautical disciplines and develops capabilities, tools, and technologies that will enhance significantly aircraft performance, environmental compatibility, and safety, as well as the capacity, flexibility, and safety of the future air transportation system.
- The **Exploration Systems Mission Directorate (ESMD)** develops systems and supports research and technology development to enable sustained and affordable human and robotic space exploration. This Directorate will develop the robotic precursor missions, human transportation elements, and life support systems for the near-term goal of lunar exploration.
- The **Space Operations Mission Directorate (SOMD)** directs spaceflight operations, space launches, and space communications and manages the operation of integrated systems in low Earth orbit and beyond, including the International Space Station (ISS). This Directorate also is laying the foundation for future missions to the Moon and Mars by using the ISS as an orbital outpost where astronauts can gather vital information that will enable safer and more capable systems for human explorers.
- **Cross-Agency Support Programs (CASP)** consists of four mission-support areas—Education, Advanced Business Systems (performed by the Integrated Enterprise Management Program), the Innovative Partnerships Program, and the Strategic Capabilities Assets Program—that serve all the Strategic Goals. Together, these areas ensure that NASA has the workforce, technologies, capabilities, and facilities needed to achieve NASA's current and future objectives.

Management for these organizations resides at NASA Headquarters. NASA's Centers support the Agency's space exploration objectives, scientific initiatives, and aeronautics research.

The Mission Directorates and CASP pursue the Agency's performance measures, presented in the FY 2007 Performance Plan, as shown below. Details of activities for each Strategic Goal are provided in the following pages.

Responsible Mission Directorate or Equivalent	Theme	Strategic Goals and Sub-goals	Outcomes
		Strategic Goal 3: Sub-goal 3A (Earth Science) Sub-goal 3B (Heliophysics)	 3A.1–3A.7 3B.1–3B.3
	Solar System Exploration (now Planetary Science*)	Strategic Goal 3: Sub-goal 3C	 3C.1–3C.4
	The Universe (now Astrophysics*)	Strategic Goal 3: Sub-goal 3D	 3D.1–3D.4
ARMD	Aeronautics Technology	Strategic Goal 3: Sub-goal 3E	 3E.1–3E.4
ESMD	Constellation Systems	Strategic Goal 4 Strategic Goal 5	4.1–4.2 5.2
	Exploration Systems Research & Technology (now Advanced Capabilities*)	Strategic Goal 5 Strategic Goal 6	5.3 6.1–6.3
	Human Systems Research & Technology (now Advanced Capabilities*)	Strategic Goal 3: Sub-goal 3F	 3F.1–3F.3
SOMD	Space Shuttle	Strategic Goal 1	1.1–1.2
	International Space Station	Strategic Goal 2	2.1–2.2
	Space and Flight Support	Strategic Goal 5 Strategic Goal 6	5.1 6.4
CASP	Education	Contribute to all Strategic Goals	ED-1–ED-3
	Advanced Business Systems		IEM-1–IEM-2
	Innovative Partnerships Program		IPP-1
	Strategic Capabilities Assets Program		SC-1

* Changes effective with the release of NASA's FY 2008 Budget Estimates.

Measuring NASA's Performance

Performance System

NASA managers calculate ratings for multi-year Outcome and APG performance based on a number of factors, including internal and external assessments.

Internally, NASA monitors and analyzes each program's adherence to budgets, schedules, and key milestones. These analyses are provided during monthly reviews at the Center, Mission Directorate, and Agency levels to communicate the health of the program. (Program's are identified in NASA's annual budget estimates, available at http://www.nasa.gov/news/budget/index.html.) Based on the ratings, managers formulate appropriate follow-up actions.

External advisors, like the NASA Advisory Council, the National Research Council, and the Aerospace Safety Advisory Panel, assess program content and direction. Also, experts from the science community, coordinated by the Science Mission Directorate, review NASA's progress toward meeting performance measures under Sub-goals 3A through 3D.

During the fiscal year, a third of the Agency's Themes also participate in OMB's Program Assessment Rating Tool (PART) evaluation, which is a rigorous and interactive program assessment that involves both internal and external reviewers.

After weighing the input from various reviews for relevance, quality, and performance, NASA managers determine a program's progress toward achieving its respective multi-year and annual Government Performance and Results Act performance measures. NASA rates these as follows:

Multi-year Outcome Rating Scale

Green	NASA achieved most APGs under this Outcome and is on-track to achieve or exceed this Outcome.
Yellow	NASA made significant progress toward this Outcome, however, the Agency may not achieve this Outcome as stated.
Red	NASA failed to achieve most of the APGs under this Outcome and does not expect to achieve this Outcome as stated.
White	This Outcome was canceled by management directive or is no longer applicable based on management changes to the APGs.

APG Rating Scale

Green	NASA achieved this APG.
Yellow	NASA failed to achieve this APG, but made significant progress and anticipates achieving it during the next fiscal year.
Red	NASA failed to achieve this APG and does not anticipate completing it within the next fiscal year.
White	This APG was canceled by management directive and NASA is no longer pursuing activities relevant to this APG, or the program did not have activities relevant to the APG during the fiscal year.

Other Trending Information

Blue	NASA exceeded (beyond a Green rating) performance expectations for this performance measure. NASA discontinued this rating as of FY 2005.
None	Although NASA may have conducted work in this area, management did not include a performance measure for this work in the fiscal year's performance plan.
8.3.1 Green	In prior years where data is available, NASA notes the applicable Outcome or APG reference number and rating to provide a Theme's performance trends. The annual Performance Report or Performance and Accountability Report for an indicated performance year provide the full text and explanations. In some cases, an Outcome or APG may track to more than one performance measures in past performance years.

During FY 2007, NASA reviewed the trending information for Outcomes to ensure completeness and made revisions where necessary. NASA incorporated the revised trending information in this Annual Performance Report.

PART Assessments

The PART assessments ask approximately 25 questions about a Theme's performance and management. Based on answers provided by the Theme, OMB applies a percentile score that yields the following ratings:

- **Effective (85–100%):** This is the highest rating a program can achieve. Programs rated Effective set ambitious goals, achieve results, are well-managed and improve efficiency.
- **Moderately Effective (70–84%):** In general, a program rated Moderately Effective has set ambitious goals and is well-managed. Moderately Effective programs likely need to improve their efficiency or address other problems in the programs' design or management in order to achieve better results.
- **Adequate (50–69%):** This rating describes a program that needs to set more ambitious goals, achieve better results, improve accountability or strengthen its management practices.
- **Ineffective (0–49%):** Programs receiving this rating are not using tax dollars effectively. Ineffective programs have been unable to achieve results due to a lack of clarity regarding the program's purpose or goals, poor management, or some other significant weakness.
- **Results Not Demonstrated:** This rating indicates that a program has not been able to develop acceptable performance goals or collect data to determine whether it is performing.

Summaries of all PART ratings to date are provided in the following Strategic Goal and Cross-Agency Support Program write-ups. For more detailed information about a Theme's PART status and follow-up actions, please go to "PART Status and Improvement Plans" section of this APR (Man-133) or visit ExpectMore.gov (www.whitehouse.gov/omb/expectmore/agency/026.html).

Other Assessments

Discussions of other assessments, including the President's Management Agenda and Major Program Annual Report, relevant to the Agency's performance are available in the "Management and Performance" section of NASA's FY 2009 Budget Estimates.

Cost of Performance

Although NASA allocates budgets and tracks costs for each of the Mission Directorates, the Agency also analyzes the cost of pursuing each of its Strategic Goals and Sub-goals, referred to as the Cost of Performance.

To measure the cost of performance, NASA maps the Mission Directorate's costs (i.e., Lines of Business as presented in the FY 2007 Agency Financial Report Addendum Statement of Net Cost) to the Strategic Goals and Sub-goals via Themes and programs. In 2003, NASA created Themes as a bridge to connect related Agency programs and projects to the Mission Directorates or equivalents that manage the programs. Themes group together similar programs, such as the programs that conduct Earth science or support the Agency's spaceflight missions, into budgeting categories. NASA uses Themes and programs to track performance areas, with Themes often contributing to a single Strategic Goal or Sub-goal, with a few exceptions.

To determine the Agency's cost of performance for each Strategic Goal and Sub-goal, NASA analyzes the initial fiscal year operating plan to determine the portion of each Mission Directorate budget allocated to each Theme and/or program, thus tying it to a particular Strategic Goal or Sub-goal. NASA analysts then use NASA's financial statements, in particular the Statement of Net Cost to allocate Line of Business expenditures to the Themes and then Strategic Goals and Sub-Goals based on the relationships determined in the initial Operating Plan.

Strategic Goal 1

Fly the Shuttle as safely as possible until its retirement, not later than 2010.

	Green	Yellow	Red	White
2 Outcomes	2 (100%)	0	0	0
6 APGs	5 (83%)	0	0	1 (17%)

Cost of Performance (in millions)
$4,049

Responsible Mission Directorate

Space Operations

Contributing Theme

Space Shuttle

Theme Description

The Space Shuttle Theme manages the Space Shuttle, currently the only U.S. launch capability providing human access to space, and the only vehicle that can support the assembly of the International Space Station (ISS). NASA will phase-out the Space Shuttle in 2010 when its role in ISS assembly is complete.

PART Assessment Rating						
Theme	**Last Year Assessed**	**Overall Rating**	**Program Purpose and Design**	**Strategic Planning**	**Program Management**	**Program Results/ Accountability**
Space Shuttle	2005	Adequate	100%	89%	50%	33%

The Space Shuttle has supported NASA's Mission for over 25 years, carrying crews and cargo to low Earth orbit, performing repair, recovery, and maintenance missions on orbiting satellites, providing a platform for conducting science experiments, and supporting construction of the International Space Station (ISS). As required by Strategic Goal 1, NASA will retire the Shuttle fleet by 2010, making way for the new generation of launch and crew exploration vehicles being developed under Strategic Goal 4. Until then, the Agency will demonstrate NASA's most critical value—safety—by promoting engineering excellence, maintaining realistic flight schedules, and fostering internal forums where mission risks and benefits can be discussed and analyzed freely.

Benefits

The Shuttle is recognized around the world as a symbol of America's space program and the Nation's commitment to space exploration. NASA's Space Shuttle Program has inspired generations of schoolchildren to pursue dreams and careers in science, technology, engineering, and mathematics. The Space Shuttle Program also provides direct benefits to the Nation by advancing national security and economic interests in space and spurring technology development in critical areas such as navigation, computing, materials, and communications. Furthermore, due to its heavy-lift capacity, the Shuttle is the only vehicle capable of completing assembly of the ISS in a manner consistent with NASA's International Partner commitments and exploration research needs. The remaining Shuttle flights will be dedicated to ISS construction and a Hubble Space Telescope service mission.

A primary public benefit of retiring the Shuttle is to redirect resources toward new programs, such as the Orion Crew Exploration Vehicle and the Ares launch vehicles being developed by the Constellation Systems Theme, needed to send humans to the Moon and beyond. NASA will use the knowledge and assets developed over nearly three decades of Shuttle operations to build a new generation of vehicles designed for missions beyond low Earth orbit. As the Shuttle fleet approaches its retirement year, the Agency gradually is directing Shuttle personnel, assets, and knowledge toward the development and support of new hardware and technologies that will support Constellation Systems vehicle. For the American public, this means continuity in the access to space and sustained U.S. leadership in technology development and civilian space exploration.

Risks to Achieving Strategic Goal 1

The Space Shuttle Program faces two main challenges. First, NASA must maintain the skilled workforce and critical assets needed to safely complete the Shuttle manifest. Second, NASA must manage the process of retiring the Shuttle and transitioning and dispositioning Shuttle capabilities when they are no longer needed for safe mission execution.

The Space Shuttle transition and retirement effort is one of the largest that the Agency has undertaken in its history. The Space Shuttle Program's assets are significant; the program occupies over 640 facilities, uses over 990,000 line items of hardware and equipment, and employs over 1,700 civil servants, with more than 15,000 work-year equivalents employed by

the prime contractors. In addition, the program employs over 3,000 additional indirect workers through Center general and administrative and service accounts. The total equipment acquisition value is over $12 billion, spread across hundreds of locations. The total facilities replacement cost is approximately $5.7 billion, which accounts for approximately one-fourth of the value of the Agency's total facility inventory. The program has over 1,500 active suppliers, and 3,000 to 4,000 qualified suppliers geographically located throughout the country.

Because of the size, complexity, and dispersion of the Space Shuttle Program's assets, Transition and Retirement will require careful planning so as to not interfere with safe mission execution and not greatly impact other Agency activities. In addition to the sheer size of asset disposition activities, the Agency must manage and protect those Shuttle capabilities that are needed to complete the Agency's Strategic Goal of completing assembly of the ISS by the end of FY 2010 using as few Shuttle flights as possible. As ISS assembly is completed and the Space Shuttle Program's mission comes to a close, Constellation Systems development activities will continue to ramp up. Use of certain legacy capabilities can reduce the time and resources necessary to achieve initial operational capability of the new designs. The Space Shuttle Program plays a key role in coordinating the smooth transition from current Shuttle operations to Constellation Systems, thereby enabling new U.S. human spaceflight capabilities that will extend exploration and permanent human presence beyond low Earth orbit to the Moon, Mars, and beyond.

FY 2008 Performance Forecast

- The Space Shuttle is manifested to fly five missions in FY 2008: four assembly and logistics flights to the ISS and a fifth servicing mission to the Hubble Space Telescope. During the flights to the ISS, the Shuttle will deliver major International Partner elements, including the European Space Agency's Columbus European Laboratory Module, portions of the Kibo Japanese Experiment Module, and Canada's Special Purpose Dexterous Manipulator.
- The Space Shuttle Program will reach several major transition milestones. Among these include transitioning to Constellation Systems major facilities at the Kennedy Space Center, including two of the four high bays in the Vehicle Assembly Building and Launch Pad 39B.

Outcome 1.1: Assure the safety and integrity of the Space Shuttle workforce, systems and processes while flying the manifest.

FY04	FY05	FY06	FY 2007
8.3.1 Green	6.1 Green	1.1 Yellow	**Green**

The Space Shuttle Program successfully completed three missions—STS-116, STS-117, and STS-118—and accomplished all primary mission objectives. The program achieved its Annual Performance Goals despite events that could have caused setbacks: significant damage to the external tank of STS-117 caused by a hailstorm at the Kennedy Space Center, while the Shuttle was on the pad awaiting launch; and the threat posed by Hurricane Dean to operations at the Johnson Space Center during the STS-118 mission.

FY 2007 Annual Performance Goals	FY04	FY05	FY06	FY 2007
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 FY 2007.	4SSP2 Yellow	5SSP1 Green	6SSP1 Red	**7SSP1 Green**
Complete 100 percent of all mission objectives for all Space Shuttle missions in FY 2007 as specified in the Flight Requirements Document for each mission.	None	None	None	**7SSP2 Green**

Outcome 1.2: By September 30, 2010, retire the Space Shuttle.

FY04	FY05	FY06	FY 2007
None	None	None	**Green**

In November 2006, NASA published the Human Space Flight Transition Plan, which outlines the Agency's approach to safely managing the remaining manifested Space Shuttle flights, completing ISS assembly, and developing new human space flight transportation systems under the Constellation Systems Program. Through joint budget development, workforce sharing, and joint review boards, including the Transition Control Board and the Joint Integrated Control Board, the Space Shuttle and Constellation Systems programs identified a number of assets for transfer or disposition. In the area of joint utilization, Shuttle and Constellation Systems are coordinating use of Launch Complex 39-B at the Kennedy Space Center to

support the Ares I-X test flight and launch-on-need support for the Hubble Space Telescope servicing mission (STS-125), the Vehicle Assembly Building at the Kennedy Space Center for Ares I-X and Space Shuttle processing, and the Michoud Assembly Facility in Louisiana for Shuttle external tank production and Orion and Ares I upper stage production. NASA also began close-out activities for Shuttle capabilities no longer needed for mission execution or Constellation Systems development, including facilities for producing Space Shuttle main engine components and facilities at the White Sands Test Facility used for testing orbiter maneuvering system rocket engines.

FY 2007 Annual Performance Goal	FY04	FY05	FY06	FY 2007
Demonstrate continued progress in identifying, evaluating, documenting, and dispositioning Space Shuttle program resources for phase-out or transition.	None	None	None	**7SSP3 Green**

Efficiency Measures

FY 2007 Annual Performance Goals	FY04	FY05	FY06	FY 2007
Complete all development projects within 110% of the cost and schedule baseline.	4SSP4 Yellow	5SSP4 Yellow	6SSP2 White	**7SSP4 White**
Deliver at least 90% of scheduled operating hours for all operations and research facilities.	None	5SSP5 Green	6SSP3 Green	**7SSP5 Green**
While ensuring the safety of ongoing flight operations and by working with exploration development programs, reduce Space Shuttle sustaining engineering hours, annual value of Space Shuttle production contracts, and the number of dedicated Space Shuttle facilities, where possible.	None	None	None	**7SSP6 Green**

Why NASA rated APG 7SSP4 White: SOMD was not scheduled to complete any development projects in the Space Shuttle Theme during FY 2007, so NASA has postponed this Efficiency Measure until a later fiscal year.

Strategic Goal 2

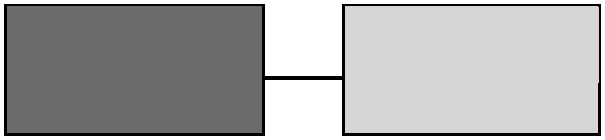
Complete the International Space Station in a manner consistent with NASA's International Partner commitments and the needs of human exploration.

	Green	Yellow	Red	White
2 Outcomes	2 (100%)	0	0	0
7 APGs	6 (86%)	0	0	1 (14%)

Cost of Performance (in millions)
$1,769

Responsible Mission Directorate

Contributing Theme



Theme Description

The ISS Theme manages ISS launch processing activities, on-orbit assembly and maintenance, and research payload and experiment delivery to orbit. The program works with NASA's International Partners to maintain and improve ISS capabilities such as appropriate crew presence and available facilities.

PART Assessment Rating

Theme	Last Year Assessed	Overall Rating	Program Purpose and Design	Strategic Planning	Program Management	Program Results/ Accountability
International Space Station	2004	Moderately Effective	100%	100%	88%	47%

Built and operated using state of the art science and technology, the ISS—and by extension Strategic Goal 2—is a vital part of NASA's program of exploration. The ISS provides an environment for developing, testing, and validating the next generation of technologies and processes needed to support Sub-goal 3F, Strategic Goal 4, and NASA's objective to return to the Moon and send human explorers deeper into space.

Benefits

The ISS is a testbed for exploration technologies and processes. Its equipment and location provide a one-of-a-kind platform for Earth observations, microgravity research, and investigations of the long-term effects of the space environment on human beings. The ISS also enables research in fundamental physics and biology, materials sciences, and medicine. Crewmembers test processes for repairing equipment in microgravity, conducting spacewalks, and keeping systems operational over long periods of time—capabilities critical to future missions.

When completed, the ISS will be the largest crewed spacecraft ever built. Many nations provide the resources and technologies that keep the ISS flying, and these international partnerships have increased cooperation and goodwill among participating nations.

Risks to Achieving Strategic Goal 2

The primary risks to Strategic Goal 2 are: the Space Shuttle Program's ability to complete the ISS manifest and to successfully complete assembly operations; the ability of the ISS Program to acquire the necessary spares to be launched on the Shuttle before retirement; and delivery and operability of the systems that support the six crew capability.

FY 2008 Performance Forecast

- In October 2007, NASA launched the Harmony Node 2 module on STS-120. It will serve as a passageway between the U.S. Destiny Laboratory and two modules to be launched in the future: the Japanese Kibo Experiment Module and the European Columbus Laboratory.
- In winter 2008, STS-122 will deliver Columbus, the first European Space Agency (ESA)-supplied ISS module. Columbus will provide additional research space.
- NASA will deliver to the ISS the Kibo pressurized section aboard STS-123 (scheduled for launch in winter 2008) and the Kibo pressurized module and Japanese Remote Manipulator System aboard STS-124 (scheduled for launch in spring 2008). These will be the first major Japanese ISS elements delivered on-orbit. When completed, Kibo will be the largest ISS module, providing both pressurized and unpressurized research facilities.
- NASA, also aboard STS-123, will deliver the Canadian Special Purpose Dexterous Manipulator, or Dextre, a multi-jointed arm that will have greater freedom of mobility than the ISS's Canadarm2 robotic arm.
- In fall 2008, STS-126 will deliver a complement of habitability hardware to enable the six crew capability.

Outcome 2.1: By 2010, complete assembly of the U.S. On-orbit Segment; launch International Partner elements and sparing items required to be launched by the Shuttle; and provide on-orbit resources for research to support U.S. human space exploration.

FY04	FY05	FY06	FY 2007
8.4.1 Green	8.1 Green 8.2 Green	2.1 Green	**Green**

With support from Shuttle flights STS-116 (ISS construction mission 12A.1), STS-117 (13A), and STS-118 (13A.1), NASA continued work on the ISS solar array and truss sections, preparing the ISS for arrival of new major elements in FY 2008. In July 2007, astronaut Clay Anderson successfully activated the Oxygen Generation System (OGS), part of the ISS's Environmental Control and Life Support System (ECLSS) located in the Destiny Laboratory. An addition to the Elekron system located in the Russian Zvezda module, the OGS is critical to supporting future six-crewmember operations.

NASA reached an agreement with the International Partners on the final ISS configuration and assembly sequence, setting a path toward assembly completion in FY 2010.

NASA also continued regular logistical resupply using both Shuttle missions and support from Russian Soyuz and Progress missions.

FY 2007 Annual Performance Goals	FY04	FY05	FY06	FY 2007
Based on the actual Space Shuttle flight rate, number of remaining Shuttle flights, and the discussions with the International Partners, update the agreed to ISS assembly sequence and transportation plan as necessary.	4ISS3 Green	5ISS3 Green	None	**7ISS1 Green**
Accomplish a minimum of 90% of the on-orbit research objectives as established one month prior to a given increment.	4ISS4 Green	5ISS4 Yellow	6ISS3 Yellow	**7ISS2 Green**
Per the final configuration agreed to by the International Partners, fly the ISS elements and logistics baselined for FY 2007.	4ISS5 Green	5ISS5 Yellow	6ISS1 Green	**7ISS3 Green**

Outcome 2.2: By 2009, provide the on-orbit capability to support an ISS crew of six crewmembers.

FY04	FY05	FY06	FY 2007
None	None	None	**Green**

NASA is on track to support six-crewmember operations in FY 2009. ISS crew successfully activated the OGS (see Outcome 2.1 above). A team at Kennedy Space Center modified Harmony (Node 2) to receive a second treadmill, which will provide needed exercise facilities for a larger crew. Harmony was launched successfully in fall 2007 and is integrated onto the ISS. NASA also is preparing other habitability hardware for launch in FY 2008: the Water Recovery System, a Treadmill with Vibration Isolation System, extra crew quarters, the Waste Collection/Hygiene Compartment, the Total Organic Carbon Analyzer, and galley. NASA also made progress in developing plans for training, crew composition and rotation, and Russian Soyuz launch timetable associated with effectively maintaining and using a six-crewmember complement.

FY 2007 Annual Performance Goals	FY04	FY05	FY06	FY 2007
Establish flight-ready status for the urine processing capability (part of the U.S. Regenerative Environmental Control Life Support System).	None	None	None	**7ISS4 Green**
In concert with the International Partners, assure a continuous crew presence on the ISS.	4ISS6 Green	5ISS6 Green	None	**7ISS5 Green**

Efficiency Measures

FY 2007 Annual Performance Goals	FY04	FY05	FY06	FY 2007
Complete all development projects within 110% of the cost and schedule baseline.	4ISS7 Green	5ISS8 Green	6ISS5 Green	**7ISS6 White**
Deliver at least 90% of scheduled operating hours for all operations and research facilities.	None	5ISS9 Green	7ISS6 Green	**7ISS7 Green**

Why NASA rated APG 7ISS6 White: SOMD was not scheduled to complete any development projects in the ISS Theme during FY 2007, so NASA has postponed this Efficiency Measure until a later fiscal year.

Strategic Goal 3: Develop a balanced overall program of science, exploration, and aeronautics consistent with the redirection of the human spaceflight program to focus on exploration.

NASA divided Strategic Goal 3 into a series of Strategic Sub-goals to adequately address the broad range of activities covered by the goal. All of the performance measures (multi-year Outcomes and APGs) associated with Strategic Goal 3 can be found under Sub-goals 3A through 3F.

Sub goal 3A

Study Earth from space to advance scientific understanding and meet societal needs.

	Green	Yellow	Red	White
7 Outcomes	6 (86%)	1 (14%)	0	0
15 APGs	11 (73%)	2 (13%)	1 (7%)	1 (7%)

Cost of Performance (in millions)
$1,397

Responsible Mission Directorate

Contributing Theme

Theme Description

The Earth Science Theme conducts research and technology development to advance Earth observations from space, improve understanding of the Earth system, and demonstrate new remote sensing science and technologies for future operational systems.

PART Assessment Rating						
Theme	**Last Year Assessed**	**Overall Rating**	**Program Purpose and Design**	**Strategic Planning**	**Program Management**	**Program Results/ Accountability**
Earth-Sun System Research	2005	Moderately Effective	100%	100%	84%	74%

Note: NASA divided the Earth–Sun System Theme into two Themes as of the FY 2008 Budget Estimates. Earth Science now is responsible for Sub-goal 3A and Heliophysics is responsible for Sub-goal 3B.

Earth is a dynamic system. Its land, oceans, atmosphere, climate, and gravitational fields are changing constantly. Some of these changes, especially short-duration and localized phenomena like hurricanes and earthquakes, are regionally significant and pose immediate hazards to humans. Other changes, like climate variability, take longer to have effects—which spread over large regions, including the entire Earth—that are revealed through long-term observations and modeling. To achieve Sub-goal 3A, NASA's Earth Science programs help researchers better understand the causes and consequences of these changes through data gathered by Earth-observing satellites, aircraft, and balloons. Using advanced computer systems, program scientists analyze and model the data into useful Earth science information and distribute it to end users around the world.

Benefits

NASA's Earth Science Division is central to three Presidential initiatives that serve the public:

- The Climate Change Research Initiative, established in 2001 to study global climate change and to provide a forum for public debate and decision-making about how the United States monitors and responds to climate change;
- The Climate Change Science Strategic Plan (July 24, 2003) with special emphasis on global observations; and
- The U.S. Ocean Action Plan, released in 2004 as part of a Bush Administration effort to ensure that benefits derived from oceans and other bodies of water will be available to future generations.

To support these initiatives, NASA and its partners—other government agencies, academia, non-profit organizations, industry, and international organizations—conduct vital research that helps the Nation manage environmental and agricultural resources and prepare for natural disasters. In the course of conducting this research, NASA applies the resulting data and knowledge with the Agency's operational partners to improve their decision-making in societal need areas such as public health, aviation, water management, air quality, and energy.

The Earth Science programs also help NASA achieve the Agency's other Strategic Goals and overall Mission:

- Earth observing satellites provide meteorological information used by NASA, the National Oceanic and Atmospheric Administration (NOAA) and the Department of Defense in providing weather forecasts that are used to fulfill their Agency mandates.
- Measurement and analysis techniques, demonstrated first in Earth orbit and applied first to Earth studies, may help advance exploration and understanding of other planets in the solar system.

Risks to Achieving Sub-goal 3A

Long-term climate observations remain at risk due to National Polar-orbiting Operational Environmental Satellite System (NPOESS) restructuring. The resulting gaps in systematic observations and/or reduced accuracy and stability in operational future observations may compromise the effectiveness of NASA's Earth Science program performance. Advancement of climate science and its resulting societal benefits require both the new Earth observations provided by advanced instruments pioneered by NASA and high-quality auxiliary measurements from proven instrumentation flown by NOAA on operational missions such as NPOESS and Geostationary Operational Environmental Satellites (GOES). Recent changes to the NOAA operational systems jeopardize the availability of the high quality operational measurements needed for NASA to achieve Sub-goal 3A. If NASA is given the responsibility of replacing these measurements without concomitant resources, the full suite of new and operational measurements will not be achieved and the effectiveness of the NASA Earth Science program will be significantly compromised.

FY 2008 Performance Forecast

NASA has completed concept studies led by NASA Centers for all the Earth Science Decadal Survey (*Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond*, published by the National Academies in 2007) missions and led community science workshops for the four missions described for implementation in the first, most immediate-priority group. As a result, NASA is prepared to implement the Decadal Survey as resources become available.

NASA continues to work with NOAA and the NPOESS program under the guidance of the Office of Science and Technology Policy (OSTP) to develop plans for the mitigation of the impacts of the NPOESS re-structuring. Planning efforts have been successful in identifying viable solutions and the required resources, which might be implemented in FY 2009.

A Senior Review in 2007 evaluated 10 of the 11 operating spacecraft in the Earth Systematic Missions Program to determine mission extensions and resources required for mission operations (Aura, still in its prime mission through July 2010, was the sole exception). Most of the spacecraft already are in their extended mission phase, and are slated to operate through the end of 2009.

Outcome 3A.1: Progress in understanding and improving predictive capability for changes in the ozone layer, climate forcing, and air quality associated with changes in atmospheric composition.

FY 04	FY 05	FY 06	FY 2007
None	None	3A.1 Green	**Green**

Polar stratospheric clouds (PSCs) play a central role in the springtime depletion of ozone particles over polar regions. These particles spur chemical reactions that release bromine and chlorine from stable compounds found in the atmosphere into chemically reactive forms responsible for ozone destruction. These same chemical reactions store nitrogen, also found in the stable compounds present in PSCs. The PSCs can sediment to lower altitudes, removing nitrogen from higher altitudes and delaying the reformation of these stable compounds—further exacerbating ozone depletion. NASA's Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO), launched in April 2006, can collect PSC data in areas not lit by the Sun, delivering the first routine daily observations across the wintertime Antarctic stratosphere and providing a more accurate view of PSC distribution. In a study published in 2007, scientists stated that CALIPSO observations for the 2006 Antarctic winter and spring provided more accurate PSC representations in global models, which are critical to forecasting the recovery of ozone for a future stratospheric state. This is particularly important for the Arctic, where winter temperatures hover near the threshold where PSCs form, with future stratospheric cooling potentially leading to enhanced cloud formation and substantially greater ozone loss.

A key instrument aboard the Terra and Aqua spacecrafts—the Moderate Resolution Imaging Spectroradiometer (MODIS)—makes measurements of aerosol and cloud properties. Recently, the MODIS science team expanded their data products through a new aerosol algorithm called "Deep Blue," which provides much-improved measurements of aerosols over bright surfaces such as deserts. As a result, MODIS aerosol data products now include large continental areas previously not available. Deep Blue has proven itself to be such an improvement that the U.S. Navy has incorporated this aerosol retrieval algorithm in their operational atmospheric forecasting system.

Scientists using MODIS and other instrument measurements of aerosol properties found apparent increases in aerosol particle size in the vicinity of clouds. They assumed the aerosol size increase was caused by relative humidity gradients

near cloud edges. Radiative transfer (the process of energy transfer in the form of electromagnetic radiation through the atmosphere) modeling of visible light in three-dimensions showed light scattered out from the sides of clouds can scatter off ambient aerosols and cause those aerosols to appear artificially large to satellite remote sensing. Quantifying this effect is important to gain a more certain estimation of aerosol properties and their impact on Earth's radiation/energy budget, the balance of incoming energy from the Sun and out-going long-wave (thermal) and reflected short-wave energy from Earth. For example, the processes associated with the radiation/energy budget keep Earth's overall temperature relatively constant. If the budget becomes unbalanced, such as through increased greenhouse warming caused by aerosols, Earth's global temperature will rise.

FY 2007 Annual Performance Goal	FY04	FY05	FY06	FY 2007
Demonstrate progress in understanding and improving predictive capability for changes in the ozone layer, climate forcing, and air quality associated with changes in atmospheric composition. Progress will be evaluated by external expert review.	None	None	6ESS7 Green	**7ESS1 Green**

3A.2: Progress in enabling improved predictive capability for weather and extreme weather events.

FY04	FY05	FY06	FY 2007
None	None	3A.2 Green	**Green**

New NASA research is providing clues about how the seemingly subtle movement of air within and around the eye of hurricanes provides energy to keep this central "powerhouse" functioning. Using data captured from satellites during field experiments, scientists discovered air patterns that changed the way they would predict a storm's strength. The spinning flow of air parcels, or vortices, in the eye can carry warm, moist eye air into the eyewall, the thunderstorms that separate the eye from the rest of the hurricane. This acts as a turbocharger for the hurricane heat engine. The new results improve understanding of the mechanisms that play significant roles in hurricane intensity.

To gain insight into the behavior of Atlantic hurricanes and understand the forces that cause differences in interannual character of these storms, NASA launched a field experiment—the NASA African Monsoon Multidisciplinary Activities (NAMMA)—to study the birth of hurricanes off the African coast. Many of the powerful late-fall storms that take aim at the United States, Gulf Coast, and eastern seaboard are born over Africa. The goal of this field experiment was to fly high-altitude research aircraft into the maw of early cloud disturbances to discover the precise mechanisms by which a storm's spin becomes organized. In addition, scientists gained a better understanding of how the Saharan Air Layer (an intensely dry, warm and sometimes dust-laden layer of the atmosphere that often overlays the cooler, more-humid surface air of the Atlantic Ocean) or dust might curb the development of these clouds into hurricanes. The major NAMMA research topics included the formation and evolution of tropical hurricanes in the eastern and central Atlantic, the composition and structure of the Saharan Air Layer, and whether or not aerosols affect cloud precipitation and influence cyclone development. The study provided improved physical understanding of tropical hurricanes, helping researchers create better computer models of hurricane development and intensification, and thereby producing more skillful forecasts.

FY 2007 Annual Performance Goal	FY04	FY05	FY06	FY 2007
Demonstrate progress in enabling improved predictive capability for weather and extreme weather events. Progress will be evaluated by external expert review.	None	None	6ESS7 Green	**7ESS2 Green**

3A.3: Progress in quantifying global land cover change and terrestrial and marine productivity, and in improving carbon cycle and ecosystem models.

FY04	FY05	FY06	FY 2007
None	None	3A.3 Green	**Green**

NASA research on terrestrial productivity, land cover, and carbon cycling rely on high-quality satellite remote-sensing data products. Validation of these data products thus is critical and provides an important means for characterizing errors and uncertainties in remote-sensing measurements that affect model results. During FY 2007, NASA investigators summarized ongoing global land product validation in a special journal issue. Papers described validation of the major data products that

are used to analyze terrestrial processes, land cover, and carbon cycling, and provided recommendations for the best use of current products while informing the design of future missions.

Scientists working within NASA's Land Cover and Land Use Change Program analyzed changes in carbon stocks in regrowing forests of the U.S. Pacific Northwest and Northwestern Russia. Forests in both regions, which are regrowing after regional disturbances, influence the exchange of greenhouse gases between land and the atmosphere. Significantly different regional, historical trends influence forest ownership and management practices that affect potential carbon storage. Results of this analysis indicate that over the next 50 years, carbon accumulation on lands managed for timber production in both regions will follow historic patterns.

Researchers have hypothesized that warming would lengthen the growing season in northern ecosystems and increase the probability of fire, leading to a positive feedback between warming, fires, carbon loss, and future climate change. A new multi-factor analysis—examining greenhouse gases, aerosols, black carbon deposition on snow and sea ice, and post-fire changes in surface albedo (or reflectivity)—of the long-term effects of a well-characterized northern forest fire indicates that the net radiative forcing may be negative. Radiative forcing is the difference between incoming and outgoing radiation energy in Earth's climate system. When the radiative forcing is negative, the climate system cools. The analysis also showed that multi-decadal increases in surface albedo had a larger impact than the fire-emitted greenhouse gases. This study illustrates the importance of interdisciplinary, multi-factor analysis and the need to examine effects over decades-to-centuries time scales.

FY 2007 Annual Performance Goals	FY04	FY05	FY06	FY 2007
Demonstrate progress in quantifying global land cover change and terrestrial and marine productivity, and in improving carbon cycle and ecosystem models. Progress will be evaluated by external expert review.	None	None	6ESS7 Green	**7ESS3 Green**
Complete Landsat Data Continuity Mission (LDCM) Confirmation Review.	None	None	None	**7ESS4 White**
Complete Orbiting Carbon Observatory (OCO) Assembly, Test and Launch Operations (ATLO) Readiness Review.	None	None	None	**7ESS6 Yellow**

Why NASA rated APG 7ESS4 White: NASA canceled this APG due to a mandated change in the procurement approach.

Why NASA did not achieve APG 7ESS6: Technical and schedule performance issues with the OCO instrument subcontractor resulted in a four-month launch delay. Consequently, SMD adjusted all major milestones, including the ATLO Readiness Review, to accommodate the new launch date.

Plans for achieving 7ESS6: As part of the rebaselined schedule, SMD plans to conduct the OCO ATLO Readiness Review in January 2008. SMD continues to monitor all its development projects to maintain cost and schedule baselines.

3A.4: Progress in quantifying the key reservoirs and fluxes in the global water cycle and in improving models of water cycle change and fresh water availability.

FY04	FY05	FY6	FY 2007
None	None	3A.4 Yellow	**Green**

NASA's Gravity Recovery and Climate Experiment (GRACE) satellite, launched March 22, 2002, is the first satellite remote-sensing mission to observe groundwater storage variability at regional scales. Groundwater is a vital resource for irrigation and domestic consumption. Without it, agricultural productivity would decrease significantly in many parts of the world, including the central plains of the United States. Researchers routinely use wells to monitor groundwater storage variability at local scales, but that approach is impractical for regional- to continental-scale monitoring. GRACE is unique among remote-sensing satellites in that it relies on observations of Earth's gravity field to infer oceanic and atmospheric circulations and terrestrial water cycling. Using numerical models to separate the contributions to terrestrial water storage variability, including soil moisture and snow, GRACE observations infer groundwater storage variations. Upon analyzing GRACE data, researchers estimated groundwater storage changes in the Mississippi River basin and its four major sub-basins. NASA-supported researchers now are applying their technique to other regions of the world where well observations are unavailable to document water declines.

To ensure the accuracy of data, it is important to constantly assess researchers' ability to measure, monitor, and model various aspects of Earth's water balance (e.g., precipitation, evaporation, soil moisture, snow runoff, atmospheric water content). Estimates of water balance over the past century show variations in the size of various water reservoirs and fluxes. Since water spends a relatively short time in the atmosphere, an annual water balance of the atmosphere should result in a balance of water entering and leaving the atmosphere. However, estimates of water balance quantities over the past century vary enough to suggest that the data collection or modeling method may have been inaccurate. A recent study by NASA-funded researchers evaluated the relative agreement between observation estimates and model estimates. They found that on average, annual estimates of precipitation and evaporation are out of balance. There are inconsistencies between the estimates of the water vapor content of the atmosphere and estimates of precipitation minus evaporation. The study points out that in order to uncover trends in water balance quantities, for example due to climate change, scientists require a two-fold enhancement of their ability to estimate the terms of the water balance and improved quantification of the ocean evaporation.

FY 2007 Annual Performance Goal	FY04	FY05	FY06	FY 2007
Demonstrate progress in quantifying the key reservoirs and fluxes in the global water cycle and in improving models of water cycle change and fresh water availability. Progress will be evaluated by external expert review.	None	None	6ESS7 Green	**7ESS5 Green**

3A.5: Progress in understanding the role of oceans, atmosphere, and ice in the climate system and in improving predictive capability for its future evolution.

FY04	FY05	FY06	FY 2007
None	None	3A.5 Yellow	**Yellow**

Scientists at NASA's Goddard Space Flight Center and the University of Colorado developed an innovative technique for using data from the GRACE satellite to estimate, with unprecedented detail, the growth and shrinkage of major drainage systems in the Greenland and Antarctic ice sheets. In Greenland, these results show significant ice loss in the southeastern section of the ice sheet, and modest losses elsewhere, while the interior has been growing. While the results show that between 2003 and 2005 the ice sheet loss was offset partially by a gain in the interior sheet, they still indicate enhanced ice loss in Greenland since the mid-1990s. These results are consistent with those from altimetry measurements from the Ice Cloud and Land Elevation Satellite (ICESat).

Scientists also showed, using passive microwave satellite data, that winter sea ice extent has significantly accelerated its decline during the last three winters (2005–2007) in a manner consistent with predictions related to greenhouse warming. In the 26 years prior to 2005, the satellite data showed that the sea ice cover in the Northern Hemisphere during winter maximum declined at the rate of approximately two percent per decade, which was modest compared to the nearly 10 percent per decade decline in the extent of the summer sea ice minimum. However, shrinkage appears to have increased significantly in winter 2005, as the ice cover at winter maximum has been consistently low and is about six percent lower than average since then. Such phenomenon is consistent with the expected warming induced by greenhouse gases, which are supposed to be most detectable during dark winter when effects of long-wave radiation are most dominant.

Why NASA did not achieve Outcome 3A.5: Performance toward this Outcome continues to be a concern due to uncertainties in climate data continuity and delays and technical issues related to the NPOESS Preparatory Project (NPP) mission. Although the NASA-developed NPP spacecraft and the NASA-supplied Advanced Technology Microwave Sounder (ATMS) instrument have been successfully delivered and tested and the ATMS is integrated onto the NPP spacecraft, significant technical and schedule problems have caused delays with the development and delivery of the NPOESS-developed Visible/Infrared Imager/Radiometer Suite (VIIRS) instrument. The performance of the instrument will not meet all of NASA's NPP Level 1 requirements and, therefore, will impact key climate research measurements of ocean color and atmospheric aerosols.

Contractor performance also poses risks to both the NPP and Glory missions. Performance issues have been causing cost and schedule overruns, which impact not only the timely implementation of the systematic Earth Observation missions, but the overall success of the flight program.

Plans for achieving 3A.5: In order to improve contractor performance and limit further cost and schedule overruns, NASA implemented management changes on the Glory mission. Management changes also were approved by the Tri-Agency (NASA, NOAA, Department of Defense) Executive Committee and implemented by the Integrated Program Office (IPO) on NPOESS.

Program funding ensures NASA support to the IPO technical management personnel, funding for the competitively selected NPP science team, and the continued NPP project requirements. NASA continues to work with partner agencies to utilize the assessment information developed by the NPP project and science team in developing a joint mitigation strategy and implementation plan.

FY 2007 Annual Performance Goals	FY04	FY05	FY06	FY 2007
Demonstrate progress in understanding the role of oceans, atmosphere, and ice in the climate system and in improving predictive capability for its future evolution. Progress will be evaluated by external expert review.	None	None	6ESS7 Green	**7ESS7 Green**
Complete Glory mission Pre-Ship Review.	None	None	None	**7ESS8 Yellow**
Complete Ocean Surface Topography Mission (OSTM) Critical Design Review (CDR).	None	None	None	**7ESS9 Green**

Why NASA did not achieve APG 7ESS8: SMD did not complete the Glory mission Pre-Ship Review. The contractor, Raytheon Space and Airborne Systems, experienced delays in developing the Aerosol Polarimetry Sensor (APS) instrument, resulting in a decision to move the instrument work to a different development facility. This caused an estimated six-month delay to the APS delivery. There are no significant technical issues with the development of this instrument.

Plans for achieving APG 7ESS8: SMD is revising project plans and scope to optimize the schedule and manpower for the late delivery of the APS. The Pre-Ship Review is scheduled for January 2009. SMD continues to monitor all its development projects to maintain cost and schedule baselines.

3A.6: Progress in characterizing and understanding Earth surface changes and variability of Earth's gravitational and magnetic fields.

FY04	FY05	FY06	FY 2007
None	None	3A.6 Green	**Green**

Accurate global topography has been the goal of explorers and surveyors for millennia because of its importance to understanding the environment and enabling societal development. The Shuttle Radar Topography Mission (SRTM) provided the first uniform high-resolution map of global topography with only 10 days of on-orbit measurement in February 2000. Although NASA released all SRTM data within two years of the SRTM mission, studies continue to characterize and improve the SRTM digital topographic data. In FY 2007, NASA-supported researchers produced a final report on the mission, its technology, its operations, the error distribution, processing, and some of the many and varied science applications.

The Aceh Earthquake and subsequent tsunami exposed the shortcomings of estimating earthquake magnitude and, therefore, tsunami potential from seismic data. Rapid assessment of conditions that could produce a tsunami is especially important for coastal communities near an earthquake epicenter because of short time between the earthquake and the subsequent tsunami. NASA-supported Global Positioning System (GPS) networks could be used in real time to estimate tsunami potential and provide input to tsunami models. NASA is moving ahead with further testing of the concept of regional GPS networks through collaborative efforts with EarthScope, state-operated networks, and international partners.

FY 2007 Annual Performance Goal	FY04	FY05	FY06	FY 2007
Demonstrate progress in characterizing and understanding Earth surface changes and variability of Earth's gravitational and magnetic fields. Progress will be evaluated by external expert review.	None	None	6ESS7 Green	**7ESS10 Green**

3A.7: Progress in expanding and accelerating the realization of societal benefits from Earth system science.

FY 04	FY 05	FY 06	FY 2007
None	None	3A.7 Green	**Green**

The Applied Sciences Program conducts projects to demonstrate, prototype, and validate the use of Earth science products in decision making, benefiting areas like public health, aviation, water management, and disaster management. Through reports that document the improvement in decision making enabled by the use of Earth science, the program enables the routine, sustained use of NASA data products. The program is developing a new, regionally-based activity to focus specifically on the Gulf of Mexico. In addition, the program is developing a new strategic plan, which will address emerging issues such as decision-support needs for climate change and the incorporation of social and economic sciences into applications of satellite observations.

FY 2007 Annual Performance Goals	FY04	FY05	FY06	FY 2007
Issue twelve reports with partnering organizations that validate that using NASA research capabilities (e.g., observations and/or forecast products) could improve their operational decision support systems.	None	None	None	**7ESS11 Green**
Complete five studies on plans to transition the results of NASA research and development, including scientific spacecraft and instruments, models, and research results, with potential to improve future operational systems of partner agencies.	None	None	None	**7ESS12 Green**

Efficiency Measures

FY 2007 Annual Performance Goals	FY04	FY05	FY06	FY 2007
Deliver at least 90% of scheduled operating hours for all operations and research facilities. (This APG is repeated under Sub-goal 3B.)	None	5SEC14 Yellow	None	**7ESS22 Green**
Peer-review and competitively award at least 80%, by budget, of research projects. (This APG is repeated under Sub-goal 3B.)	4ESA8 Green	5SEC16 Green	None	**7ESS23 Green**
Reduce time within which 80% of NRA research grants are awarded, from proposal due date to selection, by 5% per year, with a goal of 130 days.	None	None	None	**7ESS24 Red**

Why NASA did not achieve Efficiency Measure 7ESS24: Earth–Sun System research grant selection notifications were significantly delayed in FY 2007 as a result of several factors that resulted in an increase rather than a decrease to processing times. The 15-percent reduction in the Research and Analysis budget in FY 2006, maintained in FY 2007 under the year-long continuing resolution, delayed selection decisions. Additionally, due to several large triennial programs being competed in FY 2007 and the increasing pressure for funding, the number of selection notifications (599) for the Earth–Sun System Theme was 61-percent greater than in FY 2006 (373).

Plans for achieving 7ESS24: SMD is implementing a number of measures to reduce processing times and expects to make significant progress. These measures include finding greater efficiencies in the manner in which panel reviews are constructed, reassessing the steps taken to conduct the proposal review process, and instituting job sharing to afford greater support and back-up contingencies for program officers. Furthermore, it is SMD's goal to adjust the timing of review panels to achieve greater efficiency. However, it should be noted that processing times for Earth Science will likely show an increase every third or fourth year, when the program conducts several large reviews at the start of a cycle. Although staggering the scheduling of these reviews would speed processing times, doing so would have programmatic impacts and will have to be carefully considered.

Sub goal 3B

Understand the Sun and its effect on Earth and the solar system.

	Green	Yellow	Red	White
3 Outcomes	3 (100%)	0	0	0
11 APGs	8 (73%)	2 (18%)	1 (9%)	0

Cost of Performance (in millions)
$964

Responsible Mission Directorate

Contributing Theme

Theme Description

The Earth–Sun System Theme conducts research and technology development to advance Earth observations from space, improve understanding of the Earth system, and demonstrate new technologies for future operational systems. It also explores the Sun's connection with, and effects on, the solar system to better understand Earth and Sun as an integrated system, protect technologies on Earth, and safeguard human space explorers.

PART Assessment Rating

Theme	Last Year Assessed	Overall Rating	Program Purpose and Design	Strategic Planning	Program Management	Program Results/ Accountability
Earth–Sun System	2005	Moderately Effective	100%	100%	84%	74%

Note: NASA divided the Earth–Sun System Theme into two Themes as of the FY 2008 Budget Estimate. Earth Science now is responsible for Sub-goal 3A and Heliophysics is responsible for Sub-goal 3B.

Life on Earth is linked to the behavior of the Sun. The Sun's energy output is fairly constant, yet its spectrum and charged particle output are highly variable on numerous timescales. Moreover, short-term events like solar flares and coronal mass ejections (CMEs) can change drastically solar radiation emissions over the course of a single second. All of the solar system's classical nine planets orbit within the outer layers of the Sun's atmosphere, and some planetary bodies, like Earth, have an atmosphere and magnetic field that interacts with the solar wind. While Earth's magnetic field protects life, it also acts as a battery, storing energy from solar wind until it is released, modifying "space weather" that can disrupt communications, navigation, and power grids, damage satellites, and threaten the health of astronauts.

To achieve Sub-goal 3B, Heliophysics Theme researchers study the Sun and its influence on the solar system as elements of a single, interconnected Earth–Sun system using a group of spacecraft that form an extended network of sensors that allow the investigation of the magnetic sun and its effect on the planets and the solar system. Using data from these spacecraft, NASA seeks to understand the fundamental physics behind Sun–planet interactions and study space environmental hazards.

Benefits

Society is increasingly dependent on technologies that are vulnerable to solar activity and space weather events, so the need to predict solar events and mitigate their effect is critical to the public's safety, security, and the Nation's economy.

This predictive capability is critical to NASA's human and robotic space missions as well. Better understanding and improved observations of solar events and of heliophysics will provide the information needed to develop early warning systems and technologies that will protect astronauts, spacecraft, and the systems that support both from hazardous space radiation.

Risks to Achieving Sub-goal 3B

Of primary cost concern for the Heliophysics Division is the reduction of Expendable Launch Vehicle (ELV) options. Over the course of the last decade, the Delta II has been the workhorse for SMD, its loss leaving only larger and costlier Evolved ELVs (Delta IV, Atlas V) for many of the missions identified in the NASA Science Plan, or much smaller launch vehicles with significantly reduced capabilities. NASA is aggressively exploring options to maintain a vital flight program.