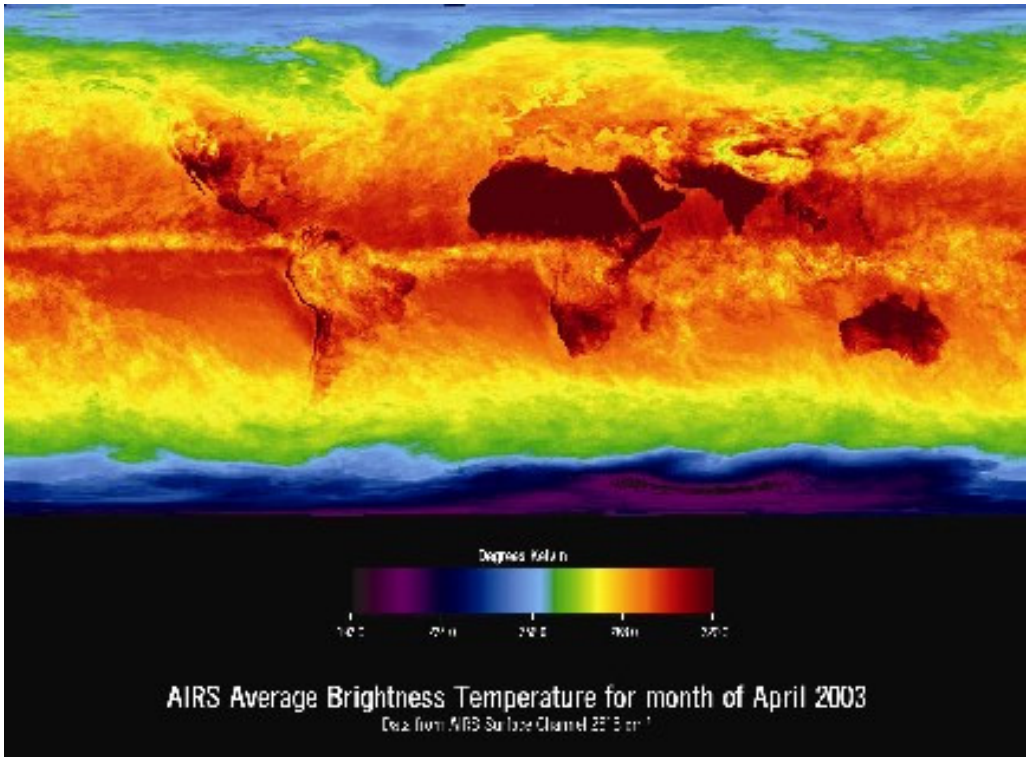
Theme: Earth System Science



The Atmospheric Infrared Sounder (AIRS) and Advanced Microwave Sounding Unit (AMSU) instruments on the Aqua satellite are generating the most accurate, high resolution measurements ever taken from space of the infrared brightness (radiance) of Earth's atmosphere, yielding a global, three-dimensional map of atmospheric temperature and humidity.

Earth System Science

MAJOR EVENTS IN FY 2005

- Several Explorer missions (OCO, Aquarius) begin implementation in FY05.
- In FY05, NASA remote sensing and modeling research in the North American Carbon Program will be supporting major intensive field campaigns, very likely in the mid-continental U.S. and in one or more coastal regions, with the exact regions to be identified through peer review processes occurring in 2004. Also, NASA, DOE, and NOAA will be completing the preparation and release of the first State of the Carbon Cycle Report, a Carbon Cycle Science Plan (CCSP) Synthesis and Assessment product.
- Cloudsat and CALIPSO will launch in FY05 and will begin providing key measurements to improve climate predictions. Specifically, these satellites will observe the roles of clouds in Earth's climate, and the role of clouds and aerosols in the Earth's radiation budget.
- NASA's next generation Earth-observing satellite, Aura, will begin supplying the most complete information yet on the health of Earth's atmosphere. The data flowing from these global observations will help scientists track the sources and processes controlling global and regional air quality, quantify the impact of aerosols, tropospheric ozone and upper tropospheric water vapor on Earth's climate, and answer other key scientific questions.
- In FY05, the Earth Science Enterprise will complete the first phase of the Earth System Modeling Framework (ESMF) development. With the completion of ESMF, new science will be enabled and the collaboration between the Earth system modeling centers will be enhanced.
- The Earth Science Enterprise will continue to conduct research, analysis, modeling, and will use data and information resulting from NASA satellites that contribute to answering critical scientific questions on the Earth system to aid policy and economic decision-makers.

Theme: Earth System Science

OVERVIEW

NASA uses the vantage point of space to observe Earth and understand both how it is changing and the consequences for life. The Earth System Science Theme works with the science community to answer questions on the frontiers of science that have profound societal importance, and for which remote sensing of the Earth can make a defining contribution. The program funds research at the Nation's universities, conducts research at NASA Centers, and collaborates with other research agencies (such as the U.S. Climate Change Science Program Office/U.S. Global Change Research Program, and the National Research Council) to define these questions and lay the scientific foundation for prioritizing and approaching them. The program is answering the scientific community's call for comprehensive observation of the Earth's major components. Research results contribute to the development of sound environmental policy and economic investment decisions. With the FY 2005 budget request, NASA will continue its progress in answering key scientific questions and demonstrating practical applications in response to national priorities.

Missions	Goals supported by this Theme	Objectives supporting these Goals
To Understand and Protect Our Home Planet	1. Understand the Earth system and apply Earth system science to improve prediction of climate, weather, and natural hazards.	1.1 Understand how the Earth is changing, better predict change and understand the consequences for life on Earth.
To Inspire the Next Generation of Explorers	7. Engage the public in shaping and sharing the experience of exploration and discovery.	7.1 Improve public understanding and appreciation of science and technology, including NASA aerospace technology, research, and exploration missions.

RELEVANCE

The NASA Earth System Science program is driven by the recognition of the societal importance of the natural variability of the Earth system and the realization that humans are no longer passive participants in global change, but are instead causing significant changes in atmospheric composition, land use and land cover, and water resources. NASA's satellites are examining the global water cycle, including the roles of precipitation and ice. Understanding how water cycles through the Earth system of oceans, atmosphere, land, and ice is essential for assessing the future of fresh water availability in the U.S. Southwest and other thirsty regions of the globe. NASA is also studying the seasonal rhythm of terrestrial and marine ecosystems on a global scale for the first time. This view of the seasonal uptake and release of carbon provides us with new insights into the role of ecosystems in the carbon cycle. This research helps us assess the impact of global change on food and fiber production. The FY 2005 budget reflects the alignment of the Earth System Science program with the President's call for action through the U.S. Climate Change Research Initiative (CCRI). In support of this effort, we are continuing the development and launch of an advanced polarimeter to increase our understanding of black carbon soot and other aerosols as causes of climate change.

Education and Public Benefits
The Earth Systems Science Theme increases public awareness and understanding of how the Earth functions as a system, and enables the use of Earth science information and results in teaching and learning at all levels of education. The Theme also builds capacity for productive use of Earth science results, technology, and information in resolving everyday practical problems via the Earth Science Applications Theme.

IMPLEMENTATION

Earth System Science employs a constellation of more than 18 Earth observing satellites that routinely make measurements with over 80 remote sensing instruments to observe the Earth. This information is used to analyze, model, and improve our understanding of the Earth system. Data gathered by these spacecraft will enable improved predictions of climate, weather, and natural hazards. NASA works with the science community to identify questions on the frontiers of science that have profound societal importance, and to which remote sensing of the Earth can make a defining contribution. These science questions become the foundation of a research strategy, which defines requirements for scientific observations. Each science focus area (see "Theme Elements" in the table below) has an implementation roadmap that shows the combination of technology, observations, modeling efforts, basic research, and partnerships needed to answer the questions over time.

Earth System Science is a multiple-project program with Theme responsibility in the Office of Earth Science at NASA Headquarters (HQ). Enterprise official is Dr.Ghassem Asrar, Associate Administrator for Earth Science at HQ. Theme Director is Dr. Jack Kaye at HQ. The Science focus area roadmaps listed below can be seen at: http://earth.nasa.gov/roadmaps.

Theme: Earth System Science

Theme Element	Purpose
Climate Variability and Change	Develop integrated models of the ocean, air, cryosphere and land surface, and apply to retrospective and future studies of climate variability and change. Some mission activities that support this science area include Terra, Aqua, Cloudsat, ICESat, Glory, Aquarius, and OCO.
Weather	Develop the technology, observational and modeling capacity needed to improve daily and extreme weather forecasting (e.g., hurricanes, tornadoes). Some mission activities that support this science area include Quikscat, GPM, and Aqua.
Atmospheric Compsoition	Understand the trace constituent and particulate composition of the Earth's atmosphere and predict its future evolution. Some mission activities that support this science area include SAGE, UARS, TOMS, Aura, Glory, OCO, and Calipso.
Carbon Cycle and Ecosystems	Understand and predict changes in the Earth's terrestrial and marine ecosystems and biogeochemical cycles. Some mission activities that support this science area include Landsat and Landsat Continuity, NPP, OCO, Terra, and Aqua.
Water and Energy cycles	Characterize and predict trends and changes in the global water and energy cycles. Some mission activities that support this science area include TRMM, GRACE, Cloudsat, Hydros, and GPM.
Earth Surface and Interior	Utilize state-of-the-art measurements and advanced modeling techniques to understand and predict changes in the Earth's surface and interior. Some mission activities that support this science area include GRACE, ICESat, and the Geodetic Network.

Tailoring: No exceptions to NPG 7120.5B have been taken.

STATUS

In FY03, this Theme advanced our knowledge of the Earth system in many ways:

- NASA ozone research over the past decade is paying dividends. Recent analyses of annual Antarctic ozone depletion over the past five years indicates a reduction in the rate of depletion. This may be an indication that worldwide efforts to reduce emissions of ozone depleting chemicals are working. NASA continues to monitor ozone concentrations.
- A NASA - Department of Energy jointly-funded study concludes that the Earth has been greening over the past 20 years. The article, appearing in the journal "Science," states climate changes have provided extra doses of water, heat and sunlight in areas where the lack of one or more of those ingredients may have been limiting plant growth. At the same time, another NASA study has found the net primary productivity has decreased over the world's oceans since the early 1980s. The decline in oceanic productivity occurred mostly at high latitudes, while ecosystems in all tropical regions and in the high latitudes of the Northern Hemisphere accounted for 80% of the increase in terrestrial productivity.
- The Atmospheric Infrared Sounder (AIRS) and Advanced Microwave Sounding Unit (AMSU) instruments on the Aqua satellite are generating the most accurate, highest resolution measurements ever taken from space of the infrared brightness (radiance) of Earth's atmosphere, yielding a global, three-dimensional map of atmospheric temperature and humidity. U.S. and European research meteorologists are using these data to improve weather models, and will employ them in an operational mode in the coming months.
- Scientists operating the joint U.S.-German GRACE satellite released the most accurate map of Earth's gravity field. GRACE is the oceanographers' newest tool to unlock the secrets of ocean circulation and its effects on climate. These early data have already improved by 10 to 100 times the accuracy of our knowledge of Earth's gravity field.
- Launching spacecraft with cutting-edge technology and instruments in a timely and cost effective manner is a key element for the continued success of Earth system research and analysis. FY 2003 saw the launch of two Earth observing satellites, ICESat and the Solar Radiation and Climate Experiment (SORCE). The instruments on these satellites will add to the 16 existing operating missions in orbit and continue to provide users with unprecedented volumes of information and data.
- South America is the latest continent for which detailed topographic data has been generated from the Shuttle Radar Topography Mission.

Theme: Earth System Science

PERFORMANCE MEASURES

Outcomes/Annual Performance Goals (APGs)	
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.

Theme: Earth System Science

Outcomes/Annual Performance Goals (APGs)	
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.
Outcome 7.1.4	*Engage the public in NASA missions, discoveries and technology through public programs, community outreach, mass media, and the Internet.*
5ESS10	Post the most exciting imagery and explanations about Earth science on the Earth observations/ESE website.
Uniform Measures	
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.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
External Peer Review	Earth Science Advisory Committee	7/03	2/04	Annual peer review
External Peer Review	National Academy of Sciences	7/03	10/05	Review of strategic plan

BUDGET

Budget Authority ($ millions)	FY 2003	FY 2004	Change	FY 2005	Comments
Earth System Science	**1,304.1**	**1,522.4**	**-113.9**	**1,408.5**	
Development	488.5	402.7	-160.3	242.4	
AURA	98.3	52.2	-47.7	4.5	
SeaWinds	5.5	4.5	-1.5	3.0	
NPOESS Preparatory Project (NPP)	128.8	103.5	+37.6	141.1	
Cloud-Aerosol Lidar and Infrared Pathfinder Satellite	32.5	28.2	-18.1	10.1	
CloudSat	25.7	16.4	-13.3	3.1	
EOSDIS	122.6	143.0	-102.8	40.2	
IceSAT	8.6				
GIFTS	22.2	26.8	-10.3	16.5	
Small Projects	44.4	28.1	-4.2	23.9	
Operations	249.1	314.9	-7.7	307.2	
Research	410.4	521.6	+38.4	560.0	
Technology and Advanced Concepts	156.1	283.2	+15.7	298.9	
Technology Infusion Program	75.0	85.3	-26.3	59.0	
Missions in Formulation	81.1	197.9	+42.0	239.9	

Indicates changes since the previous year's President's Budget Submit.
Indicates budget numbers in full cost.

Theme: Earth System Science
Development: CloudSat

PURPOSE

Objectives	Performance Measures
1.1	5ESS9-10,16

CloudSat observations will improve cloud modeling, contributing to better predictions of cloud formation and distribution and to a better understanding of the role of clouds in Earth's climate system. Clouds are a component of the Earth's hydrological cycle, and they dominate the planet's solar and thermal radiation budgets. Even small changes in their abundance or distribution could significantly alter the climate. These considerations lead scientists to believe that the largest uncertainties in climate model simulations are due to the difficulties in adequately representing clouds and their radiative properties.

OVERVIEW

CloudSat is designed to measure the vertical structure of clouds from space. CloudSat will fly a millimeter-wave (94 GHz) radar that is capable of seeing a large fraction of clouds and precipitation, from very thin cirrus clouds to thunderstorms producing heavy precipitation. CloudSat will furnish data needed to evaluate and improve the way clouds are represented in global models, thereby contributing to better predictions of clouds and a more complete knowledge of their role in climate change. CloudSat, a collaboration among NASA, the Canadian Space Agency (CSA), and the U.S. Air Force, is co-manifested with CALIPSO. The mission will fly in formation with Aqua and CALIPSO. CSA is contributing instrument components and the U.S. Air Force (USAF) is contributing ground operations. CloudSat will provide critical data helping to answer the following science question: What are the effects of clouds and surface hydrologic processes on Earth's climate? Link to project homepage for more information: http://cloudsat.atmos.colostate.edu/.

PROGRAM MANAGEMENT

CloudSat is part of the Earth Explorers program, with program responsibility delegated to the Goddard Space Flight Center (GSFC). The GSFC center Program Management Council (PMC) has CloudSat governing responsibility. Enterprise official is Dr. Ghassem Asrar, Associate Administrator for Earth Science. Theme Director is Dr. Jack Kaye. Program Director is Doug McCuistion.

TECHNICAL COMMITMENT

The baseline for this technical commitment was made in December 2001 and is detailed in the Earth Explorers Program Commitment Agreement (PCA).

Technical Specifications	FY 2005 President's Budget	Change from Baseline
Instrument	The CloudSat instrument is the Cloud Profiling Radar (CPR). The CPR is a 94-GHz nadir-looking radar that measures the power backscattered by clouds as a function of distance from the radar.	--
Launch and Mission Profile	The CloudSat satellite will be co-manifested with CALIPSO on a Delta II launch vehicle. CloudSat will fly in formation with Aqua and CALIPSO.	--
Science Data Products and Processing	The CloudSat CPR provides calibrated, range-resolved radar reflectivity measurements.	--
Mission Operations	The USAF Space Test Program will provide ground operations and manage communications. It is expected that the data will be downlinked up to seven times per day.	--
Data Archiving and Distribution	Colorado State University Cooperative Institute for Research in the Atmosphere will be responsible for processing, archiving and distributing the mission science data.	--

Schedule	FY 2005 President's Budget	Baseline	Change from Baseline
Instrument Delivery to I&T	Under replan, NET Mar-04	Nov-03	Minimum +4 months
Launch	Under replan - no earlier than 3/05	April-04	+11 months
Mission Design Life	Two years	--	--

Theme: Earth System Science
Development: CloudSat

Acquisition Strategy and Performing Organizations

Major acquisitions for CloudSat are: Science investigations; 94 GHz Cloud Profiling radar and spacecraft bus; and operations system development. MOU with CSA for radar components, and science operations (2 years). JPL is prime contractor for radar development and overall mission management. Ball Aerospace is building the spacecraft bus under contract with JPL. Data processing provided by Colorado State University under contract with GSFC. Changes since FY04 Pres. Budget: None.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	100%	Industry	3%
Cost Reimbursable	99%	Sole Source	0%	Government	0%
Fixed Price	0%		100%	NASA Intramural	94%
Grants	1%			University	3%
Other	0%	Sci Peer Review	100%	Non Profit	0%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition -Major	Selection	Goals
No major acquisitions remain.	N/A	

Agreements

Internal: GSFC/JPL - CloudSat Mission Formulation/Implementation Subprocess, 12/00. External: GSFC/Colorado State University - CloudSat Mission Implementation Phase, 12/00; GSFC/USAF, MOU Ground Support/Mission Operation, 9/00; NASA/Canadian Space Agency, LOA Development of the CloudSat Cooperative Mission, 11/99; NASA/Canadian Space Agency, Interim Agreement, Development of the CloudSat Cooperative Mission, 10/01; SCU/LPL/DOE Memorandum of Agreement; DOE ground validation data from its Atmospheric Measurements program. Changes since FY04 Pres. Budget: Implementation Phase of contracts.

Risk Mitigation

Top Risks	Y	Overall	Y	Cost	Y	Schedule	Y	Probability	Impact	Mitigation Plan
Y	Launch delay due to problems with High Voltage Power Supply (HVPS)							High	Medium	JPL tiger team rework HVPS

Independent Reviews

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Flight Readiness Review	IIRT	N/A	1/05	Update status; certify flight readiness; open MMR issues.
Launch Readiness Review	IIRT	N/A	1/05	Final review before launch.
Mission Readiness Review	IIRT	N/A	1/05	Assess readiness of mission to proceed with launch and operations.
Operational Readiness Review	IIRT	N/A	12/04	Verify that system elements meet mission requirement and are ready for launch.
Pre-environmental Review	IIRT	N/A	3/04	Assess flight hardware, software, and environmental test facilities.

Theme: Earth System Science
Development: CloudSat

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	Prior	FY03	FY04	FY05	FY06	FY07	FY08	FY09	BTC	Total	Comments
FY2005 PRESBUD	93.6	25.7	16.4	3.1	1.4					140.2	
Development	82.0	17.0	7.3	3.1	1.4					110.9	Includes operations
Launch Vehicle	11.6	8.6	9.1							29.3	
Changes since 2004 PRESBUD		-1.7	-0.1	+0.4	-0.3					-1.6	
Development		+0.7	-0.2	+3.1	+1.4					+5.0	Ops incl in dev. Full cost adj; launch date change.
Launch Vehicle		-2.4	+2.1							-0.4	
Operations			-1.9	-2.7	-1.7					-6.3	
FY2004 PRESBUD	93.6	27.4	16.5	2.7	1.7					141.8	
Launch Vehicle	11.6	11.1	7.0							29.7	
Development	82.0	16.3	7.5							105.9	
Operations			1.9	2.7	1.7					6.3	
Initial Baseline	100.9	10.3	3.1	1.5						115.8	
Development	76.5	3.7								80.2	FY01 PRESBUD
Operations		1.2	3.1	1.5						5.8	
Launch Vehicle	24.4	5.4								29.8	

Indicates changes since the previous year's President's Budget Submit.
Indicates budget numbers in full cost.

Theme: Earth System Science

Development: Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO)

PURPOSE

Objectives	Performance Measures
1.1	5ESS1,11

The CALIPSO mission will address the role of clouds and aerosols in the Earth's radiation budget, providing key measurements to improve climate predictions. Climate models predict a significant global warming in response to the rising concentrations of carbon dioxide and other greenhouse gases in the atmosphere, but uncertainties in the modeled radiative effects of aerosols (small suspended particles) and clouds contribute to the overall uncertainty in the predicitions of the climate models. Current predictive capabilities must be improved to enable policy makers to reach balanced decisions on mitigation strategies.

OVERVIEW

The mission will fly a 3-channel lidar (a laser) in formation with Aqua and CloudSat to obtain coincident observations of radiative fluxes and the atmosphere. This set of measurements is essential for quantification of global aerosol and cloud radiative effects. CALIPSO consists of a partnership between NASA and France's Centre Nationale D'Etudes Spatiale (CNES). CNES is providing a Proteus spacecraft, the imaging infrared radiometer (IIR), integrated observatory I&T, and spacecraft mission operations. This mission will improve our ability to predict the future state of Earth's climate. Together, CALIPSO and Aqua provide: 1) a global measurement suite from which the first observationally-based estimates of aerosol direct radiative forcing of climate can be made; 2) a dramatically improved empirical basis for assessing aerosol indirect radiative forcing of climate; 3) a factor of 2 improvement in the accuracy of satellite estimates of long-wave radiative fluxes at the Earth's surface and in the atmosphere; and 4) a new ability to assess cloud-radiation feedback in the climate system. CALIPSO is co-manifested with CloudSat and is scheduled to launch no earlier than January 2005. Link to project homepage for more information: http://www-calipso.larc.nasa.gov/ .

PROGRAM MANAGEMENT

CALIPSO is part of the Earth Explorers program with program responsibility delegated to GSFC. LaRC and GSFC jointly chair an integrated Program Management Council (PMC). The PMC has CALIPSO Project governing responsibility. Enterprise official is Dr. Ghassem Asrar, Associate Administrator for Earth Science. Theme Director is Dr. Jack Kaye. Program Director is Doug McCuistion.

TECHNICAL COMMITMENT

The baseline for this technical commitment was made in February 2001 and is detailed in the Earth Explorers Program Commitment Agreement (PCA).

Technical Specifications	FY 2005 President's Budget	Change from Baseline
Instruments	Three-channel Lidar, Imaging Infrared Radiometer, and Wide Field Camera.	--
Launch and Mission Profile	Satellite planned to be launched into 705km altitude, 98.08 degrees inclined orbit. CALIPSO is planned to be co-manifested w/CloudSat on a Delta II launch vehicle & fly in formation w/Aqua & CloudSat.	--
Science Data Products and Processing	Science data sets: aerosol & cloud vertical dist., aerosol extinction & optical depth/cloud extinction, optical depth, emissivity, & effective particle size & surface atmospheric radiative fluxes.	--
Mission Operations	Mission Operations Control Center at LaRC and the CNES-contributed Satellite Operations Control Center in Toulouse, France.	--

Schedule	FY 2005 President's Budget	Baseline	Change from Baseline
Spacecraft Bus Delivery to I&T	Dec-03	May-03	+ 7 months
Instrument delivery to I&T	Feb-04	May-03	+9 months
Launch	Under replan - no earlier than 3/05	April-04	+11 months
Mission Design Life	Three years	Three years	None

Theme: Earth System Science

Development: Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO)

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Major acquisitions for CALIPSO are: payload, science investigations, science data ground system, algorithm implementation, operations center development, and science operations (3 years). Prime contract with Ball Aerospace for payload awarded in August 1999. MOU agreement in place between NASA and CNES to provide the IIR and Spacecraft Proteus bus. Changes since FY04 Pres. Budget: None.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	100%	Industry	95%
Cost Reimbursable	99%	Sole Source	0%	Government	1%
Fixed Price	0%		100%	NASA Intramural	0%
Grants	1%			University	4%
Other	0%	Sci Peer Review	100%	Non Profit	0%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition -Major	Selection	Goals
No major acquisitions remain.	N/A	N/A

AGREEMENTS

Internal: GSFC/LaRC Memorandum of Understanding, April 1999. External: NASA/CNES Letter of Agreement, June 1999; NASA/CNES MOU June 2003. Changes since FY04 Pres. Budget: None.

RISK MITIGATION

Top Risks	Y	Overall	Y	Cost	Y	Schedule	Y	Probability	Impact	Mitigation Plan
Y	CNES S/C does not meet NASA launch site safety requirements							Medium	Medium	Develop safety mitigation plan

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Flight Readiness Review	IIRT	N/A	1/05	Certify flight readiness; open MMR issues.
Launch Readiness Review	IIRT	N/A	1/05	Final review before launch.
Mission Readiness Review	IIRT	N/A	1/05	Assess readiness of system to launch and assess operations.
Satellite Pre-Ship Review	IIRT	N/A	11/04	Certify that mission elements meet requirements and are ready for launch.

Theme: Earth System Science

Development: Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO)

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	Prior	FY03	FY04	FY05	FY06	FY07	FY08	FY09	BTC	Total	Comments
FY2005 PRESBUD	86.0	32.5	28.2	10.1	3.7	2.6	0.1	0.1		163.3	
Development	74.4	23.8	19.1	10.1	3.7	2.6	0.1	0.1		133.9	Includes operations.
Launch Vehicle	11.6	8.7	9.1							29.3	
Changes since 2004 PRESBUD		-1.3	-0.2	+2.5	-0.8	-0.4	+0.1	+0.1			
Development		+1.1	+18.9	+10.1	+3.7	+2.6	+0.1	+0.1		+36.6	Full cost adjustments; launch date change. Ops funding incl in dev
Launch Vehicle		-2.4	+2.1							-0.3	
Operations			-21.2	-7.6	-4.5	-3.0				-36.3	
FY2004 PRESBUD	86.0	33.8	28.4	7.6	4.5	3.0				163.3	
Development	74.4	22.8	0.2							97.4	
Operations			21.2	7.6	4.5	3.0				36.3	
Launch Vehicle	11.6	11.0	7.0							29.7	
Initial Baseline	89.5	16.0	4.5	2.2						112.2	
Development	65.0	3.2								68.2	FY2001 President's Budget
Operations		7.5	4.5	2.2						14.2	
Launch Vehicle	24.5	5.3								29.8	

Indicates changes since the previous year's President's Budget Submit.

Indicates budget numbers in full cost.

Theme: Earth System Science
Development: GIFTS

PURPOSE

Objectives	Performance Measures
1.1	5ESS2, 6, 11

The Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS) mission will validate advanced technologies for lower cost remote sensing systems, and provide a water vapor winds measurement capability to improve operational weather observation and prediction. This will enable significant improvements in the accuracy of short-term weather forecasts. GIFTS will also monitor pollutants and greenhouse gases in both the Earth's troposphere and stratosphere, improving our ability to forecast air quality.

OVERVIEW

This mission is designed to demonstrate technologies required to measure atmospheric temperature within 1 degree Kelvin and 1 km vertical resolution from geosynchronous orbit for the first time. Such measurements will enable significant improvements in the accuracy of short-term weather forecasts. In addition, GIFTS will enable advanced technologies and include: an imaging interferometer; large focal-plane arrays; low-power, high-efficiency mechanical cooler; and new data readout and signal processor electronics. These technologies will be used for measuring temperature, water vapor, wind, and chemical composition with high resolution in space and time. GIFTS is being planned as a partnership with the National Oceanic and Atmospheric Administration (NOAA). The Office of Naval Research (ONR) in the Department of the U.S. Navy had been a partner but has since been unable to continue its commitment. At this time, the instrument will be completed and NASA will continue to explore rides of opportunity and potential partnerships via U.S. inter-agency agreements, commercial, and/or international opportunities.

Link to project homepage for more information: http://nmp.jpl.nasa.gov/.

PROGRAM MANAGEMENT

GIFTS is part of the New Millennium Program (NMP), managed by the JPL NMP office. The mission is a collaboration between NASA and NOAA. The project hardware implementation and first year of mission operations is managed by Langley Research Center. Enterprise official is Dr. Ghassem Asrar. Theme Director is Dr. Jack Kaye. Program Director is Doug McCuistion.

TECHNICAL COMMITMENT

The baseline for this technical commitment was made in the NMP Program Commitment Agreement (PCA).

Technical Specifications	FY 2005 President's Budget	Change from Baseline
1	Measure the surface temperature to better than 1/2 Kelvin;	--
2	Measure temperature profiles of the atmosphere to better than +/- 1 Kelvin for 1 km layers (1 sigma);	--
3	Measure and spatially resolve the wind velocity to better than 4 m/s for 2 km layers (1 sigma);	--
4	Measure the water vapor level to better than 20% accuracy for 2 km layers (1 sigma).	--
Design for two-year lifetime. Includes an initial year to demonstrate breakthrough technologies and measurement concept, as well as an extended period over the Indian Ocean to provide imaging and other weather products.		

Schedule	FY 2005 President's Budget	Baseline	Change from Baseline
Start of Formulation	Nov-99	--	--
GIFTS Instrument Critical Design Review	Jun-04	Jun-03	+1 year
GIFTS Instrument delivery to spacecraft	Sept-05	Aug-04	+13 months
Observatory Launch Readiness Date (LRD)	TBD	Nov-05	TBD
Delivery of Mission Validation Data	Checkout +6 months	Jun-07	TBD
Observatory Operational Lifetime	Two years with 50% reliability	7 years	- 5 years

Theme: Earth System Science
Development: GIFTS

Acquisition Strategy and Performing Organizations

Major acquisitions for GIFTS-IOMI are: Contract with Space Dynamics Laboratory for the imaging interferometer instrument, complete with subcontracts for detector assemblies (BAE), high reliability lasers (Tesat), cryocoolers (Lockheed-Martin), and star tracker assemblies (Texas A&M University). Changes since FY04 Pres. Budget: None.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	99%	Industry	18%
Cost Reimbursable	100%	Sole Source	1%	Government	13%
Fixed Price	0%		100%	NASA Intramural	1%
Grants	0%			University	68%
Other	0%	Sci Peer Review	100%	Non Profit	0%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition -Major	Selection	Goals
Control Module	FY03/04	N/A
Radiation Tolerant Processor	FY03/04	N/A

Agreements

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator of Earth Science. External: Memoranda of Agreement have been signed with the Department of the Navy and NOAA. The USN withdrawal has rendered the MOA ineffectual and Project replanning is underway. NOAA-provided funding remains in effect.

Risk Mitigation

Top Risks	Y	Overall	Y	Cost	Y	Schedule	G	Probability	Impact	Mitigation Plan
Y	Risk assessment pending project replan reviews w/HQ (Mar 04)							Medium	Medium	In work

Independent Reviews

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Delta Confirmation Assessment	SMO	3/02	3/04	Establish maturity of developmental technology components; project health.
Instrument CDR	SMO/IRT	N/A	6/04	Determine instrument readiness to proceed to fabrication and assembly.
Launch Readiness Review (On Hold)	SMO/IRT	N/A	TBD	Determine overall system readiness to launch.
Mission CDR (On Hold)	SMO/IRT	N/A	TBD	Determine mission readiness to proceed to production.
Mission Confirmation Review (On Hold)	SMO	4/02	4/02	Determine readiness to proceed to implementation.
Mission Pre-Ship Review (On Hold)	SMO/IRT	N/A	TBD	Determine completeness of observatory verification and test.
Mission Readiness Review (On Hold)	Smo/IRT	N/A	TBD	Assess completeness of mission coordination, ops planning, and ground system.
Preliminary Design Review (PDR)/CDR	SMO	3/01	10/04	Establish design readiness to proceed to implementation.

Theme: Earth System Science
Development: GIFTS

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	Prior	FY03	FY04	FY05	FY06	FY07	FY08	FY09	BTC	Total	Comments
FY2005 PRESBUD	56.8	22.2	26.8	16.5	2.0	1.8	0.3			126.4	
Development	56.8	22.2	26.8	16.5	2.0	1.8	0.3			126.4	
Changes since 2004 PRESBUD		-0.1	-0.2	+1.0	+2.0	+1.8	+0.3			+4.8	
Development		-0.1	-0.2	+1.0	+2.0	+1.8	+0.3			+4.8	
FY2004 PRESBUD	56.8	22.3	27.0	15.5						121.6	
Development	56.8	22.3	27.0	15.5						121.6	
Initial Baseline	71.8	7.3	13.4	6.7	4.0					103.2	
Development	71.8	7.3	13.4	6.7	4.0					103.2	FY2002 President's Budget

Indicates changes since the previous year's President's Budget Submit.
Indicates budget numbers in full cost.

Theme: Earth System Science
Development: EOSDIS

PURPOSE

Objectives	Performance Measures
7.1	5ESS10, 11

Earth Observing System Data and Information System (EOSDIS) Science Development supports development and evolution of new and existing science data processing, archiving, and distribution functions. The work comprises the Strategic Evolution of ESE Data Systems (SEEDS), which will guide the evolution of EOSDIS, and an engineering capability within the Earth Science Data and Information System (ESDIS) project, which can provide enhancements and enable needed evolution.

OVERVIEW

The EOSDIS is an end-to-end satellite ground data and information system, which commands and controls satellites, retrieves observations from them, and converts these observations into useful scientific information. EOSDIS Development will be completed after its final release to support the upcoming EOS Aura mission in FY 2004. In addition, EOSDIS supports the development of Science Investigator-led Processing Systems (SIPS) for Aura instruments. EOSDIS also supports new Earth Science Enterprise missions and the evolution of existing systems to support new missions. Specifically, it will support the ESE Data Systems Evolution through the next decade. It is one of the largest and most successful "e-science" systems built in the U.S. that serves more than two million users of NASA-obtained data and information each year. Link to project homepage for more information: http://eosdismain.gsfc.nasa.gov/eosinfo/EOSDIS_Site/.

PROGRAM MANAGEMENT

EOSDIS Development and EOS Operations are managed by the GSFC. ESE Data System Evolution, including peer reviewed data projects, are managed by Headquarters beginning in FY 2004. The GSFC Program Management Council (PMC) has EOSDIS Project governing responsibility. Enterprise official is Dr. Ghassem Asrar, Associate Administrator for Earth Science. Theme Director is Dr. Jack Kaye. Program Director is Doug McCuistion.

TECHNICAL COMMITMENT

The EOSDIS baseline was established in 1986. The requirements are detailed in the EOS PCA.

Technical Specifications
EOSDIS supports the ground ops of the EOS missions to include s/c and instrument control, data acquisition, telemetry processing, operation of 8 DAACs, and science investgator-led processing.
EOSDIS success criteria are to successfully support the ground operations of the EOS missions: Terra, Aqua, Aura, and ICESat, including spacecraft and instrument control, data acquisition, and telemetry processing; to operate the eight Distributed Active Archive Centers (DAACs), which archive and distribute the data; to support science investigator-led processing; and to add additional capabilities for new missions in an evolutionary manner.

Schedule	FY 2005 President's Budget	Change from Baseline
Start of Formulation	Nov-88	--
Start of Implementation	Oct-90	--
Data Validation Period	6 months to 1 year after receipt by investigators (depends on maturity of instrument technology)	--
Operational Lifetime	20 years	--

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Major acquisitions are: EOSDIS Science Data Processing System, to be completed in FY03. Raytheon is the prime contractor. EOSDIS Clearinghouse (ECHO), EOSDIS Data Gateway (EDG), and Dynamic Queries, ongoing. Global Sciences and Technology, Inc. is the prime contractor for all of these smaller ongoing efforts. ESDIS is in the process of moving these separate GST procurements from multiple contracts to a consolidated 5-year GSA contract (FY03 - FY07). Changes since FY04 Pres. Budget: None.

Theme: Earth System Science
Development: EOSDIS

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	100%	Industry	99%
Cost Reimbursable	91%	Sole Source	0%	Government	0%
Fixed Price	9%		100%	NASA Intramural	0%
Grants	0%			University	1%
Other	0%	Sci Peer Review	100%	Non Profit	0%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition -Major	Selection	Goals
REASoN Cooperative Agreement Notice	Spring 2006	100% Full & Open Competition

AGREEMENTS

Internal: Several MOAs are in place to satisfy the requirements of the Science Investigator-Led Processing System (SIPS).
External: An MOA has been signed with USGS for the coordination of the United Nations Environmental Program.
Changes since FY04 Pres. Budget: None.

RISK MITIGATION

Top Risks	G	Overall	G	Cost	G	Schedule	G	Probability	Impact	Mitigation Plan
G	No Risks identified							N/A	N/A	N/A

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Annual Review	ESSAAC	11/03	2/04	Validation and peer review of program direction.
Independent Annual Review	IPAO	3/03	3/05	Affirmation of Program Commitment Agreement.

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	Prior	FY03	FY04	FY05	FY06	FY07	FY08	FY09	BTC	Total	Comments
FY2005 PRESBUD	2,456.3	122.6	143.0	40.2	39.7	39.9	39.6	39.6		2,920.9	
Development	2,456.3	122.6	143.0	40.2	39.7	39.9	39.6	39.6		2,920.9	Funding maintained at FY05 level
Changes since 2004 PRESBUD	+0.1	+48.3	+44.7	-58.4	-60.9	-59.5	-65.1	+39.6		-111.3	
Development	+0.1	+48.3	+44.7	-58.4	-60.9	-59.5	-65.1	+39.6		-111.3	Alignment to sustaining system maintenance.
FY2004 PRESBUD	2,456.3	74.3	98.3	98.6	100.6	99.4	104.7			3,032.3	
Development	2,456.3	74.3	98.3	98.6	100.6	99.4	104.7			3,032.3	

Indicates changes since the previous year's President's Budget Submit.
Indicates budget numbers in full cost.

Theme: Earth System Science
Development: AURA

PURPOSE

Objectives	Performance Measures
1.1	5ESS1, 11

The Aura mission will study the Earth's ozone, air quality, and climate, providing answers to the following questions: 1) Is the ozone layer, which shields us from the Sun's ultraviolet radiation, recovering? The release of chlorofluorocarbons (CFCs) has caused a decrease in the ozone layer during the last two decades, especially over Earth's polar regions, but detection of stratospheric ozone depletion led to the regulation and phasing-out of CFC production worldwide. 2) Is global air quality getting worse? The chemistry of Earth's lower atmosphere, the troposphere, is changing. At this level of the atmosphere, ozone pollution, a harmful by-product of agricultural burning, deforestation, urban activity, and industry, is increasing worldwide. 3) How is Earth's climate changing? Ozone and water vapor in the upper troposphere and lower stratosphere are important "greenhouse gases," playing a significant role in regulating our climate. Understanding how water vapor and ozone vary will reveal how these constituents moderate global temperature increases.

OVERVIEW

Aura is the third major satellite in the Earth Observing System constellation. The first and second missions, Terra and Aqua, are designed to study the land, oceans, and the Earth's radiation budget. Aura's chemistry measurements will follow up on measurements which NASA pioneered with its Nimbus 7 satellite (1978), continued with NASA's Upper Atmosphere Research Satellite (1991), and the Total Ozone Mapping Spectrometer (TOMS) series of missions. The satellite will be launched in 2004 and operate for five or more years. Link to project homepage for more information: http://aura.gsfc.nasa.gov/ .

PROGRAM MANAGEMENT

Aura is part of the EOS program, with program responsibility delegated to the Goddard Space Flight Center. The GSFC Program Management Council (PMC) has Aura project governing responsibility. Enterprise official is Dr. Ghassem Asrar, Associate Administrator for Earth Sciences. Theme Director is Dr. Jack Kaye. Aura Program Director is Doug McCuistion.

TECHNICAL COMMITMENT

The baseline for this technical commitment was made in 1993. However, the final baseline consistent with these requirements was not reached until 1995. The requirements are detailed in the EOS Program Commitment Agreement.

Technical Specifications	FY 2005 President's Budget	Change from Baseline
The Aura project	Four instruments on the EOS Common Spacecraft launched into a 705 km, 98.2-degree inclination, sun-synchronous orbit. The spacecraft will have an equatorial crossing time (ascending node) of 1:45 pm.	--
The High Resolution Dynamic Limb Sounder (HIRDLS)	Infrared limb-scanning radiometer designed to look through the "edge" of Earth's atmosphere to study aerosols and clouds.	--
The Microwave Limb Sounder (MLS)	Passive microwave radiometer/spectrometer which will study ozone depletion and radiation in the Earth's troposphere and stratosphere.	--
The Tropospheric Emission Spectrometer (TES)	Infrared imaging spectrometer to measure global distributions of key atmospheric pollutants.	--
The Ozone Measuring Instrument (OMI)	An imaging spectrometer to map total column densities of aerosols and ozone in the stratosphere and troposphere.	--

Schedule	FY 2005 President's Budget	Baseline	Change from Baseline
Start of Formulation	Aug-93	Aug-93	--
Spacecraft Delta PDR	Oct-99	Mar-98	+19 Months
Spacecraft Delta CDR	Aug-00	Jun-99	+17 months
Last Instrument Delivery	Nov-02	Mar-99	+17 Months
Operational Readiness Review	Nov-02	Oct-02	+13 Months
Launch Readiness Date	June 04	Dec-02	+16 Months
Data Validation Period	One yr after receipt by investigators	--	--
Observatory Operational Lifetime	5 years	5 years	None

Theme: Earth System Science
Development: AURA

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Major acquisitions for Aura are: three U.S. instruments, spacecraft development, launch vehicle services through the Kennedy Space Center (KSC). Three instruments were selected for development in 1990. MLS and TES are built by JPL. HIRDLS is built by Lockheed Martin and the fourth, OMI, was confirmed for the mission in April 1998 and is being built by the Netherlands and Finland. The spacecraft is being built as part of the EOS common spacecraft contract by NGST for GSFC. Changes since FY04 Pres. Budget: None.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	100%	Industry	63%
Cost Reimbursable	100%	Sole Source	0%	Government	11%
Fixed Price	0%		100%	NASA Intramural	0%
Grants	0%			University	26%
Other	0%	Sci Peer Review	100%	Non Profit	0%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition -Major	Selection	Goals
None, as the program is within a half year of launch.	N/A	N/A

AGREEMENTS

Internal: Launch services provided by KSC. The program is not dependent on other NASA activities outside of the control of the Associate Administrator for Earth Science.

External: HIRDLS instrument is a joint development with the United Kingdom's Natural Environmental Research Council, and the OMI instrument is provided by the Netherlands' Agency for Aerospace Programs. Both are covered by Memoranda of Agreement between the respective governments. Changes since FY04 Pres. Budget: None.

RISK MITIGATION

Top Risks	Y	Overall	Y	Cost	Y	Schedule	Y	Probability	Impact	Mitigation Plan
Y	Launch delay due to failure of HIRDLS Cryo-cooler							High	High	To be assessed mid Dec-03

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Independent Annual Review	IPAO - LARC	10/00	N/A	Affirmation of Program Commitment Agreement.
Pre-Environmental Review	SMO	3/03	N/A	Confirm Observatory is ready for environmental tests.
Pre-Ship Review	SMO	N/A	2/04	Confirm Observatory is ready for launch.

Theme: Earth System Science
Development: AURA

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	Prior	FY03	FY04	FY05	FY06	FY07	FY08	FY09	BTC	Total	Comments
FY2005 PRESBUD	621.6	98.3	52.2	4.5	3.5	0.1	0.1	0.6		780.9	
Development	604.8	63.9	45.1	4.5	3.5	0.1	0.1	0.6		722.6	
Launch Vehicle	16.8	34.4	7.1							58.3	
Changes since 2004 PRESBUD		+13.0	-0.3	-0.1	+0.1			+0.6	-0.1	+13.2	
Development	+4.3	+8.7		-0.1	+0.1			+0.6	-0.1	+13.4	Technical difficulties with TES and MLS instruments.
Launch Vehicle	-4.3	+4.3	-0.3							-0.3	
FY2004 PRESBUD	621.6	85.3	52.5	4.6	3.4	0.1	0.1		0.1	767.7	
Development	600.5	55.2	45.1	4.6	3.4	0.1	0.1		0.1	709.1	
Launch Vehicle	21.1	30.1	7.4							58.6	

Indicates changes since the previous year's President's Budget Submit.
Indicates budget numbers in full cost.

Theme: Earth System Science
Development: NPOESS Preparatory Project (NPP)

PURPOSE

Objectives	Performance Measures
1.1	5ESS4, 7, 11

NPP will continue to fulfill a national commitment to obtain and make available a 15-year data record for fundamental global climate change observations started by the Moderate-resolution Imaging Spectroradiometer (MODIS), Atmospheric Infrared Sounder (AIRS), and the combination of the Advanced Microwave Sounding Unit/Humidity Sounder Brazil (AMSU/HSB), which are the primary instruments on the EOS Terra and Aqua satellites. This is also a shared cost precursor mission to the next generation of operational polar weather satellites being developed by the National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Integrated Program Office (IPO), a joint NASA, NOAA, DoD effort. This arrangement assures NASA's long-term science observational needs are met by the operational system, and assures transfer of key technologies NASA developed as part of the EOS program into the next generation of operational satellites.

OVERVIEW

The NPP spacecraft carries the following instruments: The Advanced Technology Microwave Sounder (ATMS), developed and provided by NASA (in conjunction with the Cross-Track Infrared Sounder (CrIS)) to provide daily global observation of atmospheric temperature and humidity profiles; The Visible Infrared Imaging Radiometer Suite (VIIRS) developed and provided by NPOESS IPO to obtain global observations of land, oceans, and atmosphere for climate research and weather forecasting; The Cross-Track Infrared Sounder (CrIS) developed and provided by NPOES IPO (in conjunction with ATMS) to provide daily global observation of atmospheric temperature and humidity profiles; the Ozone Mapping and Profiler Suite (OMPS).

PROGRAM MANAGEMENT

NPP is part of the EOS program with program responsibility delegated to the GSFC. The GSFC Program Management Council (PMC) has NPP governing responsibility. Enterprise official is Ghassem Asrar, Associate Administrator for Earth Science at HQ. Theme Director is Dr. Jack Kaye. Program Director is Doug McCuistion.

TECHNICAL COMMITMENT

The baseline for this technical commitment was made in November 2003 and is detailed in the NPP Program Commitment Agreement (PCA).

Technical Specifications	FY 2005 President's Budget	Change from Baseline
The NPP Project	It will launch four instruments on the NPP spacecraft into an 824 km sun-synchronous orbit, with a descending equatorial crossing time of 10:30 AM.	--
VIIRS, supplied by IPO	Multi-spectral scanning radiometer designed to measure land, ocean, and atmospheric parameters.	--
CrIS, supplied by IPO	Michelson interferometer designed to measure temperature and moisture profiles.	--
OMPS, supplied by IPO	Nadir and limb pushbroom spectrometers designed to monitor total column and vertical ozone profiles.	--
ATMS	Scanning passive microwave radiometer designed to measure temperature and moisture profiles.	--

Schedule	FY 2005 President's Budget	Change from Baseline
MCR	4th Quarter 2003	--
CDR	4th Quarter 2003	--
Operational Readiness Review (ORR)	2nd Quarter 2006	--
Launch Readiness	1st Quarter FY 2007	--

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Major acquisitions for NPP are: ATMS Instrument, competitively awarded in December 2002 to Aerojet (subsequently bought by Northrop Grumman). Spacecraft Bus, Delivery Order awarded through the Rapid Spacecraft Acquisition contract in May, 2002. Changes since FY04 Pres. Budget: None.

Theme: Earth System Science
Development: NPOESS Preparatory Project (NPP)

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	100%	Industry	95%
Cost Reimbursable	70%	Sole Source	0%	Government	0%
Fixed Price	25%		100%	NASA Intramural	5%
Grants	0%			University	0%
Other	5%	Sci Peer Review	%	Non Profit	0%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition - Major	Selection	Goals
No major future acquisitions remain.		

AGREEMENTS

Initial Implementation Agreement with Integrated Program Office (IPO--includes NOAA and DoD) for NPP, signed 11/21/99. Final Implementation Agreement with IPO for ATMS, signed 8/2/00.

RISK MITIGATION

Top Risks	G	Overall	G	Cost	Y	Schedule	G	Probability	Impact	Mitigation Plan
Y	Delivery of IPO instruments (VIIRS and CrIS)							Medium	High	Mitigate with the IPO

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Mission Critical Design Review	IIRT	10/03	N/A	Approval to proceed to flight build.
Mission Confirmation Review	IPAO	11/03	N/A	Approval to proceed to implementation phase.
Mission Operations Requirements Review	IIRT	N/A	7/05	Confirm operations requirements of ground system.
Launch Readiness Review	IIRT	N/A	10/06	Determine launch readiness.

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	Prior	FY03	FY04	FY05	FY06	FY07	FY08	FY09	BTC	Total	Comments
FY2005 PRESBUD	127.3	128.8	103.5	141.1	61.6	6.9				569.2	
Development	127.3	128.8	103.5	141.1	61.6	6.9				569.2	
Changes since 2004 PRESBUD	+127.3	+128.8	+103.5	+141.1	+61.6	+6.9				+569.2	
Development	+127.3	+128.8	+103.5	+141.1	+61.6	+6.9				+569.2	Moved from formulation into development
FY2004 PRESBUD.											

Indicates changes since the previous year's President's Budget Submit.
Indicates budget numbers in full cost.

Theme: Earth System Science
Operations

PURPOSE

Objectives	Performance Measures
1.1	5ESS1-9,12

Earth System Science Operations encompasses spacecraft command and control, mission planning and data acquisition, tracking and data recovery, the processing of satellite instrument data to scientific geophysical-parameter sets, and the subsequent maintenance and distribution of these information products.

OVERVIEW

The broad objectives of Earth System Science Operations are to establish data sets spanning decades for research into climate and global change, and to acquire science data sets via various NASA facilities. Specific facilities include spacecraft control centers, tracking and data acquisition stations, and data processing, archiving and distribution facilities.

Note: Mission operations for Principal Investigator (PI)-managed projects such as Cloudsat, CALIPSO, Grace, and SORCE, are budgeted with the development activity for those missions. Operations for QuikScat and ACRIMSat are also budgeted under small projects development.

Ground Network http://www.wff.nasa.gov/~code452/; Operating Missions http://visibleearth.nasa.gov/Sensors/; EOS http://earth.nasa.gov/.

PROGRAM MANAGEMENT

The EOS operations responsibility was delegated to the Goddard Space Flight Center. The Systematic Measurements Program Management Council (SMPMC) has governing responsibility. Enterprise official is Dr. Ghassem Asrar, Associate Administrator for Earth Science. Theme Director is Dr. Jack Kaye. Program Director is Doug McCuistion.

TECHNICAL COMMITMENT

The baseline for each mission in operations was established during the project's Non-Advocate Review (NAR). The requirements are detailed in each mission's Program Commitment Agreement (PCA).

Technical Specifications	FY 2005 President's Budget	Change from Baseline
Operating Missions TOMS, UARS, TRMM, ERBS, Topex, ASF	Missions in their prime phase are expected to achieve their individual data delivery objectives; extended phases have reduced objectives.	--
EOS (e.g., Terra, Aqua, ICESat)	Committed to capturing 95% of science data, maintaining processing and through-put rates for all instruments, and providing archive and distribution services until 3 years after end of mission.	--
Ground Network	Tracking stations and related systems acquire data from orbiting automated spacecraft (99% availability), balloons, sounding rockets, and Space Shuttle missions (99.5% availability).	--

Schedule	FY 2005 President's Budget	Change from Baseline
EOS-DAACS, ESMO, PI Processing Federation, Networks, etc.	EOS schedules are commensurate with spacecraft prelaunch, launch and postlaunch milestones for check-out, end-to-end test, and operations throughout spacecraft prime mission lifetime plus 3 years.	--
Earth Radiation Budget Satellite (ERBS)	1986-2004	1 year extension
Ground Network	In transition from Gov't assets to commercial services. NASA plans to maintain a reliable capability to support current and future missions. Older underutilized tracking antenna sys will be retired.	--
Operating Missions (includes Alaska SAR Facility)	These operating missions have met prime objectives and are in extended mission phases.	--
TOPEX	1992-2004	1 year extension
Total Ozone Mapping Spectrometer (TOMS)	1996-2004	--
Tropical Rainfall Measuring Mission (TRMM)	1997-2004	--
Upper Atmosphere Research Satellite (UARS)	1991-2004	1 year extension

Theme: Earth System Science
Operations

Acquisition Strategy and Performing Organizations

The prime contractor for the Ground Network, UARS, and TRMM missions is Lockheed Martin under the Consolidated Space Operations Contract (CSOC). This contract covered 5 years of operations, ending in December 2003. SMCDS is the follow on contract vehicle. The prime contractor on the EOS mission is Raytheon. Changes since FY04 Pres. Budget: None

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	96%	Industry	87%
Cost Reimbursable	84%	Sole Source	4%	Government	0%
Fixed Price	4%			NASA Intramural	7%
Grants	5%		100%	University	6%
Other	7%	Sci Peer Review	%	Non Profit	0%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition	Selection	Goals
Follow-on contract to MOMS and NENS	Dec 08	100% Full & Open Competition
Follow-on to EMD	Mar 08	100% Full & Open Competition

Agreements

Internal: MOA for Mission Services and Space Communications with NASA Space Flight and Space Science Enterprises. External: National Research Council review of DAACS. Changes since FY04 Pres. Budget: None.

Risk Mitigation

Top Risks	G	Overall	G	Cost	G	Schedule	G	Probability	Impact	Mitigation Plan
G	No risks for missions in operation									

Independent Reviews

Review Types	Performer	Last Review Date	Next Review Date	Purpose
None	N/A			N/A

Budget/Life Cycle Cost

Budget Authority ($ millions)	FY 2003	FY 2004	FY 2005	Comments
FY2005 PRESBUD	249.1	314.9	307.2	
UARS, ERBS, TRMM, QuikTOMS, Seastar/Seawifs, TOMS	31.5	28.0	14.4	
Earth Science Ops	175.5	243.7	231.0	
Ground Network	42.1	43.2	61.8	
Changes since 2004 PRESBUD	+1.3	-7.3		
UARS, ERBS, TRMM, QuikTOMS, Seastar/Seawifs, TOMS	+2.7	+5.8		ERBS, UARS, TRMM continuation
Earth Science Ops	-1.1	-12.8		Alignment with Task 1 of new EMD contract
Ground Network	-0.3	-0.3		Transition from CSOC
FY2004 PRESBUD	247.8	322.2		
UARS, ERBS, TRMM, QuikTOMS, Seastar/Seawifs, TOMS	28.8	22.2		
Earth Science Ops	176.6	256.5		
Ground Network	42.4	43.5		

Indicates changes since the previous year's President's Budget Submit.
Indicates budget numbers in full cost.

Theme: Earth System Science
Research

PURPOSE

Objectives	Performance Measures
1.1	5ESS1-9,12, 13

The Earth System Science Research program is designed to answer pressing science questions, including: How is the global Earth system changing and what are the consequences for human civilization? How can we predict future changes in the Earth system? In recent years, NASA's Earth System Science program has begun to provide answers to these questions through an integrated approach using satellites, suborbital platforms, surface based observations, laboratory experiments, and computational modeling.

OVERVIEW

The Earth System Science Research program at NASA studies the Earth as a whole system, utilizing measurements made by Earth satellites, as well as by Suborbital and Airborne assets. These observations, enhanced by the work of the Mission Science Teams and Algorithm Development activities, enlarge the Earth system knowledge base and are incorporated into models in order to improve our ability to predict climate, weather, and natural hazards. Computing capabilities funded through the Research Program's Information Systems effort further support these improvements. The program also selects and funds over 1,500 U.S. scientific research tasks through the Research and Analysis activity. Scientists from approximately 17 other nations, funded by their own countries and collaborating with U.S. researchers, are also part of the program. These researchers develop Earth system models from Earth science data, conduct laboratory and field experiments, run aircraft campaigns, develop new instruments, and thus expand our understanding of our planet. In FY05, NASA Earth System Science Research program will continue to provide the technology, observations, and modeling results that contribute to the provision of answers to the questions society poses about our home planet. Link to project homepage for more information: http://www.earth.nasa.gov/science/index.html .

PROGRAM MANAGEMENT

The Earth Science Enterprise has responsibility for the Earth System Science Research program. The Enterprise official is Dr. Ghassem Asrar, Associate Administrator for Earth Science. The Science Division Director is Dr. Jack Kaye.

TECHNICAL COMMITMENT

Technical Specifications
Earth science research strategy outlines technology, observations, modeling, and basic research requirements needed to answer science questions. View roadmaps at: http://earth.nasa.gov/roadmaps.

Schedule	FY 2005 President's Budget	Change from Baseline
Research Announcements: Earth Observing System & OSTM	Estimated Selection Date: Q1 FY04	--
Research Announcements: New Investigator Program	Estimated Selection Date: Q2 FY04	--
Research Announcement: Carbon Cycle	Estimated Selection Date: Q3 FY04	--
Research Announcements: Modeling/Analysis & Physical Oceanography	Estimated Selection Date: Q3 FY04	--
Tropospheric Chemistry and the INTEX Field Mission	Estimated Selection Date: Q3 FY04	--
Research Announcements: Energy & Water Cycle	Estimated Selection Date: Q3 FY04	--
Research Announcements: CAMEX 5	Estimated Selection Date: Q4 FY04	--

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

The NASA Research program is based on full and open competition. Grants are peer reviewed and selected based on NASA Research Announcements (NRAs), Broad Agency Announcements (BAAs), and Announcements of Opportunity (AOs). Changes since FY04 President's Budget: None.

Theme: Earth System Science
Research

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	13%	Full & Open Competition	81%	Industry	8%
Cost Reimbursable	0%	Sole Source	19%	Government	7%
Fixed Price	16%			NASA Intramural	24%
Grants	51%		100%	University	61%
Other	20%	Sci Peer Review	95%	Non Profit	0%
*As of FY03 direct procurement	100%	*As of FY03 direct procurement		*As of FY03 direct procurement	100%

Future Acquisition	Selection	Goals
Earth Observing System	FY04 - 1st Qtr.	95% Sci Peer Review, 100% Grants
Ocean Surface Topography	FY04 - 1st Qtr.	95% Sci Peer Review, 100% Grants
New Investigator Program	FY04 - 2nd Qtr.	95% Sci Peer Review, 100% Grants
Carbon Cycle	FY04 - 3rd Qtr.	95% Sci Peer Review, 100% Grants
Modeling/Analysis	FY04 - 3rd Qtr.	95% Sci Peer Review, 100% Grants
Physical Oceanography	FY04 - 3rd Qtr.	95% Sci Peer Review, 100% Grants
Tropospheric Chemistry and the INTEX Field Mission	FY04 - 3rd Qtr.	95% Sci Peer Review, 100% Grants
Energy & Water Cycle	FY04 - 3rd Qtr.	95% Sci Peer Review, 100% Grants
CAMEX 5	FY04 - 4th Qtr.	95% Sci Peer Review, 100% Grants

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator of Earth Science. External: Various Memoranda of Understanding and Agreements with NOAA, National Science Foundation (NSF), USGS, and other Federal and foreign entities. Changes since FY04 Pres. Budget: None.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
External Peer Review	ESSAAC	7/03	2/04	Overall assessment of progress and priorities.

Theme: Earth System Science
Research

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	FY 2003	FY 2004	FY 2005	Comments
FY2005 PRESBUD	410.4	521.6	560.0	
EOS Science	51.3	66.6	75.7	
Suborbital Science	24.8	35.2	36.9	
Information Systems	10.4	14.8	16.2	
Algorithm Development	72.0			
Mission Science Teams	91.5	189.5	217.0	
Research & Analysis	160.4	215.5	214.2	
Changes since 2004 PRESBUD	+53.1	-1.8		
EOS Science	-4.9	-0.4		
Suborbital Science	-0.2	-0.2		
Information Systems	-0.1	-0.1		
Algorithm Development	+71.0	-81.2		Aligned with missions science teams.
Mission Science Teams	-7.9	+80.1		Algorithm development transfer and full cost adjustment.
Research & Analysis	-1.4			
CofF	-3.4			
FY2004 PRESBUD	357.3	523.4		
EOS Science	56.2	67.0		
Suborbital Science	25.0	35.4		
Information Systems	10.5	14.9		
Algorithm Development	1.0	81.2		
Mission Science Teams	99.4	109.4		
Research & Analysis	161.8	215.5		
CofF	3.4			

Indicates changes since the previous year's President's Budget Submit.
Indicates budget numbers in full cost.

Theme: Earth System Science
Technology and Advanced Concepts: Technology Infusion Program

PURPOSE

Objectives	Performance Measures
1.1	5ESS1-9

NASA's Earth Science Enterprise (ESE) is dedicated to understanding the total Earth system and the effects of natural and human-induced changes on the global environment. Advanced technology will play a major role in enabling the ESE science/applications program of the future. The Earth Science Technology Program (ESTP) enables ESE science and application programs by providing new capabilities and reducing the cost of Earth science measurements planned in the near, mid, and far term. ESTP also ensures consistency between the ESE Strategic Plan and the implementing technology strategy, as manifest in the Earth Science Technology Program and other relevant agency programs.

OVERVIEW

The Earth Science Enterprise formed the Earth Science Technology Office (ESTO) to provide strategic, science-driven technology assessments and requirements development. ESTO will integrate and prioritize these requirements among various implementing programs and projects by maintaining a link between science/applications objectives and technology investments. ESTO aggressively pursues promising scientific and engineering concepts and ensures that the program maintains an effective balance of instrument and information systems investments. ESTO implements the ESE-focused technology program, which includes: Advanced Technology Initiatives (ATI), to implement a broad array of technology developments for state-of-the-art components for instruments and Earth- and space-based platforms; the Instrument Incubator Program (IIP) to develop new and innovative instruments and measurement techniques at the system level, including laboratory development and airborne validation; Advanced Information Systems Technology (AIST) to develop end-to-end information technologies that enable new Earth observation measurements and information products; and Advanced Platform Technology (APT).

Metrics include maturing two to three technologies to the point where they can be demonstrated in space or in an operational environment, annually advancing 25% of funded technology developments one Technology Readiness Level (TRL), and enabling one new science measurement capability or significantly improve performance of an existing one.

ESTO will leverage technology investments through internal NASA program synergy and external partnerships. These efforts will include: Small Business Innovative Research (SBIR), the Mission and Science Measurement Technology Program (MSMT), which includes the NASA Institute of Advanced Concepts (NIAC) and Revolutionary Aero Space Concepts (RASC), and other agencies' (e.g., DoD) programs. Link to program homepage for more information at: http://esto.nasa.gov/.

PROGRAM MANAGEMENT

The program responsibility has been assigned to the ESTO office located at GSFC. Enterprise official is Ghassem Asrar, Associate Administrator for the Office of Earth Science at HQ. Point of Contact is George J. Komar, Program Manager, Earth Science Technology Office. This program is in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

The baseline for the ESTO technical commitment is the PCA.

Technical Specifications		FY05 Budget Submit							Change from Baseline
		FY03	FY04	FY05	FY06	FY07	FY08	FY09	
Instrument Incubator Program: maintain on average a portfolio of 30 technology investments working toward an average TRL 5.	TRL	5	5	5	5	5	5	5	--
	$M	22	30	30	30	30	30	30	--
Advanced Technolgy Initiatives: Component and subsystem technologies matured to TRL 4 or 5.	TRL	4	4	4	5	5	5	5	--
	$M	16	12	12	12	12	12	12	--
Advanced Information Systems Technology: Info systems/subsystem technology matured to an average TRL 6.	TRL	6	6	6	6	6	6	6	--
	$M	13	11	11	11	11	11	11	--

Theme: Earth System Science
Technology and Advanced Concepts: Technology Infusion Program

Schedule	FY 2005 President's Budget	Baseline	Change from Baseline
Integrated Technology Development Plan	2nd Qtr FY04	2nd Qtr FY03	+1 year
Advanced Technology Initiatives (ATI) NRA	3rd Qtr FY04	2nd Qtr FY04	+1 Qtr
Instrument Incubator Program (IIP) NRA	2nd Qtr FY05	3 rd Qtr FY04	+ 3 Qtrs
Advanced Info Systems Technology (AIST) NRA	4th Qtr FY05	3rd Qtr FY05	+ 1 Qtr

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Technology studies and development efforts are procured primarily through the NRA process. Changes since FY04 Pres. Budget: None.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	6%	Full & Open Competition	80%	Industry	11%
Cost Reimbursable	81%	Sole Source	20%	Government	7%
Fixed Price	10%		100%	NASA Intramural	38%
Grants	3%			University	20%
Other	0%	Sci Peer Review	%	Non Profit	24%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition	Selection	Goals
1. Advanced Technology Initiatives NRA	2nd Qtr FY04	Competitively awarded proposals to support ESS technology needs.
2. Instrument Incubator Program NRA	3rd Qtr FY04	Competitively awarded proposals to support ESS technology needs.
3. Advanced Info Systems Technology NRA	3rd Qtr FY05	Competitively awarded proposals to support ESS technology needs.

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator for Earth Science. External: None. Changes since FY04 Pres. Budget: None.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
External Review Committee	ESSAAC	7/03	2/04	Overall assessment of progress and priorities.

Theme: Earth System Science
Technology and Advanced Concepts: Technology Infusion Program

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	FY 2003	FY 2004	FY 2005	Comments
FY2005 PRESBUD	75.0	85.3	59.0	
Instrument Incubator Program	21.9	26.8	30.0	
Advanced Info Systems Technology	12.6	15.4	11.0	
Advanced Technology Initiatives	16.4	15.2	11.9	
Computational Technology	18.9	21.8		
IDPT	5.2	6.1	6.1	
Changes since 2004 PRESBUD	+29.0	+6.4		
Instrument Incubator Program	-0.1	-0.2		
Advanced Info Systems Technology	+2.8	+3.9		
Advanced Technology Initiatives	+7.9	+2.9		
Computational Technology	+18.9	-0.1		
IDPT	-0.5			
FY2004 PRESBUD	46.0	78.9		
Instrument Incubator Program	22.0	27.0		
Advanced Info Systems Technology	9.8	11.5		
Advanced Technology Initiatives	8.5	12.3		
Computational Technology		21.9		
IDPT	5.7	6.1		

Indicates changes since the previous year's President's Budget Submit.
Indicates budget numbers in full cost.

Theme: Earth System Science
Technology and Advanced Concepts: Missions in Formulation

PURPOSE

Objectives	Performance Measures
1.1	5ESS1-8

The next generation of Earth Science missions will provide new technology and space systems to meet the observing requirements in the Earth System Science Research strategy. NASA has identified a mission architecture over the mid-term that will help achieve specific scientific goals using a combination of systematic and exploratory missions.

OVERVIEW

The new missions selected will capitalize on NASA investments in advanced technologies to reduce lifecycle time/cost and to better relate to longer-term scientific questions and practical applications. The approach to mission selection and implementation will ensure the maturity of essential technologies during mission definition/formulation for both exploratory and systematic missions (i.e., no missions will go into implementation until key technologies are ready).

Missions in formulation include: Aquarius, which will provide the first global measurements of salt concentration on the ocean's surface (global salinity maps at 0.2 PSU accuracy on a monthly basis at 100 km resolution for three years); Glory, which includes an Aerosol Polarimeter Sensor (APS) to study black carbon interactions and impacts on Earth's climate; GPM, which will measure global precipitation and improve global water cycle prediction (precipitation products with data latency < 3 hours, research products with data latency < 72 hours, 3 years measurement with goal of 5); Landsat Data Continuity Mission (LDCM), which will continue the global land cover data set and provide synoptic, repetitive multispectral, high-resolution, digital imagery of Earth's land surfaces, and will improve assessment of rates of land-cover changes. Subsequent to the cancellation of the previously planned procurement, an interagency working group was established to study options for ensuring the continuity of Landsat data into the future. Partnership options are being investigated within the guidelines of public law, as well as existing interagency relationships. The working group is expected to present its findings in February 2004; Ocean Surface Topography, which will provide 3-year measurement of ocean surface topography, with a goal of 5 years, and will maintain the accuracy of Jason-1 (e.g., ocean topogrophy to 4.2 cm at 1/sec along-track data rate with a goal of 2.5 cm); Orbiting Carbon Observatory, which will provide global carbon dioxide measurement to characterize carbon dioxide sources and quantify their variability, and will create time-dependent global maps of carbon dioxide with relative accuracies of 0.3%.

PROGRAM MANAGEMENT

The program responsibility for each mission will be delegated to a responsible Center, or the Enterprise, as it enters implementation. Enterprise official is Dr. Ghassem Asrar, Associate Administrator for Earth Science at HQ. Program Directer is Doug McCuistion.

TECHNICAL COMMITMENT

Technical specifications of missions are subject to final approval before proceeding to implementation, and are baselined in a Program Commitment Agreement (PCA).

Schedule	FY 2005 President's Budget	Change from Baseline
GPM start of Formulation	12/01	--
GPM Mission Confirmation Review	1/07	--
GPM Launch Readiness	8/11 Core; 8/12 Constellation	--
GPM operational lifetime	3 years (5 year goal)	--
LDCM Start of Formulation.	April 2002	--
Ocean Surface Topography Mission Start of Formulation	Late 2002	--
Ocean Surface Topography Mission Confirmation Review	July 2004	--
Ocean Surface Topography Launch Readiness	Late 2007	--
Ocean Surface Topography Operational Lifetime	3 years (5 year goal)	--
Aquarius start of Formulation	October 2003	--
Aquarius Mission Confirmation Review	August 2005	--
Aquarius Launch Readiness	September 2008	--
Aquarius Operational Lifetime	3 years (5 year goal)	--
Glory (CCRI) start of Formulation	October 2003	--
Glory Mission Confirmation Review	TBD	--

Theme: Earth System Science
Technology and Advanced Concepts: Missions in Formulation

Schedule	FY 2005 President's Budget	Change from Baseline
Glory Launch Readiness	2008 (Final date TBD based on schedule changes as a result of the pending funding level included in the FY04 Omnibus Appropriations Bill.)	--
Orbiting Carbon Observatory Start of Formulation	Late 2003	--
Orbiting Carbon Observatory Mission Confirmation Review	TBD	--
Orbiting Carbon Observatory Launch Readiness	2007	--
Orbiting Carbon Observatory Operational Lifetime	2 years (4 year goal)	--

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Major acquisitions: OSTM: Laser reflector array from ITE, Inc.; GPS from Spectrum Astro; Wide Swath Ocean Altimeter mast from AEC-Able. Figures in table below represent OSTM only. The remainder of these missions are still in early formulation and the acquisition strategy is still being defined. Changes since FY04 Pres. Budget: None.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	100%	Industry	100%
Cost Reimbursable	100%	Sole Source	0%	Government	0%
Fixed Price	0%		100%	NASA Intramural	0%
Grants	0%			University	0%
Other	0%	Sci Peer Review	%	Non Profit	0%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition	Selection	Goals
GPM: Microwave imager		100% competed

AGREEMENTS

LDCM: NASA - USGS Initial Implementation Agreement, 1/11/01. Changes since FY04 Pres. Budget: None.

RISK MITIGATION

Top Risks	G	Overall	G	Cost	G	Schedule	G	Probability	Impact	Mitigation Plan
G	GPM: Reduction in International partnership contribution							Low	High	Negotiations in process

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
GPM Independent Implementation Review	IRT/IPAO	N/A	9/07	Annually during Implementation.
GPM Independent Assessment	IRT/IPAO	N/A	12/04	Assess reqs, design concepts, implementation plans, risks, and life cycle cost.
GPM Non-Advocate Review	IRT/IPAO	N/A	10/07	
OSTM Mission Confirmation Review	IPAO	N/A	7/04	Evaluate readiness to proceed to implementation.

Theme: Earth System Science
Technology and Advanced Concepts: Missions in Formulation

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	FY 2003	FY 2004	FY 2005	Comments
FY2005 PRESBUD	81.1	197.9	239.9	
GPM	11.5	28.0	29.4	Mission deferred by 2 years
LDCM	26.2	59.6	41.9	
Ocean Winds	1.0	2.7		Mission proposed for termination in FY05
Ocean Topography	23.0	39.8	26.1	
Total Column Ozone	0.2			
EOS Follow-on Missions	6.9	11.6	0.1	Mission proposed for termination in FY05
Future ESSP Missions	5.3	18.3	22.5	
Aquarius	1.0	8.2	20.5	
Orbit Carbon Observatory	2.0	17.6	45.4	
CCRI	4.0	12.1	54.0	
Changes since 2004 PRESBUD	-164.9	-76.5		
NPP	-153.1	-95.6		Transferred to development and rephase to later launch date
GPM	+2.6	-0.2		
LDCM	-18.8	-0.4		Rephasing pending consideration of mission options
Ocean Winds	+1.0			
Ocean Topography	-8.5	-0.2		Rephase to align with new mission LRD
Solar Irradiance		-2.6		Measurement aligned with Glory mission
Total Column Ozone	+0.2	-0.3		
EOS Follow-on Missions	+6.9	+10.8		
Future ESSP Missions	-2.2	-26.0		Funds distributed to OCO and Aquarius missions
Aquarius	+1.0	+8.2		Transfer from Future ESSP missions
Orbit Carbon Observatory	+2.0	+17.6		Transfer from Future ESSP missions
CCRI	+4.0	+12.1		Improperly booked under development last year; launch date moved up one year
FY2004 PRESBUD	246.0	274.4		
NPP	153.1	95.6		
GPM	8.9	28.2		
LDCM	45.0	60.0		
Ocean Winds		2.7		
Ocean Topography	31.5	40.0		
Solar Irradiance		2.6		
Total Column Ozone		0.3		
EOS Follow-on Missions		0.8		
Future ESSP Missions	7.5	44.3		

Indicates changes since the previous year's President's Budget Submit.
Indicates budget numbers in full cost.