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Office of Earth Science Enterprise (Code Y)
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The total Fiscal Year 2003 Appropriations budget request for the Office of Earth Science is $1,628 million: this is comprised of $1,310 million in direct program funding and $318 million for institutional support. There are an estimated 1,848 direct Full Time Equivalent employees included within the Earth Science Enterprise in Fiscal Year 2003.

PROGRAM GOALS

The NASA Earth Science Enterprise (ESE) carries out its mission through three broad goals:

1) **Science**: Observe, understand, and model the Earth system to learn how it is changing, and the consequences for life on Earth;
2) **Applications:** Expand and accelerate the realization of economic and societal benefits from Earth science, information, and technology;
3) **Technology:** Develop and adopt advanced technologies to enable mission success and serve national priorities.

These goals are articulated in the ESE Strategic Plan, available at:

http://www.earth.nasa.gov

The ESE is working to improve scientific understanding of the Earth system and its response to natural and human-induced changes. This knowledge will enhance the ability to predict climate change, better understand variant weather patterns and help mitigate future natural hazards. The ESE will develop and demonstrate new technologies on airborne and space-based platforms. In addition, the ESE will develop computer models to analyze and assimilate data, carry out focused scientific research studies. The ESE will utilize this information to better inform policy- and decision-makers in both the public and private sectors. The ESE activities constitute a unique national resource.

The Administration is conducting a review of the interagency U.S. Global Change Research Program (USGCRP) to determine the best government-wide approach to climate change research. It would not be prudent for NASA to pursue development of another major new Earth Science mission until the Administration has completed this review. The fiscal 2003 budget funds the continued development of the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) as well as the Landsat Data Continuity Mission (LDCM). The LDCM is being implemented as a commercial data purchase.

Also funded is formulation of an ocean topography mission to follow the Jason mission launched in 2001. This mission is being implemented in a partnership among NASA, NOAA and their European counterparts. The ocean topography mission is a transition mission (along with NPP) between research and operational mission agencies. NASA will also undertake the study of a potential global precipitation mission. If approved, the global precipitation mission will measure rainfall worldwide for both climate research and assessment of impacts on fresh water availability around the world.

Last year was a record year for the NASA Earth Science Enterprise. With the successful launch of the Jason oceanography mission and other research and application milestones, the Enterprise is well on its way to delivering vital data that leaders around the world need to make informed decisions about the health and well being of our planet. As NASA moves into this next budget cycle, the Agency intends to take time to both evaluate future missions and begin to reap the benefits of its recent success stories.

The ESE has deployed the first in a series of Earth Observing System (EOS) satellites that will concurrently observe the major interactions of the land, oceans, atmosphere, ice, and life that comprise the Earth system. The ESE activities have a direct and indirect impact upon long-term climate forecasting, disaster mitigation, wildfire prevention, environmental monitoring, disease prevention, increased agricultural productivity, as well as improved urban and suburban planning.

The ESE provides scientific answers to the fundamental question:

How is the Earth changing, and what are the consequences for life on Earth?

Highlights of the Fiscal Year 2003 budget request include:

MAJOR DEVELOPMENT AND MISSION OPERATIONS -- $804 million

The spacecraft development (including algorithms development) portion of the ESE request is comprised of EOS ($411 million) and Earth Explorers ($71 million) satellite missions and information systems. The EOS and Earth Explorers programs consist of multiple spacecraft designed to improve understanding of global climate change.

In 2001, 2 spacecraft were launched:

- Jason (December 7) -- a collaborative mission with the French space agency; is studying ocean topography and continuing the data set gathered by TOPEX/Poseidon
- SAGE III (December 10) -- is studying stratospheric aerosols and gases as part of a cooperative mission with Russia

EOS and Earth Explorer missions in development or preparation for launch through calendar year 2004, with launch year in parentheses, include:

- Aqua (2002) -- will study atmospheric temperature and humidity, clouds, sea surface temperature, and the biosphere; partnering with Japan and Brazil
- GRACE (2002) -- will observe time and geographic variations of Earth's gravity field; partnering with the German space program; riding to space aboard a Russian rocket
- ICEsat (2002) -- will examine ice sheet topography
- SORCE (2002) -- will explore solar irradiance, complementing data from ACRIMSAT and UARS, both now in orbit
- SeaWinds (2002) -- an instrument on Japan's ADEOS II satellite, will examine ocean surface winds as the successor to ongoing QuikSCAT
- Aura (2004) -- will explore tropospheric and stratospheric atmospheric chemistry
- Cloudsat (2004) -- will provide three-dimensional cloud profiles
- CALIPSO (2004) – joint NASA/French mission; will develop three dimensional aerosol profiles

Starting in fiscal 2003 the EOS Data information System (EOSDIS) operations requirements have been transferred to Mission Operations. This change reflects the near-completion of EOSDIS development and the shift in emphasis to operations and technology evolution. The EOSDIS development requirements are $74 million. The total Mission Operations requirements (including the transfer from EOSDIS) are $248 million.

The EOSDIS has been serving thousands of government and private-sector users by providing data and information from NASA satellite programs since September 1995. In addition to operating spacecraft the EOSDIS acquires, processes, and distributes data gathered by the EOS missions. This data will lay the groundwork for the government as well as commercial and academic partners to generate the higher-level data products. These higher-level data products will make it easier for researchers, educators, policy-makers and the public to understand and use ESE satellite data and information.

The Mission Operations Program acquires, processes and archives long-term data sets and validated data products. The requested funding provides for the operation of ongoing spacecraft missions and the processing of acquired data. In addition, the 2003 request includes funding for the support of the spacecraft communications and data acquisition network of ground stations. Funding for this in previous years was carried under the Space Communications budget in the SAT appropriation and most recently in the Human Space Flight appropriation. This funding responsibility transfer allows for a better depiction of the full costs supporting the Earth Science mission operations.

Research and Technology -- $506 million

The ESE science research effort ($354 million) is designed to address the following (five) fundamental questions. Each of the fundamental questions is tied to the overarching global environmental question:

How is the Earth system changing, and what are the consequences for life on Earth?

- How is the global Earth system changing? (Variability)
- What are the primary forcings of the Earth system? (Forcing)
- How does the Earth system respond to natural and human-induced changes? (Response)
- What are the consequences of changes in the Earth system for human civilization? (Consequences)
- How well can we predict future changes to the Earth system? (Prediction)

The ESE examines questions in a wide variety of disciplines including the areas of atmospheric chemistry and physics, oceanography, ecology and cryospheric science. The ESE also explores the use of orbital platforms, suborbital platforms and high-end computers, while calibrating and validating observational data. Through long-term examination of the global environment and sound science, the ESE provides decision-makers with insight into the answers to the above questions.

A robust future science program requires advances in a number of critical instrument, spacecraft and information system technologies. This budget request includes $87 million to carry out a vigorous Advanced Technology program to develop technologies for future science missions. In addition to the baseline technology program, the Advanced Technology Initiative program will identify and invest in various critical technologies.

The ESE technology strategy seeks to leverage the entire range of technology development programs offering benefits in cost, performance, and timeliness of future Earth science missions. The ESE strategy is to use open competitions for ESE-sponsored technology programs to attract the best ideas and capabilities from the broad technology community, including industry and academia.

Technology investments will be made in the following areas:

- Advanced instrument and measurement technologies for new and/or lower-cost scientific investigations into the global environment;
- Cutting-edge technologies, processes, techniques and engineering capabilities that reduce development time, operations costs and mission risk. In addition, these technologies will support rapid implementation of productive, economical, and timely missions;

- Advanced end-to-end mission information-system technologies affecting data flow from origination at the instrument/detector through data archiving. These technologies will collect and disseminate information about the Earth system that will enable productive use of ESE science and technology in the public and private sectors.

ESE celebrated a major milestone in 2001 with the completion of all mission objectives aboard the Earth Observing-1 (EO-1) satellite. The EO-1 spacecraft tested new technologies that will be used in future Landsat-continuity missions. The EO-1 instruments are a fraction of the size of previous remote-sensing instruments and were built at a fraction of the cost. The EO-1 mission has out-performed all expectations and has provided technologists new insights into next-generation remote sensing instruments.

Applications, Education and Outreach -- $62 million

Expanded scientific knowledge of the Earth will result in practical applications beneficial to all Americans. Examples of these applications include: weather and hydrologic forecasts; prediction of seasonal or longer-range climate changes; prediction of the impacts of environmental changes upon fisheries, agriculture and water resources; global air-quality forecasts; and natural hazards risk-assessments. The ESE performs a key role in demonstrating these potential applications.

The ESE goal is to expand and accelerate the realization of economic and societal benefits from Earth science, information and technology. The ESE emphasizes the development of solutions to problems of national and international importance that confront federal agencies, as well as state, local and tribal governments, and private industry. Solutions are drawn from ESE science results, data and technology that are developed in partnership with agencies that will implement them.

ESE is also training the next generation of Earth scientists and enabling K-12 teachers to incorporate remote sensing information into their science curricula. This interagency research and education program is enabling a better understanding of global environmental change while helping all students reach higher levels of achievement in science and mathematics.

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