

# THE NATIONAL ACADEMIES

*Advisers to the Nation on Science, Engineering, and Medicine*

**April 2005**

## **Earth Sciences and Applications from Space: Urgent Needs and Opportunities to Serve the Nation—*Summary***

### **SPACE STUDIES BOARD**

#### **Background**

The Earth is a dynamic planet whose changes and variations affect our communications, energy, health, food, housing, and transportation infrastructure. Understanding these changes requires a range of observations acquired from a variety of land-, sea-, air-, and space-based platforms. To assist NASA, NOAA, and the USGS develop these tools, the NRC was asked by these agencies to carry out a decadal strategy survey of Earth science and applications from space. In particular, the study is to develop the key scientific questions on which to focus Earth and environmental observations in the period 2005-2015, and a prioritized list of space programs, missions, and supporting activities to address these questions. This interim report outlines a key element of the study—the rationale for tying Earth observations to societal need—and identifies urgent near-term actions needed to achieve this goal. A final report, due in late 2006, will provide the list of recommended space missions, programs, and supporting.

#### **Findings and Recommendations**

The current U.S. civilian Earth observing system, operated by NASA, NOAA, and the USGS, is at risk of collapse. Although NOAA has plans to modernize and refresh its weather satellites, NASA has no plan to replace its Earth Observing System (EOS) platforms after their nominal six year lifetimes end beginning in 2005, and it has cancelled, scaled back, or delayed at least six planned missions. These decisions appear to be driven by a major shift in priorities at NASA to implement a new vision for space exploration, which jeopardizes its ability to address other important presidential initiatives, such as the Climate Change Research Initiative and the subsequent Climate Change Science Program. Moreover, a substantial reduction in Earth observation programs today will result in a loss of U.S. scientific and technical capacity, which could decrease the competitiveness of the United States internationally for years to come.

There are a number of issues that require immediate attention in the FY 2006 and FY 2007 budgets to address these concerns:

- Proceeding with some NASA missions that have been delayed or cancelled,
- Evaluating plans for transferring capabilities from some cancelled or scaled-back NASA missions to the NOAA-DOD National Polar-Orbiting Environmental Satellite System (NPOESS),

- Developing a technological base for future missions,
- Reinvigorating the NASA Explorer missions program, and
- Strengthening the approach to obtaining important climate observations and data.

***Delayed or cancelled missions.*** The Global Precipitation Measurement mission should be launched without further delays. In addition, NASA and NOAA should complete the Atmospheric Soundings from Geostationary Orbit GIFTS instrument and they should support the international effort to launch GIFTS by 2008.

***Transfer to NPOESS.*** Instruments on three cancelled missions—Ocean Vector Winds, Landsat Data Continuity Mission, and Glory (a mission to measure atmospheric aerosols and solar irradiance)—either may be transferred from NASA or replaced with other instruments for flight on NPOESS. While this plan has advantages and disadvantages, NASA and NOAA should commission three independently reviewed reports, to be completed by October 2005, regarding the three missions. The reviews should focus on suitability, capability, timeliness, and cost/benefit issues. The reviews could be overseen by NASA and NOAA external advisory committees or other independent advisory groups, and should be carried out by representative scientific and operational users of the data, and NOAA and NASA technical experts.

***Technological Base for Future Missions.*** Much of the recent progress in understanding the Earth as an integrated system has come from EOS. While the final report of this study will include a list of recommended new Earth observing missions and capabilities, a healthy scientific and technological base must be maintained. NASA should significantly expand existing technology development programs to ensure that new enabling technologies for critical observational capabilities are available to support potential mission starts over the coming decade.

***NASA Explorer Program.*** The Earth system science explorer program (ESSP) was developed to accommodate new scientific priorities and innovative low-cost missions into NASA's Earth science program. The continuation of a line of Explorer-class missions, directed toward understanding the Earth and developing new technologies and observational capabilities, should be supported. In addition, NASA needs to:

- Increase the frequency of Explorer selection opportunities and accelerate the ESSP-3 missions by providing sufficient funding for at least one launch per year, and
- Release an ESSP-4 announcement of opportunity in FY 2005.

***Climate Observations and Data.*** The nation continues to lack an adequate base of climate observations that will enhance knowledge about how climate is changing and provide a means to test and improve climate models. NOAA, working with the Climate Change Science Program and the international Group on Earth Observations, should create a climate data and information system to meet the challenge of the production, distribution, and stewardship of high-accuracy climate records from NPOESS and other relevant observational platforms.

**Research and Analysis.** It appears that significant resources for the research and analysis (R&A) programs that sustain the interpretation of Earth science data have been reallocated. Because the R&A programs are carried out largely through research universities, there will be an immediate and deleterious impact on graduate student, postdoctoral, and faculty research support. This development jeopardizes U.S. leadership in Earth science and observations, and undermines the vitality of the government-university-private sector partnership that has made so many contributions to society.

#### **For Further Information**

Copies of the complete report, *Earth Sciences and Applications from Space: Urgent Needs and Opportunities to Serve the Nation*, can be obtained on the National Academy Press Web site <<http://books.nap.edu/.html>>.

Support for this project was provided by the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, and the U.S. Geological Survey. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the sponsors. More information about the Space Studies Board can be found at <<http://www.nationalacademies.org/ssb/>>.

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