

Statement of

Berrien Moore III, Ph.D.
Professor and Director of the Institute for the Study of Earth, Oceans, and Space
University of New Hampshire
and
Co-Chair, Committee on Earth Science and Applications from Space
National Research Council
The National Academies

before the

Committee on Science
The U.S. House of Representatives
Hearing on
“NASA’s Earth Science Program”

Mr. Chairman, Ranking Minority Member, and members of the committee: thank you for inviting me here to testify today. My name is Berrien Moore, and I am a professor of systems research at the University of New Hampshire. I appear today in my capacity as co-chair of the National Research Council (NRC)’s Committee on Earth Science and Applications from Space: A Community Assessment and Strategy for the Future.

As you know the National Research Council is the unit of the National Academies that is responsible for organizing independent advisory studies for the federal government on science and technology. In response to requests from NASA, NOAA, and the USGS, the NRC has begun a “decadal survey” of Earth science and applications from space which is due to be completed in 2006. The guiding principle for the study, which was developed in consultation with members of the Earth science community, is to set an agenda for Earth science and applications from space, including everything from short-term needs for information, such as weather warnings for protection of life and property, to longer-term scientific understanding that is essential for understanding our planet, how it supports and sustains life, and that underpins future societal applications.

The NRC has been conducting decadal strategy surveys in astronomy for four decades. But it has only started to do them in other areas fairly recently. This is the first decadal survey in Earth science and applications from space.

Among the key tasks in the charge to the decadal survey committee is the request to:

- Develop a consensus of the top-level scientific questions that should provide the focus for Earth and environmental observations in the period 2005-2020; and
- Develop a prioritized list of recommended space programs, missions, and supporting activities to address these questions.

The NRC survey committee has prepared a brief interim report, which I am pleased to be able to summarize today. This report provides an early examination of urgent issues that require attention prior to publication of the committee's final report in the second half of 2006. A copy of the full report has also been provided for your use.

The report was requested by the sponsors of the study and by staff members of the Science Committee. The report also responds, in part, to direction in the FY 2005 appropriations bill that calls for "the National Academy's Space Studies Board to conduct a thorough review of the science that NASA is proposing to undertake under the space exploration initiative and to develop a strategy by which all of NASA's science disciplines . . . can make adequate progress towards their established goals, as well as providing balanced scientific research in addition to support of the new initiative."

The current U.S. civilian Earth observing system centers on the environmental satellites operated by NOAA; the atmosphere-, ocean-, ice-, and land-observation satellites of NASA's Earth Observing System (EOS); and the Landsat satellites, which are operated through a cooperative arrangement between NASA, NOAA, and the USGS. Over the past 30 years, NASA and NOAA have contributed to fundamental advances in understanding the Earth system and in providing a variety of societal benefits through their international leadership in Earth observing systems from space. **Today, this process of building understanding through increasingly powerful observations and thereby expanding the basis for needed applications is at risk of collapse.** Although NOAA has plans to modernize and refresh its weather satellites, NASA has no plan to replace its EOS platforms after their nominal six year lifetimes end (beginning with the end of the Terra satellite mission in 2005), and it has cancelled, scaled back, or delayed at least six planned missions, including a Landsat continuity mission.

These decisions at NASA appear to be driven by a major shift in priorities as the agency moves to implement a new vision for space exploration. We believe this change in priorities jeopardizes NASA's ability to fulfill its obligations in other important presidential initiatives, such as the Climate Change Research Initiative and the subsequent Climate Change Science Program. It also calls into question future U.S. leadership in the Global Earth Observing System of Systems, an international effort initiated by this administration. Indeed, the nation's ability to pursue a visionary space exploration agenda depends critically on our success in applying knowledge of the Earth to maintain economic growth and security on our home planet.

Moreover, a substantial reduction in NASA's Earth observation programs today will result in a loss of U.S. scientific and technical capacity, which will decrease the competitiveness of the United States internationally for years to come. U.S. leadership in science, technology development, and societal applications depends on sustaining competence across a broad range of scientific and engineering disciplines that include the Earth sciences.

The NRC's interim report identifies a number of issues for NASA and NOAA that require immediate attention in the FY 2006 and FY 2007 programs. They include the following:

- The impact of canceling or delaying NASA missions,

- The need to evaluate plans for transferring capabilities from some cancelled or scaled-back NASA missions to the NOAA-DOD NPOESS satellites,
- The adequacy of the technological base for future missions,
- The state of NASA Research and Analysis programs, which are necessary to maximize scientific return on NASA investments in Earth science and to retain the intellectual base for future missions,
- The need to reinvigorate the Explorer missions program, and
- Near-term steps that are required to develop a sustained and robust observing system from space that provides essential baseline climate observations and create a climate data and information system to meet the challenge of production, distribution and stewardship of climate records from NPOESS and other relevant observational platforms..

With regard to these issues, the committee recommends the following actions:

1. The NASA Global Precipitation Measurement mission should be launched without further delays. This mission is an international effort to improve climate, weather, and hydrological predictions through more accurate and frequent precipitation measurements.
2. NASA and NOAA should complete the fabrication, testing, and space qualification of the GIFTS (Geosynchronous Imaging Fourier Transform Spectrometer) instrument and should support the international effort to launch this instrument by 2008. GIFTS will make highly detailed measurements from geostationary orbit of temperature and water vapor and will improve the prediction of severe weather conditions as well as the range of global weather forecasts.
3. NASA and NOAA should commission three independent reviews, to be completed by October 2005, regarding three missions or instruments: (a) the Landsat Data Continuity Mission, which has been endorsed by the White House Office of Science and Technology Policy and was planned by NASA to continue the vital record of Earth land imaging after Landsat-7, which is currently failing, (b) the Glory mission to measure and characterize atmospheric aerosols and solar irradiance, which is now canceled, but which NASA had previously proposed to accelerate in response to the President's Climate Change Science Program, and (c) the suitability of the instrumentation planned for NPOESS to measure ocean winds and direction.

The guidelines for these reviews are set forth in the Interim report.

4. Mr. Chairman, we also recommend that NASA significantly expand existing technology development programs to ensure that new enabling technologies for critical observational capabilities are available to support mission starts over the coming decade. One of the problems of having nothing in the mission queue after the Global Precipitation Mission, other than smaller, principal investigator led explorer-class missions, is that focused technology development is no longer supported. Amongst the areas requiring increased technology investments are:

- Space-based interferometric synthetic aperture radar, whose numerous applications include monitoring of Earth's crustal movements caused by volcanic or seismic activity;
 - Wide swath ocean altimetry, which will provide the first synoptic observations of global ocean eddies, coastal currents and tides, and internal tides; and
 - Wind lidar, which will facilitate long sought measurements of global wind profiles, particularly over the oceans where three dimensional measurements are sparse and where most weather phenomena originate.
5. We also recommend that NASA:
- Increase the frequency of Earth Explorer selection opportunities and accelerate the frequency of launch opportunities by providing sufficient funding for at least one launch per year (that is, a return to the schedule the program originally envisioned and followed prior to recent delays), and
 - Release the next announcement of opportunity for this program in FY 2005.

NASA developed its Earth System Science Pathfinder (ESSP) program as “an innovative approach for addressing Global Change Research by providing periodic ‘Windows of Opportunity’ to accommodate new scientific priorities and infuse new scientific participation into the Earth Science Enterprise...[using]... relatively low to moderate cost, small to medium sized missions that are capable of being built, tested and launched in a short time interval.” But some of the missions now being planned may not be launched until nearly 10 years after they were selected.

6. Last, we recommend that NOAA, working with the Climate Change Science Program and the international Group on Earth Observations create a robust and sustained observing system from space that includes at a minimum a set of essential baseline climate observations. In addition NOAA 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. These functions are within NOAA's mandate to understand climate variability and change, but cannot be accomplished through the current NPOESS program or its data system architecture.

Finally, Mr. Chairman, our committee is also concerned about diminished resources for the research and analysis (R&A) programs that sustain the interpretation of Earth science data. Because the R&A programs are carried out largely through the nation's research universities, there will be an immediate and deleterious impact on graduate student, postdoctoral, and faculty research support. The long-term consequence will be a diminished ability to attract and retain students interested in using and developing Earth observations. Taken together, these developments jeopardize U.S. leadership in both Earth science and Earth observations, and they undermine the vitality of the government-university-private sector partnership that has made so many contributions to society.

Thank you for the opportunity to appear before you today. I am prepared to answer any questions that you may have.

