

Atmospheric and Ocean Sciences in the FY 2003 Budget

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HIGHLIGHTS

- Budget requests for the atmospheric and ocean sciences funding agencies are mixed. The National Science Foundation's (NSF) budget would increase 5.0 percent. The National Oceanic and Atmospheric Administration's (NOAA) R&D program would receive a 1.1 percent decrease, with increases in climate research and extreme weather warnings and forecasts including weather satellites. The National Aeronautics and Space Administration's (NASA) overall budget would increase by 0.7 percent. Department of Energy's (DOE) Biological and Environmental Research (BER) would decrease by 11.6 percent reflecting completion of FY 2002 earmarked projects. Department of Defense's (DOD) overall basic R&D would decrease by 0.8 percent. The Environmental Protection Agency's (EPA) R&D budget would increase by 5.9 percent.
- The U.S. Global Change Research Program (USGCRP) would increase by \$44 million to \$1.71 billion across nine agencies.
- The tri-agency program (DOD, NASA and NOAA) National Polar Orbiting Environmental Satellite System (NPOESS) that converges the civil and military systems into a single program remains on track with a requested budget of \$474.5 million split equally between NOAA and the Department of the Air Force.
- Oceanographic research in NOAA would decrease significantly across the board. Basic research in the Navy would rise approximately 1.3 percent. NASA's JASON mission was launched in December 2001 as a follow-on to the successful

ocean topographic experiment (TOPEX). NSF oceanography programs would increase by 13.5 percent.

- The National Space Weather Program (NSWP) would continue in FY 2003 with significant increases in NASA's Living with a Star Program and level funding for the NSF's solar-terrestrial programs. NOAA's Solar-Terrestrial Services and Research Program would have an increase of \$0.2 million.

INTRODUCTION AND POLITICAL ENVIRONMENT

Atmospheric and Ocean Sciences are an integral and vital part of the Earth system. Since the attacks of September 11, 2001, these two areas of research have become increasingly important both for homeland security and overseas military operations. Pollutants that enter the atmosphere or the oceans may interact with each other and chemically and biologically with the media which transports them. There are social and political consequences that must be addressed relative to these issues. Free and open exchange of global data for research, operations, and education is more important today than ever.

The importance of environmental knowledge to military activities has increased greatly as a result of Desert Storm, Kosovo, and Afghanistan operations. The successful use of precision-guided missiles depends on knowledge of local weather. Improved marine information is vital to surface ship, submarine and amphibious operations. The DOD acknowledges weather information as a force multiplier. As emphasis is placed on a national missile defense system, the need to understand the atmosphere in order to detect distant threats becomes vital.

Public and scientific interests have grown with regard to the effects of solar variability on the Earth's atmosphere, space systems, radio transmissions and ground based power transmission systems, and potentially the global climate. The NSWP was developed to coordinate research, improve prediction, and investigate related impacts. During 2001, the SOHO satellite observed the largest sunspot in 10 years (its surface area was as large as 13 Earth's). Also in 2001 the largest solar flare ever recorded disrupted communications, airline traffic, and power grids. A National Academy of Sciences report setting the decadal strategy for solar and space physics research is scheduled to appear in mid-2002.

NATIONAL SCIENCE FOUNDATION (NSF)

NSF's budget would increase to \$5.0 billion, an increase of \$240 million (5.0 percent; see Table II-7). That increase could be reduced by \$76.0 million if proposed transfers of programs from other agencies (NOAA, USGS, and EPA) do not take place. NSF's increase then would be \$163 million (3.4 percent). Research and Related Activities would increase to \$3.8 billion, an increase of 5.1 percent. Education and Human Resources would increase to \$908 million, an increase of 3.8 percent. Major research equipment (MRE) would decrease to \$126 million, a decrease of 9 percent. Information Technology Research would increase to \$286 million, an increase of 3 percent. Biocomplexity in the Environment would increase to \$79 million, an increase of 36 percent. All of these accounts provide resources for atmospheric and ocean sciences. (For more information on the NSF budget, see Chapter 7.)

NSF's Geosciences (GEO) Directorate would receive an increase of \$81.6 million (13.4 percent) for a total of \$691.1 million. This includes transfers of \$10 million from USGS for its Hydrology of Toxic Substances program, \$57 million from NOAA for its Sea Grant program, and \$9 million from EPA for its environmental education (STAR) program. Without the transfers, the GEO Directorate would receive an increase of \$7.6 million (1.2 percent). Included in the GEO total is \$15 million for the Climate Change Research Initiative (CCRI; see the end of this chapter). There are several activities within the MRE account that would have an impact on the atmospheric and ocean sciences. A National Ecological Observatory Network (NEON) would be funded at \$12 million. Continuing projects would be the South Pole Station (\$6 million) and Terascale Computing Systems (\$20 million).

Atmospheric Sciences Subactivity would increase by \$16.9 million (8.4 percent) to \$218.9 million. Atmospheric Sciences Research Support would increase by \$19.9 million (15.9 percent) to \$145.3 million. The National Center for Atmospheric Research would receive \$73.6 million, a decrease of \$3.0 million (3.9 percent). Included in the atmospheric support are funds to be transferred from other agencies: \$5.0 million for Sea Grants and \$3.6 million for the Environmental Education program.

Ocean Sciences Subactivity would increase by \$38 million (13.5 percent) to \$319 million. The Ocean Section would increase by \$16 million (15.4 percent) to \$120 million. The Integrative Programs Section

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would increase by \$10.4 million (11.1 percent) to \$104 million. The Marine Geosciences Section would increase by \$11.6 million (13.8 percent) to \$95 million. Included are funds that would be transferred from other agencies, \$2.5 million for Environmental Education program and \$40.8 million for Sea Grants. The Academic Research Fleet/Ship Operations would be increased by \$2.1 million (3.5 percent) to \$62.0 million for continued operation of the fleet's 28 ships. Ocean Drilling Program Operations would receive \$30 million, a decrease of \$1 million (3.2 percent) to support infrastructure associated with the drilling program and operation of the JOIDES *Resolution*. (For additional information on GEO programs, see also Chapter 16.)

U.S. Polar Programs, including Polar Research Programs and Antarctic Logistical Support, would receive \$303.8 million, an increase of \$6 million (2.0 percent). The budget would provide interdisciplinary research support for Arctic environmental changes; preliminary investigation of Antarctic subglacial lakes; and polar genomics. Emphasis would be for expanding access to Arctic oceans using the USCG Cutter *Healy* and improvements in communications capabilities also would be undertaken.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

The agency's FY 2003 request of \$3.2 billion represents a decrease of \$45.4 million or 2.0 percent below the FY 2002 budget. NOAA's R&D would decrease by 1.1 percent (see Table II-14). The reductions would be primarily in National Ocean Service (NOS) research, down \$28.6 million, and the Office of Oceanic and Atmospheric Research (OAR), down \$59.1 million because of the transfer of the Sea Grant program to NSF. Other program realignments would allow increases totaling \$148.8 million in selected areas including infrastructure (ships, computers, aircraft and buildings), satellite systems, severe weather prediction, coastal conservation, living marine resources and climate research and services and, hydrological prediction services.

NPOESS would increase by \$79.9 million to \$237.3 million for NOAA's matching share to DOD's contribution to the future converged, environmental polar-orbiting, operational satellite program. The ongoing polar-orbiting program would decrease by \$15.6 million while retaining some emphasis on ground systems and data production. There would be a decrease of \$35.1 million for a total of \$227.4 million for the

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Geostationary Global Observational Environmental Satellite (GOES) system as the next generation of GOES-R launch date slips from 2010 to 2012 reflecting the increased life of the present generation of satellites.

Climate Research and Services would increase by \$36.2 million to \$137.3 million with new efforts in carbon cycle research of \$2.3 million including \$18.0 million for the CCRI with increases for climate modeling, atmospheric and ocean observations, aerosol research and carbon monitoring.

The agency-wide initiative to improve Severe Weather Forecasts would increase by \$84.3 million for a total of \$766.7 million that includes the polar orbiting satellite program. The USWRP would receive an increase of \$1.0 million for a total of \$3.8 million. The USWRP would focus on improving the accuracy of hurricane landfall predictions and quantitative precipitation forecasts. Other increases would occur in the NWS and would include advanced hydrological forecasting, upgraded super computing efforts, and aviation weather. (For additional information on NOAA, please see Chapter 16; see also Chapter 12.)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA's overall budget would increase 0.7 percent to \$15.0 billion (see Table II-12). This includes \$3 million for the CCRI. Space Science would increase to \$3.4 billion (up 19.0 percent) which includes transfers of over \$200 million for mission support operations such as the Deep Space Network. The Space Science program includes important projects aimed at solar activity and the Earth's space environment. The High Energy Solar Spectroscopic Imager (HESSI), launched in February 2002, will study the dynamics of solar flares by producing high-resolution movies of the initiation and decay of solar flares. The Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED) mission, launched in December 2001, will provide global data in the region where the Earth's atmosphere tails off into space. Both will complement the Living with a Star Program. The Solar-Terrestrial Relations Observatory (STEREO) would receive \$74.3 million in FY 2003 and a contribution of \$16.2 million would be made to Japanese Solar B mission.

The Earth Science Enterprise (ESE) essentially faces flat funding which would result in a decrease when transfers from other NASA accounts are considered. Jason, the follow on to the TOPEX mission, was launched in

December 2001. EOS Aqua will be launched in the Spring of 2002. The NPOESS Preparatory Program (NPP) would remain on track to bridge the gap between research on the atmosphere as exemplified by Aqua and the future operational NPOESS. No new Earth Science missions would be pursued until the USGCRP is reviewed. The Earth Observing System (EOS) would rise by \$25.5 million to \$410.9 million. EOS Data Information System (EOSDIS) requirements would be shifted to Missions Operations and would be funded at \$247 million. Further development of EOSDIS and its successor would be funded at \$74 million. The Research and Technology account would decrease by \$30.8 million to \$506.3 million. (Please see Chapter 10 for more on NASA.)

OTHER AGENCIES

The DOE's Biological and Environmental Research (BER) would decrease to \$504.2 million (down 12 percent; see Table II-11). Much of the reduction reflects completion of congressionally mandated projects. Climate change research would increase to \$138 million, an increase of \$9 million for climate modeling and \$3 million for the new CCRI.

DOD basic R&D would decline by 0.8 percent in the FY 2003 request. Basic Research in the Navy would increase by 1.3 percent and decrease in the Air Force by 3.2 percent. Both these agencies have been traditional sponsors of atmospheric and oceanic research. (Please see Table II-5 for more details.)

R&D in EPA's budget would increase to \$627 million, an increase of 5.9 percent (see Table II-17). EPA's clean air goal would decrease by 4.9 percent to \$93 million including research to support the National Air Quality Standards (NAAQS) program that would reduce air toxics and acid rain risks. Research in support of Reducing Global Risks would receive \$22 million, a reduction of 1.8 percent. These programs deal with greenhouse gas emissions, ozone depletion, and the development of cleaner technologies. The Sound Science Program would receive \$257 million, a reduction of 5.9 percent. (See Chapter 12 for more on EPA.)

U.S. GLOBAL CHANGE RESEARCH PROGRAM (USGCRP)

The USGCRP was developed in FY 1990 as a Presidential Initiative and was codified by the Global Change Research Act of 1990. It is an interagency research program to provide the scientific basis for informed

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decision making. Its purpose is to increase understanding of the Earth system and provide a sound scientific basis for national and international decision making on global change issues. The program has produced a large body of important and useful research that can now be used to help countries, especially in the developing world, adapt to and assess the impact of regional changes in climate. The Congress is considering a reauthorization of the USGCRP. The Administration is preparing to hold a critical review of it. A new strategic plan has been drafted, but not released, whose purpose is to guide the program for the next decade.

The FY 2003 budget would provide \$1.7 billion for the USGCRP, an increase of \$44 million. Funding details by agencies are found in Table I-10. Expenditures for NASA's space-based observations and data systems would be \$864 million. Scientific research including surface-based observations would be \$850 million. In FY 2003, the development of any follow-on NASA satellites will pause until a review of the USGCRP and its relationship to the new CCRI are completed.

The USGCRP budget is allocated among six interdisciplinary research program elements: Atmospheric Composition, Climate Variability and Change, Global Carbon Cycle, Global Water Cycle, Terrestrial and Marine Ecosystems, and Land Use/Land Cover Change. Funds would also be allocated to Human Contributions and Responses to Change.

The budget for the scientific research elements would include: \$110 million to understand atmospheric composition and processes affecting stratospheric and tropospheric chemistry; \$305 million to enhance observational and modeling capabilities for improved understanding, prediction, and assessment of climate variability and change; \$115 million focused on understanding and quantifying carbon sources and sinks, particularly for North America; \$75 million to improve capabilities to measure the global water cycle and its relation to national water resources and management; \$110 million to understand how natural and human induced changes affect terrestrial and marine ecosystems; and \$15 million to understand what processes determine the spatial and temporal distribution of land use and land cover change. Research on human health effects of UV radiation would receive \$70 million and human contributions and responses to global change would receive \$50 million.

U.S. CLIMATE CHANGE STRATEGY: A NEW APPROACH

President Bush has established two new climate initiatives: **the Climate Change Research Initiative (CCRI)** and the National Climate Change Technology Initiative (NCCTI). These initiatives will compliment the ongoing USGCRP and any related technology research programs that address climate change issues.

The White House released a plan titled *U.S. Climate Change Strategy: A New Approach* on February 14 that builds on the President's commitments to global climate science and technology. The President established a Cabinet-level Committee on Climate Change Science and Technology Integration (CCCSTI) led by the Secretaries of Commerce and Energy in close coordination with the President's Science Advisor. The research will continue to be coordinated through the National Science and Technology Council (NSTC) in accordance with the Global Change Research Act of 1990.

The FY 2003 budget would provide \$4.5 billion in total climate spending, an increase of \$700 million over that to be spent in FY 2002. Such a commitment is unmatched in the world. Funding for basic scientific research on climate change would be \$1.7 billion. This would include \$40 million for a new Climate Change Research Initiative (CCRI). That funding would be shared among NOAA (\$18 million), NSF (\$15 million), NASA (\$3 million), DOE (\$3 million), and USDA (\$1 million). The CCRI would improve the integration of scientific knowledge, including measures of uncertainty, into decision support systems and will adopt performance metrics and deliverable products useful to policymakers in a short time frame (2-5 years).

Priorities for FY 2003 include: understanding the North American carbon cycle; developing reliable representation of the global and regional climatic forcing by atmospheric aerosols; investing in computer modeling; and ensuring high-quality, long-term climate data records.

Funding on climate change technologies would be \$1.3 billion, of which \$40 million would be provided in the DOE budget for the NCCTI. That initiative would build on an existing base of research and development in climate change technologies, primarily at DOE, EPA, and USDA. Specific research areas are being identified through an interagency review process.