



Science + Technology

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107th Congress Adjourns, Record R&D Increases on Hold

Unable to make substantial progress on fiscal year (FY) 2003 appropriations, the 107th Congress adjourned in November, leaving key decisions affecting federal research and development (R&D) funding to the 108th Congress, which will convene in January.

Although FY 2003 started on October 1, only 2 of the 13 appropriations bills, both covering defense spending, have been signed into law. These bills provide record increases for federal defense R&D (see table on page 7). The 11 nondefense appropriations bills, however, are all incomplete. Although the House and Senate have drafted initial versions that would provide increases for many nondefense R&D programs, until they are signed into law, all domestic programs will have to operate at last year's (FY 2002) funding levels through a series of temporary appropriations bills called continuing resolutions. The current continuing resolution lasts until January 11, but the appropriations process may not conclude until at least late January or February.

Defense R&D

Congress and President Bush have given final approval to \$58.8 billion for Department of Defense (DOD) R&D in FY 2003, an increase of \$9.1 billion or 18.4 percent that brings the total above its FY 1987 peak Cold War funding level to a new all-time high.

DOD weapons systems would receive much of the increase, but basic research ("6.1"; \$1.5 billion, up 6.8 percent) and applied research ("6.2"; \$4.5 billion, up 10.8 percent) would also get significant boosts. DOD "S&T" activities, encompassing research plus advanced technology development, would exceed \$11 billion for the first time to reach \$11.7 billion (up 13.5 percent), reaching 3.2 percent of the total DOD budget, in contrast to the 2.6 percent proposed in the

president's request. President Bush signed the DOD budget into law on October 23.

Nondefense R&D

Combining the defense bill with the eleven nondefense bills as they have been drafted by the Senate would boost total FY 2003 federal R&D funding to a record high of \$117 billion, an unprecedented \$14 billion (14 percent) increase over the \$103 billion provided in FY 2002. While the lion's

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Congress Passes NSF Doubling Bill

After a compromise developed in response to last-minute White House objections, the House and Senate passed the National Science Foundation (NSF) doubling bill (H.R. 4664), which authorizes NSF programs for the next five years. The bill specifies funding totals that would rise to \$9.8 billion in FY 2007, slightly more than double the agency's current FY 2002 budget of \$4.8 billion.

The bill's passage represents a major milestone in a long-term effort by the scientific community and NSF's congressional supporters to increase the agency's budget. While total federal funding of scientific research has risen dramatically in recent years, the increase has been driven mostly by support for biomedical research at the National Institutes of Health, leaving funding for many other disciplines stagnant. NSF's mission is to strengthen the nation's capabilities in all scientific disciplines.

"Improved science and math education, scientific innovation, and new technology hold the key to our nation's future economic success, as well as to our national security," said House Science Committee Chairman Sherwood Boehlert (R-NY). "... We turn to NSF to solve some of our most pressing problems; we can't turn from NSF when we decide where

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"Cybersecurity research will no longer be a backwater, but rather will become a priority at two of our premier research agencies."

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Cyber Security Bill Becomes Law

On November 27, President Bush signed into law the Cyber Security Research and Development Act (P.L. 107-305) authorizing nearly \$903 million in funds over five years to the National Science Foundation (NSF) and the National Institute of Standards and Technology (NIST). The funding will go towards an array of programs to improve basic research in computer security, encourage partnerships between industry and academia, as well as to generate a new cybersecurity workforce.

The Cyber Security Research and Development Act was introduced by House Science Committee Chairman Sherwood Boehlert (R-NY) in the aftermath of the terrorist attacks. It initially passed the House in early February by a vote of 400-12, but it wasn't until November 12 that the Senate passed an amended version of the bill. The House quickly cleared the way for the legislation to go to the White House for the president's signature.

In his remarks on the floor after final

passage of H.R. 3394, Chairman Boehlert stated that the bill is designed to "usher in a new era in cybersecurity research. Cybersecurity research will no longer be a backwater, but rather will become a priority at two of our premier research agencies." Representative Brian Baird (D-WA), who cosponsored the bill along with ranking member Ralph Hall (D-TX), added, "In today's world, security has to mean more than locking doors and installing metal detectors. Our economy relies on a vast information infrastructure that is woefully under protected. This bill puts the best and the brightest to work developing ways of making our computer networks impenetrable."

The bill authorizes a total of \$593 million between fiscal years (FY) 2003-2007 to NSF, of which \$233 million would go to basic research grants; \$144 million to the establishment of multidisciplinary computer and network security research centers; \$95 million to "capacity building"

grants to establish or improve undergraduate and graduate education programs; and \$90 million to doctoral programs. In addition, it authorizes \$25 million in development grants to establish training programs to increase the number of professors teaching courses in cybersecurity. Finally, NSF

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would receive \$6 million to support computer and network security education grants under the Scientific and Advanced Technology Act of 1992 (42 U.S.C. 1862i).

NIST would receive almost \$310 million over the same five years of which \$275 million would go towards research programs that involve a partnership between industry, academia, and government laboratories. In addition, funding may go towards post-doctoral research fellowships. The bill also provides \$32 million for intramural research conducted at NIST laboratories.

In addition to the \$310 million in research funds, H.R. 3394 provides \$2.15 million for NIST's Computer System Security and Privacy Advisory Board to conduct analyses of emerging security and research needs. Finally, the bill would provide an additional \$700,000 for the National Research Council to conduct a two-year study of our nation's existing infrastructure vulnerabilities.

Changes made by the Senate included the insertion of the \$6 million faculty grants, and language to ensure that universities and students that participate in these programs comply with federal immigration laws. ●●●

R&D Increases on Hold

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share of this increase would go to defense R&D and the National Institutes of Health (NIH), nondefense R&D excluding NIH would rise 4.4 percent. This total includes a hefty 11.9 percent increase for R&D at the National Science Foundation (NSF), which would total \$3.9 billion. The Senate would complete NIH's five-year doubling plan, providing a 16.4 percent increase in R&D funding for a total of \$26.4 billion. Most other agencies would also get increases over FY 2002, with the exception of the Transportation and Agriculture Departments, whose FY 2002 budgets were inflated with one-time emergency appropriations to respond to last year's terrorist attacks.

The nine nondefense bills drafted by the House would also provide generous increases for many R&D programs, including a 14.5 percent (\$510 million) boost for NSF R&D, a 6.9 percent (\$697 million) increase for R&D at NASA, and an 8.3 percent (\$48 million) increase in EPA R&D. The Department of Energy's Office of Science, however, would see its R&D budget fall by 0.3 percent (\$10 million). The House, however, has not drafted two of the largest—and most contentious—appropriations bills, which include the Departments of Health and Human Services, Education, and Commerce.

Outlook

The president's budget request proposed a total of \$750 billion for all discretionary spending, and he has repeatedly insisted that he will veto any appropriations bills that could cause the total to exceed that amount. The House set a \$755 billion total, but found it impossible to write 13 appropriations bills capable of winning a House majority while staying within the total. Thus, two of the biggest bills were never drafted.

The Senate discretionary spending total was set at \$771 billion, \$21 billion more than the president's request. This higher total made it possible to draft all 13 appropriations bills, but the full Senate approved only 1 nondefense bill because the floor schedule was

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Homeland Security Dept to House New S&T Infrastructure

On November 25, after months of partisan debate over personnel rules, President Bush signed legislation (P.L. 107-296) establishing a new Department of Homeland Security (DHS) with the primary mission of preventing terrorist attacks within the United States.

The new DHS umbrella will bring together nearly 170,000 federal employees and up to \$35 billion in annual budgetary resources in the largest reorganization of the federal government since the 1940s.

The new department will have significant impacts in science and technology (S&T) related to homeland security. DHS will have its own S&T policy infrastructure as well as

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S&T in the new DHS

The final version of the DHS bill creates an Under Secretary for Science and Technology, a provision absent from the Bush Administration's original proposal, to serve as the apex of a new S&T infrastructure. The under secretary, who will report directly to the Secretary of Homeland Security, will be in charge of the Directorate of Science and Technology, one of four broad directorates in the new department. This directorate will have responsibility for setting R&D goals and priorities, coordinating homeland security R&D throughout the federal government, funding its own R&D

programs, and facilitating the transfer and deployment of technologies for homeland security.

The under secretary will act as scientific and technical adviser to the secretary and will convene a Homeland Security Advisory Committee consisting of first responders, citizen groups, researchers, engineers, and businesses to provide S&T advice. DHS will create a new federally funded research and development center (FFRDC), the Homeland Security Institute, to act as a think tank for risk analyses, simulations of threat scenarios, analyses of possible countermeasures, and strategic plans for counterterrorism technology development.

The S&T directorate will also have an Office for National Laboratories to coordinate DHS interactions with Department of Energy (DOE) national laboratories that have expertise in homeland security. The office will have the authority to establish a semi-independent DHS headquarters laboratory within an existing federal laboratory, national lab, or FFRDC.

The homeland security legislation directs DHS to establish one or more university-based centers for homeland security R&D, and includes 15 detailed criteria for where to locate them. It has been widely reported that the criteria were crafted by House Majority Whip Tom Delay (R-TX) in order to favor Texas A&M University.

The DHS R&D Portfolio

The S&T directorate will house a new research agency named the Homeland Security Advanced Research Projects Agency (HSARPA), modeled on the existing Defense Advanced Research Projects Agency (DARPA) in the Department of Defense (DOD). HSARPA will award competitive, merit-reviewed grants along the entire spectrum of R&D from basic research all the way to prototyping new technology products. The legislation authorizes \$500 million in fiscal year (FY) 2003 for the agency, but the actual appropriation will have to be decided as part of the FY 2003 budget process.

In addition to HSARPA, DHS will fold in existing R&D programs from the Departments of Energy (DOE), Agriculture (USDA),

and Transportation (DOT). Precise R&D funding figures are not yet available because of the vague parameters of the final legislation, and because the FY 2003 budget process was left unfinished by the 107th Congress. While the original Bush Administration homeland security proposal sug-

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gested that DHS would have a \$3.4 billion R&D portfolio, the final legislation suggests a portfolio of up to \$800 million (see table on page 4). In contrast to the original concept, the final legislation keeps federal bioterrorism R&D programs, which could total as much as \$2 billion in FY 2003, within the Department of Health and Human Services (HHS) instead of transferring them to DHS. The Homeland Security Secretary would, however, have joint authority with the HHS Secretary to set priorities for these programs.

Next Steps and Possible Impacts

Although the DHS will have enormous impacts on the federal government and especially on goods and travelers crossing U.S. borders, the impact on scientists and

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Elections Bring Modest Changes for S&T

Online Bonus Coverage available at www.aaas.org/spp/cstc/stc

Homeland Security
Continued from page 3

engineers is minimal. Few federal scientists and engineers will be affected except a small number of DOT, USDA, or DOE contractor employees. The new priority-setting powers of DHS, however, mean that NIH bioterrorism research priorities will be set with strong input from the new department.

Potential DHS R&D Portfolio

(Budget authority in millions of dollars)

R&D Program FY 2003 Estimate

DOE National Infrastructure Simulation and Analysis Center	20
Other DOE programs	100
HSARPA (new)	500
USDA Plum Island Animal Disease Center	25
DOT Transportation Security Administration R&D	130
DOT Coast Guard R&D	24
Total DHS R&D	799

AAAS estimates of R&D based on DHS legislation, and OMB and agency data. Preliminary figures based on FY 2003 request and authorization levels. Updated 11/22/02.

Because the 107th Congress failed to complete the FY 2003 budget, all domestic programs are currently operating at FY 2002 funding levels. As a consequence, there is no money available to create new programs such as HSARPA unless funds can be shifted from existing programs. Congress hopes to finish work on FY 2003 appropriations in January, before DHS formally comes into existence 60 days after enactment of the legislation, but it will be difficult to meet this goal. It may be months, then, before the new department has the necessary resources to begin organizing its S&T infrastructure. ●●●

Kei Koizumi, director of the AAAS R&D Budget and Policy Program, contributed to this article.

FOR MORE INFORMATION:

AAAS R&D Web Site: www.aaas.org/spp/rd

NSF Doubling Bill
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to invest federal funds."

Although the House passed its original version of the NSF doubling bill in June and the Senate finished its version in October, objections raised by the White House Office of Management and Budget (OMB) delayed final passage until the very end of the session. OMB argued that five years was too long for an authorization bill, and that doubling the agency's budget would be arbitrary, and inconsistent with President Bush's efforts to lower spending and institute management reforms.

Eventually, congressional negotiators and OMB officials agreed to a compromise that removed the word "doubling" from the bill's official title, and made the final two years of the authorization contingent on NSF's progress toward meeting a set of management goals.

The agreement solidified an additional set of compromises that had already been worked out between the House and Senate versions of the bill. The final legislation does not include a Senate provision that would have combined a math and science partnership at the Department of Education with a similar program at NSF. Critics of this provision argued that the Education Department program, which distributes funding based on formula grants, is designed to have a broader reach than the NSF program and should remain separate.

Also dropped from the final bill was Senate language expanding eligibility to participate in NSF's Experimental Program to Stimulate Competitive Research (EPSCoR).

NSF had expressed concern that expanding the program would dilute the funds available to participants.

Several programs focusing on education are authorized in the bill, including the math and science partnerships program; an effort to encourage the hiring of "master teachers"; a program to encourage girls to study math and science; the "Tech Talent" program, which would provide grants to universities that increase the number of science, math, and engineering majors they graduate; and the Robert Noyce scholarship program, which would provide financial support to science, math, and engineering majors who pledge to spend 2-4 years teaching math and science in a secondary or elementary school.

The bill authorizes the creation of plant genome research centers and partnerships to conduct basic research focused on plants that are important to the developing world. The legislation also specifies funding for research programs in information technology and nanotechnology.

H.R. 4664 was formally sent to President Bush on December 9 but had not yet been signed at press time. The president, who must act within ten days for the bill to become law, is expected to sign the legislation shortly. ●●●

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FOR MORE INFORMATION:

Coalition for National Science Funding: www.cnsfweb.org

AAAS Senate Testimony on Balanced Federal R&D Funding: www.aaas.org/news/releases/2002/0522leshner.shtml

CONGRESSIONAL RESEARCH SERVICE

Copies of CRS reports for congressional use are available by calling 202/707-7132.

- **Florida Everglades Restoration: Background on Implementation and Early Lessons (RL31621)**
This report provides an outline, description, and analysis of the policy components of the Comprehensive Everglades Restoration Plan (CERP), including the multi-agency committees that coordinate and implement the policies.
- **Computer Software and Open Source Issues: A Primer (RL31627)**
This report discusses the implication of government use of open source software as opposed to commercial software. It provides an overview of the open source software community, and the impact that government use of open source could have to development of homeland security and e-government initiatives, improving government information technology management practices, strengthening security, protecting intellectual property rights, and cost and quality.
- **Federal Research and Development Organization, Policy, and Funding for Counterterrorism (RL31576)**
This report provides a detailed overview of existing funding and programs for counterterrorism R&D throughout the federal government. It discusses the current organization for interagency coordination of counterterrorism activities, and the R&D components within the proposed Department of Homeland Security. The report also discusses options for modifying interagency priority-setting and coordination for R&D activities in bioterrorism and information security.

GENERAL ACCOUNTING OFFICE

Copies of GAO Publications are available online at www.gao.gov or by calling 202/512-6000.

- **Homeland Security: CDC's Oversight of the Select Agent Program (GAO-03-315R)**
This report provides an assessment of CDC's oversight of the Select Agent Program. It found significant management weaknesses in CDC's facility registration and transfer monitoring processes that impede effective program oversight. The report recommends that CDC establish proper internal control in accordance with OMB Circular A-123, including improvements in: inspection and approval of facilities registering to transfer select agents, monitoring of the transfer and shipment of select agents, accuracy of CDC databases of registered facilities and select agent transfers, and CDC organizational structure to improve oversight.
- **Technology Assessment: Using Biometrics for Border Security (GAO-03-174)**
This report is the result of a congressionally-mandated pilot program within GAO for assessing technologies. This particular assessment analyzes what biometric technologies are

currently deployed, currently available but not yet deployed, or in development that could be deployed in the foreseeable future for use in securing the nation's borders. It addresses the effectiveness of these technologies in helping provide security to the nation's borders, and discusses the economic and effectiveness trade-offs of implementing them. Finally, the report outlines the implications of using biometric technologies and the preservation of individual liberties.

- **Intellectual Property: Federal Agency Efforts in Transferring and Reporting New Technology (GAO-03-47)**
This report provides information on how federal agencies identified, patented, and licensed inventions created in their own facilities during fiscal years 1997-2001. It analyzes the extent to which the agencies complied with the Technology Transfer Commercialization Act of 2000 requirement to submit reports on their technology transfer activities, and what the agencies have done to improve compliance with reporting requirements under the Bayh-Dole Act for inventions created under contracts and grants.

THE NATIONAL ACADEMIES

Government offices may obtain single complimentary copies by calling the Office of Congressional and Government Affairs at 202/334-1513. Others may order copies from the National Academy Press (800/624-6242, www.nap.edu).

- **Evaluating and Improving Undergraduate Teaching in Science, Technology, Engineering, and Mathematics (prepub.)**
This report discusses methods for improving undergraduate education in science, technology, engineering, and mathematics. It recommends that colleges and universities use evidence of student learning as a basis for measuring teaching effectiveness. In addition, schools should provide faculty with ongoing teaching instruction and establish endowments to reward excellent teaching. The report emphasizes, however, that no single path to high-quality evaluation of professors or academic departments is clearly superior.
- **Funding Smithsonian Scientific Research (ISBN: 0-309-08633-7)**
This report is the result of a request by OMB to assess whether the research conducted at Smithsonian research centers was "inherently unique" enough to justify noncompetitive funding. The study found that researchers at the Smithsonian Institution's National Museum of Natural History, National Zoological Park, and Center for Materials Research and Education should remain exempt from having to compete for federal dollars because they make unique contributions to the scientific and museum communities. It further found that research at the Smithsonian's Astrophysical Observatory, Environmental Research Center, and Tropical Research Institute was "world-class," and that any attempt to transfer appropriated funds away from them would have a significant effect on the quality of their research, and perhaps even end it.

scientific definitions

1. The act of making clear and distinct.
2. the act of stating a precise meaning or significance.

MARINE BIOLOGY TERMS

CONTINENTAL SHELF A broad expanse of ocean bottom sloping gently and seaward from the shoreline to the shelf-slope break at a depth of 100 to 200 meters.

SHELF-SLOPE BREAK Line marking a change from the gently inclined continental shelf to the much steeper depth gradient of the continental slope.

ABYSSAL PLAIN The deep ocean floor, an expanse at depths of 4,000 to 6,000 meters.

ABYSSOPELAGIC ZONE The 4,000 to 6,000-meter-depth zone, seaward of the shelf-slope break.

BATHYPELAGIC ZONE The 2,000 to 4,000-meter-depth zone seaward of the shelf-slope break.

ATOLL A horseshoe or circular array of islands, capping a coral reef system perched around an oceanic volcanic seamount.

ESTUARY A semi-enclosed body of water that has a free connection with the open sea and within which seawater is diluted measurably with freshwater that is derived from land drainage.

AUTOTROPHIC ALGAE Algae capable of photosynthesis and growth using only dissolved inorganic nutrients.

AUXOTROPHIC ALGAE Algae requiring a few organically derived substances, such as vitamins, along with dissolved inorganic nutrients for photosynthesis.

HETEROTROPHIC ALGAE Algae that take up organic molecules as a primary source of nutrition.

ANADROMOUS FISH Fish that spends most of its life feeding in the open ocean but that migrates to spawn in fresh water.

EL NIÑO-SOUTHERN OSCILLATION (ENSO) Condition in which warm surface water moves into the eastern Pacific, collapsing upwelling and increasing surface-water temperatures and precipitation along the west coast of North and South America.

OLIGOTROPHIC Used to describe bodies of water with low nutrient concentrations.

PARTICULATE ORGANIC MATTER Particulate material in the sea derived from the decomposition of the nonmineral constituents of living organisms.

TURBIDITY The weight of particulate matter per unit volume of sea water.

SOURCE: Glossary of Marine Biology, <http://life.bio.sunysb.edu/marinebio/glossary.html>

R&D Increases on Hold

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consumed with debates on homeland security legislation, authorization for military action against Iraq, drought and other disaster relief, and other non-budget issues.

The 108th Congress will begin with a clean legislative slate and may choose to focus immediately on appropriations. The strong performance of Republicans in the November elections, attributed in part to President Bush's active role on the campaign trail, will likely provide the president with greater leverage to bring the process to a close at his requested spending levels. A Republican-controlled Senate, moreover, may be amenable to bringing its discretionary totals in line with President Bush's request.

Thus, the hefty R&D increases proposed by the Senate and House may be in jeopardy. While the large increase for NIH approved by the Senate will probably remain because it was included in the president's budget and has strong support in both chambers, President Bush requested an overall cut in other nondefense R&D programs. Agencies such as NSF and NASA may therefore see smaller budgets if House and Senate negotiators are forced to lower their overall funding levels toward the president's rather than raising them toward the Senate's.

Also uncertain is the end date of the FY 2003 appropriations process. Even with the political will to make final decisions, January is normally a slow legislative month for Congress. But lawmakers will be mindful that the president's proposed FY 2004 budget will be released on February 3, and that a possible military campaign in Iraq will require FY 2003 supplemental defense appropriations. So it is possible that Congress will make an extraordinary push to finish this year's budget before the next one comes along, most likely by bundling the eleven bills into one or two omnibus bills. In the meantime, agencies will continue at FY 2002 funding levels, with a significant possibility that they will have to live at these levels for several more months. ●●●

Kei Koizumi, director of the AAAS R&D Budget and Policy Program, contributed to this article.

FOR MORE INFORMATION:

AAAS R&D Web Site: www.aaas.org/spp/rd

R&D in FY 2003 Appropriations

	FY 2002 Estimate	FY 2003 Request	Action by House			Action by Senate		
			FY 2003 House	Chg. from Amount	FY 2002 Percent	FY 2003 Senate	Chg. from Amount	FY 2002 Percent
Defense (military) *	49,616	54,460	58,764	9,148	18.4%	58,764	9,148	18.4%
("S&T" 6.1,6.2,6.3 + Medical) *	10,298	9,706	11,692	1,395	13.5%	11,692	1,395	13.5%
(All Other DOD R&D) *	39,319	44,753	47,072	7,753	19.7%	47,072	7,753	19.7%
National Aeronautics & Space Adm.	10,159	10,598	10,856	697	6.9%	10,798	639	6.3%
Energy	8,356	8,323	8,532	176	2.1%	8,740	384	4.6%
(Office of Science)	3,048	3,059	3,038	-10	-0.3%	3,123	75	2.5%
(Energy R&D)	1,474	1,317	1,584	110	7.5%	1,559	85	5.7%
(Atomic Energy Defense R&D)	3,834	3,947	3,910	76	2.0%	4,058	224	5.8%
Health and Human Services	23,950	27,385				27,578	3,629	15.2%
(National Institutes of Health)	22,674	26,361				26,385	3,711	16.4%
National Science Foundation	3,526	3,651	4,036	510	14.5%	3,947	421	11.9%
Agriculture	2,316	2,061	2,145	-170	-7.4%	2,262	-54	-2.3%
Interior	660	628	681	21	3.1%	688	28	4.3%
Transportation	791	768	815	24	3.1%	697	-94	-11.9%
Environmental Protection Agency	580	617	628	48	8.3%	624	45	7.7%
Commerce	1,124	1,084				1,216	92	8.2%
(NOAA)	608	605				682	74	12.2%
(NIST)	491	467				513	22	4.4%
Education	268	311				279	11	4.2%
Agency for Int'l Development	243	157	245	2	0.9%	161	-82	-33.7%
Department of Veterans Affairs	734	781	791	57	7.8%	786	52	7.1%
Nuclear Regulatory Commission	61	68	68	7	11.5%	68	7	11.5%
Smithsonian	126	131	131	5	4.0%	131	5	4.0%
All Other	333	333				357	24	7.2%
Total R&D	102,842	111,355				117,097	14,254	13.9%
Defense R&D	53,450	58,406				62,822	9,372	17.5%
Nondefense R&D	49,392	52,948				54,274	4,883	9.9%
Nondefense R&D minus NIH	26,718	26,588				27,889	1,172	4.4%

AAAS estimates of R&D in FY 2003 House and Senate appropriations bills. Includes conduct of R&D and R&D facilities.

*DOD figures are final FY 2003 House-Senate conference funding levels. All other funding levels have been approved by the House or Senate, or the Appropriations Committee in the House or Senate.

All figures rounded to the nearest million. FY 2002 figures adjusted to reflect supplemental appropriations in the FY 2002 supplemental bill (Public Law 107-206). Updated November 22, 2002.

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Frontiers in Science



Martian Water Ice Found • Scientists at the U.S. Geological Survey and Arizona State University using the Mars Odyssey Thermal Emission Imaging System (THEMIS) have discovered water ice near the edge of Mars' southern polar cap. It was first observed by THEMIS, an instrument on board NASA's 2001 Mars Odyssey spacecraft, as a region that was cooler than expected for dry soil at this latitude during the summer season. By utilizing diurnal and seasonal temperature trends observed from the Mars Global Surveyor (MGS) spacecraft, the researchers were able to conclude that the surface contains water ice. Furthermore, observations from both the Viking and Mars Odyssey missions indicate that the surface water ice may be more widespread around and under the southern cap. The proximity of the ice to the surface makes it accessible for robotic and/or human exploration missions.

---> *ScienceExpress, December 5, 2002*

Oldest New World Writing • A controversy has started to brew in the field of archaeology after a team of U.S. scientists revealed that a cylindrical seal discovered at the Olmec Center of La Venta,

Mexico, is evidence of the earliest form of writing in Mesoamerica. The seal, dating to approximately 650 B.C., includes a carving of a bird with a series of glyphs emanating from its beak, symbols that the researchers claim represent speech. Moreover, because it includes a name of a king and a calendar date, the discovery may be the first evidence of the origin of writing that influenced the great Mayan culture. Before this discovery, the earliest example of Mesoamerican writing dated from approximately 300 B.C. Because the artifact is fragmented, many other experts are reserving judgment as to its importance.

---> *Science, December 6, 2002*

A Mystery Revealed of Antineutrinos • An international team of scientists, utilizing an underground laboratory in Japan called KamLAND, have shown that the elusive antineutrino behaves a lot like its counterpart the neutrino. The experiment revealed that electron antineutrinos from nearby nuclear reactors change into *muon* or *tau* antineutrinos, just as electron neutrinos from the sun change into *muon* or *tau* neutrinos. This supports the theory that antineutrinos, like neutrinos, have mass and can oscillate or change from one type to another. Physicists have been quick to note that the experiment shows that the Standard Model of Particle Physics, which has been used to explain fundamental physics since the 1970's, is in need of updating.

---> *KamLAND, Japan, December 6, 2002*