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SPECIAL UPDATE

Largest Increase in History for Federal R&D

On December 20, more than two months into fiscal year (FY) 2002, President Bush and the 107th Congress reached final agreements on FY 2002 appropriations, including support for research and development (R&D). The federal investment in R&D exceeds \$100 billion for the first time, totaling \$103.7 billion, a \$12.3 billion or 13.5 percent increase over FY 2001. This is the largest dollar increase in history and the largest percentage increase in nearly 20 years (see table on page 3).

Because of a recession, large tax cuts enacted in June, reconstruction and relief spending after the terrorist attacks, heightened security spending, and the war in Afghanistan, the federal budget is returning to deficits after four years of surpluses. But with a bipartisan consensus that the federal government must respond effectively to the above challenges, federal spending is set to increase dramatically in FY 2002, including R&D. President Bush signed the three remaining appropriations bills into law on January 10.

All the major federal R&D agencies will benefit from the significant boost, in contrast to the proposed cuts for most agencies in the Bush Administration's initial budget request. The largest dollar and percentage increases go to the two largest R&D funding agencies, the Department of De-

fense (DOD) and the National Institutes of Health (NIH), reflecting the high priority placed on defense and health by the Bush Administration and Congress. DOD R&D grows by \$7.4 billion or 17.3 percent to reach \$50.1 billion, due to dramatic increases for missile defense development. NIH R&D increases 15.8 percent to \$22.8 billion to fulfill the fourth year of a five-year campaign to double the NIH budget, with additional funds provided to combat bioterrorism.

The total federal investment in basic and applied research will also benefit from congressional largesse growing to \$48.2 billion, an increase of 11.0 percent or \$4.8 billion over FY 2001. NIH remains the largest single sponsor of basic and applied research; in FY 2002, NIH alone will fund 46 percent of all federal support of research in these areas.

Nondefense R&D reaches another all-time high in FY 2002, the sixth year in a row that nondefense R&D has increased in inflation-adjusted terms. A large part of the recent increases has been due to steady growth in the NIH budget, and as a result, NIH R&D has become nearly as large as all other nondefense agencies' R&D funding combined. Funding for nondefense R&D excluding NIH has stagnated in recent years; after steady growth in the 1980s, funding peaked in FY 1994 and then declined sharply as a result of tight budget

conditions in the mid-1990s. The FY 2002 increases for non-NIH agencies, while large, just barely brings these agencies back to the funding levels of the early 1990s.

The following is a breakdown of appropriations for key R&D funding agencies.

Department of Defense (DOD) R&D totals \$50.1 billion, an increase of 17.3 percent or \$7.4 billion from the FY 2001 level of \$42.7 billion, the largest dollar increase in history. Most prominent is a 66.4 percent rise in R&D funding for the Ballistic Missile Defense Organization (BMDO) to \$7.0 billion, reflecting President Bush's top priority to deploy a national missile defense system. Basic research ("6.1") rises by 5.0 percent to \$1.4 billion, while applied research ("6.2") rises by 14.6 percent to \$4.2 billion. DOD S&T, which encompasses the "6.1" through "6.3" categories plus medical research, exceeds \$10 billion for the first time to reach \$10.5 billion, meeting the DOD goal of setting aside 3 percent of the DOD budget for S&T.

The **National Institutes of Health (NIH)** budget of \$23.6 billion, including emergency funds, represents a \$3.2 billion or 15.7 percent increase over FY 2001, keeping NIH on the fourth year of a course toward doubling its budget in five years. Every institute receives an increase greater than 12 percent,

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and five receive increases greater than 20 percent. Among other agencies in the **Department of Health and Human Services**, the **Centers for Disease Control and Prevention** (CDC) is the big winner with a 33.3 percent increase to \$689 million for its R&D programs. Most of the increase comes from emergency counterterrorism R&D funds designed to boost laboratory security and research on bioterrorism threats, particularly anthrax.

The **National Aeronautics and Space Administration's** (NASA) total budget of \$14.9 billion in FY 2002 represents a 4.5 percent increase over FY 2001. Total NASA R&D, which excludes the Space Shuttle and its mission support costs, increases 3.8 percent to \$10.3 billion. The troubled International Space Station, now projected to run more than \$4 billion over budget over the next five years, receives \$1.7 billion, a cut of 18.4 percent. The cut mostly reflects the transfer of Station research to the Biological and Physical Research account. The Science, Aeronautics, and Technology account receives \$7.9 billion, 11.6 percent or \$823 million more than FY 2001.

The **Department of Energy** (DOE) receives \$8.1 billion for its R&D programs in FY 2002, \$378 million or 4.9 percent more than FY 2001. R&D in DOE's three mission areas of energy, science, and defense all rise above FY 2001 levels, with small increases for energy R&D (up 1.6 percent) and science R&D (up 2.1 percent) and a larger increase for defense R&D (up 8.4 percent). This is due partially to last-minute emergency appropriations for counterterrorism R&D. While the Bush Administration proposed

drastic cuts in many of DOE's energy R&D programs, the final FY 2002 budget generally keeps funding at FY 2001 levels or provides slight increases. Most science programs receive funding close to FY 2001 levels. In defense programs, Weapons Activities R&D totals \$2.6 billion, an increase of 9 percent, mostly to fund R&D at DOE's three weapons labs which are responsible for the nation's nuclear stockpile. Nonproliferation and Verification R&D jumps 51.2 percent to \$309 million because of emergency appropriations to combat potential nuclear terrorism.

In the final **National Science Foundation** (NSF) budget, R&D funding rises 7.6 percent for a total of \$3.5 billion. Most of NSF's research directorates receive increases greater than 8 percent, in contrast to level or declining funding in the request. The largest budget increases, however, go to NSF's non-R&D programs in education and human resources for a new math and science education partnerships program. The final budget boosts funding for information technology and nanotechnology research, and the Major Research Instrumentation program. The Major Research Equipment account, which funds construction of large-scale scientific facilities, receives \$139 million, \$42 million more than the request because of funding for two projects that were not part of NSF's budget request. Another potential future NSF project, the National Underground Science Laboratory in South Dakota, receives \$10.3 million from another agency, but NSF would have oversight of future plans for the laboratory site, currently a gold mine.

The **U.S. Department of Agriculture** (USDA) receives a large budget boost from emergency funds to combat terrorism. USDA R&D totals \$2.1 billion in FY 2002, a boost of \$180 million or 9.2 percent. USDA's intramural Agricultural Research Service (ARS) receives \$40 million in emergency funds for research on food safety and potential terrorist threats to the food supply and \$73 million in R&D facilities funds to improve security at two ARS laboratories that handle pathogens. Total ARS R&D increases 22 percent to \$1.2 billion, including a large boost in Buildings and Facilities funding from \$74 million to \$192 million. The final Agriculture budget prohibits the

Initiative for Future Agriculture and Food Systems (IFAFS) program and another small program from spending mandatory R&D funds for competitively awarded research grants. The National Research Initiative, USDA's regular competitive grants program, receives \$120 million, \$15 million more than FY 2001. The final USDA budget boosts funding for congressionally designated research projects, including \$97 million (up 13.5 percent) for Special Research Grants.

The **Department of Commerce's** R&D programs receive \$1.4 billion in FY 2002, \$153 million or 12.7 percent more than FY 2001. Commerce's two major R&D agencies, the **National Institute of Standards and Technology** (NIST) and the **National Oceanic and Atmospheric Administration** (NOAA), both receive large increases. NOAA R&D rises by 15.3 percent to \$836 million, with large increases across several NOAA accounts, including the National Ocean Service (NOS) and Oceanic and Atmospheric Research (OAR). The final Commerce budget follows the Senate lead in keeping NIST's Advanced Technology Program (ATP) alive with a boost of 26.6 percent in its R&D to \$150 million. The Bush Administration and the House would have all but eliminated the program. Total NIST R&D increases 17.1 percent to \$493 million. NIST's intramural R&D programs rise by 4.3 percent to \$279 million, including some emergency funding for cyber security.

The **Department of the Interior's** R&D budget totals \$673 million in FY 2002, an increase of 6.5 percent. Although the President's FY 2002 request caused alarm in the science and engineering community because of its proposed cut of nearly 11 percent for R&D in Interior's **U.S. Geological Survey** (USGS), the final budget restores the cuts and gives USGS an increase of 3.1 percent over FY 2001 to \$567 million.

The **Environmental Protection Agency** (EPA) FY 2002 R&D budget grows substantially to \$702 million, a \$93 million or 15.3 percent increase above last year. The boost is due to \$70 million in emergency counterterrorism R&D funds. The non-emergency funds for most R&D programs remain at the FY 2001 level, though nearly 50 congressionally-designated research projects are added to the Science and Technology account and nearly 20 earmarked

- For more detailed coverage of federal R&D funding, please refer to *Congressional Action on R&D in the FY 2002 Budget* on the web at: www.aaas.org/spp/dspp/rd/ca02title.htm

A print version will be available in mid-January for \$10.95 by calling the AAAS Distribution Center at 1-800-222-7809. Complimentary copies for congressional staff are available while supplies last by calling 202/326-6661.

R&D in FY 2002 Appropriations
(Budget authority in millions of dollars)

	FY 2001 Estimate	FY 2002 Request	FY 2002 Approved	Action by Congress		Action by Congress	
				Chg. from Request Amount	Percent	Chg. from FY 2001 Amount	Percent
Defense (military)	42,743	48,454	50,134	1,680	3.5%	7,390	17.3%
("S&T" 6.1,6.2,6.3 + Medical)	9,420	8,827	10,527	1,700	19.3%	1,107	11.8%
(All Other DOD R&D)	33,324	39,627	39,607	-20	-0.1%	6,283	18.9%
National Aeronautics & Space Admin.	9,925	9,967	10,301	334	3.4%	375	3.8%
Energy	7,744	7,399	8,122	723	9.8%	378	4.9%
Health and Human Services	20,859	23,496	24,145	650	2.8%	3,287	15.8%
(National Institutes of Health)	19,710	22,395	22,822	428	1.9%	3,113	15.8%
National Science Foundation	3,279	3,226	3,527	301	9.3%	249	7.6%
Agriculture	1,959	1,801	2,139	338	18.8%	180	9.2%
Interior	631	593	673	80	13.5%	41	6.5%
Transportation	747	798	853	55	6.9%	106	14.2%
Environmental Protection Agency	609	569	702	133	23.4%	93	15.3%
Commerce	1,201	1,110	1,354	244	22.0%	153	12.7%
(NOAA)	726	772	836	64	8.3%	111	15.3%
(NIST)	421	313	493	180	57.6%	72	17.1%
Education	265	259	265	6	2.5%	0	0.1%
Agency for Int'l Development	200	193	204	11	5.7%	4	2.0%
Department of Veterans Affairs	703	722	733	11	1.5%	30	4.3%
Nuclear Regulatory Commission	50	67	68	1	2.0%	18	36.6%
Smithsonian	118	118	119	1	0.7%	1	0.7%
All Other	336	285	355	70	24.4%	19	5.6%
Total R&D	91,371	99,057	103,694	4,638	4.7%	12,324	13.5%
Defense R&D	46,243	51,996	53,928	1,932	3.7%	7,685	16.6%
Nondefense R&D	45,128	47,061	49,766	2,706	5.7%	4,638	10.3%
Nondefense R&D minus NIH	25,418	24,666	26,944	2,278	9.2%	1,526	6.0%
Basic Research	22,015	23,302	24,141	839	3.6%	2,126	9.7%
Applied Research	21,450	22,013	24,105	2,092	9.5%	2,655	12.4%
Total Research	43,464	45,314	48,246	2,932	6.5%	4,782	11.0%

AAAS estimates of R&D in FY 2002 appropriations bills. Includes conduct of R&D and R&D facilities. All figures are rounded to the nearest million. Changes calculated from unrounded figures. December 26, 2001 - Based on approved FY 2002 appropriations bills. Includes emergency appropriations for counterterrorism and national security.

R&D projects are added to other accounts. **Department of Transportation R&D** climbs to an all-time high of \$853 million in FY 2002, \$106 million or 14.2 percent more than FY 2001. The Federal Aviation Administration (FAA) receives \$50 million in emer-

gency counterterrorism funds to develop better aviation security technologies. FAA receives a total of \$373 million for R&D, a large gain of 23.9 percent because of the emergency funds and also because of guarantees of increased funding for FAA pro-

grams which became law last year. ●●●
— Kei Koizumi
AAAS R&D Budget and Policy Program

FOR MORE INFORMATION:
AAAS R&D Website: www.aaas.org/spp/R&D

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Heard off the Hill

Babbling Babies • Neuroscientists at McGill University in Montreal have found that babbling babies may be doing more than just learning to use their mouth muscles.

New findings suggest that babbling is produced by the language system in the brain. Language is covered by the brain's left hemisphere, which controls the right side of the body, so when adults speak they usually use the right side of their mouths more than the left. If baby babble is purely a muscle exercise, then it should come equally from both sides of the mouth. The McGill study found otherwise: after testing six babies, three learning English and three French, the researchers found that most babbling comes from the right side of the mouth.

---> *Science*, November 30, 2001

Baskerville Effect • Is it actually possible to be scared to death? Yes, according to researchers at UC San Diego. In China and Japan, the words "death" and "four" sound almost identical, so the number four tends to cause anxiety and stress. For example, four is sometimes omitted in floor and room numberings. The researchers examined the death certificates of 200,000 Chinese and Japanese Americans, and found 13 percent more deaths from heart attacks on the fourth day of the month. They dubbed this the "Baskerville effect" after the famous Sherlock Holmes story in which a man dies from a heart attack after a frightening encounter with a hound.

---> *Washington Post*, December 24, 2001

Move Over Energizer Bunny? • Researchers at the University of North Carolina at Chapel Hill have conducted experiments with carbon nanotubes, a new form of carbon discovered about a decade ago, and found that it may be possible to store more energy in a battery using the tiny tubes than with conventional graphite electrodes. Most rechargeable batteries in electronics today use graphite or carbonaceous materials as one of the electrodes. Carbon nanotubes are very strong tubular structures formed from a single layer of carbon atoms and are only about a billionth of a meter in diameter. The UNC scientists were able to open the closed ends of the nanotubes and reduce their lengths. This allowed the diffusion of ions into the interior space of the nanotube and reduced the diffusion time, which they believe is the reason for the enhanced storage capacity.

---> *Physical Review Letters*, January 7, 2002

The Infant Universe • For over a decade now, the Hubble Space Telescope has been producing dramatic images of distant galaxies, star formation, and other astronomical phenomena. Its latest finding is that matter in the early universe began clumping into stars much sooner than previously thought. After the big bang roughly 14 billion years ago, astronomers had suspected that the rate of star formation gradually built up over the course of several billion years. After a detailed analysis of the most sensitive images the Hubble has ever taken, it appears that a flurry of stars formed just a few hundred million years after the big bang, making the infant universe a much brighter place than astronomers had thought.

---> *Washington Post*, January 9, 2002