Order Code IB10088

Issue Brief for Congress

Received through the CRS Web

Federal Research and Development: Budgeting and Priority-Setting Issues, 107th Congress

Updated November 1, 2002

Genevieve J. Knezo
Resources, Science, and Industry

CONTENTS

Federal Research and Development: Budgeting and Priority-Setting Issues, 107th Congress

SUMMARY

Federal R&D funding priorities change over time, reflecting Presidential and national preferences. Defense R&D predominated in the 1980s, decreasing to about 50% of federal R&D in the 1990s during the Clinton Administration. In nondefense R&D, space R&D was dominant in the 1960s as the nation sought to compete with the Soviet Union; energy R&D became an additional priority during the energy-short 1970s, and, since the 1980s, health R&D has predominated. Defense R&D has started to dominate again as priorities have shifted to deal with the war against terrorism. The FY2003 budget request seeks to increase R&D funding by about 8% overall, including increases for the Department of Defense (DOD) and National Institutes of Health (NIH). R&D funding would increase also for the Departments of Education and Veterans Affairs, and EPA, NASA and NSF, although some of these latter increases are due to program shifts and new methods of counting programs that were not formerly counted as R&D. R&D funding would decrease in the Departments of Agriculture, Commerce, Interior, Transportation, and other areas. If the 16% increase in NIH R&D funding were not counted, civilian R&D funding would fall by 0.2%. Counter terrorism R&D funding is requested to double to about $3 billion. Congressional appropriations action, which is not complete, indicates that FY2003 R&D funding will exceed the requested levels.

National R&D funding continues to grow, but the federal R&D share, while surpassing the previous peak of 1992 in constant dollars, has declined to 27% of the national total. Scholars and policymakers cite the importance of R&D funding to economic growth. Debates focus on whether federal R&D should be increased across the board; how priorities should be set; and how to determine "balance" in funding between health and nonhealth fields.

Legislative priority-setting initiatives include bills to double the NSF budget within 5 years (H.R. 4664 passed in the House); and to make permanent the research and experimentation tax credit, including credit for industrial support of academic basic research (H.R. 1137, H.R. 1329, S. 41, and S. 515).

The Bush Administration included in its budget request a "Federal S&T" budget, which may presage a future unified science and technology (S&T) budget. The FY2003 budget requested funding for four interagency R&D initiatives. Other proposals made to coordinate R&D include a continuing priority-setting mechanism; a cabinet-level S&T body; functional R&D budgeting; and reestablishment of the Office of Technology Assessment in Congress (H.R. 2148) or a Science and Technology Assessment Service (H.R. 4, as passed the Senate on April 25, 2002). The Administration opposes earmarking for R&D, which it said totaled about $1.8 billion in FY2002 and because the practice distorts agency priorities. The Administration has started to use some performance measures for R&D budgeting, inspired by the Government Performance and Results Act. However, the Administration and critics say better data and concepts are needed to use performance budgeting for basic and applied research. OMB judged agencies that fund R&D using performance management measures, with NSF winning accolades for its financial management procedures.

MOST RECENT DEVELOPMENTS

The Government is being funded by a continuing resolution because appropriations action has not been concluded, due largely to differences between the House and Senate on discretionary spending levels. Two appropriations bills, that deal with defense, were signed, increasing defense R&D by 18%. The other appropriations bills that deal with R&D have not reached conference. Senate committee action was completed for all 13 appropriations bills and would increase R&D funding by almost 14% over FY2002, and over 5% more than the President's request. Most of the increase would go to defense R&D and to NIH. House appropriations committee action is not complete.

BACKGROUND AND ANALYSIS

Federal R&D funding priorities have shifted over time, reflecting Presidential preferences and national priorities. Defense R&D predominated in the 1980s but decreased to about 50% of total federal R&D in the 1990s, reflecting the Clinton Administration policy. In nondefense R&D, space R&D was dominant in the 1960s as the nation sought to meet Presidential pronouncements and to compete with the Soviet Union in the space race; energy R&D joined space as a priority during the 1970s; and since the 1980s, health R&D funding has grown as the cohort of aged population increases and the promise of life sciences and biotechnology affects national expectations. Defense, health, and counterterrorism R&D funding are projected to increase in this budget cycle. See **Figure 1**. (See also CRS Report RL30905, *Federal Research and Development: Budgeting and Priority-Setting, 1993-2000*.)

FY2002 Budget Action

The FY2002 Bush Administration R&D budget request, at $96.5 billion, would have increased R&D funding by 6.1% over the enacted FY2001 level. Funding increases were proposed for the Department of Defense (DOD) and for the National Institutes of Health (NIH), proposed to be increased to 52% of the nondefense R&D budget. R&D funding was to be flat or decline for the Department of Agriculture; for the Department of Commerce, for the Environmental Protection Agency (EPA); for the Department of the Interior, reducing the U.S. Geological Survey and Biological Research; for the Department of Energy (DOE), reducing energy R&D, energy conservation, and fossil energy and increasing the Office of Science (funding for the Spallation Neutron Source and for the National Ignition Facilities); and for the National Science Foundation (NSF).

Federal defense and nondefense R&D is funded from the discretionary (as opposed to mandatory) portion of the budget and was subject to annual caps through 2002 that are based inflation rates and other factors. (The budget request proposed to revise these caps and extend them through 2006.) The discretionary budget was proposed to be increased 4.0% over FY2001. Nondefense R&D would have increased by about 4.3%, mostly for NIH, so that other nondefense R&D funding (excluding NIH) would have decreased by about 3.0%. For FY2002, the request for budget function 250, "General science, space, and technology," which covers about 25% of federal R&D (for NSF, NASA's space activities, and DOE's basic research),was $21.0 billion in budget authority. The conference report (H. Rept. 107-55) on the budget resolution, H.Con.Res. 83, lowered funding for function 250 to $21.6

billion, decreasing budget authority below both the House and Senate-approved levels for FY2001, but still more than the requested amount.

Appropriations action raised FY2002 federal R&D funding above the requested levels for all agencies and raised total R&D funding to about $103.7 billion. Pressures to double the NIH budget and new priorities and funding to combat terrorism affected R&D appropriations levels. OMB's FY2001 *Annual Report to Congress on Combating Terrorism,* indicated that for FY2002, the Administration requested about $555 million for counterterrorism R&D in several different agencies before the terrorist attacks of September 11. The largest agency supporters are the DOD and the Department of and Health and Human Services. Congress appropriated about $1.5 billion for FY2002 counterterrorism R&D, with about one-half from regular appropriations, and one-half from emergency appropriations[1] in P.L. 107-38. (For additional details, see *Federal Research and Development for Counter Terrorism,* CRS report RL31202.)

FY2003 Budget Request

The President's R&D request totals about $112 billion, about 8% more than the appropriated level for FY2002. Similar to the patterns of funding increases for FY2002, the increases for DOD R&D, at $5.4 billion, or 11% more than last year, and for NIH, at $26.5 billion, or about 16% more than last year, account for most of the total funding increase, leaving all the other R&D funding agencies combined with less money than in FY2002.[2] Total defense R&D funding (for DOD and the Department of Energy's military/nuclear programs) would increase by almost 10%. As a result, while overall discretionary spending (from which most all R&D is funded) would rise almost 7% over FY2002, total non-defense, non-NIH R&D funding would decline or be flat. DOD R&D funding, spurred in part by anti-terrorist priorities, would rise to 52.4% of the federal R&D budget, up from 52.1% in FY2002. Most DOD R&D funding would go to the development/testing end of the funding spectrum, and DOD basic and applied research (called S&T funding in DOD terms, including funding categories 6.1, 6.2, 6.3, and medical R&D), would actually decline by about 4% from the FY2002 level. The increase in funding for NIH, would raise NIH R&D funding to about $26.5 billion, making its funding total about the same as the rest of all other non-DOD agencies' R&D funding combined, at about $26.7 billion. The rise in NIH is attributable to this being the fifth and final year of the congressional policy to double NIH's funding by 2003 and in part to increased counterterrorism funding. **See Table 1.**

The budget request would increase funding for the Department of Veterans Affairs by 6.3%; the Environmental Protection Agency, 5.9%; NASA, 4.3% (with most NASA increases, according to AAAS, due to OMB including as R&D some non-R&D support costs which formerly were not counted as R&D); and NSF, 3.5% (with almost 60% of the "increases" largely attributable to transfer of programs from other agencies, including the National Sea Grant Program from Commerce, hydrological sciences from Interior and environmental education from EPA). Decreases were requested in R&D for the Commerce Department, -0.3%, reducing funding for the Advanced Technology Program (ATP) by over 40% and the Manufacturing Extension Program by almost 90%, offset by increased funding

---

[1] "Federal R&D Climbs to Record High of $103.7 Billion," *AAAS R&D Update*, Dec. 28, 2001.

[2] AAAS, "Bush Proposes Large Increase for DOD, NIH R&D: Mix of Cuts and Increases for Other R&D Programs," Feb. 8, 2002.

for NIST intramural R&D and for some R&D in National Oceanic and Atmospheric. Administration. Decreases were proposed also for the Interior Department, - 4.8 % with cuts to the U.S. Geological Survey, and for water resources R&D; the Department of Energy, -0.5%, with a reduction for earmarks, Spallation Neutron Source construction, and for R&D on natural gas and petroleum technologies, with offsetting increases for coal R&D; and for the Department of Agriculture, -9.3%, due to reducing programs that can be earmarked and the loss of emergency anti-terrorism funds, combined with increases for competitive research grants in the National Research Initiative. AAAS projections show that nondefense R&D would increase by 8.2% from FY2002 to FY2007 after adjusting for inflation. If NIH nondefense R&D were excluded, nondefense R&D would rise 1.6% in inflation-adjusted terms. Defense R&D would rise 8.1% by 2007. The Administration identified a subset of the R&D budget, called a "Federal S&T budget," totaling $57 billion, that focuses on basic and applied research leading to the creation of new knowledge. It includes some education and training funding and excludes most development funding. This conceptualization is similar, but not identical, to a 1995 proposal made by the National Academy of Sciences.

Some cuts have been attributed to the Administration's attempt to eliminate congressional R&D earmarks and others to decreased R&D funding levels that had been increased in 2002 because of counterterrorism funding. Increases are planned for counterterrorism, laboratory security, and basic research (to be increased by about 9% to $25 billion, the highest level ever reached). OMB has proposed deficit funding, after four years of surplus spending since 1998, for a budget which seeks to increase such spending to about $767 billion. Congressional debates have focused on discretionary spending priorities for R&D versus other areas, including tax cuts, domestic programs, and homeland defense.

Counterterrorism Funding

Counterterrorism R&D funding was requested to be increased about $1.5 billion in FY2002 to about $3 billion for FY2003. Notable increases were for the National Institute

Table 2. Research and Development to Combat Terrorism, By Agency, FY2000-FY2003 (Request), Dollars in Millions[3]

Agency	FY2000 Actual	FY2001 Actual	FY2002 Enacted	Emergency Response Fund	FY2003 Request
Agriculture	$37.3	$51.7	$83.9	$91.3	$48.4
Commerce	9.6	0	6.3	0	20.0
Energy	59.7	66.2	64.9	19.0	99.8
EPA	not available	0	2.8	1.5	75.0
DHHS	109.7	102.8	119.1	180.0	1,770.9 (NIH, $1.75B; CDC, $40M; and FDA, $50M).
Justice	45.2	11.4	66.1	0	36.1
NSF	not available	7.0	7.0	0	27.0
National Security	190.0	298.9	385.5	11.0	767.2
Transportation	50.7	50.2	58.3	64.0	59.3
Treasury	2.1	1.2	1.1	0	1.1
Total	**$511.3**	**$589.4**	**$795.2**	**$366.8**	**$2,905.23**

of Allergy and Infectious Diseases, at $1.7 billion for bioterrorism R&D and for construction of containment facilities; for the Agriculture Department, increased $34 million to $406 million; for NIST, $5 million; for DOD, for anti-terrorism technologies; and for cybersecurity R&D in the Bureau of Export Administration, Department of Commerce, at an additional $20 million. The President requested a reported $176 million for R&D related to anti-terrorism in the FY2002 emergency supplemental appropriation. After the legislation was signed, the President announced that he would not release all funds appropriated, limiting counterterrorism R&D supplemental funding to about $128 million. See also CRS Report RL31576.

Congressional Budget Action, FY2003

R&D budgets are developed over an 18-month period before a fiscal year begins. Often advisory committees, influenced by professional scientific groups, recommend R&D priorities to agencies, which use this information, internally generated information, and guidance from the Office of Management and Budget (OMB) and the OSTP to determine priorities. Agencies and OMB negotiate funding request levels during the preparation of the budget before it is sent to Congress. After standing committees recommend budget levels for matters within their jurisdiction to the budget committees, Congress passes a budget resolution, which sets spending levels and recommends levels for each budget function that appropriations committees use in setting discretionary spending allocations (called 302b allocations) for each appropriations subcommittee. The resolution also gives outyear projections based on budget and economic assumptions. Each of the 13 appropriations committees report approved funding levels for agencies within their jurisdiction; appropriations bills, which give agencies spending authority, are sent to the floor, usually beginning in the summer. The House Budget Resolution, H. Con. Res. 353, passed on

[3] OMB, *Annual Report to Congress on Combating Terrorism, FY2002*, p. 27 for column labeled FY2000. The rest of the data is from: OMB, *Annual Report to Congress on Combating Terrorism, June 24, 2002*, p. 26. The 2002 report is available at [http://www.whitehouse.gov/omb/legislative/combating_terrorism06-2002.pdf].

March 21, 2002, and the Senate Budget Resolution, S. Con. Res. 100, reported on March 22, 2002, proposed FY2003 discretionary budget authority function totals for Defense and General Science, Space and Technology that were higher than proposed by the President. The resolutions also adopts the President's recommendation to complete the doubling of the NIH budget in FY2003. The House Science Committee's *Views and Estimates* of the request is posted at http://www.house.gov/science/press/107/107-192views03.pdf.

The Government is being funded by a continuing resolution because appropriations action has not been concluded, due largely to differences between the House and Senate on discretionary spending levels. Two appropriations bills, that deal with defense, were signed, increasing defense R&D by 18%. The other appropriations bills that deal with R&D have not reached conference. Senate committee action was completed for all 13 appropriations bills and would increase R&D funding by almost 14% over FY2002, and over 5% more than the President's request. Most of the increase would go to defense R&D and to NIH, with smaller increases for R&D in all other agencies except the departments of Transportation and Agriculture. House appropriations committee action is not complete. House-approved defense appropriations would increase DOD R&D funding by 8.1% over the President's requested level. Action in both houses would start action to double NSF's funding over the next five years.

Priority-Setting Issues

Current priority-setting debates focus on the functions and size of federal R&D funding as a part of national R&D and on how to balance priorities in the portfolio of federal nondefense R&D, especially between health and nonhealth R&D.

Role of the Federal Government in Supporting R&D

A core issue is to reconcile the benefits of R&D – the projected high rates of return to the economy and society from investments in R&D – with a FY2003 R&D budget request that emphasizes defense and health R&D spending and flat or modest increases in other areas of R&D and likely long-term economic and budget projections of decreasing outyear federal R&D budgets.[4] President George W. Bush's FY2002 budget said, "More than half of the Nation's economic productivity growth in the last 50 years is attributable to technological innovation and the science that supported it" (p. 29). In Spring 2000, President Clinton's Committee of Advisors on Science and Technology (PCAST), in *Wellspring of Prosperity*, described some of the payoffs from federal investments in R&D, which it said "underscores the need for sustained and cooperative support in the 21st century to avoid the dangers and seize the opportunities" (p. 2). The report described how Federal Reserve Chairman Alan Greenspan in 1999 "repeatedly cited an unexpected leap in technology as primarily responsible for the nation's record breaking economic performance. In particular, a technology-based surge in productivity appears to be contributing substantially to our economic success" (pp. 1-2).

[4] See Steven Parson and John Jankowski, "Sixth Year of Unprecedented R&D Growth Expected in 2000," *NSF Data Brief*, Nov. 29, 2000, p. 1. NSF 01-310.

Trends in Federal R&D Support. Given these assessments of the importance of federal R&D, a key priority-setting issue is how large should the federal R&D budget be in relation to its functions and the funding provided by such other R&D supporters as industry?

Federal R&D funding, while rising in terms of absolute (or nominal) dollars, is declining as a part of the national R&D total, which has grown overall to $264 billion in FY2000. In constant 1996 dollars, total national R&D increased 40% between the years 1990 and 2000, with industrial support for R&D increasing 88% but federal government support decreasing by 10%. Federal R&D has also declined from about 17% of total federal discretionary outlays in FY1965 to about 12% today.[5] In part because of economic pressures and budgetary caps, during the years FY1993 to FY1999, federal R&D funding was below the previous constant-dollar high of FY1992. As a result of Congressional action, constant-dollar R&D appropriations started to eclipse the FY1992 level beginning with FY2000. However, concerns that had been raised about the declines in federal R&D funding between 1992 and 1999 have not abated because of current projections of economic slowdown, spending to combat terrorism, and a return to deficit spending, which could raise congressional objections to proposals to increase discretionary spending.

Industry is the largest supporter and performer of national R&D, funding 68% of total R&D (the government's share is 27%), and conducting 75% of the total. Most industrial R&D is for near-term applied work and product or prototype development. The government funds 10% of R&D performed by industry. Federal support for all development, which totals about 55% of federal R&D, goes largely to industry and to defense R&D.[6]

The federal government, in contrast to industry, focuses more on supporting basic research and academic R&D. In FY2000, 31% of federal R&D expenditures went to basic research, that is long-term research, compared with 8% of industry-funded R&D. The federal government funded half of all national expenditures for long-term basic research (largely in universities and federal laboratories), while industry funded 31%.[7] Universities and colleges are the second-largest performer of national R&D, funded mostly by the federal government (58% of university research). About half of federal research dollars go to universities and 25% to mission-oriented work in federal laboratories, largely at DOD (44%) and NIH (20%).

Observations and Recent Legislative Initiatives. The federal government is the major supporter of the nation's basic research, which generates much of the knowledge that industry uses for innovative R&D, and of university research that enriches the knowledge base. As a result, some observers argue that federal support for research should be funded at increasingly higher levels as a public good to enhance the U.S. ability to advance scientifically, technologically, and economically; to broaden the knowledge base that industry uses; and to train science and technology (S&T) personnel. Related issues are

---

[5] Tables 5.4 and 9.7 in OMB, *Historical Tables, Budget of the U.S. Government, FY2001*. AAAS data show that the previous constant-dollar high in R&D budget authority was in 1992 (not 1990 as OMB reports, using outlay data).

[6] Data on R&D funding by sector based primarily on NSF, *National Patterns of R&D Resources: 2000 Data Update*. See also, Ronald L. Meeks, "Federal Survey Shows Defense Funding of Industry Is Largest Share of Federal R&D in FY2000," NSF Data Brief, February 11, 2000, NSF 00-309.

[7] Expenditures do not equal outlays or budget authority. NSF, *National Patterns, 1998*, pp. 2-3. See also NSF, *Federal Funds for Research and Development: Fiscal Years 1999, 2000, and 2001*.

whether incentives should be increased for states[8] and industry to augment support of basic and academic research, or whether too much support from these sources would overwhelm academic research with pressure to conduct short-term applied studies.[9] Among the legislative options in this area[10] is to make permanent the Research and Experimentation (R&E) tax credit that provides tax benefits and credits for industrially funded basic research in universities and is due to expire on June 30, 2004.[11] It would have been made permanent in the President's and the Senate's version of tax law revisions, but was not included in the conference report or final version of the Tax Relief Reconciliation Act, P.L. 107-16. The Administration seeks to have it made permanent. Pending bills to make it permanent include H.R. 1137, H.R. 1329, H.R. 1340, H.R. 41, S. 41, and S. 515. Legislation was introduced to allow qualified corporations to obtain economic benefit from research-related tax incentives, similar to some state laws (H.R. 2153 and S. 1049).

Priorities Among Fields of Federally Funded Research

An important question is what should be the balance among fields of federally supported research, and specifically, since health/life sciences research has consistently received priority in the non-defense area, should more funding go to support other fields of science?[12] Some are concerned that the emphasis on health R&D may presage a scarcity of knowledge and personnel in physical sciences, math, and engineering. Some observers maintain that funding should be increased for all R&D fields, and others cite the need to assess reallocating federal funding from health to nonhealth R&D. As shown in **Figure 1**, health sciences R&D has grown as a priority for about 20 years. Over the period FY1993 to FY2001, R&D funding at NIH increased almost 60% in constant dollars compared to NSF, 35%; the Department of Commerce and EPA, about 20% each; and the Agriculture Department, about 15%. R&D funding decreased in constant dollars for NASA, DOE, and DOD. NIH received about 70% of the $5 billion increase in federal basic research funding between FY1993 and FY2001. For FY2003, federally funded health-related R&D, primarily at NIH, would receive over half of the civilian R&D budget. In terms of funding by field, life sciences increased from $9.6 billion in 1991 to $18.2 billion in 2001 estimated, or 90%, while at the same time, between those years funding for physical sciences increased 5%; mathematics and computer sciences, 140%; and engineering, 32%.

NIH Funding Is Important to Congress. In 1998, the Senate passed S.Amdt. 2272 to S.Con.Res. 86, the approved Senate budget resolution. The amendment expressed the sense of the Senate that the NIH budget should double within the next five years. Beginning with FY1999, Congress started appropriating NIH funding at levels that would accomplish this task by 2003, and the budget request reflects this goal.

---

[8] The NAS held "Planning Meeting on the Role of State Funding of Research," July 13, 2001. See RAND/OSTP, *Discovery and Innovation: Federal R&D Activities in the Fifty States, June 2000.*

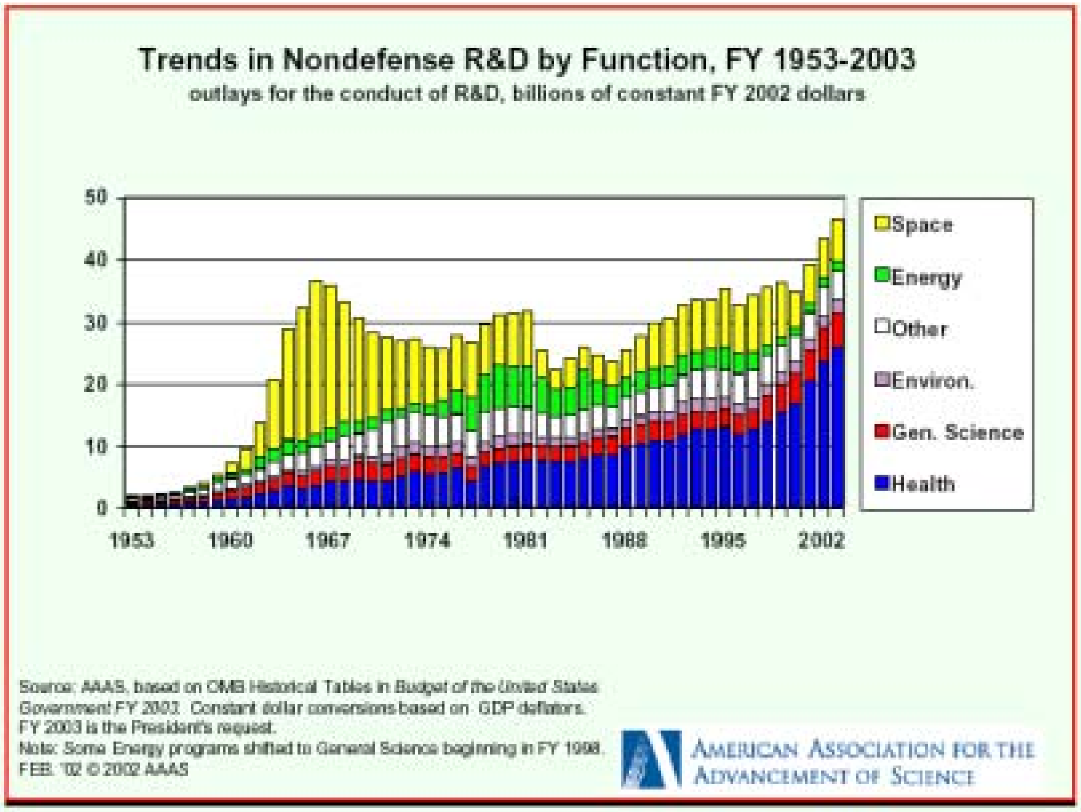
[9] NSTC, *Implementation of the NSTC Presidential Review Directive-4: Renewing the Federal Government-University Research Partnership....*, Jan. 2001.

[10] See CRS Report 95-50 SPR, *The Federal Role in Technology Development*, by Wendy Schacht.

[11] CRS Report RL30479, *The Research and Experimentation Tax Credit: Current Law and Selected Policy Issues for the 106th Congress*, by Gary Guenther.

[12] See also CRS Report RL31031, *The Changing Composition of the Federal Research and Development Portfolio*, by Michael E. Davey and Richard E. Rowberg.

Figure 1. Trends in Nondefense R&D Funding by Budget Function, FY1953-FY2003



Congressional Views About the Balance in Federal R&D Funding. There are various perspectives in Congress on the issue of balance. In the House, the Science Committee, in *Views and Estimates, Fiscal Year 2002*, said progress in biomedicine "depends on advances in a wide variety of disciplines." Members were concerned about the "minuscule" increase for NSF, and sought more funding to modernize DOE user and research facilities, more funding for NASA aeronautics, and increased investment in FAA R&D. The minority staff of the Science Committee criticized what it called the "misplaced" trend toward parity between defense and nondefense R&D; the imbalance between biomedical and physical sciences R&D; and the Administration's opposition to doubling the NSF budget and to cooperative federal-industry R&D programs, such as ATP.[13] Regarding the FY2003 R&D budget request, Science Committee Chairman Boehlert reasoned that increases in "NIH alone cannot undergird our economic health or even improve human health. Yet the NIH budget is now larger than that of the rest of civilian since agencies put together, and just the increase in the NIH budget is larger than the research budget of NSF."[14]

---

[13] President's FY2002 Budget for R&D Analysis, by Minority Staff of the Science Committee, Apr. 10, 2001.

[14] "Members Raise Concern Over Balance of Federal R&D Budget," House Science Committee Press Release, Feb. 13, 2002.

Senate Appropriations Committee report 107-43 requested that OSTP "assess the impact of reduced federal funding in nonhealth research fields and ... develop an action plan to address these issues in the fiscal year 2003 budget request" (p. 88). Former Senate Budget Committee Chairman Domenici was reported to have said during a Senate Budget Committee hearing, "[W]e're very proud that we're increasing the National Institutes of Health ... but ... you can't increase one piece of science ... and leave the other kinds of research in the doldrums.... In about five years, you're going to have the medical scientists clamoring for where are the physical scientists, ... the people that work on the newest physics of machinery and engineers and nano-engines and the like?"[15]

Professional Groups' Views About Balance. Professional groups have recommended increasing both funding and balance in support among federally funded research fields. For instance, the U.S. Commission on National Security 21st Century, in *Road Map for National Security: Imperative for Change, The Phase III Report of the U.S. Commission on National Security 21st Century,* 2001 concluded that threats to the nation's scientific and educational base are distinct new dangers to U.S. national security. It recommended doubling the federal R&D budget by 2010 to about $160 billion and improving the competitiveness of the less capable R&D institutions. A National Academy of Engineering report, *Trends in Federal Support of Research and Graduate Education,* 2001, recommended that the Administration and Congress should evaluate federal funding for research by field and assess its implications for knowledge generation and industrial growth, and increase budgets for underfunded disciplines. *New Foundations for Growth: The U.S. Innovation System Today and Tomorrow,* released by the National Science and Technology Council on January 10, 2001, recommended funding across the portfolio because "[I]t's not possible to anticipate where exciting new developments will arise. Increased funding across a carefully constructed 'portfolio' of investments will help ensure the health of the national innovation system" (pp. 12-13). The Alliance for Science and Technology Research in America (ASTRA), reportedly modeled after Research! America, an advocacy group for medical research, focuses on physical sciences. Its goals are: "To provide a strong, collaborative, political voice for math, physical sciences and engineering before the federal government that results in substantial and sustained investment; to promote strong, compelling, and mutually reinforcing messages across all groups lobbying for improved vitality of the U.S. research enterprise for those fields; and to nurture support for research for those fields among the voting public."[16]

An applications-oriented approach to setting federal R&D priorities was recommended in *Science for Society, Cutting-Edge Basic Research in the Service of Public Objectives,* May 2001, sponsored by the Packard and Sloan Foundations. It recommended that federal R&D support should include "basic science that is targeted in an area of important societal objectives, or 'Jeffersonian Science.'" This applications-oriented science would "speed societal progress"and enhance public support for science because it would more clearly link basic research and public objectives (pp. 69-70). Related to this theme, the Center for

---

[15] Richard M. Jones, "Reaction to the FY2002 Bush Administration S&T Request," *AIP Bulletin of Science Policy News,* FYI #26, Mar. 7, 2001.

[16] John T. Softcheck, "New Advocacy Organization Will Promote Funding for Research in the Non-biological Sciences," *Washington Fax,* Feb. 26, 2001. See also David Malakoff, "Perfecting the Art of the Science Deal," *Science,* May 4, 2001, pp. 830-835.

Science Policy and Outcomes has started to identify areas of federally supported research that warrant priority setting in order to achieve socially beneficial outcomes in health, earth systems, prediction in public policy, preparation for extreme events, and nanotechnology.[17]

Proposals to Increase NSF Funding. The National Science Foundation funds research across all disciplines and is the main federal source for much nonhealth-related academic research. The FY2003 budget proposed to increase NSF R&D funding by 3.6% over FY2002, which some say was inflated since it represents largely transfer of R&D programs from other agencies. Pleas have been made to double the NSF budget , for instance by the Coalition for National Science Funding (CNSF), which represents many universities and professional science associations, in a February 7, 2002 press release, when it recommended a 15% increase for NSF and doubling of its budget by FY2006. The Federation of American Societies for Experimental Biology endorsed doubling of the NSF budget as critical to biomedical research advances.[18] H.R. 4664, passed in the House on June 5, 2002, the NSF authorization bill for FY2003, would increase NSF's budget by 15% for each of FY2003, FY2004, and FY2005, which according to the bill's sponsors, would "put the NSF on the track to double its budget within five years," similar to the NIH doubling track, and thus would increase federal support for non-medical R&D in areas which have not seen increases in recent years like the larger percentage increases which have gone to biomedical R&D. The bill would also increase oversight of NSF facilities programs. H.R. 1472, from the first session, was a similar bill. FY2003 Appropriations action in both houses has set NSF on a course to double its budget over the next five years.

Federal R&D Priority-Setting Structures

Some observers recommend more centralized priority-setting for R&D in Congress and in the executive branch. Some cite a need for an executive branch mechanism to determine a unified R&D budget and to evaluate the total government R&D portfolio in terms of progress toward meeting national objectives. Others say that congressional jurisdiction for R&D is split among a number of committees and subcommittees, preventing examination of the R&D budget as a whole. This means that R&D funding can serve particular local or program interests, but may not be appropriate for a national R&D agenda. Opponents see value in a decentralized system in which budgets are developed, authorized, and appropriated separately by those most familiar with the needs of specific fields of R&D – the department or agency head and the authorizing and appropriations subcommittees with jurisdiction.

Unified Science and Technology (S&T) Budget

In a 1995 report, *Allocating Federal Funds for Science and Technology,* the NAS recommended that the President present to Congress and that the Congress consider the R&D budget as a unified whole before its separate parts for each agency are considered by individual congressional committees. It also recommended that R&D requested in the budget be reconfigured as a S&T budget, excluding defense development, testing and

[17] See [http://www.cspo.org/whoweare/twentyyear.html]; David H. Guston, E. J. Woodhouse, and Daniel Sarewitz, "A Science and Technology Policy Focus for the Bush Administration," *Issues in Science and Technology,* Spring 2001, pp. 1-4; and Michael M. Crow, "Harnessing Science to Benefit Society," *Chronicle of Higher Education,* Mar. 9, 2001, p. B20.

[18] See *Federal Funding for Biomedical and Related Life Sciences Research FY2002.*

evaluation activities, to denote the functions of creating new knowledge. The FY2002 and FY2003 budget used a modified version of the format proposed by the Academy, and identified a "Federal Science and Technology (FS&T) budget table," which, for FY2003, includes less than half of total federal R&D spending and some non-R&D funding, such as education and dissemination of information.[19] The table shows that FS&T funding increased 9% from FY2001 to FY2002. It is possible that the OMB will continue to use this alternative format, paving the way for congressional consideration of a realigned and unified S&T budget. S.Amdt. 2235 to the Senate budget resolution (S.Con.Res. 86) for FY1999 expressed the sense of the Senate that for FY2000-2004, all federal civilian S&T spending should be classified under budget function 250. This has not occurred.

Interagency R&D Initiatives

Executive Order 12881, issued by President Clinton, established the National Science and Technology Council (NSTC) with cabinet-level status. Located in the Executive Office of the President, it is the successor to the Federal Coordinating Council for Science, Engineering, and Technology. It recommends agency R&D budgets to help accomplish national objectives, advises OMB on agency R&D budgets, and coordinates presidential interagency R&D initiatives. Beginning with the FY1996 budget request, NSTC started to identify interagency R&D priorities in the budget. The FY2003 budget identified agency funding for two interagency R&D initiatives whose reporting is required by statute. They are "Networking and Information Technology R&D," at level funding with FY2001, and "U.S. Global Change Research Program," increased 2% over FY2001. The Administration included two other interagency initiatives it considers significant. These are the National Nanotechnology Initiative, with funding increased 11% over FY2002, and a Climate Change Research Initiative, which is new for FY2003. FY2004 interagency R&D initiatives are: homeland security and antiterrorism R&D, networking and information technology R&D, national nanotechnology initiative, molecular-level understanding of life processes; climate change S&T, and education research.[20]

Proposals to Coordinate Federal R&D

The National Science Board (NSB) report, *Federal Research Resources: A Process for Setting Priorities,* October 11, 2001, (NSB 01-160) recommended a *"continuing advisory mechanism"* in the Congress and in the executive branch and a strengthened OMB/OSTP relationship to coordinate R&D priorities. It said that federal R&D funding should be looked at as a five-year planned portfolio, rather than as the sum of the requirements and programs of departments. AAAS President Mary Good, recommended creating a *cabinet-level post for S&T* to help achieve balance in R&D and coordinate federal R&D and handle research policy issues.[21] The Commission on National Security recommended empowering the President's science advisor to establish *"functional budgeting,"* to identify nondefense R&D objectives that meet national needs, strengthen the OSTP, NSTC and PCAST, and improve

---

[19] Sec. 8, *FY2003 Budget, Analytical Perspectives.*

[20] *FY2004 Interagency R&D Priorities,* Memorandum, from Director, OSTP and Director, OMB, May 30, 2002.

[21] Rebecca Spieler, "AAAS President Concerned About Imbalances in Nation's R&D Portfolio...," *Washington Fax*, Feb. 21, 2001.

coordination with OMB to enhance stewardship of national R&D. The congressional science policy report, *Unlocking Our Future*, 1998, spearheaded by Representative Vernon Ehlers, called for more balance in the federal research portfolio and said that while OMB can fulfill the coordination function in the executive branch, "no such mechanism exists in the Congress. ... [When] ... committees have joint jurisdiction over or significant interest in large, complex technical program, the ... committees should ... coordinate their efforts [and] ... consider holding joint hearings and perhaps even writing joint authorization bills" (p. 7).

Legislation Introduced to Fund the OTA

The aforementioned NSB report also recommended that Congress should develop "an appropriate mechanism to provide it with independent expert S&T review, evaluation, and advice" (p. 16). Some believe that this could pertain to reestablishing the Office of Technology Assessment (OTA), which was active between 1972 and 1995 as a $22 million congressional support agency. It prepared in-depth reports and policy options about the consequences of S&T and was eliminated as part of the reductions Congress made in a FY1996 appropriations bill. In June 2001, a conference was held to assess ways to "resurrect" OTA or variants of it. Advocates cited the need for better congressional support for S&T analysis.[22] The OTA is still authorized, but funds would have to be appropriated for it. H.R. 2148, a bipartisan bill, would authorize OTA funding at $20 million annually for FY2002-FY2007. Title XVI of H.R. 4, an energy bill as passed by the Senate on April 25, 2002, would create a Science and Technology Assessment Service within the legislative branch. It would have a congressional Board and a Director and would interact with the National Research Council to select experts to work on assessments. This language is not in the version of the bill passed in House (on August 2, 2001). The proposals are in conference. In other legislation, a conference report, H. Rept. 107-259 that accompanied H.R. 2647, which was signed as P.L. 107-68, appropriated $500,000 to GAO for a technology assessment pilot project and report due June 15, 2002.

Earmarking

There is controversy about congressional designation of R&D funding for specific projects, also called earmarking. When using this practice, Congress, in report language or law, directs that appropriated funds go to a specific performer or designates awards for certain types of performers or geographic locations. Typically an agency has not included these awards in its budget request and often such awards may be made without prior competitive peer review. Critics say that earmarking undermines the authorization process and distorts agency R&D priorities. Supporters believe the practice helps to develop R&D capability in a wide variety of institutions, that it compensates for reduced federal programs for instrumentation and facilities renewal, and that it generates economic benefits in targeted regions since R&D capacity may generate industrial growth. Section 8 of *Analytical Perspectives, FY2003 Budget* reported that R&D funded at congressional direction for FY2002 totaled $1.824 billion, up almost 4% over FY2001. The *Chronicle of Higher Education,* September 27, 2002, reported that for FY2002, Congress earmarked $1.8 billion

---

[22] Wil Lepkowski, "The Mummy Blinks," *Science and Policy Perspectives,* June 25, 2001; D. Malakoff, "Memo to Congress: Get Better Advice," *Science,* June 22, 2001: 2229-2230; and M. Davis, "A Reinvented Office of Technology Assessment May Not Suit Congressional Information Requirement...," *Washington Fax,* June 18, 2001.

for universities and colleges, most of it for R&D. According to AAAS, congressional FY2002, R&D earmarks totaled $1.5 billion, with most for USDA, DOD, the Department of Energy, and NASA, in that order. So far for FY2003, AAAS estimated Senate R&D earmarks at $975 million.[23] The Administration seeks to discourage such earmarking on the grounds that it distorts agency priorities and is parochial. It sought to rescind many FY2001 earmarks in the supplemental appropriations process. The resulting law, P.L. 107-20 included some rescissions, but not as much as the President sought.[24] A conference on the pros and cons of earmarking was held on October 3, 2001[25]

Government Performance and Results Act (GPRA)

P.L. 103-62, requires agencies to define goals, set specific annual performance targets, and report annually on performance. The law is intended to ensure accountability for federal investments and that an agency's programs and priorities meet its goals. It is difficult to define priorities for most research and to measure the results quantitatively, since research outcomes can not be defined well in advance and take a long time to demonstrate. Recent actions could force agencies to identify more precisely goals for research and measures of research outcomes. The Bush Administration emphasizes the importance of performance measurement, including for R&D, as announced in *The President's Management Agenda, FY2002* and in the FY2003 budget request. Most say that more work is needed before performance measures can be used to recommend budgets for research. OMB used performance measures for management processes and gave passing marks "green or yellow lights"(to NSF) or "red lights" or failing marks (e.g. DOD and NIH).[26] As a pilot test, six performance criteria were used to evaluate the Energy Department's applied R&D programs. OMB said not enough data were available for a valid assessment, but that measures showed where funding should be increased – for research to control greenhouse gases – and decreased – for oil drilling technology and high wind-speed power research (*FY2003 Budget, Analytical Perspectives*, Sec. 8). OMB has instructed agencies on performance-related investment criteria to use for preparing FY2004 R&D budget requests.[27] It is developing performance criteria for basic research. The Ehlers report recommended that a "portfolio" approach be used when applying GPRA to basic research. P.L. 106-531 required an agency head to assess the completeness and reliability of performance data used in reports to Congress and the House adopted a rule with the passage of H.Res. 5 requiring all "committee reports [to] include a statement of general performance goals and objectives, including outcome-related goals and objectives for which the measure authorizes funding."[28]

---

[23] AAAS, "Senate Earmarks Approach $1 Billion in FY2003 Budget," Aug. 26, 2002.

[24] *Daily Report for Executives*, June 6, 2001, p. A-21, and July 13, 2001, p. A-1.

[25] See Jeffrey Brainard, "Supporters an Criticism of Congressional Earmarks Meet to Seek Consensus," *Chronicle of Higher Education,* Oct. 4, 2001, and David Malakoff, "White House Asks Community to Oppose Earmark Projects," *Science,* Sept. 28, 2001, p. 2364.

[26] On this point see "The President's FY03 Budget for Research and Development; An Analysis by the Minority Staff of the Science Committee," Feb. 6, 2002.

[27] *FY2004 Interagency R&D Priorities,* May 30, 2002, op. cit.

[28] See CRS Report RL30905, op. cit., and CRS Report RS20257, *Government Performance and Results Act: Brief History and Implementation Activities,* by Genevieve J. Knezo.

LEGISLATION

H.R. 4. (Tauzin)
The Senate version incorporates the Energy Security Policy bill, S. 517, which was introduced Mar. 12, 2001, by Senator Bingaman and passed the Senate on Apr. 25, 2002. Among other things, Title XVI would create a congressional Science and Technology Assessment Service. The House version, passed on Aug. 2, 2001, does not contain this provision. The conference committee is meeting.

S. 1172 (Durbin)
Legislative Branch Appropriations Act, 2002. Introduced July 2, 2001; passed Senate with amendments on July 19, 2001. S.Amdt. 1026 allocated $1 million to GAO to conduct a technology assessment pilot project and to report on it by June 15, 2002. The Senate vitiated passage of S. 1172 and passed **H.R. 2647** with the Senate-passed language. The House-passed bill did not contain the referenced language. The conference report contained language to fund the study at $500,000. The bill became P.L. 107-68, Nov. 12, 2001.

H.R. 64 (Ehlers)
To provide for the establishment of the position of Deputy Administrator for S&T of the EPA, and for other purposes. Introduced Jan. 3, 2001; referred to Subcommittee on Environment, Technology and Standards, Science Committee; subcommittee; favorably reported by full committee on Oct. 3, R. Rept. 107-311. House preparation for floor; placed on the Union Calendar, Calendar No. 187, Nov. 30, 2001.

H.R. 1472 (Johnson, Eddie Bernice)
To authorize appropriations for fiscal years 2002, 2003, 2004, and 2005 for the National Science Foundation, and for other purposes. Introduced Apr. 4, 2001; referred to Subcommittee on Research, Science Committee. For further action see H.R. 1858.

H.R. 2148 (Holt)
To re-establish the Office of Technology Assessment. Introduced June 20, 2001; referred to subcommittees of the Science Committee.

H.R. 4664 (Smith, Nick)
To authorize appropriations for fiscal years 2003, 2004, and 2005 for the National Science Foundation, and for other purposes. Passed the House June 5, 2002.

H.Res. 72 (Gekas)
To express the sense of the House of Representatives that the federal investment in biomedical research should be increased by $3,400,000,000 in FY2002. Introduced Feb. 28, 2001; referred to Subcommittee on Health of the Committee on Energy and Commerce.

Table 1. R&D in the Budget and Outyear Budget Projections, By Agency, Based Largely on AAAS Data

(Budget authority in millions of dollars)

SELECTED AGENCIES & PROGRAMS	FY2000 act.	FY2001 est.	FY2002 est.	FY2003 req. prelim.	% Change, FY02-03	House Apps. Floor* Comm#	Senate Apps. Floor* Comm.#	Conf. Comm. or Final	FY2004 proj.(by AAAS)	FY2005 proj.(by AAAS)	FY2006 proj. (by AAAS)	FY2007 proj.(by AAAS)	% Change FY02toFY07 Constant Dollars
Dept. of Agr. Total	$1776	$2181	$2334	$2118	**-9.3%**	$2145#	$2262#		$2286	$2273	$2319	$2373	**-7.1%**
(Agr. Res. Service)	–	*(1012)*	*(1234)*		–	*(1132)#*	*(1197)#*						
(CSREES)	–	*(594)*	*(532)*		–	*(485)#*	*(529)#*						
(Forest Service)	–	*(245)*	*(265)*		–	*(302)#*	*(298)#*						
Dept. of Commerce Total	1174	1030	1096	1100	-0.3		1201#		1122	1147	1172	1199	**-0.1**
(NOAA)	*(643)*	*(561)*	*(611)*	*(605)*	*(-1.1)*		*(682)#*						
(NIST)	*(471)*	*(413)*	*(460)*	*(483)*	*(5.0)*		*(498)#*						
(ATP) (Within NIST)	*(116)*	*(118)*	*(150)*	*(107)*	*(-28.5)*		*(159)#*						
Dept. of Defense Total	39959	42740	49492	54460	**10.0**	58845*	57663#	58764	58066	61789	60009	59065	**8.7**
(S&T (6.1-6.3+ medical))	*(8632)*	*(9365)*	*(10298)*	*(9707)*	*(-5.7)*	*11708**	*(11117)#*	*(11692)*					
(All Other DOD R&D)	*(31327)*	*(33375)*	*(39194)*	*(44753)*	*14.2*	*47137**	*(46546)#*	*(47072)*					
Dept. of Education	238	264	268	311	**16.0**		279#						
Dept. of Energy Total	6956	7733	8361	8323	**-0.5**	8532#	8740#		8470	8627	9798	8974	**-1.9**
(Atomic/Defense)/(NNSA+ Defense)	*(3201)*	*(3462)*	*(3839)*	*(3947)*	*(2.8)*	*(3910)#*	*(4058)#*		*(4003)*	*(4062)*	*(4127)*	*(4192)*	*(-0.2)*
(Energy & Science)	*(3755)*	*(4271)*	*(4522)*	*(4376)*	*(-3.2)*	*(4622)#*	*(4682)#*		*(4468)*	*(4565)*	*(4671)*	*(4782)*	*(-3.4)*
Dept. of HHS Total	18182	21045	24141	27551	**14.1**		27578#		28136	28761	29431	30104	**13.9**
(NIH)	*(17234)*	*(19807)*	*(22795)*	*(26452)*	***(16.0)***		*(26385)#*		*(27009)*	*(27610)*	*(28254)*	*(28916)*	***(15.9)***
Dept. of Interior Total	618	621	660	628	**-4.8**	681#	684#		641	654	668	682	**-5.5**
(U.S. Geological Survey)		566	583	542	**-7.0**	*(598)#*	*(595)#*						
Dept. of Transportation Total	607	718	778	736	**-5.4**	815#	697#		750	763	779	797	**-6.4**
(FAA)	*(220)*	*(301)*	*(359)*	*(222)*	–	*(248)#*	*(223)#*						
(FHA)	*(261)*	*(294)*	*(275)*	*(266)*	–	*(291)#*	*(293)#*						
(NHTSA)	*(51)*	*(58)*	*(59)*	*(59)*	–	*(60)#*	*(59)#*						
(TSA)	*new*	*agency*	*(14)*	*(130)*		*(130)#*	*(25)#*						

	FY2000 act.	FY2001 est.	FY2002 est.	FY2003 req. prelim.	% Change, FY02-03	House Apps. Floor* Comm#	Senate Apps. Floor* Comm.#	Conf. Comm. or Final	FY2004 proj.(by AAAS)	FY2005 proj.(by AAAS)	FY2006 proj. (by AAAS)	FY2007 proj.(by AAAS)	% Change FY02toFY07 Constant Dollars
Dept. of Veterans Affairs	645	719	761	810	**6.5**		786#		826	844	863	883	**6.1**
Environmental Protection Agency	558	574	592	627	**5.9**	628#	624#		640	653	669	685	**5.7**
NASA Total	9494	9887	10232	10676	**4.3**	10856#	10798#		11144	11370	11815	12240	**9.3**
(Human Space Flight)	*(3014)*	*(2901)*	*(2461)*		–	*(1878)#*	*(1878)#*						
(Science, Aeronautics, Technology)	*(6481)*	*(7024)*	*(7840(*	(8900)	–	*(9145)#*	*(9045)#*						
National Science Foundation	2931	3320	3526	3651	**3.5%**	4036#	3947#		3728	3811	3900	3991	**-7.1**
All other R&D	630	702	7631	689	-9.7%		1503#						
TOTAL	83769	91534	103150	112047	**8.6%**		115977#		116824	121726	121476	122065	**8.1**
NonDefense	40609	45332	49672	53273	**7.2%**		54256#		54755	55874	57340	58808	**8.2**
NonDefense Minus NIH	*23374*	*25525*	*26877*	*26821*	*-0.2%*		*27871#*		*27746*	*28264*	*29086*	*29892*	*1.6*
Defense	43160	46202	53478	58774	**9.9%**		61722#		62069	65851	64136	63257	**8.1**

Source: Based largely on American Association for the Advancement of Science, with tables appearing at [http://www.aaas.org/spp/dspp/rd/fy03.htm]. AAAS bases its tables on OMB data, agency budget justifications, information from agency budget offices, and appropriations action. Data in italics in parentheses are parts of the total and have been included in agency totals. Final figures for FY2002 are AAAS estimates of congressional appropriations including emergency appropriations for counterterrorism and national security. See also CRS Issue Brief 10083, "Research and Development Funding: Fiscal Year 2002," for detailed information about agency budget requests and congressional action for FY2002.