

7. RESEARCH AND DEVELOPMENT FUNDING

Technological innovation and scientific discovery have generated much of the Nation's productivity growth over the last 50 years, created millions of high-skill, high-wage jobs, and improved the quality of life in America. This innovation and discovery has been possible only through the strong national investment in

research and development (R&D), from both the public and private sectors. Data from the National Science Foundation indicate that the total national investment in R&D recently surpassed 2.7 percent of the Gross Domestic Product.

Table 7-1 shows R&D highlights of the 2002 Budget.

Table 7-1. R&D HIGHLIGHTS IN 2002 SPENDING

(Budget authority, dollar amounts in millions)

By Agency	2000	2001	2002	Percent Change: 2001 to 2002
National Institutes of Health				
Biomedical research	17,827	20,361	23,112	14%
Defense				
R&D initiative			2,600	NA
NASA				
Space Launch Initiative	30	290	475	64%
Mars Exploration Program	249	426	431	1%
Astronomical Search for Origins	118	123	194	57%
Earth Observing System Follow-on Program	15	55	130	136%
Energy				
Basic Energy Sciences	772	994	1,005	1%
Fossil Energy	404	445	544	22%
National Science Foundation				
Math and Science Partnership Initiative			200	NA
Mathematical Sciences	106	121	141	17%
Nanoscale Science, Engineering, and Technology	97	150	174	16%
Agriculture				
Biotechnology	188	197	204	4%
Bioproducts and Bioenergy	81	240	249	4%
Commerce				
Ocean Exploration		4	14	250%
National Polar-orbiting Operational Environmental Satellite	60	73	157	115%
NIST internal research	282	313	347	11%
Transportation				
Highway Surface Transportation	66	73	114	56%
Intelligent Transportation Systems Initiative	40	41	62	51%
Veterans Affairs				
Medical and Prosthetic Research	321	350	360	3%
Education				
National Institute on Disability and Rehabilitation Research	86	100	110	10%
Research and Dissemination	104	121	123	2%

Federal Research and Development Funding

R&D is the collection of efforts directed towards gaining greater knowledge or understanding and applying knowledge toward the production of useful materials, devices, and methods. Since 1949, the Budget has collected and reported information on R&D. The budget is characterized by the following categories: basic research, applied research, development, R&D equipment, and R&D facilities.

Basic research is defined as systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind.

Applied research is systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met.

Development is systematic application of knowledge toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.

Research and development equipment includes acquisition or design and production of movable equipment, such as spectrometers, microscopes, detectors, and other instruments.

Research and development facilities include the acquisition, design, and construction of, or major repairs

or alterations to, all physical facilities for use in R&D activities. Facilities include land, buildings, and fixed capital equipment, regardless of whether the facilities are to be used by the Government or by a private organization, and regardless of where title to the property may rest. This category includes reactors, wind tunnels, and particle accelerators, and the International Space Station.

Table 7–2 shows agency-by-agency spending on basic and applied research, development, and R&D equipment and facilities.

Table 7-2. FEDERAL RESEARCH AND DEVELOPMENT SPENDING

(Budget authority, dollar amounts in millions)

	2000 Actual	2001 Estimate	2002 Proposed	Dollar Change: 2000 to 2002	Percent Change: 2000 to 2002	Dollar Change: 2001 to 2002	Percent Change: 2001 to 2002
By Agency							
Defense*	39,664	41,571	45,159*	5,495*	14%*	3,588*	9%*
Health and Human Services	18,051	20,805	23,313	5,262	29%	2,508	12%
National Aeronautics and Space Administration	9,242	9,632	9,311	69	1%	-321	-3%
Energy	6,892	7,692	7,435	543	8%	-257	-3%
National Science Foundation	2,947	3,297	3,242	295	10%	-55	-2%
Agriculture	1,773	1,961	1,803	30	2%	-158	-8%
Commerce	1,110	1,096	1,029	-81	-7%	-67	-6%
Interior	618	632	593	-25	-4%	-39	-6%
Transportation	603	743	795	192	32%	52	7%
Veterans Affairs	645	703	721	76	12%	18	3%
Environmental Protection Agency	559	610	575	16	3%	-35	-6%
Education	238	265	259	21	9%	-6	-2%
Other	796	1,007	1,022	226	28%	151%	1%
TOTAL	83,138	90,010	95,253	12,115	15%	5,243	6%
Basic Research							
Defense*	1,136	1,317	1,345*	209*	18%*	28*	2%*
Health and Human Services	10,062	11,544	12,980	2,918	29%	1,436	12%
National Aeronautics and Space Administration	2,137	2,548	2,465	328	15%	-83	-3%
Energy	2,262	2,378	2,344	82	4%	-34	-1%
National Science Foundation	2,540	2,796	2,799	259	10%	3	0%
Agriculture	684	742	717	33	5%	-25	-3%
Commerce	42	40	46	4	10%	6	15%
Interior	52	57	54	2	4%	-3	-5%
Transportation	10	17	21	11	110%	4	24%
Veterans Affairs	266	290	304	38	14%	14	5%
Environmental Protection Agency	58	106	98	40	69%	-8	-8%
Education	2	2	2	0	0%	0	0%
Other	170	181	177	7	4%	-4	-2%
SUBTOTAL	19,421	22,018	23,352	3,931	20%	1,334	6%
Applied Research							
Defense*	3,405	3,664	3,741*	336*	10%*	77*	2%*
Health and Human Services	7,692	8,915	9,824	2,132	28%	909	10%
National Aeronautics and Space Administration	1,534	1,683	1,811	-277	-18%	128	8%
Energy	1,874	2,185	2,020	146	8%	-165	-8%
National Science Foundation	184	220	218	34	18%	-2	-1%
Agriculture	831	922	829	-2	0%	-93	-10%
Commerce	780	829	820	40	5%	-9	-1%
Interior	520	537	503	-17	-3%	-34	-6%
Transportation	396	456	507	111	28%	51	11%
Veterans Affairs	367	399	403	36	10%	4	1%
Environmental Protection Agency	388	369	349	-39	-10%	-20	-5%
Education	151	165	167	16	11%	2	1%
Other	344	390	361	17	5%	-29	-7%
SUBTOTAL	18,466	20,734	21,553	3,057	17%	819	4%

Table 7-2. FEDERAL RESEARCH AND DEVELOPMENT SPENDING—Continued

(Budget authority, dollar amounts in millions)

	2000 Actual	2001 Estimate	2002 Proposed	Dollar Change: 2000 to 2002	Percent Change: 2000 to 2002	Dollar Change: 2001 to 2002	Percent Change: 2001 to 2002
Development							
Defense*	35,026	36,410	39,889*	4,863*	14%*	3,479*	10%*
Health and Human Services	44	101	87	43	98%	-14	-14%
National Aeronautics and Space Administration	2,702	2,687	2,754	52	2%	67	2%
Energy	1,855	2,253	2,174	319	17%	-79	-4%
National Science Foundation	0	0	0	0	NA	0	NA
Agriculture	111	120	124	13	12%	4	3%
Commerce	130	138	83	-47	-36%	-55	-40%
Interior	29	32	30	1	3%	-2	-6%
Transportation	185	254	250	65	35%	-4	-2%
Veterans Affairs	12	14	15	3	25%	1	7%
Environmental Protection Agency	92	101	94	2	2%	-7	-7%
Education	85	98	90	5	6%	-8	-8%
Other	253	386	364	111	44%	-22	-6%
SUBTOTAL	40,524	42,594	45,954	5,430	13%	3,360	8%
Facilities and Equipment							
Defense	97	180	184*	87*	90%*	4*	2%*
Health and Human Services	253	245	422	169	67%	177	72%
National Aeronautics and Space Administration	2,869	2,714	2,281	-588	-20%	-433	-16%
Energy	901	876	897	-4	0%	21	2%
National Science Foundation	223	281	225	2	1%	-56	-20%
Agriculture	147	177	133	-14	-10%	-44	-25%
Commerce	158	89	80	-78	-49%	-9	-10%
Interior	17	6	6	-11	-65%	0	0%
Transportation	12	16	17	5	42%	1	6%
Veterans Affairs	0	0	-1	-1	NA	-1	NA
Environmental Protection Agency	21	34	34	13	62%	0	0%
Education	0	0	0	0	NA	0	NA
Other	29	46	116	87	300%	70	152%
SUBTOTAL	4,727	4,664	4,394	-333	-7%	-270	-6%

Table does not include net mandatory funding for USDA research grant programs, as follows: \$140 million in FY 2000, \$130 million in FY 2001, and \$135 million in FY 2002.

*FY 2002 entries for DOD research and facilities represent a projection from the enacted FY 2001 levels plus inflation. The entry for development includes \$2.6 billion for the R&D initiative. FY 2002 levels are subject to change as a result of the Defense Strategy Review now underway.

The Federal Science and Technology Budget

In a 1995 report from the National Academy of Sciences, the scientific community proposed a "Federal Science and Technology" budget. Such a compilation would highlight more consistently and accurately activities central to the creation of new knowledge and technologies, compared with the traditional R&D data collection reported in Table 7-2. Because the Federal

Science and Technology (FS&T) budget emphasizes research, funding for defense development, testing, and evaluation is not included. The resulting FS&T budget is about half of the total Federal spending on R&D.

Table 7-3 contains an approximation of the FS&T budget, which accounts for nearly all of Federal basic research, over 80 percent of Federal applied research, and about half of Federal non-defense development.

Table 7-3. FEDERAL SCIENCE AND TECHNOLOGY BUDGET
(Budget authority, dollar amounts in millions)

	2000 Actual	2001 Estimate	2002 Proposed	Dollar Change: 2000 to 2002	Percent Change: 2000 to 2002	Dollar Change: 2001 to 2002	Percent Change: 2001 to 2002
By Agency							
National Institutes of Health	17,827	20,361	23,112	5,285	30%	2,751	14%
NASA ¹	6,389	6,957	7,038	649	10%	81	1%
Space Science	2,524	2,658	2,786	262	10%	129	5%
Earth Science	1,675	1,702	1,496	-179	-11%	-206	-12%
Biological and Physical Research	356	393	380	24	7%	-13	-3%
Aero-space Technology	1,834	2,205	2,376	541	30%	171	8%
Defense ²	4,541	4,981	5,086 ²	545 ²	12% ²	105 ²	2% ²
Basic Research ²	1,136	1,317	1,345 ²	209 ²	18% ²	28 ²	2% ²
Applied Research ²	3,405	3,664	3,741 ²	336 ²	10% ²	77 ²	2% ²
Energy	4,353	4,910	4,682	329	8%	-228	-5%
Science Programs ³	2,788	3,179	3,160	372	13%	-19	-1%
Energy Supply	584	661	494	-90	-15%	-167	-25%
Energy Conservation ⁴	577	625	484	-93	-16%	-141	-23%
Fossil Energy ⁵	404	445	544	140	35%	99	22%
National Science Foundation	3,897	4,416	4,472	575	15%	56	1%
Agriculture	1,739	1,831	1,759	20	1%	-72	-4%
CSREES Research and Education	487	513	416	-71	-15%	-97	-19%
Mandatory research grants (net total)	140	130	135	-5	-4%	5	4%
Economic Research Service	64	66	67	3	5%	1	2%
Agricultural Research Service ⁶	830	897	916	86	10%	19	2%
Forest Service ⁷	218	225	225	7	3%	0	0%
Interior (USGS)	813	883	813	0	0%	-70	-8%
Commerce	819	809	711	-108	-13%	-98	-12%
NOAA (Oceanic and Atmospheric Research)	285	315	330	45	16%	15	5%
NIST ⁸	534	494	381	-153	-29%	-113	-23%
Environmental Protection Agency ⁹	683	732	679	-4	-1%	-53	-7%
Transportation	646	621	631	-94	-15%	12	2%
Highway research ¹⁰	490	437	443	-47	-10%	6	1%
Aviation research ¹¹	156	184	188	32	21%	4	2%
Education	317	363	368	51	16%	5	1%
Special Education Research and Innovation	64	77	70	6	9%	-7	-9%
NIDRR ¹²	86	100	110	24	28%	10	10%
Research, Development, and Dissemination	167	186	188	21	13%	2	1%
Veterans Affairs ¹³	321	350	360	39	12%	10	3%
TOTAL	42,345	47,214	49,711	7,366	17%	2,497	5%

Notes:

¹ Includes mission support.² FY 2002 entries for DOD research represent a projection from the enacted FY 2001 levels plus inflation. FY 2002 levels are subject to change as a result of the Defense Strategy Review now underway.³ Part of change in 2002 due to transfer from science programs.⁴ Excludes state grant programs.⁵ 2002 level includes \$95 million unavailable until the last day of FY 2001.⁶ Excludes buildings and facilities.⁷ Forest and Rangeland Research.⁸ Excludes Manufacturing Extension Program.⁹ Science and Technology account, including transfer from Superfund.¹⁰ Includes research and development funding for the Federal Highway Administration, the Federal Motor Carrier Safety Administration, and the National Highway Traffic Safety Administration.¹¹ Federal Aviation Administration Research, Engineering, and Development.¹² National Institute on Disability and Rehabilitation Research.¹³ Medical and Prosthetic Research.

Allocation of Federal Funding for Research

Federal funds appropriated to Executive Branch agencies may be used in different ways, ranging from grants awarded to university researchers to supporting research at Federal laboratories. In order to better understand and characterize the methods agencies use to allocate their research funding, agencies reported

how research funds are allocated in 2001 by the following five categories:

- *Research performed at congressional direction* consists of intramural and extramural research where funded activities are awarded to a single performer or collection of performers. There is limited or no competitive selection, or there is competitive selection but the research is outside of the agen-

cy's primary mission, and undertaking the research is based on direction from the Congress in law, in report language, or by other direction.

- *Inherently unique research* is intramural and extramural research where funded activities are awarded to a single performer or team of performers without competitive selection. The award may be based on the provision of unique capabilities, concern for timeliness, or prior record of performance (e.g., facility operations support for a unique facility, such as an electron-positron linear collider; research grants for rapid response studies such as Pfisteria, an environmental hazard that arose suddenly; or the National Science Foundation's merit-based renewals).
- *Merit-reviewed research with limited competitive selection* is intramural and extramural research where funded activities are competitively awarded from a pool of qualified applicants that are limited to organizations that were created to largely serve Federal missions and continue to receive most of their annual research revenue from Federal sources. The limited competition may be for reasons of stewardship, agency mission constraints, or retention of unique technical capabilities (e.g., funding set aside for researchers at laboratories or centers of the Department of Defense, the National Aeronautics and Space Administration, the Environmental Protection Agency, the National

Oceanic and Atmospheric Administration, and the National Institutes of Health; Federally-Funded Research and Development Centers; formula funds from the U.S. Department of Agriculture).

- *Merit-reviewed research with competitive selection and internal (program) evaluation* is intramural and extramural research where funded activities are competitively awarded following review for scientific or technical merit. The review is conducted by the program manager or other qualified individuals from within the agency program, without additional independent evaluation (e.g., merit-reviewed research at the Department of Defense).
- *Merit-reviewed research with competitive selection and external (peer) evaluation* is intramural and extramural research where funded activities are competitively awarded following review by a set of external scientific or technical reviewers (often called peers) for merit. The review is conducted by appropriately qualified scientists, engineers, or other technically-qualified individuals who are apart from the people or groups making the award decisions, and serves to inform the program manager or other qualified individual who makes the award (e.g., NSF's single-investigator research; NASA's research and analysis funds).

Table 7-4 lists how Federal R&D agencies report their allocation of research funding among these categories.

Table 7-4. ALLOCATION OF FEDERAL RESEARCH FUNDING, FY 2001

(Budget authority, dollar amounts in millions)

	Research Performed at Congressional Direction	Inherently Unique Research	Merit-Reviewed Research with Limited Competitive Selection	Merit-Reviewed Research with Competitive Selection and Internal Evaluation	Merit-Reviewed Research with Competitive Selection and External Evaluation	Total
By Agency						
Health and Human Services	159	107	2,819	19	17,355	20,459
Defense	614	200	1,131	2,901	135	4,981
Energy	139	1,016	2,338	321	749	4,563
National Aeronautics and Space Administration	219	171	636	1,411	1,794	4,231
National Science Foundation			168	234	2,655	3,057
Agriculture*	458	768	359		79	1,664
Commerce	97	325	54	188	205	869
Veterans Affairs	1		3		685	689
Interior	51	138	375	26	4	594
Environmental Protection Agency	38	39	195	69	134	475
Transportation	31	98		344		473
Education	4		163			167
Other	359	111	5	85	11	571
TOTAL	2,170	2,973	8,246	5,598	23,806	43,793

* Does not include net mandatory funding for USDA research grant programs of \$130 million in FY 2001.

Networking and Information Technology and Global Change Research and Development

Global Change Research program, as required by statute.

Table 7-5 shows agency-by-agency spending for Networking and Information Technology R&D and the U.S.

Table 7-5. AGENCY DETAIL OF SELECTED INTERAGENCY R&D EFFORTS

(Budget authority, dollar amounts in millions)

	2000 Actual	2001 Estimate	2002 Proposed	Dollar Change: 2000 to 2002	Percent Change: 2000 to 2002	Dollar Change: 2001 to 2002	Percent Change: 2001 to 2002
Networking and Information Technology R&D							
National Science Foundation	496	641	643	147	+30%	2	+0%
Energy	331	475	480	149	45%	5	+1%
Defense*	285	349	356*	71*	25%*	7*	2%*
Health and Human Services**	214	244	266**	46	21%	22	9%
National Aeronautics and Space Administration	129	177	181	52	40%	4	2%
Commerce	36	39	41	5	+14%	2	+5%
Environmental Protection Agency	4	4	2	-2	-50%	-2	-50%
TOTAL	1,501	1,929	1,969	468	31%	40	2%
U.S. Global Change Research Program							
National Aeronautics and Space Administration	1,161	1,162	1,072	-89	-8%	-90	-8%
National Science Foundation	187	179	178	-9	-5%	-1	-1%
Energy	113	119	121	8	+7%	2	+2%
Commerce	67	80	93	26	+39%	13	+16%
National Institutes of Health	48	52	57	9	+19%	5	+10%
Agriculture	56	56	55	-1	-2%	-1	-2%
Interior	27	27	25	-2	-7%	-2	-7%
Environmental Protection Agency	21	23	22	1	+5%	-1	-4%
Smithsonian	7	7	7	0	+0%	0	+0%
TOTAL	1,687	1,705	1,630	-57	-3%	-75	-4%
TOTAL WITHOUT NASA DEVELOPMENT	758	797	811	53	7%	14	2%

* FY 2002 entry for DOD R&D represents a projection from enacted FY 2001 levels plus inflation. FY 2002 levels are subject to change as a result of the Defense Strategy Review now underway.

** Includes \$14 million in offsetting collection in FY 2002 for the Agency for Healthcare Research and Quality. These activities were funded at \$11 million in FY 2000 and \$14 million in FY 2001.

Tax Incentives

Along with direct spending on R&D, the Federal Government has stimulated private investment in these activities with tax preferences. Current law provides a 20-percent tax credit for private research and experimentation expenditures above a certain base amount. The credit, which expired in 1999, was retroactively reinstated for five years, to 2004, in the Tax Relief Extension Act of 1999. The Budget proposes to make the Research and Experimentation (R&E) tax credit permanent. The proposed extension will cost an additional \$49.6 billion over the period from 2002 to 2011.

A permanent tax provision also lets companies deduct, up front, the costs of certain kinds of research and experimentation, rather than capitalize these costs. This tax expenditure will cost \$1.9 billion in 2001. Finally, equipment used for research benefits from relatively rapid cost recovery. The cost of this tax preference is calculated in the tax expenditure estimate for accelerated depreciation of machinery and equipment.

Table 7-6 shows a forecast of the costs of the research and experimentation tax credit.

Table 7-6. PERMANENT EXTENSION OF THE RESEARCH AND EXPERIMENTATION TAX CREDIT

(Budget authority, dollar amounts in millions)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2002 to 2011
Current Policy	6,760	5,390	4,710	2,720	1,160	.....	.....	.....	.....	.....	20,740
Proposed Extension .....	.....	.....	1,055	3,431	5,415	6,542	7,388	8,020	8,567	9,158	49,576
Total	6,760	5,390	5,765	6,151	6,575	6,542	7,388	8,020	8,567	9,158	70,316