Clinton's 'Historic' R&D Budget for Fiscal 2001 Puts Republican Congress in a Quandary FREE

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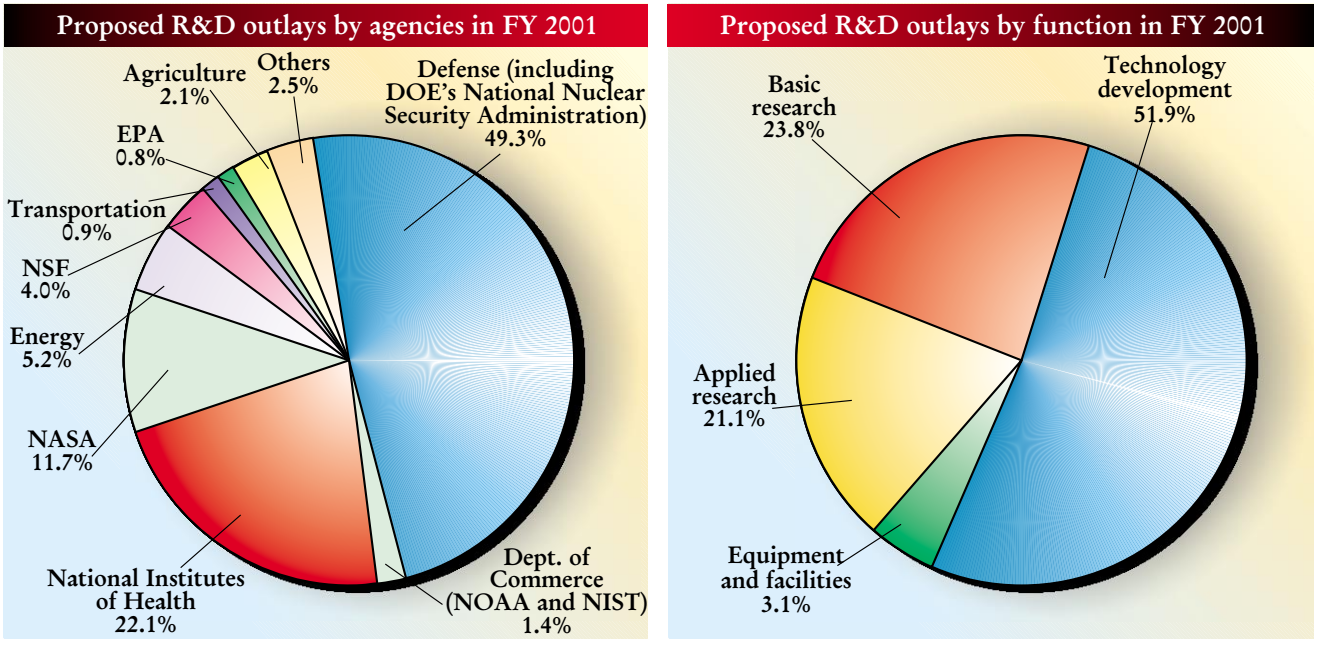
Physics Today **53** (4), 47–52 (2000);
https://doi.org/10.1063/1.883036

Clinton's 'Historic' R&D Budget for Fiscal 2001 Puts Republican Congress in a Quandary

It's a humdinger! President Clinton's eighth and last budget is his best yet for science, engineering, and education supported by federal R&D agencies. Even so, these priorities occupy a small portion of the total $1.84 trillion budget proposed for fiscal 2001, a 2.5% increase on the $1.79 trillion to be spent by the federal government this year. The new budget, according to Office of Management and Budget mathematics, would begin to wipe out in the next 13 years a national debt that had been accumulating, more or less, since 1835, when Andrew Jackson was president.

When Clinton's budget request for fiscal 2001 was released on 7 February, Neal Lane, director of the White House Office of Science and Technology Policy, characterized it as "historic" and quickly added, "I can hardly wait to get up to the Hill to present it." Even though the president had previewed his new R&D proposals in a major speech at Caltech on 21 January and his State of the Union message a week later (see PHYSICS TODAY, March, page 59), his administration's budget would increase total federal science and technology funding by $2.6 billion, or 3.1%, to $85.3 billion, and would raise federal funding of university research by $1.3 billion, or about 8%, to $17.8 billion. The prospective increases would be spread across virtually all the R&D agencies, except the Department of Defense (DOD).

The centerpiece of the proposed budget is the National Science Foundation (NSF), the only agency committed to supporting R&D across the expanse of science and engineering disciplines. NSF would receive $3.5 billion for its research account, a leap of $561 million, or 19.3%. The agency's overall increase, which includes the research and education



BALANCING BASIC RESEARCH IN BOOM TIMES. Chapter 5, "Promoting Research," of the 428-page US budget submitted to Congress for fiscal 2001 begins with a quotation from President Clinton: "We have to have a balanced research portfolio, because the research enterprise is increasingly interdependent. Advances in health care, for example, are often dependent on breakthroughs in other disciplines—such as the physics needed for medical imaging technology, or the computer science needed to develop more drugs more rapidly or to continue the mapping of the human genome." His budgeteers have succeeded in producing not only a fairly balanced R&D budget that includes almost all the basic sciences, but also the largest expansion of "investments" in research in more than three decades.

The proposed budget authorizes spending $85.3 billion for R&D at all the civilian and defense agencies, some $2.6 billion more and a 3.1% increase, which is greater than the projected 2.4% increase in the rate of inflation this year. The administration's own estimates for R&D outlays in fiscal 2001, however, would be about $2 billion less than the authorized total. Both the budget authority and outlays for defense spending in the next financial year would be less than 50% of the total R&D budget for the first time, fulfilling a promise made early in the Clinton administration.

Basic research continues to be a high priority. It would total $19.1 billion, an increase of $1.3 billion, or 5% over the expected expenditures this year, but less than the $1.8 billion request made in the fiscal 1999 budget. The administration would like to be credited with a 59% increase in civilian basic research since it took office in 1993, when the basic research account was $11.9 billion. In the same period, basic research for defense purposes will have fallen 10%, from $1.4 billion to the proposed $1.3 billion. In fiscal 2001, R&D funding at colleges and universities would rise to $17.8 billion, or 8% above this year's expected expenditures of $16.5 billion. The budget request for 2001 represents a 53% jump over the $11.7 billion in outlays back in 1993.

Department of Energy physics-related programs

	FY 1999 actual	FY 2000 request	FY 2000 current	FY 2001 request
		(millions of dollars)		
Office of Science				
High-energy physics				
Total research	149.2	160.7	158.4	156.2
University research at DOE and foreign labs and theory*	98.6	113.2	107.5	105.6
Fermilab, includes particle theory and astrophysics	10.6	9.2	8.0	7.8
SLAC, includes data gathering and analysis from BaBar detector and fabrication of Gamma Large Area Space Telescope	12.1	12.5	11.6	11.7
Brookhaven, includes experiments at AGS facility	8.2	8.2	10.0	9.8
Lawrence Berkeley, includes experiments at Fermilab and data taking at SLAC's BaBar detector	11.3	11.0	11.1	11.0
Argonne, including collaborations at Fermilab and DESY	5.7	5.5	5.6	5.6
Other physics research at L. Livermore and Los Alamos	2.7	1.0	4.5	4.6
Total high-energy physics technology**	65.7	67.5	70.8	74.3
Facility operations, including personnel, equipment and power	444.8	444.9	439.9	444.6
Fermilab, includes Tevatron operation for about 22 weeks	209.9	212.7	212.9	207.0
SLAC, includes use of B-factory for about 36 weeks	112.3	118.3	115.4	114.5
Brookhaven, includes AGS for about 17 weeks***	42.4	5.3	4.9	7.5
Other facilities support, including Argonne and Berkeley	10.3	21.2	17.0	27.3
Large Hadron Collider located at CERN†	65.0	70.0	70.0	70.0
Waste management	4.9	4.9	4.9	10.4
Small business programs	0.0	12.5	14.7	7.8
Nuclear physics				
Total low-energy nuclear physics	32.3	34.1	33.8	34.0
Holifield Radioactive Ion Beam Facility at Oak Ridge	14.1	14.6	13.2	14.1
University research, includes accelerators at University of Washington and Triangle Universities facility, Duke U.	9.9	10.1	9.7	10.5
Other national laboratory research, mainly at underground Sudbury Neutrino Observatory, a joint US–Canada–Britain facility	3.2	3.3	4.8	3.4
Nuclear data activities at Brookhaven	4.7	5.0	4.9	5.1
Small business research and Lawrence and Fermi awards	0.3	1.1	1.1	1.0
Total medium-energy nuclear physics	115.7	111.1	118.9	125.4
National laboratory research at Thomas Jefferson facility, Brookhaven's Laser Electron Gamma Source, Los Alamos's Liquid Scintillator Neutrino Detector, and Neutron Science Center	19.6	20.0	20.0	20.4
Thomas Jefferson National Accelerator Facility operations	65.4	67.2	66.5	68.4
Bates Linear Accelerator Center operations at MIT††	13.5	2.5	10.9	12.8
University research, includes work at Bates, Thomas Jefferson facility, and DESY laboratory in Germany	16.7	15.7	16.4	16.9
Small business research program	0.4	5.7	5.1	5.4
Other operations at Brookhaven's Alternate Gradient Synchrotron	0.0	0.0	0.0	1.5
Total heavy-ion nuclear physics	146.9	181.9	179.4	192.4
University research, includes accelerator facilities at Lawrence Berkeley, Texas A&M, Yale, and, in FY 2001, Brookhaven's Relativistic Heavy Ion Collider (RHIC)	17.5	17.0	17.4	18.0
National laboratory research at Argonne's Atlas, Brookhaven's RHIC, and Lawrence Berkeley's 88-inch cyclotron	36.1	33.5	33.6	33.3
RHIC/AGS accelerator pre-operations and operations	66.8	76.7	75.2	78.9
RHIC experimental research and user support	8.1	29.4	27.3	29.3
Argonne and Lawrence Berkeley facilities operations	12.6	13.1	13.0	13.1
Other national labs modifications and maintenance	5.5	9.4	10.1	10.8
Brookhaven waste management activities	0.0	0.0	0.0	6.0
Small business research program	0.4	2.8	2.8	3.0
Nuclear theory at universities and national labs	15.6	15.8	15.7	18.2
Construction and major items of equipment	10.2	9.0	9.1	5.7
Fusion energy sciences				
Total fusion energy sciences program†††	216.1	222.6	244.7	247.3
Tokamak experimental research, includes DIII-D at General Dynamics, Alcator C-MOD at MIT, electric tokamak at UCLA, and international collaborations in Europe, Japan, and South Korea	45.8	45.9	47.6	44.5
Alternative experimental concepts, includes Madison Symmetric Torus at University of Wisconsin, field-reversed configuration at University of Washington, National Spherical Torus Experiment (NSTX) at Princeton Plasma Physics Laboratory, and inertial fusion experiments	37.3	35.0	53.2	50.3
Fusion energy theory	22.7	23.0	24.5	27.5
General plasma science	6.2	6.5	8.0	8.5
Facility operations, include TFTR decontamination and decommissioning at Princeton Plasma Physics Laboratory, operation and improvements at DIII-D and Alcator C-MOD, and NSTX; also waste management activities at Princeton laboratory	61.7	69.4	71.5	77.4
Enabling R&D, mainly engineering and materials research	43.5	42.8	34.7	33.6
Small business research programs	0.0	4.9	5.2	5.5
Basic energy sciences				
Total basic energy sciences	783.2	888.0	771.6	1015.8
Materials sciences research, includes condensed matter physics, materials chemistry, neutron and x-ray scattering, and Experimental Program to Stimulate Competitive Research (EPSCOR)	186.6	188.3	184.1	210.6
Chemical sciences research, includes atomic, molecular, and optical physics and chemical physics	132.1	139.2	131.7	148.9

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portfolios as major facilities, would add up to an all-time high of around $4.6 billion, a boost of $675 million, or 17%—doubling the largest dollar increase ever attained. No wonder Rita Colwell, who heads NSF, told reporters on Budget Day, "This is very exciting. . . . We couldn't ask for a better way to mark NSF's 50th anniversary." Best of all, more than $300 million of the proposed boost would not be "tied to any specific initiative," said Colwell. "This gives us the flexibility we've been seeking for years."

The president's budget also calls for the Department of Energy (DOE) to go up nearly 9% higher than its current appropriation, to a total of $18.9 billion. DOE's science office, which is the government's largest supporter of the physical sciences and sponsor of major scientific facilities used by a variety of disciplines, would be raised by $337 million, or 12% above the current fiscal year, to $3.2 billion. Energy Secretary Bill Richardson boasted that Clinton's request is "the largest increase in our science business line since 1992 and reflects our commitment to keep America at the cutting edge."

NASA would get an increase for the first time during the Clinton presidency. The fiscal 2001 request is up 3% to $13.7 billion, and, what's more, the administration's out-year projections would have NASA's budget climbing to $15.5 billion by fiscal 2005. Asked what he thought of the proposed increase for next year, NASA Administrator Dan Goldin beamed, "For my answer, just look at the smile on my face." Space science would get nearly half of the proposed $435 million increase, giving it a budget of $2.4 billion. Goldin said he sees NASA "returning to its roots—cutting edge, fundamental R&D."

The Department of Commerce's two R&D agencies fare wonderfully well for a change. The National Institute of Standards and Technology (NIST) would get an increase of $77 million to $713 million, a 12% jump, with the research laboratories slated for a $55.1 million bump, to $332.3 million. The Advanced Technology Program, which has been treated shabbily by the Republican-dominated Congress in recent years, is set for a $32.9 million rise, to $175.5 million. The National Oceanographic and Atmospheric Administration would receive a large $489 million jump in its budget, to a total of $2.9 billion, or 20% more than this year. According to the agency's administrator, James Baker, "Most of our programs are things Congress likes," though he

admits that the agency generally has done better in getting funds for operational rather than research activities.

The 2001 budget requests a 5.6% rise for the National Institutes of Health (NIH), always a favorite in Congress, and the increase amounts to a whopping $1 billion, for a total of $18.8 billion. The proposed addition is less than half of the $2.2 billion increase NIH received in fiscal 2000. Still, funds for most of its institutes and centers would get increases of between 5% and 6%. With one of the agency's top priorities being HIV/AIDS research, NIH's Office of AIDS Research would receive $2.1 billion, up nearly 8% over the current year.

By contrast, DOD's R&D budget, which traditionally is the major source of funding for mathematics and computer research, would fall slightly by 0.2% to $38.6 billion, mostly because of sharp cuts in applied research and exploratory development across all three services as well as organizations such as the Defense Advanced Research Projects Agency (DARPA). Although the Clinton budget would provide a substantial $11 billion, or 4%, increase in the total DOD budget of $292 billion in 2001, the additional funds would mostly go to weapons procurement and day-to-day operations. Among the department's range of R&D categories, the "6.1" (basic research) account would receive an increase of $55 million, or 4.8%, to $1.2 billion, after an even larger rise in fiscal 2000. DARPA would go up 4% to $2 billion—the increase devoted mainly to its fundamental information technology and biological warfare research programs. The Ballistic Missile Defense Organization is marked up for a 15% boost in its R&D account, to $3.9 billion, including $1.7 billion, up from $1 billion this year, for the troubled National Missile Defense program.

On 1 February, congressional leaders of both parties emerged from a White House meeting and said they and Clinton were working from the same set of priorities. Everyone claimed there wasn't the temperament or the time, in an election year, for a lengthy and contentious budget battle. But with the release of Clinton's proposed budget a week later, both sides returned to their prickly partisan positions. Thus ended the budget comity, and the comedy so often played out on the floors of Congress began in earnest.

Even before Clinton's budget reached Capitol Hill, Republican budget hawks pecked at it. "The president has presented the American

Department of Energy physics-related programs

	FY 1999 actual	FY 2000 request	FY 2000 current	FY 2001 request
	(millions of dollars)			
National user facilities operations				
Advanced Light Source, Lawrence Berkeley	31.2	31.7	31.0	35.4
Advanced Photon Source, Argonne	86.2	87.7	85.6	94.7
National Synchrotron Light Source, Brookhaven	32.2	32.8	32.1	36.5
Stanford Synchrotron Radiation Laboratory	23.4	22.0	23.3	22.5
High Flux Beam Reactor, Brookhaven‡	22.8	22.6	19.6	17.5
High Flux Isotope Reactor, Oak Ridge	30.4	34.6	34.5	34.2
Intense Pulsed Neutron Source, Argonne	12.1	12.0	11.7	13.6
Manuel Lujan Jr Neutron Scattering Center, Los Alamos	7.4	7.5	7.4	10.0
Spallation Neutron Source, Oak Ridge	28.6	17.9	17.9	19.1
Radiochemical Engineering Development Center, Oak Ridge	7.0	7.2	7.0	7.1
Combustion Research Facility, Sandia–California	5.0	5.1	5.0	5.8
Small business research programs	0.0	14.6	14.2	15.3
Congressional offset applied to basic energy sciences	1.5	0.0	0.0	0.0
Congressional "earmark" for University of Nevada	0.5	0.0	0.0	0.0
Engineering and geosciences, include geophysical imaging, mineral thermodynamics, and climate change	41.7	37.5	37.1	40.8
Energy biosciences, include plant genomics, biomaterials, and climate change	29.1	31.2	30.7	33.7
Construction projects				
Spallation Neutron Source, Oak Ridge	101.4	196.1	100.0	261.9
Combustion Research Facility-Phase II, Sandia–California	4.0	0.0	0.0	0.0
Energy supply R&D				
Solar and renewable resources technologies, includes photovoltaic, geothermal, and electric energy systems	380.2	446.0	357.2	456.0
Nuclear energy, includes isotope production, reactor research, and advanced radioisotope power systems	284.6	269.3	285.2	308.4
Advanced scientific computing research				
Mathematical, information and computational sciences, includes the National Energy Research Scientific Computing Center and ES net managed by Lawrence Berkeley	151.9	198.9	127.9	182.0
Energy research analyses	1.0	1.0	1.0	1.0
Science education, involving university faculty, precollege teachers and students, undergraduate fellowships, and the National Science Bowl program	4.5	4.5	4.5	6.5
Weapons activities				
National Nuclear Security Administration				
Core stockpile stewardship R&D, maintenance, evaluation, dismantlement and disposal, production support, including quality control and assurance, and stockpile management	721.6	††	760.0	836.6
Stockpile stewardship campaigns to increase scientific and technical knowledge for weapons certification, including advanced radiography, inertial confinement fusion ignition and high yield, applications and modeling, design and production technologies, and tritium readiness	999.6	††	928.6	1049.9
Readiness in technical base and facilities operations including National Ignition Facility (NIF) at Lawrence Livermore, Dual-Axis Radiographic Hydro Test Facility (DARHT) at Los Alamos, Y-12 Site at Oak Ridge, and materials recycle and recovery; Advanced Simulation and Computing (ASCI) component	1784.2	††	1870.0	1953.6
Total stewardship operations and management	3505.4	††	3558.6	3840.1
Program direction	221.1	246.5	203.6	224.1
Construction, including NIF at Lawrence Livermore, DARHT at Los Alamos, Tritium Extraction Facility at Savannah River, and Strategic Computing Complex at Los Alamos	519.0	††	530.3	414.2
Secure transportation program	91.4	††	91.5	115.7
Subtotal, weapons activities	4336.8	4531.0	4383.9	4594.0
Use of prior year balance	(51.0)	0.0	(7.7)	0.0
Proposed supplemental	0.0	0.0	(55.0)	0.0
Total weapons activities	4285.8	4531.0	4321.2	4594.0
Other defense activities				
Nonproliferation and national security	776.5	767.3	728.1	0.0
Intelligence, includes nuclear materials protection and dismantlement and accountability of former Soviet weapons	0.0	0.0	34.9	38.1
Counterintelligence, includes cyber protection against espionage, sabotage, and emerging concerns	6.9	0.0	37.4	45.2
Security and emergency operations	0.0	0.0	0.0	340.4
Environment, safety, and health	93.1	††	107.6	109.1
Russian plutonium and uranium disposition	525.0	NA	0.0	0.0
Additional activities	870.5	††	808.0	22.3
Total, other defense activities	2272.0	††	1716.0	555.1

*The university program supports research groups at 102 universities. In FY 1999, the number of graduate students and postdocs funded at US universities was 6550; in addition 4840 graduate students and postdocs were supported at DOE facilities.

**Highlights in FY 2001 are the commissioning of the Main Injector at Fermilab, the initial operation of the B-factory at CERN and the continued tests of a new experimental facility at Fermilab called Neutrinos at the Main Injector (NuMi).

***Brookhaven's Alternating Gradient Synchrotron was transferred in FY 1999 from the high-energy program to the nuclear physics program and operates in it as the injector of proton beams for RHIC.

†In FY 1999 and FY 2000, funding for the LHC was used for R&D and testing on superconducting materials, cable, and wire, calculation on such issues as design instrumentation, and magnet prototypes for the accelerator system and the two detectors, Atlas and CMS.

††In FY 2001, the BLAST detector at Bates will be completed and will initiate commissioning for a research program in FY2002–2004. Upon completion of the BLAST program in FY 2004, the Bates facility will begin a two-year phaseout.

†††The fusion program funds research at 54 colleges and universities in the US and supports research for DIII-D at General Atomics.

‡On 21December 1996, the HFBR was shut down for normal refueling. Before its scheduled restart, a plume of tritiated water emanating from a leak in the reactor's spent fuel tank was discovered. On 16 November 1999, the Secretary of Energy announced the permanent closing of the HFBR, and it is now in a permanent shutdown mode.

‡‡With the creation of the National Nuclear Security Administration (NNSA) within DOE on 1 March 2000, the defense programs budget has been restructured for FY 2000 and FY 2001. The new semiautonomous agency excludes accounts for nonproliferation and national security, naval reactors, and Russian plutonium and uranium disposition, and includes programs in intelligence, counterintelligence, and security, among others, that were absent from previous DOE budgets.

National Science Foundation physics-related programs

	FY 1999 actual	FY 2000 request	FY 2000 current	FY 2001 request
		(millions of dollars)		
NSF total	3690.5	3954.5	3930.2	4572.4
Research and related activities	2821.6	3004.0	2958.5	3540.7
Mathematical and physical sciences	733.7	754.0	757.6	881.2
Physics research projects support	99.6	103.5	106.7	142.8
Physics facilities, user support*	63.2	63.9	61.6	55.9
Total physics research	162.7	167.4	168.4	198.7
Chemistry research projects support	113.5	117.7	118.1	130.1
Chemistry instrumentation and infrastructure	21.8	20.8	20.9	31.9
Total chemistry	135.3	138.5	139.0	162.0
Materials research projects support	93.7	97.3	103.0	125.8
Materials research science and engineering centers**	56.8	53.7	53.9	59.5
National facilities and instrumentation***	35.9	39.5	34.3	35.3
Total materials research	186.4	190.5	191.2	220.6
Astronomy research and instrumentation	41.0	43.8	43.6	59.8
Astronomy facilities	77.6	78.4	79.3	79.9
Astronomical sciences	118.5	122.2	122.9	139.7
Mathematics research and project support	69.5	73.3	74.3	91.3
Infrastructure support	31.2	32.0	32.0	38.9
Total mathematical sciences	100.7	105.3	106.3	130.2
Multidisciplinary research projects support†	29.9	30.0	29.9	30.0
Major research facilities and equipment	56.7	85.0	93.5	45.0
Large Hadron Collider (at CERN in Geneva)	22.0	15.9	15.9	16.4
Earthscope: US Array and San Andreas Fault Observatory at Depth (SAFOD)††	0.0	0.0	0.0	17.4
High Performance Instrumented Airborne Platform for Environmental Research (HIAPER)	0.0	0.0	8.5	0.0
Millimeter Array	9.0	8.0	8.0	6.0
National Ecological Observatory Network (NEON)†††	0.0	0.0	0.0	12.0
Network for Earthquake Engineering Simulation	0.0	7.7	7.7	28.2
Polar support aircraft upgrades	20.0	12.0	12.0	0.0
South Pole station modernization	5.7	5.4	5.4	13.5
Terascale computing systems	0.0	36.0	36.0	45.0
Geosciences				
Atmospheric sciences research projects support	94.5	95.9	96.0	118.3
National Center for Atmospheric Research	70.5	68.2	68.9	75.8
Earth sciences projects support	63.2	62.8	65.9	78.0
Instrumentation and facilities ‡	26.9	29.3	26.9	31.0
Continental dynamics	8.8	9.1	8.8	9.5
Ocean sciences research support	117.6	125.0	125.0	153.7
Oceanographic centers and facilities	52.2	48.5	49.3	62.8
Ocean drilling program	44.3	46.8	47.0	54.0
Computer and information science and engineering‡‡				
Computer-communications research	60.3	62.2	60.2	69.2
Information and intelligent systems	41.2	43.1	41.6	53.7
Experimental and integrative activities	57.6	59.9	57.6	63.3
Advanced computational infrastructure and research, including partnerships program (PACI) and terascale computing system (see major research equipment)	78.1	85.4	78.1	84.2
Advanced networking infrastructure and research	61.4	62.0	60.9	68.8
Information technology research (ITR)	0.0	110.0	90.0	190.0
Education and human resources	662.5	711.0	690.9	729.0

*In FY 2001, construction and upgrade projects will be completed at Michigan State University's National Superconducting Cyclotron Laboratory, the Cornell Electron Storage Ring (CESR), and the Laser Interferometer Gravitational-Wave Observatory (LIGO).

**In FY 2001, up to four new Materials Research Science and Engineering Centers will be established through open competition in such fields as nanoscale research and technology, information technology, and the interface between materials and biology.

***During FY 2000, a comprehensive review of the National High Magnetic Field Laboratory will be conducted to evaluate its progress and determine the actual level of support for its R&D programs in FY 2001 and beyond.

†These activities include particularly novel, challenging, or complex projects in research and education that might not be funded for institutional or procedural reasons. Examples for FY 2001 include university–industry collaborations through the Grant Opportunities for Academic Liaison with Industry (GOALI) program to broaden graduate and postdoctoral experience and research conducted by multidisciplinary groups of scientists, mathematicians, and engineers that could result in next generation instrumentation that integrates computation and measurement.

††Funding is sought in FY 2001 to initiate this project for a multipurpose geophysical instrument array that will enable scientists to gain knowledge and understanding of the structure and dynamics of the North American continent with high-resolution seismometers. The total cost of the project is estimated at $74.8 million over the period FY 2001–2004.

†††Funding is requested to initiate construction of this network of ten observatories that will pursue interdisciplinary research on ecological systems at all levels of biological organization from molecular genetics to entire ecosystems. The network is estimated to cost $100 million over the period FY 2001–2006.

‡This line includes support of the Global Seismographic Network, managed by Incorporated Research Institutions for Seismology (IRIS). The network was critical to assessing the nuclear weapons tests of India and Pakistan in May 1998, and its outposts are part of the Comprehensive Test Ban Treaty's monitoring system. NSF also supports the University Navister Consortium, which collects precise geodetic measurements using global positioning systems (GPS), accelerator-based mass spectrometers, ion-beam microprobes, and synchrotron beam lines to obtain high resolution imaging of Earth structures.

‡‡NSF leads all federal agencies in basic research and education relating to computer science and engineering. About 37% of the funding is in research grants, which provide support for more than 4500 postdoctorates, trainees, and graduate and undergraduate students.

people with a budgetary fantasy," sneered House Budget Committee Chairman John R. Kasich of Ohio. "Much of it is a rehash of previous proposals that have already been rejected. As far as I'm concerned, it's dead on arrival." The House Appropriations Committee Chairman, Bill Young of Florida, had a slightly different take. "Reading through the details of the president's budget, I became alarmed by the number of new government initiatives, huge programmatic increases, and fancy bureaucratic rhetoric. In my wildest dreams, I cannot see his proposals become reality. We simply will not have the funds. The president didn't just blow the spending lids. He blew all commitment to fiscal restraint and sanity." House Science Committee Chairman F. James Sensenbrenner Jr, a Wisconsin Republican, warned against "budgetary game-playing," recalling that Clinton proposed a funding increase for NSF two years ago that was linked to his unsuccessful attempt to increase tobacco taxes.

Nonetheless, Clinton believes his budget will prevail in Congress, mostly because of his success in previous budget battles. The projected surpluses in the Social Security trust fund are now treated as largely untouchable by Democrats and Republicans alike. Clinton and his congressional opponents are walking different paths this election year, though they both have the same goal—to win the White House and Congress in November. For this reason, Clinton stressed his conservative assumptions for the future fiscal surplus in his budget arithmetic, which is smaller than the Republican estimate or even the projection of the Congressional Budget Office, whose figure relies on maintaining the spending caps that both sides accepted in the 1997 Balanced Budget Act. The spending caps for discretionary programs were ignored last year, and Clinton's budget would doff the caps this year, so that the new budget would include spending increases for health care and education—core issues of this year's elections—as well as for R&D. Clinton also has proposed small tax cuts for the less-well-off and a higher military budget, to steal the Republicans' clothes.

The House and Senate budget committees have initiated resolutions setting revenue targets and spending ceilings for broad categories of discretionary programs. The resolutions are carried out in the fall by passing specific appropriations and tax bills. The House measure allots about $597 billion for discretionary programs other

than such entitlements as Social Security and Medicare and Medicaid. This figure is significantly less than the $625 billion required to pay for Clinton's request for fiscal 2001. The difference in the numbers sets the stage for the annual confrontation between the White House and Congress.

Still, both political parties seem to agree on the need for a more balanced R&D portfolio, so that NSF's or DOE's basic science programs won't be shortchanged to fatten defense applicaitons or to pad accounts at NIH or NASA.

Both Democrats and Republicans applaud Clinton's greater support of the $514 million information technology research program, though they may disagree on the details. Similarly, there is bipartisan intoxication with the administration's $495 million nanotechnology initiative, which aims to develop computers the size of sugar cubes by manipulating matter at the atomic and molecular levels.

Below are some budget highlights:

National Science Foundation. The budget would provide $326 million for the agency's leading role in information technology (IT) research (among six other government agencies), principally in long-term computer science projects and in improving access to supercomputers for scientists and engineers, in keeping with recommendations of the President's Information Technology Advisory Committee. The budget also would allot $217 million for the new nanotechnology initiative. NSF's new facilities account soars by 45% to $139 million, led by a $17 million down payment for a $75 million mobile seismic array and $12 million to start a $93 million network of high-tech ecological observatories. Funding for biocomplexity, a research field favored by Colwell, would leap by 172%, to $136 million.

Department of Energy. After a year of being battered by allegations of lax security at DOE's weapons labs and charges by the President's Foreign Intelligence Advisory Board of a dysfunctional department, Richardson said "It's time to return to science." Spending on core science programs would get a 12% increase to $3.2 billion, with initiatives to advance scientific computing as part of the IT project, along with robotics, and bioengineering. Nanoscale science would increase from $47 million this year to $83.1 million next year. The budget also proposes $6.2 billion for energy resources, which include improved efficiencies, renewable sources, and electricity reliability. DOE's budget calls for $281 million

NASA physics-related programs

	FY 1999 actual	FY 2000 request	FY 2000 current	FY 2001 request
		(millions of dollars)		
Space science and exploration				
Chandra X-ray Observatory*	45.3	0.0	4.1	0.0
Space Infrared Telescope Facility (SIRTF) development	119.7	125.0	123.4	117.6
Hubble Space Telescope development and upgrades	159.6	140.4	160.1	168.1
Relativity (Gravity Probe-B) mission development**	61.3	40.5	49.9	13.8
Thermosphere, Ionosphere, Mesosphere Energetics and Dynamics (TIMED) development	53.3	16.0	27.5	0.0
Stratospheric Observatory for Infrared Astronomy (SOFIA) construction and development	58.2	45.1	39.0	33.9
Payload and instrument development	29.2	—	13.6	7.1
X-ray spectrometer and foil mirrors for Japan's Astro-E	6.4	0.0	0.0	0.0
Remote sensing instruments on ESA's Rosetta mission	12.5	6.2	6.1	1.4
Cluster II international solar–terrestrial physics mission***	5.0	1.0	1.0	0.0
Shuttle-international astrophysics projects, includes three ESA spacecraft—X-ray mirror mission, Integral gamma-ray observatory, and Planck background radiation satellite	5.0	2.8	6.0	5.2
Spartan reusable spacecraft to be flown aboard shuttles	0.3	1.0	0.5	0.5
Explorer series				
Far Ultraviolet Spectroscopy Explorer (FUSE)	14.6	0.0	0.0	0.0
Medium-class Explorers, includes Microwave Anisotropy Probe (MAP), Magnetopause-to-Aurora Global Exploration (IMAGE), Swift Gamma-Ray Burst Explorer and Full-Sky Astrometric Mapping Explorer (FAME)	90.2	42.3	34.1	15.1
Small-class Explorers, includes Transition Region and Coronal Explorer (TRACE), Wide-field Infrared Explorer (WIRE), High Energy Solar Spectroscopic Imager (HESSI), and Galaxy Evolution Explorer (GALEX)	67.3	0.0	41.0	17.9
University-class Explorers (UNEX), includes Cosmic Hot Interstellar Plasma Spectrometer (CHIPS) and Inner Magnetosphere Explorer (IMEX)	14.8	0.0	5.0	7.4
High Energy Transient Explorer-II (HETE)†	11.1	0.0	3.2	0.0
Explorer planning (all others)	6.8	25.0	28.3	95.7
Discovery series development				
Stardust to gather and return dust from comet Wild-2	21.3	0.0	0.0	0.0
Genesis to collect charged particles in the solar wind	82.9	50.3	50.2	7.3
Comet Nucleus Tour (CONTOUR) to assess comet diversity	0.0	51.8	51.8	45.6
Future missions, include Deep Impact to fire projectile into comet P/Tempel1 and MESSENGER mission to Mercury	19.7	78.5	52.8	135.9
Micromissions	0.0	0.0	0.0	8.0
Mars Surveyor series development				
1998 orbiter and lander††	17.0	0.0	0.0	0.0
1999 orbiter and lander	162.2	126.8	117.0	34.2
Mars telecommunications network and micromissions	0.0	4.1	6.0	35.0
Future missions, include possible ESA Mars Express	48.5	114.8	125.4	257.5
Mission operations and data analysis	115.2	85.3	75.4	80.0
Supporting research and technology				
Core program for space science and cross enterprise technology, including telerobotics and computing	211.5	259.6	254.5	272.0
Focused programs, including astronomical search for origins and advanced deep space systems technology	226.6	367.5	342.9	424.5
Research and analysis	192.2	182.2	237.6	211.6
Data analysis	210.9	289.8	291.6	312.0
Suborbital program				
Balloon experiments	13.5	13.5	13.3	15.3
Sounding rockets	29.3	24.0	23.6	23.6
Life and microgravity sciences and applications	263.5	256.2	274.7	302.4
Earth sciences (formerly Mission to Planet Earth)				
Earth Observing System (EOS), includes multiple spacecraft collecting climate change data, such as QuickScot and Landsat-7	547.6	564.6	500.9	447.1
EOS data information system (EOSDIS)	261.7	231.5	261.9	252.0
Earth probes, including Total Ozone Mapping Spectrometer, Vegetation Canopy Lidar, and Triana mission	109.3	138.2	163.6	120.4
Research and technology, including applications and commercialization	439.7	420.2	469.4	533.3
Mission operations	55.5	54.6	47.6	42.7
Academic programs	138.5	138.5	138.8	100.0
Space station development				
International space station construction and research	2096.7	2482.7	2048.1	1724.5
Russian program assurance for service module and Proton launch	203.0	200.0	200.0	300.0
Crew return vehicle based on X-38 experience	0.0	148.0	75.0	90.0

*Originally scheduled for launch in June 1998, the Chandra X-ray Observatory, formerly the Advanced X-ray Astrophysics Facility (AXAF), was delayed by budget cuts and technical troubles. It was renamed in December 1998 in honor of the late Subrahmanyan Chandrasekhar, a University of Chicago astrophysicist and Nobel laureate. The observatory was launched in July 1999.

**The purpose of this mission (once called Gravity Probe-B) is to verify Einstein's theory of general relativity by measuring the "dragging of space" by rotating matter and the space-time curvature known as the "geodetic effect." Launch is scheduled for September 2001.

***The original Cluster mission was lost on 4 June 1996 in the explosion of an Ariane-5 rocket. Cluster II's four spacecraft are designed to carry out three-dimensional measurements of the Earth's magnetosphere. Approved by NASA and ESA, it is scheduled for launch in June 2000 on two Russian Soyuz vehicles.

†HETE-II is an international collaboration (France, Italy, Japan, and the US) to be launched in June 2000 from Kwajalein Island in the Pacific. It replaces the first version, which was destroyed during a third-stage power failure in November 1996. HETE-II will seek to gather precise positions of gamma-ray bursters and other high-energy transient sources.

††This line refers to the Mars Climate Orbiter, launched in December 1998, and the Mars Polar Lander, sent aloft in January 1999. Both were lost on arriving at the planet. As a consequence, the entire Mars Surveyor Program is undergoing major replanning.

Department of Defense physics-related programs

	FY 1999 actual	FY 2000 request	FY 2000 current	FY 2001 request
	(millions of dollars)			
Army				
Research sciences	122.3	125.6	125.9	132.2
In-house laboratory independent research	12.1	14.2	14.1	14.5
University and industry research centers	42.3	47.1	64.4	54.4
Total basic research (6.1)	176.7	186.9	204.4	201.1
Total applied research (6.2)	612.6	523.8	790.9	602.5
Navy				
Research sciences	339.5	361.1	358.8	381.1
In-house laboratory independent research	14.6	15.6	15.5	16.3
Total basic research (6.1)	354.1	376.7	374.3	397.5
Total applied research (6.2)	550.7	523.8	622.4	527.1
Air Force				
Total basic research (6.1)	197.5	209.5	213.8	206.1
Total applied research (6.2)	582.0	507.6	596.8	590.3
Defense-wide				
Research sciences	57.4	64.3	67.6	90.4
In-house laboratory independent research	2.1	2.0	2.0	2.0
University research initiatives	220.4	216.8	224.0	253.6
Gulf War illness research	22.6	19.2	24.5	17.0
Government–industry cosponsorship of university research	4.2	6.4	6.2	6.7
Experimental program to stimulate competitive research	--	--	--	9.9
Chemical and biological defense research	28.5	31.4	44.0	33.2
Total basic research (6.1)	335.3	340.0	368.4	412.8
Total applied research (6.2), including Next Generation Internet and computing systems	1311.9	1372.3	1400.3	1424.4
Total advanced technology development (6.3)	1819.4	1727.8	1811.1	1657.2
Defense Advanced Research Projects Agency (DARPA)				
Total basic research (6.1)	57.4	64.3	67.6	90.4
Total applied research (6.2), including materials, electronics, computing, and Next Generation Internet	900.9	1372.3	941.7	1025.6
Defense Threat Reduction Agency	341.8	350.7	376.1	365.2
Ballistic Missile Defense Organization (BMD) including National Missile Defense demonstration and validation	3909.9*	2944.4	3427.7	3943.2

*Includes $770 million from FY 1999 emergency supplemental legislation.

NOAA physics-related programs

	FY 1999 actual	FY 2000 request	FY 2000 current	FY 2001 request
	(millions of dollars)			
Oceanic and atmospheric research				
Climate and air quality research				
Interannual and seasonal climate research, including El Niño and La Niña phenomena	12.9	12.9	16.7	14.9
Long-term climate and air quality research, including high-performance computing and numerical modeling	36.9	48.1	42.6	43.3
Climate observation and services, including climate reference network and Climate Prediction Center*	0.0	0.0	0.0	24.0
Climate and global change, including Global Atmospheric Baseline Observatories and ocean observations using satellites and robotic floats	60.0	69.7	69.6	72.1
Global Learning and Observations to Benefit the Environment (GLOBE) (NOAA-wide)**	5.0	5.0	3.0	5.0
Atmospheric programs				
Weather research, including numerical modeling and forecasting	41.7	41.0	43.3	41.4
Solar–terrestrial services and research	5.7	6.1	6.9	6.2
Sea Grant college program	56.0	51.5	58.6	59.3
Undersea research program	15.5	9.0	13.7	5.6
Acquisition of data	15.0	13.0	12.9	12.9

*A new program that is designed to turn observations, data, and research into generational systems and products and to provide decadal and centennial temperature and precipitation monitoring.
**This program is intended to increase the awareness and understanding of K-12 students in the US to climate and environmental phenomena and processes.

NIST physics-related programs

	FY 1999 actual	FY 2000 request	FY 2000 current	FY 2001 request
	(millions of dollars)			
Laboratory research and core services				
Physics	28.3	28.9	28.4	39.5
Materials science and engineering	51.1	52.5	51.0	59.0
Electronics and electrical engineering	38.2	39.1	38.4	40.0
Chemical science and technology	32.3	33.9	32.1	33.3
Computer science and applied mathematics	43.8	47.8	44.2	56.3
Research support activities, including postdoctoral fellows	30.0	30.9	31.9	49.3
Manufacturing engineering	19.3	19.7	19.1	23.8
Technology assistance	17.0	18.1	17.4	17.2
Building and fire research	14.8	13.7	14.7	13.9
Total measurement and standards laboratories	274.8	284.6	277.2*	332.3
Baldrige National Air Quality Awards program	4.9	5.0	4.9	5.2
Advanced Technology Program (ATP)	197.4**	238.7	142.6	175.5
Manufacturing Extension Partnership (MEP)	106.8	99.8	104.2	114.1
Institute for Information Infrastructure Protection (IIIP)	0.0	0.0	0.0*	50.0
Construction of research facilities	650.1	650.0	643.7	721.7

*Excludes proposed supplements of $1 million for laboratories and $4 million for IIIP.
**Total excludes $6 million recission specified by Congress in FY 1999 omnibus budget act.

for the Spallation Neutron Source, under construction at Oak Ridge National Laboratory and $70 million for the Large Hadron Collider being built (in partnership with other countries) at CERN in Switzerland. Congress included in the defense authorization act of 1999 (PL 106-65) the creation of a semiautonomous National Nuclear Security Administration within DOE. NNSA came into being on 1 March with funds from the department's defense account, but for fiscal 2001 the budget would provide $6.2 billion for the new agency. Among the most expensive initiatives in the budget is the stockpile stewardship program, which uses computer simulation and laboratory tests to assess the safety and reliability of nuclear weapons without exploding any. Funding for this effort would increase by $282 million, to $3.8 billion. Pete V. Domenici, a New Mexico Republican who chairs the Senate Energy and Water Development Appropriations Subcommittee, praised the increase for stockpile stewardship, but argued that additional funds would be needed for the National Ignition Facility, a powerful laser fusion facility under construction at the University of California's Lawrence Livermore National Laboratory, which has been beset by construction delays and cost overruns. DOE proposes to reduce funding for building the stadium-sized facility by $173 million in fiscal 2001.

NASA. Calling universities "the furnace of innovation," Goldin declared at his budget briefing on 7 February that the agency would explore ways in which universities could take part in NASA research and projects. He also spoke about partnerships with other agencies, particularly NSF. Goldin noted that the budget proposed spending $20 million to jack up the "Living With a Star" initiative—a series of missions, enhancements to current programs, and partnerships with other agencies (NSF, NOAA and the Air Force are already involved) to better understand and ultimately predict Sun–Earth interactions. NASA's budget also contains $1.4 billion for the Earth Sciences program, a decrease of $37.6 million, or 2.6% below the current year. The program has been restructured to make research and technology activities more easily understood by Congress. The International Space Station, which has been plagued for two years by Russia's failure to deliver a key service module, would be funded at $2.1 billion, a decrease of $208.6 million, or 9%, in fiscal 2001. **IRWIN GOODWIN**