Science Budget: Selective Growth

Presidential initiatives in computers, global change, biotechnology, and materials push up some budgets; big science and NSF favored; but slow growth for biomedical research

WHEN PRESIDENT BUSH UNVEILED HIS 1993 budget proposals on 29 January, there were smiles on the faces of top officials in many science agencies. "In the future, I hope that the budgets will be as good as this year's," said Walter Massey, as he proudly outlined his first allotment as director of the National Science Foundation (NSF). No wonder he was grinning: NSF would get an 18% overall increase next year and a 21% boost in its basic research funds. Presidential science adviser D. Allan Bromley was equally ebullient: Increases like those for NSF "testify to [the Administration's] abiding commitment to make the investments in science and technology that this nation needs to remain prosperous and secure," he bragged.

The bottom line for R&D might not seem much to celebrate, however. The total budget for all the federal government's science and technology programs would grow from $74.6 billion to $76.6 billion—an increase of less than 3%. That's even below the 3.3% inflation rate the Administration is projecting for 1993. But there's a good reason why the overall increase is so small: Defense R&D—which currently accounts for 60% of total government expenditure on science and technology—would get only a modest increment. Civilian R&D, on the other hand, would grow by 7%, from $28.3 billion to $30.4 billion. And within those totals, basic research would fare even better, climbing to $14.3 billion, an increase of 8%.

A variety of initiatives that span several different agencies—focusing on biotechnology, global change, materials, computing, and science and math education—are singled out for special mention in the budget documents, and in some cases they would get huge increases as well. Big science also comes out a winner, with $650 million (a 34% increase) proposed for the Superconducting Super Collider (SSC) and $2.25 billion (11%) for the Space Station. But the Administration, evidently sensitized by persistent complaints from practitioners of little science that they are getting shortchanged, is quick to point out that investigator-initiated research in NSF, the National Institutes of Health (NIH), and the Department of Energy (DOE) would grow by 9%—almost three times the anticipated rate of inflation.

Not every official in the government's science agencies was smiling, however. The National Aeronautics and Space Administration (NASA), struggling to accommodate the space station in what NASA administrator Richard Truly calls an "extremely constrained" budget, has proposed dropping a couple of already-approved science missions: a U.S.-European project to rendezvous with an asteroid and a test of Einstein's theory of general relativity. Several National Oceanic and Atmospheric Administration research programs have been scheduled for surgery—as they have in previous years. And the total increase proposed for NIH is only 5%, barely enough to stay ahead of inflation (see page 674).

Nevertheless, the overall increases for civilian R&D are noteworthy for the fact that they are included in a budget awash in red ink—the deficit is projected at a record $350 billion—in which domestic expenditure is frozen at last year's level (see box p. 673). As Bromley noted, R&D programs are caught in "truly a zero-sum game," in which increases must be offset by cuts in other areas. And in an election year, it's politically difficult to cut domestic programs, many of which have vocal constituencies, to make room for growth in science. The Administration's rationale for tilting domestic priorities a little toward R&D, said Bromley, is the expectation that these investments will pay off in international competitiveness, economic growth, and improved health.

Whether that rationale will be sufficient to carry the

The Big Picture (millions of dollars)

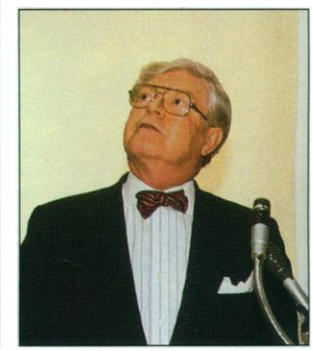
Government-wide totals	1989 Actual	1992 Enacted	1993 Proposed	% Change: 1992 to 1993
Conduct of R&D:				
Basic Research	**10,615**	**13,254**	**14,322**	**+8%**
Civilian	9,650	12,053	13,086	+9%
Defense	965	1,201	1,236	+3%
Applied Research and Development	**51,298**	**57,839**	**59,302**	**+3%**
Civilian	11,620	16,257	17,313	+6%
Defense	39,678	41,582	41,988	+1%
Subtotal, Conduct of R&D	**61,913**	**71,093**	**73,624**	**+4%**
R&D facilities	2,293	3,498	2,933	-16%
Total, conduct of R&D and facilities	**64,206**	**74,591**	**76,557**	**+3%**

SOURCE: OMB

Basic Research (millions of dollars)

Department or Agency	1989 Actual	1992 Enacted	1993 Proposed	% Change: 1992 to 1993
Health and Human Services (National Institutes of Health)	4,413 (4,052)	5,459 (5,019)	5,800 (5,328)	+6% (+6%)
National Science Foundation	1,563	1,839	2,221	+21%
Energy	1,383	1,789	1,859	+4%
National Aeronautics and Space Administration	1,385	1,860	2,068	+11%
Defense-military	951	1,170	1,203	+3%
Agriculture	486	611	639	+5%
Other Agencies	434	526	532	+1%
Total	**10,615**	**13,254**	**14,322**	**+8%**

Looking up for R&D. *Science adviser D. Allan Bromley lauds growth in hard times.*



SUSAN MUNIAK

proposals through Congress is debatable. The entire budget will face a tough time as Republicans and Democrats spar over election-year tax breaks, health insurance, cuts in the defense budget, and domestic programs aimed at off-setting some of the impact of the recession. If experience is any guide, however, Congress is unlikely to make substantial changes in the R&D proposals. Last year, for example, according to an analysis by the American Association for the Advancement of Science (*Congressional Action on Research and Development in the 1992 Budget*, AAAS, January 1992), Congress appropriated a total amount for R&D that was within 0.1% of the Administration's request. Congress did, however, shift some funds around, adding to the requests for NIH and DOE and slicing some off the proposed budgets for NASA and NSF.

That's not to say that the R&D budget will be uncontroversial. The ink was barely dry on the budget when Representative George Brown (D–CA), chairman of the House Committee on Science, Space, and Technology, sharply criticized the amount proposed for defense R&D. At about $43 billion, it would account for 59% of the total federal R&D budget—only a shade lower than this year's 60:40 split even though the justification for some defense programs has collapsed along with the Soviet Union. "Although the trend is certainly in the right direction, the pace is clearly insufficient in light of both the declining military threat and the importance of civilian R&D to economic recovery," said Brown.

Big "Science" Scorecard
(millions of dollars)

Project	1992	1993 proposed	Change
Space Station	2,029	2,250	11%
Superconducting Super Collider	484	650	34%
Human Genome Project	164	175	7%
Strategic Defense Initiative	4,100	5,400	31%

SOURCE: NASA, OMB, DOD

Presidential Initiatives
(millions of dollars)

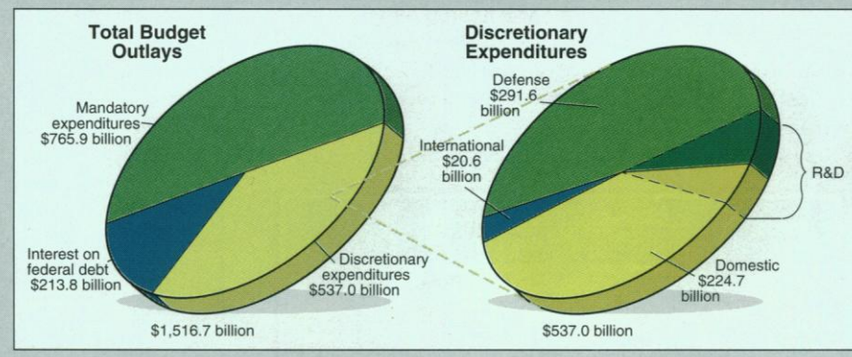
	1992	1993 proposed	Increase
High-performance computing and communications	665	803	23%
Advanced materials	1,659	1,821	10%
Biotechnology	3,759	4,030	7%
Global change research	1,110	1,372	24%
Math and science education	1,955	2,092	7%

It's hard to predict how defense R&D will fare on Capitol Hill this year, however. For one thing, defense planning is in flux as the United States and Russia are talking about substantial cuts in strategic nuclear weapons. And for another, the Administration is moving toward a policy in which major weapons systems would be developed and tested but not necessarily produced—a policy that would shift emphasis toward R&D. One thing is certain, however, the huge increase proposed for the Strategic Defense Initiative (SDI), which would grow from $4.1 billion this year to $5.4 billion in 1993, will make SDI once again a focus of controversy on Capitol Hill. Much of the increase would be aimed at developing a ground-based system for defense against limited or accidental attack.

Civilian big science projects will also attract congressional fire. Last year, the Space Station became the prime target in the R&D budget when the House Appropriations Committee, cheered on by 15 scientific societies who signed a statement critical of the project, recommended that it be terminated. In an impressive display of political muscle, however, NASA and its allies in the aerospace industry easily overcame the committee's opposition. There will be more complaints about the station this year, but congressional aides are predicting that it will not be in serious trouble. Instead, they suggest, the SSC might be vulnerable—especially if the Administration fails to secure substantial

Science and the Domestic Spending Squeeze

Your family income next year is projected to be $116,480. About $76,590 will be eaten up by mandatory payments for items such as taxes and your pension plan. Another $21,300 will go to pay interest on debts you have foolishly accumulated over the years. And, in an agreement worked out with your creditors, you can spend a maximum of $53,700 on living expenses, including housing, health care, food, and education. That still leaves you spending some $35,000 more than you earn. Multiply each figure by $10 million, and you have a snapshot of President Bush's 1993 federal budget.



Out of $1,516 billion in spending proposals, only $537 billion is so-called discretionary spending—money that is not already earmarked for items such as Medicare, Social Security, and interest payments that must be spent by law. Discretionary spending includes the entire amount proposed for R&D. According to a budget agreement worked out in late 1990 between Congress and the White House, the domestic portion of discretionary spending will increase by about the rate of inflation, projected to be around 3.3%, while the defense portion will decline by about 7%. This means that the increases proposed for civilian R&D—about 7%—must be taken from other domestic programs. Items slated for surgery include such popular programs as housing support and mass transit subsidies.

The competition for discretionary dollars will be played out in the appropriations committees in Congress. In particular, the National Aeronautics and Space Administration and the National Science Foundation will find themselves directly up against housing programs because they are included in the same appropriations bill as the Department of Housing and Urban Development. Some relief may come if defense spending is reduced by more than the budget agreement allows. That might permit domestic discretionary expenditure to rise. The White House, however, will argue that any extra savings be offset by election-year tax breaks. ■ **C.N.**

foreign contributions. So far, only South Korea has made a definite commitment.

The Administration's five inter-agency R&D initiatives (see chart p. 673) should get a smoother passage through Capitol Hill. These efforts have been put together by panels operating under the Federal Coordinating Council on Science, Engineering, and Technology (FCCSET, pronounced "fix-it"), a once-moribund committee that Bromley has resurrected to provide better planning and focus for programs that traditionally have been handled piecemeal by individual agencies.

Last year, three FCCSET initiatives were included in the budget: a nine-agency high-performance computing initiative aimed at increasing the speed and capacity of computer hardware by a factor of 1000 and the transmission rate of data networks by a factor of 100; an 11-agency global change research effort; and an 11-agency program in science and math education. In each case, Congress added to the budget request, and this year the Administration is coming back for more: $803 million (a 23% increase) for computing; $1.37 billion (24%) for global change; and $2.1 billion (7%) for education, with the biggest increases proposed for precollege programs. The Administration was sufficiently impressed with the reception last year that it has added two new initiatives—on materials R&D and biotechnology—and given all five efforts the symbolic title of "Presidential Initiatives."

According to Bromley, FCCSET is considering adding another special initiative next year, in advanced manufacturing R&D. For an administration that has long resisted putting money into industrial R&D, that would be a significant political breakthrough. But even in this budget there are signs that the Administration is softening its stance: It is proposing a 27% increase in support for manufacturing technologies by nondefense agencies, to reach a total of $321 million. Included is a new $105 million program in NSF and modest support

Civilian R&D: The Big Four Federal Spenders

National Institutes of Health

Biomedical researchers are likely to experience a sense of déjà vu when they glance at this budget. As in past years, while science agencies like the National Science Foundation are slated for percentage increases well into the double digits, the budget for the National Institutes of Health (NIH) would grow by only 4.9%. The Centers for Disease Control would fare a little better with a 7.6% increase, and the research programs of the Alcohol, Drug Abuse, and Mental Health Administration would rise by 5.8%. Congress usually adds to the Administration's request, however.

Within NIH's $9.4 billion budget, the sum allocated to research grants would increase by 7.1% to $5.3 billion. This would permit 461 more grants to be funded than in 1992, though the number of new and competing grants would decline slightly to 5800. Intramural research would grow more slowly, by 5%, while money specificially allocated to contracts and training would get no increase at all.

Included in NIH's budget is $873 million for AIDS research, an increase of only 3.8% over 1992. Two areas singled out for special attention are research on women's health and health problems of minorities, which would get a total of $89 million, up from $25 million this year.

Researchers shouldn't count on receiving some of NIH's funds anytime soon. The Administration is proposing that almost $620 million, mostly in research grants, be held up until 30 September 1993, the last day of the fiscal year. The idea is that the funds will actually be spent in fiscal year 1994, so they won't add to the 1993 deficit. The same trick is being played this year, with some $400 million being held back.

SOURCE: HHS

National Institutes of Health
(millions of dollars)

	1992	1993	Change
Research Project Grants	$4,927	$5,277	+ $350
(Number)	(21,671)	(22,132)	(+ 461)
Centers	787	788	+ 1
Research Training	309	309	–
R&D Contracts	644	644	–
Intramural Research	992	1,042	+50
Research Support	411	432	+21
Extramural Construction	12	12	–
Women's Health	25	44	+19
Minority Health	–	45	+ 45
Other Research	742	730	-12
NIH Facilities Repairs	104	73	-31
Total	**$8,953**	**$9,396**	**+ $443**
Full-time equivalents	14,907	15,139	+232

National Aeronautics and Space Administration

The National Aeronautics and Space Administration (NASA) drew up its wish list this year under strict instructions from Congress not to ask for real growth of more than 5% and a mandate from the White House not to seek more than $15 billion in toto. The "extremely constrained" budget that resulted, as NASA chief Richard Truly called it, is nonetheless fairly generous to science. While the funding for the entire agency would grow by only 4.5%—rising from $14.353 billion to a total of $14.993 billion—the budget for the Office of Space Science and Applications would increase by 9%, to $2.985 billion. This would permit a start to be made on two small lunar probes for launch in the late 1990s. The only other big category in NASA that would rise as rapidly is the Space Station, for which Truly is seeking $2.25 billion next year—an increase of 11%.

Sacrifices will have to be made to accommodate this growth. Truly's biggest single cut would do away with the program to build new rockets for the space shuttle, the Advanced Solid Rocket Motor project, based in the home district of House Appropriations Committee Chairman Jamie Whitten (D–MS). Truly said he was dropping this $469 million item because improvements made to the existing motors after the Challenger accident have worked well. Whitten may see it differently. Cuts are also being made in shuttle operations and in two major science programs. The Comet Rendezvous Asteroid Flyby (CRAF) mission will be canceled, a decision that will rankle with NASA's collaborators in Europe. However, according to one scientist who asked not to be named, Truly rescued another planetary mission from oblivion—the Cassini probe to examine the rings of Saturn—after appealing all the way to the president's office. But he did not save another well-rated science mission that would test aspects of Einstein's theory of general relativity, a project called Gravity Probe B. It will die, unless the group of researchers at Stanford who have saved it from the ax before can once again rally support for it in Congress.

for the Advanced Technology Program in the National Institute of Standards and Technology. The industrial research community is not yet impressed, however, and will be urging Congress to up the ante.

Academic researchers will also be pressing their case. The budget includes $11.5 billion for R&D at colleges and universities, a 5% increase over this year. But, as Bromley acknowledges, "even with these numbers we will be unable to remove the frustration felt by many in the academic research community" as more and more researchers chase fewer and fewer grants. According to a calculation in the budget document, the success rate for applications to NIH and NSF, corrected for multiple submissions, has declined from 40% to 33% in recent years.

There's one area of frustration among academic researchers that this budget makes no attempt to relieve: the unavailability of money for new research facilities. The budget document explicitly declines to funnel federal dollars into special facilities funds, as many in the universities and Congress have advocated. And that will only increase the incentive to go directly to Congress for such funds through the now well-trodden pork-barrel route. According to a survey by the Office of Science and Technology Policy, reported in the budget, scientific pork-barrel funding set an all-time record last year. There were 566 separate "earmarks" totaling a staggering $966 million, some $346 million of which went to academic institutions. Almost $500 million of the total earmarks came in budgets that were the same or below the 1992 request, which means that the funds were taken directly from other projects.

The budget will now be handled piecemeal by appropriations committees on Capitol Hill, which generally complete their work around the time the fiscal year begins on 1 October. ■ COLIN NORMAN

With reporting from Ivan Amato, David Hamilton, Richard Kerr, Eliot Marshall, Joseph Palca, and Richard Stone.

National Science Foundation

Amid all the red ink and slow growth that characterizes most of the federal budget, one agency stands out: the National Science Foundation (NSF). With a proposed budget increase of almost 18%, NSF would climb past the $3 billion mark for the first time. In 1987 the Reagan Administration proposed doubling NSF's budget by 1992; that target was missed, but NSF director Walter Massey elatedly points out that if this proposed increase is approved by Congress and followed up with a similar boost next year, the doubling would be achieved by 1994.

SOURCE: NSF

National Science Foundation
(millions of dollars)

	1992	1993 proposed	Change
Research	1,875	2,212	18%
Biological Sciences	274	321	17%
Computer Science	211	272	28%
Engineering	258	312	21%
Geosciences	404	472	17%
Math and Physical Science	623	726	17%
Social and Behavioral	86	108	26%
EPSCOR	18	0[1]	n/a
Education	465	479	3%
Instrumentation	33	33	0%
Antarctic	88	163[2]	85%
Critical Technologies Inst.		1	n/a
Salaries and Expenses	109	135	24%
Inspector General	3.5	4	14%
Total	2,573	3,027	18%

[1] Moved to education account in 1993.
[2] Includes about $90 million formerly paid by the Department of Defense.

All of NSF's research directorates would share in the largess, with each slated for increases of at least 17%. Part of these huge infusions of new cash will cover NSF's share of interagency special initiatives in high-performance computing (a 30% increase), materials science (20%), biotechnology (18%), and global change (50%). Indeed, NSF's part of these four programs combined would amount to $950 million, 43% of the agency's total research budget—up from $750 million and 40% this year. Growth in research support outside these favored areas would be more modest, but still well above the 7% average increase proposed for all civilian R&D.

The budget includes $105 million for a new program on advanced manufacturing. Two new engineering research centers would be established—focusing on advanced intelligent manufacturing and materials synthesis and processing—but no new science and technology centers are planned.

Education programs would get a more modest increase, only 3%. But that's not unusual. Every year, the Administration tries to hold back the growth in NSF's education directorate, and each year Congress adds to the request. Last year, for example, NSF requested $390 million and Congress appropriated $465 million.

How will all this play on Capitol Hill? If last year is any guide, quite well. Congress shaved about $88 million off the request for research in 1992 and added about $75 million to education.

Department of Energy

The Department of Energy (DOE) is proposing to increase its spending on R&D by 11%, from $2.70 billion to $3.01 billion. That looks like healthy growth—especially since overall federal domestic expenditure is frozen. But closer inspection reveals that more than half the increase would go to the Superconducting Super Collider. Its budget would grow by 34%, from $484 million this year to $650 million next, with an additional $133 million promised from the state of Texas. DOE is also hoping for another $100 million in 1993 from foreign contributors, though only India has made a firm commitment of $50 million so far.

Elsewhere in the DOE research budget, growth is relatively sparse—although even flat budgets look good to programs such as high-energy and nuclear physics that were told last fall to expect a 10% budget cut. Exceptions are areas of basic energy sciences that are tied into interagency initiatives in computer technology, materials, biotechnology, and global change. The department has also managed to include funds for major construction projects, including $30 million for the Fermilab Main Injector and $71.4 million for Brookhaven's Relativistic Heavy Ion Collider. As for research on conservation and renewable energy technologies, DOE is requesting $772 million—slightly less than Congress appropriated for this year but a huge increase over the $553 million DOE requested a year ago.

Growth in DOE's research budget would be more healthy if it were not for Congress's penchant for adding pork-barrel projects to the department's budget. According to Energy Secretary James Watkins, congressional "earmarks" added up to more than $117 million this year. "There's an enormous attack at the closing end of each budget cycle on Capitol Hill where you convert good research into bricks and mortar," he said. ■ C.N.