Science Escapes Brunt of Budget Ax

But spending on biological sciences would be hit, while support for military technology, physical sciences, and engineering would be increased; NIH would be the main casualty

ANYBODY reading the Reagan Administration's budget proposals for science and technology for fiscal year (FY) 1987 is likely to experience a strong feeling of déjà vu mixed with a sense of unreality. The main themes of massive increases for military technology, sharp boosts for physical sciences and engineering, and cuts in biomedical research could have been taken straight from previous Reagan budgets. And, as in previous years, the chances that Congress will go along with some of the Administration's proposals are virtually zero.

The sense of unreality about this budget stems in large measure from the fact that a substantial overall increase is being proposed for R&D at a time when severe cuts are being applied to government spending in an attempt to reduce the federal deficit. Obligations for R&D, including facilities, are slated to rise by some 16 percent, from $54 billion this year to $63 billion in FY 1987, while many other programs are being slashed or eliminated entirely. And the unreality is compounded by the fact that the figures were put together before last month's shuttle disaster, which means that much of the budget for the National Aeronautics and Space Administration could be meaningless.

The overall budget bears the marks of the Gramm-Rudman-Hollings legislation, which decrees that the federal deficit must be reduced from its current level of some $208 billion to $144 billion in FY 1987 (which begins on 1 October), and to zero in FY 1991. Unless these targets are met, the legislation would impose automatic, across-the-board cuts in most government programs. Although the constitutionality of the legislation is under review by the Supreme Court, a cut of 4 to 5 percent is almost certain to be applied in FY 1986 (see *Science*, 31 January, p. 443), and this is reflected in the budget documents.

In theory, at least, President Reagan's budget proposals would reduce the deficit to $143.6 billion next year, even though defense spending would increase substantially and no new taxes would be imposed. This feat would be achieved by axing a large range of domestic programs for which there is considerable political support in Congress. Thus there is likely to be a huge fight over the priorities in this budget, and R&D will be a part of it (see page 789).

As in past years, the rationale for increasing funding for R&D at a time of fiscal restraint is to support national defense and industrial competitiveness. At the same time, the Administration is continuing to insist that some applied research programs in nonmilitary areas should be left to private industry. The pressure to cut the deficit, says John McTague, Reagan's acting science adviser, "means that, in fiscal year 1987 and beyond, the federal government can fund only those activities that are necessary for it to fund, not those which are merely good and worthy."

The emphasis on national defense is reflected in the fact that military R&D, including weapons-related work supported by the Department of Energy, would go up by 25 percent, from $35.7 billion to $44.4 billion, while civilian R&D would be held roughly constant at about $16.4 billion. This would mean that the military would claim 73 percent of the federal R&D budget, up from about 50 percent in 1980. Virtually all this massive increase for defense R&D would go into the applied research and development end of the R&D spectrum; basic research supported by the Department of Defense would be held approximately constant in FY 1987. (These figures do not take into account inflation, which is projected to be about 4 percent in FY 1987.)

Enhancing industrial competitiveness is the stated reason why disproportionate increases are being proposed for basic research in physical sciences and engineering. Departments and agencies such as the Department of Energy, the National Science Foundation, and NASA would see their combined spending on basic research increase by more than 13 percent, while agencies that support primarily life sciences would be given only a 1.7 percent boost in their basic research budgets (see table on p. 786).

The most prominent casualty of this proposed emphasis on the physical sciences would be the National Institutes of Health. As in past years, the Administration is attempting to cut NIH's budget in two stages. It has proposed a rescission in appropriated funds for the current fiscal year, followed by a deeper cut for next year. If the Administration were to get its way, NIH's total budget

CONDUCT OF RESEARCH AND DEVELOPMENT BY MAJOR DEPARTMENTS AND AGENCIES

(In millions of dollars)

Department or agency	Obligations			Outlays		
	1985 actual	1986 estimate	1987 estimate	1985 actual	1986 estimate	1987 estimate
Defense-Military functions	31,099	33,485	41,823	27,878	29,267	32,693
Health and Human Services	5,444	5,524	5,471	4,997	5,561	5,532
(National Institutes of Health)	(4,824)	(4,905)	(4,672)	(4,419)	(4,957)	(4,752)
Energy	4,901	4,785	4,886	4,900	4,778	4,819
National Aeronautics and Space Administration	3,235	3,594	4,051	2,970	3,528	3,743
National Science Foundation	1,346	1,334	1,508	1,186	1,338	1,455
Agriculture	941	922	907	889	913	911
Transportation	430	364	277	417	416	331
Interior	389	381	345	414	403	351
Environmental Protection Agency	320	334	310	275	318	332
Commerce	399	380	297	373	383	311
Agency for International Development	210	206	203	204	208	209
Veterans Administration	227	186	194	215	182	187
All other [1]	550	531	531	527	538	544
Total	**49,491**	**52,024**	**60,803**	**45,244**	**47,832**	**51,418**

[1] Includes the Departments of Education, Justice, Labor, Housing and Urban Development and Treasury, the Tennessee Valley Authority, the Smithsonian Institution, the Corps of Engineers, the Nuclear Regulatory Agency, and the Federal Emergency Management Agency. [Source: OMB]

for FY 1986 would drop from the $5.36 billion approved by Congress to $5.07 billion—about the same level as FY 1985—and it would decline further in FY 1987 to $4.94 billion. As in past years, Congress is unlikely to agree.

The parsimonious treatment of NIH would have a severe impact on the flow of R&D funds into the universities. According to an analysis by the Office of Science and Technology Policy, federal support for academic science, after correction for inflation, will drop slightly between FY 1985 and FY 1986, after 3 straight years of healthy increases. In FY 1987, it would just climb back to the FY 1985 level.

But that is not the whole story for academic science. The Administration is again planning an assault on the indirect costs paid to universities as overhead on research grants and contracts. Indirect costs vary widely from university to university, and they have generally been growing faster in recent years than the direct costs of doing research.

For FY 1986, the Department of Health and Human Services is proposing to fix one component of indirect costs—the portion charged to university administration—at a flat 26 percent of direct costs. Next year, it will drop the rate to 20 percent. A similar proposal is said to be under consideration by the Office of Management and Budget for all government departments and agencies, but it is still under negotiation in the White House. Groups that represent university administrations are outraged that they have not yet been consulted on the proposals.

Last year's budget imposed a freeze on new R&D programs. This year, a few new starts have been proposed. They include:

■ The National Aerospace Plane. The Administration is proposing to speed up development of a supersonic aircraft capable of flying to the upper edges of the atmosphere at speeds up to 25 times the speed of sound. The plane, which got enthusiastic backing last year from former science adviser George Keyworth II (*Science*, 10 January, p. 105), would be capable of lifting payloads into orbit and reaching any point on the globe within 3 hours. Some $200 million has been proposed for development of the plane in FY 1987—$45 million from NASA and $155 million from DOD—for what could ultimately be a $3-billion project. The idea, which Reagan dubbed the "Orient Express" in his State of the Union address, was warmly received by some key members of the House Science and Technology Committee at a hearing on 6 February. But it may get a frostier reception from much of Congress at a time of tight budgets.

■ A 1- to 2-GeV synchrotron. The Department of Energy has selected the Advanced Light Source at the Lawrence Berkeley Laboratory as the next major materials science facility. A construction start has been proposed for FY 1987, and the total cost is expected to be about $100 million. The selection follows three separate studies of priorities for materials science facilities over the past year, but DOE's choice may prove to be controversial since the studies gave highest scientific priority to a higher energy machine in the 6-GeV range. However, the Advanced Light Source, which was first proposed by DOE in FY 1984, is furthest along in the development process.

■ The Continuous Electron Beam Accelerator Facility (CEBAF). This machine, which was to have been in the lineup for a new start in FY 1986 but got caught in last year's freeze, was rated top priority for nuclear physics research by an advisory panel 2 years ago. It is scheduled to be built at Newport News, Virginia, by a consortium of southeastern universities.

■ The Topography Experiment (TOPEX). A joint U.S.–French satellite to study the surface topography of the global oceans, TOPEX is the only major new start in NASA's current budget. Planned for launch in 1991—by the European Ariane rocket—it was also bumped from last year's budget because of the freeze on new starts.

How is Congress likely to treat the general themes in the R&D proposals? If past years are any guide, it will reduce the totals proposed for military research and boost budgets for biomedical research. What it will do with NASA's budget in the wake of the shuttle calamity is anybody's guess, but to judge by comments from legislators since the explosion, support for manned space programs is likely to remain high.

As for the proposals for increasing basic research in physical sciences and engineering, there is likely to be sympathy in Congress. But with many programs that are politically more popular scheduled for the knife, the levels proposed may be difficult to sustain. Last year, it should be remembered, Congress failed to endorse the healthy increases proposed for NSF.

The following are the Administration's detailed proposals for individual programs and agencies:

■ **Defense.** The $44.4 billion proposed for military R&D in the departments of Defense and Energy is heavily weighted toward applied research and development. Less than 3 percent is officially designated as basic research.

Indeed, DOD's basic research would be held approximately constant between FY 1986 and FY 1987, at about the $1-billion

CONDUCT OF BASIC RESEARCH BY MAJOR DEPARTMENTS AND AGENCIES

(In millions of dollars) [1]

Department or agency	Obligations			Outlays		
	1985 actual	1986 estimate	1987 estimate	1985 actual	1986 estimate	1987 estimate
Agencies supporting primarily physical sciences and engineering: [2]						
National Science Foundation	1,262	1,256	1,423	1,111	1,260	1,372
Defense—Military functions	860	940	987	705	834	759
Energy	926	922	1,045	896	907	1,018
National Aeronautics and Space Administration	728	857	1,085	704	870	1,018
Interior	131	132	118	142	145	121
Commerce	23	22	20	23	21	20
Other Agencies [3]	12	13	11	11	14	13
Subtotal	3,942	4,142	4,688	3,592	4,051	4,321
Agencies supporting primarily life and other sciences: [4]						
Health and Human Services	3,229	3,290	3,353	2,954	3,303	3,381
(National Institutes of Health)	(3,024)	(3,077)	(2,938)	(2,765)	(3,099)	(2,988)
Agriculture	447	434	434	406	423	427
Smithsonian Institution	71	71	79	61	66	73
Environmental Protection Agency	39	39	37	25	36	38
Veterans Administration	15	15	16	16	15	15
Education	12	11	10	6	6	11
Other Agencies [5]	15	15	14	15	16	14
Subtotal	3,828	3,875	3,942	3,483	3,865	3,958
Total	**7,769**	**8,017**	**8,630**	**7,076**	**7,915**	**8,279**

[1] Amounts reported in this table are included in totals for conduct of R&D.
[2] Includes mathematics and computer sciences.
[3] Includes the Corps of Engineers, the Federal Emergency Management Agency, the Tennessee Valley Authority, and the Department of Transportation.
[4] Includes psychology and social sciences.
[5] Includes the Departments of Labor, Justice, and Treasury, and the Agency for International Development. [Source: OMB]

level, following a healthy increase from FY 1985 to FY 1986. Within this total, a new Universities Research Initiative would be continued, although it would not grow as fast as some in the university community would like. The initiative, which will support university facilities, high-risk academic research, fellowships, and multidisciplinary research centers, has a budget for FY 1986 of about $90 million. Next year, the Administration is proposing $50 million. Although that may look like a cut, part of this year's funds will be spent next year and the plan is to spend about $75 million in each of the first 2 years. DOD officials are hoping to go up to about $100 million in FY 1988, the third year of the program.

Within the rest of DOD's R&D budget, the Strategic Defense Initiative (SDI) is clearly the big winner. The total SDI budget is slated to rise from $2.8 billion this year to $4.8 billion in FY 1987, an increase of more than 70 percent. In addition, spending on SDI in DOE would climb from $288 million to $603 million, chiefly for work on directed energy weapons. It is, however, highly unlikely that Congress will agree to these huge increases. Last year, for example, the Administration asked for $3.7 billion in FY 1986, but Congress reduced it to $2.8 billion—even though the Administration applied heavy pressure by arguing that a vigorous program was vital for the U.S. position in arms control negotiations with the Soviet Union.

Within the proposals for SDI, the largest increase would go to directed energy weapons, especially free-electron lasers and ground-based lasers. A substantial boost is also requested for surveillance and tracking programs and kinetic energy weapons, and there is also a proposal for a "national test bed facility" for SDI simulations.

Elsewhere in DOD, the largest R&D increase will support development of a small intercontinental ballistic missile, the Midgetman, to be placed on mobile launchers.

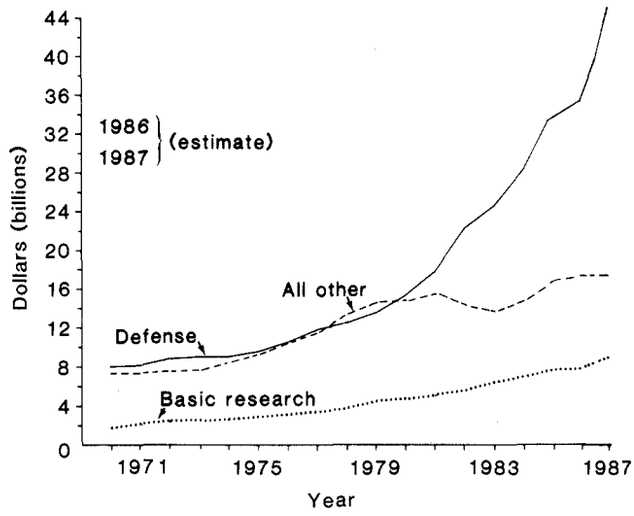
■ **Biomedical research.** By now it has become almost routine. The Administration proposes little or no increase in the budget for NIH, Congress approves a hefty increase, and the Administration comes back and tries to undo Congress's work. This year, the pattern is repeated in spades.

A year ago, the Administration proposed a budget for NIH in FY 1986 that would have been almost $300 million below the FY 1985 level. Congress said "no," and instead approved a budget of $5.36 billion—some $300 million above FY 1985. The total will, however, be reduced to $5.13 billion by the automatic cuts imposed by Gramm-Rudman, and now the Administration is proposing a rescission of another $60 million, bringing NIH's FY 1986 total to $5.07 billion, almost the same as last year. For FY 1987, the total would go down to $4.94 billion, if the Administration gets its way. Once again, Congress is very unlikely to give the Administration its way.

The budget documents depict the Administration's proposals for NIH as an effort "to stabilize federal support for NIH" by allowing it to support a total of 18,000 investigator-initiated grants per year. In past years, attention has been focused on how many new grants NIH will be able to fund but, the budget documents point out, "Since NIH usually promises 3 years of support to research grant recipients, congressional increases in new grants result in unbudgeted costs for subsequent years." Clearly, the fight over NIH's budget will continue, but in a year when cutting the federal deficit is the chief game in town, the battle will be more intense.

The Administration has also proposed a couple of changes in the budget for acquired immune deficiency syndrome (AIDS) that are likely to draw some attention. The first is a proposal for a cut in the budget already approved by Congress. The Administration is asking Congress to rescind some $41 million from the $234 million it voted for AIDS research and education in FY 1986. Included in this proposed rescission is $16 million for a program to demonstrate alternative methods of delivering health care to AIDS patients, $14 million for research, and $11 million for education programs. For FY 1987, the Administration wants to spend $213 million. The Administration says it still regards AIDS as its "number one health priority," but says the funds approved for FY 1986 could not be spent wisely. Congress is likely to disagree, especially since it largely followed recommendations of Administration officials in formulating the appropriations.

The other AIDS-related proposal is to establish an office in the Department of Health and Human Services, under the assistant secretary for health, to plan and coordinate the AIDS effort. All funds for AIDS would be channeled through the office, in accordance with a comprehensive plan for research and control. This proposal is likely to be approved by Congress. Indeed, last year Congress itself recommended the appointment of an AIDS czar. Reagan has also asked Surgeon General C. Everett Koop to prepare a major report on AIDS.



The militarization of R&D

The Administration's budget would put 73 percent of federal R&D dollars into military programs. In 1980, military and nonmilitary R&D spending were about equal.[Basic research funds are included in the totals for defense and other programs.]

■ **National Science Foundation.** NSF's proposed 9 percent boost for research support is "really a moderate increase" in view of the opportunities, says NSF director Erich Bloch. In view of the major cuts in the budgets of most other nondefense agencies, however, it is remarkable.

Engineering again comes out the chief winner, with a proposed increase of 14 percent, in part to expand the engineering research centers program. Six centers are already in operation, and the budget envisages eight or nine more by the end of FY 1987. Mathematical and physical sciences would get a 9.6 percent boost—16 percent for mathematics alone—and biological, behavioral and social sciences would rise by 8.6 percent. The Astronomical, Atmospheric, Earth, and Ocean Sciences directorate would get the smallest increase of the research directorates, 5.7 percent, in part reflecting a stretch-out in the schedule for completing the Very Long Baseline Array. It is now scheduled for completion in 1991.

Four areas have been singled out for special attention next year. Funding for biotechnology would be increased by $20 mil-

lion, reaching $106.5 million. Support for computational science and engineering would by boosted throughout NSF's directorates, rising from $57 million to $84 million, with emphasis on multidisciplinary, collaborative programs. Some $18 million is requested for a program involving a series of interrelated global geoscience studies. Part of the international Global Habitability project, this is aimed at gaining a better understanding of phenomena and processses such as earthquakes, El Niño, acid rain, and deforestation. And NSF is requesting a modest increase for programs aimed at encouraging participation of women and minorities in science and engineering.

Finally, NSF support for science education would go up from $87 million to only $89 million. However, since the Reagan Administration tried to eliminate these funds entirely when it first came to power, even a minor increase in a year of tight budgets is something of a victory for supporters of the program.

■ **Space program.** Until the cause of the shuttle disaster and its implications for the space program have been ascertained, NASA's budget proposals should be regarded as, at best, preliminary. Since it would cost some $2 billion to replace the lost orbiter, whatever NASA eventually decides will have an enormous impact on its budget.

For the moment, at least, NASA is planning to go ahead with the space station on the schedule set last year. Some $410 million has been requested—$100 million less than NASA wanted—to move the space station program from the R&D to the development phase, with the aim of getting the thing in operation by 1994. A preliminary design, incorporating contributions by other countries, is supposed to be ready by 1 April.

NASA is also requesting funds for the National Aerospace Plane and the TOPEX mission mentioned above. There has been some speculation that development of the aerospace plane might be accelerated to take some of the load off the shuttle fleet. McTague told the House Science and Technology Committee that the plane is expected to put payloads into near-earth orbit for less than 10 percent of the cost of sending them up on the shuttle. But he added that a prototype is unlikely to be ready before the early 1990's and full-scale development will take several more years. As a replacement for Challenger, the aerospace plane is clearly not a contender.

■ **High energy physics.** With two major new accelerator projects—the Tevatron at Fermilab and the Stanford Linear Collider—expected to be in full-scale operation by this time next year, FY 1987 should be a good year for U.S. high energy physics. It is also likely to be a year of intense political discussion about the next big machine, the Superconducting Super Collider (SSC).

A series of reviews and decisions over the next few months will set the stage for this debate. On 1 April, the SSC design group is scheduled to submit its report to DOE, and this will kick off a major internal review of the project during the spring and early summer. If DOE decides to back the SSC, funds to begin construction will be included in the department's preliminary budget proposals for FY 1988, which will be forwarded to the Office of Management and Budget in mid-September. If the White House goes along—and this would probably require presidential endorsement—a formal proposal will be sent to Capitol Hill this time next year, in the FY 1988 budget. Then the debate will begin in earnest.

A series of reviews and decisions over the next few months could determine the fate of the Superconducting Super Collider.

Meanwhile, the Administration has requested a budget of $547 million for high energy physics in FY 1987, an increase of $52 million over this year's funding. The increase will permit operation of existing facilities at about 50 percent of their design capacity; a 75 percent usage level is considered optimal, according to DOE officials.

■ **Energy research and development.** With oil prices dipping below $20 a barrel, the Administration may have an opportunity this year to force through changes that it has long pursued in federal support for energy R&D. It has proposed major reductions in the budgets for research on fossil fuels, energy conservation, renewable energy sources, and some nuclear power programs, arguing that these are not the responsibility of the federal government.

The fossil energy budget would be slashed from $343 million to $150 million, mostly by cutting out applied research and development projects. The conservation budget would drop from $171 million to $71 million, and the renewable energy budget would be cut from $174 million to $92 million.

As for nuclear power, although the total funding would drop by only $44 million, from $377 million to $333 million, research on advanced reactors would be slashed from $129 million to $50 million, while work on nuclear reactors for space and defense needs would climb from $20 million to $72 million. This boost reflects programs to meet the large power demands of space-based "Star Wars" weaponry.

Once again, the magnetic fusion program would take a substantial hit, dropping from $365 million in FY 1986 to $333 million next year. This would be the third straight year of major cuts. The chief impact, according to DOE officials, would be to concentrate on development of tokamak machines. This means that the Lawrence Livermore Laboratory's Mirror Fusion Test Facility, which is being upgraded at a cost of $364 million, would be mothballed without ever being switched on.

■ **Environmental, agricultural, and earth sciences.** Aside from NSF's $18-million increase in support for global geoscience programs, the budget gives environmental and earth science research relatively short shrift.

The Environmental Protection Agency's R&D budget would drop by 6 percent, to $295 million, with extramural programs taking a $21-million cut while intramural research would be boosted by $4 million. Similarly, the budget of the U.S. Geological Survey would decline to $396 million, $34 million less than Congress appropriated for FY 1986. Research on acid rain, which is supported by six separate agencies, would rise by only $2 million, from an estimated level of $83 million in FY 1986.

But these proposals look positively magnanimous compared with the Administration's budget for the National Oceanic and Atmospheric Administration. Once again, the Sea Grant Program and the Coastal Zone Management Program are scheduled for the ax, and the Administration is proposing to limit NOAA to a single polar-orbiting weather satellite instead of a dual-satellite system. These proposals have all been made in previous budgets, and Congress has always rejected them.

As for agricultural research, the Agricultural Research Service would get a boost from $478 million to $513 million. Department officials say they will continue recent efforts to shift the ARS budget toward basic research and emphasize the development of export products. ■ COLIN NORMAN

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