Carter Budget Tilts "Back to Basics" for Research

In his State of the Union message on 19 January, President Jimmy Carter all but said he is giving up his hope of balancing the federal budget by 1981. Nevertheless, the budget he has just sent to Congress for fiscal year 1979 reflects his strong fiscal conservatism. But, given the President's insistence on holding down federal spending, basic research fared comparatively well, as it did for the past 2 years under the Administration of former President Gerald R. Ford (*Science*, 28 January 1977). In keeping with the tone of his recent remarks about science, Carter had this to say in the State of the Union message:

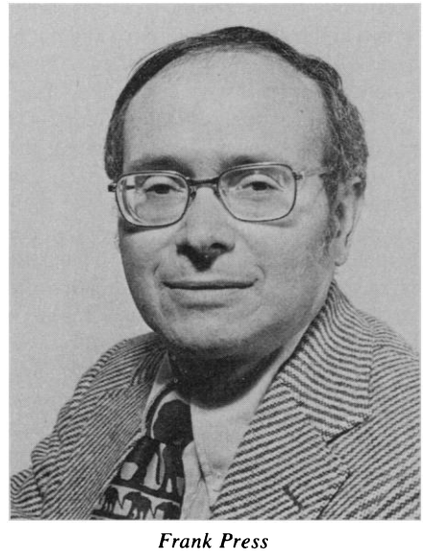
> The health of American science and technology and the creation of new knowledge is important to our economic well-being, to our national security, to our ability to help solve pressing national problems in such areas as energy, environment, health, natural resources. I am recommending a program of real growth of scientific research and other steps that will strengthen the Nation's research centers and encourage a new surge of technological innovation by American industry. The budget increase of 11% for basic research will lead to improved opportunities for young scientists and engineers, and upgraded scientific equipment in the Nation's research centers. I am determined to maintain our Nation's leadership role in science and technology.

In response to a question at the annual budget briefing for the press, White House science adviser Frank Press said the research and development budget for FY 1979 marks the "third year of a trend toward increased spending," adding that this year it is at an even more "accelerated rate."

Press also called the FY 1979 R & D budget "unique" because of the President's involvement in the science budget process from its start in early spring and because of his strong personal commitment to the philosophy it represents with respect to spending for science. This budget, Press says, signals a new commitment to basic research, which overall will be increased by about 6 percent (not 11) in real, after-inflation dollars if the President has his way with Congress. Support of basic research, Press maintains, will come at the expense of demonstration projects (such as the Clinch River Breeder program), some of which are already on line and others still in planning stages, that will be either scrapped or postponed. When the cutbacks in these applied areas are merged with the increases in basic research in a total federal research and development (R & D) budget, the overall increase is 6.1 percent above 1978 for a proposed total of $27.9 billion. Although the increase for R & D spending barely keeps pace with inflation, obligations specifically directed at basic research—$3.6 billion—are 10.9 percent above last year's level of slightly less than $3.3 billion.

Press attaches particular importance to the way in which this year's R & D budget was put together. In an interview with *Science*, he described the process as one that began last spring with a series of meetings designed to sort out the issues and develop an overall science budget philosophy before anyone started talking dollars and cents. "We felt it was necessary first to evaluate the state of American science," Press recalls. "We found it to be basically sound, but not as healthy as we would like."

To develop a budget philosophy, Press and W. Bowman Cutter, an executive director of the Office of Management and Budget (OMB), met with Vice President Walter Mondale, with university presidents, industrial leaders, and government agency heads. They also met with Bruce Smith and Joseph J. Karlesky, authors of a National Science Foundation (NSF) study on "The State of Academic Science: The Universities in the Nation's Research Effort" (*Science*, 10 June 1977). And they took into consideration other reports on various aspects of the nation's scientific enterprise by the NSF and the National Academy of Sciences. Among their conclusions were these: (i) it is increasingly difficult for young Ph.D.'s to get jobs, in part because of an entrenched, aging faculty, (ii) the country is beginning to lag in scientific instrumentation, and (iii) the quality of once high-caliber science departments is slipping.



Frank Press

The back to basics philosophy having been set, the next step was to convince cabinet members and agency heads to support it when it came time to draft specific agency budgets—making decisions about what to put in and what to leave out. In what veteran budget watchers agree was an unusual move, Press and Cutter went from department to department to argue their case with Defense Secretary Harold Brown, Energy Secretary James Schlesinger, Health, Education, and Welfare Secretary Joseph A. Califano, Jr., and others. (Cooperation between the White House science office and OMB is said to have been unusually good this year.)

All in all, Press believes he has won his case on basic research, although he readily acknowledges that the test will be in getting Congress to authorize the funds and in how the different agencies then spend them. For instance, with respect to his plans to increase opportunities for young scientists and improve the country's scientific instrumentation, the budget documents contain no specific proposals on these points, nor special funds for them. Press hopes that these problems will be addressed naturally, as agencies spend their basic research funding increases. But uncooperative agencies could scuttle the whole effort were they not to spend the money in accordance with Press's philosophical priorities. Press also says that the demonstration projects throughout government were judged against a set of criteria developed during his analysis of the health of American science and technology.

And as always, there will be Congress to contend with, particularly in light of the cutbacks of several demonstration projects. Some of these have strong congressional support, and it is likely that Congress will try to restore some projects the President is proposing to do without. So the budget that the President submits in mid-January is only the begin-

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ning of a story that cannot be finally written for several months.

National Institutes of Health

Philosophically speaking, the proposed budget for the National Institutes of Health (NIH) does what scientists have been saying it should for several years now: it tilts toward basic research. In terms of dollars, however, the NIH budget is not one to get carried away with. It is a standstill budget with a rate of growth that does not even keep up with inflation. (The proposed increase is a mere $4.2 million for an NIH total budget of $2.8 billion.)

Nevertheless, NIH director Donald S. Fredrickson says that the situation is not all bad. "This may be a good year to step back and take a good look at what we should be doing," he observes, adding (in a phrase that is pure Fredrickson) with the new emphasis on basic research, "The sand is being washed back on the shore." During the past several years, NIH has been pushed by political pressures to spend more and more money on demonstration projects (such as those to get new cancer drugs out to community hospitals) and large-scale clinical trials (such as those designed to prove that cholesterol-lowering drugs reduce the risk of heart attacks). Fredrickson notes that it is time to ask hard questions about whether such efforts, which are enormously costly, can actually provide the answers they're supposed to.

Personally, Fredrickson is sympathetic—even pleased—with the back to basics philosophy, but he concedes it will be tough to implement inasmuch as it means "reprogramming some $90 million to $95 million" within the NIH budget. Fredrickson predicts that this will mean delaying a number of planned projects rather than wholesale abandonment of ongoing demonstration programs or clinical trials. However, he does foresee some specific changes—among them, a switch from large contracts to smaller investigator-initiated grants in the cancer virology program that has dominated the National Cancer Institute budget for 6 or 7 years.

The one institute that is in line for a substantial increase is the National Institute of Child Health and Human Development, which is being allotted $33 million in new money. The bulk of it—$29 million—is earmarked for research on human reproduction and for studies on the development of human fetuses and infants. Califano says, "This may be the most important item in the budget." This singling out of NICHHD is in keeping with the President's avowed interest in children and, as Califano says, is in response to the virtual epidemic of teenage pregnancies in this country. (Last year, an estimated 1 million teenagers became pregnant and more than half chose to keep their babies.) Both Carter and Califano are dead set on finding "alternatives to abortion" for coping with the problem.—BARBARA J. CULLITON

National Science Foundation

A major beneficiary of Carter's interest in basic research, as expressed in OMB director Thomas McIntyre's overall budget message for the press, was the National Science Foundation. Although the 1979 NSF budget proposal reflects a slightly slower growth rate than in the past few years, and thus this Administration's overall cost-consciousness, the Foundation's budget authority would grow by $70 million to $940.9 million, or a 2.2 percent real growth in addition to the 6 percent estimated as lost to inflation. That portion of the budget allocated for grants to colleges and universities will itself rise an overall 9 percent, according to NSF director Richard Atkinson.

Additional features of the budget that were highlighted in Atkinson's briefing are:

- An increase for Mathematical and Physical Sciences and Engineering of $22 million, particularly for conversion of the Cornell University synchrotron into a colliding beam facility, and for submicrometer research.
- An increase for Astronomical, Atmospheric, Earth, and Ocean Sciences of $17 million, partially for a convective storms program and for new geochemistry instrumentation.
- An increase for Biological, Behavioral, and Social Sciences of $15 million, much of it for studies of the political economy in the social sciences area, which had been targeted for a funding increase following a National Academy of Sciences report last year.
- The largest percentage increase—27 percent, or $16 million—went to the newly reorganized Applied Science and Research Applications Directorate (*Science*, 30 September 1977), ending the long funding slide that had plagued its predecessor, RANN, and indicating the strength of its integrated basic research and problem-focused research efforts.
- A slight decrease in funding for Scientific, Technological, and International Affairs, reflecting the end of preparations for the upcoming U.N. Conference on Science and Technology and improved efforts by the private sector in information science, according to Atkinson.
- An increase for Science Education Activities of $3.6 million, largely for a program to increase participation in science by minorities at the junior high school level, reflecting the concerns of Atkinson and science adviser Frank Press that young people are exiting from science curricula at that point.

National Aeronautics and Space Administration

Although the White House Office of Science and Technology Policy has a study of national space policy currently under way, the beginnings of a Carter "space policy" are already reflected in the 1979 budget proposals for NASA, according to Frank Press.

Under the proposals, the agency's budget would grow by 7.5 percent to $4.37 billion, and four major new projects would be developed: the solar polar satellite, to study radiation near the sun's polar regions ($13 million); an earth radiation budget satellite, to study the net amount of radiation absorbed by the earth in particular regions ($8 million); and a halogen occultation experiment, to measure from a satellite the effect of chlorine on ozone in the upper atmosphere ($6.1 million); and a solar mesospheric explorer satellite, to study the effect of solar radiation on ozone in the mesosphere ($5 million). Significant new funds would also be added to existing projects—the LANDSAT-D earth resources survey satellite and the Space Telescope—but a major program, the Space Shuttle, would be cut back from an expected five shuttle orbiters to only four.

This last decision was made by Carter personally, according to NASA administrator Robert Frosch. Not satisfied with OMB recommendations for cutting the project, NASA officials went directly to Carter to discuss the "full range of arguments, from three orbiters and one launch site to five orbiters and two launch sites," he said. Eventually they ended up with the compromise of four orbiters and two launch sites.

Although Frosch told *Science* that the shuttle was the only project discussed specifically with the President, it is known that other NASA priorities did not fare too well at OMB. After the application of zero-based budgeting techniques, NASA recommended that major budget emphasis be placed on space applications and aeronautical research and technology, followed by space science and then the provision of current and future space capabilities. The largest percentage increase granted by OMB went to space sciences, however, followed by

space and terrestrial applications and then aeronautical research.

An explanation for the rearrangement may be found in Carter's previously noted enthusiasm for basic research, and in the budget statement:

> This administration intends to give increased emphasis to the use of existing capabilities for scientific and practical applications, in contrast to the development of major new capabilities beyond the shuttle, such as a large manned space station.

With the statement of Press that this year's NASA budget "represents the slope of a curve," the Administration's emphasis in the current proposals may be expected to become even more pronounced over the next few years.

Environmental Protection Agency

The executive budget process that has just been completed was the first that was supposed to involve zero-based budget (ZBB) techniques, a management tool close to the heart of President Carter that is designed to encourage agencies to justify each expenditure and rank programs according to specified goals. What all that can mean, of course, is a lot of paperwork and confusion, but at one federal agency the process was intensively applied with apparently dazzling results. That agency was the Environmental Protection Agency (EPA), whose budget took a real (inflation-corrected) jump of 33 percent in the 1979 proposals to reach $1.1 billion, and whose efforts have been held up as an example by the White House to officials at other agencies.

Although EPA did not apply ZBB completely by the book, meaning the gospel of its creator, Peter Pyhrr, what it amounted to was a division of the agency's programs into distinct units, and then a ranking of the units by pyramiding levels of management. "At each level, it forced people to really contemplate what the agency's responsibilities are, consider their own work and the work of others in light of these responsibilities, and then to find the most efficient ways of doing the things they found most important," according to William Drayton, the EPA assistant administrator for planning and management.

In practical terms, ZBB resulted in diminished emphasis on programs perceived to be less important than others, and the consequent transfer of more than 600 people to those deemed more important. More people and money, for example, were directed to:

- safe drinking water, which was seen as a more serious problem than, for example, hazardous waste disposal (26 percent increase in funding);
- toxic substance control, for expanded analysis and control of hazardous chemicals as part of the implementation of the Toxic Substances Control Act (97 percent funding increase);
- pesticide registration, for review of the safety of 40,000 untested pesticide products (29 percent funding increase); and
- overall enforcement of current standards (29 percent funding increase).

As a result of ranking alternative agency priorities, a decision was made to increase research and development on health effects of pollution—particularly the relationship of cancer incidence to environmental pollution, the effects of acid rain, and an assessment of pollution exposure levels—and to decrease the amount of research on ecological pollution effects. Similarly, less emphasis will be placed on noise pollution control: "This was a direct result of ZBB," according to Drayton. "The public is very supportive of the program and we all have an aversion to noise here at EPA, but the people and resources for new priorities have to come from somewhere. As far as we know, very few people are being killed right now because of noise."

—R. JEFFREY SMITH

Table 1. Federal funding for conduct of basic research by major agencies (millions of dollars). [Source: Office of Management and Budget]

Department or Agency	FY 1978 estimate	FY 1979 estimate
Health, Education, and Welfare	863	992
(National Institutes of Health)	(763)	(856)
National Science Foundation	688	755
National Aeronautics and Space Administration	468	520
Energy	433	468
Defense (military functions)	321	364
Agriculture	245	262
Interior	158	164
Smithsonian Institution	31	33
Commerce	27	31
Environmental Protection Agency	20	28
All Other	35	31
Total	3288	3647

Department of Defense

Military research, which comprises some 45 percent of the total federal research budget, will receive a healthy increase of 9 percent, or 3 percent above inflation, if the $12.7 billion budget for FY 1979 proposed by the President is approved by Congress in the coming year.

The increase in defense research reflects not only the Administration's advertised interest in strengthening American research but a general emphasis in this year's proposed budget on defense matters. The entire defense budget proposed is $126 billion, or $9.2 billion above the FY 1978 level, and reverses the recent trend of steady decreases in DOD's share of the total federal budget.

The Carter research budget for the DOD increases some trends that were begun at the close of the Ford Administration. For instance, basic research funding to colleges and universities will increase by 11.2 percent, pursuant to a policy begun by Ford's last defense research chief Malcolm Currie of rebuilding DOD's ties to college campuses, which were severed during the period of the Vietnam war. In FY 1979, the DOD will spend $384 million on college and university campuses. Much of this money will go for increases in basic research. The OMB estimates that DOD's basic research budget will increase 13 percent for FY 1979, to $364 million.

Funding for one of DOD's key research agencies, the Advanced Research Projects Agency, will also increase by approximately $50 million to $337 million.

The defense research budget also reflects the Carter Administration's strategic policy decisions and contains some surprises. The decision not to produce the B-1 bomber, for instance, is reflected in a whopping decrease in funding for completion of the fourth and last B-1 prototype, from $400 million in FY 1978 to $105 million in FY 1979. These B-1 cuts were the subject of intense controversy in Congress last year, where pro–B-1 members hoped to keep the program alive. The 1979 proposed cut is also likely to be the subject of controversy on Capitol Hill this year.

By the same token, the defense research budget increases funds for work on cruise missiles, the long-range, unmanned missiles that the Administration decided to develop as a substitute for the B-1. In FY 1979, DOD will spend $642 million on three separate cruise missile R & D programs—almost twice the amount it will spend at colleges and universities and six times the amount spent on the B-1.

One surprise in the research budget for the Air Force is that not more was proposed for developing the mobile M-X

missile, which is to be the next generation of land-based, strategic missiles, and the development of which was approved earlier by Defense Secretary Brown. The FY 1979 budget contains only a modest increase, to $158 million, for M-X development, and at a budget briefing Brown was cautionary about the program's future. He said that research was needed on the public acceptability and basing modes of the missile before full development could proceed. The missiles would be hidden in underground trenches or under shell-type domes so that an enemy could not be certain of destroying them in a first-strike nuclear attack.—DEBORAH SHAPLEY

Department of Energy

The Department of Energy (DOE) is sending its maiden budget request to Congress with ambitious plans predicated on the eventual passage of the long-stalled National Energy Act. Formed on 1 October 1977, DOE came into existence with 19,100 employees and an inherited $10.3 billion budget. Now it is asking for $12.6 billion for FY 1979, for more than $1 billion in supplemental spending authority for the current budget year, and for still other energy-related tax expenditures that do not show up in the DOE budget.

This display of budgetary vigor and program growth does not extend, however, to research and development despite a total energy R & D budget of nearly $3.3 billion. DOE is proposing a $150 million cut in the breeder reactor program, some increases in conservation, coal, and basic research, and overall a nearly constant energy R & D budget (see Table 2). In fact, with the notable exception of the breeder program, there is little evidence of any distinct Carter policy for energy research or signs that the new department has yet come to grips with the competing claims of new energy technologies.

DOE officials reject the suggestion that this is a transitional budget as far as R & D is concerned—"This is Jim Schlesinger's budget," as one spokesman put it. But five of eight assistant secretaries for the new department have yet to be sworn in, including those most directly concerned with R & D, and it is no secret that DOE's leadership has been preoccupied with internal reorganization and the fate of energy legislation in Congress. In any case, the budget leaves the impression that R & D has not yet been accorded a great deal of attention and that the inertia of past policies has largely prevailed.

Table 2. Department of Energy budget authority.

Program	$ millions	
	FY 1978*	FY 1979
Fission	1062	905
Breeder	517	367
Fuel cycle	285	247
Other	260	291
Fossil	684	724
Coal	579	618
Other	105	106
Fusion	325	334
Solar	303	309
Other renewables†	31	35
Geothermal	106	130
Conservation	301	381
Basic energy sciences‡	185	233
Environment	218	209
Total energy R & D	3215	3260
Biomedical and physics	397	426

*Includes pending supplemental budget request. †Biomass and small hydroelectric. ‡Includes advanced technology.

The breeder program, however, has in the past year undergone a major shift in policy, away from the Clinch River demonstration plant and the very high priority given rapid breeder development by the Nixon and Ford administrations, and toward a more long-term effort. It is a controversial shift. Breeder critics such as Tom Cochran, of the Natural Resources Defense Council, describes the $150 million approvingly as "a significant cut," and Carl Goldstein, of the Atomic Industrial Forum, says that without the Clinch River plant "the breeder program runs the risk of eroding the industrial base" for breeder technology. In addition to slowing the breeder effort and closing out Clinch River, the new budget adds $57 million in new money for work on alternative breeders and advanced reactor concepts.

Conservation programs are to be greatly expanded in FY 1979. While much of the increase in conservation spending is for such things as insulating homes of low-income families, the budget also includes a proposed $80 million increase for development of improved energy storage devices, waste heat utilization, and other conservation technologies. Coal R & D also received a boost; to the amount shown in Table 2 must be added $210 million in construction funds for several coal gasification demonstration plants. Geothermal also got a substantial increase.

The National Energy Act calls for tax incentives to stimulate use of solar energy and the DOE budget includes $64 million for heating and cooling demonstrations and installations in federal buildings, in addition to the amounts in Table 2. But the solar R & D budget is essentially flat, except for a $24 million construction request for a power tower demonstration plant (not included in Table 2). Magnetic containment fusion, too, is held to a token increase. Laser fusion programs and facilities funded as military projects add $313 million to the total in Table 2.

The DOE budget shows no evidence of wholesale cancellation or deferment of large demonstration projects. Department officials, at a briefing for reporters, indicated that they knew of no plans to institute such a policy and some said they were in fact unfamiliar with science adviser Press's comments on the matter. Insiders say there is something of a debate on the question of demonstration plants under way within the department. Basic energy research did get a very substantial increase in the DOE budget, however, with boosts for materials, engineering, and geoscience research.

For reasons that have more to do with history than logic, DOE is the major source of funds for high energy and nuclear physics research and conducts some life science and biomedical research, in addition to its energy mission. Physics programs got a $31 million increase in the new budget, and in addition the largest single new project in DOE—$265 million for construction of the Isabelle intersecting storage rings at Brookhaven National Laboratory.

With over $3 billion a year, energy research has become a major peak in the national R & D scene. But despite gradual changes by successive administrations and especially by Congress, the pattern of R & D funding bears a recognizable relation to the priorities and programs that dominated energy research in an earlier era, before energy became a question of national concern. The long shadow of the Atomic Energy Commission may be seen in the commitment to nuclear power, which still counts for more (28 percent) than the Carter Administration's commitment to coal (22 percent). The priorities accorded fusion (10 percent), solar (9 percent), and conservation (12 percent) appear to reflect bureaucratic happenstance more than any explicit calculus of their national importance. Nonetheless, there are signs that energy research is reaching a kind of maturity and that management of the program is tightening. The sums involved are large enough that the scientific and engineering community's involvement with energy research, already substantial, can be expected to grow.

—ALLEN L. HAMMOND

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