FY '89 budget: Lean and much less defense-oriented

Late last week, President Reagan released his blueprint for federal spending in fiscal year (FY) 1989, which begins in October 1988. While it includes a $2.7 billion increase for research and development (R&D) spending — to $64.6 billion — this increase barely covers the rate of inflation being predicted for FY '88 by the Office of Management and Budget. Although there are several substantial increases tucked away within this somewhat austere budget proposal, most are aimed at a few large-ticket items like the space station, space shuttle and Superconducting Super Collider.

In sharp contrast to recent years, the administration has proposed some of its toughest fiscal belt-tightening in defense programs. In FY '88, for example, the President proposed giving defense — which accounts for two-thirds of the federal R&D budget — almost a 14 percent increase (and that's *after* adjusting for inflation). In FY '89, defense programs would increase roughly 2 percent — that's a projected decline of 1.6 percent in real dollars from the previous year. By contrast, civilian programs in the FY '89 budget would climb an average of 6 percent — or 2.4 percent after inflation.

Except for the major decline in defense increases, there's a general similarity between the R&D policies evident in this year's budget proposal and those of the past few years. For instance, the administration is once again proposing: to eliminate the congressionally popular Sea Grant Program; to double the National Science Foundation (NSF) budget over five years; to roughly halve budgets for the Energy Department's programs in fossil energy and energy conservation; to merge and shrink the National Bureau of Standards (NBS) fire-technology and building-technology programs; and to greatly expand the Strategic Defense Initiative (SDI). Though these and many similar administration proposals have not survived the congressional budget-crafting process intact — often for several years running — they show up again in the 1989 budget plan.

Basic research: Though the President has proposed a 6.4 percent increase for basic research, all disciplines do not fare equally. Basic research within agencies conducting primarily physical science and engineering would climb an average 10.7 percent, whereas agencies whose R&D is directed more toward life, environmental and social sciences would grow only 1.9 percent in those areas. Yet even this gross distinction masks the fact that overall basic-research increases would occur within only a few agencies: 20.5 percent at the NSF, 11.8 percent at NASA, 6.8 percent at the Department of Energy (DOE), 1.6 percent at the Department of Defense (DOD) and 2.9 percent at the National Institutes of Health (NIH). Basic-research programs at the departments of Interior, Commerce and Agri-

FY '88: Who got what for research and development?

While science programs were not immune to the deficit-cutting atmosphere that permeated the long battle over the budget for fiscal year (FY) 1988, federally funded research and development (R&D) survived fairly well overall.

According to an analysis released last week by the American Association for the Advancement of Science (AAAS), Congress authorized a total of $61.1 billion for R&D programs — that's $6 billion less than the administration's request but $2 billion more than the estimated R&D expenditures in FY '87. Basic research received $9.8 billion, which, with inflation, represents an increase of about 3 percent from FY '87. Boosts to the budgets of the Department of Energy (DOE) and the National Institutes of Health (NIH) account for much of this increase. As in past years, Congress cut the administration's request for defense-related R&D (including the Strategic Defense Initiative program, which received less than its FY '87 appropriation) while raising nondefense R&D spending. Still, defense R&D accounts for 67 percent of federal R&D funds.

The main science casualty of the FY '88 budget battle was the National Science Foundation (NSF), which had been riding high on the administration's plan to increase NSF funding by 17 percent in 1988 and to double its budget over the next five years. But Congress allotted the agency only $1.7 billion, which represents a 5.5 percent increase over FY '87 levels but is 9 percent below the administration's request. In slicing up the NSF pie, Congress increased support of science education programs, especially at the precollege level, to $139.2 million, which is 21 percent above the President's request and 41 percent higher than the amount allocated in FY '87. But these increases came at the expense of research programs, which make up about 85 percent of NSF's budget. For these, the FY '88 level is only 3 percent higher than the previous year, and with inflation, this means NSF has a shade less money to distribute in grants than it did last year. Without the expected increases, NSF has decided to delay a multimillion-dollar program that would have begun to establish a series of new science and technology centers this year.

NASA also received less than requested. Here the administration had asked for $3.6 billion for R&D, a 14.9 percent increase above FY '87, but Congress allocated $249 million less. Most space R&D programs received increases and, unsolicited, Congress added money for two new initiatives, an industrial space facility and an extended-duration orbiter. But funding for the space station was curtailed and Congress, granting only $425 million of the $767 million requested, directed the agency to revise the schedule and scope of the project.

At the DOE, funding for high-temperature superconductivity was nearly doubled to $18 million, and according to AAAS, R&D programs overall received a 7 percent boost above FY '87 levels. Of particular note, Congress supplied the $25 million requested for R&D for the $4.4 billion Superconducting Super Collider but declined to provide the $10 million requested for its construction.

At NIH, funding for AIDS research rose 77 percent to $448 million, while non-AIDS funding increased by 4.8 percent. In the Public Health Service (which includes NIH), AIDS research funding was set at $931 million, in line with the trend over the last six years of roughly doubling support for AIDS research each year. In total, federal spending on AIDS research, treatment and testing in FY '88 will be $1.5 billion.

Finally, Congress continued to ignite controversy with allocations that bypass the scientific review process. AAAS notes, for example, that FY '88 was a record year for pork barrel funding (SN: 4/18/87, p.246), with Congress earmarking money for specific construction projects and, for the first time, for specific research programs as well — all without agency review. Congress earmarked an estimated $108 million of the Department of Defense (DOD) budget and more than $145 million of DOE's funding. In another move, Congress stipulated that no more than 14 percent of DOD's University Research Initiative funds ($110 million was given in FY '88 to boost basic DOD research at universities) can go to any one state. DOD and some university officials and scientists see this as a dangerous precedent that sacrifices scientific goals in favor of geographic equality.

— *S. Weisburd*

culture, at the Environmental Protection Agency (EPA) and at the Veterans Administration would all stagnate or shrink.

NSF, with the largest basic-research budget, is slated for the biggest R&D increase. "For the last three years there has been no real growth of the research activities of NSF," explains NSF Director Erich Bloch. In the current budget plan, dramatically expanded emphasis would be given to NSF funding of science and engineering education – especially at the primary, secondary and undergraduate levels – and to research in areas such as superconductivity, materials science, parallel computing, biological communications and manufacturing systems.

Defense: While DOD as a whole is not slated for big R&D increases, its lead research program is. The President has asked for a 28 percent increase – to $4.5 billion – for DOD's Strategic Defense Initiative program. DOE's share of SDI funding would climb 13.6 percent, to $402 million in FY '89. DOD's research into new tactical systems would increase $500 million, roughly 4 percent, and support for the joint NASA-DOD aerospace plane would rise to $350 million, a 37.8 percent increase.

Physical sciences: Although DOE's R&D spending would not keep pace with inflation under the President's budget, several of its physics programs would do quite well. The agency's "general science" budget, for example, is slated for a 49 percent increase, although most of that increase would go primarily to one project, the Superconducting Super Collider. That project's funding would increase almost 15-fold – to $363 million – as construction on the $5.32 billion project began. Funding for another general-science project, the 6-to-7-GeV Synchrotron Light Source, would double – to $12.1 million – allowing construction of the $456 million facility to begin at Argonne (Ill.) National Laboratory.

DOE's superconductivity funding would climb 41.8 percent in FY '89, with almost 43 percent of that $28 million increase going for work on the new high-temperature superconductors. NBS's high-temperature superconductivity research would climb even more dramatically – 270 percent, to $10.3 million, ultimately aimed at the measurement and electronic applications of superconductivity.

Overall, NBS's research budget would grow more than 9 percent to fund increases in such areas as methods for ensuring the security of sensitive information stored in computers and characterization of high-performance composite materials. Although NBS was asked, beginning in FY '88, to develop new centers for the transfer of innovative manufacturing technology to industry, the $5-million-a-year program would be put on hold and its staff eliminated – at least for the year – under the President's new budget plan.

Safety research within the Nuclear Regulatory Commission would increase 22.8 percent, partially in response to a call for more and better research by the National Academy of Sciences last year (SN: 1/17/87, p.38).

Biomedicine: Most striking of the line items in the Health and Human Services (HHS) budget is funding to combat AIDS. For the first time, all HHS funds related to the "research, control and prevention" of AIDS will be placed in a separate account for distribution to HHS agencies by the Assistant Secretary for Health. About $1.3 billion has been requested for FY '89, a 37 percent increase. Of this, roughly one-third is earmarked for AIDS education, the rest for basic research and drug development. This split in priorities, says HHS Secretary Otis R. Bowen, was based on input from agency and outside experts.

Previously, AIDS-related funding was appropriated to individual HHS agencies, such as NIH and the Centers for Disease Control. Because it was pulled out into a separate category this year, NIH's overall '89 budget request appears to drop (see graph). But when one accounts for NIH's projected share of the AIDS funding, R&D spending for the combined institutes would actually increase about 5 percent over FY '88. Also included in the NIH funding request is $25 million for construction of a new Food and Drug Administration (FDA) lab for AIDS research, to be built on the NIH campus.

The budget for the Alcohol, Drug Abuse and Mental Health Administration, another HHS agency, would increase about 5 percent, providing more than $1.3 billion for research, grants to states and prevention programs. Other items in the HHS budget request are a 1.4 percent increase (to $523 million) for the Centers for Disease Control and a 3.3 percent increase (to $468 million) for the FDA. HHS funding for research grants given to scientists outside the agency would increase nearly 9 percent.

Among new federal funding priorities is the human genome project, an effort to identify all the genes in human cells (SN: 8/15/87, p.101). According to White House Science Adviser William R. Graham, the FY '89 request of $46 million for the project – spread among a range of agencies, including $19 million at DOE – would increase funding for this project by 64 percent.

Space sciences: Two big items account for most of the whopping increase being sought for NASA. Nearly $1 billion would go to begin full-scale hardware development for the planned U.S. space station; that's almost 2½ times its present funding level. The space shuttle program would receive more than $4.84 billion – a 27 percent boost and 42 cents of every proposed NASA dollar. NASA's request also includes about $195 million to buy a few of the unmanned nonshuttles known these days as expendable launch vehicles (ELVs), though responsibility for most ELV launchings is to be left to private industry. While paltry compared with

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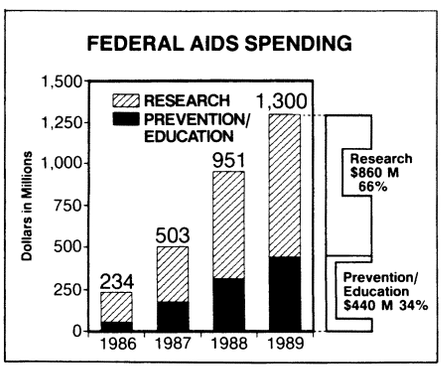
R&D BY MAJOR AGENCIES
(In millions of dollars)

Agency	Budget obligation* 1987 actual	1988 estimate	1989 estimate	% change from '88
Defense – Military functions	36,088	37,899	38,787	+ 2.3
Health and Human Services	6,643	7,174	7,938	+10.6
(NIH)	(5,850)	(6,318)	(6,229)	– 1.4
NASA	3,787	4,779	5,416	+13.3
Energy	4,724	5,071	5,165	+ 1.9
National Science Foundation	1,464	1,524	1,827	+19.9
Agriculture	946	1,018	985	– 3.2
Interior	403	419	396	– 5.5
Environmental Protection Agency	348	350	374	+ 6.9
All others	1,687	1,717	1,629	– 5.1
Total	56,089	59,952	62,517	+ 4.3

*Figures involve some rounding
Adapted from 1989 Budget: Special Analysis J



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shuttle funding, this amount represents a seven-fold rise, and is a direct result of the Challenger disaster and of widespread reaction from various oversight groups, Congress and, belatedly, NASA itself.

The only new scientific satellite proposed for NASA's budget is the Advanced X-Ray Astrophysics Facility, to be placed in earth-orbit by the shuttle by 1996. A small but significant increase of $16 million – to $84 million – would boost studies of planetary-science data already in hand (in hopes of slowing a perceived mini-brain-drain of scientists and graduate students in the field before several upcoming or envisioned projects such as the Galileo Jupiter mission reach their goals). Absent is any money for a mission called the Comet Rendezvous Asteroid Flyby, whose major goal would be to spend years following a comet as it approaches and recedes from the sun.

In line with the President's recent national space policy directive (SN: 2/20/88, p.118) is $100 million for a "Pathfinder Program" to develop advanced technologies for major space endeavors such as an inhabited moon base and human exploration of Mars.

Geosciences: Two-thirds of what the administration proposes cutting from the National Oceanic and Atmospheric Administration (NOAA) budget would come from slashing $102 million from its (formerly $282 million) R&D budget. To make those R&D cuts, NOAA would terminate or reduce scores of projects, including the National Undersea Research Program, which provides funding for the *Alvin* submersible and the *Aquarius* underwater habitat (SN: 12/19&26/87, p.391). As with NOAA's Sea Grant Program, most of these programs have been scheduled for termination before. Among the few new initiatives budgeted for NOAA is the $15 million Global Geosciences Program to study and improve prediction of climate change.

Funding for the U.S. Geological Survey would drop $23 million – with more than half that to come from its R&D programs. These cuts would terminate research in coastal erosion processes and reduce funding in earthquake monitoring, geologic mapping and energy resources.

Environment: EPA's air pollution research would increase 10 percent, or $6.7 million, in FY '89. However, that entire increase and more would go to boost one air program: the study of stratospheric-ozone depletion. To help finance a $7.3 million increase in ozone studies, some $1 million would be cut from programs to develop monitoring methods for such hazardous air pollutants as benzene and carbon tetrachloride, and another $250,000 would be excised from programs on health effects of pollutants controlled under the Clean Air Act, such as sulfur dioxide and carbon monoxide.

DOE's research into the sources and biological effects of radon gas would climb 27.3 percent, to $14 million. Similarly, EPA's research into technologies for reducing indoor radon levels would increase 36 percent in FY '89 – some $1.1 million. *– J. Raloff with staff reports*

An earlier dawn for modern humans?

Burnt flints from a cave in Israel have yielded evidence that anatomically modern humans were living in the Middle East around 92,000 years ago, about 50,000 years earlier than most previous estimates, according to a team of French and Israeli scientists.

The new date suggests that a primitive form of modern humans inhabited southwest Asia before the Neanderthals, whose remains in the same region date to approximately 60,000 years ago, say Helene Valladas of the National Research Center in Gif sur Yvette, France, and her colleagues. This supports the notion that modern *Homo sapiens* originated in Africa and colonized the globe, report the scientists in the Feb. 18 NATURE, while other groups, such as the Neanderthals, became extinct. Neanderthals probably migrated to the Middle East from Europe as Ice Age glaciers descended, add the researchers, but were not ancestors of modern humans.

Valladas and her co-workers used the recently developed thermoluminescence dating technique to analyze 20 charred flint flakes from an Israeli cave called Qafzeh, near Nazareth. The flakes were in the same layer of earth as modern human bones that were excavated 15 years ago, and may have been charred in a hearth or campfire.

The thermoluminescence technique is based on the priniciple that when some substances, such as ceramic and stone, are heated, radioactive isotopes are released in the form of light, thus resetting a predictable cycle of radioactive decay. By reheating the artifacts and measuring radioactive decay products in the light emitted, researchers can estimate the time elapsed since heating last took place.

If the dates from Qafzeh are accurate, writes anthropologist Christopher Stringer of the London-based British Museum in an accompanying editorial, Valladas and her co-workers are correct to question the conventional view that Neanderthals preceded modern *H. sapiens* in southwest Asia. Furthermore, he says, the findings reinforce the view that Neanderthals were a separate species rather than a closely related subspecies of *H. sapiens*.

By 90,000 years ago, suggests Stringer, *H. sapiens* may have split into a southern group, represented by fragmentary fossils from a South African site tentatively dated at between 80,000 and 110,000 years old, and a northern group whose remains extend from Ethiopia to the Middle East.

Wherever the original "Eden" for modern humans might be, says Stringer, it remains unclear why it took 50,000 years for the Qafzeh people to spread into Europe – first inhabited by the Neanderthals about 125,000 years ago – and eastern Asia.

A more fundamental question, says anthropologist Erik Trinkaus of the University of New Mexico in Albuquerque, concerns the accuracy of the thermoluminescence dates for Qafzeh. "To my knowledge, there is no independent way to verify the new dates," he says, "and geochemists disagree on the accuracy of thermoluminescence dating."

If primitive modern humans did inhabit southwest Asia 90,000 years ago, their relationship to the Neanderthals becomes more difficult to explain, adds Trinkaus. Of the two populations, Neanderthals appear to have been the poorer foragers, so how could they have effectively competed for food with an established group of *H. sapiens*? If Neanderthals and modern humans lived in the same region without competition, how did two populations exploiting the same resources with similar tools coexist for so long in an area about the size of Rhode Island?

Although these are puzzling questions and thermoluminescence dating is not foolproof, "I have no basis to argue with the [Qafzeh] dates at this point," says anthropologist Fred Smith of the University of Tennessee in Knoxville. "The Near East may have been a population contact zone for modern humans and Neanderthals."

But there is evidence for anatomical similarity between Neanderthals and early *H. sapiens* in central Europe, notes Smith, which argues against Stringer's contention that Neanderthals were a separate species.

Milford Wolpoff of the University of Michigan in Ann Arbor accepts the new Qafzeh dates and expands on Smith's suggestion of a population contact zone. In his view, "This is the first direct evidence that Neanderthals could breed with people from other parts of the world." Combining that with the evidence for anatomical similarity between the two populations, he suggests that Neanderthals and early *H. sapiens* were distinct races that interbred and produced the line of fully modern *H. sapiens* around 40,000 years ago.

– B. Bower