Science Funding Soars to Record Heights

An end-of-the-session congressional spending spree pushed the federal R&D budget above $90 billion, an all-time high that was expected to be safe even from a lame-duck Congress and president.

Back in early February, when President Clinton released his budget request for fiscal 2001, science adviser Neal Lane was excited about the funding proposals for science, engineering, and education. "Historic," Lane was quoted as saying about Clinton's science budget. "I can hardly wait to get up to the Hill to present it."

When Lane, the director of the Office of Science and Technology Policy, came down from the Hill in July, however, he was less enthusiastic. The $2.8 billion increase proposed by the president for the "Twenty-First Century Research Fund" had been cut by $1 billion, and words like, "disaster" and "devastating" were heard within the scientific community. The cuts stemmed primarily from federal spending caps that congressional appropriators were trying to adhere to, even though everyone on the Hill knew the caps were unrealistic and eventually would be broken. To move the budgeting process along, money was taken from two appropriation bills that contained money for NSF, NASA, and the National Institutes of Health, and funneled to other bills. Congressional leaders made clear that both NSF and NIH would eventually get big increases, but the money would not come until the end of the session.

The energy and water funding bill for the Department of Energy got caught in a dispute between the House of Representatives and the Senate, with the House putting a lot of money into water projects while the Senate financed defense. The funding numbers for DOE's science programs were not particularly good in either version of the bill, and there was concern within the science community that if the two sides merely compromised on the bill, many of the programs would see a funding decline of a few percentage points, compared to fiscal 2000. And given the ongoing security problems at Los Alamos, it was easy for budget cutters to target DOE.

By the end of July, Lane's office was saying that unless the budget numbers changed, the Spallation Neutron Source (SNS) would die, high-energy and nuclear physics programs would suffer, and even the much-vaunted nanotechnology initiative would be "seriously hampered."

In search of a "new trajectory of funding for science and technology," Lane called about 15 scientists into the Roosevelt Room of the White House on 28 July and urged them to mobilize the scientific community. Science funding was in trouble, Lane said, and it was time for the scientists to explain the implications of the proposed budget cuts to Congress.

Spending record set

As anticipated, the federal spending caps began to fall apart after the congressional recess in August, due in part to the large surplus, and money started flowing into the budget. So much money, in fact, that total federal research and development spending topped $90 billion for the first time and was approaching $91 billion as PHYSICS TODAY went to press, an increase of about $7.6 billion over fiscal 2000.

The unnerving up-and-down budget scenario has occurred on the Hill for the past few years, and is a process that one government employee compared with the Disney movie, *Mr. Toad's Wild Ride*.

The SNS not only didn't die, it received $279 million, just short of the requested amount of $281 million and a 136% increase over last year's funding of $118 million. High-energy physics got a 2.2% bump, from $693 million to $708 million; and nuclear physics rose 3.6%, from $348 million to $360 million. While those increases aren't great, they'll do, DOE officials said.

And while Clinton's nanotechnology initiative didn't get the $217 million he wanted, it did receive $150 million, more than the $97 million it got in fiscal 2000.

One of the casualties in the last days of the congressional session was Rep. Vern Ehlers's (R-Mich.) National Science Education Act. Although the $235 million bill had 118 cosponsors and bipartisan support, it died after several Democrats raised last-minute concerns over a provision that would have provided money to private schools for hiring special "master teachers" in science and mathematics.

The bills containing funding for NIH, the National Oceanographic and Atmospheric Administration (NOAA), and NIST had not been passed as this article was written. But science money wasn't the focus of the haggling between Congress and the White House over funding measures, and it was apparent that overall, science and technology did extremely well in this year's budget.

The following are R&D budget highlights by agency:

▷ **NSF.** When the final funding numbers came in for the agency in early October, NSF Director Rita Colwell sounded a lot like Lane had earlier in the budget process. "It is truly an historic action, for which I am extremely grateful," Colwell said, after receiving the largest dollar increase in the agency's history, in either real or constant dollars. NSF received $4.43 billion for 2001, a $529 million increase over 2000.

Funding for the Research and Related Activities category, which includes most of the agency's R&D programs, was nearly $3.4 billion, an increase of 13.2% over last year. Of that amount, mathematical and physical sciences received $846 million, an 11.6% increase. Much of the $150 million in funding for the new nanotechnology initiative comes from the mathematical and physical sciences budget.

Last year, one of the big winners at NSF was research in information technology, with the agency getting $90 million and the lead role in a government-wide information technology initiative. This year, NSF received $215 million for the program, known as the Information Technology Research initiative, less than the $280 million requested, but more than double last year's level. That funding is part of a large increase in the NSF's Computer and Information Science and Engineering directorate, which received a 24.8% increase, from $388 million to $485 million.

▷ **DOE.** Research and development

© 2000 American Institute of Physics, S-0031-9228-0012-350-6

Physics-Related R&D for Fiscal 2001

	FY 2000 actual	FY 2001 request	FY 2001 pending	Percentage gain (loss) 2000–2001
	(millions of dollars)			
National Science Foundation (total)	**3897**	**4572**	**4426**	**13.6**
Total research and related activities	2958	3541	3350	13.2
Mathematical and physical sciences	758	881	846	11.6
Engineering	382	457	415	8.6
Geosciences	488	583	557	14.2
Computer-information science and engineering	388	529	485	24.8
US polar programs	253	285	283	11.8
Major research equipment	94	139	122	30.1
Education and human resources R&D	121	110	119	(1.7)
Other education and human resources programs	570	619	669	17.3
Department of Energy (total)	**17 553**	**19 142**	**19 649**	**11.9**
Total science	2638	2969	3006	14.0
High-energy physics	693	704	708	2.2
Large Hadron Collider	70	70	70	0.0
Nuclear physics	348	364	360	3.6
Fusion energy sciences	245	244	249	1.8
Basic energy sciences	772	1008	1003	30.0
Spallation Neutron Source	118	281	279	136.3
Advanced scientific computing research	128	182	168	31.5
Multiprogram laboratory support	19	22	22	15.5
National Nuclear Security Administration (NNSA) R&D	3101	3191	3456	11.4
Weapons activities	2201	2273	2508	13.9
Stockpile R&D	236	243	272	15.4
Inertial confinement fusion	100	121	251	151.2
National Ignition Facility (construction)	247	74	199	(19.4)
Nonproliferation & verification R&D	183	191	208	13.3
Nuclear safeguards & security	27	26	26	(5.5)
National Aeronautics and Space Administration (total)	**13 601**	**14 035**	**14 285**	**5.0**
Space science	2193	2399	2488	13.5
Life and microgravity sciences	275	302	314	14.4
Earth science	1443	1406	1486	3.0
Academic programs	139	100	133	(4.1)
Space Station R&D	2323	2115	2115	(9.0)
Department of Defense R&D, Test and Evaluation	**39 344**	**38 576**	**41 936**	**6.6**
Total basic research (6.1)	1161	1217	1313	13.1
Army	204	201	210	2.8
Navy	374	397	393	5.1
Air Force	214	206	211	(1.2)
Defense-wide	368	412	498	35.3
Total applied research (6.2)	3410	3114	3680	7.9
Defense Advanced Research Projects Agency (DARPA)	1876	1951	2002	6.7
Ballistic Missile Defense Organization	3482	3943	4205	22.7
Department of Commerce				
Total NOAA R&D (tentative)	591	594	635	7.4
Total NIST R&D (tentative)	458	497	420	(8.3)
Scientific and technical research	236	269	257	9.0
Advanced Technology Program	115	148	123	7.0
Construction	107	36	35	(67.4)

SOURCE: AAAS, AIP

funding for the department increased 12.5% over fiscal 2000, jumping from $7.1 billion to $8 billion. Science-related R&D in DOE's Office of Science is up 14% to $3 billion, almost making the 15% increase that the office's director, Mildred Dresselhaus, has set as an annual target.

Within the DOE science budget, the big winner is basic energy sciences, which received $1 billion, a 30% increase. More than a quarter of that amount—$279 million—will go to construction and development of the once-threatened SNS, to be built at Oak Ridge National Laboratory in Tennessee.

Funding for computing and technology research, previously called advanced scientific computing research, increased from $128 million to $168 million.

While officials are breathing a sigh of relief over the restored funding in high-energy physics (up 2.2%), nuclear physics (up 3.6%), and fusion energy sciences (up 1.8%), there is still concern that what essentially amounts to a cost-of-living bump in funding isn't enough to keep or attract first-rate scientists to the nation's research labs.

R&D for defense rose $404 million to $3.7 billion, a 12.3% increase. Most of that money falls under the control of the newly created National Nuclear Security Administration, the semi-autonomous agency within DOE charged with overseeing the nuclear weapons stewardship program. The NNSA got $6.1 billion in total funding, about a third of DOE's entire budget.

Weapons activities, which include most of the stockpile stewardship programs, received $2.5 billion, an increase of 13.9% over fiscal 2000. Within that budget is $199 million for the controversial National Ignition Facility, nearly a 20% drop from last year's budget but significantly more than the $74 million that was requested. NIF has been plagued with cost overruns, delays, and mismanagement, which have increased the projected cost to $3.5 billion from original estimates of $2 billion. Because of the problems, Congress is withholding $69 million of fiscal 2001 funding until several planning and progress reports are received. Congress also wants to explore the possibility of scaling down NIF.

▷ **NASA.** NASA Administrator Daniel Goldin used terms like "excellent" and "robust" to describe the space agency's fiscal 2001 budget. The total NASA budget increased 5%, from $13.6 billion in fiscal 2000 to almost $14.3 billion this fiscal year. While a 5% increase seems modest compared to the double-digit increases at DOE and NSF, NASA's budget has been essentially flat for several years.

The space agency's R&D budget, which excludes the space shuttle program, showed a $610 million increase to $6.2 billion in the Science, Aeronautics, and Technology (SAT) account. SAT includes most of NASA's R&D work, excluding the space station. Space science went up 13.5% to $2.5 billion, including $75 million for the Mars Lander 2003 program. The lander is part of an aggressive program that includes six major missions to Mars in the next 10 years and at least two sample return missions in the following decade.

The International Space Station got $2.1 billion, a 9% reduction in funding that NASA officials had expected. The space shuttle program gets a 5.1% boost, to $3.1 billion.

▷ **NOAA.** The Commerce Department funding bill, which includes NOAA, was still in play in Congress as this article was written. NOAA officials thought their money was fairly solid and expected to get $635 million in fiscal 2001, an increase of 7.4% over fiscal 2000. The agency's main research program, oceanic and atmospheric research, jumped from $301 million to $323 million. "Overall we're really pleased," a NOAA official said. "We've had a lot of increases."

▷ **NIST.** The institute, also funded in the Commerce bill, showed a 5.9% decline in its total budget, but that is because the fiscal 2000 budget included $72 million in a one-time appropriation to fund construction of the

new Advanced Measurement Laboratory in Maryland. With that anticipated drop taken into account, NIST programs did well, with the institute's intramural laboratory research programs increasing by 9% to $257 million. The institute's Advanced Technology Program, which some House Republicans view as corporate welfare and have tried repeatedly to kill, was saved in the Senate and increased by 7% to $123 million. **JIM DAWSON**

Entrepreneur Founds Theory Institute in Canada

Putting his money where his mouth is, a successful businessman hopes he's setting a trend in funding physics.

Canadian physics is unwrapping a thoughtful gift: Mike Lazaridis, a 39-year-old former engineering major, is using a chunk of the fortune he's amassed as a high-tech entrepreneur to found the Perimeter Institute for Theoretical Physics in Waterloo, Canada.

With his gift of Can$100 million (about $78 million), Lazaridis hopes to make the Perimeter Institute a focal point for theoretical physics in Canada. The money, along with Can$10 million apiece from two of Lazaridis's colleagues, will be used for startup costs and toward setting up an endowment for the institute. Waterloo is donating the site of a defunct ice hockey arena in the city center, and there is talk of contributions from the Canadian provincial and national governments. Scientists are expected to start coming to the Perimeter Institute next fall.

"Just being able to welcome and host the kind of intellectual capital that will be visiting and staying in the region will really benefit [Canadian physics and the local community]," says Lazaridis. "The real ongoing investment is in the people that dedicate themselves to unlocking secrets."

Elementary particles and fields, quantum gravity, quantum computing, cosmology, and astrophysics are among the likely areas of research, although the topics will be up to the physicists who come to the Perimeter Institute—so named because of the mathematical allusion of the acronym, PI, and to suggest pushing boundaries.

Flexible, bold, innovative

In shaping plans for the institute, the executive director, Howard Burton, visited more than a dozen research centers in North America and Europe. He cites as models the Institute for Advanced Study in Princeton, the Institute for Theoretical Physics at the University of California, Santa Barbara, and the Santa Fe Institute in New Mexico. These institutes vary in terms of their ties to universities, and in the extent to which research is driven by programs versus by individual scientists, says Burton. "We wanted to benefit from their experiences and get a sense of what would work best for us."

The plan is to host, at any given time, about 40 scientists from around the world. Junior and senior scientists will be invited to come for stays ranging from a few months to renewable five-year terms. The Perimeter Institute will not offer permanent positions but is arranging with nearby universities to offer joint tenured and tenure-track appointments. Says University of Waterloo President David Johnston, "We look at this as a very attractive magnet for talent."

"The amazing thing is that someone decided to go not for a big ticket item, but for fundamental physics. It's going to have a huge impact on theoretical physics in Canada," says Dick Bond, who heads up the Canadian Institute for Theoretical Astrophysics at the University of Toronto. "There is desire for a strong interaction—but how it will materialize is still unclear," Bond says. In addition to forging ties with universities and CITA, the Perimeter Institute plans to collaborate with the Canadian Institute for Advanced Research, which supports networks of scientists in selected research areas. Those collaborations and other aspects of the Perimeter Institute are still being worked out.

"We are trying to pursue a mandate that allows us to be flexible, bold, and innovative, so as to be able to concentrate on both established areas of inquiry and on as yet unestablished areas," says Burton, who holds a PhD in physics from the University of Waterloo. "We want to have a warm, convivial atmosphere where junior and senior people can interact and it's not particularly hierarchical—we are trying not to be star-driven." But, says Bond, "there is tremendous competition for the best people in theoretical physics," and who they hire will be critical to the Perimeter Institute's success.

Trees for the future

For Lazaridis, founder and co-CEO of Research in Motion, whose signature product is BlackBerry™, a handheld wireless e-mail device (used by, among others, US Vice President Al Gore), putting his money to work for theoretical physics was a no-brainer: "It's exciting stuff—cosmology, quantum mechanics, gravity, time dilation. If you go back in science history, you realize that the discoveries and breakthroughs of today rely on the pure thought from the beginning of this century. Semiconductors would have passed us by if we didn't know quantum mechanics," he says. "We need to start planting trees today so the generation to come will have enough understanding to find what it needs for new technologies."

"It's ironic that my choice of engineering is allowing me to invest in fundamental physics," says Lazaridis. "We are hoping to become a catalyst for more support of theoretical physics." **TONI FEDER**

BRUCE HAWKINS/CITY OF WATERLOO

THE PERIMETER INSTITUTE'S logo was unveiled on 23 October by founding entrepreneur Mike Lazaridis (center); the institute's executive director, Howard Burton (left); and Waterloo mayor Joan McKinnon.