NSF Fiscal Year 1996 Budget Request

On February 6, President Clinton sent to Congress the Fiscal Year 1996 Budget Request for the National Science Foundation (NSF). Reflecting the increasingly thrifty tone in Washington, this year's requested increase is 3.0%, about half the percentage increase the Foundation requested last year. However, it is in line with the Administration's plans for a 3.5% rise in federal spending on basic research. The NSF plays a key role in the national science funding picture, providing nearly half of all federal support for nonmedical basic research at academic institutions. In the mathematical sciences, NSF is the major funder, providing 58% of all federal support.

This year's budget request puts emphasis on increasing funding for NSF programs that support research. Each of the NSF research directorates—Biological Sciences, Computer and Information Science and Engineering, Geosciences, Mathematical and Physical Sciences (MPS), and Social, Behavioral, and Economic Sciences—are slated for increases of 7%–8%. Pursuing a different strategy this year, the NSF has requested a slight decrease, 2.4%, for the Education and Human Resources (EHR) directorate. In recent years, Congress has allocated more money to EHR than the NSF requested. As a result, the EHR budget grew almost 600% over the past decade. In a budget briefing, NSF Director Neal Lane pointed out that, with several systemic educational reform programs in operation, a period of evaluation is appropriate for EHR.

Among the research directorates, MPS has the highest requested increase, 8.3%. The Division of Mathematical Sciences (DMS) is set for an increase of 7.6%, the lowest among the MPS divisions. The higher increases for the other divisions result primarily from funding for large-scale facilities such as the National High Magnetic Field Laboratory, the Cornell Electron Storage Ring, and the National Radio Astronomy Observatory. When it comes to the budget item "Research Project Support", which primarily refers to individual or small group grants, growth in the DMS is stronger than in the other MPS divisions. For example, the Division of Astronomical Sciences is set to receive an increase of only 3.1% for "Research Project Support"; for DMS the figure is 7.8%.

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New MPS Office

This year the MPS introduced a new line-item into its budget—the Office of Multidisciplinary Activities (OMA). As a set of activities, OMA is not really new; its genesis can be found in a small discretionary fund, which was known as the "opportunity fund" and was overseen by MPS Director William Harris. The purpose of the fund was to support projects that did not fit into the standard MPS programs. For example, it was able to quickly make available funds for data

analysis of the collision between Comet Shoemaker-Levy and Jupiter. Other projects in OMA include support of multidisciplinary research in optical science and engineering, environmental science and technology, and biotechnology. The OMA will also encourage academic-industrial interactions, through a program of postdoctoral positions and senior scientist exchanges between academia and industry. Originally, that program started in the DMS, and its success there inspired the MPS to expand it to other disciplines.

The establishment of the OMA was greeted by a controversial article in the February 3, 1995, issue of *Science* magazine. Contending that some segments of the scientific community opposed the OMA, the article said that the American Astronomical Society (AAS) was going so far as to write a letter of protest to the NSF. The $30.0 million fiscal 1995 budget for OMA has been funded primarily through contributions by the MPS divisions, and the article suggested that astronomers were worried about the OMA cutting into their basic research program. The article also alluded to fears that the OMA will divert money from theoretical to applied research and to complaints that the NSF established OMA without consulting the scientific community. Since the *Science* article appeared, the two astronomers quoted in it—AAS President Frank Shu of the University of California, Berkeley, and Bruce Margon of the University of Washington, Seattle—have said that they were inaccurately quoted and that they are not opposed to the OMA. In particular, Shu points out that although the AAS Council at one point considered writing a letter to protest the OMA, after a January meeting in which NSF officials explained the purpose of the new office, the Council decided the letter was unnecessary. Shu says that although he believes the NSF at first did not get enough input from the scientific community, that input is now occurring and the NSF is responding appropriately.

Richard Herman, a dean and mathematician at the University of Maryland (and chair of the Joint Policy Board for Mathematics), and Peter Eisenberger, director of the Princeton Materials Institute, wrote a letter to the editor in response to the *Science* article; Herman and Eisenberger cochair the MPS Advisory Committee. Calling the article "highly distorted", the letter points out that the Advisory Committee worked with the MPS staff and members of the scientific community in planning the OMA. "[I]t does a disservice to the science community to imply, as the *Science* article does, that OMA represents a distortion of the science community's views," the letter states. A more accurate view is that "those with disciplinary-oriented interests are concerned (understandably) about the loss of resources to those who are interested in working with others in different disciplines." The letter calls the OMA a "bold move...to respond to the changing reality of today's research enterprise."

As has been the case in the past years, the NSF is increasing its commitments to participation in broad-based federal strategic initiatives.

Margaret Wright of AT&T Bell Laboratories, a member of the Mathematical Sciences Subcommittee of the MPS Advisory Committee, says that the OMA "is meant in no way to be a shift from basic to applied research. The MPS Advisory Committee would not have supported OMA if this were true." Wright explains that for many years the feeling in MPS was that much excellent interdisciplinary research went unfunded simply because of bureaucratic boundaries and that the OMA was one mechanism to address this situation. E. F. Infante of the University of Minnesota, Wright's colleague on the subcommittee, agrees. He says that the OMA is "a good thing for the mathematical and physical sciences in general and for mathematics in particular. Certainly, the establishment of OMA does not detract funding from mathematics (or the other MPS disciplines) but provides for a better, more appropriate evaluation than the ones previously in place."

Table notes

The following tables, prepared by AMS staff, present different aspects of the NSF budget. Table I helps readers to see the Division of Mathematical Sciences (DMS) budget in the context of the whole National Science Foundation budget. Table II shows the DMS budget in the context of the Mathematical and Physical Sciences Directorate. Table III presents information broken down in the same way as in Table I, showing constant dollar changes in the budget figures.

Table 1: National Science Foundation

Millions of Dollars

	1992 Actual	Change	1993 Actual	Change	1994 Actual	Change	1995 Plan	Change	1996 Request
(1) Mathematical Sciences Research Support	$76.5	0.4%	$75.6	-2.2%	$75.9	7.3%	$81.4	7.6%	$87.6
(2) Other Research Support (Note a)	1868.3	7.7%	2003.0	7.8%	2157.3	10.6%	2385.4	3.7%	2474.4
(3) Education and Human Resources (Note b)	441.4	14.4%	505.1	12.7%	569.0	7.9%	614.0	-2.4%	599.0
(4) Salaries and Expenses (Note c)	113.9	0.5%	114.5	11.3%	127.4	4.9%	133.6	2.5%	137.0
(5) Science and Technology Centers	47.1	9.3%	51.5	11.9%	57.6	5.0%	60.5	2.5%	62.0
(6) Totals	$2547.1	8.0%	$2749.7	8.6%	2987.2	9.6%	$3274.9	2.6%	$3360.0
(7) (1) as a % of the sum of (1) and (2)	3.9%		3.7%		3.4%		3.3%		3.4%
(8) (1) as a % of (6)	3.0%		2.8%		2.5%		2.4%		2.6%

Note a: Support for research and related activities in areas other than the mathematical sciences. Includes scientific research facilities and instrumentation, Antarctic program, and certain research centers. Excludes Science and Technology Centers. **Note b:** The programs in this category provide support in all fields, including the mathematical sciences.
Note c: Administrative expenses of operating the Foundation, including the Office of the Inspector General.

Table 2: Directorate for Mathematical and Physical Sciences

Millions of Dollars

DIVISION	1992 Actual	% of Total	1993 Actual	% of Total	1994 Actual	% of Total	1995 Plan	% of Total	1996 Request	% of Total
(1) Mathematical Sciences	$76.5	(13.1%)	$75.6	(12.9%)	$75.9	(12.3%)	$81.4	(12.6%)	$87.6	(12.5%)
(2) Astronomical Sciences	109.9	(18.8%)	100.8	(17.2%)	99.0	(16.0%)	99.7	(15.5%)	$107.9	(15.5%)
(3) Physics	136.6	(23.4%)	126.2	(21.5%)	125.1	(20.2%)	128.0	(19.9%)	$139.8	(20.0%)
(4) Chemistry	108.4	(18.6%)	108.3	(18.5%)	110.8	(17.9%)	118.7	(18.4%)	$129.1	(18.5%)
(5) Mathematical Research	131.3	(22.5%)	151.6	(25.9%)	154.0	(24.9%)	160.9	(25.0%)	$176.0	(25.2%)
(6) Science and Technology Centers	21.5	(3.7%)	23.5	(4.0%)	24.3	(3.9%)	25.9	(4.0%)	$26.6	(3.8%)
(7) Office of Multi-disciplinary Activities	—		—		28.8	(4.7%)	30.0	(4.7%)	$31.3	(4.5%)
(8) Totals	$584.2		$585.9		$617.9		$644.6		$698.3	

Table 3: Compilation of the NSF Budget, 1991–1996

Millions of Dollars

	1991 Actual	1992 Actual	1993 Actual	1994 Actual	1995 Plan	1996 Request	1991–1994 Increase	1991–1996 Increase
(1) Mathematical Sciences Research Support	$72.0	$76.5	$75.6	$75.9	$81.4	$87.6	5.4%	21.7%
Constant Dollars	*52.9*	*54.5*	*52.3*	*51.2*			*-3.2%*	
(2) Other Research Support	1872.6	1868.3	2003.0	2157.3	2385.4	2474.4	15.2%	32.1%
Constant Dollars	*1374.9*	*1331.7*	*1386.2*	*1455.7*			*5.9%*	
(3) Education and Human Resources	322.0	441.4	505.1	569.0	614.0	599.0	76.7%	86.0%
Constant Dollars	*236.4*	*314.6*	*349.6*	*383.9*			*62.4%*	
(4) Salaries and Expenses	104.1	113.9	114.5	127.4	133.6	137.0	22.4%	31.6%
Constant Dollars	*76.4*	*81.2*	*79.2*	*86.0*			*12.6%*	
(5) Science and Technology Centers	42.4	47.1	51.5	57.6	60.5	62.0	35.8%	46.2%
Constant Dollars	*31.1*	*33.6*	*35.6*	*38.9*			*25.1%*	
(6) Totals	$2413.1	$2547.1	$2749.7	$2987.2	$3274.9	$3360.0	23.8%	39.2%
Constant Dollars	$1771.7	*$1815.5*	*$1902.9*	*$2015.7*			*13.8%*	

Current dollars are converted to constant dollars using the Consumer Price index (based on prices during 1982–1984).

Strategic Initiatives

As has been the case in the past several years, the NSF is increasing its commitments to participation in broad-based federal strategic initiatives. These include research in the following areas: Advanced Materials and Processing; Biotechnology; Civil Infrastructure Systems; Environment and Global Change; High Performance Computing and Communications; Manufacturing; and Science, Mathematics, Engineering, and Technology Education. Grants supporting work in these areas are spread throughout the Foundation. Each of these areas is slated for increases of 5%–8%, except for the education area, which will grow by only 1.4%.

The DMS is one of the few divisions in the NSF that participates in all of the strategic areas. In the FY 1996 budget document, the DMS- requested increase of $5 million for the "Research Project Support" component is billed as an increase for participation in the initiatives and for support of research in nonlinear science, particularly nonlinear optics. So far, the DMS has not issued calls for proposals in the strategic areas; its participation in the initiatives comes through the natural connections to those areas found in the proposals already being submitted to the various DMS programs. However, this mode of operation may have to change if the trend toward targeting specific amounts to initiatives continues.

At the time of this writing, Congress was gathering testimony on the NSF FY 1996 budget request; on March 2, 1995, Richard Herman, chair of the Joint Policy Board for Mathematics, presented testimony in support of the request to the Subcommittee on Basic Research of the Committee on Science for the House of Representatives. Congress will debate and deconstruct the budget to its liking, ultimately producing an authorization bill that will tell the NSF how much it has to spend on what. The authorization bill is due at the start of the 1996 fiscal year on October 1, 1995.

The key group in the Senate that oversees the NSF budget—the Veterans' Affairs, Housing and Urban Development, and Independent Agencies Appropriations Subcommittee—has a new chair. The former chair is Barbara Mikulski, the Maryland Democrat who sent shock waves through the scientific community last year with her threat to shift funds from NSF to other agencies if the Foundation did not pursue more "strategic research", Mikulski is now the ranking minority member. Chairing the subcommittee is Christopher Bond, a Missouri Republican. The *FYI* electronic newsletter of the American Physical Society notes that Bond consistently supported the space station and consistently opposed the Superconducting Supercollider. With the new lineup on this important subcommittee and with savings-minded Republicans dominating the scene, just how the appropriations bill will turn out is anyone's guess.

—Allyn Jackson

The following consists of excerpts of the text prepared by the staff of the Division of Mathematical Sciences of the NSF and submitted to Congress as part of the Administration's Budget Request for the Fiscal Year 1996.

Millions of Dollars

CATEGORY	1994 Actual	1995 Plan	1996 Request	% Change
Research Project Support	$62.07	$65.22	$70.31	7.8%
Infrastructure Support	$15.97	$18.40	$19.55	6.3%
TOTAL for DMS	$78.04	$83.62	$89.86	7.5%

Mathematical Sciences

The FY Budget Request for the Division of Mathematical Sciences (DMS) is $89.86 million, an increase of $6.24 million, or 7.5%, over the FY 1995 Current Plan of $83.62 million.

Mathematics underpins all of the scientific and engineering disciplines and is an important component of all research in strategic areas. NSF plays a crucial role in the support of academic research in the mathematical sciences, providing approximately 50% of all federal support. In all areas of the mathematical sciences, Foundation-supported research involves a broader range of infrastructure, fundamental research, and cross-disciplinary research topics than those sponsored by the mission agencies.

Ongoing activities with Research Project Support include areas such as classical analysis, modern analysis, geometric analysis, topology, foundations, algebra, number theory, applied mathematics, statistics, probability, and computational mathematics. Awards support fundamental and cross-disciplinary research in the mathematical sciences, with grants usually including funding for graduate and post doctoral students as well as computing equipment and other research needs. The Science and Technology Center for Computation and Visualization of Geometric Structures at the University of Minnesota (the "Geometry Center") is also supported.

Infrastructure Support includes various efforts that cut across the mathematical sciences including: research institutes; postdoctoral research fellowships; shared scientific computing research equipment; and undergraduate pro-

grams managed in collaboration with the NSF's Education and Human Resources Activity.

The FY 1996 request includes increases that will strengthen the participation of the mathematical sciences in a variety of interagency, NSF, and MPS (Mathematical and Physical Sciences) research thrusts. They reflect both the importance of mathematical and statistical modeling, simulation, control, visualization, and algorithm development, and the readiness of the mathematical sciences to enhance research in these areas. The problems of science are framed in the language of the mathematical sciences; thus, the mathematical sciences as both the modeling tool and the language of science are continually challenged to develop new constructs that expand capabilities.

- Research Project Support increases by $5.09 million in FY 1996 to a total of $70.31 million. This increment will enhance capabilities in nonlinear science (nonlinear optics in particular), and increase the Mathematical Sciences Subactivity participation in the High Performance Computing and Communications, Environment and Global Change, Civil Infrastructure, Manufacturing, Advanced Materials and Processing, and Biotechnology strategic areas.
- An increment of $1.15 million for Infrastructure Support to a total of $19.55 million will enhance activities in the Science, Mathematics and Engineering and Technology Education strategic area, with emphasis on Research Experiences for Undergraduates sites and postdoctoral fellowships, and will improve access of the mathematical community to advanced communications technology.

Changes in Budget Structure

The DMS proposes to combine the Disciplinary Research program element and the Cross-Disciplinary and Computational Research program into a new program element, Research Project Support. The restructuring will integrate the existing disciplinary, cross-disciplinary, and computational programs of DMS. These scientific programs are already highly integrated and this change will recognize this reality and provide for better management. This does not change the scope or mission of these research activities; rather, it is requested to enhance management and coordination and recognize the already integrated research environment.

The Special Projects program element will be renamed Infrastructure Support. The word 'Infrastructure' more appropriately describes this program investment, which includes large institutes, curriculum, equipment and instrumentation, conference activities, and a variety of education and human resource development projects.

A crosswalk of the FY 1995 Current Plan for this new budget structure is shown below.

Millions of Dollars

Old Program Elements	New Program Elements		TOTAL Old Structure
	Research Project Support	Infrastructure Support	
Disciplinary Research	$47.05	—	$47.05
Cross-Disciplinary & Computational Research	$18.17	—	$18.17
Special Projects	—	$18.40	$18.40
TOTAL New Structure	**$65.22**	**$18.40**	**$83.62**