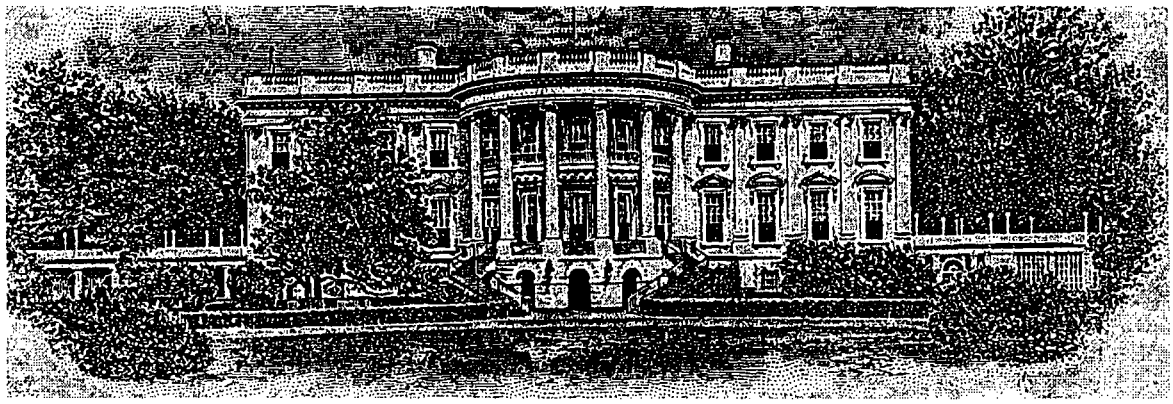
Science Leadership Exchange



A Research and Education Program Briefing by the
National Science and Technology Council
Committee on Fundamental Science
March 28, 1995

Science
Leadership
Exchange

SCIENCE LEADERSHIP EXCHANGE
A Research and Education Program Briefing

by the

National Science and Technology Council
Committee on Fundamental Science

March 28, 1995

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Office of Science and Technology Policy

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T.J. Glauthier, Associate Director for Natural Resources, Energy and Science, Office of Management and Budget

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Office of Science and Technology Policy

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Harold Varmus, Director

2:35 NSF
Neal Lane, Director

2:55 DOD
Anita Jones, Director of Defense Research and Engineering

3:15 NASA
Alan Ladwig, Associate Administrator for Policy and Plans

3:35 Energy
James Decker, Deputy Director, Office of Energy Research

3:55 Break for stretch

4:00 USDA
Floyd Horn, Acting Under Secretary, Research, Education and Economics

4:15 EPA
Robert Huggett, Assistant Administrator, Research and Development

4:30 Commerce
Kathryn Sullivan, Chief Scientist, NOAA

4:45 Discussion

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B

Divider Title: _____

Office of Science and Technology Policy
Overview

by

M.R.C. GREENWOOD
Associate Director for Science
Office of Science and Technology Policy

to the

Science Leadership Exchange

March 28, 1995

The

Office of Science and Technology Policy Overview

for the

Science Leadership Exchange

(a research and education program briefing)

Committee on Fundamental Science

March 28, 1995

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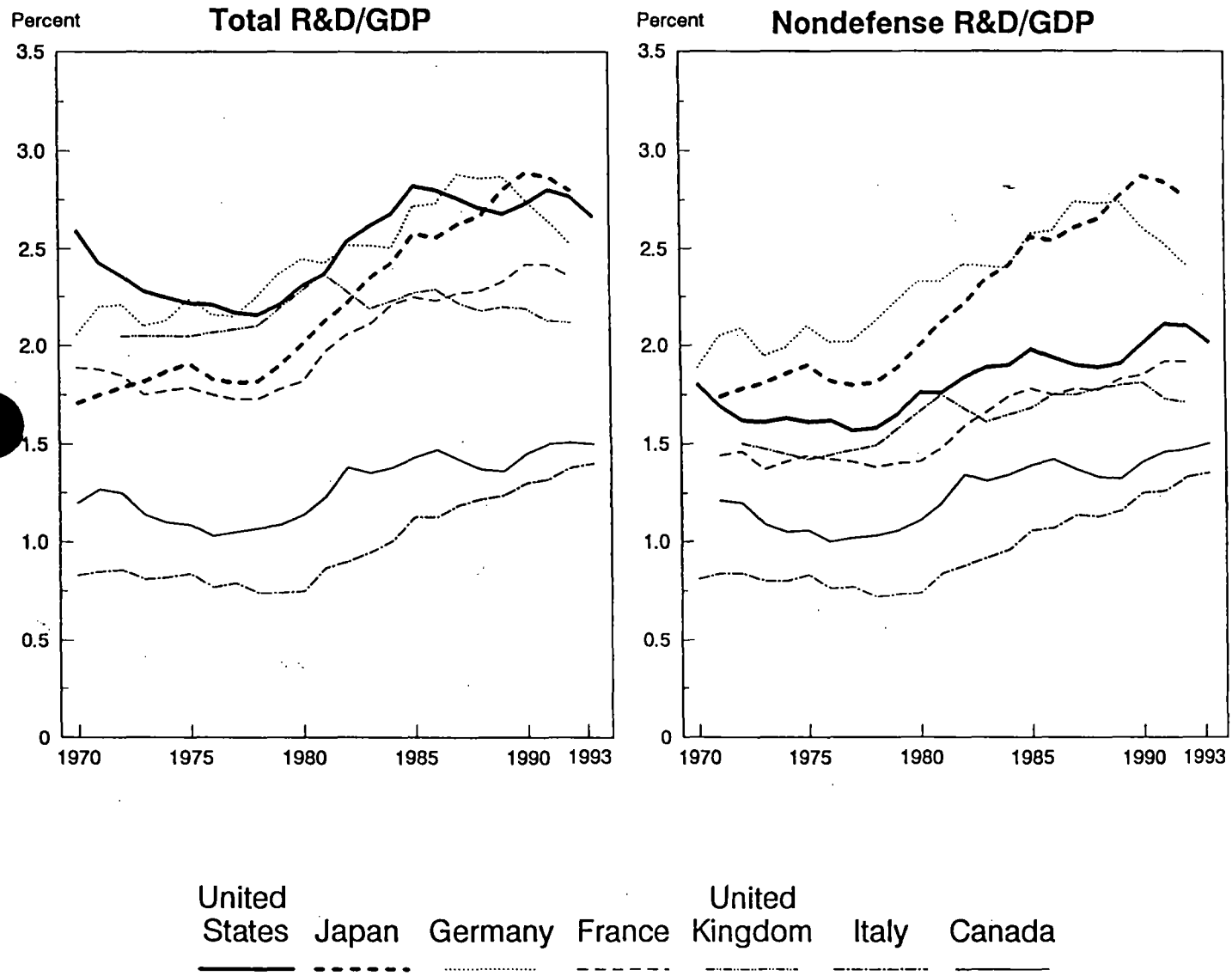
Importance of Science and Technology Investments

* **Provides economic benefits. Industry R&D has accounted for:**
  - **about 1/4 of overall productivity growth in recent decades**
  - **rates of return of about 30 percent**
  - **social rate of return well over 50 percent**

* **Supports Federal needs:**
  - **missions: national security, food production, environmental quality, health, etc.**
  - **social rates of return -- difficult to estimate, but most economists believe it provides the highest return of any Federal investment**
  - **producing the next generation of scientists and engineers, developing a technically competent workforce and a scientifically literate citizenry**

R&D as a percentage of GDP, by country: 1970-93

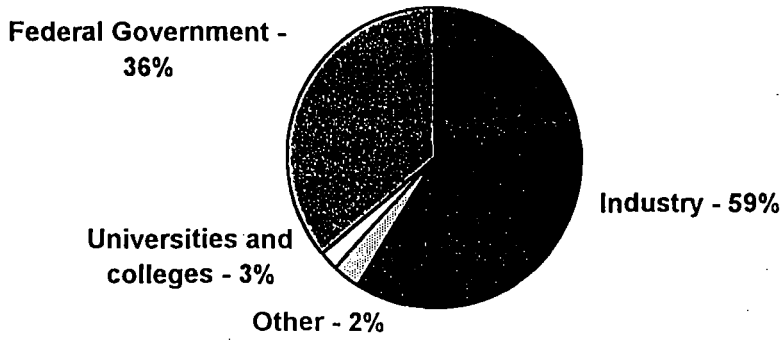


Source: NSF/Science Resources Studies

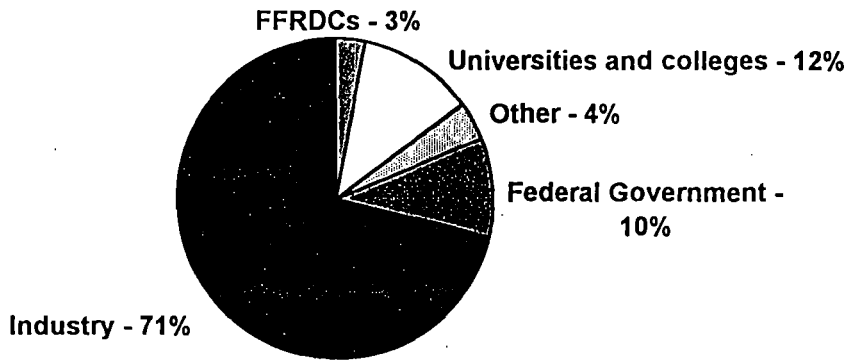
OSTP-2

National R&D expenditures: 1994

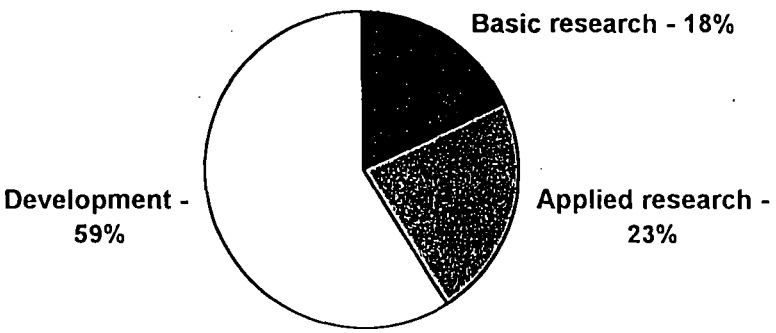
By source of funds



By performing sector



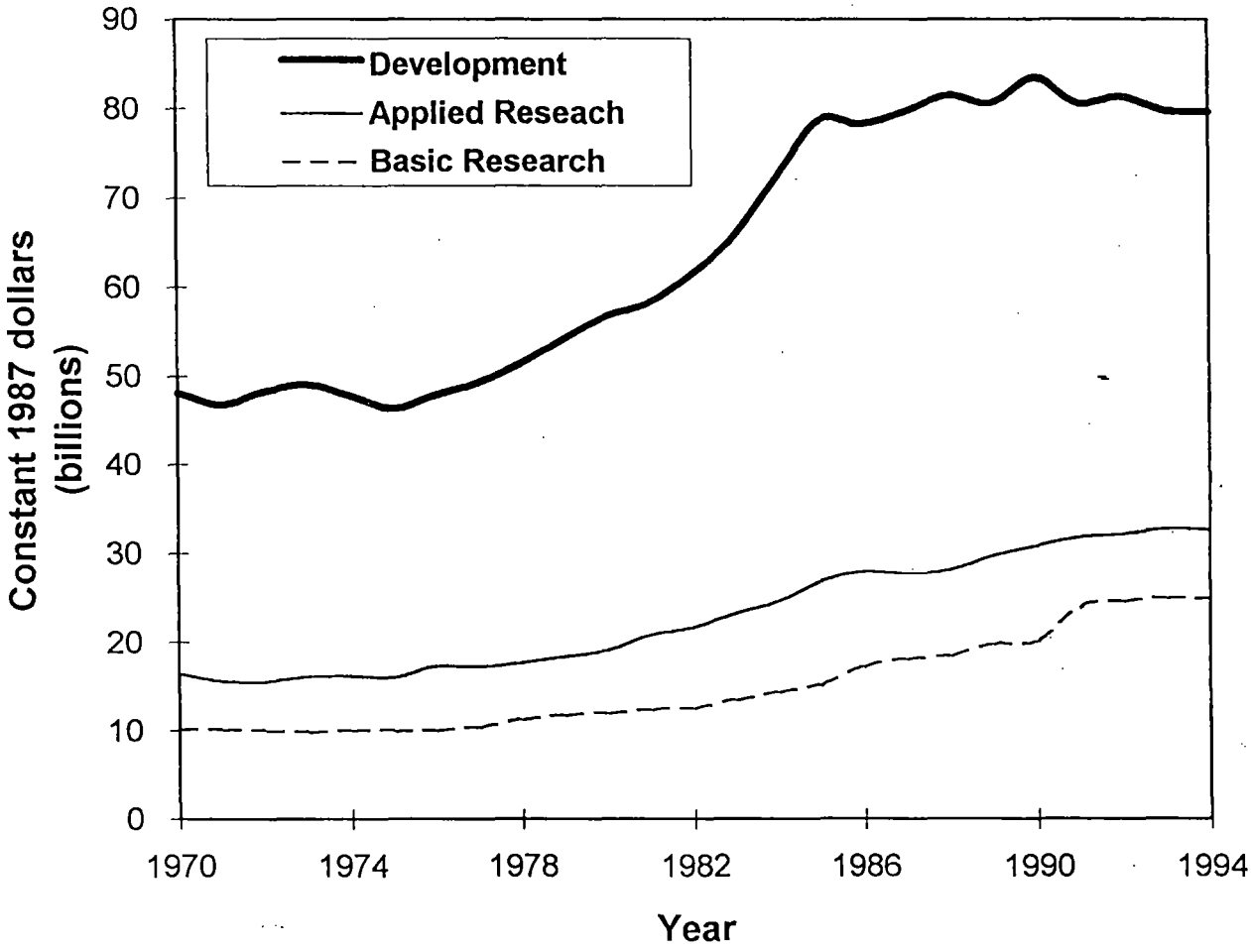
By character of work



urce: NSF/Science Resources Studies

OSTP-3

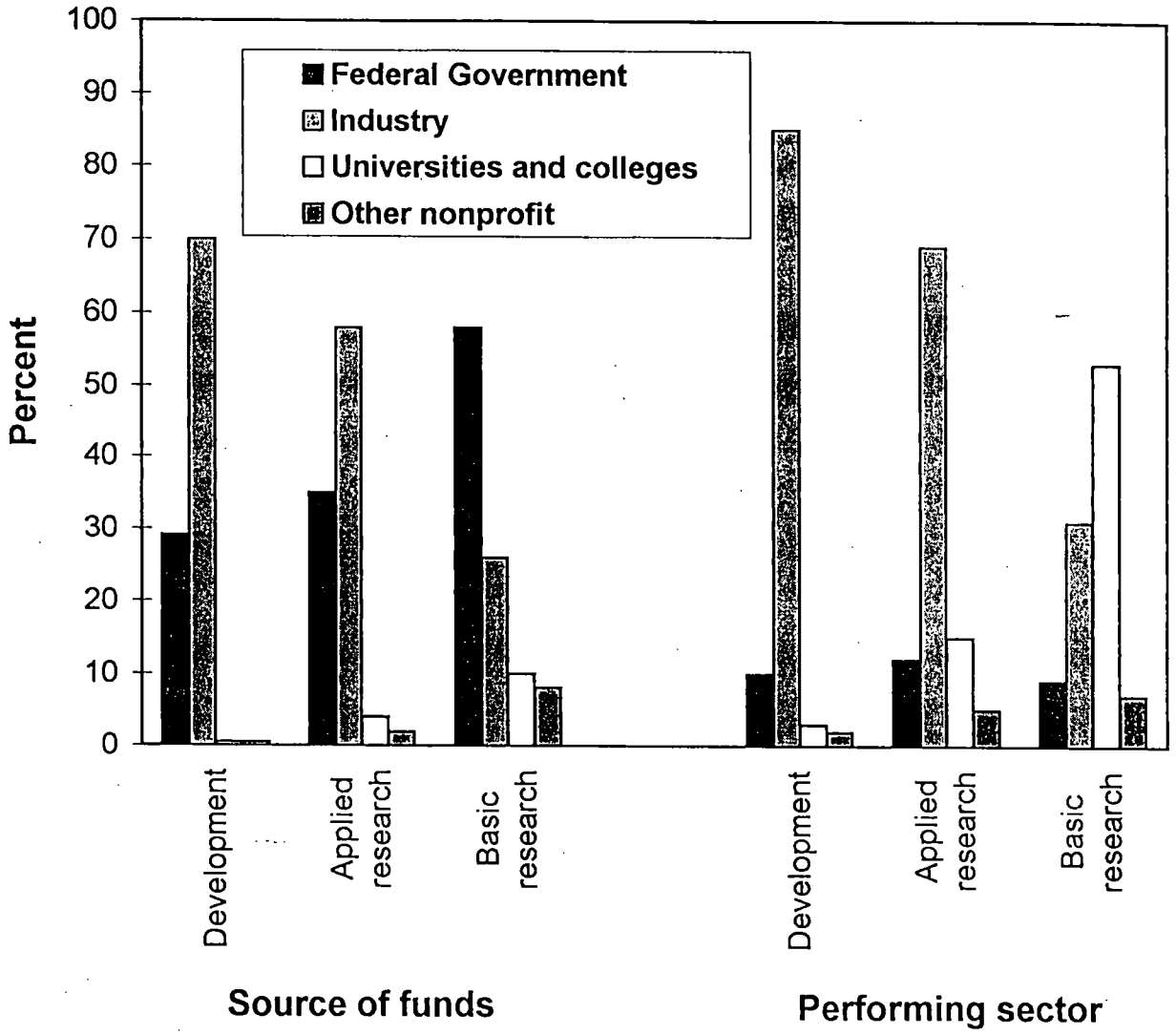
R&D expenditure trends: 1970-94



Note: The sample design for estimating industry R&D statistics was revised for 1991 and later years.

Source: NSF/Science Resources Studies

National R&D expenditures, funders, and performers, by character of work: 1994



Source: NSF/Science Resources Studies

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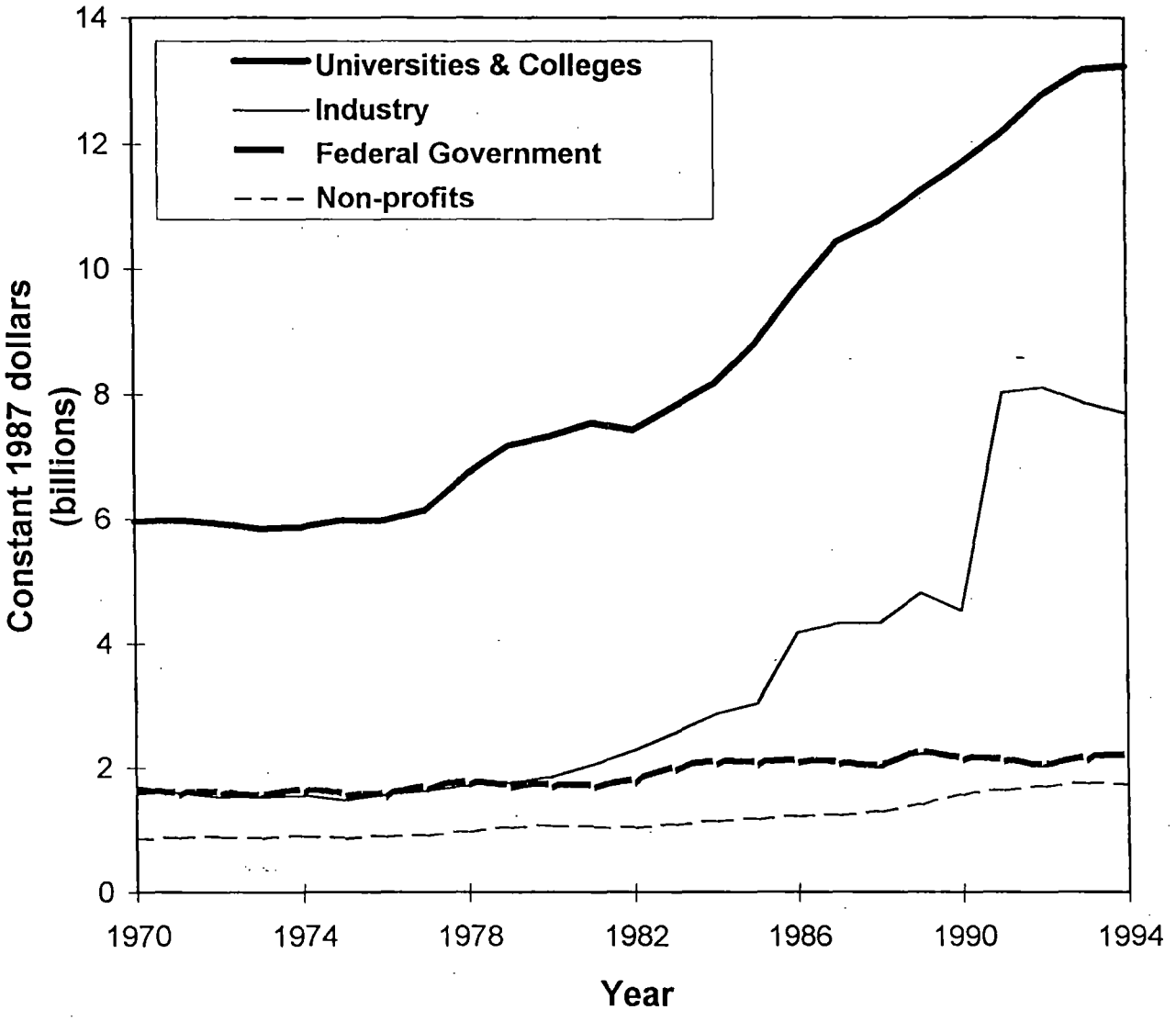
Basic research performance, by sector: 1970-94



Note: The sample design for estimating industry R&D statistics was revised for 1991 and later years.

Source: NSF/Science Resources Studies

OSTP-6

President's FY 1996 Priorities

* Deficit reduction

* Broad range of high priority investments (including fighting crime, training, science and technology)

* A "middle class" tax cut

* Creating a smaller, more efficient Federal government

These commitments have created a very tough budget environment, requiring difficut decisions and a well thought-out investment strategy to ensure the best return for the nation's taxpayers.

National Science and Technology Council Research Goals

* Job Creation and Economic Growth
* World Leadership in Science, Mathematics, and Engineering
* National Security
* Environmental Quality
* Health and Safety
* Education and Training
* Communication and Information Infrastructure

World Leadership in Fundamental Science

* Basic research is essential to achieving national goals of improved health, environment, prosperity, national security, and quality of life

* Strong national commitment to fundamental science continues

* Basic research shows the largest percentage increase in S&T budget 3.5%

* Nondefense academic R&D would increase 4.0%

* Fraction of merit reviewed research continues to increase 3.0%

Funding of Research and Development by Agency
(budget authority, dollar amounts in millions)

Agency	1993 Actual	1995 Estimate	1996 Proposed	Dollar Change 1995-1996	% Change 1995-1996
Defense	38,898	36,272	35,161	-1,111	-3.1%
HHS	10,472	11,676	12,123	+447	+3.8%
NASA	8,873	9,455	9,517	+62	+0.7%
Energy	6,896	6,637	7,125	+488	+7.4%
NSF	2,012	2,450	2,540	+90	+3.7%
Agriculture	1,467	1,554	1,499	-55	-3.6%
Commerce	793	1,284	1,404	+120	+9.3%
Transportation	613	687	755	+69	+10.0%
Interior	649	687	697	+9	+1.4%
EPA	511	589	682	+93	+15.8%
Other	1,308	1,423	1,380	-42	-3.0%
Total	**72,493**	**72,713**	**72,883**	**+170**	**+0.2%**
Basic Research	13,362	13,975	14,467	+493	+3.5%
Applied Research	13,608	14,569	14,686	+117	+0.8%
Development	42,795	42,107	41,768	-339	-0.8%
Facilities	2,727	2,063	1,962	-101	-4.9%
Civilian	30,329	33,815	34,902	+1,087	+3.2%
Defense	42,164	38,898	37,981	-918	-2.4%
Academic R&D	11,674	12,418	12,533	+115	.9%
Merit Reviewed R&D	NA	28,454	29,344	+890	+3%

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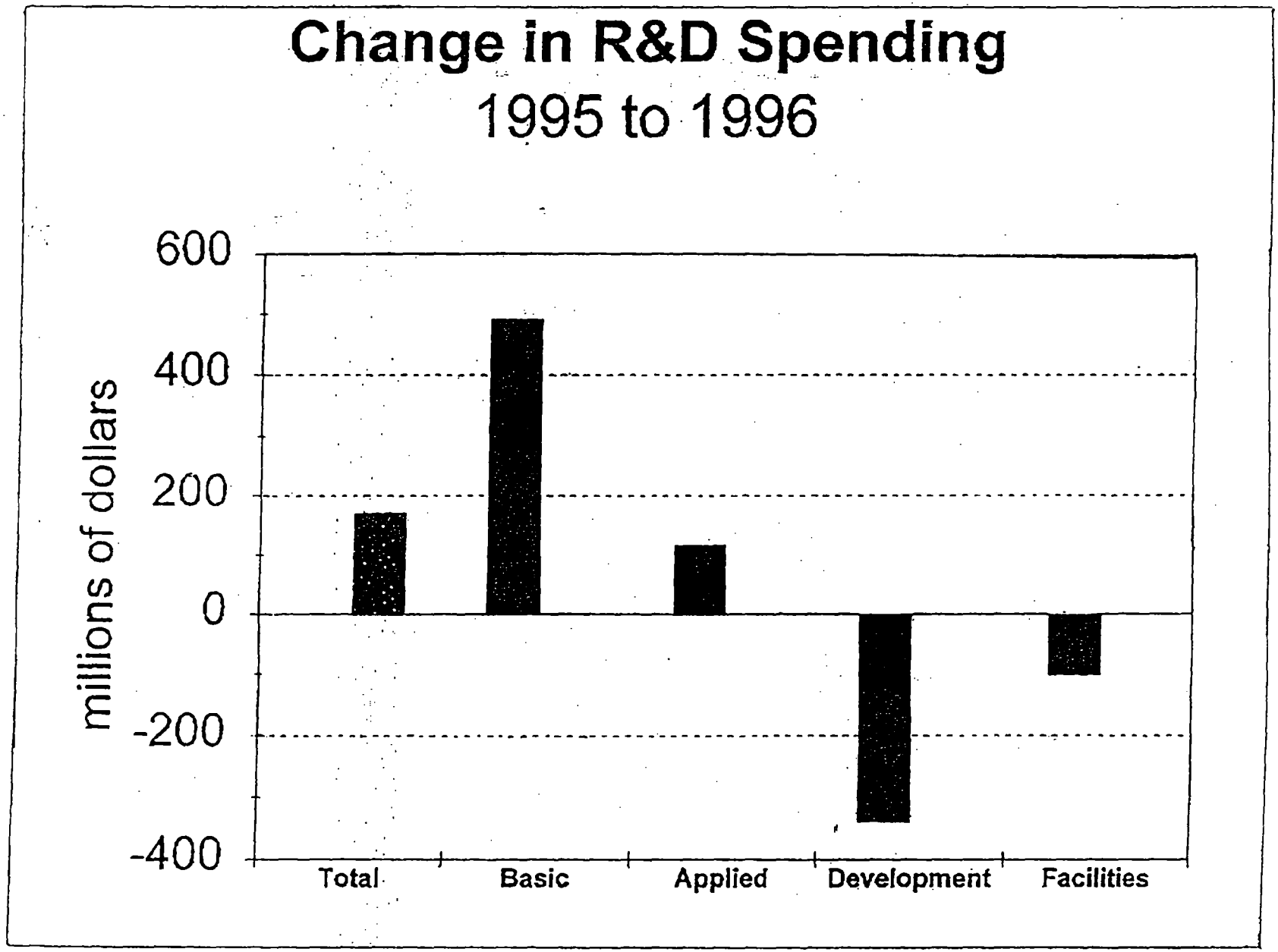

Change in R&D Spending
1995 to 1996
600
400
200
0
-200
-400
millions of dollars
Total
Basic
Applied
Development
Facilities

OSTP-11

Basic Research in the FY 1996 Budget by Agency (budget authority in millions of dollars)

	FY 1994 Actual	FY 1995 Est.	FY 1996 Budget	% Change FY 95–96 Current $	% Change FY 95–96 Constant $
Defense (military)	1,167.2	1,227.0	1,213.9	−1.1%	−4.0%
NASA	2,014.4	1,850.2	1,841.3	−0.5%	−3.4%
Energy	1,619.5	1,685.0	1,784.5	5.9%	2.8%
HHS	6,024.0	6,226.1	6,454.8	3.7%	0.7%
NIH	(5,887.0)	(6,086.0)	(6,310.8)	3.7%	0.7%
NSF	1,870.7	1,960.4	2,107.6	7.5%	4.4%
Agriculture	609.6	603.6	614.8	1.9%	−1.1%
Interior	84.0	78.6	79.6	1.3%	−1.7%
Transportation	2.0	2.0	2.0	0.0%	−2.9%
EPA	101.4	102.2	119.7	17.1%	13.7%
Commerce	37.2	43.7	48.6	11.2%	8.0%
Education	5.3	5.6	5.2	−7.1%	−9.9%
AID	6.0	6.9	4.1	−40.6%	−42.3%
Veterans Affairs	16.3	16.3	16.7	2.5%	−0.5%
Smithsonian	131.2	132.2	136.2	3.0%	0.0%
Tennessee Valley Auth.	8.9	9.0	11.8	31.1%	27.3%
Corps of Engineers	5.1	5.9	5.7	−3.4%	−6.2%
Labor	8.4	14.3	14.7	2.8%	−0.2%
Justice	5.4	5.7	6.0	5.3%	2.2%
TOTAL R&D	13,716.6	13,974.8	14,467.3	3.5%	0.5%
Defense	1,174.3	1,233.7	1,221.1	−1.0%	−3.9%
Non-defense	12,542.3	12,741.1	13,246.2	4.0%	0.9%

Source: AAAS, based on OMB supporting data for R&D exhibits.

OSTP-12

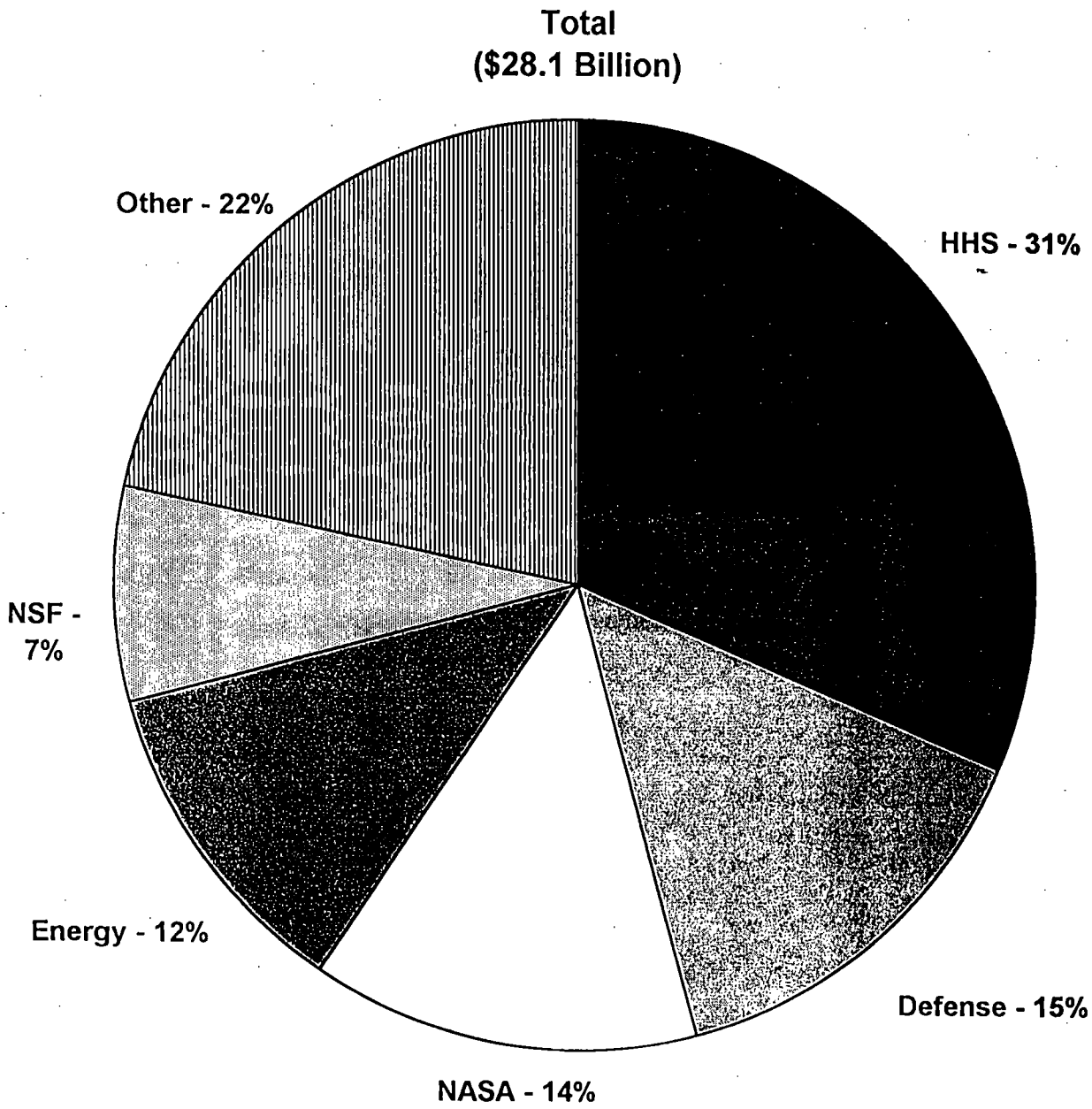
Support for R&D at Colleges and Universities in the FY 1996 Budget by Agency (budget authority in millions of dollars)

	FY 1994 Actual	FY 1995 Est.	FY 1996 Budget	% Change FY 95–96 Current $	% Change FY 95–96 Constant $
Defense (military)	1,494.9	1,667.7	1,351.1	−19.0%	−21.3%
NASA	732.1	773.9	782.3	1.1%	−1.9%
Energy	623.6	653.2	663.0	1.5%	−1.5%
HHS	5,831.1	6522.1	6771.5	3.8%	0.8%
NSF	1,693.2	1,867.1	1,992.0	6.7%	3.6%
Agriculture	440.7	434.6	438.4	0.9%	−2.1%
Interior	47.0	47.0	44.4	−5.5%	−8.3%
Transportation	59.2	60.7	63.3	4.3%	1.2%
EPA	143.0	145.9	185.2	26.9%	23.2%
Commerce	70.7	84.1	80.1	−4.8%	−7.5%
Education	108.6	109.4	114.4	4.6%	1.5%
AID	23.8	24.4	19.6	−19.7%	−22.0%
Veterans Affairs	1.0	1.6	1.6	0.0%	−2.9%
Nuclear Reg. Comm.	6.3	4.7	4.7	0.0%	−2.9%
Tennessee Valley Auth.	1.9	5.5	5.6	1.8%	−1.2%
Corps of Engineers	4.1	4.4	4.4	0.0%	−2.9%
Labor	3.6	10.2	10.5	2.9%	−0.1%
HUD	0.9	1.2	1.2	0.0%	−2.9%
Justice	0.0	0.1	0.0	−100.0%	−100.0%
TOTAL R&D	11,285.7	12418.3	12533.7	0.9%	−2.1%
Defense	1,531.6	1,702.4	1,385.1	−18.6%	−21.0%
Nondefense	9,754.1	10715.9	11148.6	4.0%	1.0%

Source: AAAS, based on OMB supporting data for R&D exhibits.

OSTP-13

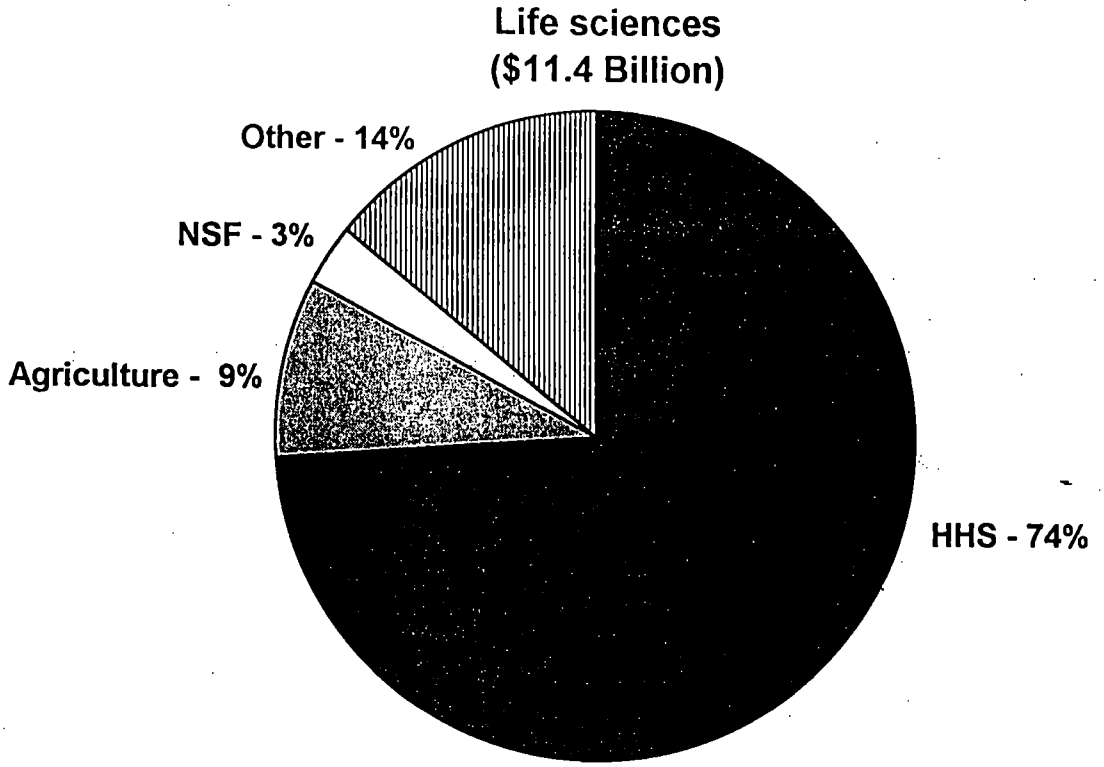
Estimated Federal obligations for research: 1994

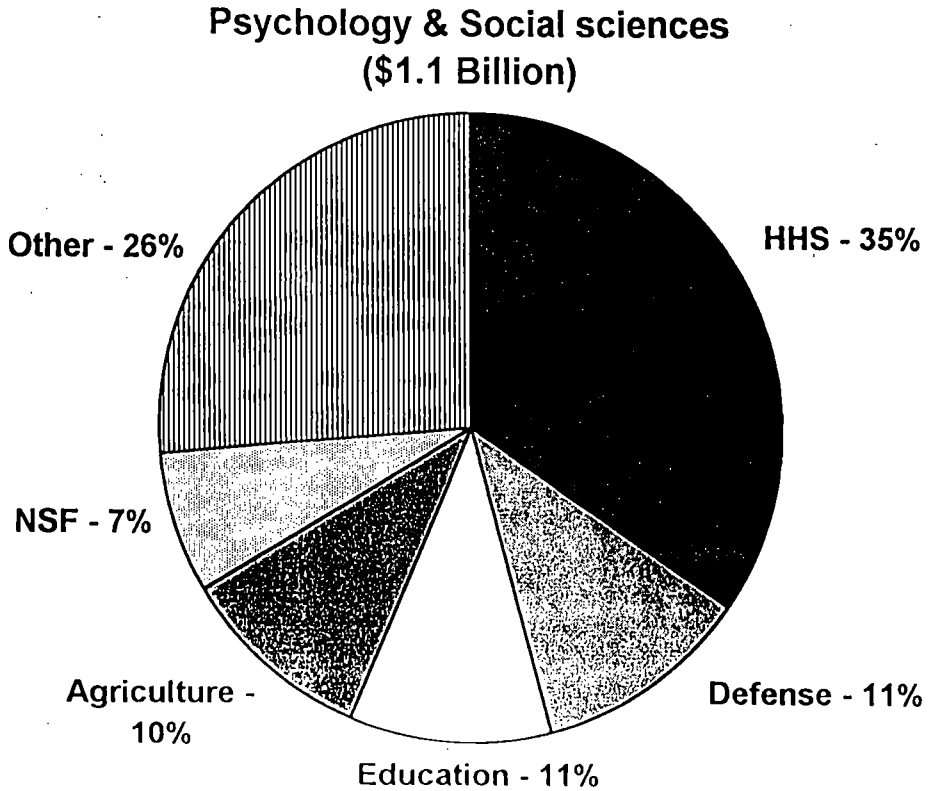


Source: NSF/ Science Resources Studies

OSTP-14

Estimated Federal obligations for research: 1994

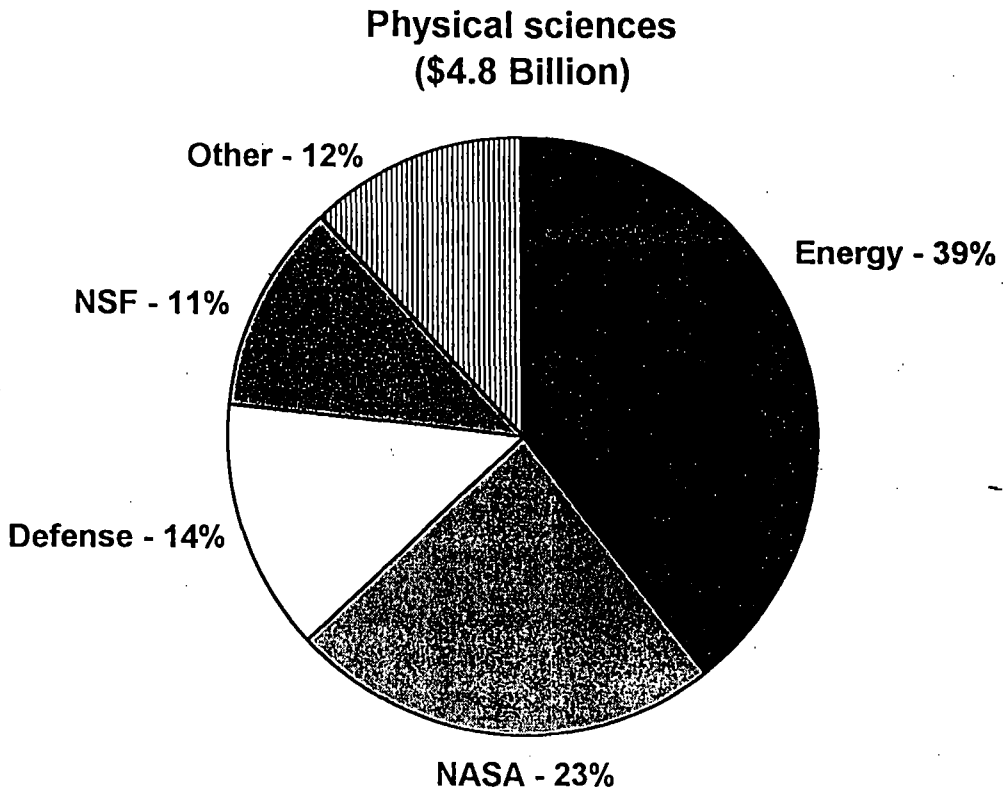


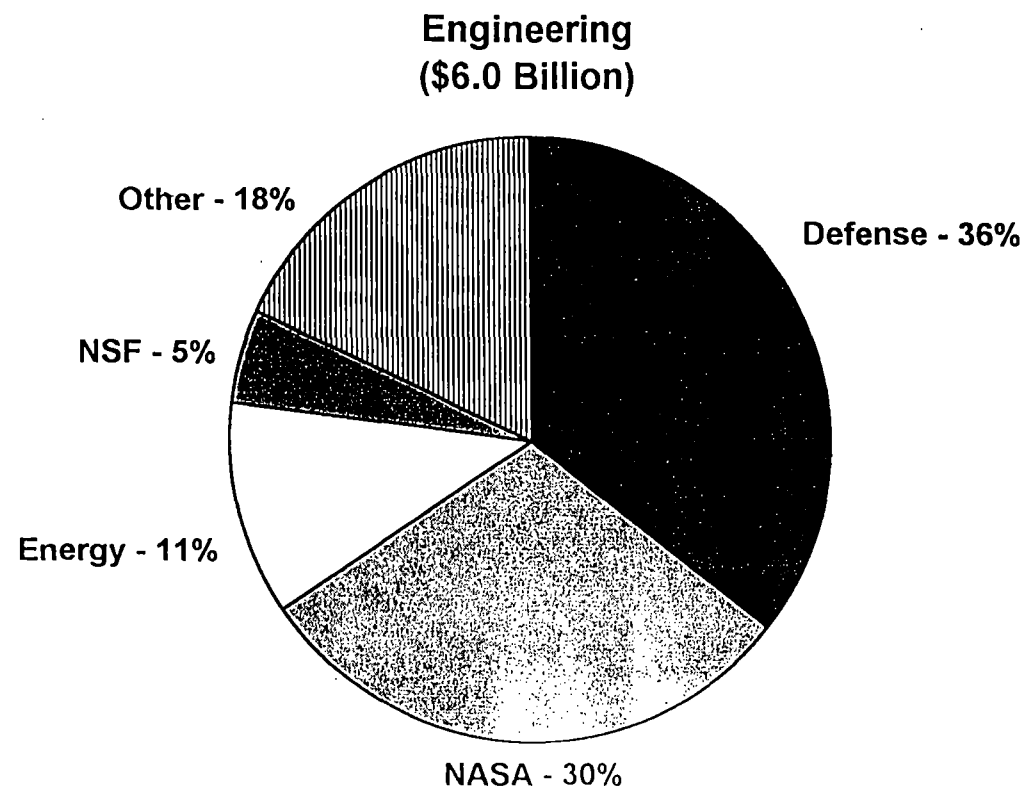


Source: NSF/ Science Resources Studies

OSTP-15

Estimated Federal obligations for research: 1994



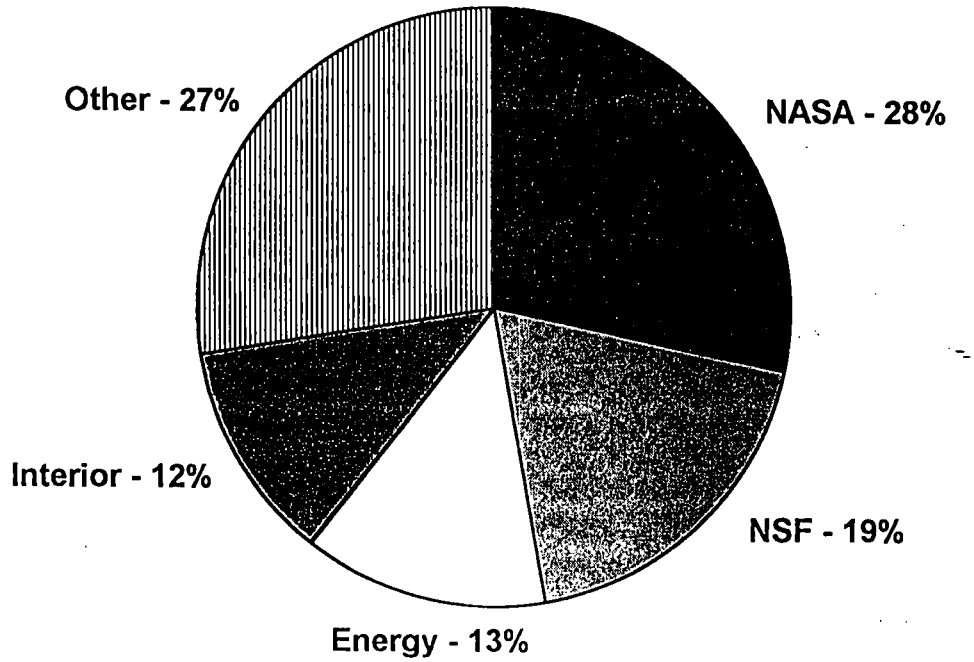


Source: NSF/ Science Resources Studies

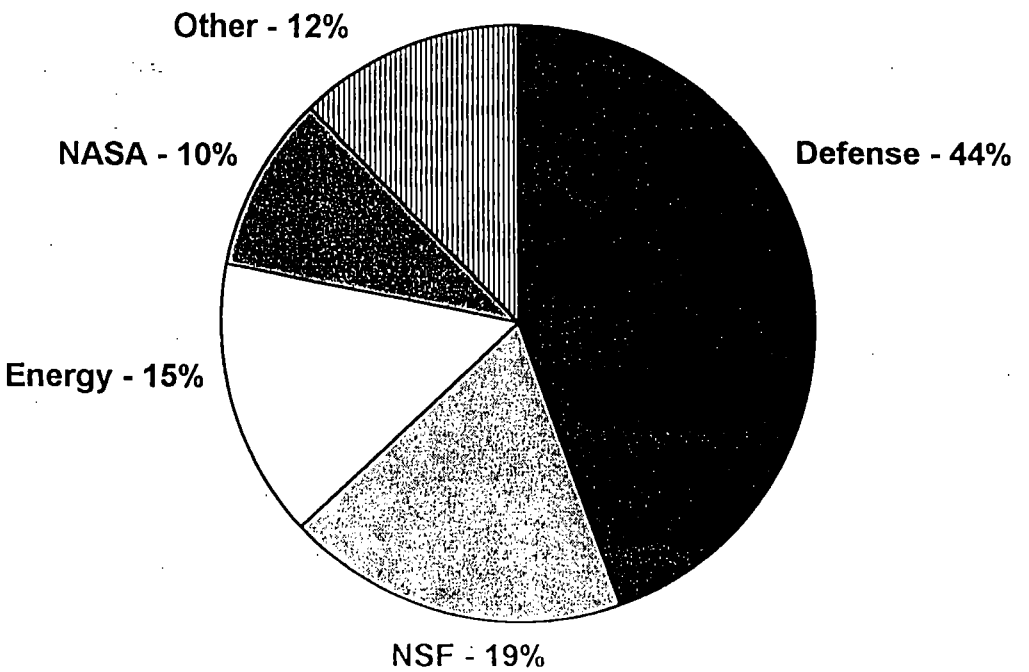
OSTP-16

Estimated Federal obligations for research: 1994

Environmental sciences ($2.5 Billion)



Mathematics and Computer science ($1.5 Billion)



Source: NSF/ Science Resources Studies

OSTP-17

Estimated Federal obligations for research, by agency and field of science and engineering: fiscal year 1994

[Dollars in thousands]

Agency and subdivision	Total	Life sciences	Psychology	Physical sciences	Environmental sciences	Mathematics and computer sciences	Engineering	Social sciences	Other sciences, n.e.c.
Total, all agencies	28,123,803	11,372,809	346,401	4,832,467	2,542,055	1,468,682	6,005,491	708,623	847,275
Departments:									
Department of Agriculture, total	1,299,802	999,533	525	88,186	12,296	17,761	66,325	112,207	2,969
Agricultural Cooperative Service	3,576	0	0	0	0	0	0	3,576	0
Agricultural Marketing Service 1/	4,272	4,272	0	0	0	0	0	0	0
Agricultural Research Service	595,856	525,384	0	55,970	3,667	2,796	8,019	20	0
Cooperative State Research Svc	416,452	323,917	0	22,229	2,546	0	22,574	45,186	0
Economic Research Service	51,461	0	0	0	0	0	0	51,461	0
Federal Grain Inspection Service	1,000	1,000	0	0	0	0	0	0	0
Forest Service	208,800	130,240	525	9,987	6,083	11,300	35,732	11,964	2,969
Human Nutrition Information Svc	13,142	13,142	0	0	0	0	0	0	0
Nat'l Agricultural Statistics Svc	3,665	0	0	0	0	3,665	0	0	0
Office of International Cooperation & Development	1,578	1,578	0	0	0	0	0	0	0
Department of Commerce, total	743,215	95,309	309	114,134	285,632	56,551	141,526	16,129	33,625
Bureau of the Census	3,101	0	304	0	0	2,014	0	715	68
Economic Development Admin	500	0	0	0	0	0	0	500	0
National Institute of Standards & Technology	265,536	0	0	96,090	623	39,040	129,486	297	0
National Oceanic & Atmospheric Administration	468,853	95,309	5	18,044	285,009	15,497	6,815	14,617	33,557
National Telecommunications & Information Administration	5,225	0	0	0	0	0	5,225	0	0
Department of Defense, total	4,415,904	305,923	128,153	660,532	267,825	652,737	2,250,940	1,843	147,951
Department of the Army	841,773	134,339	28,494	108,507	35,447	70,147	453,218	1,191	10,430
Department of the Navy	969,000	51,680	33,468	225,683	145,025	60,660	441,159	0	11,325
Department of the Air Force	1,012,400	58,340	36,895	207,031	34,795	88,717	579,005	362	7,255
Defense agencies	1,592,731	61,564	29,296	119,311	52,558	433,213	777,558	290	118,941
Department of Education	142,587	14,473	4,927	0	0	2,687	5,375	115,125	0
Department of Energy	3,513,206	303,082	0	1,907,358	334,455	221,706	722,069	516	24,020
Dept of Health & Human Svcs, total	9,484,344	8,413,899	150,241	185,029	0	25,192	100,317	243,045	366,621
Administration on Aging 2/	2,474	0	0	0	0	0	0	2,474	0
Admin for Children & Families 2/ 3/	17,419	0	0	0	0	0	0	17,419	0
Agency for Health Care Policy & Research 4/	135,645	27,129	0	0	0	2,713	0	69,179	36,624
Centers for Disease Control	183,053	183,053	0	0	0	0	0	0	0
Food & Drug Administration	151,200	151,200	0	0	0	0	0	0	0
Health Care Financing Admin	68,600	0	0	0	0	0	0	68,600	0
Health Resources & Svcs Admin	10,892	10,892	0	0	0	0	0	0	0
National Institutes of Health 5/	8,866,093	8,035,625	150,241	185,029	0	22,479	100,317	42,405	329,997
Office of the Assistant Secretary for Health	6,000	6,000	0	0	0	0	0	0	0
Office of the Secretary	15,868	0	0	0	0	0	0	15,868	0
Social Security Administration	27,100	0	0	0	0	0	0	27,100	0

See explanatory information, if any, and SOURCE at end of table.

OSTP-18A

Estimated Federal obligations for research, by agency and field of science and engineering: fiscal year 1994

[Dollars in thousands]

Agency and subdivision	Total	Life sciences	Psychology	Physical sciences	Environmental sciences	Mathematics and computer sciences	Engineering	Social sciences	Other sciences, n.e.c.
Department of Housing & Urban Dvlpmt	12,776	0	0	0	85	125	84	12,077	405
Department of the Interior, total	544,973	93,936	0	33,511	306,984	14,858	91,249	4,435	0
Bureau of Land Management	6,463	5,186	0	0	1,242	0	0	35	0
Bureau of Mines	84,506	0	0	0	8,494	0	76,012	0	0
Bureau of Reclamation	6,600	2,000	0	1,500	0	0	3,100	0	0
Geological Survey	349,880	2,150	0	32,011	292,247	14,658	8,414	400	0
Minerals Management Service	5,024	0	0	0	1,301	0	3,723	0	0
National Park Service	7,700	0	0	0	3,500	200	0	4,000	0
Office of the Secretary	200	0	0	0	200	0	0	0	0
US Fish & Wildlife Service	84,600	84,600	0	0	0	0	0	0	0
Department of Justice, total	17,425	1,100	2,500	0	0	800	400	11,785	840
Bureau of Prisons 6/	2,500	0	500	0	0	0	0	2,000	0
Immigration & Naturalization Svc	400	0	0	0	0	0	400	0	0
Office of Justice Programs	14,525	1,100	2,000	0	0	800	0	9,785	840
Department of Labor, total	20,713	0	0	0	0	0	0	20,713	0
Bureau of Labor Statistics	7,000	0	0	0	0	0	0	7,000	0
Employment & Training Admin	3,349	0	0	0	0	0	0	3,349	0
Occupational Safety & Health Administration	3,765	0	0	0	0	0	0	3,765	0
Office of the Secretary	3,323	0	0	0	0	0	0	3,323	0
Pension Benefit Guaranty Corp	696	0	0	0	0	0	0	696	0
Pension & Welfare Benefit Admin	2,580	0	0	0	0	0	0	2,580	0
Department of State	5,383	0	0	0	0	0	0	5,383	0
Department of Transportation, total	281,237	16,662	13,740	3,496	16,535	30,175	180,983	17,863	1,783
Coast Guard	6,147	0	737	0	756	1,536	3,118	0	0
Federal Aviation Administration	75,146	11,818	10,131	1,645	1,300	8,817	39,852	0	1,783
Federal Highway Administration	149,704	1,607	2,872	482	14,329	14,286	104,452	11,676	0
Federal Railroad Administration	13,999	0	0	1,119	0	0	11,060	1,820	0
Federal Transit Administration 7/	6,000	0	0	0	0	0	6,000	0	0
Maritime Administration	1,741	0	0	0	50	0	1,691	0	0
National Highway Traffic Safety Administration	26,978	3,237	0	0	0	5,126	14,298	4,317	0
Office of the Secretary	772	0	0	250	0	0	472	50	0
Research & Special Programs Administration	750	0	0	0	100	410	240	0	0
Department of the Treasury, total	21,458	160	457	5,675	0	14,312	0	854	0
Bureau of Engraving & Printing	5,025	0	0	5,025	0	0	0	0	0
Internal Revenue Service 8/	14,312	0	0	0	0	14,312	0	0	0
Office of Thrift Supervision 9/	854	0	0	0	0	0	0	854	0
United States Customs Service	650	0	0	650	0	0	0	0	0
United States Secret Service 10/	617	160	457	0	0	0	0	0	0
Department of Veterans Affairs	173,700	155,430	13,578	0	0	0	4,692	0	0

See explanatory information, if any, and SOURCE at end of table.

OSTP-18b

Estimated Federal obligations for research, by agency and field of science and engineering: fiscal year 1994

[Dollars in thousands]

Agency and subdivision	Total	Life sciences	Psychology	Physical sciences	Environmental sciences	Mathematics and computer sciences	Engineering	Social sciences	Other sciences, n.e.c.
Other agencies:									
Advisory Commission on Intergovernmental Relations	1,939	0	0	0	0	0	0	1,939	0
Agency for International Dvlpmt	282,863	206,349	0	0	0	3,500	954	26,080	45,980
Appalachian Regional Commission	900	0	0	0	0	0	0	900	0
Consumer Product Safety Commission	147	0	0	100	0	0	47	0	0
Environmental Protection Agency	576,900	216,100	3,100	110,300	107,000	13,300	121,500	1,600	4,000
Federal Communications Commission	1,745	0	0	0	0	123	1,037	585	0
Federal Trade Commission	876	0	0	0	0	0	0	876	0
Library of Congress	2,106	0	0	0	0	0	0	0	2,106
National Aeronautics & Space Admin	4,096,065	171,037	13,997	1,134,899	721,719	141,566	1,884,777	50	28,020
National Archives & Records Admin	280	0	0	280	0	0	0	0	0
National Science Foundation	2,216,967	339,817	14,874	553,672	481,190	273,289	307,382	68,288	178,455
Nuclear Regulatory Commission	122,094	0	0	0	0	0	122,094	0	0
Smithsonian Institution	100,900	35,244	0	28,163	7,084	0	0	30,409	0
Tennessee Valley Authority	27,351	4,755	0	7,132	1,250	0	3,084	630	10,500
US Arms Control & Disarmament Agency	1,000	0	0	0	0	0	0	1,000	0
United States Information Agency	656	0	0	0	0	0	656	0	0
US International Trade Commission	14,291	0	0	0	0	0	0	14,291	0

1/ Data reported for the Agricultural Marketing Service include funds for the Office of Transportation beginning in 1989.

2/ In fiscal year 1991 Human Development Services was replaced by the Administration for Children and Families and by the Administration on Aging. Beginning in fiscal year 1992, data shown for the Administration for Children and Families are separate from obligations for the Administration on Aging.

3/ Obligations reported for the Administration for Children and Families may be incomplete due to unavailability of data.

4/ In fiscal year 1991 the Agency for Health Care Policy and Research became separate from the Office of the Assistant Secretary for Health.

5/ Fiscal year 1992 figures include obligations from the Alcohol, Drug Abuse, and Mental Health Administration. Due to reorganization within the Department of Health and Human Services, the Alcohol, Drug Abuse, and Mental Health Administration ceased to exist as of October 1992, and its research and development functions are reported with the National Institutes of Health data beginning with this volume (XLII).

6/ Formerly listed as Federal Prison System

7/ Name changed from Urban Mass Transit Administration on Dec. 18, 1991

8/ Due to the reorganization of the Internal Revenue Service and subsequent unavailability of data, fiscal year 1992 figures are taken from estimates made in the Volume XLI submission.

9/ In 1989 the Federal Home Loan Bank Board was replaced by the Office of Thrift Supervision. In 1990 the Office of Thrift Supervision became part of the Department of the Treasury.

10/ Formerly listed as Office of Protective Research

NOTE: Only those agencies that had obligations in the variables represented by this table appear in the table. For a complete list of the Federal agencies that have been included in the Federal Funds Survey, refer to appendix A.

KEY: n.e.c. = Not elsewhere classified

SOURCE: National Science Foundation/SRS, Survey of Federal Funds for Research and Development: Fiscal Years 1992, 1993, and 1994

Estimated Federal R&D obligations, by agency and performing sector: 1993

Performer	Performer total Federal obligations	Primary funding source		Secondary funding source	
	Millions of dollars		Percent		Percent
Total R&D	69,754	DOD	52	HHS	16
Federal intramural laboratories	16,643	DOD	50	NASA	16
Industrial firms	31,203	DOD	79	NASA	14
Industry-administered FFRDCs	2,142	DOE	82	DOD	15
Universities and colleges	11,764	HHS	53	NSF	16
University-administered FFRDCs	3,703	DOE	59	NASA	20
Other nonprofit institutions	2,957	HHS	58	DOD	9
Nonprofit-administered FFRDCs	721	DOD	62	DOE	30
Basic research	14,184	HHS	41	NSF	15
Federal intramural laboratories	2,893	HHS	38	NASA	21
Industrial firms	1,104	NASA	56	HHS	19
Industry-administered FFRDCs	227	DOE	95	HHS	5
Universities and colleges	7,070	HHS	50	NSF	24
University-administered FFRDCs	1,468	DOE	66	NASA	23
Other nonprofit institutions	1,228	HHS	71	NSF	11
Nonprofit-administered FFRDCs	79	DOE	86	DOD	11
Applied research	13,715	HHS	25	DOD	25
Federal intramural laboratories	4,948	DOD	28	NASA	18
Industrial firms	2,955	DOD	47	NASA	29
Industry-administered FFRDCs	451	DOE	83	DOD	5
Universities and colleges	3,183	HHS	58	DOD	14
University-administered FFRDCs	916	DOE	75	NASA	16
Other nonprofit institutions	976	HHS	54	AID	24
Nonprofit-administered FFRDCs	101	DOE	61	HHS	14
Development	41,855	DOD	76	NASA	11
Federal intramural laboratories	8,802	DOD	74	NASA	13
Industrial firms	27,144	DOD	85	NASA	10
Industry-administered FFRDCs	1,464	DOE	80	DOD	20
Universities and colleges	1,511	HHS	60	DOD	28
University-administered FFRDCs	1,318	DOE	42	DOD	37
Other nonprofit institutions	753	HHS	43	DOD	28
Nonprofit-administered FFRDCs	541	DOD	81	DOE	16

AID = Agency for International Development
DOD = Department of Defense
DOE = Department of Energy
FFRDC = Federally funded research and development center
HHS = Department of Health and Human Services
NASA = National Aeronautics and Space Administration
NSF = National Science Foundation

OSTP-19

Funding of Research and Development: Highlights
(budget authority, dollar amounts in millions)

Agency	1993 Actual	1995 Estimate	1996 Proposed	Dollar Change 1995-1996	% Change 1995-1996
Basic Research User Facilities	NA	NA	100	+100	NA
Environment & Natural Resources	NA	5,339	5,536	+197	+4%
US Global Climate Change Research Program*	1,531	2,118	2,157	+39	+2%
Environmental Technology Initiative*	67	139	192	+53	+38%
High Performance Computing and Communications	762	1,080	1,142	+63	+6%
Education and Training Technology	NA	328	335	+8	+2%
Partnership for a New Generation of Vehicles	NA	246	333	+87	+35%
Construction & Building	NA	141	169	+28	+20%
Physical Infrastructure for Transportation	NA	247	321	+74	+30%
Advanced Technology Program (DoC)	68	431	491	+60	+14%
Manufacturing Extension Partnerships (DoC)	18	91	147	+56	+62%
National Institute of Standards and Technology Inhouse Research (DoC)	193	259	300	+41	+16%
Technology Reinvestment Project	472	443	500	+57	+13%

* US Global Change Research Program and Environmental Technology Initiative are parts of the Enviornment and Natural Resource Initiative.

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Divider Title: _____

National Institutes of Health

DEPARTMENT OF HEALTH AND HUMAN SERVICES

March, 1995
Contact Point: NIH Office of Public Information
(301-496-1766)

Department of Health and Human Services
Public Health Service
The National Institutes of Health

NIH: THE FEDERAL INVESTMENT IN BIOMEDICAL SCIENCE

The National Institutes of Health (NIH) is the principal agency for U.S. investment in biomedical science. Comprising twenty-three Institutes, Centers and Divisions (ICDs), NIH is an integral part of our Nation's commitment to improving the health and quality of life of its citizens. Through the conduct, support and promotion of biomedical research, NIH pursues science to expand fundamental knowledge about the nature and behavior of living systems, to apply that knowledge to extend the health of human lives, and to reduce the burdens resulting from disease and disability. To achieve its mission, NIH supports more than 50,000 scientists working at 1,700 institutions across the U.S. This broad-based research agenda yields rich and varied returns in the form of advances leading to new therapeutic and diagnostic methods, more effective approaches to health promotion and disease prevention, and savings in health-care expenditures.

NATIONAL INSTITUTES OF HEALTH - Dr. Harold Varmus, Director

	Director	Acronym
National Cancer Institute	Dr. Sondik*	NCI
National Heart, Lung, & Blood Institute	Dr. Lenfant	NHLBI
National Institute of Dental Research	Dr. Slavkin	NIDR
National Institute of Diabetes, Digestive & Kidney Diseases	Dr. Gorden	NIDDK
National Institute of Neurological Disorders & Stroke	Dr. Hall	NINDS
National Institute of Allergy & Infectious Diseases	Dr. Fauci	NIAID
National Institute of General Medical Sciences	Dr. Cassman*	NIGMS
National Institute of Child Health & Human Development	Dr. Alexander	NICHD
National Eye Institute	Dr. Kupfer	NEI
National Institute of Environmental Health Sciences	Dr. Olden	NIEHS
National Institute on Aging	Dr. Hodes	NIA
National Institute of Arthritis, Musculoskeletal & Skin Diseases	Dr. Lockshin*	NIAMS
National Institute of Deafness & Other Communication Disorders	Dr. Snow	NIDCD
National Institute of Mental Health	Dr. Cowdry*	NIMH
National Institute of Drug Abuse	Dr. Leshner	NIDA
National Institute of Alcohol Abuse and Alcoholism	Dr. Gordis	NIAAA
National Institute for Nursing Research	Dr. Grady	NINR
National Center for Research Resources	Dr. Vaitukaitis	NCRR
National Center for Human Genome Research	Dr. Collins	NCHGR
Fogarty International Center	Dr. Schambra	FIC
National Library of Medicine	Dr. Lindberg	NLM
Office of the Director	Dr. Varmus	OD
Office of AIDS Research	Dr. Paul	OAR
Buildings & Facilities	Mr. Ficca	B&F

* Acting

DHHS-National Institutes of Health

Summary of Appropriations
(Dollars in Thousands)

	FY 1996 President's Budget		
	ICD Estimate	Proposed AIDS Distribution	ICD Estimate Including AIDS
NCI	$1,994,007	$225,790	$2,219,797
NHLBI	1,279,096	57,925	1,337,021
NIDR	168,341	12,309	180,650
NIDDK	748,798	11,735	760,533
NINDS	648,255	23,807	672,062
NIAID	557,354	596,018	1,153,372
NIGMS	907,674	26,135	933,809
NICHD	526,177	60,713	586,890
NEI	300,693	9,125	309,818
NIEHS	278,832	6,051	284,883
NIA	445,823	1,785	447,608
NIAMS	235,428	3,039	238,467
NIDCD	172,399	1,650	174,049
NIMH	558,580	93,556	652,136
NIDA	298,738	153,331	452,069
NIAAA	185,712	10,135	195,847
NINR	50,159	4,896	55,055
NCRR	316,544	68,370	384,914
NCHGR	166,678	1,000	167,678
FIC	15,267	9,694	24,961
SUBTOTAL	9,854,555	1,377,064	11,231,619
NLM	136,311	3,162	139,473
OD	230,256	27,598	257,854
Office of AIDS Res.	1,407,824	(1,407,824)	---
B&F	144,120	---	144,120
TOTAL	11,773,066	2,815,648	11,773,066

NATIONAL INSTITUTES OF HEALTH

FY 1996 Request
Budget Assumptions

	(Dollars in Thousands) TOTAL	NON-AIDS	AIDS
FY 1995 Current Estimate	$11,305,546	$ 9,969,820	$ 1,335,726
FY 1996 Request	11,773,066	10,365,242	1,407,824
Dollars	467,520	395,422	72,098
Percent	4.1%	4.0%	5.4%

BRDPI FY 1996 - FY 2000 = 4.3%

GDP FY 1996 - FY 2000 = 3.0%

	Increase	Total Program
PRESIDENT'S AREAS OF EMPHASIS: (amounts and ICD allocation identified by NIH)	**$68.4 million**	
• Tuberculosis	$ 2.1 million	$ 53.1 million
• Office of Research on Women's Health	$ 4.5 million	$ 17.3 million
• High Performance Computing (HPCC)	$ 8.3 million	$ 78.9 million
• Breast Cancer - Includes $5 million for mutations and environmental cancer	$49.1 million	$426.2 million
• (Breast Cancer Action Plan)	($10.0 million)	($ 20.0 million)
• Minority Health Initiative	$ 4.5 million	$ 62.8 million

NIH AREAS OF EMPHASIS:	**$121 million**
• The Brain and Brain Disorders	$ 16.7 million
• Disorders of Development and Reproductive Biology	$ 5.9 million
• Bone, Muscle & Connective Tissue Diseases	$ 9.0 million
• Mutations and Environmental Cancer - (includes $5 million under NCI breast cancer)	$ 5.0 million
• Shared Resources	$ 10.0 million
• DNA Sequencing Technology	$ 10.0 million
• Prevention Research - Emerging infections - Vaccines - Behavior	$ 10.0 million
• Gene Therapy	$ 10.0 million
• Structural Biology and Drug Design	$ 7.5 million
• Clinical Center Training • Modern computer technology as it relates to Clinical Research and training through patient care, clinical research and clinical training. • Offset to future MF tap	$ 1.5 million
• Communications Infrastructure	$ 3.0 million
• Buildings and Facilities	$ 30.0 million
• Office of the Director	$ 2.5 million

MECHANISMS OF SUPPORT

Biomedical research activities at NIH are funded through a variety of mechanisms of support. Some important differences among these mechanisms include distinctions between:

- Intramural research and extramural research - Intramural research is defined as research conducted within NIH facilities. Extramural research is defined as research conducted at institutions outside of NIH, including academic institutions, medical colleges, state and local governments, and private industry. The majority, (approximately 80%) of NIH funded research is extramural.

- Investigator-initiated activities and NIH program-initiated activities - Several mechanisms involve formal collaborations between NIH, the extramural research community, and private industry and fall on a continuum between investigator-initiated and NIH-initiated research. Examples include NIH-supported extramural mechanisms such as research project grants (RPGs), Requests for Applications and cooperative agreements, and inhouse mechanisms such as intramural research.

Within each of the mechanisms of support, NIH strives to manage its public funds prudently. The NIH requires that appropriate steps be taken to ensure high quality results, to establish safeguards to prevent conflicts of interest, to ensure the integrity of the scientific research community and the integrity of research results, and to require that minorities and women be included in study populations.

Peer Review

Central to NIH's mission is support of biomedical research of the highest quality. All NIH funded research is subject to peer review. Each extramural application undergoes a peer review process based upon two sequential levels of review in which the research proposal is first reviewed for technical and scientific merit by an Initial Review Group composed of scientists selected for their competence in particular scientific areas. Second, the application is reviewed by a National Advisory Council or Board to evaluate the application's scientific merit and program relevance as it reflects the mission of the funding component to which the proposal has been assigned.

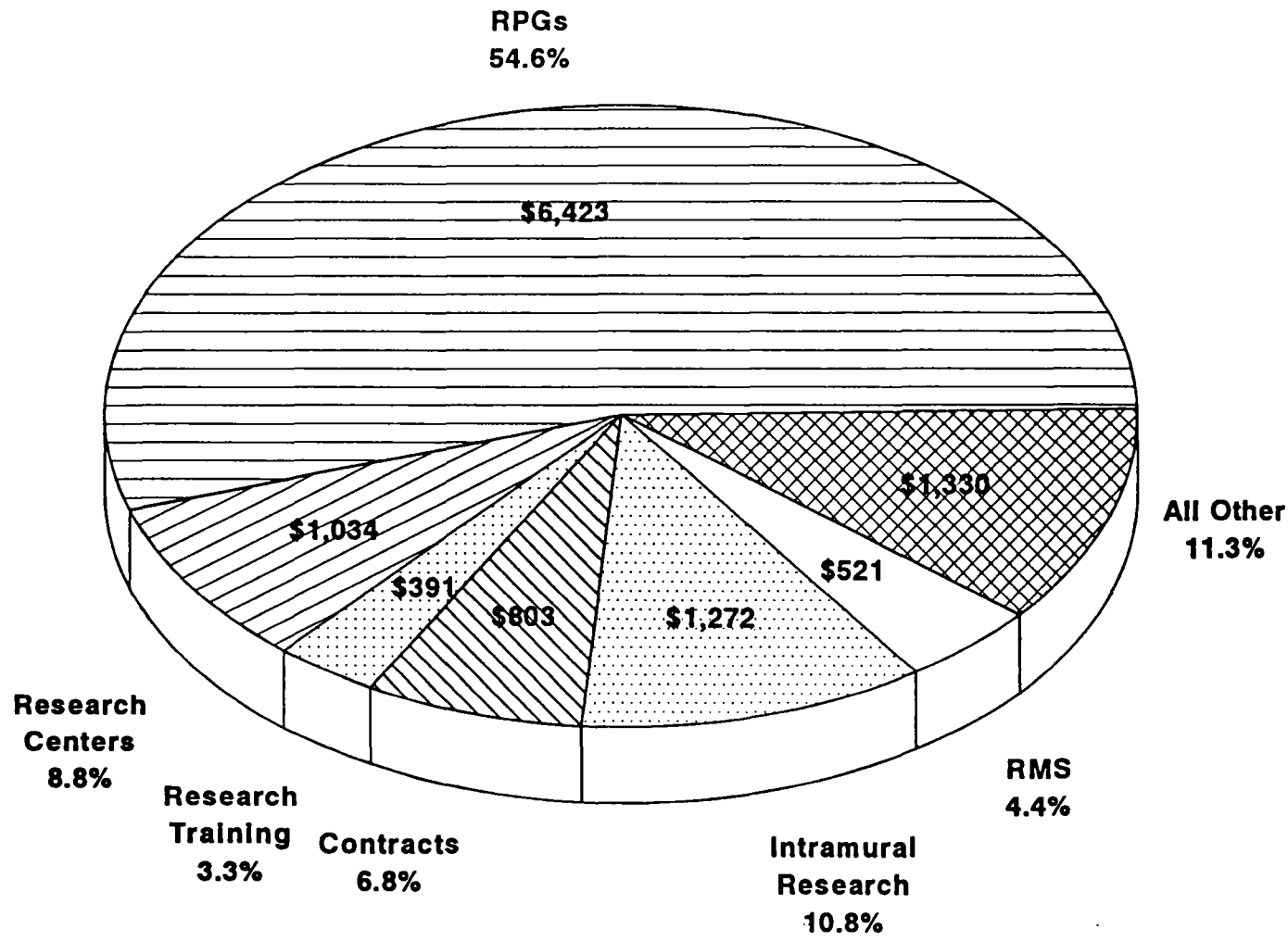
The review and evaluation of research projects and investigators in the NIH intramural laboratories is performed by boards of scientific counselors composed of non-Federal scientists with outstanding achievement and expertise in relevant areas of research.

NAT ONAL INSTITU ES OF HEAL H

Percentage Share of NIH Total by Mechanism
FY 1996 Estimate

(Dollars in Millions)

Total $11,773



TOP FIVE NIH ADVANCES

- **Advances in Understanding and Diagnosing Cancers.** Scientists are making significant inroads against a number of cancers, including breast, prostate and colorectal cancers and melanoma. The recent cloning of a **breast cancer** susceptibility gene brings us closer to understanding the origins of a disease that will be diagnosed in 200,000 women and fatal in 50,000 this year. Investigators have also identified a chromosomal region that contains a second familial breast cancer gene and are working to pinpoint the specific gene. These are important steps toward identifying mutations that can lead to breast cancer, developing tests to identify women who are at increased risk for the disease, and studying the effects of environmental agents that may contribute to the development of some breast cancers.

  Colorectal cancer is another cancer prevalent in the U.S. One form of this disease is hereditary non-polyposis colorectal cancer (HNPCC), which affects as many as 1 in 200 Americans. Persons with HNPCC are especially prone to developing cancers at other organ sites. Scientists have recently identified mutations in four genes responsible for more than 90 percent of HNPCC. These genes normally function in "proofreading" DNA by detecting and repairing any mistakes that occur during cell division. When these genes are defective, mistakes in DNA are propagated. Further study of this mechanism may lead to the development of a diagnostic test for HNPCC and shed light on how other cancers develop.

  Researchers have identified a key piece in the puzzle of **melanoma**, an aggressive and often lethal cancer. Most melanomas arise spontaneously and involve damage to the p16 gene, which normally suppresses tumor growth. Now scientists have demonstrated that in about 10 percent of all melanoma cases, mutations in p16 are passed on from one generation to the next, giving rise to the development of inherited melanoma. This finding is an important first step on the path to developing a diagnostic test to identify individuals especially prone to this fast-spreading cancer, as well as to finding ways to treat the disease early or prevent it altogether.

- **Hormone Replacement Therapy and Heart Disease Risks**. The Postmenopausal Estrogen/Progestin Interventions (PEPI) - the first major clinical trial to examine the effects of sex hormones on heart disease risk factors in postmenopausal women - found that all four of the hormonal regimens tested produced significant increases in levels of HDL cholesterol. For women, a high level of HDL is believed to provide strong protection against coronary heart disease. Estrogen taken alone and estrogen combined with natural progesterone yielded the greatest increases in HDL. The study also found that all of the active treatments tested caused significant decreases in LDL ("bad") cholesterol and fibrinogen, a blood clotting factor predictive of stroke and heart attack. Further, neither estrogen taken alone nor estrogen/progestin combinations

increased blood pressure, as had been previously believed. The results also indicated that combination hormonal therapy may be the preferred treatment for women who have a uterus. These study results provide scientifically based guidance for postmenopausal women and their physicians seeking safe hormonal regimens that will improve their heart disease risk factors.

- **AZT Reduces Mother-to-Child HIV Transmission.** The transmission of HIV from infected pregnant women to their newborn offspring is the principal source of pediatric HIV/AIDS worldwide. Annually in the U.S., approximately 7,000 infants are born to HIV+ mothers, with as many as 2,000 of them infected with HIV. Investigators sought to reduce this transmission by giving Zidovudine (AZT) to HIV-infected women during their pregnancy and delivery, and to their offspring for six weeks following delivery. With these treatments, the transmission rate of HIV from mother-to-child was reduced by approximately 67 percent. This therapy could potentially prevent HIV infection in up to 1,300 children per year.

- **New advance in treating sickle cell disease.** Sickle cell disease affects 1 in 500 African Americans. Painful crisis, the most common manifestation of sickle cell disease, not only impairs the quality of life and productivity of affected individuals, but also frequently requires affected individuals to seek relief in emergency rooms and to be hospitalized. In addition, sickle cell patients often require chronic transfusion therapy and are therefore, at risk for disease transmission, iron overload, alloimmunization (which can lead to difficulties in finding compatible blood units for future transmissions). NIH has completed a clinical trial of the drug hydroxyurea, the first therapeutic agent for patients with sickle cell disease (SCD) to show promise of clinical efficacy without life-threatening toxicity. The trial was halted ahead of schedule when interim analysis of data indicated that daily administration of hydroxyurea reduced the frequency of painful episodes and associated hospital admissions by about 50 percent. Hydroxyurea therapy also reduced by half the frequency of acute chest syndrome, a life-threatening complication of SCD. Moreover, patients receiving hydroxyurea required 50 percent fewer units of tranfused blood than patients who tool a placebo, a finding that has important public health implications. The results of this trial are expected to improve quality of life for SCD patients and reduce the costs associated with their care.

- **Mouse Model for Obesity Leads to Discovery of Obesity Gene.** In perhaps the greatest discovery in obesity research to date, researchers have isolated a defective mouse gene that results in profound obesity and non-insulin-dependent diabetes mellitus. The scientists located the gene by studying a strain of mouse that can weigh up to five times more than normal. Their studies suggest a mechanism for how the obesity gene controls the amount of fat deposition. The normal mouse gene appears to be switched on in fat tissue, where it generates a protein that is secreted into the

bloodstream and, once it reaches the appetite-controlling area of the brain, acts to regulate food intake. A defective obesity gene may produce little or no protein, and so the brain would not receive the proper message about the status of body fat stores, and appetite control would be lost. Investigators used their knowledge of the mouse gene to pinpoint a nearly identical obesity gene in human DNA. Because of the close similarity between the human and mouse genes, it is likely that they perform similar functions. Scientists are now investigating whether the gene is mutated in obese humans. It is likely that human obesity will be much more complicated than obesity in the mouse, possibly involving multiple genes and proteins. Nonetheless, this landmark research may eventually lead to more effective medical therapies for weight problems, and to testing for genetic predisposition for obesity early in life, when dietary modification might help prevent obesity and reduce the prevalence of many chronic obesity-related including non-insulin-dependent diabetes.

NIH-SPONSORED RESEARCH BENEFITS:

HEALTH, SAVINGS, AND ECONOMIC STIMULUS

*LITHIUM TREATMENT FOR MANIC-DEPRESSIVE ILLNESS
($145 B TOTAL)

*FLUORIDATION FOR PREVENTION OF DENTAL CARIES
($4 B/YEAR)

*VACCINE FOR HEMOPHILUS INFLUENZA TYPE B
($400 M/YEAR)

*HELICOBACTER AS CAUSE OF GASTRIC ULCERS
($700 M/YEAR)

*AZT PREVENTION OF HIV TRANSMISSION AT BIRTH
(1000 CASES/YEAR)

*CONTROL OF SICKLE CELL DISEASE WITH HYDROXYUREA

*DEVELOPMENT OF RECOMBINANT DNA METHODS--->
BIOTECHNOLOGY INDUSTRY FOR MEDICAL,
AGRICULTURAL AND OTHER USES ($50 B/YEAR)

*BIOLOGICAL AND CHEMICAL DISCOVERIES--->
DRUG DEVELOPMENT BY THE PHARMACEUTICAL
INDUSTRY (>$100 B/YEAR)

SOME REASONS WHY THE FUTURE OF NIH IS EXCITING

***THE HUMAN GENOME PROJECT**:

RISK ASSESSMENT, PREVENTION, AND TREATMENT OF COMMON AND RARE INHERITED DISEASES

*** THE MOLECULAR BASIS OF CANCER**:

NEW OPPORTUNITIES FOR DIAGNOSIS AND THERAPY

*** NEUROSCIENCE**:

MENTAL HEALTH, DRUG AND ALCOHOL ADDICTION, AND MANY OTHER NEUROLOGICAL DISEASES

*** OTHER LABORATORY SCIENCES**
(IMMUNOLOGY, MICROBIOLOGY, CELL BIOLOGY):

EMERGING INFECTIONS, DISEASES OF METABOLISM AND AGING, AND MANY OTHER CONDITIONS

*** COMMON SCIENTIFIC PRINCIPLES**:

COOOPERATION AMONG ICD'S IN PURSUIT OF INDEPENDENT OBJECTIVES

NATIONAL INSTITUTES OF HEALTH

Examples of Collaborative Efforts with Other Federal Agencies

Human Genome Project: NCHGR - DOE

HIV Nucleic Acid Sequencing Database: NIAID - DOE

Malaria and Dengue Vaccine Development: NIAID - U.S. Army

Toxic Chemical Release Inventory Database (TOXNET): NLM - EPA

High Performance Computing and Communications: NLM, NCRR, NCI - NASA; ARPA and NSA, DOD; NSF; DOE; NIST, DOC

Hearing Aid Initiative: NIDCD - VA

SpaceLab Life Sciences-4, Neurolab: NIDCD, NIA, NINDS - NASA, NSF, ONR, National Space Development Agency of Japan, Canadian Space Agency, Centre National d'Etudes Spatiales, European Space Agency Headquarter, and the German Space Agency.

Superfund Research, Development and Training Programs: NIEHS - EPA

Protein Data Bank/Molecular Structure Data Base: NIGMS, NLM - NSF, DOE

Protein Engineering Workshop: NIGMS - NSF, DOE, NIST

Women's Interagency HIV Study: NIAID, NICHD, NIDR - CDC, ACHPR

AIDS Clinical Trials: NIAID - VA

Radon Exposure Research: NIEHS - EPA

Electric and Magnetic Field (EMF) Research: NIEHS - DOE

Research to develop assays and protocols to reduce or eliminate the use of animals in acute testing: NIEHS - ATSDR, CPSC, DOD, DOE, DOI, DOT, FDA, NIOSH, OSHA

Breast Cancer Imaging: NCI - NASA

Nutrition and Cancer Research: NCI - USDA

Basic Research in Environmental and Occupational Cancers: NCI - EPA, NIOSH, CPSC

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Divider Title: _____

National Science and Technology Council
Committee on Fundamental Science

LEADERSHIP EXCHANGE

NATIONAL SCIENCE FOUNDATION

Director: Neal Lane
Deputy Director: Anne C. Petersen

Briefing Materials

Point of Contact for Further Information
Judith S. Sunley, Asst. to the Director for Science Policy and Planning
Phone: 703-306-1018
Fax: 703-306-0109
E-mail: jsunley@nsf.gov

National Science Foundation
Fiscal Year 1996 Budget Request
Overview

FY 1996 Request = $3,360 million

NSF's investments in research and education strengthen and help secure the nation's capability to excel in science and engineering. As a principal supporter of fundamental research conducted at colleges and universities and of mathematics, science, and engineering education, NSF helps to provide the nation with both the base of advanced knowledge and the highly skilled workforce needed to pursue and capitalize on opportunities in science and technology.

NSF's FY 1996 request is shown in Figure 1.

The Return on Investments in NSF

There is general consensus among economists and policy researchers that public investments in science and engineering yield very high annual rates of return to society (i.e., well over 20 percent). At a recent conference conducted jointly by the American Enterprise Institute and the Brookings Institution, many top researchers, including former Council of Economic Advisers Chairs Michael Boskin and Charles Schultze, agreed that research and development has a significant and important positive effect on economic growth and living standards. Furthermore, the activities supported by NSF -- namely fundamental research and education based at academic institutions -- are generally viewed as among the most productive of all Federal investments.

Figure 1

NSF FY 1996 Budget Request
(Dollars in Millions)

	FY 1995 Plan	FY 1996 Request	Change Amount	Change Percent
Research & Related Activities[1]	2,280.00	2,454.00	174.00	7.6%
Education & Human Resources	605.97	599.00	(6.97)	-1.2%
Academic Research Infrastructure[2]	118.13	100.00	(18.13)	-15.3%
Major Research Equipment[1]	126.00	70.00	(56.00)	-44.4%
Salaries & Expenses	123.97	127.31	3.34	2.7%
NSF Headquarters Relocation	5.20	5.20	0.00	0.0%
Office of Inspector General	4.38	4.49	0.11	2.5%
Total, NSF[1]	$3,263.65	$3,360.00	$96.35	3.0%

[1] $35 million available for LIGO in FY 1994 within R&RA was rescinded and restored in the FY 1995 plan within MRE. Total new budget authority for NSF in FY 1995 is $3.228 billion.
[2] Assumes proposed rescission of $131.87 million in ARI.

In recent years, NSF's investments have enabled numerous important advances that have extended the frontiers of knowledge, contributed to addressing many of the nation's most pressing concerns and priorities, and provided education and training opportunities for the science and engineering workforce.

- NSF has worked in partnership with NASA and other organizations to support research on the collision between Comet Shoemaker-Levy 9 and Jupiter. Researchers using NSF-supported supercomputing resources predicted the time and place of the individual collisions. Images of the impacts have been made widely available via electronic networks to researchers, teachers, and the general public. Astronomers and planetary scientists supported by NSF and NASA continue to analyze data from the collisions to determine the long-term effects on Jupiter's atmosphere and structure as well as how such collisions might have influenced the Earth's development.

- Micro-electromechanical systems (MEMS) -- mixtures of sensors, motors, and computers that can fit on the head of a pin -- have emerged as a valuable commercial technology thanks in large part to NSF's timely support of fundamental research. The current market for MEMS devices is estimated to exceed $1 billion, and the automobile industry now uses MEMS devices in airbags and electronic ignition systems. Support provided through NSF's engineering activities led to the first micro-motors and other crucial advances.

- NSF's leadership in mathematics, science, engineering, and technology education has enabled 25 states, 25 urban areas, six rural regions, and scores of colleges and universities to plan for and, in many instances, initiate total system reform efforts. These efforts are based on the premise that all students can achieve at much higher levels than at present.

- Research in mathematical economics supported by NSF has yielded new insights into the dynamics of competition in the marketplace. The Federal Communications Commission

drew upon these insights when designing the auctions to allocate licenses for use of the electromagnetic spectrum -- auctions that have netted billions of dollars to the U.S. Treasury.

Through its FY 1996 budget request, NSF will continue to seek the most promising and highest quality investments in research and education. The roughly 20,000 projects NSF supports annually are selected strictly on the basis of merit and cover all disciplines of the sciences and engineering and all levels of education. The research and education community has direct input into NSF's funding decisions; this year, for example, over 60,000 researchers and educators are expected to participate in the process of reviewing proposals submitted to the Foundation.

In addition, NSF employs a variety of mechanisms to increase the return on the nation's investments in research and education -- including fostering industry/university/government partnerships and state/Federal partnerships in research and education, supporting multidisciplinary approaches to solving complex problems, participating in interagency activities coordinated by the National Science and Technology Council, and promoting international cooperation and cost-sharing.

NSF's Investment Goals

The Administration's August 1994 report, *Science in the National Interest*, outlined a policy framework for all Federal investments in fundamental science, mathematics, and engineering. The report stressed that "America's future demands investment in our people, institutions, and ideas. Science is an essential part of this investment, an endless and sustainable resource with extraordinary dividends."

Consistent with the Administration's policy framework, the NSF has developed a strategic plan that was endorsed by the National Science Board in October of 1994. The plan identifies a course of action in keeping with the Foundation's long-standing tradition of excellence and its commitment to working in partnership with other organizations dedicated to advancing science and engineering.

The plan sets forth three broad goals to help guide the agency's investments:

- Enable the United States to uphold a position of world leadership in science, mathematics, and engineering.

- Promote the discovery, integration, dissemination, and employment of new knowledge in service to society.

- Achieve excellence in U.S. science, mathematics, engineering, and technology education at all levels.

Upholding World Leadership. NSF's first goal -- enable the United States to uphold a position of world leadership in science, mathematics, and engineering -- serves as the agency's capstone goal. NSF's programs are essential to upholding U.S. world leadership because they sustain what is truly the nucleus of the nation's scientific enterprise -- basic research conducted

at academic institutions and education in engineering and the sciences. This support produces both the new knowledge and the talented people that enable the U.S. to realize opportunities in science and technology.

While NSF accounts for only 3 percent of total Federal spending for R&D, it provides nearly one-half of all Federal support for non-medical basic research performed by colleges and universities, and roughly 30 percent of total Federal support for science, mathematics, engineering, and technology education. Furthermore, in many core scientific disciplines, such as physics, chemistry, computer science, mathematics, biology, and the geosciences, NSF is the dominant source of Federal support for university basic research, as Figure 2 illustrates.

Figure 2

Upholding World Leadership

NSF Share of Total Federal Support for Basic Research at Academic Institutions and for Mathematics and Science Education

Discipline	Share of Federal Support
Social Sciences	61%
Mathematics	58%
Computer Science	56%
Geosciences	51%
Biological Sciences (Non-Medical)	43%
Physical Sciences	42%
Engineering	33%
Science, Mathematics, Engineering & Technology Education	30%
NSF Share of Total Federal R&D	3%

NSF's FY 1996 request includes a balanced set of investments that will help uphold the agency's leadership role in fundamental research and education. The Foundation's request for Research and Related Activities would increase by 8 percent over the 1995 level to a total of $2,454 million. NSF is also seeking nearly $600 million for its Education and Human Resources activity, $70 million for Major Research Equipment, and $100 million for investments in Academic Research Infrastructure.

Knowledge In Service to Society. NSF employs a variety of mechanisms that help all Americans reap the benefits resulting from advances in science and engineering, in keeping with the agency's second goal of advancing knowledge in service to society. In recent years, NSF has increased its emphasis on industry/academe partnerships to improve knowledge transfer between the different sectors and better prepare students of science and engineering for careers in industry and government. NSF's support for advanced computing and networking has helped make tools and resources such as the Internet and the World Wide Web available to anyone with a personal computer.

Another mechanism NSF employs to promote the discovery and integration of knowledge in service to society is the support of research and education in strategic areas of national priority.

In FY 1996, nearly two-thirds of the agency's support for fundamental research and education can be related to seven broadly-defined areas where advances in fundamental research and education are necessary to address key challenges facing the nation. These areas include the Advanced Materials and Processing Program, Biotechnology, Civil Infrastructure Systems, Environment and Global Change, High Performance Computing and Communications, Manufacturing, and Science, Mathematics, Engineering, and Technology Education. As is shown in Figure 3, NSF expects to increase its total investment in these areas by more than $85 million in FY 1996. NSF works closely with other Federal agencies to define priorities in these areas.

Figure 3

Basic Research and Education in Interdisciplinary Strategic Areas
(Millions of Dollars)

	FY 1995 Estimate	FY 1996 Estimate	Percent Change
Advanced Materials & Processing Program	$213	$226	6.0%
Biotechnology	$166	$177	6.2%
Civil Infrastructure Systems	$55	$57	5.1%
Environment & Global Change	$329	$356	7.9%
High Performance Computing & Communications	$297	$314	5.6%
Manufacturing	$128	$136	6.2%
Science, Math, Engineering & Technology Education	$647	$656	1.4%

NSF also gives special emphasis to emerging areas of science and engineering that show great promise for advancing fundamental knowledge and for spurring economic and social progress. In this budget request, areas receiving additional focus include optical science and engineering, environmentally conscious design and manufacturing, the development of human capital, research on water and watersheds, and arctic research.

Achieving Excellence in Education. To achieve excellence in U.S. science, mathematics, engineering, and technology education, NSF supports programs at all educational levels -- from preschool to the postgraduate level. These programs aim to engage all students in science -- not just those who will become scientists, engineers, technicians, and teachers -- so that they can gain the scientific and technological literacy needed to function and prosper in our increasingly technology-based society. These programs also place great emphasis on evaluation in order to track their progress and identify promising projects for widespread dissemination.

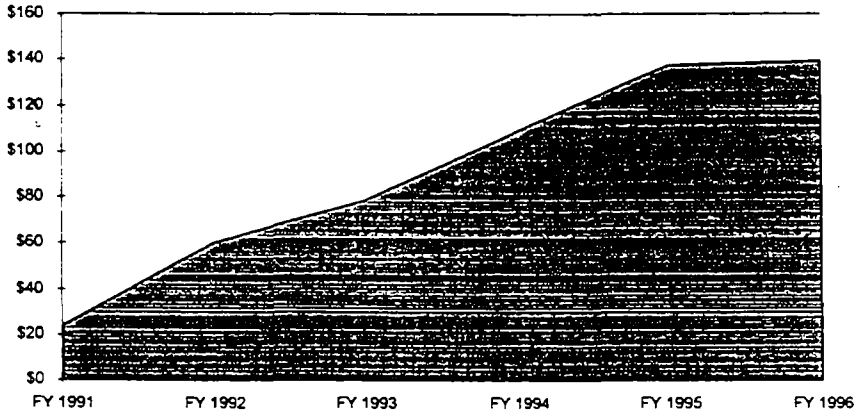
As is shown in Figure 4, over the past five years NSF has greatly increased its investment in a number of systemic reform activities that foster comprehensive change at the city, state, regional, and national level. The underlying premise of these activities is that to attain world class standards in mathematics and science education, we must replace isolated and piecemeal reform efforts with more ambitious, coordinated approaches that involve many aspects of the system. The potential impact of this approach has become apparent. Less than five years ago, for example, NSF began supporting a national effort to reform the teaching of calculus. One of the major projects under this effort began as a consortium of eight institutions,

but the materials developed through it are now in use on over 300 campuses and reach over 20% of the undergraduate students enrolled in introductory calculus.

Figure 4

Support for Systemic Reform

(Millions of Dollars)



Core Programmatic Strategies

To help reach each of its three goals, the NSF has identified four core strategies for its programs in research and education:

- Develop Intellectual Capital
- Strengthen the Physical Infrastructure
- Integrate Research and Education
- Promote Partnerships

These four strategies provide specific direction for NSF's proposed investments to help realize the agency's long-term goals.

Develop Intellectual Capital. Virtually all of NSF's programs help to develop and strengthen the nation's "intellectual capital." NSF's investments expand the reservoir of science and engineering knowledge, talent, and ideas, creating a valuable resource for our entire society. These investments contribute to the intellectual growth of talented scientists and engineers, and they provide opportunities for young people to work on projects at the cutting edge of science and engineering.

As is shown in Figure 5, the projects supported by NSF will involve an estimated 210,000 scientists, mathematicians, engineers, teachers, and students in FY 1996. This includes professional scientists and engineers engaged in research and teaching, recipients of NSF graduate and postdoctoral fellowships and traineeships, students at the graduate, undergraduate, and high school level participating in research projects, and other activities, such as secondary school students attending summer science camps.

Figure 5

Numbers of People Involved in NSF Activities

	FY 1995 Estimate	FY 1996 Estimate
Senior Researchers	25,300	26,100
Other Professionals	10,100	10,300
Postdoctoral Associates	4,400	4,500
Graduate Students	22,300	22,900
Undergraduate Students	22,400	22,800
K-12 Teachers	10,300	10,100
K-12 Students	105,100	113,700
Total Number of People	199,900	210,400

NSF also recognizes that to develop intellectual capital, it must draw upon a pool of ideas and talent that is as diverse and inclusive as possible. For this reason, NSF supports many programs -- including the Alliances for Minority Participation, the Visiting Professorships for Women, and Minority Postdoctoral Fellowships -- that aim to attract more women, minorities, and persons with disabilities to the science and engineering workforce. The Alliances for Minority Participation program (AMP), for example, has established the far-reaching goal of generating a nearly four-fold increase in the number of minority students receiving undergraduate degrees in science and engineering. The 20 AMP consortia, the oldest of which has been in operation for less than three years, have already produced a net increase of 1,500 baccalaureate science and engineering degrees awarded to students from underrepresented groups of the population.

Strengthen the Physical Infrastructure. Extending the frontiers of science and engineering requires advanced facilities, specialized equipment, highly-technical instruments, and effective logistical support. The infrastructure investments supported by NSF enable scientists and engineers to see farther into the universe and deeper into the structure of matter and living systems, while offering students and faculty the opportunity to work with cutting-edge technologies and conduct research in unique settings, such as the polar regions.

NSF's infrastructure investments comprise a balanced portfolio that includes large facilities such as astronomical observatories, particle accelerators, and research vessels as well as smaller, "table-top" instruments that are often developed and customized by scientists and engineers as part of their ongoing research. Key infrastructure investments in NSF's FY 1996 request include:

- Continuing Construction of LIGO -- The Laser Interferometer Gravitational Wave Observatory. When operational in 2001, LIGO will be the first large-scale facility capable of detecting gravitational waves. Gravitational waves were first predicted by Albert Einstein but have yet to be observed directly. NSF is seeking $70 million for its Major Research Equipment Appropriation to fund continuing construction of LIGO.

- NSF support for instrumentation and other equipment used in research projects will increase by nearly 12 percent to a total of $208 million. These investment generally yield

very high returns, as instruments developed to advance fundamental research are often adapted for uses in medicine, telecommunications, and other sectors.

- In Polar Programs, funding for arctic research will increase 23% to nearly $32 million. As part of this increase, support for arctic logistics will triple, increasing by $1.5 million over the 1995 level at which it was established. The logistics funds will provide coordinated support to the increasing number of large interdisciplinary projects located in the arctic region, including the design of an ice station camp in the Beaufort Sea.

- Support for Earth Science Facilities will increase by 15% to $14 million. This includes support for the Global Seismic Network, which enables rapid analysis of earthquakes, monitoring of nuclear proliferation, and the study of thermal processes deep within the Earth.

Other infrastructure projects receiving increases in FY 1996 include the National High Magnetic Field Laboratory, the Cornell Electron Storage Ring, the National Radio Astronomy Observatory, the National Superconducting Cyclotron Laboratory, the National Center for Atmospheric Research, Supercomputer Centers, and the NSFNET. NSF's Academic Research Infrastructure program will be funded at $100 million. Construction of the Gemini Telescopes will proceed with funds appropriated for FY 1995.

Integrate Research and Education. The best way to learn science is by doing science. Through learning experiences based on inquiry and discovery, students gain the ability to gather, analyze, and present complex information and to use advanced technologies in the workplace. For this reason, essentially everything NSF supports relates to learning at one level or another.

NSF's FY 1996 budget employs many different mechanisms that promote the close coupling of research and education in schools, colleges, and universities. Examples include:

- *Faculty Early Career Development Program (CAREER)*: NSF established the CAREER program in FY 1995 to enable NSF-supported scientists and engineers to develop their skills in both research and teaching. The awards provide a framework for junior-level university faculty to link their research projects with their teaching and mentoring responsibilities. In FY 1996, NSF expects to provide approximately $50 million for awards under the CAREER program.

- *Research Experiences for Undergraduates (REU)*: NSF's REU programs nationwide that give undergraduate students the chance to participate directly in research projects. In FY 1996, NSF expects to increase its investment in REUs by 6% to a total of almost $27 million.

- A number of programs within NSF's Education and Human Resources Account promote the effective use of technology and media for the teaching of math and science. For example, NSF supports such television programs as *Bill Nye the Science Guy* and *The Magic School Bus* and funds the development and distribution of teaching materials that complement the programming.

NSF also participates in the interagency Global Learning and Observations to Benefit the Environment (GLOBE) initiative.

Promote Partnerships. Partnerships are central to the Foundation's overall investment strategy. Reaching the agency's goals requires collaboration with many different partners, including the academic community, industry, elementary and secondary schools, other Federal agencies, state and local governments, international partners, and other institutions engaged in science and engineering. These partnerships improve the return on NSF's investments by forging stronger links between the agency's programs and their potential contribution to society.

NSF's proposed investments in FY 1996 will continue to foster innovative partnerships in research and education.

- NSF's Engineering, Mathematical and Physical Sciences, and Computer and Information Science and Engineering Activities support the Grant Opportunities for Academic Liaison with Industry (GOALI) program. GOALI allows scientists and engineers from university and industry to work together in a variety of settings and encourages collaboration at the conceptual stage of a research project. Total support for the GOALI program is expected to increase by at least $5 million in FY 1996 to a total of approximately $15 million.

- The NSF and the Environmental Protection Agency have entered an environmental research partnership. The partnership emphasizes the support and merit review of fundamental environmental research in three areas: 1) Water and Watersheds, 2) Technology for a Sustainable Environment, and 3) Valuation and Environmental Policy. NSF is devoting over $8 million to this effort, and the combined investment by NSF and EPA exceeds $20 million.

- The 18 NSF supported Long Term Ecological Research (LTER) sites have initiated an International Long Term Ecological Research Network that includes representatives from 17 nations. This activity will promote global scientific collaboration and data exchange in environmental research.

NSF's FY 1996 budget will also provide for sustained investments in other programs that foster partnerships, including Engineering Research Centers, Science and Technology Centers, and NSF's participation in government-wide initiatives coordinated by the National Science and Technology Council.

Investments in Efficiency and Productivity

Consistent with the Government Performance and Results Act (GPRA) and the National Performance Review (NPR), NSF is exploring and testing various mechanisms to streamline the agency's operations and improve its ability to serve the research and education community. These efforts are also intended to identify appropriate performance measures for NSF's programs in research and education.

- *FinanceNet*: NSF has worked closely with NPR staff to develop and coordinate FinanceNet -- a forum for exchanging ideas and promoting reinvention efforts in the financial management community.

- *FastLane*: FastLane is an experimental program relying on advanced information technologies, including the Internet and the World Wide Web, to redesign and streamline how NSF does business with the research and education community. Through FastLane, NSF forms are now available electronically via the Internet, and many financial transactions with the university community are conducted via electronic mail.

Also in accordance with the GPRA, NSF has established pilot projects to develop performance measures for its programs in research and education. These projects are currently reviewing the High Performance Computing and Communications Initiative, the Science and Technology Centers, and Specialized Research Facilities in the Mathematical and Physical Sciences. The results of these pilot projects will aid in implementing performance planning on an agency-wide basis.

Conclusion

It was 50 years ago -- in July of 1945 -- that Vannevar Bush, science advisor to Presidents Roosevelt and Truman, issued his short but powerful treatise, *Science: The Endless Frontier*, which outlined the government's appropriate role in "promoting the flow of new scientific knowledge and the development of scientific talent in our youth." While our society has undergone many changes and endured nearly a half century of cold war since those words were written, the NSF continues to fulfill this role for our society, refining and updating Bush's original vision in keeping with the nation's evolving needs.

Today, America is moving forward into a new era. Science is now widely recognized not only as an endless frontier but also as an endless resource. In the November 1994 issue of the *Atlantic Monthly* magazine, the noted social scientist and corporate advisor Peter Drucker observed that our nation is entering a new economic order, "an economic order in which knowledge, not labor or raw material or capital, is the key resource." The ability of both nations and individuals to acquire and use knowledge, especially knowledge derived from science and technology, has become the primary determinant of our overall level of economic prosperity and social progress.

This presents a clear challenge to the National Science Foundation. Because the NSF's core purpose is to advance knowledge in science and engineering, it can and should provide the leadership necessary to help all Americans succeed in this new era and realize the benefits brought by scientific and technological progress. The research and education programs supported by NSF enable both the nation's capability to excel in science and engineering and the ability of individuals throughout our society to pursue opportunities in science and technology.

Through its strategic plan, the Foundation has developed an investment strategy in keeping with the growing importance of science and engineering as a national resource. NSF's FY 1996 budget request is built upon this strategy, and this investment will serve the national interest both today and well into the 21st Century.

MODES OF SUPPORT

The National Science Foundation funds a broad range of activities focused on strengthening the nation's scientific and engineering research enterprise. Support for research and education activities comes in many forms. Research project awards are made to individuals and small groups of investigators and include support for postdoctoral researchers and students. NSF also supports research centers, national user facilities, development and acquisition of instrumentation for individual or shared use, graduate and postdoctoral fellowships, systemic educational reform activities, and workshops and conferences. These activities can be characterized as follows:

(Millions of Dollars)

Modes of Support	FY 1994 Estimate	FY 1995 Estimate	FY 1996 Estimate	% Change FY 1995 -1996
Research Projects	$1,485	$1,560	$1,672	7.2%
Facilities	604	738	710	(3.7%)
Centers	186	202	208	3.0%
Education & Training	585	630	633	0.4%
TOTAL [1]	$2,860	$3,131	$3,223	3.0%

[1] Excludes Salaries and Expenses, NSF Headquarters Relocation, and Office of Inspector General

RESEARCH PROJECTS

Research projects provide support for individuals and small groups devoted both to disciplinary research in traditional fields and to cross-disciplinary fields of national importance. Components of projects include support for researchers along with postdoctoral associates and undergraduate or graduate assistants. Funding is also provided for the instrumentation and equipment necessary to perform research, as well as other related costs such as travel and conference support. In addition, some funding may be included for items such as data bases, laboratories, and museums. Also included under this mode is support targeted for young investigators, women and minority researchers, as well as funding to meet the Foundation's statutory requirements for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs.

FACILITIES

NSF supports large, multi-user facilities which require long-term commitments of support. These facilities are characteristically too large, complicated, or expensive for individual researchers or small distributed groups to construct alone. Support for these national facilities is essential to advance U.S. research capabilities to perform world class research. These facilities meet the need for multi-user access to state-of-the-art research facilities that would otherwise be unavailable. Facility support includes funds to build, maintain, renovate, or operate NSF user facilities.

NSF facilities include: the National Center for Atmospheric Research, Gemini 8-meter telescopes, the National High Magnetic Field Laboratory, the Laser Interferometer Gravitational Wave Observatory, national astronomy centers, NSFNET, the oceanographic research fleet, the nanofabrication facility, and supercomputing centers. Support is also provided for research and research training facilities modernization, and for arctic and antarctic logistics needs.

CENTERS

NSF support for centers is based on the premise that some scientific questions and research problems can best be addressed through the multidisciplinary, long-term, coordinated efforts of many researchers. Although the individual centers' goals are diverse, NSF's centers share common traits, including well-defined coordination with industry to ensure the timely transfer of knowledge into the private sector. Centers also have strong educational components, aiding in the training of the nation's next generation of scientists and engineers and encouraging students of all ages to participate in science.

Types of centers supported by NSF include: Science and Technology Centers, Engineering Research Centers, the National Center for Earthquake Engineering Research, the Center for Ecological Analysis and Synthesis, Long Term Ecological Research Sites, Materials Research Science and Engineering Centers, Minority Research Centers of Excellence, Industry/University Cooperative Research Centers, State Industry/University Cooperative Research Centers, and the National High Field FT-ICR Mass Spectrometry Center.

EDUCATION & TRAINING

NSF's education and training programs support activities from kindergarten through postdoctoral levels, and also include public science literacy. NSF efforts in education and training programs are aimed at enabling U.S. students to become scientifically literate citizens as well as ensuring a well-trained workforce that can maintain U.S. leadership in science and technology.

Programs for K-12 education and training include rural, urban, and statewide systemic reform initiatives, teacher enhancement programs, and teacher preparation programs. At the undergraduate level, NSF supports course and curriculum development, Engineering Education Coalitions, and the Advanced Technological Education program. Graduate programs include research fellowships, research traineeships, and research training groups, as well as dissertation improvement awards.

In some shape or form, virtually all NSF programs actually have an education and training component, through developing knowledge and skills which participants did not have before. Additional support for educational and training efforts provided through research projects, centers and facilities also includes targeted funds for activities such as Research Experiences for Undergraduates and Research in Undergraduate Institutions. Research grants also provide support targeted for investigators early in their careers such as Presidential Faculty Fellows and the Faculty Early Career Development Program (CAREER).

Through all of these modes of support, NSF also places special emphasis on groups which have been historically underrepresented in science and engineering fields; namely, women, minorities, and persons with disabilities. Programs supporting historically underrepresented groups include: Research Improvement in Minority Institutions, Visiting Professorships for Women, Minority Research Centers of Excellence, and Model Institutions for Excellence.

RESEARCH AND RELATED ACTIVITIES $2,454,000,000

The FY 1996 Budget Request for the Research and Related Activities (R&RA) Appropriation is $2,454.00 million, an increase of $174.00 million, or 7.6 percent, over the FY 1995 Current Plan of $2,280.00 million.

The R&RA Appropriation supports activities that enable the United States to uphold world leadership in all aspects of science and engineering, and to promote the discovery, integration, dissemination and employment of new knowledge in service to society. Research activities contribute to the achievement of these goals through expansion of the knowledge base; integration of research and education; stimulation of knowledge transfer among academia and the public and private sectors; and bringing the perspectives of many disciplines to bear on complex problems important to the nation.

(Millions of Dollars)

	FY 1994 Actual	FY 1995 Current Plan	FY 1996 Request	Change Amount	Change Percent
Biological Sciences	287.88	300.95	323.96	23.01	7.6%
Computer and Information Science and Engineering	239.52	258.27	275.57	17.30	6.7%
Engineering	296.73	319.53	344.16	24.63	7.7%
Geosciences	404.16	419.49	451.48	31.99	7.6%
Mathematical and Physical Sciences	617.88	644.57	698.28	53.71	8.3%
Social, Behavioral, and Economic Sciences	98.21	113.79	122.87	9.08	8.0%
U.S. Polar Research Programs	158.38	158.80	172.28	13.48	8.5%
U.S. Antarctic Logistical Support Activities	64.10	62.60	62.60	0.00	0.0%
Critical Technologies Institute	1.50	2.00	2.80	0.80	40.0%
TOTAL, R&RA [1]	$2,168.36	$2,280.00	$2,454.00	$174.00	7.6%

[1] For comparability, Fiscal Year 1994 funds for Major Research Equipment (MRE) which were appropriated in R&RA are presented in the MRE Account.

The R&RA Appropriation funds a broad range of fundamental research activities, including awards for individuals and small groups of investigators; research centers; national user facilities such as the Advanced Scientific Supercomputing Centers, National Astronomy Centers, and the Academic Research Fleet; development and acquisition of instrumentation for individual or shared use; postdoctoral fellowships; education and training activities; and workshops and conferences. R&RA also provides support for activities such as international scientific partnerships, research activities and logistics in the Arctic and Antarctic regions, and collection and dissemination of information on research in science and technology.

Merit review is the principal tool in selecting among proposals for funding. Review emphasizes the capabilities of the investigators; the innovation, importance and relevance of the ideas and approaches; and the potential for enhancing the human and physical infrastructure of science and engineering.

Roughly $1,575 million, or approximately 64 percent, of R&RA supports disciplinary and interdisciplinary research projects submitted by individual investigators and small groups. A significant portion of this research focuses on areas of strategic importance to the nation and to societal needs.

About $590 million, or 24 percent, of the R&RA funding supports unique national facilities such as telescopes, research ships, accelerators, and supercomputers, all of which enable a broad range of research activities, including research in strategic areas.

Support for centers totals $200 million in FY 1996, or approximately 8 percent of the R&RA total. These centers encourage the growth of strong partnerships among academia, industry and government, and include such programs as the State Industry/University Cooperative Research Centers, Engineering Research Centers, and the Materials Research Science and Engineering Centers.

About $88 million, or almost 4 percent, of R&RA goes to innovative programs which support science, mathematics, and engineering education and training at the undergraduate, graduate, and post-doctoral levels. Targeted programs include Engineering Education Coalitions, Multidisciplinary Research Training Groups, Graduate Fellowships for Women in Engineering, and Postdoctoral Fellowships. In addition to these targeted programs, research projects, centers, and facilities all contain an educational component in their activities. These R&RA efforts complement activities that are largely aimed at systemic reform in the K-12 levels supported through the Education and Human Resources Account.

A summary of the Activities within R&RA follows:

The **Biological Sciences** (BIO) Activity fosters understanding of the underlying principles and mechanisms governing life. Research ranges from the study of the structure and dynamics of biological molecules, such as proteins and nucleic acids, through cells, organs and organisms, to studies of populations and ecosystems. It encompasses processes that are internal to the organism as well as those that are external, and includes temporal frameworks ranging from measurements in real time through individual life spans, to the full scope of evolutionary time. The 7.6 percent increase, to a total of $323.96 million in FY 1996, will primarily support research in biotechnology, biodiversity, and terrestrial ecology related to global change.

Research in the **Computer and Information Science and Engineering** (CISE) Activity includes system software design, theory of computing, engineering design, prototyping, testing, and deployment of cutting-edge computing and communications systems to address complex research problems. The 6.7 percent increase, to a total of $275.57 million in FY 1996, is principally directed toward research in ubiquitous computing, human-machine interaction and information access, parallel and distributed computing, and toward multidisciplinary challenges – laying the groundwork for future information technology that can help solve complex computational and communications intensive problems of scientific and societal importance. Additional experimental high-speed networking activities will be supported. The Supercomputer Centers will initiate new cooperative activities with other high performance computation facilities nationwide, and their computational infrastructure will be enhanced to carry out leading edge research.

The **Engineering** (ENG) Activity seeks to enhance long-term economic strength, security, and quality of life for the nation by fostering innovation, creativity, and excellence in engineering education and research. ENG seeks to promote the natural synergy between engineering education, fundamental research, and the application of technical knowledge. The ENG Activity's 7.7 percent increase, to a total of $344.16 million for FY 1996, will primarily go to support research in areas such as intelligent sensing and control systems and environmentally conscious manufacturing. Funds are included to meet the mandated level for the Foundation-wide Small Business Innovation Research (SBIR) program and the authorized level for the Small Business Technology Transfer (STTR) program.

The **Geosciences** (GEO) Activity supports research in the atmospheric, earth, and ocean sciences. Basic research in the geosciences advances the scientific knowledge of the Earth's environment, including resources such as water, energy, minerals, biological diversity, and coral reefs. GEO supported research also advances the ability to predict natural phenomena of economic and human significance, such as climate changes, weather, earthquakes, fish-stock fluctuations, and disruptive events in the solar-terrestrial environment. The 7.6 percent increase, to $451.48 million in FY 1996,

will support fundamental research and national user facilities across the geosciences, including new and enhanced efforts in international programs, forecasting and climate modeling, and studies of continent-ocean margins.

The **Mathematical and Physical Sciences** (MPS) Activity supports research in mathematics, astronomy, physics, chemistry, and materials science. Major equipment and instrumentation such as particle accelerators and telescopes are provided to support the research needs of individual investigators. The 8.3 percent increase, to $698.28 million in FY 1996, will be directed to areas including multidisciplinary research in optical science and engineering, environmental science and technology, biotechnology, nanosciences, and will enhance support for facilities and instrumentation.

The **Social, Behavioral and Economic Sciences** (SBE) Activity stimulates scientific progress in these fields. Research focuses on how various social and economic systems are organized and operate, and how cognitive and cultural factors influence human behavior. Activities include the Human Capital Initiative and a consortium for research on violence to be initiated in FY 1995. The Activity also includes programs that promote international scientific cooperation and provide authoritative data on science and engineering and the characteristics of the nation's research and education enterprise. The 8.0 percent increase, to $122.87 million in FY 1996, will support research on human genetic diversity, learning and intelligent systems, and research on democratic processes.

Polar Programs, which includes the **U.S. Polar Research Programs** and **U.S. Antarctic Logistical Support Activities**, supports multi-disciplinary research in Arctic and Antarctic regions. Polar regions play a critical role in world weather and climate and provide unique research opportunities in environmental sciences, ranging from the ocean bottom, through the ice layer, and into space. The 6.1 percent increase in Polar Programs, to $234.88 million, will be directed entirely to U.S. Polar Research Programs. Priority is given to increases for arctic research, including Arctic logistics. Increases are also provided for studies of the oceans surrounding Antarctica, research on Antarctic ice sheets, and for science facilities and operations that make Antarctic research possible.

The **Critical Technologies Institute** is a Federally-Funded Research and Development Center that provides analytical support to the Office of Science and Technology Policy by identifying near-term and long-term objectives for research and development; analyzing the production capability and economic viability of technologies; and providing options for achieving R&D objectives.

EDUCATION AND HUMAN RESOURCES $599,000,000

The FY 1996 Budget Request for Education and Human Resources (EHR) is $599.00 million, a decrease of $6.97 million, or 1.2 percent, from the FY 1995 Current Plan of $605.97 million.

(Millions of Dollars)

	FY 1994 Actual	FY 1995 Current Plan	FY 1996 Request	Change Amount	Change Percent
Educational System Reform	80.31	96.44	95.35	(1.09)	(1.1%)
Experimental Program to Stimulate Competitive Research	31.05	36.92	35.91	(1.01)	(2.7%)
Elementary, Secondary and Informal Education	198.68	195.75	194.15	(1.60)	(0.8%)
Undergraduate Education	78.51	84.25	83.43	(0.82)	(1.0%)
Graduate Education	59.21	66.79	66.79	0.00	0.0%
Human Resource Development	74.58	76.75	74.80	(1.95)	(2.5%)
Research, Evaluation and Communications	46.69	49.07	48.57	(0.50)	(1.0%)
Total, EHR	$569.03	$605.97	$599.00	($6.97)	(1.2%)

Education and Human Resources (EHR) has responsibility for defining and funding programs and projects that support the educational aspects of the Foundation's mission. The programs supported by EHR represent a cohesive and comprehensive set of activities, including informal science experiences, which encompass every level of education and every region of the country. Programmatic activities provide direct support to students and teachers, the development of curriculum and associated materials and equipment, and capacity building support for institutions and states. EHR also plays a major role in the Foundation's long standing commitment to developing human resources for the science and engineering workforce of the future .

In FY 1991, EHR initiated the first major federal agency program encompassing comprehensive, systemic approaches to improve science and mathematics education, particularly at the K -12 level. The Statewide Systemic Initiatives (SSI), followed by the Urban Systemic Initiatives (USI) in FY 1993 and the Rural Systemic Initiatives (RSI) in FY 1994, and local systemic activities, illustrate this approach. The focus is on whole systems aimed at making improvements in science, mathematics and technology education at the state level, major urban centers, and rural areas through the involvement of broad partnerships in the development of goals, solutions and actions. The goal of total system reform is based on the underlying philosophy that all students can learn and achieve in science and mathematics at much higher levels than at present.

EHR is a major participant in interagency activities for science, mathematics, engineering and technology education (SMETE); EHR support will total $530.88 million in FY 1996. These activities address many of the challenges posed by *Goals 2000: Educate America Act.* All subactivities participate in these activities.

The following table provides SMETE support by level of education:

SUPPORT BY EDUCATION LEVEL

(Millions of Dollars)

	FY 1995 Estimate	FY 1996 Estimate	Change Amount	Change Percent
K-12	355.59	354.78	-0.81	-0.2%
Undergraduate	103.15	102.50	-0.65	-0.6%
Graduate	67.50	67.50	0.00	0.0%
Public Understanding of Science	6.10	6.10	0.00	0.0%
Total, SMETE	532.34	530.88	-1.46	-0.3%
Other*	73.63	68.12	-5.51	-7.5%
TOTAL, EHR	605.97	599.00	-6.97	-1.2%

* includes EPSCoR, part of Applications of Advanced Technologies, Visiting Professorships for Women, Faculty Awards for Women, Research Improvement in Minority Institutions and Minority Research Centers for Excellence.

EHR participation in the **High Performance Computing and Communications (HPCC)** initiative will total $12.0 million in FY 1996. In the Applications of Advanced Technology (AAT) program, EHR supports the expansion of the Networking Infrastructure for Education (NIE) test beds, demonstration projects, and research and development related to interagency collaborations.

Participation in these interagency activities will help create a sustainable infrastructure for education reform and expand other NSF initiatives.

The FY 1996 budget request by level of education includes:

K-12 Support

The FY 1996 budget request will provide support at the K-12 level totaling $354.78 million, a decrease of $810,000 from the FY 1995 Current Plan. This support is focused primarily in the Systemic Reform and Elementary, Secondary and Informal Science Activities of EHR.

- **Systemic Reform ($95.35 million):** although there is a slight reduction in the FY 1996 request from the FY 1995 level, the Urban Systemic Initiatives (USI) will enable up to sixteen of the target cities to conduct implementation activities and the Rural Systemic Initiatives (RSI) will provide up to two implementation awards. The Statewide Systemic Initiatives (SSI) will begin its sixth year with several states, from the first cohort, moving into Phase II where exemplary activities will receive support for an additional 2 - 5 years.

- **Advanced Technological Education (ATE) ($7.83 million):** a new program in FY 1994, will be maintained at approximately the FY 1995 level. ATE, jointly funded through in the Elementary, Secondary and Informal Science and the Undergraduate Education Activities, promotes improvement in secondary curricula and instruction to help in the transition of students to an increasingly technology-based workforce.

- **Comprehensive Partnerships for Minority Student Achievement (CPMSA) ($9.82 million):** helps school districts with sizable minority enrollments to implement systemic reform initiatives, thereby enhancing the quality of education for K-12 underrepresented students.

- Funding will be sustained at $234.78 million for other K-12 activities including: Teacher Enhancement and Teacher Preparation programs; Instructional Materials Development; Informal Science Education, programs for minorities, women and persons with disabilities; the Young Scholars program; and selected activities in research studies and evaluation supporting K-12 education in the Research, Evaluation and Communications Activity.

Undergraduate Support

The FY 1996 budget request will provide support at the undergraduate level totaling $102.5 million, a decrease of $650,000 from the FY 1995 Current Plan. This support is focused primarily in the Undergraduate Education and the Human Resource Development Activities. This funding also supports evaluation of undergraduate programs in the Research, Evaluation and Communications Activity. Programs supported include:

- **Course and Curriculum ($22.24 million)** supports the intellectual effort necessary to restructure courses and curriculum in light of current needs, new technologies, improved teaching methods, and new knowledge within and across disciplines.

- **Instrumentation and Laboratory Improvement ($20.84 million)** supports projects designed to generate new and improved approaches to laboratory and field-based instruction.

- **Advanced Technological Education ($15.52 million)** supports improvements in advanced technological education at the national and regional level.

- **Alliances for Minority Participation ($26.41 million)** aims to raise the quality of undergraduate education received by underrepresented minority students, to increase significantly the number of them who earn baccalaureate degrees in SMET, and who go on for higher education. Early results show significant increases in a number of institutions.

- Other undergraduate activities ($17.49 million) will be sustained at the FY 1995 levels and include continued support for Faculty Enhancement and minority programs.

Graduate Support

The FY 1996 budget request will sustain support at the graduate level totaling $67.50 million, unchanged from the FY 1995 level.

- **Graduate Fellowships** maintains the modest increases in both the stipend and the cost of education allowance provided in FY 1995, and at the same time the number of fellows will remain at approximately 2,400. The **Graduate Research Traineeship** program will be sustained at the FY 1995 level to maintain support for ongoing projects. No new traineeship positions are planned.

Public Understanding of Science

Support for Public Understanding of Science projects remains at the FY 1995 level of $6.10 million. This support comes from the Elementary, Secondary, and Informal Science (ESIE) and the Research, Evaluation and Communications (REC) Activities.

- **Informal Science Education ($5.40 million)** in ESIE supports projects designed to provide rich and stimulating environments outside of school where individuals of all ages, interests, and backgrounds can increase their appreciation and understanding of science, mathematics, and their applications.

- **Research in Teaching and Learning ($700,000)** in REC focuses on public literacy in science, encompassing all ages from kindergarten through adulthood.

Additional highlights:

Following on the successes of the Invitational Conferences held in February 1993 and February 1994, EHR will host a third conference on February 23-25, 1995, **Joining Forces: Spreading Successful Strategies**. This conference continues the building of partnerships among local, state and national groups for effective systemic reform, and for the development of collaborative strategies. Successful NSF-supported projects in mathematics and science education are presented that demonstrate the progress in systemic reform.

The third annual national conference on **Diversity in the Scientific and Technological Workforce** was held on September 29 - October 1, 1994, in Washington, D.C. The conference was attended by more than 1,900 representatives from the Congress, colleges, universities, industry, professional associations, and federal and state agencies. Over 300 students in NSF-supported projects, as well as 600 students and teachers from local areas attended the conference.

Number of People Involved in EHR Activities

	FY 1994 Estimate	FY 1995 Estimate	FY 1996 Estimate
Senior Researchers	5,530	5,796	5,745
Other Professionals	1,893	2,043	2,030
Post-Doctorates	293	315	312
Graduate Students	3,960	4,365	4,335
Undergraduate Students	7,332	8,063	7,717
K-12 Students	9,250	10,130	9,965
K-12 Teachers	75,140	104,981	113,581
Total Number of People	103,398	135,693	143,685

FACILITIES

The National Science Foundation supports large, multi-user facilities which require long-term commitments for support. These facilities are usually of a scale too large, complex, or expensive for individual or small groups of researchers to construct. They meet the need for multi-user access to state-of-the-art research facilities that would otherwise be unavailable. Support for these unique National facilities is essential to advance U.S. research capabilities required for world-class research. Support also includes funding for staff and support personnel to assist scientists in conducting research at the facilities.

NSF supports the following facilities:

(Millions of Dollars)

	FY 1994 Estimate	FY 1995 Estimate	FY 1996 Estimate	% Change 95 - 96
Advanced Scientific Computing Centers	66.90	70.90	74.90	5.6%
NSFNET	39.11	45.22	46.22	2.2%
National Center for Atmospheric Research	53.30	59.18	65.63	10.9%
National Astronomy Centers	65.45	63.38	70.39	11.1%
Laser Interferometer Gravitational Wave Observatory	0.03	85.00	70.00	-17.6%
National High Magnetic Field Laboratory	12.00	12.00	15.00	25.0%
GEMINI 8-Meter Telescopes	17.01	41.00	0.00	-100.0%
National Nanofabrication Users Network	3.45	3.55	3.80	7.0%
Academic Research Fleet/Ship Operations	49.06	49.20	53.00	7.7%
Academic Research Infrastructure	53.04	59.07	50.00	-15.4%
Polar Facilities	168.64	166.77	171.77	3.0%
Other Facilities[1]	75.56	82.49	89.49	8.5%
TOTAL	$603.55	$737.76	$710.20	-3.7%

[1] Other facilities include physics, materials research, ocean sciences, atmospheric sciences, and earth sciences facilities.

CENTERS

The National Science Foundation supports a variety of centers programs. While the programs are diverse, they do share several premises:

- Some scientific questions and research and technical problems can best be addressed through the multidisciplinary, long-term, coordinated research efforts of a number of scientists and engineers working together on fundamental research addressing the many facets of a complex problem;
- A strong educational component to aid the training of this nation's next generation of scientists and engineers and to encourage the participation in science and engineering of students of all ages; and
- A well-defined coordination with industry to ensure that research is relevant to national needs and that knowledge quickly migrates into the private sector.

NSF plans to support 170 centers by the close of FY 1995. In FY 1996, no new center programs will be initiated; however, there will be competitions within some of the existing center programs possibly leading to some turnover within the programs. The centers and center programs are listed below.

(Millions of Dollars)

	Year of Program Initiation	FY 1995 Number of Centers	FY 1995 Estimate	FY 1996 Estimate	Percent Change
Engineering Research Centers	1985	21	$51.73	$52.43	1.4%
Science & Technology Centers	1987	25	60.47	62.01	2.5%
Industry/University Cooperative Research Centers	1973	53	4.13	4.13	0.0%
State Industry/University Cooperative Research Centers	1991	10	3.72	4.02	8.1%
Minority Research Centers of Excellence	1987	8	7.98	7.73	-3.1%
Materials Research Science & Engineering Centers	1972	29	44.41	47.41	6.8%
Center for Ecological Analysis and Synthesis	1995	1	2.00	2.00	0.0%
Long-Term Ecological Research Sites	1980	18	12.20	12.20	0.0%
National Center for Earthquake Engineering Research	1988	1	4.00	4.00	0.0%
National Center for Environmental Decision-Making Research	1995	1	1.00	1.00	0.0%
Research Centers on the Human Dimensions of Global Change	1995	NA	5.00	5.00	0.0%
National Consortium for Research on Violence	1995	1	2.00	2.00	0.0%
National High Field FT-ICR Mass Spectrometry Center	1994	1	1.00	1.00	0.0%
Critical Technologies Institute	1993	1	2.00	2.80	40.0%
TOTAL		170	$201.64	$207.73	3.0%

NSF Funding Profile

Approximately half of the awards that are supported in a particular fiscal year are competitively reviewed in that year through NSF's merit review process. The other awards are continuations of projects that were competitively reviewed in a prior year. The funding rate is the number of competitive awards made during a year as a percentage of total proposals competitively reviewed. It indicates the probability of winning an award when submitting proposals to NSF.

The annualized award size displays the annual level of support provided to awardees by dividing the total dollars of each award by the number of years over which it extends. Both the average and the median annualized award size for competitively reviewed awards are shown.

Average duration is the length of the award in years. The duration calculation is limited to research projects and excludes other categories of awards which fund infrastructure-type activities such as equipment and conference awards which do not require multi-year support.

The Quantitative Data Tables provided under a separate tab are based on all proposals and awards, including competitive awards, contracts, cooperative agreements, supplements and amendments to existing grants and contracts.

NSF FUNDING PROFILE

	FY 1994 Estimate	FY 1995 Estimate	FY 1996 Estimate
Total Number of Awards	19,346	19,819	20,362
Statistics for Competitive Awards			
Number	10,300	10,600	10,900
Funding Rate	32%	32%	32%
Median Annualized Award Size[1]	$55,977	$58,200	$61,100
Average Annualized Award Size[1]	$71,144	$74,000	$77,700
Average Duration (yrs.) [1]	2.6	2.7	2.8

[1]Statistics for average award size and duration for Research Projects only. Excludes facilities, centers, fellowships, and travel.

INTERAGENCY COOPERATION

NSF participates in approximately 150 memoranda of understanding or interagency agreements involving federal agencies and private sector organizations. NSF also has formal international agreements with at least twenty countries.

The agreements cover activities such as cooperation and coordination in research programs, including joint programs; joint funding of research projects; operations and logistical support for major facilities, including the U.S. Antarctic Program; establishment of the South Pole satellite relay communications link; and joint seminars and workshops.

Federal agencies with which NSF maintains memoranda of understanding or interagency agreements include:

AID
NRC
DoED
FHA
DOC (NIST, NOAA)
DOD
STATE
NEH
FAA
EPA
HHS (NIH,NIMH, NIA, NICHD, NIDCD, NLM)
AGRICULTURE (USDA)
NASA
DOE
FEMA
DOI (Fish & Wildlife, USGS)
LABOR (BLS)

Private sector organizations with which NSF has agreements include:

Alfred P. Sloan Foundation
Whitaker Foundation
Semiconductor Research Corporation
Electric Powere Research Institute

NSF Senior Management

Dr. Neal F. Lane, Director

Dr. Anne C. Petersen, Deputy Director

Dr. Joseph Bordogna, Assistant Director, Engineering (ENG)

Dr. Marta Cehelsky, Executive Officer, National Science Board (NSB)

Dr. Mary E. Clutter, Assistant Director, Biological Sciences (BIO)

Mr. Thomas Cooley, Staff Associate for Issues Management (O/D)

Dr. Robert W. Corell, Assistant Director, Geosciences (GEO)

Dr. Susan Cozzens, Office Head, Office of Policy Support (OPS)

Dr. Karl A. Erb, Senior Science Advisor, Office of the Director (O/D)

Dr. William C. Harris, Assistant Director, Mathematical and Physical Sciences (MPS)

Mr. Joseph L. Kull, Director, Office of Budget, Finance and Award Management (BFA)

Dr. William A. Lester, Jr., Senior Fellow for Science and Engineering **and** Assistant to the Director for Human Resource Development (O/D)

Dr. Cora Marrett, Assistant Director, Social Behavioral and Economic Sciences (SBE)

Ms. Constance K. McLindon, Director, Office of Information and Resource Management (IRM)

Dr. Nathaniel G. Pitts, Director, Office of Science & Technology Infrastructure (STI)

Ms. Kathryn Rison, Staff Assistant for Administration and Management (O/D)

Mr. Lawrence Rudolph, Acting General Counsel, Office of General Counsel (OGC)

Dr. Cornelius W. Sullivan, Director, Office of Polar Programs (OPP)

Ms. Linda Sundro, Inspector General, Office of the Inspector General (OIG)

Dr. Judith Sunley, Assistant to the Director for Science Policy and Planning (O/D)

Mr. Joel Widder, Acting Director, Office of Legislative and Public Affairs (OLPA)

Dr. Luther S. Williams, Assistant Director, Education and Human Resources (EHR)

Dr. Paul R. Young, Assistant Director, Computer and Information Science and Engineering (CISE)

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Divider Title: _____

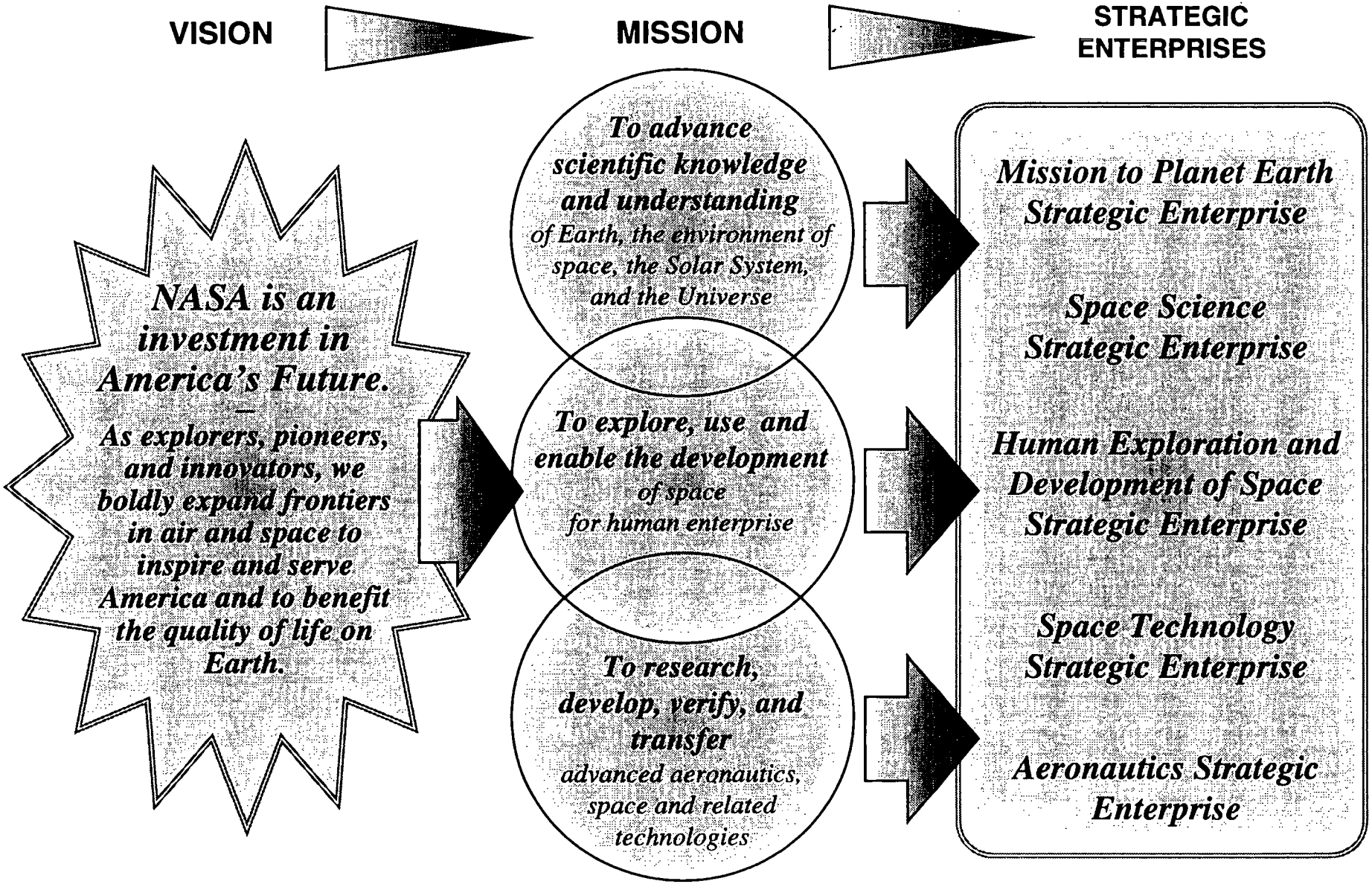
SCIENCE RESEARCH AT THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

PRESENTATION FOR
SCIENCE LEADERSHIP EXCHANGE
COMMITTEE ON FUNDAMENTAL SCIENCE

ALAN LADWIG
ASSOCIATE ADMINISTRATOR FOR
POLICY AND PLANS
NASA HEADQUARTERS

MARCH 28, 1995

NASA Strategic Organization



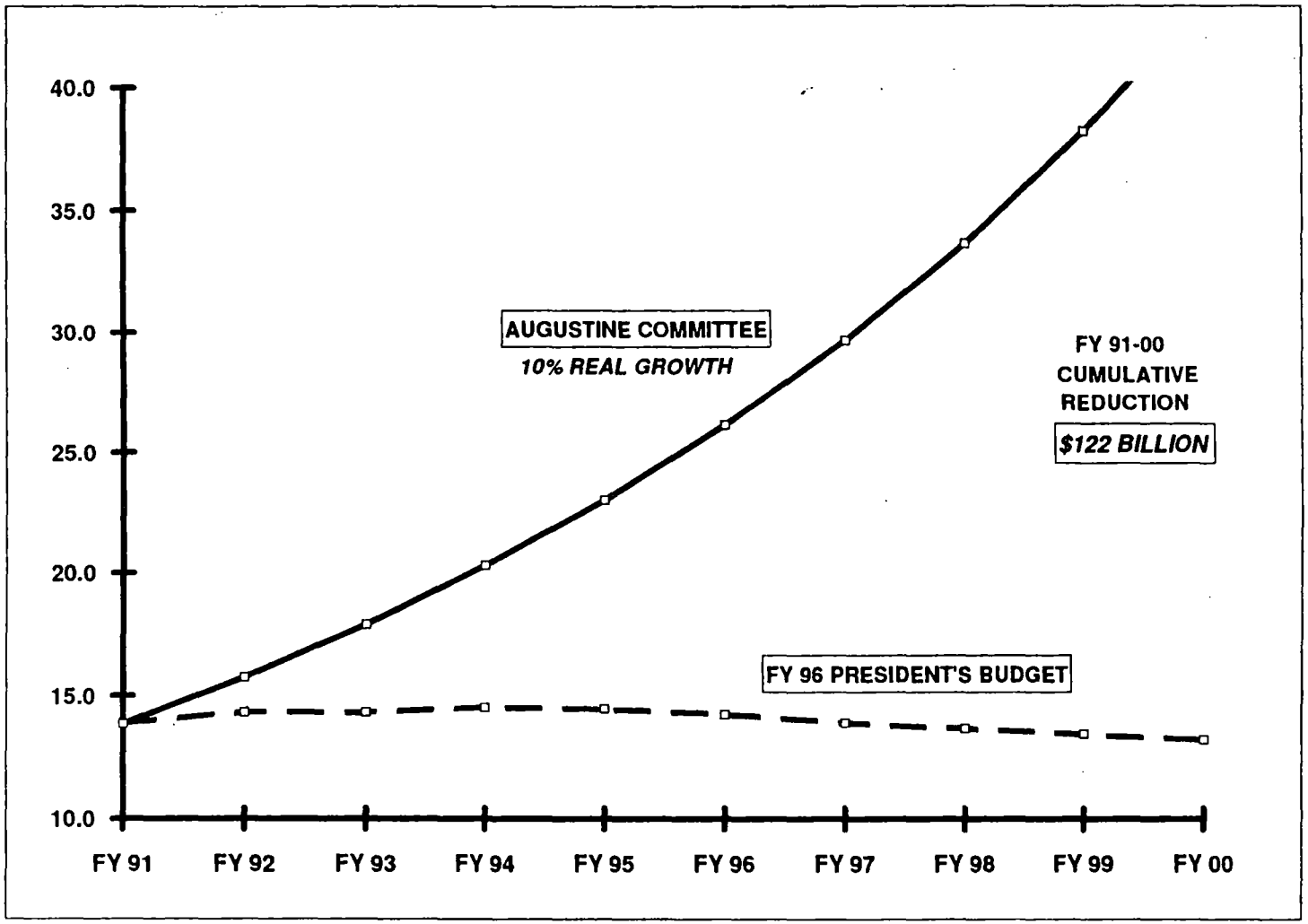
ROLE OF SCIENCE RESEARCH AT NASA

- Science programs are unique element of Nation's total investment portfolio in basic and applied research:
    - Space Science Enterprise
    - Mission to Planet Earth
    - Human Exploration and Development of Space (Includes Life and Microgravity Science and Applications)
- A means to acquire new insight and understanding about Earth, the Solar System, the Universe and the nature of biological and physical systems
- NASA flight programs distinguish our science research from other agencies
- Provides capacity to contribute to public awareness of science and enhance science and technology literacy

ROLE OF SCIENCE RESEARCH AT NASA

- Space provides unique vantage point, laboratory environment, and venue for carrying out wide range of investigations:
- Access to full electromagnetic spectrum
- Provides view beyond turbulence of Earth's atmosphere
- Provides close up views of planets and planetary systems
- Provides global perspective of Earth
- Access to zero gravity
- Exploration opportunities for humans and robotic spacecraft

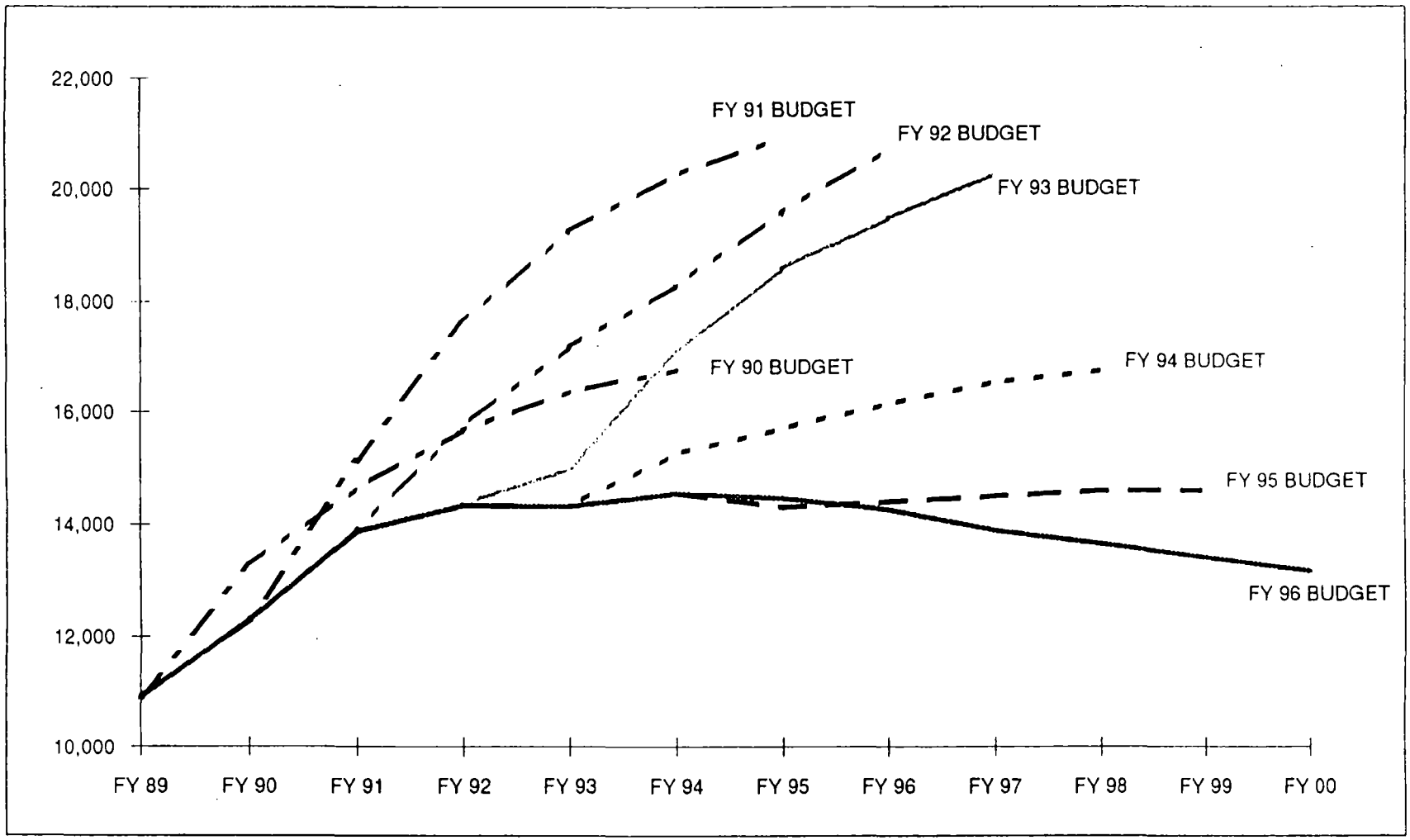
AUGUSTINE COMMITTEE PROJECTION
VS
FY 1996 PRESIDENT'S BUDGET



	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 91-00	
COMMITTEE ON FUTURE OF U.S. SPACE	13.9	15.8	17.9	20.3	23.0	26.1	29.7	33.7	38.2	43.4	262	
			113.6%	*113.5%*	*113.4%*	*113.5%*	*113.5%*	*113.5%*	*113.5%*	*113.5%*		*(10% REAL GROWTH)*
FY 1996 PRESIDENT'S BUDGET	13.9	14.3	14.3	14.5	14.5	14.3	13.9	13.7	13.4	13.2	140	
NET REDUCTION	0	-1	-4	-6	-9	-12	-16	-20	-25	-30	-122	*(-47% TOTAL REDUCTION)*

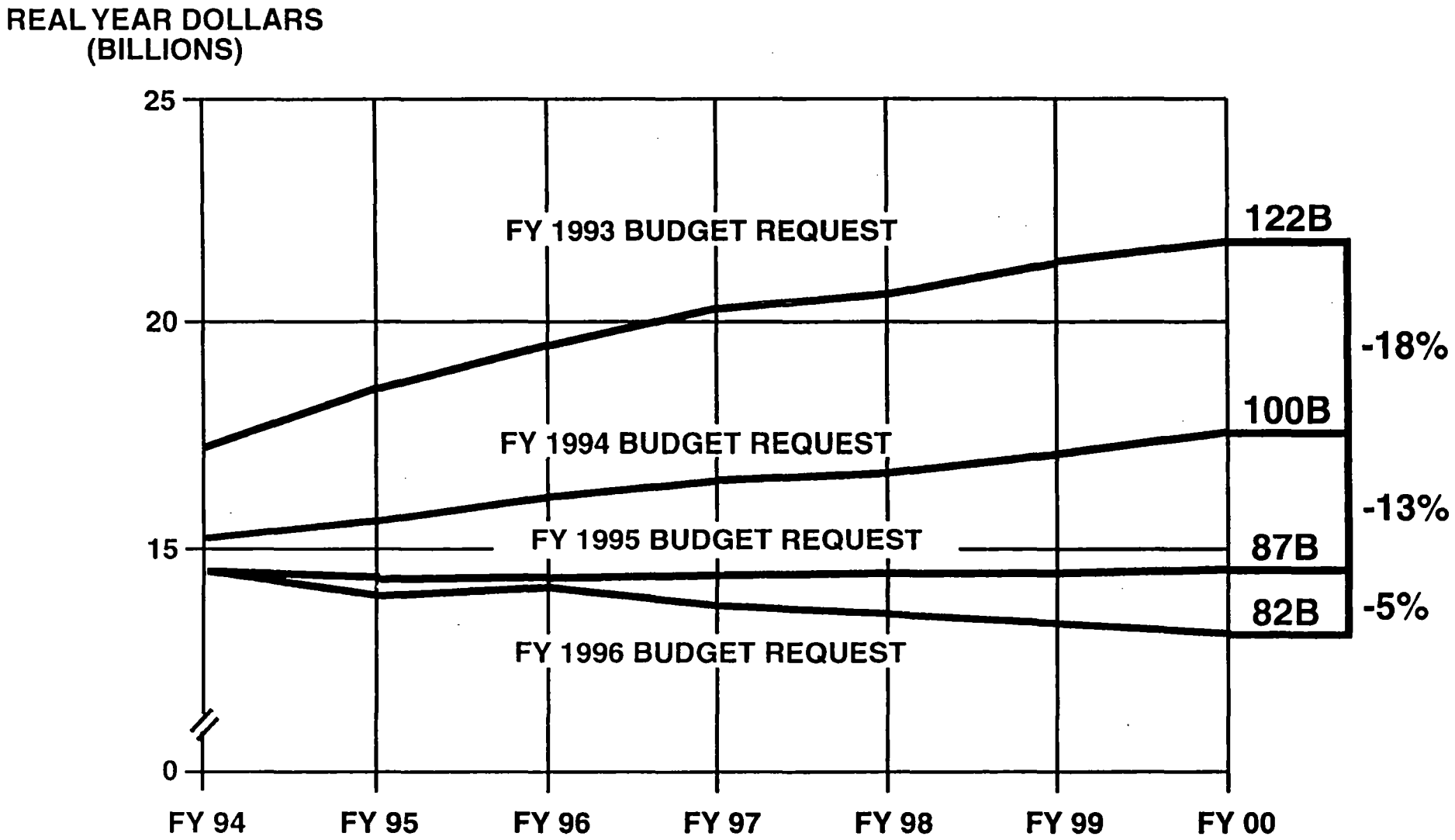
SUMMARY OF NASA FUNDING PROFILES

(#s IN BOLD ARE ACTUALS)



	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00
FY 1990 CONG REQUEST	10,898	13,274	14,635	15,671	16,366	16,759						
FY 1991 CONG REQUEST	**10,897**	12,297	15,125	17,637	19,257	20,261	20,926					
FY 1992 CONG REQUEST	**10,897**	**12,295**	13,868	15,754	17,174	18,295	19,581	20,706				
FY 1993 CONG REQUEST	**10,897**	**12,295**	**13,868**	14,353	14,993	17,064	18,594	19,470	20,273			
FY 1994 CONG REQUEST	**10,897**	**12,295**	**13,868**	**14,334**	14,323	15,265	15,713	16,143	16,542	16,760		
FY 1995 CONG REQUEST	**10,897**	**12,295**	**13,868**	**14,334**	**14,323**	14,551	14,300	14,400	14,500	14,600	14,600	
FY 1996 CONG REQUEST	**10,897**	**12,295**	**13,868**	**14,334**	**14,323**	**14,549**	14,464	14,260	13,896	13,653	13,411	13,168

FY 1996 PRESIDENT'S BUDGET



FY 1996 PRESIDEN'TS BUDGET

	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	
HUMAN SPACE FLIGHT	**6,074.3**	**5,514.9**	**5,509.6**	**5,443.6**	**5,342.8**	**5,313.5**	**5,177.6**	
SCIENCE, AERO & TECHNOLOGY	**5,792.5**	**5,943.6**	**6,006.9**	**6,054.1**	**6,261.2**	**6,332.9**	**6,533.1**	
SCIENCE	**4,157.3**	**4,405.1**	**4,362.3**	**4,291.8**	**4,264.2**	**4,363.8**	**4,594.9**	
SPACE SCIENCE	1,920.9	2,012.6	1,958.9	1,811.9	1,637.6	1,527.0	1,546.3	
LIFE & M-GRAVITY	507.5	483.1	504.0	523.1	537.2	591.6	608.0	
MSSN TO PLANET EARTH	1,068.0	1,340.1	1,341.1	1,379.4	1,483.0	1,498.1	1,580.8	
MSSN COMMUNICATIONS SERVICES	581.0	481.2	461.3	474.9	489.9	512.8	528.8	
LAUNCH SERVICES	37.1	37.0	37.6	40.0	39.9	41.3	41.7	CODE X MISSION SUPPORT
ACADEMIC PROGRAMS (50%)	42.8	51.1	59.4	62.5	66.1	69.5	71.7	
FUTURE PLANNING WEDGE					10.5	123.5	217.6	2/3 OF WEDGE IN 99/00
AERONAUTICS/TECHNOLOGY	**1,635.3**	**1,538.5**	**1,644.7**	**1,762.3**	**1,997.1**	**1,969.2**	**1,938.3**	
AERONAUTICS	1,067.2	882.0	917.3	996.8	1,085.0	975.9	873.7	
SPACE ACCESS & TECHNOLOGY	525.3	605.4	668.0	703.0	846.0	862.1	884.1	
ACADEMIC PROGRAMS (50%)	42.8	51.1	59.4	62.5	66.1	69.5	71.7	
FUTURE PLANNING WEDGE						61.7	108.8	
MISSION SUPPORT	**2,667.4**	**2,589.2**	**2,726.2**	**2,819.5**	**2,877.9**	**2,934.6**	**2,897.5**	
INSPECTOR GENERAL	**14.7**	**16.0**	**17.3**	**16.8**	**16.4**	**16.1**	**15.7**	
NAS FACILITIES		**400.0**						
TOTAL NASA REQUEST	**14,548.9**	**14,463.7**	**14,260.0**	**14,334.0**	**14,498.3**	**14,597.1**	**14,623.9**	
LESS: OMB-DIRECTED OUTYR RED'N (3/5/7/9%)				***-437.8***	***-844.9***	***-1,186.3***	***-1,456.3***	*MAINTAIN $2.1B FOR ISSA*
FY 1996 PRESIDENT'S BUDGET	**14,548.9**	**14,463.7**	**14,260.0**	**13,896.2**	**13,653.4**	**13,410.8**	**13,167.6**	
% OF NASA BUDGET (BEFORE CUTS)	***29%***	***30%***	***31%***	***30%***	***29%***	***30%***	***31%***	
SCIENCE PROGRAMS	*24%*	*27%*	*27%*	*26%*	*25%*	*26%*	*27%*	
SCIENCE SUPPORT	*5%*	*3%*	*4%*	*4%*	*4%*	*4%*	*3%*	

ISSUE: HAS NASA MAINTAINED ITS COMMITMENT TO SCIENCE?

	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	
FY 1996 BUDGET: NASA SCIENCE PROGRAM	**4,157.3**	**4,405.1**	**4,362.3**	**4,291.8**	**4,264.2**	**4,363.7**	**4,594.9**	
SCIENCE PROGRAMS	**3,496.4**	**3,835.8**	**3,804.0**	**3,714.4**	**3,668.3**	**3,740.2**	**3,952.7**	
SPACE SCIENCE	1,920.9	2,012.6	1,958.9	1,811.9	1,637.6	1,527.0	1,546.3	
LIFE & M-GRAVITY	507.5	483.1	504.0	523.1	537.2	591.6	608.0	
MSSN TO PLANET EARTH	1,068.0	1,340.1	1,341.1	1,379.4	1,483.0	1,498.1	1,580.8	
FUTURE PLANNING WEDGE					10.5	123.5	217.6	2/3 OF WEDGE
SCIENCE SUPPORT	**660.9**	**569.3**	**558.3**	**577.4**	**595.9**	**623.6**	**642.2**	
MSSN COMMUNICATIONS SERVICES	581.0	481.2	461.3	474.9	489.9	512.8	528.8	
LAUNCH SERVICES	37.1	37.0	37.6	40.0	39.9	41.3	41.7	CODE X MISSION SUPPORT
ACADEMIC PROGRAMS	42.8	51.1	59.4	62.5	66.1	69.5	71.7	50% OF TOTAL PROGRAM
% OF NASA BUDGET (EXCL UNRESOLVED REDUCTIONS)	***29%***	***30%***	***31%***	***30%***	***29%***	***30%***	***31%***	
% SCIENCE PROGRAMS	*24%*	*27%*	*27%*	*26%*	*25%*	*26%*	*27%*	
% SCIENCE SUPPORT	*5%*	*3%*	*4%*	*4%*	*4%*	*4%*	*3%*	

THE NASA SCIENCE PROGRAM, AS DEFINED ABOVE, HAS HISTORICALLY COMPRISED 25-30% OF THE TOTAL BUDGET. THE FY 1996 PRESIDENT'S BUDGET MAINTAINS THIS LEVEL OF SUPPORT FOR THE OVERALL SCIENCE PROGRAM. THIS EQUATES TO AN ANNUAL SCIENCE BUDGET OF APPROXIMATELY $4 - 4.5 BILLION.

THE IMPACT OF THE OMB-DIRECTED BUDGET REDUCTIONS IS NOT REFLECTED IN THIS ASSESSMENT SINCE THESE CUTS ARE STILL UNRESOLVED.

THE AGENCY REMAINS COMMITTED TO MAINTAINING OUR COMMITMENT TO SCIENCE AND WILL MAKE EVERY EFFORT TO MITIGATE THE IMPACTS OF THESE REDUCTIONS ON THE SCIENCE BUDGET

ISSUE: IS NASA PLANNING TO MAKE ANY BIG REDUCTIONS TO SCIENCE (E.G. HST) IN ORDER TO FUND NEW INITIATIVES?

THE FY 1996 REQUEST ADDS $1.6 BILLION TO THE OSS BUDGET THROUGH FY 2000 TO SUPPORT 7 ITEMS:

GGS	*REPRICED DUE TO LAUNCH DELAYS*
ASTRO-E	*RESTORATION OF SOME SCIENCE LOST DUE TO AXAF-S CANCELLATION PER CONGRESSIONAL DIRECTION*
NEW MILLENNIUM	*REQUIRED TO ACCELERATE INFUSION OF NEW TECHNOLOGIES INTO FUTURE ROBOTIC MISSIONS*
DISCOVERY	*ADDED FOLLOW-ON MISSIONS TO CONTINUE THE PROGRAM BEYOND MARS PATHFINDER AND NEAR*
SOFIA	*REPLACES THE AGING KAO (IN OPERATION SINCE 19675)*
SIRTF	*LAST OF THE "GREAT OBSERVATORIES" (SIGNIFICANTLY DESCOPED) FY 98 NEW START*
ROSETTA	*ESA COMET MISSION PROVIDES MEANS TO OFFSET SCIENCE LOSS DUE TO TERMINATION OF CRAF (FY 99 START)*

THESE PROGRAMS WERE FUNDED BY CONTRIBUTIONS FROM BOTH INSIDE AND OUTSIDE THE OSS PROGRAM:

48% ($771M) OF THE FUNDS REQUIRED CAME FROM REDUCTIONS TO THE OSS BASELINE

- *DELETION OF THE AGENCY FUNDING WEDGE IN FY 98-99*
- *MISSION OPERATIONS EFFICIENCIES*
- *TENTATIVE DISCONTINUATION OF GRAVITY PROBE-B (UNDER REVIEW)*

THE OTHER 52% CAME FROM OFFSETS TO OTHER AGENCY INITIATIVES

REDUCTIONS TAKEN TO OSS MO&DA PROGRAMS RESULTED IN A SAVINGS OF $425M THROUGH FY 2000

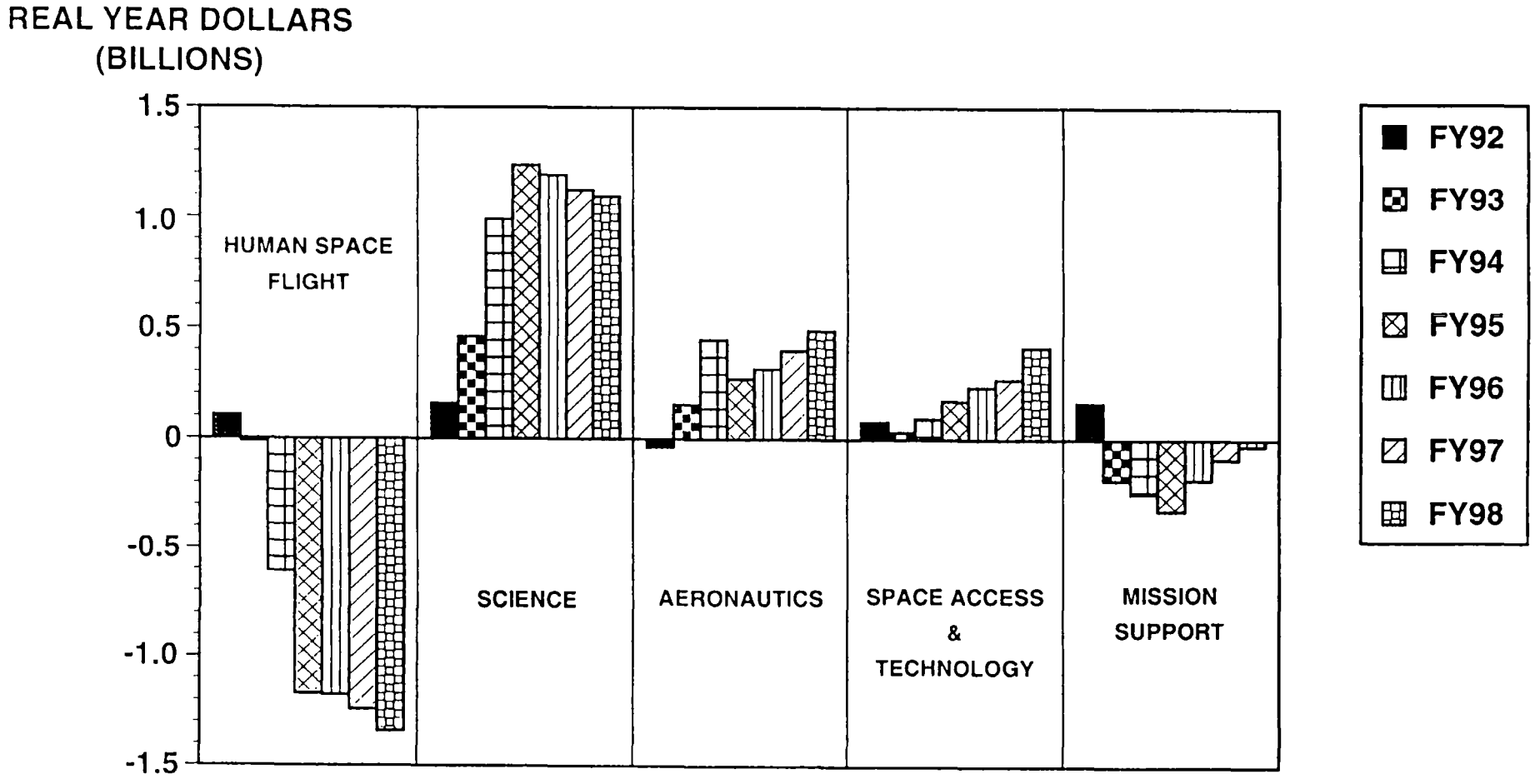
HST	*REDUCED COSTS FOR FUTURE INSTRUMENTS, REDUCE RESERVES, OPERATIONS EFFICIENCIES*
CASSINI	*DELETE CRUISE SCIENCE, STREAMLINE OPERATIONS, ETC.*
MOSO	*DESCOPE MISSION SUPPORT FOR FUTURE MISSIONS AT JPL, RESERVES, EFFICIENCIES*
AXAF/GALILEO	*REDUCE RESERVES*
AIRBORNE	*TERMINATION OF KUIPER OPERATIONS IN FY 96 AS OFFSET TO SOFIA NEW START*

DESPITE SIGNIFICANT FUNDING REDUCTIONS, THESE SAVINGS WERE TAKEN WITHOUT MAJOR IMPACTS TO SCIENCE

SAVINGS WERE TARGETED AT REDUCTIONS IN OPERATIONS vs SCIENCE

THIS IS CONSISTENT WITH OUR OVERALL PLAN TO REDUCE INFRASTRUCTURE COSTS --- NOT PROGRAM CONTENT

FY 1996 PRESIDENT'S BUDGET
CHANGES FROM FY 1991



THE ABOVE INFORMATION DOES NOT REFLECT THE UNRESOLVED PERCENTAGE REDUCTION DIRECTED BY THE ADMINISTRATION

FY 1996 CONGRESSIONAL BUDGET
SPACE SCIENCE
(millions of dollars)

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000
FY 1995 BUDGET RUNOUT	1,934.2	2,035.5	1,919.2	1,737.6	1,462.6	1,288.5	
CHANGE	-13.3	-22.9	39.7	74.3	175.0	238.5	1546.3
FY 1996 BUDGET REQUEST	1,920.9	2,012.6	1,958.9	1,811.9	1,637.6	1,527.0	1,546.3

WHAT'S CHANGED:

- o GGS mission repriced to support launch delays of Wind & Polar from mid-1994 to November 1994 and December 1995, respectively. Program delays required a net increase to OSS budget of $75 million.

- o Astro-E requested as FY 1996 new start to develop selected hardware for an X-Ray Spectrometer (XRS) which will fly aboard Japanese spacecraft in August 1999. Requires a total agency commitment of $80 million ($16M in FY 94-95).

- o New Millennium Spacecraft initiative requested as FY 1996 new start. Level-of-effort program will develop new technologies in conjunction with technology demonstration flights beginning in FY 1997-98 timeframe.

- o Future Discovery missions added beginning in FY 1996 as successors to Mars Pathfinder and NEAR. Funding supports a planned launch rate of one per year beginning in FY 1999 aboard Delta II or Med-lite launch vehicles.

- o SOFIA added as new start in FY 1996 with planned first flight in FY 2000. Total development cost of $239 million supports acquistion, refurbishment and modification of used 747 with German-provided I/R telescope. Funding requirements for SOFIA partially offset by planned termination of KAO operations beginning in FY 1996.

- o Mission definition funds added in FY 1996-97 for SIRTF with planned development start in FY 98 and launch in FY 2002. Estimated total life cycle cost commitment of $600-650 million.

- o Funding for Rosetta mission added in FY 98 and beyond to support U.S. participation in ESA comet mission. Planned new start in FY 1999 for launch in FY 2003. Requires agency commitment of $100-125 million.

- o FUSE mission being restructured from $250 million Delta-class mission launched in FY 2000 to $100 million MIDEX mission launched in FY 1998 aboard a Med-lite. Savings in Explorer development will be applied towards future MIDEX/UNEX missions.

FY 1996 CONGRESSIONAL BUDGET
SPACE SCIENCE

WHAT'S CHANGED (Continued):

- o Development of Gravity Probe-B (GP-B) is under review by the National Academy of Sciences. Continuation beyond FY 1995 will require an additional $325-350 million agency commitment.

- o MO&DA efficiencies assumed in the FY 1996 request reduces total OSS budget requirements by $362 million through FY 2000. HST reduction of $185 million reduces funds for new instruments and replacement hardware. Mission Operations and Support Office (MOSO) at JPL reduced by 20% per year. Cassini total MO&DA budget reduced from $1.3 billion to $755 million by implementation of planned operations efficiences, reduced inflation assumptions, etc. Modest reductions were also taken from Galileo and AXAF. Despite significant reductions, no major science impacts are anticipated to any of these programs.

WHAT'S THE SAME:

- o Development runouts for major missions, AXAF and Cassini, remain unchanged since FY 1995 budget.

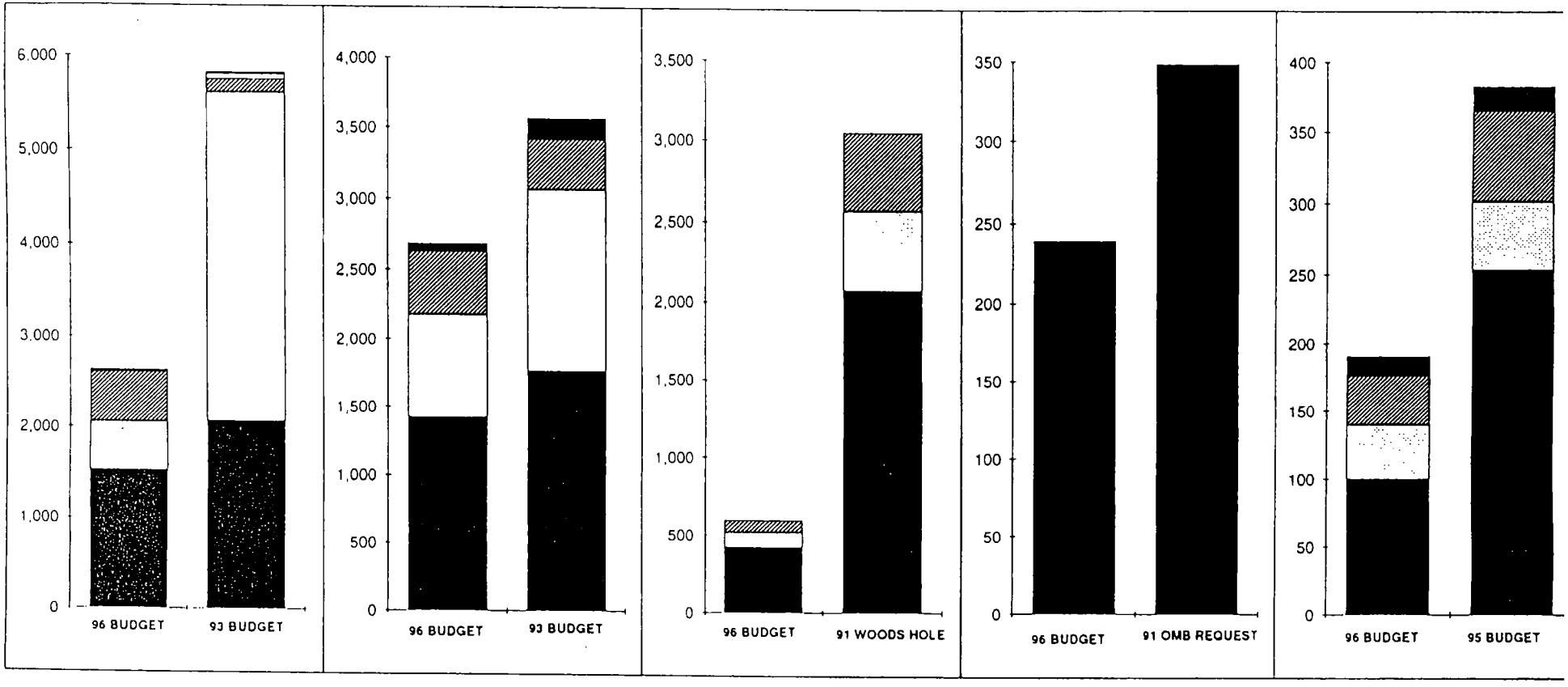
- o Explorer Development funding remains unchanged in total despite the restructuring of FUSE and other internal adjustments to XTE and ACE. TRACE and WIRE selected as next SMEX missions with planned launches in FY 1997-98 timeframe.

- o Mars Surveyor remains unchanged since last submission. Funding still supports MGS launch in November/December 1996 aboard Delta II. Dual launches also planned in 1998 and 2001 for communications orbiters and soft landers. Potential foreign participation (i.e. Russia) under consideration for 2001 missions.

- o Baseline R&A program remains unchanged from the FY 1995 budget with the exception of augmentations for SIRTF and Rosetta mission definition studies. Excluding these, overall funding beyond FY 1995 is level.

- o Information Systems runout also remains unchanged. Funding profile is level beyond FY 1995.

OFFICE OF SPACE SCIENCE
SUMMARY OF MAJOR COST REDUCTIONS
(IN MILLIONS OF REAL YEAR DOLLARS)



AXAF

ATD	54	54
DEV	1,472	2,022
OPS	530	3,528
ELV	554	145
TRACK	4	55
CoF	18	18
TOTAL	2,631	5,822

CASSINI

DEV	1,422	1,765
OPS	755	1,300
ELV	452	352
TRACK	54	148
TOTAL	2,683	3,565

SIRTF

DEV	422	2,076
OPS	95	491
ELV	76	480
TRACK	N/A	N/A
TOTAL	594	3,046

SOFIA

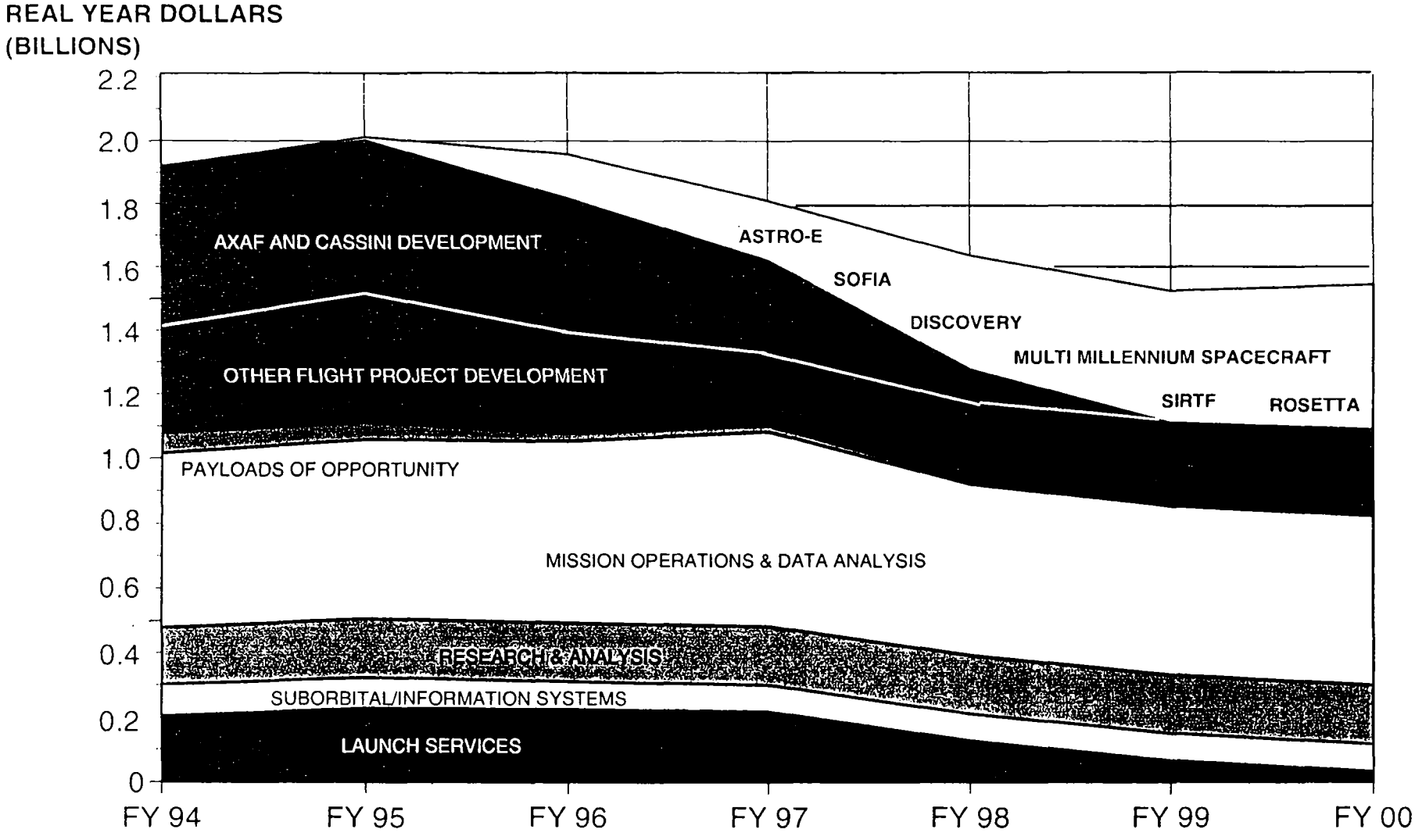
DEV	239	348
TOTAL	239	348

FUSE

DEV	100	254
OPS	40	48
ELV	36	63
TRACK	14	18
TOTAL	190	383

SPACE SCIENCE

FY 1996 PRESIDENT'S BUDGET



THE ABOVE INFORMATION DOES NOT REFLECT THE UNRESOLVED PERCENTAGE REDUCTION DIRECTED BY THE ADMINISTRATION

FY 1996 CONGRESSIONAL BUDGET
MISSION TO PLANET EARTH
(millions of dollars)

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000
FY 1995 BUDGET RUNOUT	1,050.7	1,286.4	1,341.1	1,370.5	1,436.2	1,480.0	
CHANGE	17.3	53.7	0.0	8.9	46.8	18.1	1,580.8
FY 1996 BUDGET REQUEST	1,068.0	1,340.1	1,341.1	1,379.4	1,483.0	1,498.1	1,580.8

WHAT'S CHANGED:

Added Global Observations to Benefit the Environment (GLOBE) at $5M per year
Added RadarSat launch services for Canadian mission in 2000
Added New Technology Earth Probes in beginning in FY 1999 with first launch in 2000
Rebaselined EOS to maintain EOS programmatic and scientific integrity
Reorganized EOS Science into MTPE Science so EOS instrument investigators, EOS interdisciplinary science investigators, and Mission to Planet Earth science investigators are unified
Small Changes to Tropical Rainfall Measuring Mission (TRMM) and Scatterometer budgets because of Total Ozone Mapping Spectrometer (TOMS) launch slip
Earth Probes Include TOMS on a Russian spacecraft after 2000
Payload and Instrument Development, Information Systems, Mission Operations & Data Analysis, and Science reduced
Consortium for International Earth Science Information Network (CIESIN) Building Rescinded (FY 1993 $27M)
Landsat DOD funding ($25M); included in EOS

WHAT'S THE SAME:

CIESIN (Socio-Economic Data and Application Center (SEDAC))
Earth System Sciences Building
EOS AM-1

FY 1996 CONGRESSIONAL BUDGET
LIFE & MICROGRAVITY SCIENCES AND APPLICATIONS
(millions of dollars)

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000
FY 1995 BUDGET RUNOUT	515.3	470.9	527.4	545.6	512.5	535.2	
CHANGE	-7.8	12.2	-23.4	-22.5	24.7	56.4	608.0
FY 1996 BUDGET REQUEST	507.5	483.1	504.0	523.1	537.2	591.6	608.0

WHAT'S CHANGED:

Added funding ($10 million/year) for cooperative NASA/NIH activities in biotechnology
Added a series of low-temperature physics research missions
Augmented a separate Aerospace Medicine program
The FY 1995-directed addition of a Life and Microgravity Science Spacelab mission (LMS) in 1996 is included
Substituted 4 Spacehab pressurized payload carriers for 3 Spacelab missions to Mir
Reduced costs in the Mir and Space Station payload program due to efficiencies/better definition
Funding included for microgravity facility modification at MSFC for Space Station payload development ($3 million)

WHAT'S THE SAME:

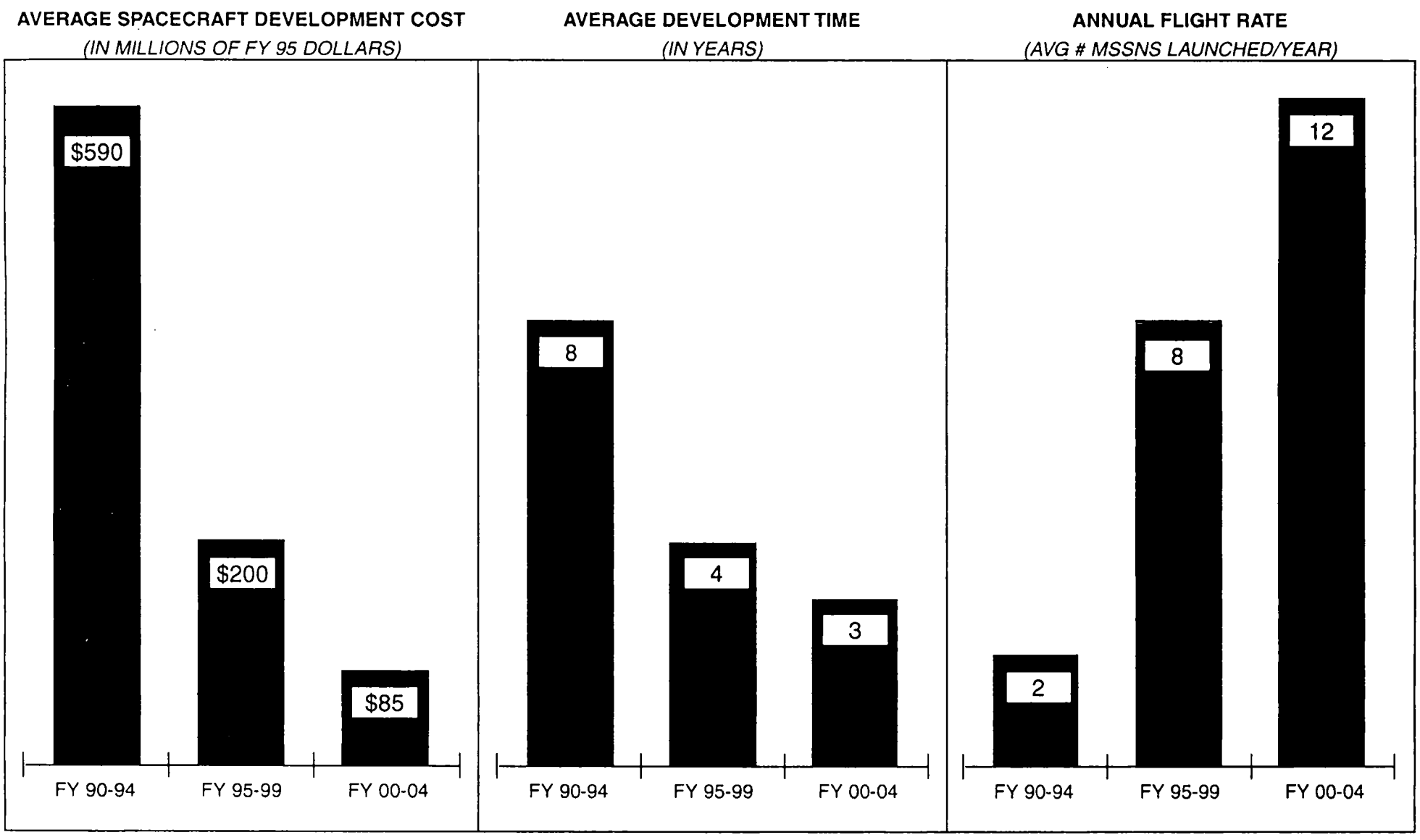
6 Spacelab missions in FY 1995-98
6 Space Station facilities
Active program of Research and Analysis

FASTER, BETTER, CHEAPER

- Smaller, more focused missions
- Shorter development time
- More frequent launches
- Use of advanced instruments and spacecraft technology to achieve higher performance at lower cost
- Focus on technology transfer to and from industry
- Focus on international cooperation to share cost, knowledge, and reduce risk

FASTER, BETTER, CHEAPER

NASA SPACE SCIENCE AND MISSION TO PLANET EARTH PAYLOADS



FY 2000-04 CONSISTENT WITH A TOTAL AGENCY BUDGET OF ~ $13 BILLION

Current Situation

- **In FY 1996, if funded at or near the requested level of $14,260 million, we can execute our current programs and get the new programs off and running. Very importantly, FY 1996 can be a year when the changes are set in motion to address the new constraints of the future.**
- **The reductions needed in the FY 1997-2000 period require difficult decisions and major changes in the cultures of NASA. In essence, they require the field installations to become *not independent but interdependent* of each other and other agencies (federal, university) for science, engineering, and facilities.**
- ***The key to this change is an attitudinal change where the size of the inputs ($, CS/SSC, facilities) is not a relevant metric. The relevant metric will be Outputs.***

SCIENCE POLICY GUIDE

- Establish policies to convey NASA science to the public
- State basic principles for establishing science program goals for fundamental, strategic, basic, and applied research
- Establish how NASA will set priorities and resolve conflicts
- Define research programs and missions
- Define roles of NASA Centers, industry, and universities

COMMITMENT TO QUALITY

- Develop performance measurements as called for in Government Performance and Results Act
- Apply metrics to research programs:
    - Program Initiation Phase
      Evaluate importance of research against other programs
    - Program Development and Implementation Phase
      Define expected accomplishments, actual costs, schedule
    - Program Evaluation Phase
      Degree intended goals and accomplishments were met
- Advisory committees
- Peer review

NASA REINVENTION PROCESS