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ABSTRACT

This report discusses the support of research and development (R&D) by the federal government through appropriate agencies; it uses data from an annual survey of federal agencies following the preparation of their budgets for 1984. Therefore, this information reflects the continuation of Reagan administration policies to strengthen the United States economy and to increase national security. The report is divided into three sections: (1) the 1984 budget (examining federal R&D in the national economy, character of work, fields of science and engineering, budget allocations by function, and agency programs); (2) performers of federally funded R&D (including industrial firms, federal intramural, universities and colleges, fields of science/engineering, and federally funded R&D centers); and (3) geographic distribution, 1982 (considering the leading states, relative rates of growth, distribution of funds by performer, factors in R&D performing capability, and R&D plant). Also included is a summary of more recent data which became available after the survey was completed; this summary provides information on federal R&D levels of support proposed for 1985. (The data discussed in this report, which provide an overview of current and recent historical trends in government R&D funding, are useful to planners and decision-makers in government, industry, and college/university settings.) (JN)

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foreword

This 32nd edition *Federal Funds for Research and Development* is one part of an extensive series of recurring National Science Foundation (NSF) reports on research and development (R&D) funding. The report discusses the support of research and development by the Federal Government through appropriate agencies, by drawing data from an annual survey of Federal agencies following the preparation of their budgets for 1984. Therefore, this information reflects the continuation of administration policies to strengthen the U.S. economy and increase our national security. In addition, the report includes a summary of more recent data which became available after the survey was completed. This summary provides information on Federal R&D levels of support proposed for 1985.

The data presented here, which provide a broad overview of current and recent historical trends in government R&D funding, provide a useful aid to planners and decision-makers at universities and colleges, in industry, and at all levels of government.

Edward A. Knapp
Director
National Science Foundation

July 1984

notes

The data for fiscal years 1982, 1983, and 1984, shown in detailed statistical tables, text tables, and charts were collected from Federal agencies from March through August 1983. They were based on the agency budgets contained in the President's 1984 budget to Congress.

The data for 1982 are actual. Those for 1983 and 1984 are estimated. The 1983 data represent obligations estimated in the second quarter of fiscal year 1983 and reflect congressional appropriations through that period. The data for 1984 are based on amounts proposed in the 1984 budget presented by the President to Congress in February, 1983.

Table and chart details may not add to totals because of rounding.

To obtain accurate historical data, use only the latest detailed statistical tables C-113 through C-133 in *Federal Funds*, Volume XXXII (NSF 83-319) and not data published earlier. Agencies revise prior-year data when important changes occur in program classifications. Only the latest tables incorporate such changes. More complete historical data are provided in *Federal Funds for Research and Development: Detailed Historical Tables: Fiscal Years 1955-84*, available on request from the Division of Science Resources Studies, National Science Foundation.

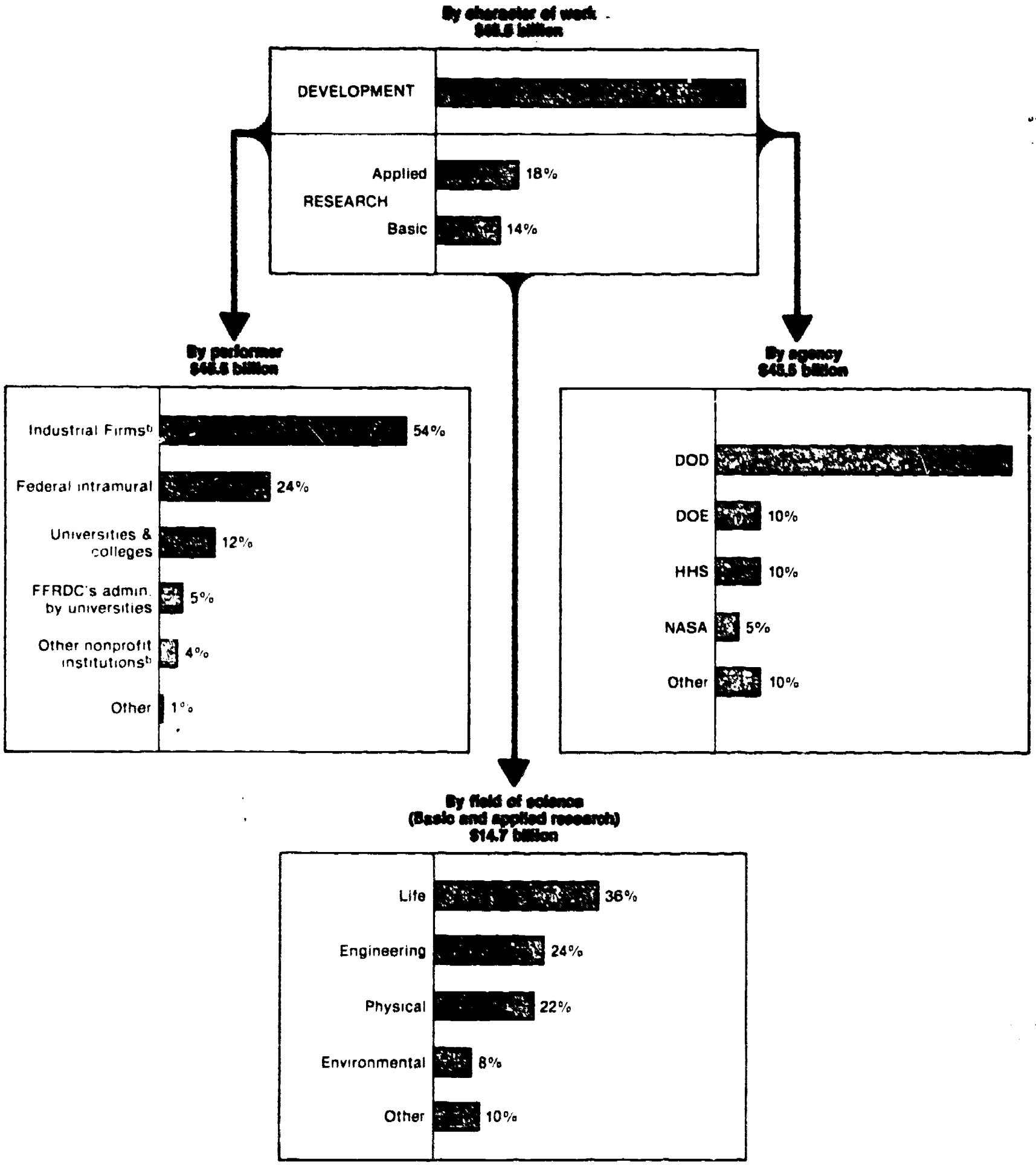
acknowledgments

This report was prepared in the Division of Science Resources Studies under the general guidance of Charles E. Falk, Director, and William L. Stewart, Head, R&D Economic Studies Section. Gerard Glaser, Study Director, Government Studies Group, provided direction. Joseph J. Geraci, Vanessa Richardson, and Stephen Gould were responsible for analysis of the data and writing of the text. Dorothy K. Ham prepared statistical materials and graphic illustrations.

contents

[1] See notes on p. 39.

Distribution of Federal obligations for research and development: FY 1984 (est.)[a]



[a]These data are based on the President's 1984 budget to Congress as presented in January 1983. They exclude R&D plant data.
[b]Includes federally funded research and development centers (FFRDC's) administered by this sector.
SOURCE: National Science Foundation

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summary update

The President's budget for fiscal year 1985, which contains updated data for 1984 and proposed funding levels for 1985, was released while this report was being prepared. The following briefly summarizes that budget's major features.

Data in subsequent sections of the report, which are based on a survey of how Federal agencies plan to allocate the research and development (R&D) funds proposed by the President for 1984 are set out here in greater detail. They do not reflect recent congressional action on the President's budget.

The R&D support levels proposed in the President's 1985 budget appear in the following table:

The 1985 budget includes $51.8 billion for research and development, 14 percent over the 1984 level. As in the 1984 budget, most of the increase in 1985 Federal R&D funding is proposed for defense-related activities with the Department of Defense showing an estimated 23-percent gain.

The administration has proposed continued support of R&D activities with strong increases in basic research obligations across all fields of science. These increases occur mainly in agencies supporting primarily the physical sciences and engineering, such as: The Department of Energy (18 percent over 1984), the National Aeronautics and Space Administration (16 percent), the Department of Defense (15 percent), and the National Science Foundation (13 percent). The 10 percent increase for overall Federal basic research funding indicates a real increase after inflation of almost 6 percent above 1984 (See chart.)

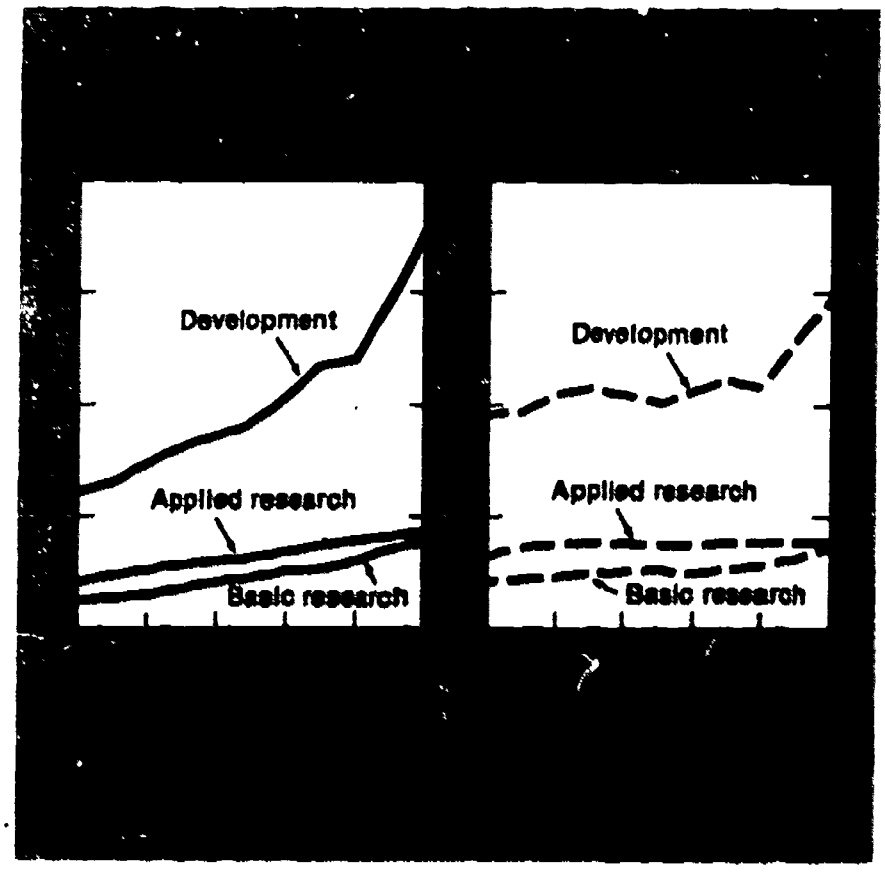
Federal obligations for research and development by major department and agency

[Dollars in millions]

Agency	1984	1985	Percent change 1984-85
Total	$45,279	$51,776	+14.3
Defense—Military functions	27,636	33,852	+22.5
Department of Health and Human Services	4,859	4,950	+1.9
(National Institutes of Health)	(4,240)	(4,342)	+2.4
Department of Energy	4,844	4,885	+.8
National Aeronautics and Space Administration	3,257	3,341	+2.6
National Science Foundation	1,239	1,408	+13.6
Department of Agriculture	872	898	+3.0
Department of Transportation	519	498	-4.0
Department of the Interior	415	363	-12.5
Environmental Protection Agency	250	281	+12.4
Department of Commerce	357	272	-23.8
Agency for International Development	225	264	+17.3
Veterans Administration	223	198	-11.2
Nuclear Regulatory Commission	191	168	-12.0
All other[1]	393	396	+.8

[1] Includes the Departments of Education, Justice, Labor, Housing and Urban Development, and Treasury, the Tennessee Valley Authority, the Smithsonian Institution, the Corps of Engineers, and the Federal Emergency Management Agency.

SOURCE Office of Management and Budget



introduction

This report is one of several National Science Foundation (NSF) reports based on surveys that obtain data on research and development (R&D) funding and scientific and engineering (S/E) personnel in the major sectors of the national economy. The data in the *Federal Funds* series cover Federal agency funding of R&D programs. In the latest report, the data were based on the survey of R&D outlay and obligation levels as reported in the *Federal Funds for Research and Development, Fiscal Years 1982, 1983, and 1984*, Volume XXXII survey, that was conducted by NSF between March and August, 1983. The 91 agency respondents represent all Federal departments, agencies, and agency subdivisions that sponsored R&D programs during the 1982-84 budget period.

Federal agencies provided R&D data to the Office of Management and Budget (OMB) for inclusion in "Special Analysis K: Research and Development," in *The Budget of the United States Government, Fiscal Year 1984*, presented to Congress in January, 1983. R&D data in the OMB document and in the *Federal Funds* survey were based on the same definitions. They are reconcilable. Data in the *Federal Funds* survey, however, are classified in greater detail and include the smaller R&D support agencies not covered by OMB.

In detailed statistical tables, the *Federal Funds* categories cover Federal R&D data by agency, character of work (basic research, applied research, and development), performer, and field of science for 1982-84. They include State distribution for 1982. These categories were set forth earlier in a separate NSF document.[2] The detailed statistical tables include historical data for the 1974-84 period.

Data in the detailed statistical tables for fiscal year (FY) 1974 through FY 1982 are actual. Data for the next two years are estimated. Data for FY 1983 reflect obligations estimated in the second quarter of that year, including obligations carried over from prior-year appropriations, as reported by the agencies at that time. Data for FY 1984 are based on amounts requested in the President's 1984 budget. While 1984 data for some agencies include estimates for carryovers, they do not reflect subsequent appropriations or changes made by executive apportionment.

[2] National Science Foundation, *Federal Funds for Research and Development, Fiscal Years 1982, 1983, and 1984*, Volume XXXII (Detailed Statistical Tables) (NSF 83-319) (Washington, D.C., 20550, 1984). These are available without charge.

Federal Funds data are comparable from one year to the next and provide a useful measure of trends. Users should be aware, however, that some R&D programs are not identified as budget line items, and have been separated by agency respondents from other, larger programs in the agency budget accounts. R&D programs must then be further subdivided into survey categories: basic research, applied research, development, performing sectors, and fields. They must also be identified in terms of distribution to States. If agency records are kept by categories other than those requested in the survey, respondents must must decide for themselves exactly how to report their data.

Respondents' experience in meeting the survey requirements and reporting accurately within established definitions have continued to improve the reliability of the data. When reexamination of reporting systems and concepts has resulted in reclassification of data, agencies have revised prior-year data according to the latest taxonomy. For this reason, users of historical data should use only the series in the latest *Detailed Statistical Tables* or in the extensive historical tables NSF issues separately. These are available on request from the NSF Division of Science Resources Studies.

section 1.

the 1984 budget

federal research and development in the national economy

In 1984, the Federal Government is expected to obligate $45.5 billion for research and development. This is 18 percent more than the 1983 total of $38.7 billion (table 1). In real terms it represents a gain of nearly 13 percent. This increase contrasts with current-dollar growth of 6 percent in the total 1984 Federal budget (table 2).

Federal research and development (R&D) support related to national security, basic research, and long-term energy technologies such as magnetic fusion received special emphasis in 1984. Within basic research, special emphasis was given to mathematics and the computer sciences, the physical sciences, and engineering as an aid to national defense and to U.S. competitiveness in high-technology industries.

As in the 1982 and 1983 budgets, high priority is given in the 1984 budget to improving national defense capabilities. In the budgets for these three years consistent real increases have been provided for defense. There have been consistent decreases for energy and natural resource and environment programs, with the largest

Table 1. Federal R&D obligations by agency

[Dollars in millions]

Agency	Actual			Estimated			
	1974	1982	Average annual percent change 1974-82	1983	Percent change 1982-83	1984	Percent change 1983-84
Total	$17,410	$36,433	+9.7	$38,710	+6	$45,497	+18
Department of Defense	8,420	20,623	+11.8	23,125	+12	29,736	+29
Department of Energy	[1]1,489	4,708	+15.5	4,605	-2	4,517	-2
Department of Health and Human Services	[2]2,163	3,941	+7.8	4,327	+10	4,435	+3
National Institutes of Health	1,737	3,433	+8.9	3,774	+10	3,853	+2
Other Health and Human Services	426	508	+2.2	553	+9	582	+5
National Aeronautics and Space Administration	3,002	3,078	+.3	2,416	-22	2,463	+2
National Science Foundation	556	975	+7.3	1,060	+9	1,240	+17
Department of Agriculture	379	797	+9.8	853	+7	846	-1
Department of Transportation	[3]393	310	-2.9	394	+27	520	+32
Department of the Interior	192	381	+8.9	397	+4	328	-18
Department of Commerce	158	336	+9.9	339	+1	234	-31
Environmental Protection Agency	169	335	+8.9	241	-28	208	-14
Agency for International Development	21	200	+32.5	175	-12	207	+18
Nuclear Regulatory Commission	42	220	+22.9	210	-5	200	-5
Veterans Administration	85	137	+6.2	163	+19	160	-2
Department of Education	[4]127	128	+.1	145	+14	126	-13
Other agencies	213	263	+2.6	260	-1	276	+6

[1] Engery Research and Development Administration.
[2] Data have been adjusted to reflect only health and human services programs (without education).
[3] Includes R&D programs of the Maritime Administration.
[4] Office of Education plus National Institute of Education.

SOURCE: National Science Foundation

decreases directed to energy. Nondefense R&D obligations decline 3 percent in real terms from 1983 levels. Defense R&D obligations comprise about 12 percent of total defense obligations. Nondefense R&D obligations account for about 19 percent of the total discretionary nondefense budget (exclusive of entitlement payments, interest, and other financial transactions).

Since 1981, Federal R&D outlays have been increasing as a share of total Federal budget outlays. Anticipated outlays for R&D support represent 5.6 percent of estimated Federal budget outlays for 1984 (chart 1). This compares with 4.9 percent in 1981, and 6.0 percent in 1974. The increases since 1981 correspond to an increase in the Department of Defense (DOD) R&D outlays as a share of total outlays from 2.4 percent to 3.2 percent over the same time period. Since 1974, Federal non-DOD R&D outlays have fluctuated between 3.3 percent (1974) and 2.4 percent (1984) of total outlays. In 1983 and 1984, DOD outlays have accounted for over one-half of total Federal R&D outlays. In each fiscal year between 1967 and 1982, non-DOD R&D outlays have exceeded DOD outlays.

Table 2. Federal overall budget outlays and R&D obligations and outlays: fiscal years 1960-84

[Dollars in millions]

Fiscal year	Total budget outlays[1]	Research, development, and R&D plant		R&D & R&D plant outlays as a percent of total budget outlays
		Obligations	Outlays	
1960	$ 92,223	$ 8,080	$ 7,744	8.4
1961	97,795	9,607	9,287	9.5
1962	106,813	11,069	10,387	9.7
1963	111,311	13,663	12,012	10.8
1964	118,584	15,324	14,707	12.4
1965	118,430	15,746	14,889	12.6
1966	134,652	16,179	16,018	11.9
1967	157,608	17,149	16,859	10.7
1968	178,134	16,525	17,049	9.6
1969	184,645	16,310	16,348	8.9
1970	195,652	15,863	15,734	8.0
1971	210,172	16,154	15,971	7.6
1972	230,681	17,098	16,727	7.3
1973	245,647	17,574	17,489	7.1
1974	267,912	18,176	18,297	6.8
1975	324,245	19,860	19,551	6.0
1976	364,473	21,616	21,021	5.7
1977	400,506	24,818	22,883	5.7
1978	448,368	27,141	25,128	5.6
1979	490,997	29,621	27,041	5.5
1980	576,675	31,386	30,636	5.3
1981	657,204	34,590	34,066	5.2
1982	728,375	37,822	38,549	5.3
1983 (estimate)[2]	805,202	40,079	43,660	5.4
1984 (estimate)[2]	848,483	47,064	48,697	5.7

[1] Outlays include expenditures plus net lending.

[2] These estimates are based on amounts shown in *The Budget of the United States Government, Fiscal Year 1984*, Executive Office of the President, Office of Management and Budget.

SOURCES: National Science Foundation and Office of Mangement and Budget

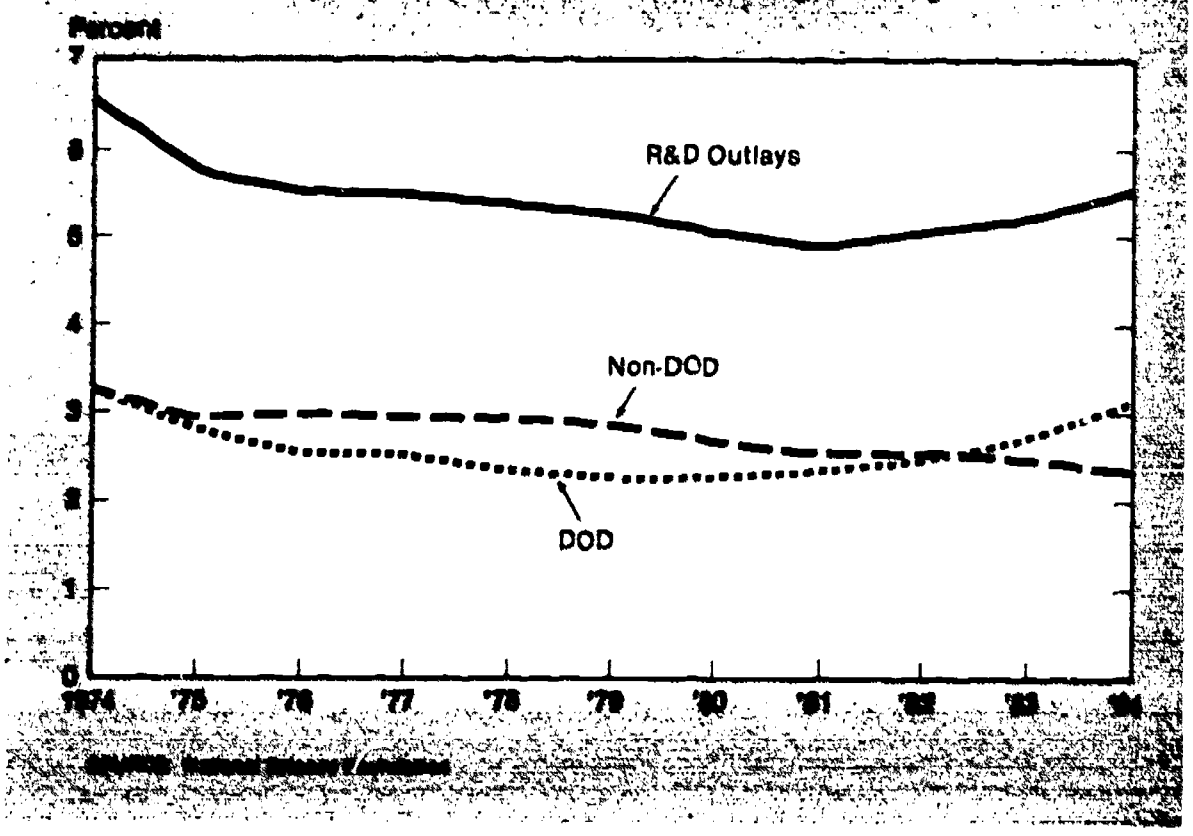
character of work

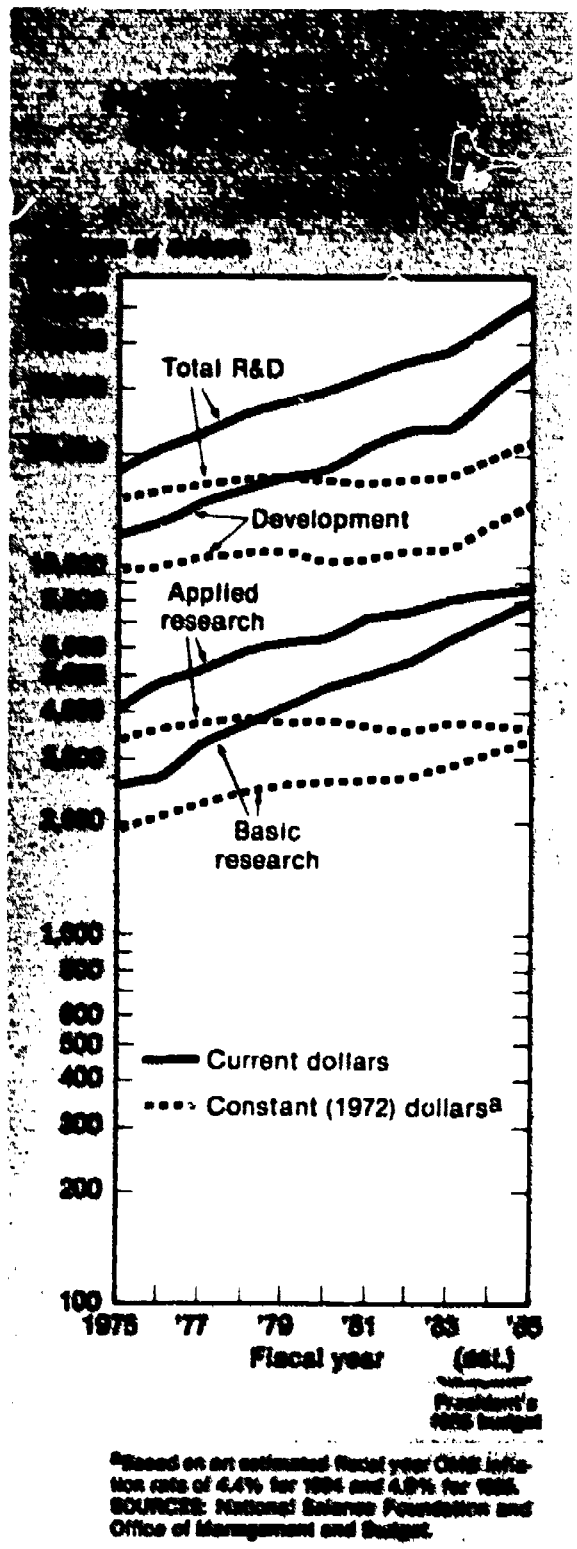
While Federal current-dollar R&D obligations show an overall increase of 18 percent from 1983 to 1984, the components of R&D support—basic research, applied research, and development—show significantly varied rates of change (chart 2). Development, which accounts for 64 percent of R&D obligations, shows an increase of 26 percent. By contrast applied research, which accounts for 17 percent of R&D obligations, shows a slight decrease (less than 1 percent). An increase of 9 percent for basic research completes the spectrum of change for 1984 R&D support. In real terms development shows an increase of 20 percent, applied research, a decrease of 5 percent, and basic research, an increase of 4 percent.

basic research

A period of real growth in Federal obligations for basic research that began in 1976 has continued in 1983 and 1984. This real growth was interrupted during 1981

Chart 1. Total Federal R&D outlays as a percentage of total Federal budget outlays





[a]Based on an estimated fiscal year GNP inflation rate of 4.4% for 1984 and 4.0% for 1985.
SOURCE: National Science Foundation and Office of Management and Budget.

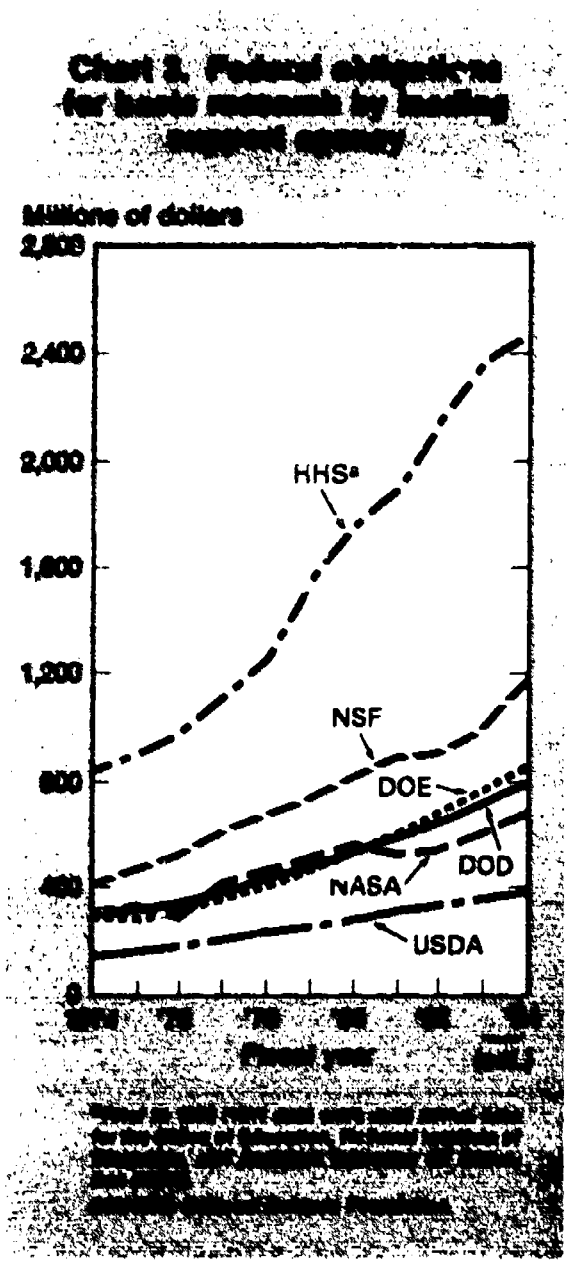
and 1982 as part of wide-ranging Government austerity measures. However, 1983 obligations for basic research increased in real terms to a level of 6 percent above 1980 obligations, and a real increase of 4 percent is estimated for 1984 over 1983. These increases are comparable to an average annual real increase of 5.9 percent between 1976 and 1980. Basic research obligations represent 15 percent of the Federal R&D obligations total in 1984. This is the same percentage as in 1980, and an increase of 13 percent in 1976.

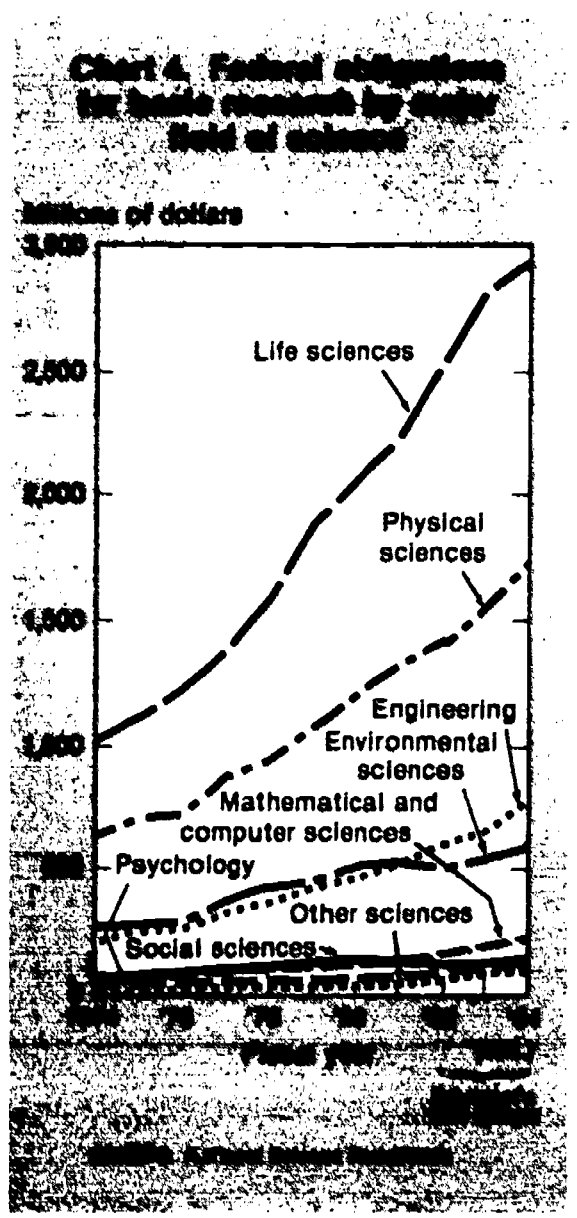
The agencies leading in support of basic research in 1984 are the Department of Health and Human Services (HHS) (39 percent), the National Science Foundation (NSF) (18 percent), DOD (13 percent), the Department of Energy (DOE) (12 percent), and the National Aeronautics and Space Administration (NASA) (10 percent) (chart 3). The National Institutes of Health (NIH) within HHS accounts for 35 percent of the 1984 basic research total. One-half of all basic research obligations are expected to be directed to universities and colleges, and one-quarter to Federal intramural activities.

Three fields of science receive special emphasis in increased Government-wide support of basic research in 1984. Mathematics and computer sciences, engineering, and the physical sciences show increases of 23 percent, 18 percent, and 11 percent, respectively. NSF shows the largest increase for basic research (18 percent), in part because these fields represent almost one-half of NSF basic research obligations (chart 4). Life sciences continue to show the largest share of basic research obligations. This share declined, however, from 46 percent to 44 percent between 1982 and 1984.

applied research

The decrease in Federal obligations for applied research in 1984 continues a real decline that began in 1979. Between 1973 and 1978 applied research obligations rose in real terms at an average annual growth rate of 4.1 percent.





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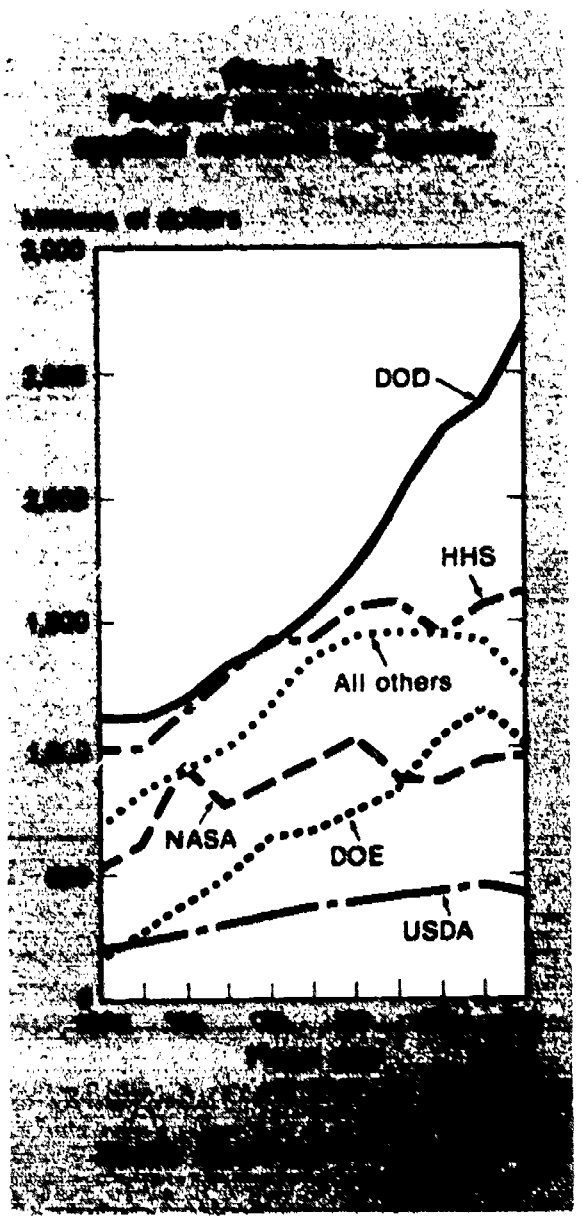
The agencies that lead in support of applied research in 1984 are DOD (34 percent), HHS (20 percent), DOE (13 percent), NASA (12 percent), and the Department of Agriculture (USDA) (5 percent) (chart 5). Of these agencies, only DOD shows a real increase (8 percent) for 1984 over 1983. Since 1980, DOD has showed an average real annual increase of 4.4 percent. DOD now accounts for one-third of Federal applied research obligations, up from 30 percent in 1982 and 1983. DOE shows the largest percentage decrease for applied research in 1984, after receiving significant real increases in 1982 and 1983. USDA applied research obligations in 1984 are expected to be 9 percent below 1983 levels. In real terms, this is the lowest USDA applied research budget since 1972.

Among the fields of science, the most significant real decreases in applied research obligations are for the life sciences (5 percent), environmental sciences (15 percent), and engineering (9 percent). The physical sciences increase in real terms by 7 percent. These four fields account for 88 percent of all applied research obligations in 1984. Engineering is the largest applied research field, accounting for one-third of all obligations in 1984.

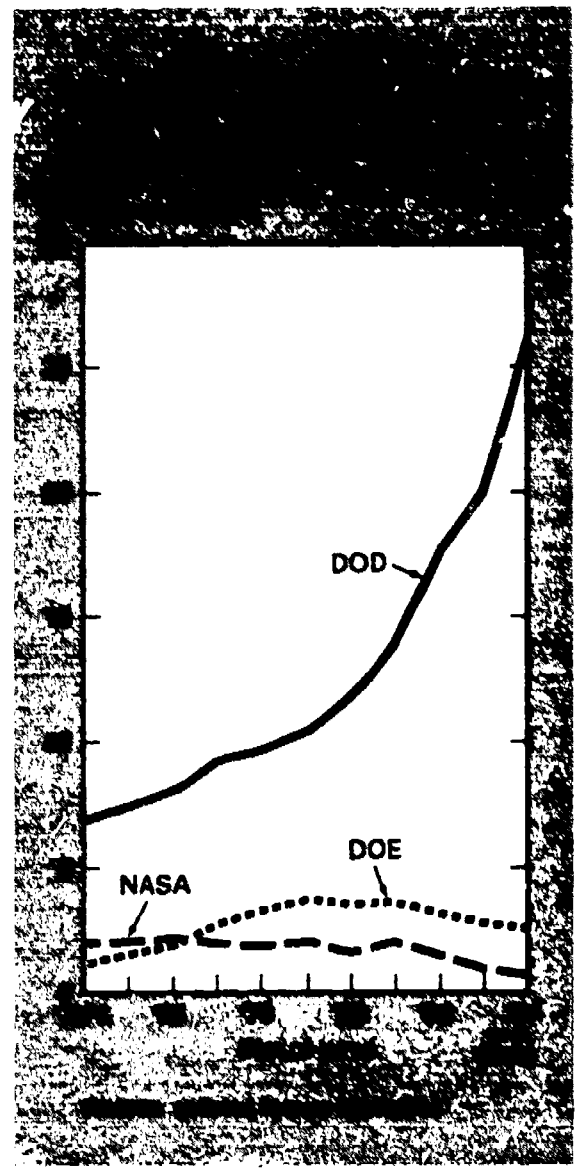


development

After falling almost steadily in constant dollars from 1967 to 1976, Federal support of development began to grow, showing a year-to-year increase in real terms. Between 1978 and 1982, an upward surge occurred in NASA support for the final phases of space shuttle development. But as NASA shuttle programs have become operational, and as DOE energy development programs have been phased down in nonnuclear areas, most development growth stems from DOD (chart 6).

Development accounts for 90 percent of the increase in total obligations for research, development, and R&D plant for 1984 over 1983, and two-thirds of total obligations. In turn, DOD accounts for 99 percent of the increase in development obligations, and 85 percent of all development obligations. DOD accounted for 81 percent of development obligations in 1983. DOE, NASA, Department of Transportation (DOT), and HHS are the major agencies with development activities apart from DOD. These four agencies account for 14 percent of all 1984 development obligations. Overall 1984 development obligations show an increase in real terms of 20 percent over 1983. DOD shows an increase in real terms of 26 percent.

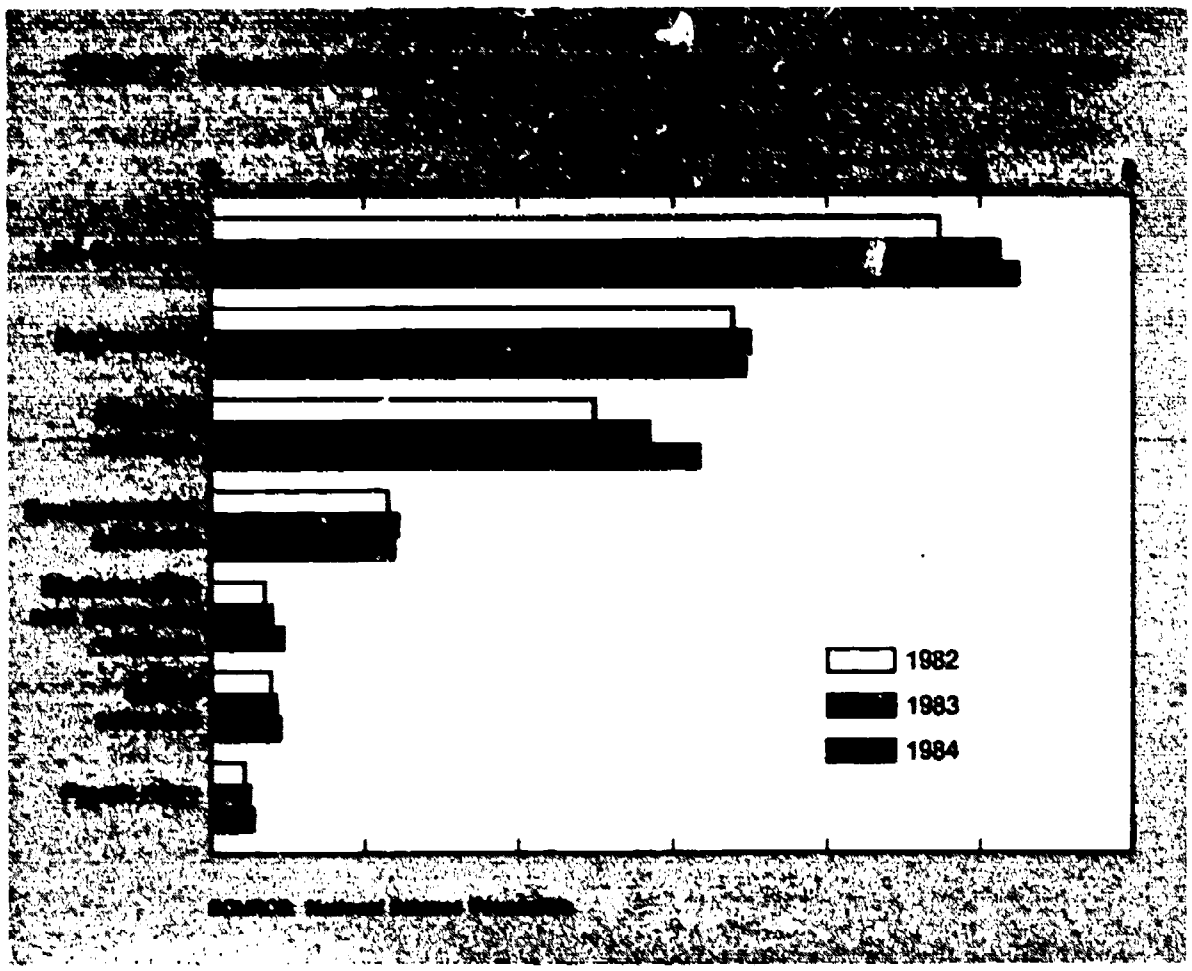
Since 1979, development funds have been significantly reallocated among the five leading agencies with development activities. The Federal budget's emphasis on defense has produced increasingly rapid growth in DOD development funding since 1979 when DOD accounted for 60 percent of obligations; the other four leading agencies accounted for 37 percent. Percent change in real terms for development obligations in 1984 are 79 percent above 1979 levels for DOD, and 52 percent below 1979 levels for the other four agencies. In real terms, DOE development obligations in 1984 are 45 percent lower than in 1979, NASA 72 percent lower, and HHS



50 percent lower. DOT development obligations, which increased by 33 percent in real terms between 1983 and 1984, are 4 percent above 1979 levels.

fields of science/ engineering

Federal obligations for research were expected to reach $14.7 billion in 1984, up 4 percent from the 1983 level. The research total subsumes seven major fields of science plus a "not elsewhere classified" category covering multidisciplinary projects within a broad field and single-discipline projects for which a separate field is not specified in the *Federal Funds* reporting system (chart 7).



The life sciences, with $5.3 billion, will receive an estimated 36 percent of all Federal research funds in 1984. Support for this field, growing at an average annual rate of 9.5 percent during 1974-83, increases 2 percent in 1984. Among the major fields of research funded by Federal agencies, life sciences is the largest. This mainly reflects biomedical research programs of NIH and the basic agricultural research programs of USDA. Biological research is the largest funding category in life sciences, and also accounts for the largest percentage (16 percent) of all Federal research obligations. Medical research is the third largest funding category, accounting for 14 percent of obligations in 1984. Basic research in the life sciences is expected to increase 5 percent. Applied research activities will decrease 1 percent in 1984, primarily as a result of reductions in USDA and Interior programs.

Engineering research accounts for 24 percent of the Federal research total or $3.5 billion. It grew at an average annual rate of 9.4 percent over the 1974-83 period, but is expected to fall slightly in 1984. This decrease results from reductions in applied research programs of DOE, Interior, USDA, and Department of Commerce. The largest increase (11 percent) is shown in electrical engineering research. Obligations for aeronautical engineering show a 5-percent increase, metallurgy and materials engineering a 7-percent increase and chemical engineering shows a decrease of 22 percent. Basic engineering research has an increase of 18 percent, while applied research declines by 5 percent.

Support for the physical sciences, an estimated 22 percent of the research total, or $3.2 billion, is expected to grow 12 percent in 1984. Average annual increases in support over the last decade have occurred at about the same rate. Major support for this field is provided by DOD, DOE, NASA, and NSF with smaller overall gains in both basic and applied research. Research in physics accounts for 65 percent of physical science obligations. This is the second largest percentage (14 percent) of all Federal research obligations. Federal support for physics research, which has grown in real terms by 93 percent over the 1975-84 period, had a real increase of 7 percent in 1984. Support of physical sciences as a whole grew 57 percent in real terms in the 1974-84 period.

The environmental sciences, 8 percent of the total and now funded at $1.2 billion, grew an estimated 7.5 percent annually from 1974-83. Federal funding is expected to decrease 3 percent in 1984 as a result of significant reductions in NASA, National Oceanic and Atmospheric Administration, and the Interior. These offset the 16-percent increase in NSF support. Applied research programs are expected to decrease 12 percent from 1983 with large reductions in the Interior and DOE. Atmospheric research shows an increase of 8 percent.

Mathematics and computer sciences, with $482 million in 1984, account for a relatively small combined share of all Federal research funds (3 percent of the total). They received a 21-percent increase (17 percent in mathematics and 24 percent in computer sciences) in the 1984 budget—by far the largest relative increase of any field. Together these fields also lead in relative annual growth—14.9 percent from 1974-83. DOD will provide increased applied research support to this field, especially in the computer sciences area. NSF will increase basic research support in mathematics.

The social sciences and psychology, principally supported through NIH, each account for 3 percent of the 1984 Federal research total, or $704 million, and show the slowest relative annual growth of any field from 1974-83. Psychology, however, is expected to grow at 13 percent in 1984, largely because of increased support for applied research by DOD. Growth of 2 percent in the social sciences is driven primarily by a 9-percent increase in basic social science research by NSF and HHS, but is offset by a 2-percent reduction in applied research.

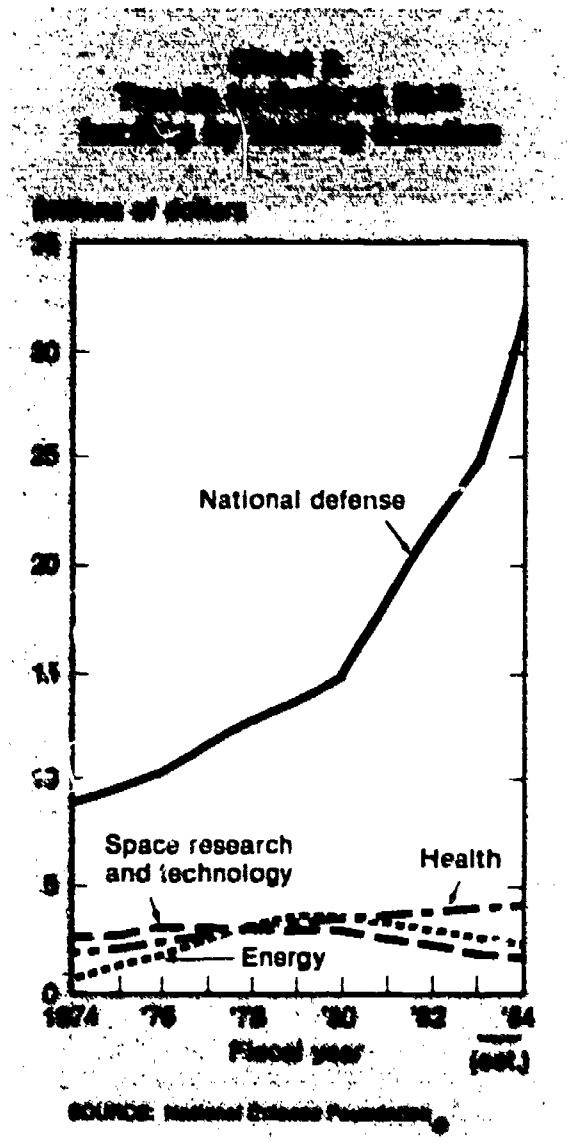
budget allocations bv function

The major Federal R&D support programs fall mostly within seven functional budget categories: National defense, energy, natural resources and environment, agriculture, transportation, health, and general science, space, and technology (chart 8). The leading features of R&D planning in the 1984 budget are as follows:

- National defense R&D programs show an increase of $7.1 billion, or 28 percent, following large relative increases in 1982 and 1983. The R&D activities in this function are sponsored by DOD and DOE.
- Health R&D programs show an increase of $107 million, or 3 percent—an amount below the anticipated inflation rate compared with a 10 percent gain in 1983. Almost all programs within this function are conducted by HHS.
- Energy R&D programs show a decrease of $274 million, or 11 percent, following a dec[illegible] $432 million, or 14 percent, in [illegible] ee agencies are included in R&[illegible] ts in energy: DOE, the Nuclear Regulatory Commission (NRC), and the Environmental Protection Agency (EPA).
- Space research and technology R&D programs show a decrease of $14 million, or 1 percent, with emphasis given to space science programs. NASA conducts all the R&D activity under this function.
- General science R&D programs show an increase of $228 million, or 15 percent, compared with a 10-percent gain in 1983. This function consists of NSF programs and two programs of DOE.
- Transportation R&D programs show an increase of $197 million, or 22 percent, compared with a 13-percent increase in 1983, both years reflecting real growth. This function is comprised of subdivisions of DOT and NASA.

R&D priorities, measured in terms of shares of the total held by various functional areas, have continued to shift over the 1982-84 period, with the most dramatic change occurring in national defense. This functional area accounted for 61 percent of the total in 1982, then grew to 65 percent in 1983 and 70 percent in 1984.

The share held by the health function has been relatively constant over the



1982-84 period, at approximately 11 percent. The energy share has fallen from 8 percent in 1982 to 5 percent in 1984, and the space share from 7 percent to 4 percent in the same period.

In 1984 the four leading functions—national defense, health, energy, and general science, space, and technology—account for 93 percent of the total (table 3). Transportation, natural resources and environment, and agriculture each represent 2 percent. The remaining eight functions together account for almost 2 percent of the total.

agency programs

dod

The DOD R&D program is oriented toward the development of strategic and tactical weapons and supporting systems to provide for the Nation's defense. In 1984 the DOD increase in R&D support was 29 percent to $29.7 billion (chart 9), the largest 1-year increase in the 1974-84 period. The average annual increase between 1974 and 1980 was 8.[illegible] percent. The average annual increase between 1980 and 1984 has been 20.9 percent. DOD obligations make up 65 percent of the Federal

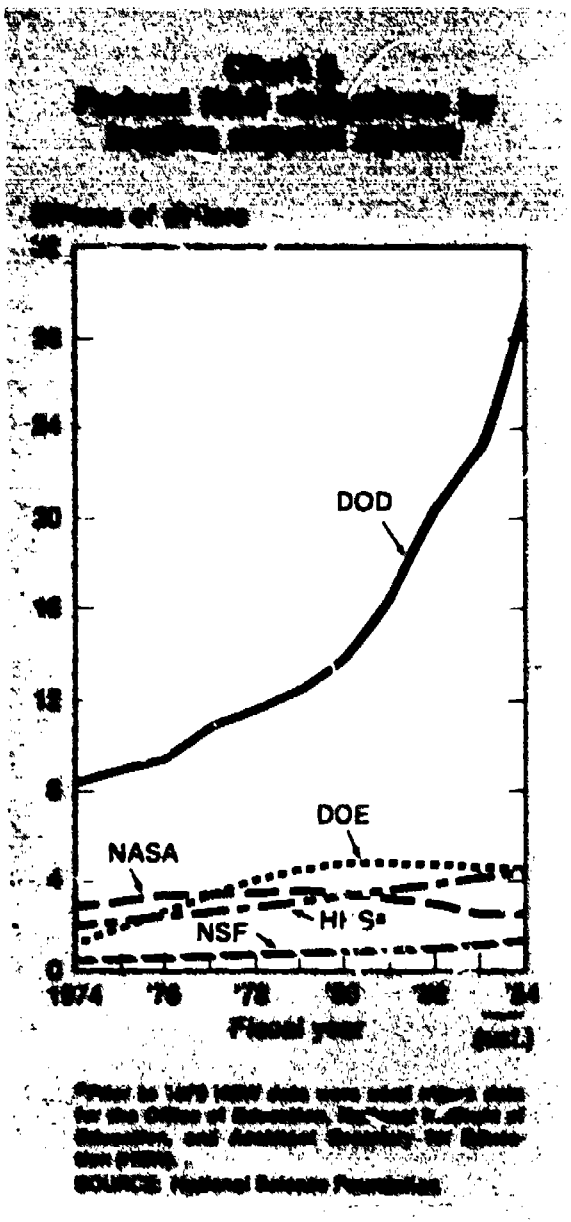
Table 3. Budget authority for research and development by budget function[1]

[Dollars in millions]

Budget function	1982 actual	1983 (est.)	1984 (est.)
Total	$36,115	$38,455	$45,663
National defense	22,070	24,913	31,984
Health	3,869	4,249	4,356
Energy	3,012	2,580	2,306
Space research and technology	2,584	1,883	1,897
General science	1,359	1,492	1,720
Transportation	791	894	1,091
Natural resources and environment	965	927	788
Agriculture	693	747	748
Education, training, employment, and social services	228	220	226
International affairs	165	152	161
Veterans benefits and services	139	158	159
Commerce and housing credit	104	107	91
Income security	32	42	43
Administration of justice	31	33	42
Community and regional development	63	48	39
General government	10	10	12

[1]Listed in descending order of 1984 budget authority. One budget function—general science, space and technology—has been divided into two functions in this analysis: Space research and technology, and general science.

SOURCE: National Science Foundation



R&D total in the 1984 budget, the highest share attained in the past decade. This share contrasts with the average 50 percent DOD held over the decade.

The chief source of growth in 1984 is the strategic programs mission area which is expected to increase 55 percent to $9.2 billion. Air Force strategic programs are expected to grow 41 percent to $6.5 billion with emphasis on the M-X missile system. other strategic programs include a planned $1.1 billion for the Navy's Trident II missile programs as well as a planned increase for the Army's Ballistic Missile defense systems technology development. DOD tactical programs in 1984 are scheduled for an estimated 22-percent increase over 1983 (to $8.9 billion). Advanced technology development programs are expected to increase 50 percent to $1.2 billion, with emphasis on the Very High Speed Integrated Circuits program and the Strategic Computing program. Intelligence and communications R&D programs are expected to increase 31 percent to $3.6 billion. Technology base programs are expected to increase 10 percent in 1984 to $3.5 billion. Approximately one-fourth of the R&D funds in the technology base area are in support of basic research.

doe

R&D funding for DOE activities is planned to decrease 2 percent to $4.5 billion in 1984. Between 1977 (the Department's first year) and 1981, DOE R&D funding increased at an average annual rate of 8.8 percent. In the 1981-84 period, funding has decreased at an average annual rate of 2.8 percent.

Atomic energy defense activities, the leading R&D program within DOE, is expected to increase 10 percent to $1.5 billion with continued emphasis on weapons research, development, and testing. Basic research funding shows an increase of 12 percent in 1984 over 1983. Civilian energy programs with the largest planned decreases are the nonnuclear programs such as fossil energy (57 percent) and energy conservation (59 percent). Nuclear fission, the largest DOE nondefense program area, is scheduled for a 7-percent increase to $767 million in 1984. A number of new initiatives are planned in 1984 to enhance the research productivity of the U.S. scientific community. These include a new center for materials research at the Lawrence Berkeley Laboratory, expansion of the National Synchrotron Light Source at Brookhaven National Laboratory, and a new colliding beam facility at the Stanford Linear Accelerator Center.

hhs

Federal R&D obligations to HHS grew 3 percent to $4.4 billion in the 1984 budget. Between 1979 (when education programs were transferred to a separate department) and 1984, HHS R&D obligations have increased at an average annual rate of 5.5 percent.

NIH, accounting for 87 percent of all HHS R&D funds, increases its support by 2 percent, reaching an estimated $3.8 billion. Each of the 11 separate institutes within NIH receive slight increases in 1984. Biomedical research continues to be the primary focus of NIH research funding. The Alcohol, Drug Abuse, and Mental Health Administration receives the largest relative gain—13 percent to $321 million. Basic research, which accounts for 56 percent of HHS R&D obligations, shows an increase of 3 percent. The Centers for Disease Control and Food and Drug Administration each receives for research and development a 7-percent increase over 1983.

nasa

NASA R&D programs develop new space technologies and provide new knowledge about the Earth, the solar system, and the universe. NASA's R&D obligations are expected to increase 2 percent in 1984 to $2.5 billion. A 22-percent reduction in R&D funding occurred in 1983 following initiation of space shuttle operations in November 1982 and concurrent conclusion of the major R&D phase of the shuttle program. R&D funding for NASA in 1984 is 18 percent below 1974 levels in current dollars, and 60 percent below 1974 levels in constant dollars.

Funding emphasis for NASA in 1984 will continue to be in the space science and applications programs, particularly physics, astronomy, and planetary exploration. New initiatives in 1984 include a Venus Radar Mapper, a numerical aerodynamic simulation capability at Ames Research Laboratory, and development of advanced composites for large aircraft structures. Ongoing R&D projects include the Space Telescope and the Advanced Communications Technology Satellite.

nsf

The R&D programs of NSF are expected to total $1.2 billion in 1984, 17 percent higher than 1983. Current-dollar NSF R&D obligations have increased in the 1974-84 period at an average annual rate of 8.5 percent. In real terms 1984 funding is 10 percent above 1974 levels. Basic research, which accounts for 95 percent of this agency's total R&D obligations, will

grow an estimated 18 percent in 1984. The additional funds are largely devoted to strengthening support of research in mathematics, computer sciences, physical sciences, and engineering.

usda

Total USDA R&D obligations are expected to decline slightly from $853 million in 1983 to $848 million in 1984. This is the first decrease (current dollar) in the 1974-84 period. Between 1974 and 1983 USDA R&D obligations increased at an average annual rate of 9.5 percent. In real terms 1984 funding is 10 percent above 1974 levels. The Agricultural Research Service (ARS), which accounts for 54 percent of USDA R&D obligations, shows an increase of 2 percent in 1984. This is offset by decreases in the R&D activities of the U.S. Forest Service and the Economic Research Service of 4 percent and 6 percent, respectively. Obligations for USDA basic research increased by 5 percent. Obligations for applied research and development decline by 5 percent and 3 percent, respectively.

dot

DOT is scheduled to receive the largest relative gain in R&D obligations of all agencies—nearly 32 percent—which will raise that agency's total to $520 million. Most of this growth is accounted for by an increase of approximately 113 percent (to $304 million) for the Federal Aviation Administration (FAA) for R&D activities on an advanced air traffic control computer. DOT R&D funding has fluctuated significantly in the 1974-84 period. The change in real terms for 1984 funding is 31 percent below 1974 levels.

section 2.

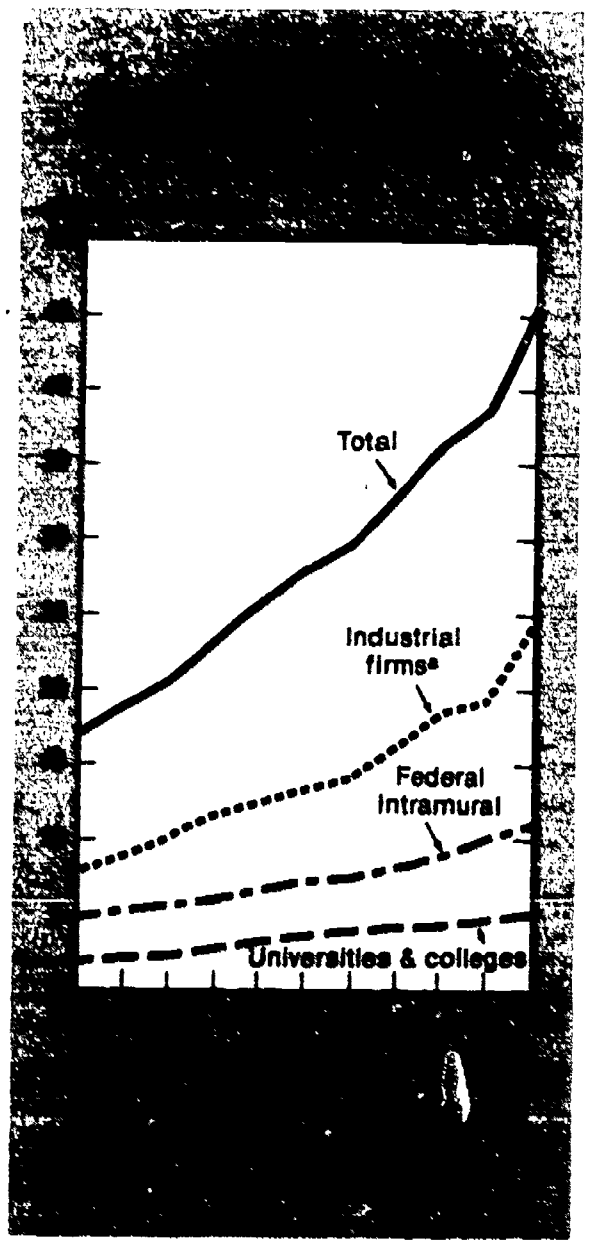
performers of federally funded research and development

Industrial firms continue to be the largest performers of Federal research and development. They are the fastest growing group in terms of Federal support for research and development. The following section discusses the growth trends of the major sectors in terms of Federal R&D support within the Federal total, with emphasis on the most recent years.

the background

As in the past three and one-half decades, the largest share of total Federal R&D support has been allocated to extramural performers. In the 1984 budget the share of R&D funding to extramural performers accounted for approximately 76 percent of the total Federal R&D obligations, or $34.5 billion.

Federal intramural funding, however, has been increasing steadily (chart 10). Since 1967, growth in intramural funds has been more stable than for any other performing sector. As a result of recent increased growth in DOD funds, of which only 23 percent is for intramural activities, the gap between intramural and extramural funding is widening. This was the prevailing relationship during the late sixties when DOD also dominated Federal R&D activities. In 1983, Federal intramural activities declined from an estimated 26 percent of the total Federal R&D obligations to an estimated 24 percent in FY 1984.



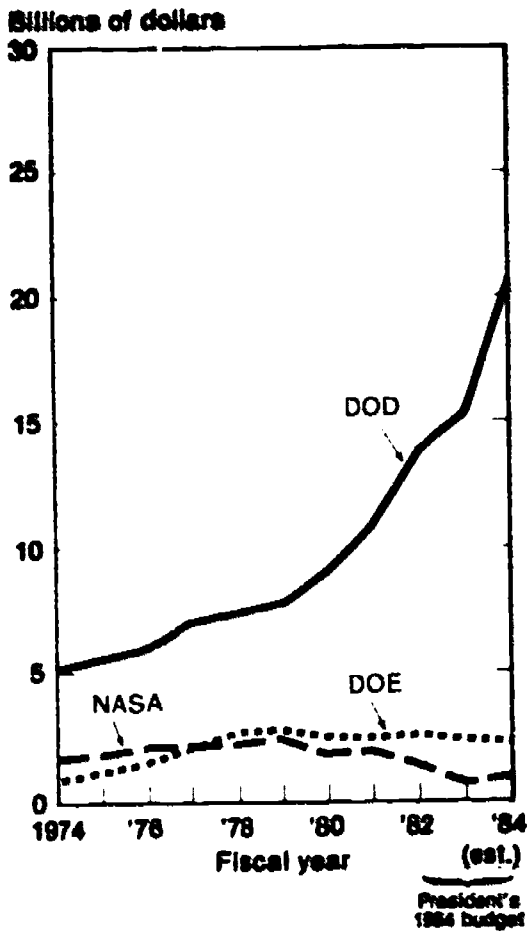
industrial firms

Industrial firms (including federally funded research and development centers (FFRDC's))[3] are the largest performers of federally funded research and development, accounting for 54 percent of all Federal R&D obligations proposed for 1984. Federal funding to industrial firms increased by 28 percent to $24.6 billion in 1984. This is the fourth consecutive year that Federal R&D funds to industry have grown at a higher rate than any other performing sector. In constant dollars, Federal R&D funding to industrial firms increased an average annual rate of 1.6 percent for the period from 1974 to 1981. For the years 1981 through 1984, the constant-dollar average annual rate of growth was 9.0 percent. The major factor influencing

[3] Throughout this analysis references to industrial firms include data for industry administered FFRDC's.

these increases is the growth in DOD funding which increased 35 percent over 1983, to $20.6 billion (chart 11). Together, DOD, DOE, and NASA accounted for an estimated 96 percent of all Federal R&D funding directed to industrial firms.

Chart 11. Trends in Federal R&D obligations to industrial performers[a] by leading support agency

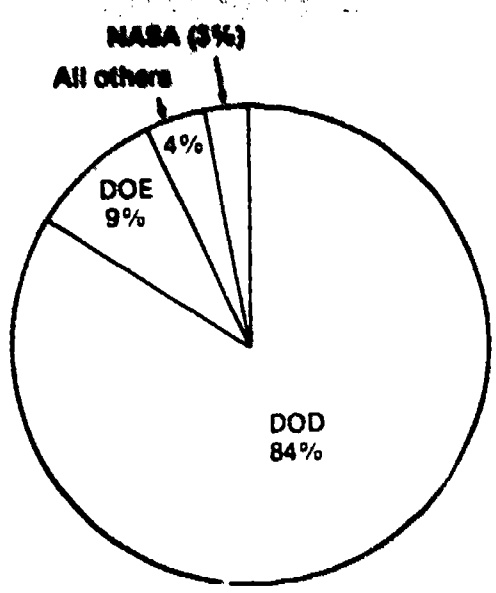


[a]Includes federally funded research and development centers (FFRDC's) administered by this sector.
SOURCE: National Science Foundation

dod

DOD continues to rank first among Federal agencies providing Federal R&D support to the industrial sector. DOD currently accounts for 84 percent of all Federal funding for research and development directed to industrial firms (chart 12). This is the largest share that DOD has had since 1960. Prior to 1982 the DOD share was typically between 60 percent and 80 percent. The 35-percent increase in DOD obligations to industrial firms in 1984 is more than three times the average annual rate of growth of 11.5 percent for the period from 1973 to 1983.

Chart 12. Share of Federal R&D obligations to industry[a] by selected agency: FY 1984 (est.)



[a]Includes Federally funded research and development centers (FFRDC's) administered by this sector.
SOURCE: National Science Foundation

doe

DOE funds for research and development to industrial performers account for 9 percent of all Federal funds to this sector, or $2.5 billion. Because DOE has typically relied on FFRDC's to conduct nuclear R&D activities, over one-half of DOE's R&D funds to industry is allocated to FFRDC's. This is in contrast to DOD and NASA which direct very little of their federally funded industrial R&D obligations to FFRDC's. Federal funding for DOE-sponsored R&D activities in the industrial sector declined 9 percent from the 1983 level.

nasa

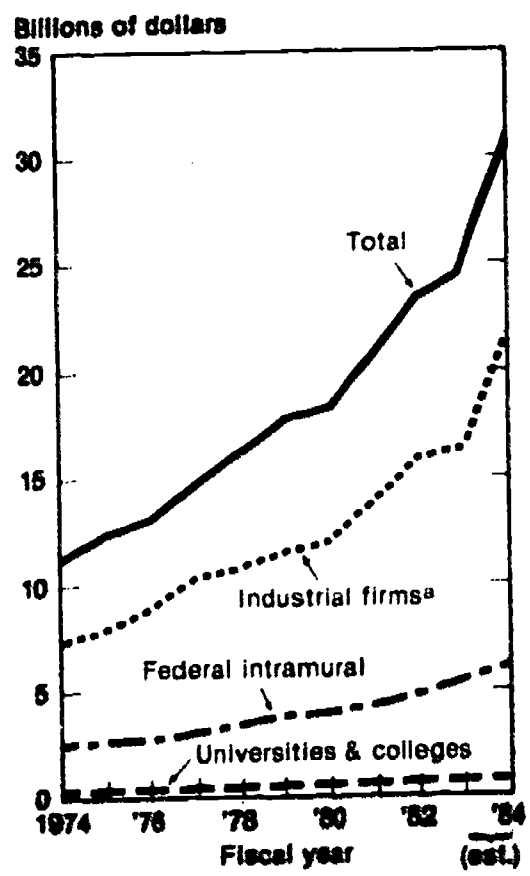
NASA funding, which accounts for 3 percent of all federally supported research and development in the industrial sector, rose 2 percent in 1984 to $814 million after a 44-percent decrease in 1983. Variations in NASA funding can often be accounted for by cycles inherent in the course of activities related to large-scale programs such as the Apollo moon landing in the late sixties and the space shuttle, both of which required substantial efforts by industrial contractors.

character of work

Of the $24.6 billion in Federal R&D funds allocated to industrial firms, an estimated 88 percent is expected to be directed to development programs. Applied research accounted for 10 percent and basic research accounted for 2 percent of all Federal R&D funds to industry.

The industrial sector is the largest performer of federally funded development programs (chart 13). Federal obligations for industrial development activities accounted for 48 percent of all Federal funding for research and development or 70 percent of all Federal funding for development in 1984. Approximately $21.6 billion in Federal funds were allocated to

Chart 13. Federal obligations for development by major performer



[a]Includes federally funded research and development centers (FFRDC's) administered by this sector.
SOURCE: National Science Foundation

development programs in the industrial sector. This is a 32-percent increase over 1983 levels. The large increase in funding for 1984 is the result of DOD funding increases, which accounted for 88 percent of all industry contracted development activities. DOE accounted for 9 percent and NASA accounted for 2 percent of the total.

Applied research funds directed to industrial performers accounted for 31 percent of all federally funded applied research. In 1984, Federal funding for applied research within industry rose only 1 percent to $2.5 billion. DOD, which is the largest supporter of applied research within the industrial sector and accounts for 60 percent of the funding, increased its obligations by 19 percent. DOE funding, which accounts for 13 percent of the total, declined 36 percent. Applied research funding from NASA remained constant and accounts for 11 percent of the applied research total for industry.

In the 1984 budget Federal funds for basic research directed by industry accounted for 6 percent of all Federal obligations for basic research and increased 10 percent. NASA, DOD, and DOE accounted for 32 percent, 31 percent, and 19 percent, respectively, of the industry-directed basic research total. All of these agencies increased their funding for basic research conducted by industry in 1984.

federal intramural

The Federal Government is the second largest performer of federally funded R&D programs, following the industrial sector. Federal intramural funding currently accounts for an estimated 24 percent of the Federal R&D total. Federal intramural performance is expected to reach $11.0 billion in 1984—a 7-percent increase over 1983. This increase exceeds the projected rate of inflation for this period.

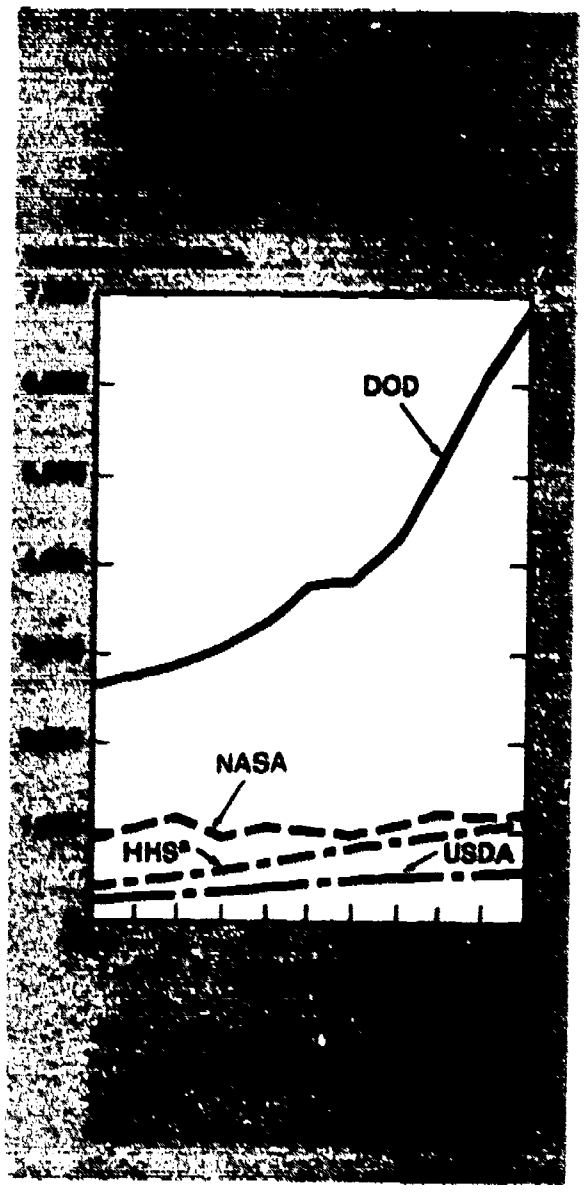
Much of the cost of intramural work is for personnel who are either directly involved with the performance of R&D projects or, as is the case in agencies such as NSF, who are responsible for the administration of R&D activities. In 1984, personnel costs are expected to account for 49 percent of the Federal obligations for total research and development to intramural performers.

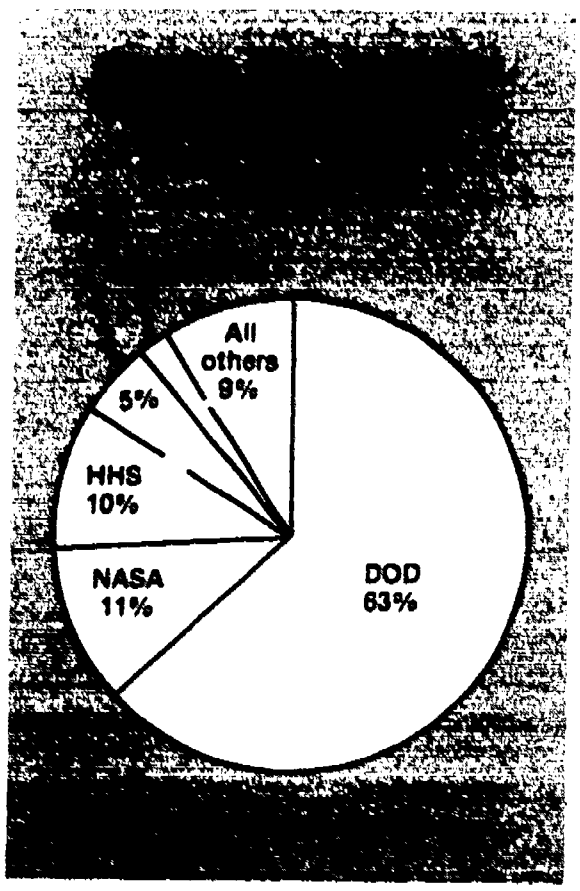
An estimated 58 percent of the support for intramural performance is expected to be allocated to development programs, 26 percent to applied research, and 16 percent to basic research. DOD, NASA, and HHS accounted for approximately 83 percent of all Federal intramural R&D funding in 1984.

dod

DOD has typically ranked first among Federal agencies in terms of its intramural R&D funds, averaging more than one-half of total Federal obligations for intramural research and development during the period from 1974 to 1984. In 1984, an estimated 63 percent of the total intramural R&D funding, or $6.9 billion, is accounted for by DOD (chart 14). DOD intramural funding grew relatively slowly between 1973 and 1982. Since 1982, however, the indicated increases for DOD were greater than any other agency (chart 15). The percentage increase in 1984 for intramural DOD funding is expected to be 14 percent.

In 1984, the percentage of DOD funds allocated to intramural development remained stable at 83 percent, compared to 82 percent in 1983. Applied research has declined to 13 percent and basic research has fallen to 4 percent of the total. DOD allocated approximately $5.7 billion to intramural development in 1984. As a result of an 85-percent increase in the development allocation to intramural Defense Agencies, the obligations for DOD's intramural development rose 16 percent. Basic and applied research within DOD intramural research and development rose 7 percent and 5 percent, respectively.





nasa

Since 1967 NASA has ranked second behind DOD in intramural R&D funding. NASA's average annual rate of growth has been the lowest of the leading intramural support agencies. In 1984, NASA intramural funds increased by only 1 percent to $1.2 billion. Since 1974, NASA's percentage of all Federal obligations for research and development by intramural performers has dropped from 20 percent to 11 percent.

In contrast to DOD, NASA has been reducing its development efforts and increasing its emphasis on research. This is evidenced by increased emphasis on space sciences research. In 1984, NASA's funding for intramural research rose 7 percent while funding for development fell 17 percent. NASA's funding for basic research rose 18 percent in 1984, and applied research increased 1 percent. Basic research now accounts for a 31-percent share of the total, and applied research, 49 percent. NASA's intramural funding for development has fallen to 20 percent. This decline reflects the Administration's efforts to increase the role of private sector involvement in development programs, as well as a change in emphasis on the space shuttle program. Because the space shuttle is now operational rather than developmental, funds previously allocated for its development are now being allocated to operational functions.

hhs

HHS, ranked third in intramural R&D funding, currently accounts for 10 percent of the Federal intramural total. During the period from 1973 to 1981, HHS intramural funds grew at an average annual rate of 11.6 percent. Since 1981, however, intramural growth has lessened. Federal obligations to HHS for intramural research and development rose only 3 percent in 1984 to $1.1 billion.

NIH continues to account for the largest fraction of HHS intramural R&D funds, with a 74-percent share. The strong growth within HHS in the seventies was the result of NIH's expansion of research during that period in the fields of cancer and heart disease. From 1973 to 1981 NIH funding advanced at an average annual rate of 12.3 percent. In 1984, NIH funding rose 2 percent over 1983 to $797 million.

The second largest user of HHS intramural funds is the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA). ADAMHA, accounting for 11 percent of HHS's intramural obligations, increased funds by 5 percent over the 1983 levels.

HHS leads all other agencies in intramural basic research support. In the department's 1984 budget $536 million was allocated to intramural basic research. This is one-half of all HHS Federal obligations for research and development by intramural performers.

usda

USDA conducts intramural research in fields related to agriculture and forestry. Sixty-eight percent of USDA research and development is performed intramurally, and these funds increased 2 percent to $578 million in 1984.

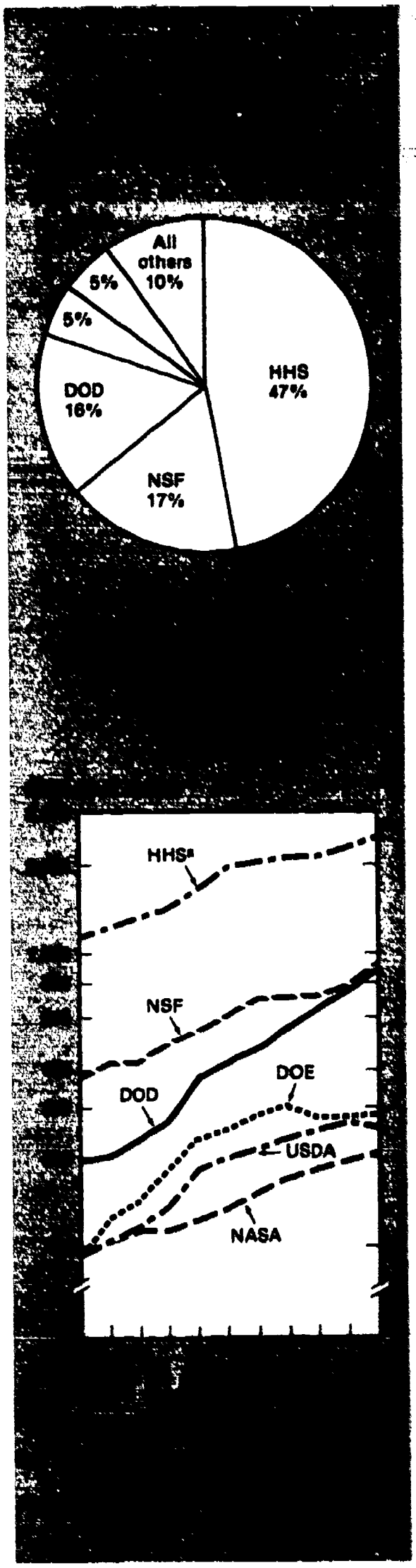
ARS accounts for 72 percent of the USDA intramural R&D total, while the Forest Service comprises 16 percent, and the Economic Research Service, approximately 8 percent. ARS allocated 91 percent of its total research budget to intramural activities. Basic research accounts for 55 percent, and applied research, 45 percent of the ARS intramural research total. The Forest Service places greater emphasis on applied research, which received 62 percent of their research allocation.

USDA sponsorship of applied research now accounts for 50 percent of all Federal obligations to USDA for intramural research and development. This is a slight decline from 1983 levels. Support to basic research remained at 45 percent.

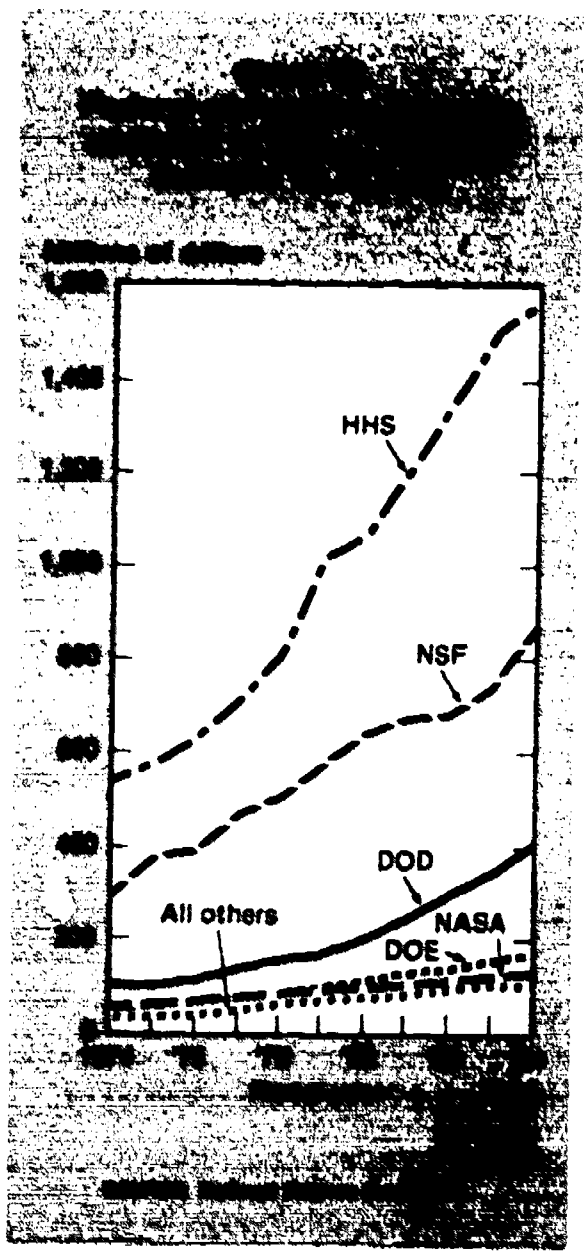
universities and colleges

Universities and colleges accounted for 12 percent of all Federal R&D obligations in the 1984 budget. Support to this sector grew 5.5 percent over the 1983 levels, bringing academic R&D funding to $5.3 billion. HHS is the largest contributing agency to academic research and development and accounts for 47 percent of academia's Federal R&D funding (chart 16). This department increased its support to academia by 3 percent in 1984. Within HHS, NIH accounting for 93 percent of academic R&D support, increased its funds to universities and colleges by 2 percent in 1984.

The 5.5-percent overall rise in Federal R&D funding to universities and colleges can be attributed primarily to NSF and DOD. NSF, responsible for 17 percent of the total, increased its support by 18 percent (chart 17). DOD increased its funding by 14 percent and accounts for 16 percent of the total.



Federal funding to universities and colleges registered constant-dollar gains in 1983 and 1984 after declines in the two previous years. Research continues to outweigh development in terms of total R&D support to the academic sector. In 1984, approximately 89 percent of all Federal R&D funding within academia will be spent on research. An estimated 63 percent of the total will be for basic research. This is a 9-percent increase over 1983 funding. Universities and colleges are the largest performers of federally funded basic research, accounting for $3.3 billion in Federal funds. HHS and NSF continue to be the major contributors to basic research support directed to universities and colleges (chart 18).



fields of science/ engineering

Within the academic sector, the 1984 budget reflects a significant increase in federally funded research in the physical sciences, engineering, environmental sciences, and mathematics and the computer sciences. Federal funds for research in mathematics and computer sciences increased 23 percent; engineering increased 15 percent; and physical sciences and environmental sciences each increased 13 percent in 1984. HHS, the largest support agency of research in the academic sector, accounted for 49 percent of all Federal funds. NSF accounted for a 20-percent share of the funds to this sector, followed by DOD with 12 percent of the total.

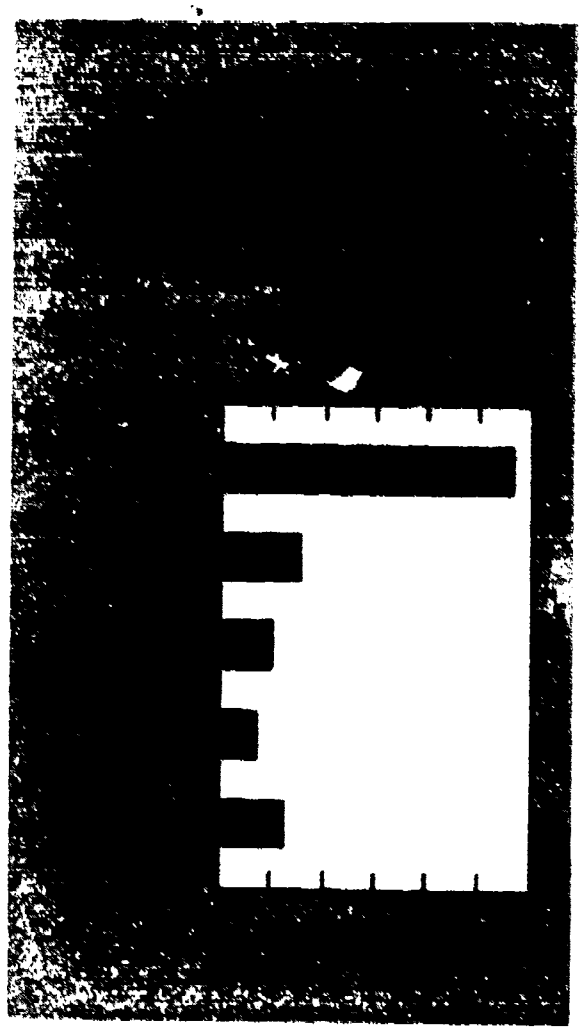
Approximately 89 percent of HHS's funds allocated to universities and colleges are for research in the life sciences; more specifically, the biological (excluding environmental) sciences. Total life sciences research obligations by HHS to universities and colleges increased by 3 percent in 1984.

Federal obligations for physical sciences research—15 percent of all academic research funds—increased almost 13 percent in 1984 (chart 19). Major increases in funding took place in NSF, DOD, and NASA. NSF, sponsoring 41 percent of all Federal support for research in the physical sciences, increased its funding by 21 percent in 1984. DOD's obligations to the physical sciences increased by 17 percent, while NASA increased its physical sciences research support by 21 percent.

Federal obligations for engineering research in academia increased 15 percent over the 1983 levels. DOD, which accounts for 41 percent of all Federal funding for engineering research in universities and colleges, increased its obligations by 19 percent in 1984. NSF, with a 33-percent share, increased its funding 22 percent.

Federally supported academic research in the environmental sciences increased by 13 percent in 1984. DOE, having a 4-percent share in this area, more than tripled its funding, while NSF, with a 60-percent share, increased its environmental sciences research funding by 13 percent.

Federally funded research in universities and colleges in the mathematical and computer sciences rose by 23 percent. DOD, which provides 54 percent of the Federal support in this field, increased its



funding by 29 percent in 1984. NSF, whose share is 38 percent, increased its funding by 20 percent.

ffrdc's

FFRDC's perform or manage research and development for Federal agencies. Currently, there are 34 FFRDC's; these centers typically meet a set of particular R&D needs of Federal agencies or, in some instances, they provide major nationally utilized research facilities at universities. Each center is administered by an industrial firm, a university or university consortium, or an independent nonprofit institution. The centers differ from Federal laboratories in that FFRDC's are predominantly staffed and operated by contract employees, rather than government employees.

In 1984, FFRDC's accounted for approximately 10 percent of all Federal R&D funding, or $4.6 billion. DOE continues to be the major source of R&D funding to FFRDC's. In the 1984 budget DOE provided FFRDC's with $3.0 billion or 64 percent of the total allocated to FFRDC's. DOD followed with $1.1 billion or 24 percent.

University-administered FFRDC's received $2.3 billion in R&D funds from the Federal Government in 1984—an increase of 10 percent over 1983—or approximately one-half of all R&D obligations to FFRDC's (table 4). The share of R&D funding for FFRDC's administered by industrial firms, 35 percent, rose 6 percent to $1.6 billion. FFRDC's administered by nonprofit institutions received $683 million, or 15 percent of the total, to reflect a 20-percent increase in funding to FFRDC's administered by nonprofit institutions. This growth can be attributed to significant increases in DOD support.

Although all FFRDC's conform to the same set of definitional criteria, they have marked differences in functions. In order to highlight these differences, the centers have been grouped into four categories according to primary activity: Research Laboratories, R&D Laboratories, Study and Analysis Centers, and System Engineering/System Integration Centers. This separation permits a clearer and more accurate appraisal of the nature of their functions. The categories are defined in the technical notes section and centers are listed by category in appendix B. The data are based on FY 1982 information, the latest data for which data for individual centers are available.

r&d plant

In 1984, the Federal Government is expected to obligate 1.6 billion to R&D plant. Funds for R&D plant are primarily for the acquisition, construction, or renovation of land, equipment, or facilities for use in R&D activities at Federal or non-Federal installations. Significant changes in funding for R&D plant can occur from year to year due to startings and completion of construction projects, and the cyclical nature of renovation and repair.

The $1.6 billion in R&D obligations represent a 14-percent increase over the $1.4 billion estimated for 1983. In 1983 and 1984 the largest share of R&D plant was allocated to Federal intramural performers (table 5). In 1984 Federal intramural R&D plant funding increased 29 percent to $644.1 million. Federal support for R&D plant to FFRDC's administered by industrial firms increased 24 percent to $411.3 million. R&D plant obligations to FFRDC's administered by universities and colleges rose 14 percent in 1984 to $390.3 million. Together, these three performers account for 92 percent of all Federal R&D plant funding.

With $872.6 million in Federal obligations for R&D plant in 1984, DOE continues to rank first among all Federal agencies (chart 20). Although DOE R&D plant funding is expected to increase 10 percent in 1984, the prevailing trend in recent years has been to reduce Federal support of research and development and associated plant that is viewed by the Administration as being more appropriately conducted by the private sector. DOE currently accounts for 55 percent of R&D plant funding. DOD funding, which accounts for 28 percent of federally supported R&D plant, rose 36 percent in 1984 to $438.2 million. The large increase that took place in DOD funding in 1977 was due to major facility modifications of Air Force installations. NASA funds for R&D plant increased 54 percent to $150.5 million in 1984. This increase provides for the construction of several new facilities. NASA currently accounts for 10-percent share of R&D plant obligations. DOE, DOD, and NASA account for 93 percent of all Federal R&D plant funding in 1984.

Table 4. Federal obligations for research and development by performer: fiscal years 1974 and 1982-84

[Dollars in millions]

Performer	Actual			Estimated			
	1974	1982	Average annual percent change 1974-82	1983	Percent change 1982-83	1984	Percent change 1983-84
Total	$17,410	$36,433	+9.7	$38,710	+6	$45,497	+18
Federal intramural	4,911	9,141	+8.1	10,228	+12	10,970	+7
Industrial firms[1]	8,345	18,698	+10.0	19,254	+3	24,571	+28
Universities and colleges	2,214	4,606	+9.6	4,996	+9	5,271	+6
FFRDC's administered by universities	789	1,977	+12.2	2,089	+6	2,292	+10
Other nonprofit institutions	672	1,092	+6.3	1,177	+8	1,336	+14
FFRDC's administered by other nonprofit institutions	199	521	+12.9	568	+9	683	+20
State and local governments	214	184	-1.9	210	+14	189	-10
Foreign	65	214	+16.1	188	-12	185	-2

[1] Includes federally funded research and development centers (FFRDC's) administered by this sector.

SOURCE: National Science Foundation

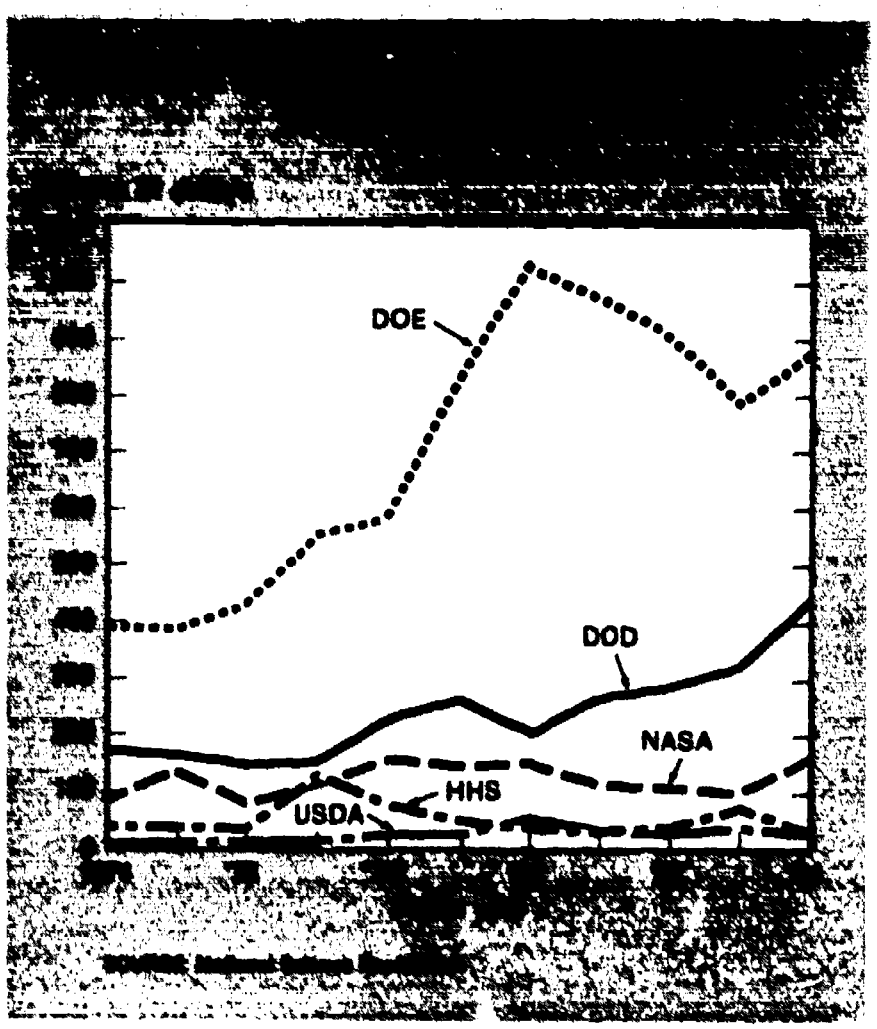


Table 5. Federal obligations for R&D plant by performer

[Dollars in thousands]

Performer	1982 actual	1983 (est.)	1984 (est.)
Total	$1,389,774	$1,369,294	$1,566,562
Federal intramural	426,029	499,280	644,091
Industrial firms	110,436	151,854	70,599
FFRDC's administered by industrial firms	362,190	330,861	411,250
Universities and colleges	30,262	32,512	39,978
FFRDS's administered by universities and colleges	441,660	341,298	390,273
Other nonprofit institutions	6,578	4,444	4,665
FFRDC's administered by nonprofit institutions	9,446	5,673	2,155
State and local governments	—	—	—
Foreign	3,173	3,342	3,546

SOURCE: National Science Foundation

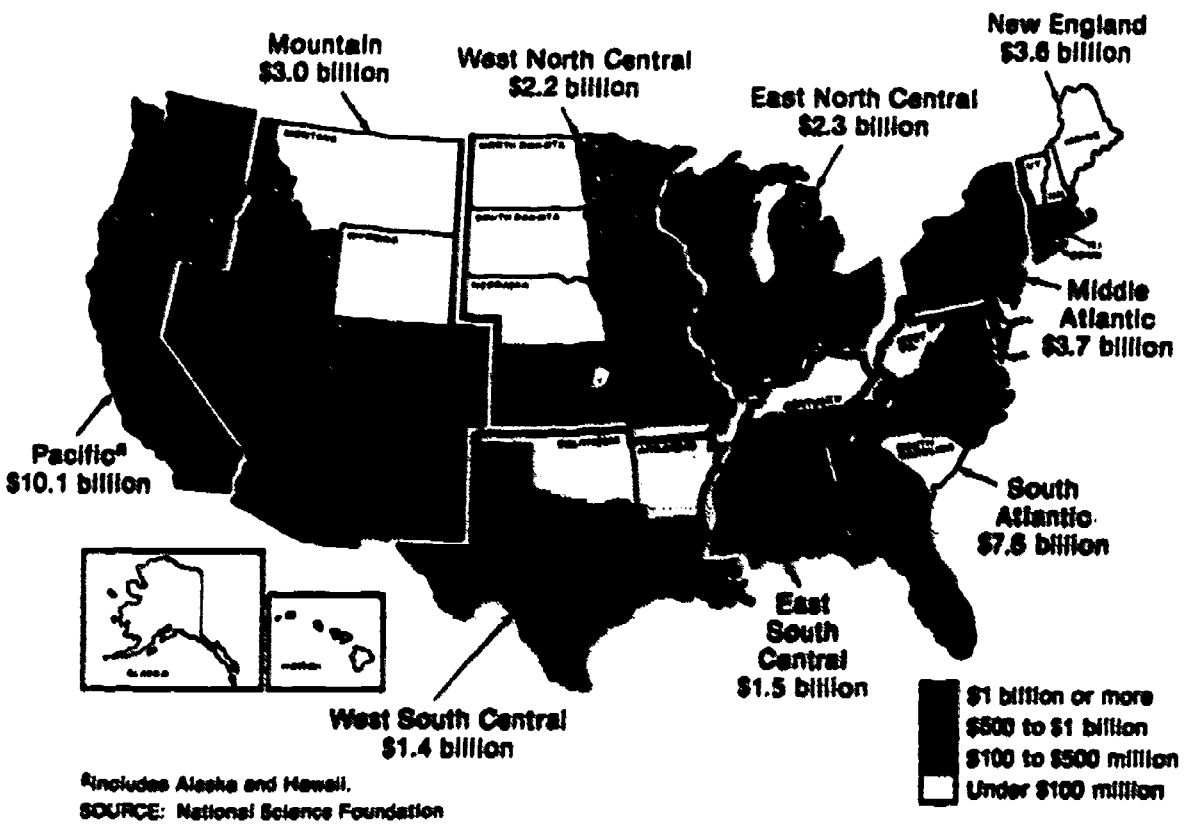
section 3.

geographic distribution, 1982

In 1963, 1965, and 1968, and annually since 1968, data have been collected on the geographic distribution of Federal R&D funds. The data are based on agency award records compiled after all funds for a fiscal year have been obligated. Geographic data were not yet available for 1983 and 1984 when this report was prepared. In 1982, the 10 agencies participating in the geographic portion of the survey[4] reported a total of $35.4 billion in R&D obligations, almost 97 percent of the Federal R&D total in that year. These agencies also reported $1.4 billion in R&D plant obligations.

In 1982, every State and the District of Columbia received Federal R&D support.[5] California received the greatest amount—$8.9 billion; South Dakota the least amount—$19.0 million. Eleven States—California, Maryland, Massachusetts, Florida, New York, New Mexico, Virginia, Pennsylvania, Texas, Washington, and Ohio—each showed more than $1 billion in Federal R&D obligations (chart 21). Since 1979, the first five of these States, plus Pennsylvania, Texas, and Ohio, have remained in the $1 billion-or-more category.

Chart 21. Distribution of total Federal R&D obligations by State: FY 1982



[a]Includes Alaska and Hawaii.
SOURCE: National Science Foundation

[4]The Departments of Agriculture, Commerce, Energy, Defense, Interior, Transportation, and Health and Human Services, the Environmental Protection Agency, the National Aeronautics and Space Administration, and the National Science Foundation

[5]For purpose of this analysis the District of Columbia is considered a State

the leading states

Distribution of Federal R&D obligations to the various States from 1972 through 1982 show that nearly one-half the States have accounted for approximately 90 percent of the total (table 6). Each year, between 16 and 18 States have each accounted for 2 percent or more of the Federal R&D total, and these States, with few exceptions, have been the same ones, year after year, even though their rank order has changed somewhat (chart 22). They are States which offer established industrial R&D capabilities or contain Federal intramural installations or university and college complexes with a wide variety of well developed research and technical specialization.

California has received the largest share of Federal R&D support each year since such data were first collected in 1963. That year, California accounted for 35 percent of the total. California's share has never been less than 21 percent (1972) and was 25 percent in 1982. This State has the largest concentration of aircraft and aerospace firms in the Nation as well as a heavy concentration of electronics firms, industries that receive large shares of DOD and NASA contracts. The $8.9 billion directed to California in 1982 was a 26-percent increase over the previous year, and significantly higher than the 8-percent average annual increase for the 1972-81 period (table 7). The major portion of the 1982 increase was related to increased DOD contracts to industrial performers in the State.

For Maryland the share-of-total has increased since 1963, when it was less than 6 percent, to a high in 1980 of 9 percent. In 1981, Maryland's share-of-total fell to 8 percent and has remained at this mark in 1982. The $2.9 billion directed to Maryland represented a 10-percent increase over 1981, three percentage points below the previous 9-year average annual rate. Maryland with its many Federal R&D installations, continues to dominate Federal intramural R&D obligations. Just over two-thirds of all Federal R&D support go to intramural performers within that State. Maryland's largest Federal installations are the Naval Air Test Center (DOD), Edgewood Arsenal Laboratories (DOD), National Institutes of Health (HHS), and Goddard Space Flight Center (NASA), the National Bureau of Standards (Commerce), and the Agricultural Research Center (USDA).

Massachusetts, with $2.8 billion Federal R&D obligations in 1982, has ranked third in receipt of such funds since 1973, and has commanded approximately 8 percent of the Federal R&D total since 1978. This State is heavily dependent on DOD contracts to industry. These accounted for 51 percent of the Federal R&D total for Massachusetts in 1982, a net gain of 3 percent over 1981. In fact, DOD R&D support to all performers in Massachusetts accounted for 77 percent of the Federal R&D total in this State. HHS, which contributed the second largest amount of R&D funds within the State, primarily supported university and other nonprofit performers. Both DOD and NASA also provided significant shares of their R&D support to universities and colleges in the State and increased their level of support over that of the previous year. The 15-percent increase in total Federal R&D obligations to Massachusetts, 1982 over 1981, was greater than the 11-percent annual average of the previous 9 years. This 1-year increase was almost entirely attributed to increased DOD support; in particular, DOD contracts to industry. Massachusetts also has a large number of universities with extensive research capabilities supported primarily by DOD and HHS.

In 1982, Florida moved up to fourth place in receipt of Federal R&D support. With $1.8 billion, 5 percent of the total, Florida received an increase of 29 percent over 1981 primarily with a $382 million increase from DOD and a $22 million increase from NASA. DOD and NASA accounted for 93 percent of all Federal

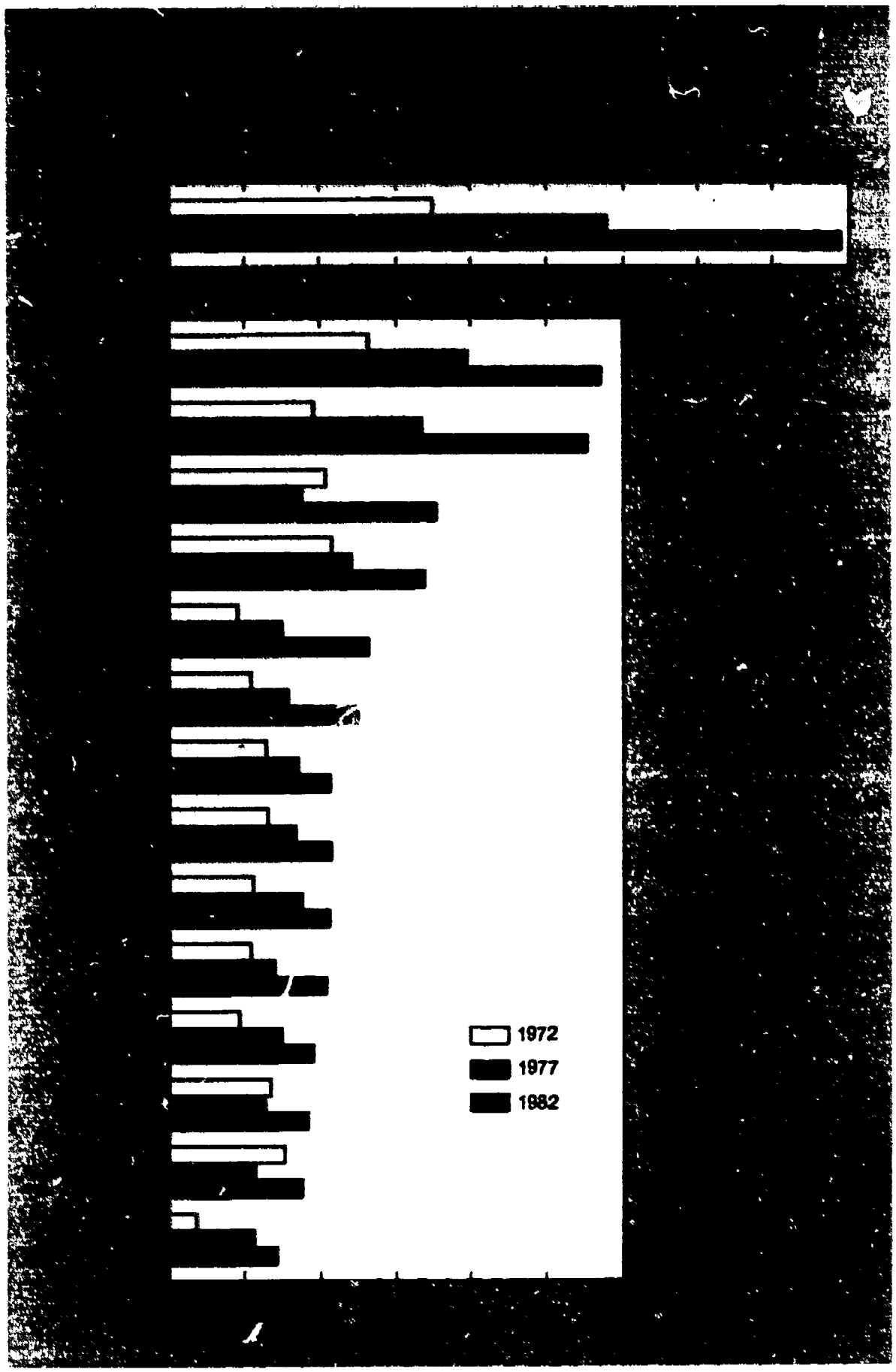
Table 6. Percent distribution of Federal R&D obligations to the 20 States leading in such support in fiscal year 1982 for selected years

[Dollars in millions]

State	1972	1976	1981	1982
Total, all States	$16,262	$20,255	$31,930	$35,362
	Percent distribution			
California	21.4	27.1	22.1	25.1
Maryland	8.1	8.9	8.1	8.1
Massachusetts	5.9	6.3	7.5	7.8
Florida	6.3	3.9	4.3	5.0
New York	6.6	5.5	4.9	4.8
New Mexico	2.8	3.1	3.8	3.7
Virginia	3.3	3.7	3.3	3.6
Pennsylvania	3.9	4.1	3.4	3.2
Texas	4.0	4.1	3.2	3.0
Washington	3.3	3.5	3.3	2.9
Ohio	3.2	3.1	3.5	2.9
District of Columbia	2.8	2.8	2.9	2.7
Missouri	4.2	2.0	2.6	2.6
New Jersey	4.7	2.4	2.4	2.5
Tennessee	1.2	2.1	2.8	2.0
Kansas	.2	.2	1.5	1.8
Alabama	2.2	1.8	1.5	1.6
Colorado	2.3	1.2	2.0	1.6
Illinois	1.8	2.0	1.8	1.5
Connecticut	1.0	1.2	1.5	1.2
All other States[1]	10.9	11.1	13.6	12.6

[1] Includes outlying areas and offices abroad.

SOURCE: National Science Foundation



R&D obligations directed to this State in 1982. Ninety-five percent of the Federal total was directed to intramural and industrial performance. Most of the intramural activities have taken place at the Kennedy Space Center in the development of NASA space transportation systems, and at Eglin and Patrick Air Force Bases, both within the site of the Eastern Test Range. The 42-percent increase over 1981 in DOD support reflects a 55-percent increase to intramural performers as well as the growth of ongoing strategic defense activities, such as the Air Force weapons testing program.

New York, with almost $1.7 billion in 1982, also received 5 percent of the Federal R&D total. The 9-percent increase over the 1981 level doubled the annual average funding rate of the previous 9 years. Approximately 49 percent of all Federal R&D obligations were directed to industrial performers and their related FFRDC's. Another 27 percent were slated for university-and-college performers. DOD,

Table 7. Federal R&D obligations by geographic division and State for selected years

[Dollars in millions]

Division and State	1972	1981	Average annual percent change 1972-81	1982	Percent change 1981-82
Total, all States	$1[illegible].8	$31,929.6	7.8	$35,331.6	10.7
Pacific	[illegible]3.2	8,304.6	8.0	10,118.0	21.8
Alaska	46.0	51.8	1.3	40.0	-22.8
California	3,473.1	7,049.7	8.2	8,888.3	26.1
Hawaii	47.4	49.9	.6	44.5	-10.8
Oregon	53.7	105.8	7.8	106.3	.7
Washington	537.9	1,047.5	7.7	1,038.9	-.8
South Atlantic	3,560.6	6,674.3	7.2	7,563.6	13.3
Delaware	17.4	25.9	4.5	34.6	33.6
District of Columbia	462.1	921.0	8.0	954.6	3.6
Florida	1,022.5	1,373.7	3.3	1,776.4	29.3
Georgia	71.9	195.0	11.7	217.3	11.4
Maryland	1,318.1	2,585.1	7.8	2,850.2	10.3
North Carolina	83.3	259.8	13.5	272.8	5.0
South Carolina	26.3	96.1	15.5	98.7	2.7
Virginia	529.6	1,066.4	8.1	1,268.1	18.9
West Virginia	29.4	151.2	20.0	91.0	-39.8
Middle Atlantic	2,481.0	3,416.0	3.6	3,711.9	8.7
New Jersey	763.1	775.4	.2	887.9	14.5
New York	1,075.6	1,557.7	4.2	1,692.5	8.7
Pennsylvania	642.3	1,082.9	6.0	1,131.5	4.5
New England	1,259.8	3,172.5	10.8	3,567.3	12.4
Connecticut	169.2	485.0	12.4	439.6	9.4
Maine	16.3	24.4	4.6	23.9	-2.0
Massachusetts	961.2	2,407.1	10.7	2,775.2	15.3
New Hampshire	21.5	54.8	11.0	50.8	-7.3
Rhode Island	68.95	182.5	11.4	242.1	32.7
Vermont	22.8	18.7	2.2	35.7	90.9
Mountain	1,214.4	3,018.4	10.6	3,002.8	-.5
Arizona	89.9	367.7	17.0	264.5	-28.1
Colorado	369.1	632.8	6.2	556.6	-12.0
Idaho	75.9	119.5	5.2	127.0	6.3
Montana	19.0	45.4	10.2	42.7	-5.9
Nevada	140.3	263.0	7.2	376.3	43.1
New Mexico	451.5	1,224.1	11.7	1,322.6	8.0
Utah	58.9	305.7	20.1	287.9	-5.8
Wyoming	9.9	58.2	21.7	25.4	-56.4
East North Central	1,179.6	2,349.3	8.0	2,260.1	-3.8
Illinois	291.0	572.6	7.8	543.0	-5.2
Indiana	100.5	170.1	6.0	186.2	9.5
Michigan	186.3	357.2	7.5	376.7	5.5
Ohio	521.7	1,117.2	8.8	1,024.8	-8.3
Wisconsin	80.1	132.2	5.7	129.4	-2.1
West North Central	906.0	1,829.6	8.1	2,151.3	17.6
Iowa	37.9	147.4	16.3	136.3	-7.5
Kansas	31.3	471.0	35.2	637.7	35.4
Minnesota	127.0	309.0	10.4	378.6	22.5
Missouri	679.5	820.4	2.1	911.3	11.1
Nebraska	11.7	31.7	11.7	32.0	.9
North Dakota	10.5	40.1	16.0	36.5	-9.0
South Dakota	8.1	10.2	2.6	19.0	86.3
West South Central	789.9	1,477.1	7.1	1,400.1	5.2
Arkansas	13.2	31.2	10.0	43.5	39.4
Louisiana	103.6	231.8	13.8	236.8	-28.6
Oklahoma	29.1	82.4	12.3	65.6	-20.4
Texas	653.0	1,031.7	5.2	1,054.3	2.2
East South Central	678.9	1,603.7	10.8	1,486.7	-7.3
Alabama	359.0	493.5	3.6	561.5	13.8
Kentucky	32.1	101.0	13.6	97.2	-3.8
Mississippi	60.7	125.5	8.4	125.7	.2
Tennessee	187.1	883.6	18.8	702.3	-20.5
Outlying areas	18.4	38.9	8.7	40.7	4.6
Offices abroad	46.1	47.2	.3	59.0	25.0

SOURCE: National Science Foundation

HHS, and DOE were the prime support agencies, DOD concentrating on industry, HHS on universities and colleges, and DOE on FFRDC's administered by universities.

While the same States remain among the 15 to 20 leaders year after year, their rank order changes. All of the leading five States in 1982 had been among the leading five during the 1972-82 decade. Florida shifted out of this group in some years. Aside from the five leaders, States that rose to the top 10 during the decade are Texas, New Mexico, Virginia, Ohio, Pennsylvania, and Washington.

relative rates of growth

Of the 11 States receiving $1 billion or more of total Federal R&D support in 1982, New Mexico, Massachusetts, and California showed the greatest average annual rates of funding growth for the 10-year period 1972-82 (table 8). Among the 20 leading States, the three that showed the highest average annual rates of growth were Kansas (35 percent), Tennessee (14 percent), and New Mexico (11 percent).

For New Mexico, the growth rate of 11.3 percent chiefly reflects DOE support to FFRDC's administered by industrial firms, such as the Sandia National Laboratories in Albuquerque and the Los Alamos National Laboratory. For Virginia, which averaged a 9.1 percent annual rate of growth, support was primarily from DOD. This included Navy contracts to industry for shipbuilding and engineering, and support for DOD intramural installations, such as the Army Laboratories at Fort Belvoir. NASA was also an important provider of Federal R&D obligations in Virginia; for example, at the Langley Research Center in Hampton and Wallops Flight Center on Wallops Island.

Kansas, with an average annual growth rate of 35.2 percent for the decade, received increasing DOD contracts to industry, a trend begun in 1978. Tennessee, with an average annual 10-year growth rate of 14.1 percent, derived approximately two-thirds of all Federal support from DOE. Approximately four-fifths of that support went to industrial firms and to the Oak Ridge National Laboratory (an industrially admin-

istered FFRDC). DOD also provided substantial R&D support to Tennessee.

Among the leading 20 States with the highest relative growth from 1981 to 1982 were Kansas (up 35 percent), Florida (up 29 percent), California (up 26 percent), Virginia (up 19 percent), and Massachusetts (up 15 percent).

While all of the 10 leading States except Texas showed absolute increases in 1982 of more than $500 million over 1972, five of the 10 "second-tier" States had absolute increases of more than $300 million for the same period. New Jersey, with the smallest average annual growth rate in the 10-year period, reflected declines in support from 1973 to 1976. Even with some later gains, New Jersey's level of support in 1982 was close to that of 1972.

distribution of funds by performer

For many years, four Federal agencies—DOD, NASA, DOE, and HHS—have been responsible for approximately nine-tenths of total Federal R&D obligations. Their patterns of support to performers in the various States largely determine the patterns of distribution of all Federal R&D obligations. The States with R&D performance capabilities necessary to satisfy the needs of these four Federal agencies also tend to lead the other States in receipt of total Federal R&D support. Such States easily accommodate aircraft, aerospace, and electronics firms, and have concentrations of university research talent, including modern medical research teams. They have geographic areas suitable for testing missiles, aircraft, spacecraft, and explosives.

The 10 States leading in Federal R&D performance were responsible for 77 percent of all the support to Federal intramural efforts; 71 percent of all Federal support to industry; 63 percent of total support to universities and colleges; and 83 percent of the total to nonprofit organizations.

When States are compared by performing sectors, those that have remained among the top five in receipt of Federal R&D funds year after year contain a strong balance of performer capabilities (charts 23, 24, and 25). Thus, in 1981, as in prior years, California led in Federal R&D obli-

Table 8. Relative growth in the fiscal year 1972-82 period in Federal R&D obligations to the 20 states leading in such support in fiscal year 1982

[Dollars in millions]

State	1972	1982	Average annual percent change 1972-82
Total, all States	$16,261.8	$35,361.6	8.1
California	3,473.1	8,888.3	9.8
Maryland	1,318.1	2,850.2	8.0
Massachusetts	961.2	2,775.2	11.2
Florida	1,022.5	1,776.4	5.7
New York	1,075.6	1,692.5	4.6
New Mexico	451.5	1,322.6	11.3
Virginia	529.6	1,268.1	9.1
Pennsylvania	642.3	1,131.5	5.8
Texas	653.0	1,054.3	4.9
Washington	537.9	1,038.9	6.8
Ohio	521.7	1,024.8	7.0
District of Columbia	462.1	954.6	7.5
Missouri	679.5	911.3	3.0
New Jersey	763.1	887.9	1.5
Tennessee	187.1	702.3	14.1
Kansas	31.3	637.7	35.2
Alabama	359.0	561.5	4.6
Colorado	369.1	556.6	4.2
Illinois	291.0	543.0	6.4
Connecticut	169.2	439.6	10.0
All other States[1]	1,763.9	4,344.3	9.4

[1] Includes outlying areas and offices abroad.

SOURCE National Science Foundation

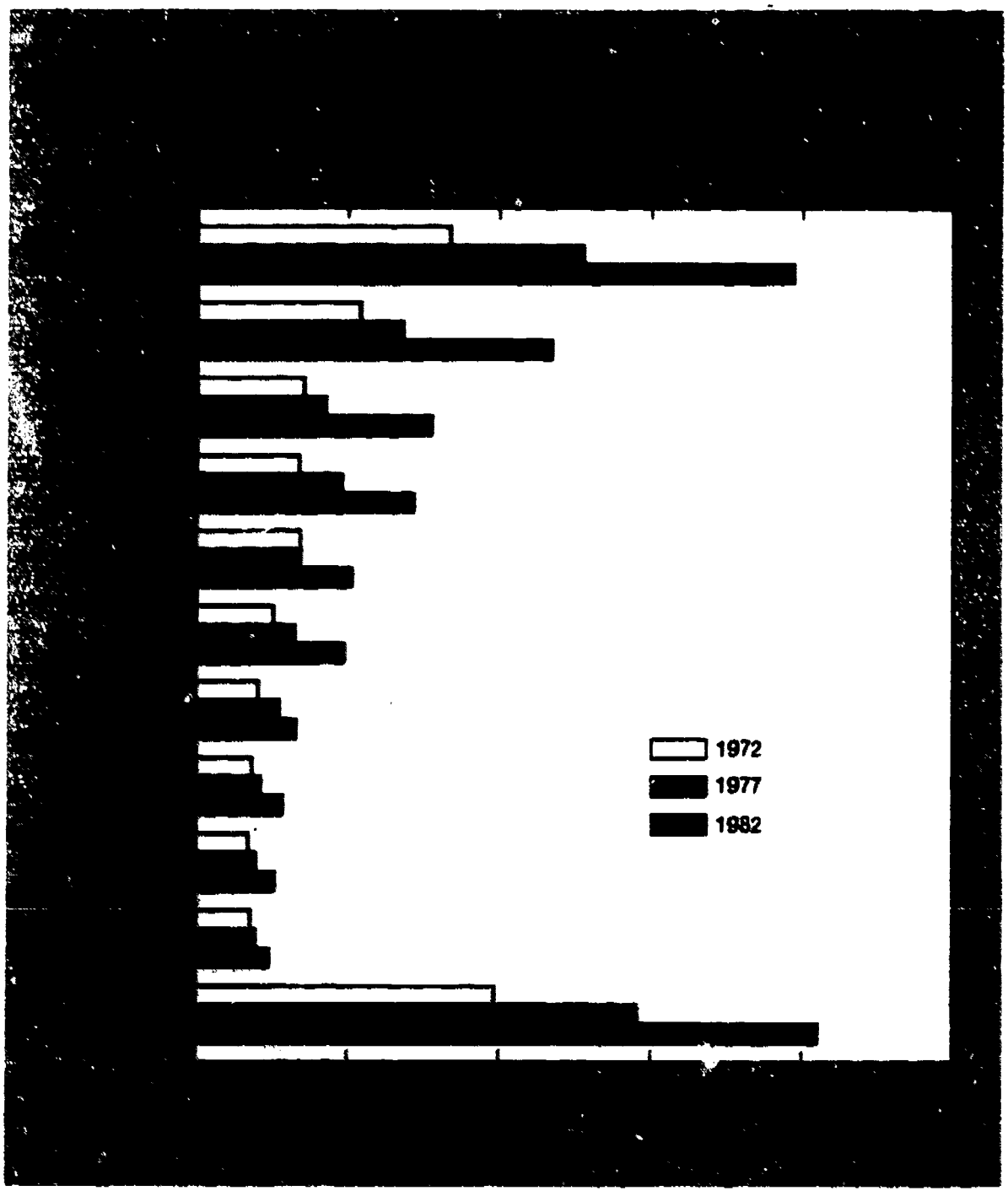
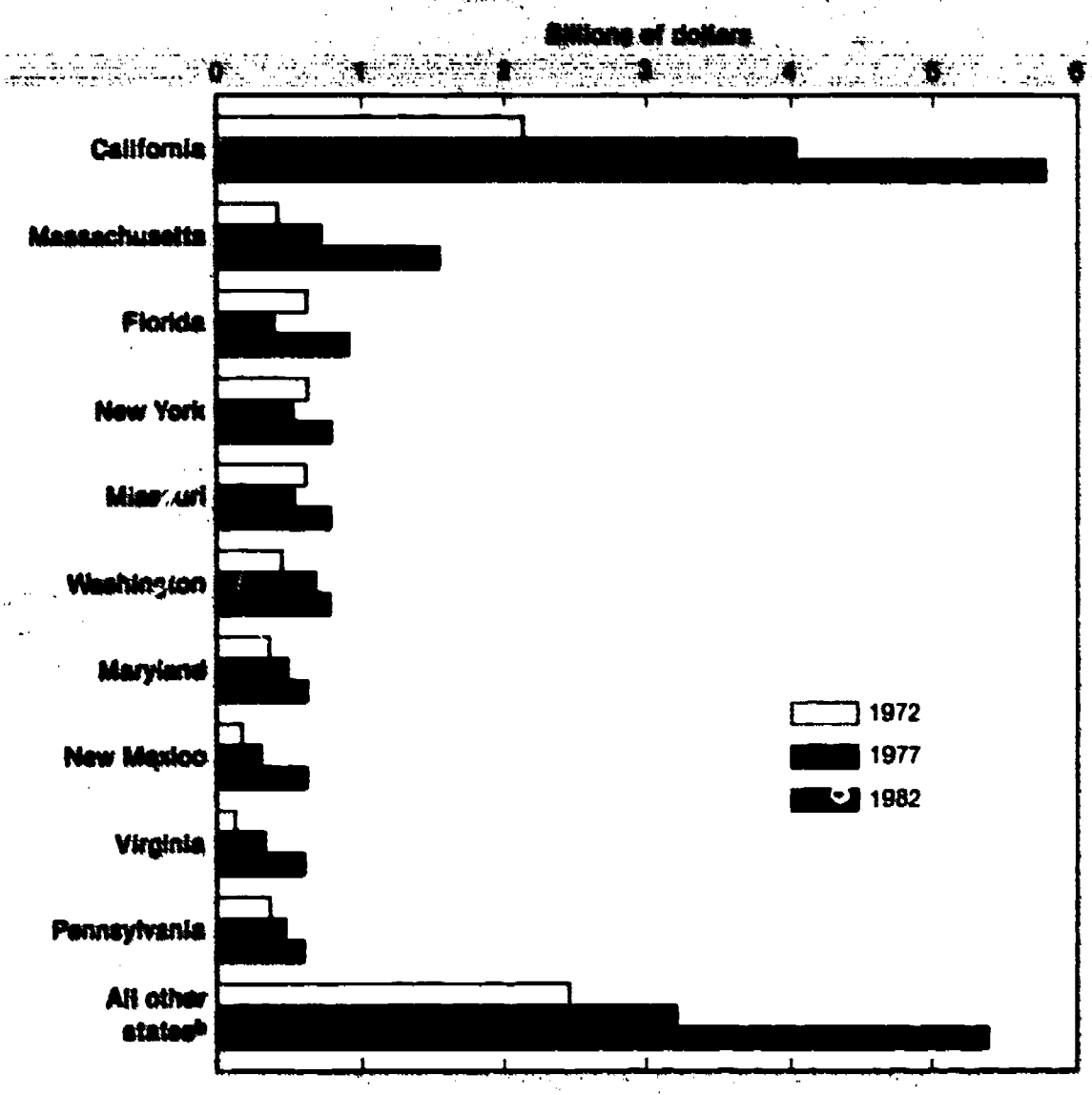
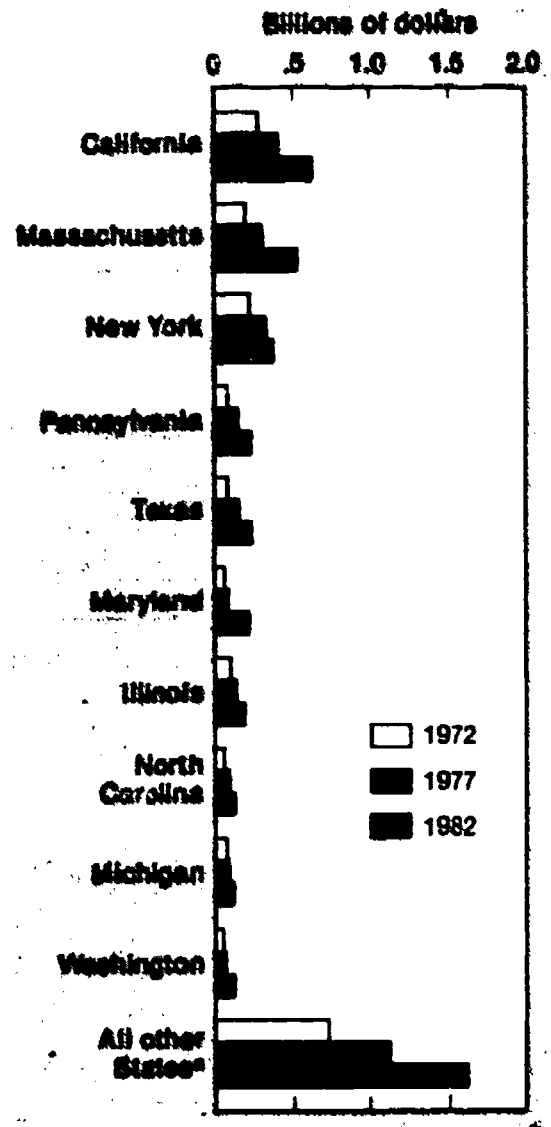


Chart 24. Federal obligations to industrial firms[a] in the 10 States leading in such support in FY 1982 for selected years



[a]Includes federally funded research and development centers (FFRDC's) administered by this sector.
[b]Includes outlying areas and offices abroad.
SOURCE: National Science Foundation

Chart 25. Federal R&D obligations to universities and colleges in the 10 States leading in such support in FY 1982 for selected years



[a]Includes outlying areas and offices abroad.
SOURCE: National Science Foundation

gations directed to industry as well as to universities and colleges and their associated FFRDC's, and ranked second in support to Federal intramural activities as well as to nonprofit organizations and their associated FFRDC's. Maryland led all the States in Federal intramural support and was sixth in support to academia. Massachusetts was second to California in support of industry, universities and colleges, nonprofit institutions, and associated FFRDC's. It was tenth in support of Federal intramural performers.

New Mexico, while ranked sixth in total R&D support and eighth in Federal support to industry, led the States in support to industry-administered FFRDC's. It ranked second to California in level of support to university-administered FFRDC's (entirely because of the location of DOE-supported R&D centers within the State).

Concentrations of Federal R&D obligations among a few States are found in areas where the number of performers of one type is very low. For instance, in 1982 FFRDC's administered by universities were found in only 14 States and 67 percent of Federal R&D support to these centers was concentrated in the top 10 of the overall leading States. In the case of FFRDC's administered by other nonprofit organizations, 90 percent of the Federal R&D support was directed to the 10 leading States (these centers were in only 6 of the States).

factors in r&d performing capability

R&D obligations can be ranked by State and compared with such measures of national resources as population, total scientists and engineers, and doctoral scientists and engineers (table 9). Although there are no direct causal relationships, the data indicate that the top 10 States in Federal R&D obligations were the same top 10 in other resources, with the single exception of New Mexico.

Table 9. Distribution of Federal R&D obligations by State compared with other national indicators by State: fiscal year 1982

State	Total Federal R&D obligations		Population		Total scientists and engineers		Doctoral scientists and engineers	
	Rank	Percent of total	Rank	Percent of total	Rank	Percent of total	Rank	Percent of total
United States, total	$35,362 million		$232 million[1]		$3,589 thousand (prel.)		$379 thousand (est.)	
California	1	25.14	1	10.68	1	12.07	1	12.15
Maryland	2	8.06	19	1.84	11	2.76	9	3.69
Massachusetts	3	7.85	11	2.50	7	4.11	5	4.42
Florida	4	5.02	7	4.50	10	2.81	13	2.39
New York	5	4.79	2	7.63	2	7.47	2	9.75
New Mexico	6	3.74	37	.59	30	.95	24	1.17
Virginia	7	3.59	13	2.37	12	2.62	12	2.70
Pennsylvania	8	3.20	4	5.12	4	5.06	4	4.79
Texas	9	2.98	3	6.60	3	6.26	3	4.90
Washington	10	2.94	20	1.83	14	2.15	16	1.98
Ohio	11	2.90	6	4.66	6	4.29	8	3.95
District of Columbia	12	2.70	47	.27	21	1.76	10	3.48
Missouri	13	2.58	15	2.14	13	2.20	22	1.66
New Jersey	14	2.51	9	3.21	9	3.68	7	4.40
Tennessee	15	1.99	17	2.01	22	1.49	21	1.66
Kansas	16	1.80	32	1.04	28	.97	35	.74
Alabama	17	1.59	22	1.70	31	.86	31	.92
Colorado	18	1.57	27	1.32	17	2.04	14	2.11
Illinois	19	1.54	5	4.94	5	4.80	6	4.41
Connecticut	20	1.24	26	1.36	18	2.04	17	1.83
Minnesota	21	1.07	21	1.79	15	2.13	18	1.78
Michigan	22	1.07	8	3.93	8	3.85	11	3.24
Nevada	23	1.06	43	.38	51	.18	50	.18
Utah	24	.81	36	.67	32	.86	34	.80
North Carolina	25	.77	10	2.60	20	1.77	15	2.09
Arizona	26	.75	29	1.24	27	1.02	28	1.06
Rhode Island	27	.68	41	.41	42	.38	39	.48
Louisiana	28	.67	18	1.88	23	1.49	25	1.13
Georgia	29	.61	12	2.44	24	1.42	23	1.41
Indiana	30	.53	14	2.36	19	1.87	19	1.75
Iowa	31	.39	28	1.25	29	.96	32	.92
Wisconsin	32	.37	16	2.06	16	2.09	20	1.69
Idaho	33	.36	40	.42	39	.47	42	.38
Mississippi	34	.36	31	1.10	37	.53	37	.62
Oregon	35	.30	30	1.14	25	1.22	26	1.06
South Carolina	36	.28	24	1.38	33	.84	33	.89
Kentucky	37	.27	23	1.58	34	.77	29	.97
West Virginia	38	.26	34	.84	36	.59	38	.50
Oklahoma	39	.19	25	1.37	26	1.12	27	1.06
New Hampshire	40	.14	42	.41	44	.30	46	.28
Hawaii	41	.13	39	.43	43	.38	40	.45
Arkansas	42	.12	33	.99	40	.44	41	.44
Montana	43	.12	44	.35	45	.30	45	.34
Alaska	44	.11	51	.19	49	.21	49	.20
North Dakota	45	.10	46	.29	47	.26	47	.23
Vermont	46	.10	49	.22	48	.23	44	.36
Delaware	47	.10	48	.26	41	.41	30	.93
Nebraska	48	.09	35	.69	35	.61	36	.62
Wyoming	49	.07	50	.22	46	.26	51	.18
Maine	50	.07	38	.49	38	.51	43	.37
South Dakota	51	.05	45	.30	50	.19	48	.23
Outlying areas and offices abroad	—	.28	—	—	—	1.95	—	.26

[1] Provisional estimate of resident population as of July 1, 1981.

SOURCES. Department of Commerce and the National Science Foundation

r&d plant

Of the 10 leading States in Federal R&D support in 1982, 6 ranked within the leading 10 in Federal support for R&D plant. Whereas these States together—California, New Mexico, Maryland, Washington, New York, and Pennsylvania—accounted for approximately 80 percent of total Federal R&D obligations, they accounted for 59 percent of Federal R&D plant support (table 10).

The 10 leading States in Federal R&D plant support accounted for over three-fourths of all Federal R&D plant support.

Of the leading agencies in R&D plant obligations in 1982—DOE, DOD, and NASA—DOE support accounted for 66 percent of the total; DOD, 21 percent; and NASA, 8 percent. In the case of DOD and NASA, data for R&D plant are underreported; much of the cost of R&D plant is included in the R&D costs reported for extramural performers without plant separately broken out. Thus, in most States for which R&D plant obligations are shown, the leading agency is DOE.

California received the largest share of R&D plant support, with approximately 24 percent of the Federal total. DOE accounted for almost three-fifths of all Federal agency R&D plant obligations to that State, and DOD accounted for almost one-third. Nearly two-thirds of the DOE R&D plant support in California was directed to the E. O. Lawrence Laboratories in Livermore and Berkeley, both of which are administered by the University of California.

In Richland, Washington support by DOE for Hanford Engineering Development Laboratory accounted for nearly 100 percent of total R&D plant obligations in that State.

Washington, Tennessee, and South Carolina rank among the top 10 recipients of Federal R&D plant obligations. The larger share of these obligations represent DOE contracts to FFRDC's administered by industrial firms.

Table 10. Federal obligations for R&D plant in the 10 States leading in such support by agency: fiscal year 1982

[Dollars in millions]

	Total	DOE	DOD	NASA	HHS	USDA	DOT	NSF	Interior
Total	$1,380	$914	$291	$114	$25	$21	$12	$2	$ 1
California	335	187	107	37	1	2	—	—	—
New Mexico	197	186	10	—	—	(1)	—	—	(1)
Maryland	82	2	54	6	17	3	—	—	—
Washington	81	80	—	—	(1)	1	—	—	—
Illinois	74	73	—	—	—	1	—	—	—
Tennessee	65	65	(1)	—	—	(1)	—	—	—
South Carolina	65	65	—	—	—	(1)	—	—	—
New York	65	58	4	—	2	1	—	—	—
New Jersey	57	47	4	—	—	(1)	5	1	—
Pennsylvania	51	46	5	—	—	1	—	—	—
All other States[2]	308	105	107	71	5	12	7	1	1

[1] Less than $500,000.
[2] Includes outlying areas and offices abroad.

SOURCE: National Science Foundation

appendixes

a. technical notes
b. federally funded research and development centers
c. statistical tables

NOTE

The detailed statistical tables for this volume have been published separately under one cover (NSF 83-319). Included on pp. 40-45 in this volume are detailed statistical tables C-1, C-2, and C-3, as well as a complete listing of all the tables.

Detailed statistical tables may be obtained gratis from the National Science Foundation, Washington, D.C. 20550.

appendix a

technical notes

scope and method

During the period March through August 1983 a total of 33 Federal agencies and their subdivisions—93 individual respondents—submitted data in response to the *Annual Survey of Federal Funds for Research and Development*, Volume XXXII, conducted by the National Science Foundation (NSF) and distributed in February and March 1983. In nearly all cases the data received from the agencies were reported as obligations and outlays incurred, or expected to be incurred, regardless of when the funds were appropriated or whether they were identified in the respondents' budgets specifically for research and development (R&D) activities. The exception was the National Aeronautics and Space Administration (NASA), for which the same kinds of transactions were reported in terms of budget plan, which approximates obligations.

Federal agencies provided R&D data earlier to the Office of Management and Budget (OMB) for inclusion in "Special Analysis K: Research and Development" in *The Budget of the United States Government, Fiscal Year 1984*. This was one of the budget documents presented to the Congress in January 1983. The R&D data in the agency submissions to OMB and to the *Federal Funds* survey were based on the same definitions and are reconcilable. But the data in the *Federal Funds* survey include smaller R&D support agencies not covered by "Special Analysis K" and are classified in more detailed categories.

definitions

The definitions are essentially unchanged from prior *Federal Funds* surveys.

1. research, development, and r&d plant

This heading includes all direct, indirect, incidental, or related costs resulting from or necessary to research, development, and R&D plant, regardless of whether the research and development are performed by a Federal agency (intramurally) or performed by private individuals and organizations under grant or contract (extramurally). Research and development exclude routine product testing, quality control, mapping and surveys, collection of general-purpose statistics, experimental production, and the training of scientific personnel.

a. **Research** is systematic study directed toward fuller scientific knowledge or understanding of the subject studied. Research is classified as either basic or applied according to the objectives of the sponsoring agency.

> In **basic research** the objective of the sponsoring agency is to gain fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind.

> In **applied research** the objective of the sponsoring agency is to gain knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.

b. **Development** is systematic use of the knowledge or understanding gained from research, directed toward the production of useful materials, devices, systems, or methods, including design and development of prototypes and processes. It excludes quality control, routine product testing, and production.

c. **R&D plant** (R&D facilities and fixed equipment, such as reactors, wind tunnels, and radio telescopes) includes acquisition of, construction of, major repairs to, or alterations in structures, works, equipment, facilities, or land, for use in R&D activities at Federal or non-Federal installations. Excluded from the R&D plant category are expendable equipment and office furniture and equipment. Obligations for foreign R&D plant are limited to Federal funds for facilities located abroad and used in support of foreign research and development.

2. obligations and outlays

a. **Obligations** represent the amounts for orders placed, contracts awarded, services received, and similar transactions during a given period, regardless of when the funds were appropriated and when future payment of money is required.

b. **Outlays** represent the amounts for checks issued and cash payments made during a given period, regardless of when the funds were appropriated.

The obligations and outlays reported cover all transactions from all funds available to an agency from direct appropriations, trust funds, or special account receipts, corporate income, or other sources, including funds appropriated by the President, that the agency has received or expects to receive. The amounts reported for each year reflect obligations and outlays for that year, regardless of when the funds were originally authorized or received and regardless of whether they were appropriated, received, or identified in the agency's budget specifically for research, development, or R&D plant.

An agency making a transfer of funds to another agency includes such transfers in its report of obligations and outlays. The receiving agency does not report, for purposes of this survey, funds transferred to it from another agency. Similarly, a subdivision of an agency that transfers funds to another subdivision within that agency reports such obligations or outlays as its own.

Obligations and outlays for work performed in foreign countries include funds directly available to Federal agencies and special foreign currencies separately appropriated. The latter currencies are derived largely from provisions of Public Law 480, 1954, as amended.

3. cost coverage

Funds reported for research and development reflect full costs. In addition to costs of specific R&D projects, the applicable overhead costs are also included. The amounts reported include the costs of planning and administering R&D programs, laboratory overhead, pay of military personnel, and departmental administration.

4. fiscal year

The fiscal year in the Federal Government accounting period begins October 1 of a given year and ends September 30 of the following year; thus, fiscal year (FY) 1982 began on October 1, 1981, and ended September 30, 1982.

5. agency

An agency is an organization of the Federal Government whose principal executive officer reports to the President. The only exception is the Library of Congress, also included in the survey, whose executive officer reports to the Congress. The term subdivision refers to any major organizational unit of a reporting agency, such as a bureau, administration, office, or service.

6. performers

Performers are either intramural organizations accomplishing operating functions or extramural organizations or persons receiving support or providing services under a contract or grant.

a. **Intramural performers:** Agencies of the Federal Government. Their work is carried on directly by their own personnel. Obligations reported under this category are for activities performed directly by a reporting agency, or they represent funds that the agency transfers to another Federal agency for performance of work. The ultimate performer must be a Federal agency. If the ultimate performer is *not* a Federal agency, the funds so transferred are reported by the transferring agency under the appropriate extramural performer category (industrial firms, universities and colleges, other nonprofit institutions, etc.). Intramural performance includes the costs of supplies and equipment, essentially of an "off-the-shelf" nature, that are procured for use in intramural research and development. The cost of Federal personnel engaged in planning and administering intramural and extramural R&D programs is also included as part of the intramural performance total.

b. **Extramural performers:** Organizations outside the Federal sector that perform with Federal funds under contract or grant. Only those costs associated with actual extramural R&D performance are reported, but these would include costs of materials and supplies to carry out R&D activities. Costs of "off-the-shelf" supplies and equipment procured from extramural suppliers and required to support intramural research and development are considered as part of the costs of intramural performance and not as part of the costs of extramural performance. Extramural performers are identified as follows:

i. **Industrial firms:** Those organizations that may legally distribute net earnings to individuals or to other organizations.

ii. **Universities and colleges:** Institutions engaged primarily in providing resident and/or accredited instruction for at least a 2-year program above the secondary school level. Included are colleges of liberal arts; schools of arts and sciences; professional schools, as in engineering and medicine, including affiliated hospitals; associated research institutes; and agricultural experiment stations.

iii. **Other nonprofit institutions:** Private organizations, other than educational institutions, no part of whose net earnings inure to the benefit of a private stockholder or individual, and other private organizations organized for the exclusive purpose of turning over their entire net earnings to such nonprofit institutions.

iv. **Federally funded research and development centers (FFRDC's):** R&D-performing organizations exclusively or substantially financed by the Federal Government that are supported by the Federal Government either to meet a particular R&D objective or, in some instances, to provide major facilities at universities for research and associated training purposes. Each center is administered either by an industrial firm, a university, or another nonprofit institution.

In general, all of the following criteria are met by an organization before it is included in the FFRDC category: (1) Its primary activities include one or more of the following: Basic research, applied research, development, or management of research and development (specifically excluded are organizations engaged primarily in routine quality control and testing, routine service activities, production, mapping and surveys, and information dissemination); (2) it is a separate operational unit within the parent organization or is organized as a separately incorporated organization; (3) it performs actual research and development or R&D management either upon direct request of the Federal Government or under a broad charter from the Federal Government, but in either case

under the direct monitorship of the Federal Government; (4) it receives its major financial support (70 percent or more) from the Federal Government, usually from one agency; (5) it has, or is expected to have, a long-term relationship with its sponsoring agency (about five years or more), as evidenced by specific obligations assumed by it and the agency; (6) most or all of its facilities are owned by, or are funded under contract with, the Federal Government; and (7) it has an average annual budget (operating and capital equipment) of at least $500,000.

FFRDC's are grouped into four categories—research laboratories, R&D laboratories, study and analysis centers, and system engineering/system integration centers—according to their primary activity to reflect the differences in the nature and activities of the centers.[1]

Research laboratories are principally used for the pursuit of research (as distinguished from development). Most concentrate on basic research in one particular area and many provide major, unique, research facilities for national use.

R&D laboratories engage in various facets of the R&D process. Most are multiprogram laboratories active in a variety of science and/or engineering areas, though some specialize in a broad functional area such as national security or nuclear energy. Most of these institutions contain major national research and/or testing facilities.

Study and analysis centers are involved exclusively in analytical activities; no hardware-related laboratory research or development is carried out.

System engineering/system integration centers primarily provide systems engineering, R&D system integration, and management support for definition and development of large technical systems.

v. **State and local governments:** State and local government agencies, excluding State and local universities and colleges, agricultural experiment stations, medical schools, and affiliated hospitals. (Federal R&D funds obligated directly to such State and local educational institutions are included under the universities-and-colleges category in this survey.) Research and development under the State- and local-government category are performed either directly by State or local agencies or by other organizations under grant or contract from such agencies. Regardless of the ultimate performer, Federal R&D funds directed to State and local government are reported under the State- and local-government category, and no other.

vi. **Foreign performers:** Foreign citizens, organizations, or governments, as well as international organizations, such as NATO, UNESCO, and WHO, performing work abroad financed by the Federal Government. Excluded are payments to U.S. agencies, organizations, or citizens performing research and development abroad for the Federal Government; the survey does not seek information on "offshore" payments. Also excluded are payments to foreign scientists performing in the United States.

vii. **Private individuals:** Individuals receiving a Federal R&D grant or contract award directly; in this case obligations are reported under "industrial firms."

7. fields of science/ engineering

The fields of science/engineering in this survey are divided into eight broad field categories, each of them consisting of a number of detailed fields. The broad fields are life sciences, psychology, physical sciences, environmental sciences, mathematics and computer sciences, engineering, social sciences, and other sciences not elsewhere classified. The following listing presents the fields grouped under each of the broad fields, together with illustrative disciplines.

a. **Life sciences** consist of five detailed fields: biological (excluding environmental), environmental biology, agricultural, medical, and life sciences not elsewhere classified. The illustrative disciplines provided below under each of these detailed fields are not intended to be sharp definitions; they represent examples of disciplines generally classified under a given detailed field. A discipline, however, may be classified under another detailed field when the major emphasis is elsewhere. Research in biochemistry could be reported as biological, agricultural, or medical, depending on the orientation of the project. Human biochemistry would be classified under biological, but animal biochemistry or plant biochemistry would be under agricultural. Examples of disciplines under each of the detailed fields are as follows:

Biological (excluding environmental): anatomy; biochemistry; biology; biometry and biostatistics; biophysics; botany; cell biology; entomology and parasitology; genetics; microbiology; neuroscience (biological); nutrition; physiology; zoology; other biological, n.e.c.[2]

Environmental biology: ecosystem sciences; evolutionary biology; limnology; physiological ecology; population biology; population and biotic community ecology; systematics; other environmenal biology, n.e.c.[2]

Agricultural: agronomy; animal sciences; food science and technology; fish and wildlife; forestry; horticulture; plant sciences; soils and soil science; phytopathology; phytoproduction; agriculture, general; other agriculture, n.e.c.[2]

Medical: internal medicine; neurology; obstetrics and gynecology; ophthalmology; otolaryngology; pediatrics; preventive medicine; pathology; pharmacology; psychiatry; radiology; surgery; dentistry; pharmacy; veterinary medicine; other medical, n.e.c.[2]

Life sciences, n.e.c.[2]

b. **Psychology** deals with behavior, mental processes, and individual and group characteristics and abilities. Psychology is divided into three categories: biological aspects, social aspects, and psychological sciences not elsewhere classified. Examples of disciplines under each of these fields are as follows:

Biological aspects: experimental psychology; animal behavior; clinical psychology; comparative psychology; ethology.

Social aspects: social psychology; education, personnel, vocational psychology, and testing; industrial and

[1] The categories were established in December 1982 by a Task Force of representatives of agencies responsible for FFRDC's at the request of the Office of Science and Technology Policy.

[2] Not elsewhere classified. Includes multidisciplinary projects within a broad field and single-discipline projects for which a separate field has not been assigned.

engineering psychology; development and personality.

Psychological sciences, n.e.c.[2]

c. **Physical sciences** are concerned with understanding of the material universe and its phenomena. They comprise the fields of astronomy, chemistry, physics, and physical sciences not elsewhere classified. Examples of disciplines under each of these fields are as follows:

Astronomy: laboratory astrophysics; optical astronomy; radio astronomy; theoretical astrophysics; Gamma-ray, neutrino astronomy.

Chemistry: inorganic; organo-metallic; organic; physical.

Physics: acoustics; atomic and molecular condensed matter; elementary particle, nuclear structure; optics; plasma.

Physical sciences, n.e.c.[2]

d. **Environmental sciences** (terrestrial and extraterrestrial) are concerned (with one exception) with the gross nonbiological properties of the areas of the solar system that directly or indirectly affect man's survival and welfare; they comprise the fields of atmospheric sciences, geological sciences, oceanography, and environmental sciences not elsewhere classified. The one exception is that obligations for studies pertaining to life in the sea, or other bodies of water, are reported as support of oceanography and not biology. Examples of disciplines under each of these fields are as follows:

Atmospheric sciences: aeronomy; solar; weather modification; extraterrestrial atmospheres; meteorology.

Geological sciences: engineering geophysics; general geology; geodesy and gravity; geomagnetism; hydrology; inorganic geochemistry; isotopic geochemistry; organic geochemistry; laboratory geophysics; paleomagnetism; paleontology; physical geography and cartography; seismology; soil sciences.

Oceanography: biological oceanography; chemical oceanography; physical oceanography; marine geophysics.

Environmental sciences, n.e.c.[2]

e. **Mathematics and computer sciences** employ logical reasoning with the aid of symbols and are concerned with the development of methods of operation employing such symbols, and in the case of computer sciences, with the application of such methods to automated information systems. Examples of disciplines under each of these fields are as follows:

Mathematics: algebra; analysis; applied mathematics; foundations and logic; geometry; numerical analysis; statistics; topology.

Computer sciences: programming languages; computer and information sciences (general); design, development, and application of computer capabilities to data storage and manipulation; information sciences and systems; systems analysis.

Mathematics and computer sciences, n.e.c.[2]

f. **Engineering** is concerned with studies directed toward developing engineering principles or toward making specific scientific principles usable in engineering practice. Engineering is divided into eight fields: aeronautical, astronautical, chemical, civil, electrical, mechanical, metallurgy and materials, and engineering not elsewhere classified. Examples of disciplines under each of these fields are as follows:

Aeronautical: aerodynamics.

Astronautical: aerospace; space technology.

Chemical: petroleum; petroleum refining; process.

Civil: architectural; hydraulic, hydrologic; marine; sanitary and environmental; structural; transportation.

Electrical: communication; electronic; power.

Mechanical: engineering mechanics.

Metallurgy and materials: ceramic; mining; textile; welding.

Engineering, n.e.c.:[2] agricultural; industrial and management; nuclear; ocean engineering systems.

g. **Social sciences** are directed toward an understanding of the behavior of social institutions and groups and of individuals as members of a group. These sciences include anthropology, economics, political science, sociology, and social sciences not elsewhere classified. Examples of disciplines under each of these fields are as follows:

Anthropology: archaeology; cultural and personality; social and ethnology; applied anthropology.

Economics: econometrics and economic statistics; history of economic thought; international economics; industrial, labor, and agricultural economics; macroeconomics; microeconomics; public finance and fiscal policy; theory; economic systems and development.

Political science: area or regional studies; comparative government; history of political ideas; international relations and law; national political and legal systems; political theory; public administration.

Sociology: comparative and historical; complex organizations; culture and social structure; demography; group interactions, social problems and social welfare; sociological theory.

Social sciences, n.e.c.:[2] linguistics; research in education; research in history; socioeconomic geography; research in law, e.g., attempts to assess the impact on society of legal systems and practices.

h. **Other sciences not elsewhere classified** includes multidisciplinary and interdisciplinary projects that cannot be classified within one of the broad fields of science.

8. geographic distribution of 1982 r&d obligations

a. Nine agencies participated in the survey covering the geographic distribution of obligations for research and development and R&D plant. These nine agencies accounted for 97 percent of total Federal R&D and R&D plant obligations in 1982. The respondents were the Departments of Agriculture (USDA); Commerce; Energy (DOE); Defense (DOD); Health and Human Services (HHS); the Interior; and Transportation (DOT); the Environmental Protection Agency (EPA); NASA; and NSF.

b. Data were requested for the "actual" year 1982 in terms of the principal location (State or outlying area) where the work

was performed by the prime contractor, grantee, or intramural organization. When this information was not available in their records, the respondents were asked to assign the obligations to the State, outlying area, or office abroad where the headquarters of the U.S. prime contractor, grantee, or intramural organization was located.

c. Obligations were reported for research and development as a combined amount.

d. Specifically omitted from the geographic survey were R&D obligations to foreign performers and obligations for R&D plant used in support of foreign performers. Foreign performer data, by country, are reported in another part of the *Federal Funds* survey.

changes in reporting

Responses from the agencies in this survey, as in the previous ones, reflect revisions of estimates for the latest two years of the previous report, in this case fiscal years 1982 and 1983. Such revision is part of the budgetary cycle. From time to time responses also reflect reappraisals and revisions in classification of various aspects of agencies' R&D programs. When this occurs, NSF requires the agencies to provide revised prior-year data to maintain consistency and comparability with the most recent concepts.

limitations of the data

Funds for research and development were reported on a 3-year basis comparable with the 1984 budget, upon which the data were based. The respondents reconciled the data reported to the *Federal Funds* survey with amounts for research and development provided to OMB for the 1984 budget. The amounts reported for each year, as already stated, are the obligations or outlays incurred in that year, regardless of when the funds were authorized or received by an agency and regardless of whether the funds were identified in the agency's budget specifically for research, development, and/or R&D plant.

Data submitted by the Federal agencies for 1982 are considered to be actual since they represent virtually completed transactions. Amounts reported for 1983 and 1984 are estimates in that they are subject to further appropriation, apportionment, or deferral decisions. The effects of these and other, later actions on 1983 and 1984 outlays and obligations will be reflected in the next report.

Respondent judgment is often necessary in classifying the data. Most agency R&D programs must be separated by agency respondents from other, larger programs because they are not identified as budget-line items. R&D programs, once identified, must then be further subdivided into the survey categories: Basic research, applied research, development, performers, and fields of science/engineering. Over the years, however, the participating agencies have developed increasing skill and consistency in meeting the survey requirements.

Some agencies have not been able to report the full cost of research and development. For example, the headquarters costs of planning and administering R&D programs of DOD (estimated at a fraction of 1 percent of the DOD R&D total) are not included because this agency has stated that identification of the amounts is impracticable.

R&D plant data are also to some extent underreported because of the difficulty encountered by some agencies, particularly DOD and NASA, in identifying and reporting them. While DOD reports obligations for R&D plant under its construction appropriation, that agency is able to identify only a small portion of the R&D plant support within R&D contracts funded from the RDT&E appropriation. NASA cannot separately identify these portions of industrial R&D contracts that apply to R&D plant. It subsumes R&D plant data in the R&D data covering industrial performance; R&D plant data for other NASA performing sectors can be, and are, reported.

relation to other reports

1. federal support to universities and colleges

NSF conducts a separate survey covering Federal support to individual universities and colleges. This survey is based on data provided by the Federal agencies under the reporting system established by the former Committee on Academic Science and Engineering (CASE) of the Federal Council for Science and Technology. The reports resulting from these surveys are entitled *Federal Support to Universities, Colleges, and Selected Nonprofit Institutions* and are referred to as the CASE reports.

Both the CASE and *Federal Funds* reports provide data on Federal obligations for research and development and R&D plant to universities and colleges and to university-administered FFRDC's. The CASE report, however, is based on obligations of Federal agencies to each *individual* academic institution, whereas the *Federal Funds* report is concerned with obligations to universities and colleges as a performer *group*. The CASE report additionally includes funds for non-R&D activities, such as science education and nonscience support. Further, the CASE survey is based on reports of only 15 agencies (USDA; Commerce; DOD; the Departments of Education, Housing and Urban Development, Interior, DOE, HHS, and Labor; DOT; EPA; NASA; NSF; the Agency for International Development; and the Nuclear Regulatory Commission), whereas the *Federal Funds* survey is composed of obligations of all agencies with R&D programs. The 15 respondents to CASE, however, account for more than 98 percent of total Federal R&D support to universities and colleges and all obligations to university-administered FFRDC's.

The different reporting procedures have led to the reporting of different totals to the CASE and *Federal Funds* surveys, as follows:

a. The obligations for research and development to universities and colleges reported for *Federal Funds* in 1982 amounted to $4,605 million, or $25 million more than the amount reported for CASE.

b. The R&D obligation total for university-administered FFRDC's, as reported to *Federal Funds*, was $1,977 million in 1982, or $77 million more than reported for CASE. For *Federal Funds*, the amount subcontracted by the NASA university-administered Jet Propulsion Laboratory was included in ultimate-performer categories; whereas for CASE, the subcontracted amount was included in the R&D obligations to FFRDC's administered by universities.

c. Total R&D plant obligations to universities and colleges reported to the *Federal Funds* survey were $30 million in 1982, or $1 million less than the amount reported to the CASE survey.

d. Total R&D plant obligations to university-administered FFRDC's, as reported to *Federal Funds*, were $442 million in 1982, or $36 million more than reported to CASE.

The following factors should also be considered in comparing the data appearing in the two reports:

For *Federal Funds* each agency includes as part of its obligations the amounts transferred to other agencies for R&D activities. A receiving agency does not report funds transferred from another agency. In the CASE survey, by contrast, the data are reported by the agency that makes the *final* distribution of the funds to a given institution. Thus, for the CASE survey, agencies include funds received from other agencies and exclude funds transferred to other agencies, the reverse of the *Federal Funds* process. Although such transfers should balance each other out with no resulting changes in total R&D obligations, these different reporting requirements add to the possibility of differences between the two reports.

The CASE responses are in many instances prepared by different operating units within the agencies from those that prepare the *Federal Funds* responses. The CASE data are also collected several months earlier than the *Federal Funds* data. Theoretically, these conditions should not add to reporting differences, but in practice, differences do arise.

2. special analyses, budget of the united states

In a section of *Special Analyses, Budget of the United States Government*, OMB publishes estimates of obligations and outlays for research, development, and R&D plant. These data, as shown in "Special Analysis K: Research and Development" in the 1984 budget, did not provide as much detail on character of work as *Federal Funds* data, and they did not include information on performers, fields of science/engineering, or geographic distribution.

"Special Analysis K" and *Federal Funds* utilized the same definitions for research and development and for R&D plant. The estimates for research and development published in the two reports are comparable, even though minor differences exist. The comparison between the two reports is as follows:

Total Federal R&D obligations
(Billions of dollars)

	FY 1982	FY 1983	FY 1984
Federal Funds . .	$36.4	$38.7	$45.5
Special Analysis K . .	36.4	38.9	45.8

3. federal r&d funding by budget function: fiscal years 1982-84

NSF published a special report under the above title, providing an analysis of Federal R&D programs by budget function categories. The *Federal Funds*, Volume XXXII survey, by contrast, reported on R&D funding by agencies rather than by functional categories. The *Federal Funds* report provided obligational data rather than budget authority data, which formed the basis for the function report. The R&D budget authority data for 1982-84 in the function report were based on information provided to OMB by the agencies as background for "Special Analysis K" in the 1984 budget. Further program information was based on budget justification documents of the leading R&D support agencies and information provided directly to NSF by some of the smaller agencies.

4. other reports

a. Agencies may classify their R&D programs for purposes other than those for which the *Federal Funds* survey is conducted. Definitions and guidelines that are suitable to these other purposes may result in information that is not comparable with the data transmitted to NSF for *Federal Funds*.

appendix b

federally funded research and development centers, fiscal years 1982-84

Note: Total Federal obligations for R&D and R&D plant support to each FFRDC in fiscal year 1982 are shown in parentheses. The overall total is $4,816,966,000.

department of defense
office of the secretary of defense

Administered by other nonprofit institutions:

Institute for Defense Analyses (IDA), Arlington, Virginia ($6,183,000)

department of the navy

Administered by universities and colleges:

Center for Naval Analyses (University of Rochester), Arlington, Virginia ($21,957,000)

department of the air force

Administered by universities and colleges:

Lincoln Laboratory (Massachusetts Institute of Technology), Lexington, Massachusetts ($155,112,000)

Administered by other nonprofit institutions:

Aerospace Corporation, El Segundo, California ($207,225,000)

C³I Division (MITRE Corporation),[3] Bedford, Massachusetts ($147,739,000)

Project Air Force (RAND Corporation),[4] Santa Monica, California ($14,848,000)

department of health and human services

national institutes of health

Administered by industrial firms:

Frederick Cancer Research Center (Litton Bionetics, Inc., Litton Industries), Frederick, Maryland ($31,318,000)

department of energy

Administered by industrial firms:

Bettis Atomic Power Laboratory (Westinghouse Electric Corp.), Pittsburgh, Pennsylvania ($282,921,000)

Energy Technology Engineering Center (Rockwell International Corporation), Santa Susana, California ($36,405,000)

Hanford Engineering Development Laboratory (Westinghouse-Hanford Corp.), Richland, Washington ($287,698,000)

Idaho National Engineering Laboratory (EG&G Idaho, Inc.; Exxon Nuclear Idaho Co.; Argonne National Laboratory, West; Westinghouse Electric Corp.), Idaho Falls, Idaho ($143,706,000)

Knolls Atomic Power Laboratory (General Electric Company), Schenectady, New York ($231,492,000)

Oak Ridge National Laboratory (Union Carbide Corp.), Oak Ridge, Tennessee ($201,300,000)

Sandia National Laboratories (Western Electric Co., Inc.-Sandia Corp.), Albuquerque, New Mexico ($558,756,000)

Savannah River Laboratory (E.I. duPont de Nemours & Co., Inc.), Aiken, South Carolina ($95,020,000)

Administered by universities and colleges:

Ames Laboratory (Iowa State University of Science and Technology), Ames, Iowa ($15,553,000)

[3] Only the C³ Division of the MITRE Corporation is reported as an FFRDC. All other agency support to MITRE is reported under "other nonprofit institutions excluding FFRDC's."

[4] Only the Project Air Force portion of the RAND Corporation is reported as an FFRDC. All other agency support to RAND is reported under "nonprofit institutions excluding FFRDC's."

Argonne National Laboratory (University of Chicago and Argonne Universities Assoc.), Argonne, Illinois ($223,896,000)
Brookhaven National Laboratory (Associated Universities, Inc.), Upton, Long Island, New York ($164,404,000)
E. O. Lawrence Berkeley Laboratory (University of California), Berkeley, California ($130,728,000)
E. O. Lawrence Livermore National Laboratory (University of California), Livermore, California ($590,276,000)
Fermi National Accelerator Laboratory (Universities Research Association, Inc.), Batavia, Illinois ($139,758,000)
Los Alamos National Laboratory (University of California), Los Alamos, New Mexico ($490,165,000)
Oak Ridge Associated Universities, Oak Ridge, Tennessee ($9,250,000)
Princeton Plasma Physics Laboratory (Princeton University), Princeton, New Jersey ($125,340,000)
Stanford Linear Accelerator Center (Stanford University), Stanford, California ($71,188,000)

Administered by other nonprofit institutions:
Pacific Northwest Laboratory (Battelle Memorial Institute), Richland, Washington ($90,800,000)
Solar Energy Research Institute (Midwest Research Institute), Golden, Colorado ($53,224,000)

national aeronautics and space administration

Administered by universities and colleges:
Jet Propulsion Laboratory (California Institute of Technology), Pasadena, California ($208,485,000)

national science foundation

Administered by universities and colleges:
Cerro Tololo Inter-American Observatory (Association of Universities for Research in Astronomy, Inc.), La Serena, Chile ($6,057,000)
Kitt Peak National Observatory (Association of Universities for Research in Astronomy, Inc.), Tucson, Arizona ($11,220,000)
National Astronomy and Ionosphere Center (Cornell University), Arecibo, Puerto Rico ($5,320,000)
National Center for Atmospheric Research (University Corporation for Atmospheric Research), Boulder, Colorado ($32,534,000)
National Radio Astronomy Observatory (Associated Universities, Inc.), Green Bank, West Virginia ($15,097,000)
Sacramento Peak Observatory (Association of Universities for Research in Astronomy, Inc.), Sunspot, New Mexico ($2,000,000)

categories of ffrdc's[5]

Total of Federal obligations, for R&D and R&D plant support to each FFRDC in is fiscal year 1982 shown in parentheses. The overall total is $4,816,966,000.

research laboratories ($314,492,000)

DOE: Fermi National Accelerator Laboratory ($139,758,000)
DOE: Stanford Linear Accelerator ($71,188,000)
HHS/NIH: Frederick Cancer Research Center ($31,318,000)
NSF: Cerro Tololo Inter-American Observatory ($6,057,000)
NSF: Kitt Peak National Observatory ($11,220,000)
NSF: National Astronomy and Ionosphere Center ($5,320,000)
NSF: National Center for Atmospheric Research ($32,534,000)
NSF: National Radio Astronomy Observatory ($15,097,000)
NSF: Sacramento Peak Observatory ($2,000,000)

[5] Categories are defined in the Technical Notes under Performer FFRDC's

r&d laboratories ($4,094,522,000)

DOD/AF: Lincoln Laboratory ($155,112,000)
DOE: Ames Laboratory ($15,553,000)
DOE: Argonne National Laboratory ($223,896,000)
DOE: Bettis Atomic Power Laboratory ($282,921,000)
DOE: Brookhaven National Laboratory ($164,404,000)
DOE: E.O. Lawrence Berkeley Laboratory ($130,728,000)
DOE: E.O. Lawrence Livermore National Laboratory ($590,276,000)
DOE: Energy Technology Engineering Center ($36,405,000)
DOE: Hanford Engineering Development Laboratory ($287,698,000)
DOE: Idaho National Engineering Laboratory ($144,706,000)
DOE: Knolls Atomic Power Laboratory ($231,492,000)
DOE: Los Alamos National Laboratory ($490,156,000)
DOE: Oak Ridge Associated Universities Studies ($9,250,000)
DOE: Oak Ridge National Laboratory ($201,300,000)
DOE: Pacific Northwest Laboratory ($90,800,000)
DOE: Princeton Plasma Physics Laboratory ($125,340,000)
DOE: Sandia National Laboratories ($558,756,000)
DOE: Savannah River Laboratory ($95,020,000)
DOE: Solar Energy Research Institute ($53,224,000)
NASA: Jet Propulsion Laboratory ($208,485,000)

study and analysis centers ($52,988,000)

DOD/AF: Project Air Force ($14,848,000)
DOD/Navy: Center for Naval Analysis ($21,957,000)
DOD/OSD: Institute of Defense Analysis ($16,183,000)

system engineering/system integration centers ($354,964,000)

DOD/AF: Aerospace Corporation ($207,225,000)
DOD/AF: C³I Division of MITRE ($147,739,000)

appendix c

detailed statistical tables

Detailed Statistical Tables for Volume XXXII have been published separately (NSF 83-319). Only tables C-1, C-2, and C-3 are included in this report, pp. 40-45.)

Research, Development, and R&D Plant

Research and Development—Agency, Character of Work, and Performer

Total Research—Agency, Performer, and Field of Science

Basic Research—Agency, Performer, and Field of Science

Applied Research—Agency, Performer, and Field of Science

Development—Agency and Performer

R&D Plant

Total Research Performed at Universities and Colleges—Agency and Field of Science

Basic Research Performed at Universities and Colleges—Agency and Field of Science

Applied Research Performed at Universities and Colleges—Agency and Field of Science

Foreign Performers—Research and Development

Foreign Performers—Basic Research

Special Foreign Currency Program

Geographic Distribution—Research and Development and R&D Plant

Federal Intramural Personnel Costs

Historical Data

OUTLAYS

OBLIGATIONS

notes

- Estimates for 1984 are based on *The Budget of the United States Government, Fiscal Year 1984*, as submitted to Congress by the administration, and do not reflect subsequent appropriations and apportionment actions.

- Details may not add to totals because of rounding.

- Asterisks appearing in lieu of figures indicate that the amounts are less than $50,000 or less than .05 percent.

- The abbreviation "FFRDC's" appearing in statistical tables refers to federally funded research and development centers.

- The Agency for International Development is included within the International Development Cooperation Agency.

- The Bonneville Power Administration, within the Department of the Interior: the Bureau of Alcohol, Tobacco, and Firearms, within the Department of Treasury; the Community Services Administration; and the Office of Personnel Management no longer fund R&D projects and have been omitted this volume.

- In tables showing extramural performers, obligations of the Department of Agriculture to agricultural experiment stations are included within obligations to universities and colleges.

- Defense Agencies within the Department of Defense include the Defense Advanced Research Projects Agency, the Defense Nuclear Agency, the Defense Communications Agency, the Defense Mapping Agency, the Defense Logistics Agency, the Uniformed Services University of the Health Sciences, and technical support, Joint Chiefs of Staff/Office of the Secretary of Defense.

- The Office of Legal Policy within the Department of Justice replaces the Office of the Attorney General.

- R&D data reported by the National Aeronautics and Space Administration are in terms of budget plan rather than obligations.

- The historical tables for Volume XXXII, providing data on R&D totals for 1974 through 1984 (C-113 through C-133), are not comparable with totals for those years in appendix tables issued to accompany earlier *Federal Funds* reports. Some prior-year changes occur almost almost every year, thus changing totals in many categories.

NOTE: For trend comparisons, use only these tables, appendix C, for Volume XXXII. Do not use the earlier tables in the Federal Funds series.

TABLE C-1. SUMMARY OF FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT: FISCAL YEARS 1982, 1983, AND 1984

(MILLIONS OF DOLLARS)

ITEM	ACTUAL, 1982	ESTIMATES 1983	% CHG 1982-1983	1984	% CHG 1983-1984
TOTAL OUTLAYS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT	35,766.8	39,584.8	10.7%	45,316.0	14.5%
RESEARCH AND DEVELOPMENT	34,390.7	38,158.8	11.0	43,834.1	14.9
R&D PLANT	1,376.1	1,426.0	3.6	1,481.9	3.9
TOTAL OBLIGATIONS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT	37,822.4	40,079.4	6.0	47,063.6	17.4
RESEARCH AND DEVELOPMENT	36,432.6	38,710.1	6.3	45,497.0	17.5
PERFORMERS:					
FEDERAL INTRAMURAL 1/	9,141.0	10,228.3	11.9	10,969.9	7.3
INDUSTRIAL FIRMS	17,192.2	17,729.3	3.1	22,957.4	29.5
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	1,506.4	1,525.1	1.2	1,614.4	5.9
UNIVERSITIES AND COLLEGES	4,605.5	4,996.1	8.5	5,270.7	5.5
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	1,976.7	2,088.9	5.7	2,291.9	9.7
OTHER NONPROFIT INSTITUTIONS	1,091.7	1,176.7	7.8	1,335.6	13.5
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	520.6	568.1	9.1	683.2	20.3
STATE AND LOCAL GOVERNMENTS	184.3	210.0	14.0	189.1	-10.0
FOREIGN	214.3	187.6	-12.4	184.8	-1.5
RESEARCH	13,022.2	14,154.3	8.7	14,663.2	3.6
PERFORMERS:					
FEDERAL INTRAMURAL 1/	4,194.2	4,577.0	9.1	4,636.6	1.3
INDUSTRIAL FIRMS	2,156.6	2,340.0	8.5	2,426.6	3.7
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	487.3	515.1	5.7	502.0	-2.5
UNIVERSITIES AND COLLEGES	4,045.4	4,407.5	9.0	4,667.1	5.9
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	1,056.7	1,165.3	10.3	1,286.8	10.4
OTHER NONPROFIT INSTITUTIONS	743.5	804.4	8.2	785.9	-2.3
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	104.2	83.8	-19.5	96.1	14.7
STATE AND LOCAL GOVERNMENTS	125.9	144.6	14.8	139.7	-3.4
FOREIGN	108.3	116.7	7.7	122.5	5.0
FIELDS OF SCIENCE:					
LIFE SCIENCES	4,745.5	5,133.0	8.2	5,251.0	2.3
PSYCHOLOGY	218.4	241.4	10.5	271.7	12.5
PHYSICAL SCIENCES	2,500.4	2,851.7	14.1	3,178.8	11.5
ENVIRONMENTAL SCIENCES	1,148.3	1,218.6	6.1	1,188.6	-2.5
MATHEMATICS AND COMPUTER SCIENCES	350.1	399.4	14.1	481.6	20.6
ENGINEERING	3,386.6	3,501.5	3.4	3,486.9	-.4
SOCIAL SCIENCES	385.9	425.5	10.3	432.3	1.6
OTHER SCIENCES, NEC	287.0	383.1	33.5	372.3	-2.8
BASIC RESEARCH	5,481.6	6,086.0	11.0	6,615.4	8.7
PERFORMERS:					
FEDERAL INTRAMURAL 1/	1,465.5	1,650.4	12.6	1,774.3	7.5
INDUSTRIAL FIRMS	270.9	301.5	11.3	331.3	9.9
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	87.4	89.1	1.9	97.7	9.7
UNIVERSITIES AND COLLEGES	2,727.1	3,018.3	10.7	3,299.0	9.2
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	516.7	578.7	12.0	663.4	14.6
OTHER NONPROFIT INSTITUTIONS	355.6	373.5	5.0	384.9	3.1
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	9.0	7.9	-12.6	7.4	-5.2
STATE AND LOCAL GOVERNMENTS	24.5	35.0	43.0	27.5	-21.3
FOREIGN	24.9	31.8	27.6	33.9	6.6
FIELDS OF SCIENCE:					
LIFE SCIENCES	2,526.0	2,796.4	10.7	2,926.6	4.7
PSYCHOLOGY	89.9	99.0	10.2	105.2	6.2
PHYSICAL SCIENCES	1,393.8	1,556.8	11.7	1,731.5	11.2
ENVIRONMENTAL SCIENCES	520.1	560.3	7.7	605.9	8.1
MATHEMATICS AND COMPUTER SCIENCES	165.1	195.8	18.6	240.0	22.6
ENGINEERING	610.5	665.5	9.0	786.0	18.1
SOCIAL SCIENCES	120.2	125.2	4.1	136.4	8.9
OTHER SCIENCES, NEC	56.1	87.2	55.4	83.8	-3.9
APPLIED RESEARCH	7,540.6	8,068.3	7.0	8,047.9	-.3
PERFORMERS:					
FEDERAL INTRAMURAL 1/	2,728.7	2,926.6	7.3	2,862.3	-2.2
INDUSTRIAL FIRMS	1,885.7	2,038.5	8.1	2,095.3	2.8
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	400.0	426.0	6.5	404.3	-5.1
UNIVERSITIES AND COLLEGES	1,318.3	1,389.3	5.4	1,372.1	-1.2
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	540.0	586.6	8.6	623.4	6.3
OTHER NONPROFIT INSTITUTIONS	387.9	430.9	11.1	401.1	-6.9
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	95.2	76.0	-20.2	88.7	16.7
STATE AND LOCAL GOVERNMENTS	101.4	109.6	8.0	112.2	2.4
FOREIGN	83.4	84.9	1.8	88.6	4.4
FIELDS OF SCIENCE:					
LIFE SCIENCES	2,219.5	2,336.7	5.3	2,324.5	-.5
PSYCHOLOGY	128.5	142.4	10.8	166.5	16.9
PHYSICAL SCIENCES	1,106.5	1,295.0	17.0	1,447.4	11.8
ENVIRONMENTAL SCIENCES	628.3	658.3	4.8	582.7	-11.5
MATHEMATICS AND COMPUTER SCIENCES	185.0	203.7	10.1	241.6	18.6
ENGINEERING	2,776.1	2,836.0	2.2	2,700.9	-4.8
SOCIAL SCIENCES	265.8	300.3	13.0	295.9	-1.5
OTHER SCIENCES, NEC	231.0	296.0	28.2	288.5	-2.5

CONTINUED ON NEXT PAGE

TABLE C-1. SUMMARY OF FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT: FISCAL YEARS 1982, 1983, AND 1984

(MILLIONS OF DOLLARS)

- CONTINUED

ITEM	ACTUAL, 1982	ESTIMATES 1983	% CHG 1982-1983	1984	% CHG 1983-1984
DEVELOPMENT	23,410.4	24,555.7	4.9%	30,833.3	25.6%
PERFORMERS:					
FEDERAL INTRAMURAL 1/	4,946.8	5,651.3	14.2	6,333.4	12.1
INDUSTRIAL FIRMS	15,035.7	15,389.3	2.4	20,530.9	33.4
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	1,019.1	1,010.0	-.9	1,112.4	10.1
UNIVERSITIES AND COLLEGES	560.0	588.6	5.1	603.7	2.6
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	920.0	923.6	.4	1,005.0	8.8
OTHER NONPROFIT INSTITUTIONS	348.1	372.3	6.9	549.6	47.6
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	416.4	484.3	16.3	587.1	21.2
STATE AND LOCAL GOVERNMENTS	58.4	65.5	12.2	49.4	-24.6
FOREIGN	106.0	70.9	-33.0	62.3	-12.2
R&D PLANT	1,389.8	1,369.3	-1.5	1,566.6	14.4
PERFORMERS SUPPORTED:					
FEDERAL INTRAMURAL	426.0	499.3	17.2	644.1	29.0
INDUSTRIAL FIRMS	110.4	151.9	37.5	70.6	-53.5
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	362.2	330.9	-8.6	411.3	24.3
UNIVERSITIES AND COLLEGES	30.3	32.5	7.4	40.0	23.0
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	441.7	341.3	-22.7	390.3	14.4
OTHER NONPROFIT INSTITUTIONS	6.6	4.4	-32.4	4.7	5.0
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	9.4	5.7	-39.9	2.2	-62.0
FOREIGN	3.2	3.3	5.3	3.5	6.1

1/ COSTS ASSOCIATED WITH THE ADMINISTRATION OF INTRAMURAL AND EXTRAMURAL PROGRAMS ARE COVERED AS WELL AS ACTUAL INTRAMURAL PERFORMANCE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE C-2. FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT, BY AGENCY: FISCAL YEARS 1982, 1983, AND 1984

(MILLIONS OF DOLLARS)

AGENCY AND SUBDIVISION	OBLIGATIONS 1982	OBLIGATIONS ESTIMATES 1983	OBLIGATIONS ESTIMATES 1984	OUTLAYS 1982	OUTLAYS ESTIMATES 1983	OUTLAYS ESTIMATES 1984
TOTAL, ALL AGENCIES	37,822.4	40,079.4	47,063.6	35,766.8	39,584.8	45,316.0
DEPARTMENTS						
DEPARTMENT OF AGRICULTURE, TOTAL	818.7	887.7	874.9	828.4	872.8	869.8
AGRICULTURAL COOPERATIVE SERVICE	1.7	1.7	1.4	1.7	1.8	1.6
AGRICULTURAL MARKETING SERVICE	1.2	1.5	-	1.5	1.5	-
AGRICULTURAL RESEARCH SERVICE	426.0	469.4	472.4	436.1	464.2	470.3
COOPERATIVE STATE RESEARCH SERVICE	219.0	244.9	231.7	219.8	230.4	232.3
ECONOMIC RESEARCH SERVICE	39.3	39.0	45.0	37.0	38.7	41.3
FOREST SERVICE	112.5	105.5	101.2	116.0	108.2	101.1
HUMAN NUTRITION INFORMATION SERVICE	8.5	8.2	6.6	3.8	12.5	6.6
OFFICE OF INTERNATIONAL COOPERATION AND DEVELOPMENT	2.6	8.8	7.5	4.6	6.8	7.7
OFFICE OF TRANSPORTATION	.9	.8	.8	.9	.8	.8
STATISTICAL REPORTING SERVICE	7.0	7.9	8.2	7.0	7.9	8.2
DEPARTMENT OF COMMERCE, TOTAL	337.3	349.6	236.6	286.5	325.3	251.3
BUREAU OF THE CENSUS	3.8	4.4	4.5	3.7	4.2	4.5
ECONOMIC DEVELOPMENT ADMINISTRATION	9.6	10.0	-	12.1	14.0	.8
NATIONAL BUREAU OF STANDARDS	89.9	104.3	80.3	87.6	95.5	82.5
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION	222.0	220.8	142.1	174.1	201.0	153.8
NATIONAL TELECOMMUNICATIONS & INFORMATION ADMIN	11.3	8.9	8.3	8.0	9.6	8.5
OFFICE OF THE SECRETARY	*	.5	.7	.2	.3	.5
PATENT AND TRADEMARK OFFICE	.7	.7	.7	.7	.7	.7
DEPARTMENT OF DEFENSE, TOTAL	20,913.1	23,448.1	30,173.7	18,482.9	22,248.4	27,214.8
DEPARTMENT OF THE ARMY	3,785.2	3,982.0	4,936.2	3,414.4	3,855.8	4,560.7
MILITARY FUNCTIONS	3,756.2	3,952.6	4,906.9	3,385.3	3,826.4	4,531.3
MILITARY CONSTRUCTION	21.3	10.8	26.0	10.3	15.9	15.0
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	145.7	144.7	152.2	145.3	144.5	151.9
RDT&E APPROPRIATION	3,589.2	3,797.1	4,728.7	3,229.7	3,666.0	4,364.4
CIVIL FUNCTIONS (CORPS OF ENGINEERS)	29.0	29.4	29.4	29.0	29.4	29.4
DEPARTMENT OF THE NAVY	6,001.0	6,197.9	8,311.4	5,394.7	6,082.0	7,326.2
MILITARY CONSTRUCTION	39.5	35.8	107.2	21.0	35.8	51.7
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	130.3	145.2	145.1	129.9	144.8	144.7
RDT&E APPROPRIATION	5,829.8	6,013.9	8,055.3	5,240.3	5,900.7	7,128.9
SPECIAL FOREIGN CURRENCY PROGRAM	1.3	3.0	3.8	3.5	.7	.9
DEPARTMENT OF THE AIR FORCE	9,442.6	11,074.0	13,997.0	8,209.1	10,317.6	12,746.1
MILITARY CONSTRUCTION	41.4	85.4	80.1	26.5	53.3	72.1
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	365.7	402.0	425.0	388.4	394.0	417.0
RDT&E APPROPRIATION	9,035.5	10,586.6	13,491.9	7,794.2	9,870.3	12,257.0
DEFENSE AGENCIES	1,643.3	2,130.4	2,872.8	1,420.0	1,943.2	2,518.8
RDT&E APPROPRIATION	24.7	14.9	14.0	1,420.0	1,943.2	2,518.8
DIRECTOR OF TEST & EVALUATION, DEFENSE	41.0	63.8	56.3	44.8	49.8	53.0
DEPARTMENT OF EDUCATION	128.0	145.4	126.3	150.1	173.6	161.1
DEPARTMENT OF ENERGY	5,622.2	5,399.7	5,389.5	5,785.4	5,987.0	5,681.0
DEPARTMENT OF HEALTH AND HUMAN SERVICES, TOTAL	3,965.4	4,395.9	4,460.1	4,052.1	4,323.2	4,414.2
ALCOHOL, DRUG ABUSE & MENTAL HEALTH ADMINISTRATION	251.4	284.2	322.3	292.0	297.9	323.8
CENTERS FOR DISEASE CONTROL	75.0	71.6	76.8	88.4	72.5	60.1
FOOD & DRUG ADMINISTRATION	75.0	113.6	83.9	59.4	67.3	78.2
HEALTH CARE FINANCING ADMINISTRATION	29.1	30.0	30.0	29.1	30.0	30.0
HEALTH RESOURCES AND SERVICES ADMIN	10.1	9.9	1.2	17.5	20.3	5.4
HUMAN DEVELOPMENT SERVICES	27.2	25.0	11.9	33.0	25.9	23.6
NATIONAL INSTITUTES OF HEALTH	3,452.6	3,805.8	3,875.2	3,475.0	3,758.6	3,838.0
OFFICE OF ASSISTANT SECRETARY FOR HEALTH	16.1	16.9	18.5	29.0	17.9	17.9
OFFICE OF THE SECRETARY	13.4	14.7	11.0	13.4	14.7	11.0
SOCIAL SECURITY ADMINISTRATION	15.5	24.3	29.3	15.4	18.2	26.3
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT	28.9	31.9	27.2	37.0	34.7	31.2
DEPARTMENT OF THE INTERIOR, TOTAL	382.4	398.7	329.0	394.9	431.1	358.8
BUREAU OF LAND MANAGEMENT	5.3	6.6	6.7	5.3	6.6	6.7
BUREAU OF MINES	94.8	104.9	67.9	105.2	119.8	81.8
BUREAU OF RECLAMATION	10.1	9.8	10.0	10.7	12.5	10.0
GEOLOGICAL SURVEY	153.6	150.3	136.0	150.1	166.8	144.6
MINERAL MANAGEMENT SERVICE	-	1.5	1.5	-	1.2	1.2
NATIONAL PARK SERVICE	11.2	11.8	12.5	11.2	11.8	12.5
OFFICE OF THE SECRETARY	.5	6.8	1.6	.4	6.1	1.5
OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT	1.5	1.5	1.0	1.4	2.0	2.0
OFFICE OF WATER RESEARCH & TECHNOLOGY	12.3	7.5	-	20.3	10.9	-
UNITED STATES FISH AND WILDLIFE SERVICE	94.2	98.0	91.8	90.4	93.4	98.6

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TABLE C-2. FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT, BY AGENCY: FISCAL YEARS 1982, 1983, AND 1984

(MILLIONS OF DOLLARS)

- CONTINUED

AGENCY AND SUBDIVISION	OBLIGATIONS 1982	OBLIGATIONS ESTIMATES 1983	OBLIGATIONS ESTIMATES 1984	OUTLAYS 1982	OUTLAYS ESTIMATES 1983	OUTLAYS ESTIMATES 1984
DEPARTMENT OF JUSTICE, TOTAL	36.7	35.4	33.7	36.6	36.1	36.4
DRUG ENFORCEMENT ADMINISTRATION	3.2	2.6	2.3	2.7	2.9	3.0
FEDERAL BUREAU OF INVESTIGATION	2.7	1.1	2.6	1.1	2.0	1.5
FEDERAL PRISON SYSTEM	1.7	2.1	1.6	1.7	2.1	1.6
IMMIGRATION AND NATURALIZATION SERVICE	.6	1.2	.5	.3	1.2	.5
OFFICE OF JUSTICE ASSISTANCE, RESEARCH, AND STATISTICS	18.0	27.5	16.0	30.4	26.8	19.1
OFFICE OF LEGAL POLICY	.4	.8	.7	.4	1.1	.6
DEPARTMENT OF LABOR, TOTAL	25.4	18.0	19.6	29.4	18.8	18.2
BUREAU OF LABOR STATISTICS	.3	.3	.4	.3	.3	.4
EMPLOYMENT STANDARDS ADMINISTRATION	1.4	2.0	1.3	1.3	1.9	1.2
EMPLOYMENT AND TRAINING ADMINISTRATION	16.1	7.2	8.3	20.2	8.1	7.3
LABOR-MANAGEMENT SERVICES ADMINISTRATION	.7	.8	1.8	.7	.7	1.5
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION	4.9	5.7	5.7	4.9	5.7	5.7
OFFICE OF THE SECRETARY	.9	1.0	1.2	.9	1.0	1.2
PENSION BENEFIT GUARANTEE CORPORATION	1.1	1.0	1.0	1.1	1.0	1.0
DEPARTMENT OF STATE, TOTAL	1.5	1.6	1.6	1.5	1.6	1.6
DEPARTMENTAL FUNDS	1.5	1.6	1.6	1.5	1.6	1.6
DEPARTMENT OF TRANSPORTATION, TOTAL	322.0	408.8	543.5	360.0	380.3	470.4
COAST GUARD	20.0	20.0	22.0	20.0	20.0	22.0
FEDERAL AVIATION ADMINISTRATION	99.4	156.4	326.9	110.9	133.2	250.5
FEDERAL HIGHWAY ADMINISTRATION	40.3	53.9	48.7	42.5	45.5	50.4
FEDERAL RAILROAD ADMINISTRATION	24.5	29.5	17.0	25.6	33.0	12.5
MARITIME ADMINISTRATION	11.1	17.3	13.0	18.9	18.3	15.2
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION	55.9	59.7	57.5	60.2	58.6	56.9
OFFICE OF THE SECRETARY	3.3	5.6	7.3	5.6	5.5	6.0
RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION	6.1	7.3	5.6	6.5	6.0	4.6
URBAN MASS TRANSPORTATION ADMINISTRATION	61.4	59.1	45.5	69.8	60.3	52.3
DEPARTMENT OF THE TREASURY, TOTAL	13.4	16.2	16.5	13.6	16.4	16.5
BUREAU OF ENGRAVING AND PRINTING	4.8	5.0	5.1	4.8	5.0	5.1
INTERNAL REVENUE SERVICE	5.4	8.4	8.7	5.4	8.4	8.7
OFFICE OF PROTECTIVE RESEARCH	-	*	*	.3	.3	*
UNITED STATES CUSTOMS SERVICE	3.2	2.7	2.6	3.2	2.7	2.6
OTHER AGENCIES						
ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS	2.0	2.0	2.0	1.8	1.9	2.0
AGENCY FOR INTERNATIONAL DEVELOPMENT	205.9	181.5	213.2	188.6	253.3	259.3
APPALACHIAN REGIONAL COMMISSION	.4	.3	-	.4	.3	-
CONSUMER PRODUCT SAFETY COMMISSION	.2	.5	.5	.2	.5	.4
ENVIRONMENTAL PROTECTION AGENCY	335.1	240.8	207.7	336.2	295.2	249.8
FEDERAL COMMUNICATIONS COMMISSION	1.2	1.2	1.0	1.2	1.2	1.1
FEDERAL EMERGENCY MANAGEMENT AGENCY	9.2	3.7	13.0	8.8	3.5	12.4
FEDERAL HOME LOAN BANK BOARD	2.7	3.0	3.1	2.7	3.0	3.1
FEDERAL TRADE COMMISSION	1.2	1.7	1.7	1.2	1.7	1.7
GENERAL SERVICES ADMINISTRATION	1.0	.7	1.8	1.0	.7	1.8
INTERNATIONAL TRADE COMMISSION	3.8	4.0	4.4	3.8	4.0	4.4
LIBRARY OF CONGRESS	5.7	6.0	6.0	5.4	6.2	6.1
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	3,191.6	2,513.5	2,613.0	3,252.9	2,646.1	3,600.3
NATIONAL SCIENCE FOUNDATION	976.8	1,062.7	1,248.5	1,015.1	1,004.1	1,145.3
NUCLEAR REGULATORY COMMISSION	220.3	209.5	199.7	208.6	205.5	199.7
SMITHSONIAN INSTITUTION	52.9	57.3	63.9	48.4	56.4	58.4
TENNESSEE VALLEY AUTHORITY	85.3	75.1	78.5	89.5	75.4	78.4
UNITED STATES ARMS CONTROL AND DISARMAMENT AGENCY	1.9	1.2	6.1	1.9	1.2	6.1
UNITED STATES INFORMATION AGENCY	.1	2.2	6.4	*	.9	5.3
VETERANS ADMINISTRATION	140.1	175.8	170.9	140.7	174.5	165.2

* INDICATES AMOUNT LESS THAN $50,000.

SOURCE: NATIONAL SCIENCE FOUNDATION

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TABLE C-3. FEDERAL FUNDS FOR TOTAL RESEARCH AND DEVELOPMENT, BY AGENCY: FISCAL YEARS 1982, 1983, AND 1984

(MILLIONS OF DOLLARS)

AGENCY AND SUBDIVISION	OBLIGATIONS 1982	OBLIGATIONS ESTIMATES 1983	OBLIGATIONS ESTIMATES 1984	OUTLAYS 1982	OUTLAYS ESTIMATES 1983	OUTLAYS ESTIMATES 1984
TOTAL, ALL AGENCIES	36,432.6	38,710.1	45,497.0	34,390.7	38,158.8	43,834.1
DEPARTMENTS						
DEPARTMENT OF AGRICULTURE, TOTAL	797.3	852.9	848.4	807.2	839.1	847.3
AGRICULTURAL COOPERATIVE SERVICE	1.7	1.7	1.4	1.7	1.8	1.6
AGRICULTURAL MARKETING SERVICE	1.2	1.5	-	1.5	1.5	-
AGRICULTURAL RESEARCH SERVICE	404.9	445.0	456.3	417.5	423.4	454.2
COOPERATIVE STATE RESEARCH SERVICE	219.0	234.9	221.7	219.8	228.4	226.3
ECONOMIC RESEARCH SERVICE	39.3	39.0	45.0	37.0	38.7	41.3
FOREST SERVICE	112.1	105.0	100.8	113.2	107.3	100.6
HUMAN NUTRITION INFORMATION SERVICE	8.5	8.2	6.6	3.8	12.5	6.6
OFFICE OF INTERNATIONAL COOPERATION AND DEVELOPMENT	2.6	8.8	7.5	4.6	6.8	7.7
OFFICE OF TRANSPORTATION	.9	.8	.8	.9	.8	.8
STATISTICAL REPORTING SERVICE	7.0	7.9	8.2	7.0	7.9	8.2
DEPARTMENT OF COMMERCE, TOTAL	336.3	338.6	224.3	285.4	315.2	248.9
BUREAU OF THE CENSUS	3.8	4.4	4.5	3.7	4.2	4.5
ECONOMIC DEVELOPMENT ADMINISTRATION	9.6	10.0	-	12.1	14.0	.8
NATIONAL BUREAU OF STANDARDS	88.8	93.6	78.0	86.6	85.7	80.1
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION	222.0	220.5	142.1	174.1	200.7	153.8
NATIONAL TELECOMMUNICATIONS & INFORMATION ADMIN	11.3	8.9	8.3	8.0	9.6	8.5
OFFICE OF THE SECRETARY	*	.5	.7	.2	.3	.5
PATENT AND TRADEMARK OFFICE	.7	.7	.7	.7	.7	.7
DEPARTMENT OF DEFENSE, TOTAL	20,622.6	23,125.1	29,725.5	18,251.2	21,959.5	26,865.7
DEPARTMENT OF THE ARMY	3,760.5	3,965.0	4,904.1	3,400.9	3,834.9	4,539.8
MILITARY FUNCTIONS	3,731.5	3,935.6	4,874.8	3,371.8	3,805.5	4,510.4
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	145.7	144.7	192.2	145.3	144.5	151.9
RDT&E APPROPRIATION	3,585.8	3,790.9	4,722.6	3,226.5	3,661.0	4,358.5
CIVIL FUNCTIONS (CORPS OF ENGINEERS)	29.0	29.4	29.4	29.0	29.4	29.4
DEPARTMENT OF THE NAVY	5,845.1	6,043.7	8,063.3	5,269.4	5,933.7	7,158.0
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	130.3	145.2	145.1	139.9	144.8	144.7
RDT&E APPROPRIATION	5,713.4	5,895.5	7,914.4	5,126.0	5,788.2	7,012.4
SPECIAL FOREIGN CURRENCY PROGRAM	1.3	3.0	3.8	3.5	.7	.9
DEPARTMENT OF THE AIR FORCE	9,357.9	10,937.3	13,864.0	8,141.4	10,213.0	12,621.1
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	365.7	402.0	425.0	388.4	394.0	417.0
RDT&E APPROPRIATION	8,992.2	10,535.3	13,439.0	7,753.0	9,819.0	12,204.1
DEFENSE AGENCIE	1,618.1	2,115.3	2,847.8	1,394.8	1,928.1	2,493.8
RDT&E APPROPRIATION	-	-	-	1,394.8	1,928.1	2,493.8
DIRECTOR OF TEST & EVALUATION, DEFENSE	41.0	63.8	56.3	44.8	49.8	53.0
DEPARTMENT OF EDUCATION	128.0	145.4	126.3	150.1	173.6	161.1
DEPARTMENT OF ENERGY	4,708.2	4,605.4	4,516.8	4,842.1	5,080.1	4,799.7
DEPARTMENT OF HEALTH AND HUMAN SERVICES, TOTAL	3,940.7	4,326.7	4,434.8	4,015.3	4,294.4	4,380.0
ALCOHOL, DRUG ABUSE & MENTAL HEALTH ADMINISTRATION	248.1	284.1	320.8	291.7	295.1	321.9
CENTERS FOR DISEASE CONTROL	75.0	71.6	76.8	88.4	72.5	60.1
FOOD & DRUG ADMINISTRATION	73.0	76.6	82.1	58.4	61.3	65.7
HEALTH CARE FINANCING ADMINISTRATION	29.1	30.0	30.0	29.1	30.0	30.0
HEALTH RESOURCES AND SERVICES ADMIN	10.1	9.9	1.2	17.5	20.3	5.4
HUMAN DEVELOPMENT SERVICES	27.2	25.0	11.9	33.0	25.9	23.6
NATIONAL INSTITUTES OF HEALTH	3,433.1	3,773.7	3,853.2	3,439.6	3,738.6	3,818.1
OFFICE OF ASSISTANT SECRETARY FOR HEALTH	16.1	16.9	18.5	29.0	17.9	17.9
OFFICE OF THE SECRETARY	13.4	14.7	11.0	13.4	14.7	11.0
SOCIAL SECURITY ADMINISTRATION	15.5	24.3	29.3	15.4	18.2	26.3
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT	28.9	31.9	27.2	37.0	34.7	31.2
DEPARTMENT OF THE INTERIOR, TOTAL	381.1	397.1	327.8	393.6	429.4	357.2
BUREAU OF LAND MANAGEMENT	5.3	6.6	6.7	5.3	6.6	6.7
BUREAU OF MINES	94.7	104.7	67.9	105.0	119.6	81.8
BUREAU OF RECLAMATION	10.1	9.8	10.0	10.7	12.5	10.0
GEOLOGICAL SURVEY	153.6	150.3	136.0	150.1	166.8	144.6
MINERAL MANAGEMENT SERVICE	-	1.5	1.5	-	1.2	1.2
NATIONAL PARK SERVICE	11.2	11.8	12.5	11.2	11.8	12.5
OFFICE OF THE SECRETARY	.5	6.8	1.6	.4	6.1	1.5
OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT	1.5	1.5	1.0	1.6	2.0	2.0
OFFICE OF WATER RESEARCH & TECHNOLOGY	11.4	7.2	-	19.4	10.5	-
UNITED STATES FISH AND WILDLIFE SERVICE	93.9	97.0	90.6	90.1	92.4	97.0

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TABLE C-9. FEDERAL FUNDS FOR TOTAL RESEARCH AND DEVELOPMENT, BY AGENCY: FISCAL YEARS 1982, 1983, AND 1984

(MILLIONS OF DOLLARS)

- CONTINUED

AGENCY AND SUBDIVISION	OBLIGATIONS			OUTLAYS		
	1982	ESTIMATES		1982	ESTIMATES	
		1983	1984		1983	1984
DEPARTMENT OF JUSTICE, TOTAL	26.7	25.4	23.7	26.6	26.1	26.4
DRUG ENFORCEMENT ADMINISTRATION	3.2	2.6	2.3	2.7	2.9	3.0
FEDERAL BUREAU OF INVESTIGATION	2.7	1.1	2.6	1.1	2.0	1.5
FEDERAL PRISON SYSTEM	1.7	2.1	1.6	1.7	2.1	1.6
IMMIGRATION AND NATURALIZATION SERVICE	.6	1.2	.5	.3	1.2	.5
OFFICE OF JUSTICE ASSISTANCE, RESEARCH, AND STATISTICS	18.0	27.5	16.0	30.4	26.8	19.1
OFFICE OF LEGAL POLICY	.4	.8	.7	.4	1.1	.6
DEPARTMENT OF LABOR, TOTAL	25.4	18.0	19.6	29.4	18.8	18.2
BUREAU OF LABOR STATISTICS	.3	.3	.4	.3	.3	.4
EMPLOYMENT STANDARDS ADMINISTRATION	1.4	2.0	1.3	1.3	1.9	1.2
EMPLOYMENT AND TRAINING ADMINISTRATION	16.1	7.2	8.3	20.2	8.1	7.3
LABOR-MANAGEMENT SERVICES ADMINISTRATION	.7	.8	1.8	.7	.7	1.5
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION	4.9	5.7	5.7	4.9	5.7	5.7
OFFICE OF THE SECRETARY	.9	1.0	1.2	.9	1.0	1.2
PENSION BENEFIT GUARANTEE CORPORATION	1.1	1.0	1.0	1.1	1.0	1.0
DEPARTMENT OF STATE, TOTAL	1.5	1.6	1.6	1.5	1.6	1.6
DEPARTMENTAL FUNDS	1.5	1.6	1.6	1.5	1.6	1.6
DEPARTMENT OF TRANSPORTATION, TOTAL	310.1	394.5	520.0	347.0	369.4	451.7
COAST GUARD	20.0	20.0	22.0	20.0	20.0	22.0
FEDERAL AVIATION ADMINISTRATION	94.3	142.6	303.9	106.6	126.0	232.3
FEDERAL HIGHWAY ADMINISTRATION	40.3	53.9	48.7	42.5	45.5	50.4
FEDERAL RAILROAD ADMINISTRATION	18.2	29.5	17.[illegible]	17.4	29.8	12.5
MARITIME ADMINISTRATION	11.1	17.3	13.[illegible]	18.9	18.3	15.2
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION	55.4	59.2	57.0	59.7	58.1	56.4
OFFICE OF THE SECRETARY	3.3	5.6	7.3	5.6	5.8	6.0
RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION	6.1	7.3	5.6	6.5	6.0	4.6
URBAN MASS TRANSPORTATION ADMINISTRATION	61.4	59.1	45.5	69.8	60.3	52.3
DEPARTMENT OF THE TREASURY, TOTAL	13.3	16.1	16.4	13.6	16.4	16.4
BUREAU OF ENGRAVING AND PRINTING	4.8	5.0	5.1	4.8	5.0	5.1
INTERNAL REVENUE SERVICE	5.4	8.4	8.7	5.4	8.4	8.7
OFFICE OF PROTECTIVE RESEARCH	-	*	*	.3	.3	*
UNITED STATES CUSTOMS SERVICE	3.1	2.6	2.6	3.1	2.6	2.6
OTHER AGENCIES						
ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS	2.0	2.0	2.0	1.8	1.9	2.0
AGENCY FOR INTERNATIONAL DEVELOPMENT	199.9	175.2	206.5	178.3	237.6	243.3
APPALACHIAN REGIONAL COMMISSION	.4	.3	-	.4	.3	-
CONSUMER PRODUCT SAFETY COMMISSION	.2	.5	.5	.2	.5	.4
ENVIRONMENTAL PROTECTION AGENCY	335.1	240.8	207.7	336.2	295.2	249.8
FEDERAL COMMUNICATIONS COMMISSION	1.2	1.2	1.0	1.2	1.2	1.1
FEDERAL EMERGENCY MANAGEMENT AGENCY	9.2	3.7	13.0	8.8	3.5	12.4
FEDERAL HOME LOAN BANK BOARD	2.7	3.0	3.1	2.7	3.0	3.1
FEDERAL TRADE COMMISSION	1.2	1.7	1.7	1.2	1.7	1.7
GENERAL SERVICES ADMINISTRATION	1.0	.7	1.8	1.0	.7	1.8
INTERNATIONAL TRADE COMMISSION	3.8	4.0	4.4	3.8	4.0	4.4
LIBRARY OF CONGRESS	5.7	6.0	6.0	5.4	6.2	6.1
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	3,077.9	2,416.0	2,442.5	3,140.7	2,538.0	3,461.8
NATIONAL SCIENCE FOUNDATION	975.3	1,060.2	1,240.5	1,013.6	1,001.6	1,137.3
NUCLEAR REGULATORY COMMISSION	220.3	209.5	199.7	208.6	205.5	199.7
SMITHSONIAN INSTITUTION	52.4	55.7	63.6	48.0	55.1	58.0
TENNESSEE VALLEY AUTHORITY	85.0	74.9	78.3	89.3	75.1	78.2
UNITED STATES ARMS CONTROL AND DISARMAMENT AGENCY	1.9	1.2	6.1	1.9	1.2	6.1
UNITED STATES INFORMATION AGENCY	.1	2.2	6.4	*	.9	5.3
VETERANS ADMINISTRATION	137.3	162.7	159.8	137.7	157.4	156.4

* INDICATES AMOUNT LESS THAN $50,000.

SOURCE: NATIONAL SCIENCE FOUNDATION

other science resources publications

Science Resources Studies Highlights

	NSF No.	Price
R&D Funds		
"Dollar Value of U.S. R&D Expenditures Overseas Declined in 1982	83-329	-----
S/E Personnel		
"Science and Engineering Jobs Grew Twice as Fast as Overall U.S. Employment with Industry Taking the Lead	84-319	-----
"Science and Engineering Employment in Academia Grew 3% in 1983	84-317	-----
"Graduate Science/Engineering Enrollment Grew by 2% Between Fall 1981 and 1982. With Computer Science, Up 20%, Leading Growth	84-313	-----
"1982 Job Market for New Science and Engineering Graduates About the Same as That of Previous Years	84-310	-----
"Industry Reports Shortages of Scientists and Engineers Down Substantially From 1982 to 1983	84-303	-----
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Technical Employment Growth Accelerates in Selected Nonmanufacturing Industries	83-321	-----
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"Manufacturing Employment Becoming Increasingly More Technological	83-303	-----

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Characteristics of Recent Science/Engineering Graduates: 1982	84-318	-----
Academic Science/Engineering: Scientists and Engineers, January 1983	84-309	-----
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Science and Engineering Doctorates: 1960-82	[illegible]	-----
Scientists, Engineers, and Technicians in Manufacturing and Nonmanufacturing Industries: 1980-81	83-324	-----
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Trends to 1982 in Industrial Basic Research	83-302	$3.50
S/E Personnel		
Scientific and Technical Work Force in Trade and Regulated Industries Shows Major Shift in Occupational Composition 1979-82	83-323	-----
Projected Response of the Science, Engineering, and Technical Labor Market to Defense and Nondefense Needs, 1982-87	84-304	-----
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A Guide to NSF Science/Engineering Resources Data	84-301	-----
Science and Technology Data Book	83-318	-----

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