

R&D in the New England States

A Presentation on July 20, 2000
The Capitol

American Association for the Advancement of Science
(AAAS Center for Science, Technology, and Congress
AAAS R&D Budget and Policy Program)

American Association for the Advancement of Science
Center for Science, Technology and Congress
1200 New York Ave, NW
Washington, DC 20005
(202) 326-6600
www.aaas.org/spp/dspp/cstc/cstc.htm

This report is a special presentation on the impact of federal R&D to states and regions. It is an update to an earlier 1997 AAAS report, *The Future of Science and Technology in New England: Trends and Indicators*, and is part of a AAAS series of reports on the state and regional impacts of federal R&D. More information on these reports can be found on the AAAS Center for Science and Technology Congress web site (www.aaas.org/spp/dspp/cstc/cstc.htm) and at the AAAS R&D Budget and Policy Program home page (www.aaas.org/spp/R&D).

Highlights

- The New England states received a total of **\$4.7 billion in federal R&D** obligations in FY 1998, the latest year for which state-level data are available. New England's share of the U.S. total was 6.4 percent in FY 1998, slightly more than New England's 5.0 percent share of the U.S. population (see Chart 1 and Table 1).
- **Almost two thirds of federal R&D to New England is performed by industry and academic institutions.** Nonprofits are the third significant performer of R&D with \$789 million in obligations in FY 1998. New England nonprofits receive more than a quarter of all federal R&D funds to nonprofits. Five of the top 10 nonprofit recipients of federal R&D are in New England, including the top three (Mitre Corporation, Mass. General Hospital, and Brigham and Women's Hospital).
- The **Department of Defense (DOD) is the largest federal supporter of R&D** in New England, providing \$2.3 billion in FY 1998, nearly two thirds of which went to Massachusetts (see Table 2 and Chart 2). DOD funds a similar percentage of all federal R&D. Nearly all of DOD's support funds R&D in industrial firms. Before defense cutbacks, DOD used to fund a majority of federal R&D to New England.
- The **Department of Health and Human Services (HHS) is the second largest federal sponsor**, for a total of \$1.5 billion in FY 1998, mostly from the National Institutes of Health. New England is especially competitive for HHS funding, and receives 11 percent of all HHS R&D. HHS is responsible for more than half of all federal support for R&D at New England colleges and universities, and also at nonprofit institutions.
- The National Science Foundation (NSF) spent 10 percent of its total R&D budget in New England in FY 1998, and was the third largest agency supporter.
- From FY 1970 through 1987, federal R&D to the New England states climbed to over \$7 billion (in constant FY 2000 dollars) and then immediately fell in FY 1988 as a result of cuts in DOD R&D funding, and has stayed relatively constant since then (see Chart 3).
- Massachusetts received the lion's share of federal R&D over that time period and experienced the greatest amount of change in its federal R&D funding. In FY 1998, Massachusetts received 67 percent of the total federal R&D that went to New England. The remaining states have had less dramatic change in their federal R&D funding during that same time period.
- Massachusetts' ranking among the top recipients of federal R&D has dropped from a consistent 3rd until the mid 1980s down to 7th in FY 1998. Rhode Island and New Hampshire have improved their rankings over the past several decades, Rhode Island from 35th in 1970 to 25th in 1998, and New Hampshire from 38th to 32nd. Vermont, Connecticut, and Maine have remained stable in rankings.
- Overall, New England's 6.4 percent share of federal R&D is above the region's 5 percent share of the U.S. population, but both shares are declining (see Chart 4).
- **New England universities and colleges received a total of \$1.3 billion in federal R&D** in FY 1998, approximately 9.5 percent of the U.S. total (see Chart 5 and Table 3).

- New England is home to over 16 major universities and colleges that conduct federal R&D. Four are ranked in the top 50 recipients of federal R&D (MIT (7th), Harvard (9th), Yale, and Boston University). An additional 7 are ranked in the top 100 recipients of federal R&D (see Table 3).
- Federal R&D to New England academic institutions is highly concentrated - MIT, Harvard, and Yale together receive more than half the total.
- Of the total \$1.3 billion that went to universities and colleges in FY 1998, 56 percent (\$755 million) came from HHS (NIH). NSF was second with \$213 million (16 percent), and DOD was third with \$143 million (11 percent). (See Table 3 and Chart 6.)
- New England institutions are competitive for R&D funds. Nearly 15 percent of the Department of Energy's (DOE) academic R&D support goes to New England, and 10 percent of NSF. DOD and HHS each send 9 percent of their academic R&D funds to New England.
- **New England institutions depend on the federal government for nearly 70 percent of their total R&D performance**, including more than 75 percent for MIT, Harvard, Yale, and Boston University. Nationwide, the federal government funds nearly 60 percent of all R&D performed at universities, dwarfing all other funding sources (see Table 4).
- Although total federal R&D funding to New England universities has increased over time (see Chart 7), **New England universities' share of total federal R&D to universities has been declining for some time, as other regions' universities become more competitive for federal R&D funds** (see Chart 8). The decline is due almost entirely to loss of market share by Massachusetts institutions.
- In New England, as in the United States, **industry is the dominant performer of R&D**. Of the \$16.9 billion in R&D (all sources of funds, including non-federal) performed in New England in 1997, \$13 billion was performed by industry (see Table 5 and Chart 9).
- Although New England is only 5.0 percent of the U.S. population, New England performs 8.0 percent of total U.S. R&D of \$211 billion.
- Most of industry's performance of R&D in New England and the U.S. comes from industry's own funds (see Table 6 and Chart 10). **A majority of New England's R&D is financed by industry** (\$11 billion out of nearly \$17 billion). The remainder of industry's performance of R&D is funded mostly by the Department of Defense.

There are six tables for each of the New England states providing details of federal R&D to Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

Table 1. Federal R&D to New England by Performer, Fiscal Year 1998
(obligations in millions of dollars)

	Federal Labs	Industry	Univs./ Colleges	FFRDCs*	Nonprofits	State/ Local	TOTAL
Connecticut (23)	18	379	268	0	24	6	695
Maine (44)	11	44	16	0	32	2	105
Massachusetts (7)	302	992	833	284	707	5	3,123
New Hampshire (32)	37	164	69	0	2	1	272
Rhode Island (25)	235	78	61	0	23	2	399
Vermont (47)	4	13	38	0	1	1	58
Total New England	608	1,670	1,284	284	789	17	4,653
U.S. Total	17,017	32,252	13,329	6,378	2,946	429	72,350
N.E. % of U.S.	3.6%	5.2%	9.6%	4.5%	26.8%	4.0%	6.4%

Source: National Science Foundation, *Federal Funds for Research and Development Fiscal Years 1998, 1999, and 2000, 2000.*

R&D data are for the 10 largest R&D supporting agencies only.

* Federally Funded Research and Development Centers. Government-owned, contractor-operated laboratories.

Numbers in parentheses refer to ranking among 50 states and DC in federal R&D received.

R&D = conduct of R&D and R&D plant (facilities and capital equipment).

Table 2. Federal R&D to New England by Agency, Fiscal Year 1998
(obligations in millions of dollars)

	DOD	HHS	NSF	NASA	DOE	DOC	other	TOTAL
Connecticut (23)	284	237	27	63	55	6	23	695
Maine (44)	48	32	6	3	0	6	9	105
Massachusetts (7)	1,441	1,125	178	143	106	44	86	3,123
New Hampshire (32)	184	36	13	18	1	11	10	272
Rhode Island (25)	301	50	18	3	2	8	17	399
Vermont (47)	14	29	5	1	1	1	8	58
Total New England	2,271	1,509	246	232	164	76	154	4,653
U.S. Total	35,193	13,949	2,464	9,871	6,599	997	3,277	72,350
N.E. % of U.S.	6.5%	10.8%	10.0%	2.3%	2.5%	7.6%	4.7%	6.4%

Source: National Science Foundation, *Federal Funds for Research and Development Fiscal Years 1998, 1999, and 2000, 2000.*

R&D data are for the 10 largest R&D supporting agencies only.

Numbers in parentheses refer to ranking among 50 states and DC in federal R&D received.

R&D = conduct of R&D and R&D plant (facilities and capital equipment).

Table 3. Federal R&D to New England Colleges and Universities, Fiscal Year 1998
(obligations in millions of dollars)

	HHS	NSF	DOD	DOE	NASA	USDA	other	TOTAL
MIT (7)	56	41	58	59	27	0	6	248
Harvard (9)	178	20	11	7	6	1	8	230
Yale (12)	183	14	7	9	4	1	0	218
Boston U (30)	88	13	13	3	5	0	4	126
U MA Worcester (81)	51	0	1	0	1	0	0	53
Woods Hole (82)	0	38	12	0	1	0	0	51
U Conn (86)	30	9	3	1	0	2	2	47
Dartmouth (92)	32	6	3	0	1	0	1	44
Tufts (97)	36	3	1	1	0	0	1	42
Brown (98)	20	10	6	2	2	0	0	41
U Vermont (100)	28	4	1	1	0	4	1	39
U MA Amherst (104)	8	16	3	2	1	4	0	35
U NH Durham (120)	2	5	0	1	8	2	5	24
U Rhode Island (124)	6	7	2	0	1	2	5	23
Brandeis (130)	16	3	1	1	0	0	0	22
Northeastern (140)	5	5	6	1	1	0	0	18
All Other	16	18	15	2	2	5	6	64
Total New England	755	213	143	91	61	20	41	1,324
U.S. Total	7,993	2,094	1,547	623	791	590	365	14,004
N.E. % of U.S.	9.4%	10.1%	9.2%	14.5%	7.7%	3.5%	11.2%	9.5%

Source: National Science Foundation, *Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, Fiscal Year 1998, 2000.*

Figures may differ from other tables because of differing survey methods.

Figures in parentheses denote national rank among universities and colleges receiving the most federal R&D funds.

R&D = conduct of R&D and R&D plant (facilities and capital equipment).

Table 4. Total R&D Expenditures at New England Colleges and Universities by Source of Funds, Fiscal Year 1998
(expenditures in millions of dollars)

	Federal	State/ Local	Industry	Institutional Funds	All Other	TOTAL R&D	Federal / Total R&D
MIT (8)	311	3	61	28	11	413	75.2%
Harvard (17)	252	0	10	0	44	306	82.3%
Yale (26)	205	1	16	16	24	263	78.1%
U Conn (69)	53	12	10	49	10	134	39.6%
Boston U (72)	104	2	9	0	15	130	80.3%
Tufts (94)	61	1	6	17	7	92	66.4%
U MA Amherst (97)	43	7	6	27	6	90	48.0%
U MA Worcester (102)	54	16	3	6	4	83	64.8%
Woods Hole (109)	65	0	0	2	8	75	86.3%
Brown (111)	44	0	2	25	3	74	60.0%
Dartmouth (116)	45	3	3	8	6	65	69.4%
U Vermont (121)	31	3	6	12	6	58	54.4%
U NH (127)	26	5	4	9	8	52	49.5%
Brandeis (135)	28	0	0	5	12	45	63.0%
U Rhode Island (146)	33	3	0	1	0	38	87.8%
U Maine (155)	13	2	7	11	0	33	39.4%
All Other	75	4	13	15	12	118	63.2%
Total New England	1,444	61	154	232	178	2,069	69.8%
U.S. Total	15,077	1,928	1,870	4,999	1,861	25,735	58.6%
N.E. % of U.S.	9.6%	3.1%	8.3%	4.6%	9.5%	8.0%	

Source: National Science Foundation, *Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 1998*, 2000.

These data differ significantly from the federal R&D data for the following reasons:

1/ data are from performer surveys rather than funding sources; 2/ data are in expenditures rather than obligations; and 3/ R&D in this survey does not include R&D facilities.

Figures in parentheses denote national rank among universities and colleges performing the most R&D (all sources of funds).

Table 5. Total R&D (all funding sources) in New England by Performer, 1997
(expenditures in millions of dollars)

	Federal Labs	Industry	Univs./ Colleges	FFRDCs*	Nonprofits	TOTAL
Connecticut (16)	33	3,014	393	0	15	3,454
Maine (47)	6	83	33	0	27	149
Massachusetts (5)	361	8,300	1,268	515	652	11,097
New Hampshire (35)	37	652	108	0	2	799
Rhode Island (32)	202	704	112	0	22	1,040
Vermont (42)	7	246	60	0	1	314
Total New England	646	12,999	1,973	515	719	16,853
U.S. Total **	16,814	157,539	25,001	6,286	3,036	211,268
N.E. % of U.S.	3.8%	8.3%	7.9%	8.2%	23.7%	8.0%

Source: National Science Foundation, *National Patterns of R&D Resources 1999 Data Update*, 1999.

* Federally Funded Research and Development Centers. Government-owned, contractor-operated laboratories. FFRDCs operated by universities/colleges and nonprofits only. Industry FFRDCs are included under industry.

** U.S. Total includes approximately \$2.6 billion not distributed by performer.

Nonfederal support for FFRDCs and nonprofits are not included.

State and local government performance of R&D is not included.

Numbers in parentheses are ranking among 50 states and DC in total R&D performed.

Conduct of R&D only (R&D facilities and capital equipment excluded).

These data differ significantly from the federal R&D data for the following reasons:

1/ data are for calendar year 1997 rather than FY 1998; 2/ data are from performer surveys rather than funding sources; and 3/ data are in expenditures rather than obligations.

Table 6. Total R&D (all funding sources) in New England by Funding Source, 1997
(expenditures in millions of U.S. dollars)

	Federal Government*	Industry*	Univs./ Colleges	State / Local Government	Nonprofits	TOTAL
Connecticut (16)	597	2,732	76	14	35	3,454
Maine (47)	68	69	11	2	0	149
Massachusetts (5)	3,841	7,006	125	29	96	11,097
New Hampshire (35)	279	484	15	8	12	799
Rhode Island (32)	416	594	27	1	3	1,040
Vermont (42)	50	243	11	3	6	314
Total New England	5,251	11,128	265	56	153	16,853
U.S. Total **	64,912	135,384	4,686	1,940	1,754	211,268
N.E. % of U.S.	8.1%	8.2%	5.7%	2.9%	8.7%	8.0%

Source: National Science Foundation, *National Patterns of R&D Resources 1999 Data Update*, 1999.

* For some states, detailed data on federal vs. industry funding of industry-performed R&D are missing. Some values in these columns are imputed based on federal R&D obligations data for FY 1997.

** U.S. Total includes approximately \$2.6 billion not distributed by funding source.

Nonfederal government support for FFRDCs and nonprofits are not included.

State and local government support for their own R&D performance is not included.

Numbers in parentheses are ranking among 50 states and DC in total R&D performed.

Conduct of R&D only (R&D facilities and capital equipment excluded).

These data differ significantly from the federal R&D data for the following reasons:

1/ data are for calendar year 1997 rather than FY 1998; 2/ data are from performer surveys rather than funding sources; and 3/ data are in expenditures rather than obligations.

Table. Federal R&D to Connecticut by Agency and Performer, Fiscal Year 1998
(obligations in millions of dollars)

	DOD	HHS	NASA	DOE	NSF	DOT	other	TOTAL
Federal Labs	5	0	0	0	0	9	4	18
Industry	260	7	59	44	2	4	3	379
Univs. / Colleges	9	216	2	11	24	0	5	268
FFRDCs *	0	0	0	0	0	0	0	0
Nonprofits	10	11	2	0	0	0	0	24
State / Local Govts.	0	3	0	0	0	2	1	6
Total Connecticut	284	237	63	55	27	15	14	695
U.S. Total	35,193	13,949	9,871	6,599	2,464	583	3,691	72,350
CT % of U.S.	0.8%	1.7%	0.6%	0.8%	1.1%	2.5%	0.4%	1.0%

Source: National Science Foundation, Federal Funds for Research and Development
Fiscal Years 1998, 1999, and 2000, 2000.

R&D data are for the 10 largest R&D supporting agencies only.

* Federally Funded Research and Development Centers. Government-owned, contractor-operated laboratories.

R&D = conduct of R&D and R&D plant (facilities and capital equipment).

Table. Federal R&D to Maine by Agency and Performer, Fiscal Year 1998
(obligations in millions of dollars)

	DOD	HHS	NSF	DOC	Interior	USDA	other	TOTAL
Federal Labs	3	0	0	4	3	0	0	11
Industry	42	2	0	0	0	0	0	44
Univs. / Colleges	3	1	4	1	1	4	2	16
FFRDCs *	0	0	0	0	0	0	0	0
Nonprofits	1	27	2	1	0	0	1	32
State / Local Govts.	0	1	0	0	0	0	1	2
Total Maine	48	32	6	6	4	4	4	105
U.S. Total	35,193	13,949	2,464	997	532	1,527	17,687	72,350
Maine % of U.S.	0.1%	0.2%	0.3%	0.6%	0.7%	0.3%	0.0%	0.1%

Source: National Science Foundation, *Federal Funds for Research and Development Fiscal Years 1998, 1999, and 2000, 2000.*

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* Federally Funded Research and Development Centers. Government-owned, contractor-operated laboratories.

R&D = conduct of R&D and R&D plant (facilities and capital equipment).

Table. Federal R&D to Massachusetts by Agency and Performer, Fiscal Year 1998
(obligations in millions of dollars)

	DOD	HHS	NSF	NASA	DOE	DOC	other	TOTAL
Federal Labs	191	1	1	25	0	31	53	302
Industry	827	89	17	25	18	9	8	992
Univs. / Colleges	105	435	149	43	82	4	14	833
FFRDCs *	284	0	0	0	0	0	0	284
Nonprofits	34	597	10	50	7	1	9	707
State / Local Govts.	0	2	0	0	0	0	3	5
Total Massachusetts	1,441	1,125	178	143	106	44	86	3,123
U.S. Total	35,193	13,949	2,464	9,871	6,599	997	3,277	72,350
MA % of U.S.	4.1%	8.1%	7.2%	1.5%	1.6%	4.4%	2.6%	4.3%

Source: National Science Foundation, Federal Funds for Research and Development
Fiscal Years 1998, 1999, and 2000, 2000.

R&D data are for the 10 largest R&D supporting agencies only.

* Federally Funded Research and Development Centers. Government-owned, contractor-operated laboratories.

R&D = conduct of R&D and R&D plant (facilities and capital equipment).

Table. Federal R&D to New Hampshire by Agency and Performer, Fiscal Year 1998
(obligations in millions of dollars)

	DOD	HHS	NASA	NSF	DOC	USDA	other	TOTAL
Federal Labs	28	0	0	1	3	3	2	37
Industry	150	3	8	1	2	0	0	164
Univs. / Colleges	5	33	10	11	6	2	3	69
FFRDCs *	0	0	0	0	0	0	0	0
Nonprofits	2	0	0	0	0	0	0	2
State / Local Govts.	0	0	0	0	0	0	1	1
Total New Hampshire	184	36	18	13	11	5	6	272
U.S. Total	35,193	13,949	9,871	2,464	997	1,527	8,349	72,350
NH % of U.S.	0.5%	0.3%	0.2%	0.5%	1.1%	0.3%	0.1%	0.4%

Source: National Science Foundation, *Federal Funds for Research and Development Fiscal Years 1998, 1999, and 2000, 2000.*

R&D data are for the 10 largest R&D supporting agencies only.

* Federally Funded Research and Development Centers. Government-owned, contractor-operated laboratories.

R&D = conduct of R&D and R&D plant (facilities and capital equipment).

Table. Federal R&D to Rhode Island by Agency and Performer, Fiscal Year 1998
(obligations in millions of dollars)

	DOD	HHS	NSF	EPA	DOC	NASA	other	TOTAL
Federal Labs	218	0	0	10	5	0	2	235
Industry	75	1	0	1	0	0	0	78
Univs. / Colleges	8	25	17	1	2	3	5	61
FFRDCs *	0	0	0	0	0	0	0	0
Nonprofits	0	22	1	0	0	0	0	23
State / Local Govts.	0	1	0	0	0	0	1	2
Total Rhode Island	301	50	18	12	8	3	8	399
U.S. Total	35,193	13,949	2,464	635	997	9,871	9,241	72,350
RI % of U.S.	0.9%	0.4%	0.7%	1.9%	0.8%	0.0%	0.1%	0.6%

Source: National Science Foundation, Federal Funds for Research and Development
Fiscal Years 1998, 1999, and 2000, 2000.

R&D data are for the 10 largest R&D supporting agencies only.

* Federally Funded Research and Development Centers. Government-owned, contractor-operated laboratories.

R&D = conduct of R&D and R&D plant (facilities and capital equipment).

Table. Federal R&D to Vermont by Agency and Performer, Fiscal Year 1998
(obligations in millions of dollars)

	HHS	DOD	USDA	NSF	Interior	DOC	other	TOTAL
Federal Labs	0	1	2	0	1	0	0	4
Industry	0	11	0	0	0	0	1	13
Univs. / Colleges	28	1	4	4	0	0	1	38
FFRDCs *	0	0	0	0	0	0	0	0
Nonprofits	1	0	0	0	0	1	0	1
State / Local Govts.	0	0	0	0	0	0	1	1
Total Vermont	29	14	5	5	1	1	3	58
U.S. Total	13,949	35,193	1,527	2,464	532	997	17,687	72,350
Vermont % of U.S.	0.2%	0.0%	0.4%	0.2%	0.3%	0.1%	0.0%	0.1%

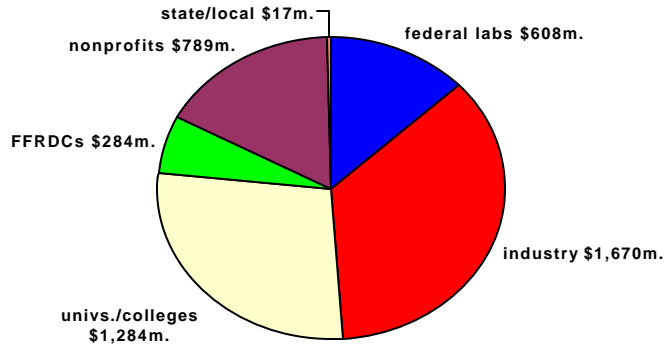
Source: National Science Foundation, *Federal Funds for Research and Development Fiscal Years 1998, 1999, and 2000, 2000.*

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* Federally Funded Research and Development Centers. Government-owned, contractor-operated laboratories.

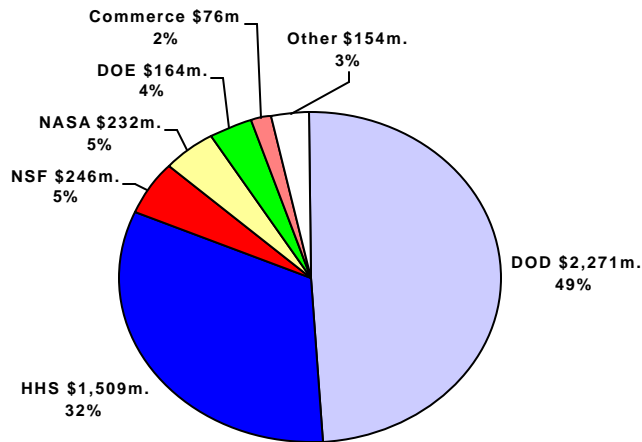
R&D = conduct of R&D and R&D plant (facilities and capital equipment).

Chart 1. Federal R&D to New England by Performer
 FY 1998 (obligations in millions of dollars)
 Total: \$4.7 billion



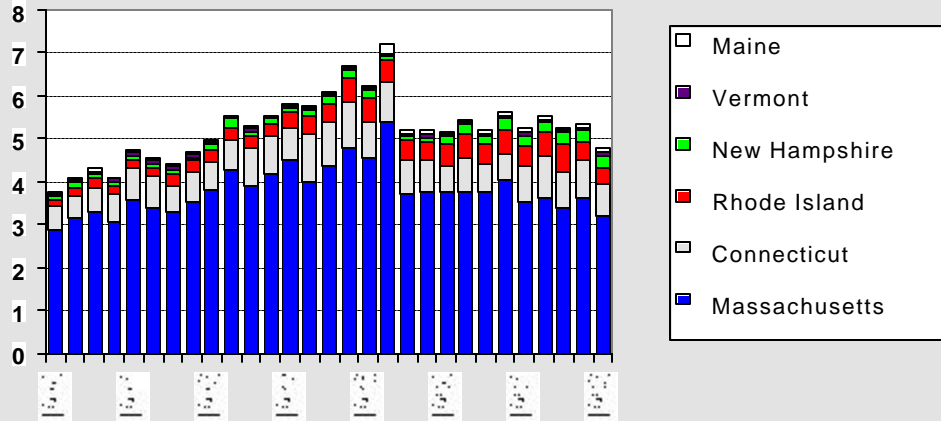
Source: National Science Foundation, Federal Funds for Research and Development, Fiscal Years 1998, 1999, and 2000, 2000.
 R&D = conduct of R&D and R&D plant.
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Chart 2. Federal R&D to New England by Agency
 FY 1998 (obligations in millions of dollars)
 Total: \$4.7 billion



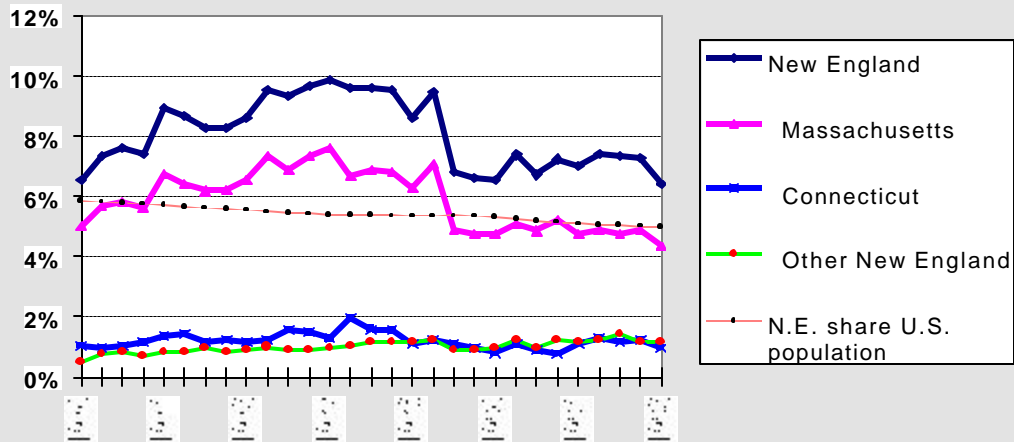
Source: National Science Foundation, Federal Funds for Research and Development, Fiscal Years 1998, 1999, and 2000, 2000.
 R&D = conduct of R&D and R&D plant.
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Chart 3. Federal R&D to New England, FY 1970-1998
(billions of constant FY 2000 dollars)



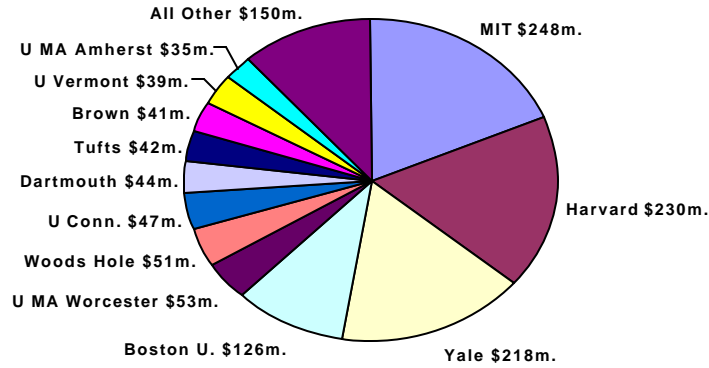
Source: National Science Foundation, Federal Funds for Research and Development Historical Tables.
R&D = conduct of R&D and R&D plant.
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Chart 4. New England share of federal R&D, FY 1970-1998
(percent of total federal R&D)



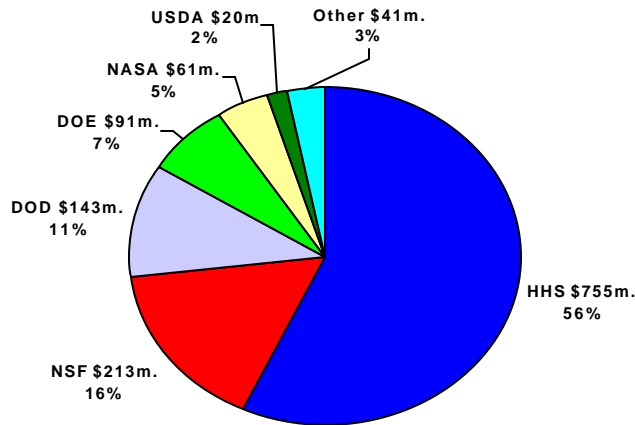
Source: National Science Foundation, Federal Funds for Research and Development Historical Tables.
R&D = conduct of R&D and R&D plant.
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Chart 5. Federal R&D to New England Colleges and Universities
 FY 1998 (obligations in millions of dollars)
 Total: \$1.3 billion



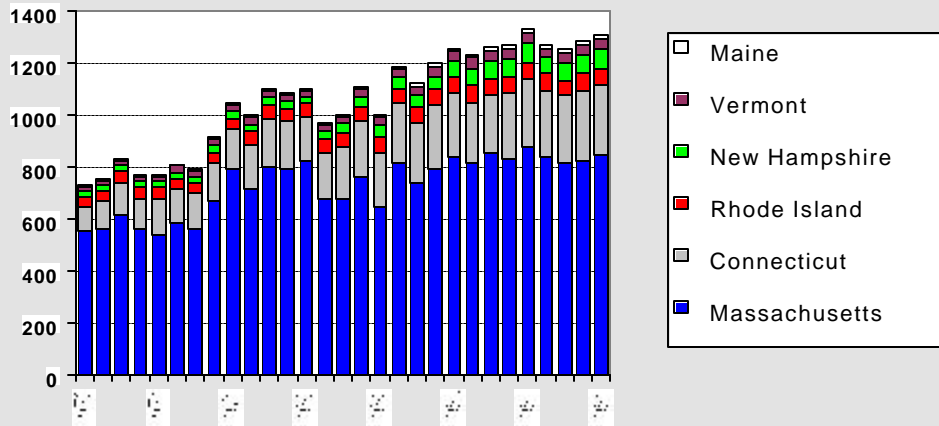
Source: National Science Foundation, *Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, FY 1998, 2000.*
 R&D = conduct of R&D and R&D plant.
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Chart 6. Federal R&D to New England Colleges and Universities
 FY 1998 (obligations in millions of dollars)
 Total: \$1.3 billion



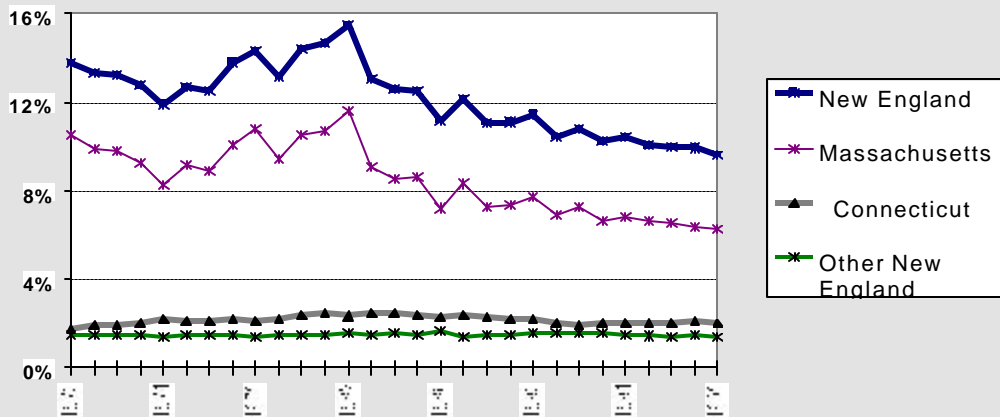
Source: National Science Foundation, *Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, FY 1998, 2000.*
 R&D = conduct of R&D and R&D plant.
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Chart 7. Federal R&D to New England Universities and Colleges, FY 1970-1998
 (millions of constant FY 2000 dollars)



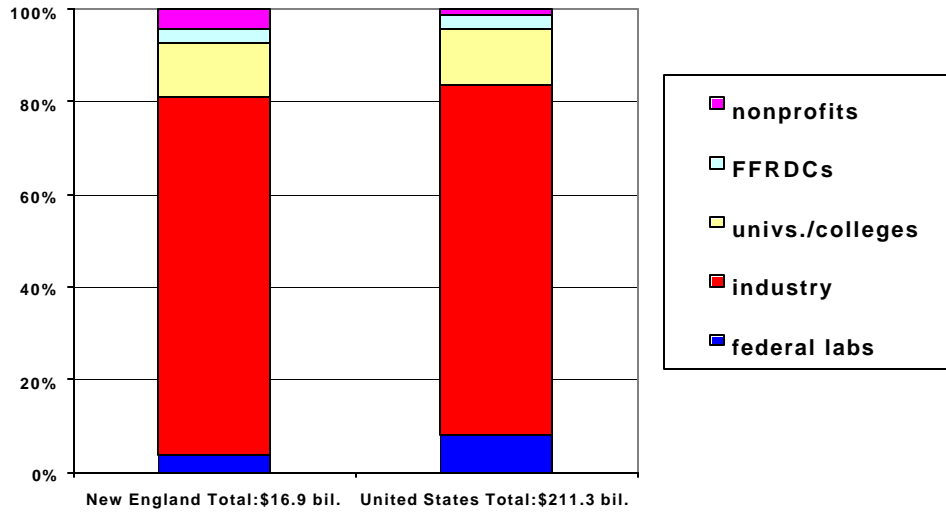
Source: National Science Foundation, Federal Funds for Research and Development Historical Tables.
 R&D = conduct of R&D and R&D plant.
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Chart 8. New England Universities and Colleges' Share of Federal Academic R&D, FY 1970-1998
 (percent of total federal support of univ/college R&D)



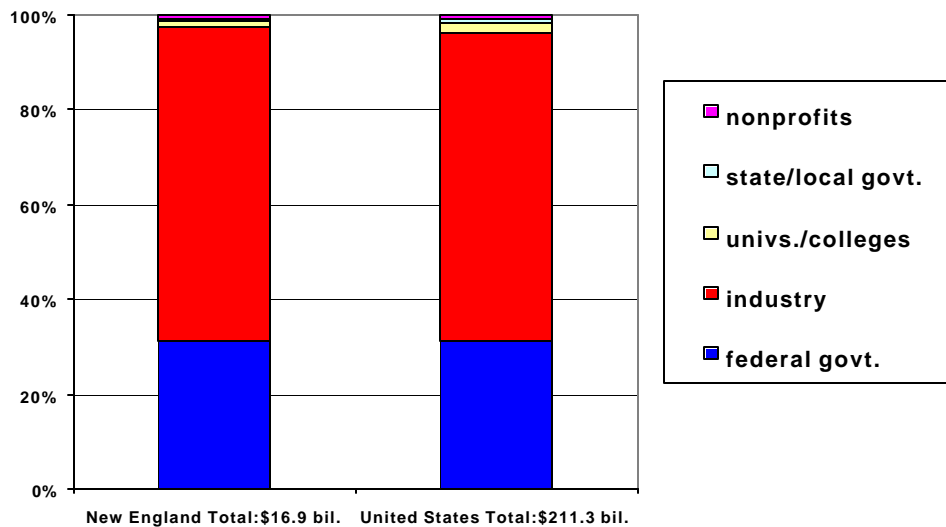
Source: National Science Foundation, Federal Funds for Research and Development Historical Tables.
 R&D = conduct of R&D and R&D plant.
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**Chart 9. Total R&D in New England and U.S.
by Performer, 1997**
(expenditures in billions of dollars)



Source: National Science Foundation, National Patterns of R&D Resources, 1999. conduct of R&D only. JULY 2000 © 2000 AAAS

**Chart 10. Total R&D in New England and U.S.
by Source of Funds, 1997**
(expenditures in billions of dollars)



Source: National Science Foundation, National Patterns of R&D Resources, 1999. conduct of R&D only. JULY 2000 © 2000 AAAS