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## **R&D in the FY 2002 Department of Defense Budget (REVISED July '01)**

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**Note: This chapter has been revised since the publication of the print AAAS Report XXVI to reflect the amended FY 2002 DOD budget request and the FY 2001 supplemental appropriations bill.**

### **HIGHLIGHTS**

- The Department of Defense (DOD), the largest federal sponsor of R&D, finally submitted a full FY 2002 budget request in late June after a review of defense spending priorities. The amended FY 2002 request replaces a placeholder request submitted in April. The amended FY 2002 budget asks for multi-billion dollar increases in DOD programs: the total DOD budget would increase \$27.0 billion to reach \$328.9 billion in FY 2002, a 9.0 percent boost.
- DOD R&D would receive an even larger percentage increase of 13.4 percent to reach \$48.5 billion, \$5.7 billion more than this year. There would be large increases to DOD's development accounts, but basic research and applied research funding would actually decline under the revised budget plan (see Table II-2). Basic research (the "6.1" category) would fall 1.0 percent to \$1.3 billion, while applied research (the "6.2" category) would fall 0.5 percent to \$3.7 billion.
- The biggest winner in the FY 2002 budget would be the Ballistic Missile Defense Organization (BMDO). Its work on national and theater missile defenses, mostly in development, is a high priority

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for the Bush Administration and would receive \$7.0 billion, an increase of 67.4 percent. BMDO's FY 2002 budget would be double the FY 2000 funding level and would be focused on developing and deploying a working national missile defense system within the next few years.

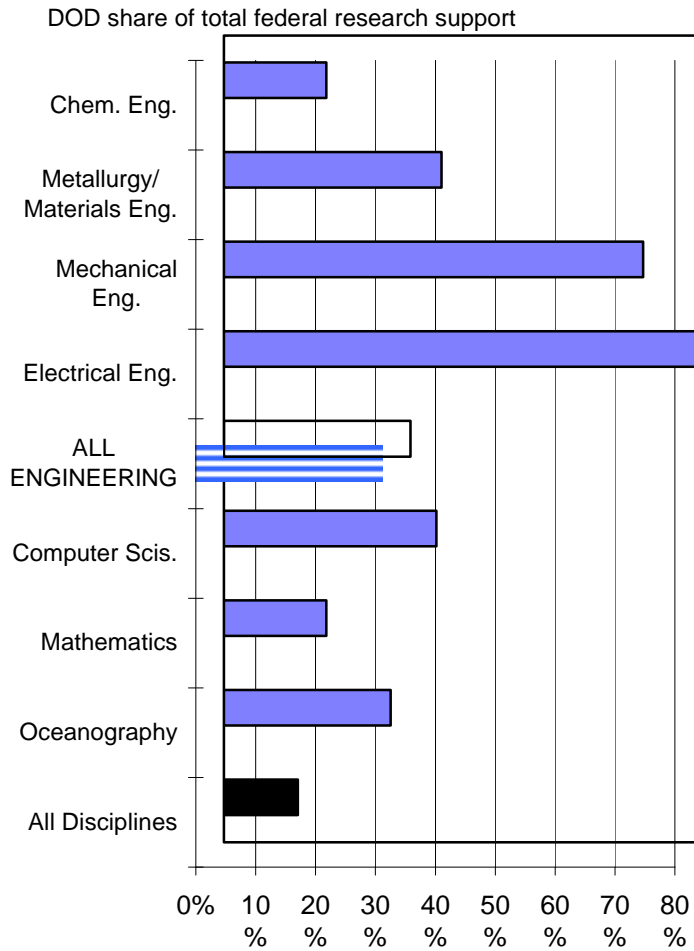
### **DEFENSE R&D: AN OVERVIEW**

The Department of Defense (DOD) is by far the largest supporter of R&D in the federal government, accounting for nearly half the total. In the 1980s, DOD supported nearly two-thirds of total federal R&D. Because of defense cutbacks following the end of the Cold War, however, DOD's support for R&D declined by a third since its peak in FY 1987 but has begun to rebound in recent years.

While most agencies break out R&D into the three categories of basic research, applied research, and development, DOD divides its RDT&E (Research, Development, Test, and Evaluation) account into seven categories, each with a numerical code: Basic Research (known as "6.1"), Applied Research ("6.2"), Advanced Technology Development ("6.3"), Demonstration and Validation ("6.4"), Engineering and Manufacturing Development ("6.5"), Management Support ("6.6"), and Operational Systems Development ("6.7"). DOD also funds some R&D and support costs in non-RDT&E accounts.

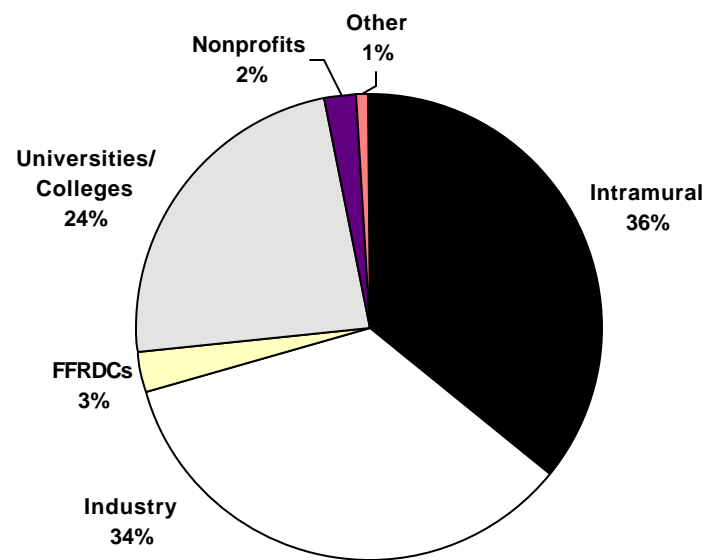
DOD is responsible for a little over 10 percent of all federal support of basic and applied research ("6.1" and "6.2"), but is a key sponsor for several science and engineering (S&E) disciplines. DOD supports 35 percent of all federal research in the computer sciences and nearly a third of all engineering research, as well as significant shares of research in mathematics and oceanography (see Figure 1). DOD's impact is even greater in several engineering sub-disciplines such as electrical engineering (see Chapter 24) and mechanical engineering (see Chapter 25). DOD funds research in these disciplines for their contributions to national defense, but this research is also a key source for major innovations in the civilian economy, most evident in DOD's early support for research that led to the now-ubiquitous Internet. DOD is also a key supporter of social sciences research (please see Chapter 21.)

Figure 1. DOD Funding of Research by Selected Science and Engineering Disciplines, FY 1999



Source: National Science Foundation, SRS, Federal Funds for Research and Development Fiscal Years 1999, 2000, and 2001, 2001. Basic and applied research only. Development and R&D facilities are not classified by discipline.

**Figure 2. DOD Funding of Research  
by Performer, FY 1999**



Source: National Science Foundation, SRS, *Federal Funds for Research and Development Fiscal Years 1999, 2000, and 2001*, 2001. Basic and applied research only. Excludes development.

The “6.1,” “6.2,” and “6.3” categories are often grouped together as “Science and Technology” (S&T). This category includes basic research, applied research, and generic technology development. These programs contribute to a broad knowledge base with potential applications to a wide variety of military as well as civilian uses. S&T is separate from the “6.4” and higher categories, which are focused on the development and testing of specific weapons systems. Nearly all DOD support for R&D at colleges and universities comes from the S&T accounts.

A majority of DOD’s R&D (and nearly all the work in categories “6.4” and higher) is performed by industrial firms such as the large defense contractors Lockheed Martin and Boeing. FFRDCs (federally funded research and development centers), defense laboratories, and colleges and universities also perform R&D. If one excludes DOD development, which is nearly exclusively performed by industry, DOD basic and applied research (“6.1” and “6.2”) are performed by a diverse group of institutions (see Figure 2). A third of DOD research is performed by DOD laboratories, while another third is performed by industry. 24 percent of DOD basic and applied research is performed by universities and colleges.

### **PRIORITIES IN DOD R&D**

Tables II-2 through II-6 show DOD’s R&D in detail. Table II-2 shows DOD R&D by “6.x” category, Table II-3 by agency and department, and II-4 by character of work. Table II-5 shows DOD basic research, and Table II-6 looks at historical trends in DOD R&D.

This year, with the Bush Administration new to office, DOD did not submit a full FY 2002 budget in April as the other federal agencies did; instead, the agency conducted a review of defense spending priorities led by Secretary of Defense Donald Rumsfeld that resulted in a full FY 2002 request in late June. The Defense Strategy Review, as it was called, was expected to result in a major reordering of DOD priorities for the next several years but the final FY 2002 request fell short of that expectation: although it adds billions of dollars in spending to the DOD budget and calls for some new initiatives, it falls short of proposing major realignments in defense strategy or overhauls in current DOD practices. Major policy decisions on DOD strategy have been deferred until the

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Quadrennial Defense Review later this year and the FY 2003 budget request next February, and the amended FY 2002 budget request has been packaged instead as a catch-up budget to address past funding shortfalls arising from DOD's current strategic needs.

The FY 2002 figures in Tables II-2 through II-6 show the amended FY 2002 budget request which would add billions of dollars to the April placeholder request. The tables also reflect \$5.6 billion in additional FY 2001 funds enacted in July as part of the FY 2001 supplemental appropriations bill, of which \$486 million went to DOD R&D.

The Bush Administration's revised budget proposes multi-billion dollar increases for DOD programs including R&D, in sharp contrast to the Clinton Administration's habit of requesting cuts each year. The total DOD budget would jump \$27.0 billion or 9.0 percent to \$328.9 billion, with substantial increases across the DOD budget for R&D, military personnel, operations and maintenance, family housing, and military construction. Of the major accounts, only procurement would fail to increase by 8 percent or more, and in fact would decline slightly. DOD R&D would increase \$5.7 billion or 13.4 percent to \$48.5 billion (see Table II-2).

The big winner in the DOD R&D budget would be the Ballistic Missile Defense Organization (BMDO). BMDO received a substantial boost from \$3.5 billion in FY 2000 to \$4.2 billion in FY 2001, but the revised request would send its FY 2002 budget soaring to \$7.0 billion, a 67.4 percent increase in one year and a doubling of funding over two years (see Table II-3). The Bush Administration has repeatedly affirmed that missile defense is a top priority in U.S. defense strategy. There would be no funds for research and only \$133 million for generic technology development in BMDO's FY 2002 budget; nearly all BMDO funds would go to advanced development, testing, manufacturing development, and evaluation of missile defense systems. In the FY 2002 budget, currently separate programs for national missile defense and theater missile defense would be merged into a more integrated program for ballistic missile defense. The Bush Administration's goal is to deploy a small-scale national missile defense system as early as 2004.

R&D IN THE FY 2002 DEPT. OF DEFENSE BUDGET (REVISED 7/01)

In sharp contrast to the substantial increases in most areas of the DOD budget, DOD support of basic and applied research would actually decline in FY 2002. Basic research funding (the “6.1” category) would fall 1.0 percent to \$1.3 billion after a nearly 16 percent increase last year. Table II-5 shows that there would be increases for basic research in the three services (Army, up 5.7 percent; Navy, 3.1 percent; and Air Force, up 3.8 percent) but there would be a steep 9.1 percent drop in basic research sponsored by the Defense Agencies, a reversal of the pattern of the past few years when the services’ basic research programs shrank in relation to the Defense Agencies. The overall decline in DOD “6.1” funding is due to a proposed \$52 million cut in University Research Initiatives in the Office of the Secretary of Defense (OSD); although much of this cut is due to the deletion of FY 2001 congressionally designated projects, there would be cuts to core funding for many research areas. Defense Research Sciences, the basic research program of the Defense Advanced Research Projects Agency (DARPA), would increase by 11.2 percent to \$121 million.

Applied research funding (the “6.2” category) would decline by 0.5 percent or \$17 million to \$3.7 billion in FY 2002 after an eight percent increase last year. There would be cuts to most “6.2” programs in the Army, Navy, BMDO, and OSD, partially offset by a boost in Air Force funding for aerospace-related research and increases for DARPA research in information technology, materials, and electronics.

DOD funding of “S&T” (the “6.1” through “6.3” categories) would stall at \$8.8 billion, down 2.6 percent from FY 2001 (see Table II-2). Adding in medical research outside the RDT&E account (see next paragraph), S&T would also total \$8.8 billion, but the decline would be 6.1 percent. Advocates of DOD S&T investments pushed last year for \$9.0 billion in FY 2001 S&T funds, a goal Congress granted, and are pushing for an investment of \$10.0 billion in FY 2002. The requested decline will make this goal much harder to reach, although Congress has tended to be more supportive of S&T funding than the Pentagon. Advocates of DOD S&T in the science and engineering community argue that DOD S&T funding is essential for building the knowledge and technology base for future DOD needs, and have successfully argued that post-Cold War cutbacks over the past decade eroded this base. In the past year, there has been growing support inside and outside the Pentagon for setting 3 percent of

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the DOD budget as a goal for the proper level of S&T investment, which led to hopes that the amended FY 2002 budget would propose a large boost for S&T. The revised FY 2002 budget, while affirming 3 percent as a worthwhile goal, allocates only 2.7 percent of the DOD budget for S&T.

Beginning in the early 1990s, Congress has appropriated funds for congressionally designated medical research programs in the DOD budget. In the past, nearly all of these funds were appropriated in the Army, but in FY 2000 Congress appropriated nearly all of them outside the RDT&E accounts in Defense Health Programs (see Table II-2). The FY 2001 total of \$412 million for medical research includes \$175 million for breast cancer research, \$100 million for prostate cancer, \$12 million for ovarian cancer, and additional funds for peer-reviewed research on other medical topics. DOD's policy is not to request continuing funds for most congressionally designated projects; the FY 2002 request is for \$65 million for other medical projects, but Congress is sure to add on funds for the cancer programs.

#### **OUTLOOK FOR DEFENSE R&D**

Although Congress has finally received the DOD budget, its fate on Capitol Hill is still on hold because of its staggering price tag. When Congress established its spending plan for FY 2002 in May, it worked with a placeholder request for DOD of \$310 billion, already a large increase over FY 2001. Because the revised request would add an additional \$18 billion to that amount, there is serious disagreement as to where the extra funds might come from, with a number of options including offsetting cuts in DOD, offsetting cuts in domestic programs, or drawing down budget surpluses being considered. Adding to the political difficulty are complaints from some defense observers that even the \$329 billion revised request may be too small: procurement funding would actually decline in the budget despite near-universal agreement in the Pentagon and Congress that it needs to be boosted substantially. The budget also relies on some cost-cutting measures, such as removing B-1 fighter planes in three states and initiating a new round of military base closings, that have already received scathing criticism from Congress.

R&D IN THE FY 2002 DEPT. OF DEFENSE BUDGET (REVISED 7/01)

There is increasing fear that approving the DOD request might increase federal spending enough to force the government tap into the politically sacred Social Security surplus, especially in the outyears. This dilemma could force Congress to make a difficult choice between holding back DOD spending or tapping Social Security funds. To delay the unpleasant choice as long as possible, Congress has put off initial consideration of the Defense appropriations bill until at least September, and it may be November or even December before a final FY 2002 DOD budget is approved. In such an environment, the fate of the DOD budget is by no means assured, and especially vulnerable are the basic and applied research programs; already slated for a cut, they will face tremendous fiscal pressure from other programs in a competition for scarce resources, especially if higher defense priorities such as procurement or higher budget priorities such as keeping the budget in balance begin to crowd out the funds available for defense R&D.

Table II-2. R&D in the Department of Defense

**Table II-2. R&D in the Department of Defense (REVISED July '01)**  
(budget authority in millions of dollars)

	FY 2000 Actual	FY 2001 Estimate	FY 2002 Budget	Change FY 01-02 Amount Percent	
<b>Research, Development, Test, and Evaluation (RDT&amp;E)</b>					
Basic Research ("6.1")	1,139	1,317	<b>1,304</b>	-13	-1.0%
Applied Research ("6.2")	3,409	3,676	<b>3,659</b>	-17	-0.5%
Total Research	4,548	4,993	<b>4,963</b>	-30	-0.6%
Adv. Tech. Development ("6.3")	3,789	4,015	<b>3,815</b>	-200	-5.0%
Total Science & Technology	8,337	9,008	<b>8,778</b>	-230	-2.6%
Demons. and Valid. ("6.4")	6,514	7,993	<b>11,381</b>	3,388	42.4%
Eng. & Manufacturing Dev. ("6.5")	8,879	8,893	<b>10,249</b>	1,356	15.3%
Management Support ("6.6")	3,076	2,639	<b>2,786</b>	146	5.5%
Operational Sys. Dev. ("6.7")	11,947	12,961	<b>14,235</b>	1,274	9.8%
BA Adjustment	-46	-180	<b>0</b>	180	-100.0%
Total RDT&E	38,706	41,315	<b>47,429</b>	6,115	14.8%
Medical Research <sup>1</sup>	295	412	<b>65</b>	-347	-84.1%
Other Appropriations <sup>2</sup>	959	1,017	<b>959</b>	-57	-5.6%
<b>Total DOD R&amp;D</b>	39,959	42,743	<b>48,454</b>	5,711	13.4%
Total Conduct of R&D	39,865	42,565	<b>48,274</b>	5,709	13.4%
Total R&D Facilities & Equip.	95	178	<b>180</b>	2	1.1%

Source: OMB data for R&D for FY 2002, *Budget of the United States Government FY 2002*, DOD "RDT&E Programs" (R-1), FY 2002 DOD budget amendment.

**Note: FY 2002 DOD figures revised to reflect amended FY 2002 budget request.**  
**FY 2001 figures adjusted to reflect FY 2001 supplemental appropriations.**

<sup>1</sup> Medical research appropriated in Defense Health Programs, not RDT&E.

These funds are not included in "6.2" (applied research).

<sup>2</sup> R&D support in military personnel, O&M, and other appropriations. Includes R&D on chemical agents and munition destruction.

Character of work ("6.x" categories) are expressed in total obligational authority (TOA).

BA Adjustment converts TOA into budget authority.

All figures are rounded to the nearest million. Changes calculated from unrounded figures.

**Please see Chapter 6 for a discussion of DOD R&D.**

Table II-3. DOD R&amp;D by Departments and Agencies

**Table II-3. DOD R&D by Military Departments and Agencies (REVISED July '01)**

(budget authority in millions of dollars)

	FY 2000	FY 2001	FY 2002	Change FY 01-02	
	Actual	Estimate	Budget	Amount	Percent
<b>Research, Development, Test, and Evaluation (RDT&amp;E)</b>					
Army	5,330	6,247	<b>6,694</b>	447	7.2%
Navy	9,044	9,555	<b>11,123</b>	1,568	16.4%
Air Force	14,511	14,190	<b>14,344</b>	154	1.1%
Defense Agencies	9,525	11,098	<b>15,051</b>	3,953	35.6%
<i>Ballistic Missile Defense Org.</i>	3,457	4,204	<b>7,036</b>	2,832	67.4%
<i>Def. Adv. Res. Projects Agency</i>	1,850	2,010	<b>2,281</b>	271	13.5%
<i>Secretary of Defense</i>	1,177	1,506	<b>1,595</b>	89	5.9%
<i>Classified Agencies</i>	1,737	1,965	<b>2,492</b>	527	26.8%
<i>Other</i>	1,304	1,412	<b>1,646</b>	233	16.5%
Director of Test and Evaluation	265	0	<b>0</b>	0	--
Director of Operational Test & Eval	31	223	<b>217</b>	-6	-2.5%
Total RDT&E	38,706	41,315	<b>47,429</b>	6,115	14.8%
Medical Research <sup>1</sup>	295	412	<b>65</b>	-347	-84.1%
Other Appropriations <sup>2</sup>	959	1,017	<b>959</b>	-57	-5.6%
<b>Total DOD R&amp;D</b>	39,960	42,743	<b>48,454</b>	5,711	13.4%

Source: OMB data for R&D for FY 2002, *Budget of the United States**Government FY 2002*, DOD "RDT&E Programs" (R-1), FY 2002 DOD budget amendment.**Note: FY 2002 DOD figures revised to reflect amended FY 2002 budget request.****FY 2001 figures adjusted to reflect FY 2001 supplemental appropriations.**<sup>1</sup> Medical research appropriated in Defense Health Programs, not RDT&E.<sup>2</sup> R&D support in military personnel, O&M, and other appropriations.**DOD Military Budget (in BILLIONS of dollars discretionary budget authority)**

	FY 2000	FY 2001	FY 2002	Change FY 01-02	
	Actual	Estimate	Budget	Amount	Percent
RDT&E (see above)	38.7	41.3	<b>47.4</b>	6.1	14.8%
Military Personnel	73.8	76.0	<b>82.3</b>	6.3	8.3%
Operations and Maintenance	108.1	112.4	<b>125.7</b>	13.3	11.8%
Procurement	55.0	61.9	<b>61.6</b>	-0.3	-0.5%
Military Construction	5.1	5.4	<b>5.9</b>	0.5	10.1%
Family Housing	3.5	3.7	<b>4.1</b>	0.4	10.4%
Revolving and Management Funds	3.1	1.2	<b>2.5</b>	1.2	101.8%
Allowances, Offsets, Other	0.0	0.0	<b>-0.5</b>	-0.5	--
<b>Total DOD Discret. Budget</b>	287.3	301.9	<b>328.9</b>	27.0	9.0%

DOD military budget only (excludes civilian activities of the Corps of Engineers).

Table II-4. DOD R&D by Character of Work

**Table II-4.** Department of Defense R&D by Character of Work (**REVISED July '01**)  
(budget authority in millions of dollars)

	FY 2000 Actual	FY 2001 Estimate	FY 2002 Budget	Change FY 01-02 Amount	Percent
<b>Current Dollars</b>					
Basic Research	1,139	1,317	<b>1,304</b>	-13	-1.0%
Applied Research <sup>1</sup>	3,704	4,088	<b>3,724</b>	-364	-8.9%
Total Research	4,843	5,405	<b>5,028</b>	-377	-7.0%
Development	35,021	37,160	<b>43,246</b>	6,086	16.4%
Total Conduct of R&D	39,865	42,565	<b>48,274</b>	5,709	13.4%
R&D Facilities <sup>2</sup>	95	178	<b>180</b>	2	1.1%
<b>Total DOD R&amp;D</b>	39,960	42,743	<b>48,454</b>	5,711	13.4%
<b>Constant FY 2001 Dollars</b>					
Basic Research	1,163	1,317	<b>1,277</b>	-40	-3.0%
Applied Research <sup>1</sup>	3,783	4,088	<b>3,648</b>	-440	-10.8%
Total Research	4,946	5,405	<b>4,925</b>	-480	-8.9%
Development	35,765	37,160	<b>42,357</b>	5,197	14.0%
Total Conduct of R&D	40,711	42,565	<b>47,282</b>	4,717	11.1%
R&D Facilities <sup>2</sup>	97	178	<b>176</b>	-2	-1.0%
<b>Total DOD R&amp;D</b>	40,808	42,743	<b>47,458</b>	4,715	11.0%

Source: OMB data for R&D for FY 2002, *Budget of the United States Government FY 2002*, DOD "RDT&E Programs" (R-1), FY 2002 DOD budget amendment.

**Note: FY 2002 DOD figures revised to reflect amended FY 2002 budget request. FY 2001 figures adjusted to reflect FY 2001 supplemental appropriations.**

<sup>1</sup> Includes medical research appropriated outside RDT&E.

<sup>2</sup> Includes expenses for major capital equipment used for R&D.

All figures are rounded to the nearest million. Changes calculated from unrounded figures.

**Please see Chapter 6 for a discussion of DOD R&D.**

Table II-5. DOD Funding for Basic Research ("6.1")

**Table II-5.** Department of Defense Funding for Basic Research ("6.1") (REVISED July '01)  
(budget authority in millions of dollars)

	FY 2000 Actual	FY 2001 Estimate	FY 2002 Budget	Change FY 01-02	
				Amount	Percent
<b>Army</b>					
In-House Indep. Research	14	14	15	0	3.4%
Defense Research Sciences	123	137	138	2	1.2%
Univ. & Indus. Research Ctrs.	65	59	69	10	16.6%
Total Army	201	210	222	12	5.7%
<b>Navy</b>					
In-House Indep. Research	15	16	16	0	0.6%
Defense Research Sciences	352	378	390	12	3.2%
Total Navy	367	394	406	12	3.1%
<b>Air Force</b>					
Defense Research Sciences	208	213	221	8	3.8%
Total Air Force	208	213	221	8	3.8%
<b>Defense Agencies</b>					
In-House Indep. Research	2	2	2	0	5.4%
Defense Research Sciences	63	109	121	12	11.2%
Univ. Research Initiatives*	223	314	262	-52	-16.5%
Gov't / Industry University Res.	6	7	3	-3	-48.6%
Force Health Protection	25	29	27	-2	-8.2%
Chem. and Bio. Defense	43	40	39	0	-1.2%
Total Defense Agencies	362	500	455	-46	-9.1%
<b>Total DOD</b>					
In-House Indep. Research	31	33	33	1	2.1%
Defense Research Sciences	746	836	870	34	4.1%
Univ. Research Initiatives *	223	314	262	-52	-16.5%
Gov't / Industry University Res.	6	7	3	-3	-48.6%
Chem. and Bio. Defense	43	40	39	0	-1.2%
Univ. & Indus. Research Ctrs.	65	59	69	10	16.6%
Force Health Protection	25	29	27	-2	-8.2%
<b>Total DOD Basic Research</b>	1,139	1,317	1,304	-13	-1.0%

Source: OMB data for R&D for FY 2002, *Budget of the United States**Government FY 2002*, DOD "RDT&E Programs" (R-1), FY 2002 DOD budget amendment.**Note: FY 2002 DOD figures revised to reflect amended FY 2002 budget request.****FY 2001 figures adjusted to reflect FY 2001 supplemental appropriations.**

All figures are rounded to the nearest million. Changes calculated from unrounded figures.

\* - Includes DEPSCoR program; FY 2002 includes High Energy Laser Research Initiative.

Table II-6. DOD R&D Trends, FY 1965-2002

**Table II-6.** Trends in Department of Defense R&D, FY 1965 - FY 2002 (**REVISED July '01**)  
(budget authority in millions of dollars)

Fiscal Year	Basic Research <sup>1</sup>		Total DOD R&D	
	Current Dollars	Constant FY 2001 \$	Current Dollars	Constant FY 2001 \$
1965	347	1,601	6,865	31,665
1970	323	1,238	7,491	28,701
1975	305	861	9,167	25,874
1980	552	1,076	14,150	27,583
1985	851	1,264	31,632	46,977
1986	954	1,383	35,000	50,756
1987	894	1,262	37,136	52,412
1988	897	1,226	38,126	52,105
1989	951	1,252	38,578	50,771
1990	931	1,181	37,869	48,030
1991	1,155	1,410	37,209	45,424
1992	1,140	1,356	37,779	44,944
1993	1,312	1,524	38,848	45,139
1994	1,179	1,341	35,510	40,387
1995	1,175	1,308	35,349	39,351
1996	1,098	1,199	35,783	39,053
1997	1,032	1,105	37,238	39,864
1998	1,012	1,068	37,569	39,655
1999	1,064	1,107	38,888	40,479
2000	1,139	1,163	39,960	40,808
2001 (estimate)	1,317	1,317	42,743	42,743
2002 (budget)	1,304	1,277	48,454	47,458

Source: National Science Foundation historical reports, the R-1, and OMB data on R&D for FY 2002. Constant dollar conversions based on OMB's GDP deflators.

**Note: FY 2002 DOD figures revised to reflect amended FY 2002 budget request. FY 2001 figures adjusted to reflect FY 2001 supplemental appropriations.**

<sup>1</sup> Budget authority for DOD "6.1" category. Some figures reflect later DOD revisions.

**Please see Chapter 6 for a discussion of DOD R&D.**