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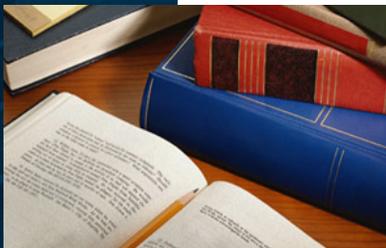
The Massachusetts Defense Industry: Characteristics and Economic Impact

Part I: Industry analysis

Part II: Economic impact analysis

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Executive summary

Purpose of the study

To inform its effort to maintain and develop the state's competitive position in the defense technology industry, MassDevelopment commissioned a study to examine the nature, scale, and competitiveness of the defense industry in Massachusetts. Carried out by the University of Massachusetts' Donahue Institute, the two-part analysis looks at the nature and scope of Massachusetts business activities generated by defense and homeland security contracts over the following topic areas: historical trends; scale of contracting activity; key industry sectors and sub-sectors; the nature of products and services; and research and development strengths. The study also provides an economic impact analysis that documents the output and employment effects generated by the defense industry in the Commonwealth. All years referenced are federal fiscal years.

Conclusions

The defense sector, defined in this study as commercial activity generated by U.S. defense and homeland security contracts, military personnel payroll, and retiree benefits paid to state residents, is a key driver of the Massachusetts economy. During 2005, defense sector spending in Massachusetts by federal agencies totaled \$9.2 billion and generated an additional \$5.5 billion in indirect spending. All told, defense sector spending impacts accounted for 4.6 percent of the state's gross domestic product in 2005. Critical industry players in the Commonwealth include both large and small businesses. While large businesses earned the largest share of profits (68 percent of contract awards), small businesses also play an important role in the industry (earning 13 percent of Massachusetts contract awards).

Summary of key findings

Characteristics of the defense industry in Massachusetts

Scale and distribution of contracting activities in Massachusetts

Prime contracts

- Prime contracts – those worth at least \$25,000 – generated \$9.1 billion in revenues to Massachusetts businesses and institutions in 2006, an increase of \$744 million (8.9 percent) from 2005.
- In 2005, prime contracts represented approximately 2.8 percent of Massachusetts GDP, an increase from 2000, when prime contracts represented about 1.7 percent of Massachusetts GDP.
- The dollar value of prime contract awards between 2000 and 2005 increased 91.6 percent – a far higher rate than the 18.5 percent growth rate in the Massachusetts GDP during that time.

All contracts

- Federal fiscal year 2005 defense and security contracting activity in Massachusetts involved 13,391 contracts providing products and services worth \$9.8 billion or the equivalent of three percent of Massachusetts GDP. Of these, 12,202 contracts worth \$9.6 billion were from the Department of Defense (DoD), with the remainder coming from the Department of Homeland Security (DHS).
- Massachusetts ranked eighth among states in DoD prime contract awards in 2005.
- The 13,391 contracts went to 2,435 Massachusetts companies.
- These Massachusetts-based contractors performed most of their work – \$8.1 billion or 83 percent of it by dollar value – in Massachusetts itself.
- The largest proportion of contract awards (\$6.5 billion or 67 percent of the total) went to “large U.S. businesses,” while more than \$1.2 billion in contracts (13 percent of the total) went to small Massachusetts businesses.
- Four major defense technology sectors operate in Massachusetts: professional and technical services (26 percent of all Massachusetts defense and homeland security contracts in FY05); computer and electronic

product manufacturing (nearly 23 percent of all contracts in FY05); transportation equipment manufacturing (14.5 percent of all contracts in FY05); and telecommunications manufacturing (9.8 percent of all contracts in FY05).

- More than 32,000 jobs were directly dependent on defense and security contracting activities in Massachusetts.

Defense products and services provided by Massachusetts firms

- 41 percent of DoD procurements were for the purchase of supplies, 31 percent were for services and 27 percent were for research, development, test and evaluation services (RDTE). In contrast, close to 60 percent of DHS procurements were for services (many not highly technical in nature) and only 24 percent were for products.
- The DoD is, relative to the DHS, the major consumer of high-technology products and services from Massachusetts companies.
- Major manufactured defense product groups include transportation equipment manufacturing (\$1.3 billion in sales), communications equipment manufacturing (\$1.0 billion) and weapons manufacturing (\$928 million).
- Fourteen of 16 product types purchased by DoD involve complex, technology-based manufacturing.
- Nineteen of the 20 highest-valued products supplied by Massachusetts companies are produced by technology-intensive industry sectors.
- Within the defense services category, major product groups include technical and professional services (\$1.29 billion) and equipment maintenance and inspection (\$944 million).
- In FY05, five of the top ten service sectors, all of which clearly build upon the critical mass of professional and/or technically-trained workers in Massachusetts, represented \$1.8 billion or 60 percent of the dollar value of all DoD service contracts.
- Of the ten top-valued services provided by Massachusetts defense contractors to the DoD, all but two require highly trained professional and technical workers.

-
- Within defense-related research and development, top product groups include technical and professional R&D (\$993 million), other R&D (\$886 million), and weapons-related R&D (\$552 million).
 - RDTE services are predominantly provided by Commonwealth companies in high-technology sectors. Spending in these sectors amounted to 95 percent of RDTE spending in FY05.
 - DHS procurements from Massachusetts for supplies were dominated by purchases of high-tech products, the most lucrative of which by far was electronics and optics, which brought in \$18 million in DHS contracts.
 - DHS procures services with relatively lower skilled labor requirements. Moderate skill sectors include seven of the top ten product sectors in terms of dollar value of contracts.

SBIR and STTR research awards

- In 2005, Massachusetts ranked first in the nation in defense-related Small Business Technology Transfer (STTR) awards and second in Small Business Innovation Research (SBIR) awards, receiving more than \$137 million from both programs. This amount accounted for nearly 17 percent of the STTR defense funding and more than 12 percent of SBIR defense funding for 2005.
- In 2004, more than 50 percent of total SBIR and STTR awards to Massachusetts came from the Department of Defense or the Department of Homeland Security. In 2005, nearly 50 percent of SBIR funding and nearly 60 percent of STTR funding came from these two departments.
- Despite Massachusetts' front-runner status, the number of SBIR and STTR contracts awarded to Massachusetts dropped from 528 to 503, or 4.7 percent, from 2004 to 2005; total funding dropped more deeply, however, by 13 percent.
- In both 2004 and 2005, products related to sensors, electronics and electronic warfare received the highest level of SBIR awards and funding, though funding increased from roughly \$30 million for 103 grants in 2004 to more than \$37 million for just 91 grants in 2005.
- Other significant defense technology sectors in Massachusetts, defined by larger numbers of awards and higher levels of funding, include information systems technology, weapons, and materials and processes. Funding declined across these three categories, however, from 2004 to 2005.

-
- DHS spending in the Commonwealth dramatically increased from 2004 to 2005 – from \$599,000 to more than \$3 million. This spending increased most dramatically in three divisions: human factors; chemical and biological; and explosives.
 - In 2004, projects related to information systems technology received the most awards and funding from STTR with more than \$5 million. In 2005, projects related to sensors, electronics and electronic warfare received the most awards, but the majority of funding for Massachusetts projects went to materials and processes.

DHS grants

- In 2005, Massachusetts received nearly \$62.5 million in grants from the Department of Homeland Security, accounting for 2.5 percent of the nation's \$2.5 billion allocation.

Economic impact analysis

Total economic impacts

- In 2005, defense industry production and spending on salaries for military personnel and retirees in the state generated a combined total of \$9.2 billion in direct impacts – \$8.4 billion in contracts and another \$746 million in disposable income from salaries and retirement benefits.
- This combined spending generated an additional \$5.5 billion in indirect and induced impacts.
- Combined economic impacts within the Commonwealth total \$14.7 billion.
- Defense industry production and spending on military salaries in Massachusetts support 114,560 jobs.

Economic impacts of defense sector spending

- In 2005, \$8.4 billion in contracts went to contractors who performed work in Massachusetts. Through the multiplier effect, every dollar that went to contractors generated an additional \$0.61 in spending. These contracts generated an additional \$5.2 billion of indirect and induced activities in the state.
- In 2005, Massachusetts defense contracts directly supported 32,240 jobs in the state. Through the multiplier effect, defense-related economic activity generated an additional 39,187 jobs in the state, yielding a total of 71,427 jobs generated by defense contract activities in the Commonwealth.

-
- The search, detection and navigation instruments sector generates the highest level of economic impacts within the state, generating more than \$1.2 billion in annual impacts for the Commonwealth. Contracts to the next top-ranked industry sectors – aircraft engine and engine parts manufacturing and scientific research and development services – together contribute \$1.9 billion annually.

Economic impacts of Massachusetts military active and retiree payroll spending¹

- In 2005, 35,925 military service members, staff, and retirees residing in Massachusetts received more than \$787 million in payroll and \$308 million in retirement benefits, a total of \$1.095 billion.
- Disposable income for these active duty personnel, civilian staff and retirees totaled more than \$745 million in 2005, generating an additional \$161 million in indirect impacts and \$193 million in induced impacts. These individuals thus generate \$1.099 billion in total economic impacts.
- Spending by military personnel and retirees directly supports the equivalent of 4,484 additional jobs in the state. Indirect and induced employment generated by military household spending brings the total number of jobs generated by military personnel spending to 7,208.

¹ Most numbers (personnel- and contract-related figures) in this study are reported on a fiscal year basis. Massachusetts National Guard figures are reported, however, on calendar-year basis.

Part I: Characteristics of the defense industry in Massachusetts

Introduction

In this section, we describe and characterize the Massachusetts defense industry. We do this by analyzing the sector's major driving force: contracts and R&D awards that Massachusetts contractors received from the Department of Defense and the Department of Homeland Security.² While defense-related sales do take place to other entities (other national defense agencies, for example), in this report we refer to the contracting activity with DoD and the DHS as the "defense industry." The items procured annually by these two federal departments represent the vast majority of defense-related business activity in Massachusetts.³ By analyzing the nature of these awards to Massachusetts businesses, we can characterize the nature of the defense industry in the Commonwealth and catalogue its strengths. This report includes data, figures and analysis to provide an overview of the defense industry in the state. All references to annual time periods refer to federal fiscal years. The discussion encompasses the following topics:

- Scale and value of defense and security contracts to Massachusetts
- Description of the industry (including key industry sectors) as it exists in Massachusetts
- Identification of specific industry codes associated with each industry sector
- Employment and payroll data related to the defense technology industry in Massachusetts
- Employment and payroll data for military personnel and retirees in Massachusetts
- Discussion of major products and services procured from Massachusetts contractors
- Research and development awards (SBIR and STTR) to Massachusetts businesses and institutions

² The data sets are publicly available and include a wide range of information. Department of Defense procurement data are available through the Department of Defense Personnel and Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>. Department of Homeland Security procurement data are available through the Federal Procurement Data System (FPDS), <http://www.fpds.gov/>.

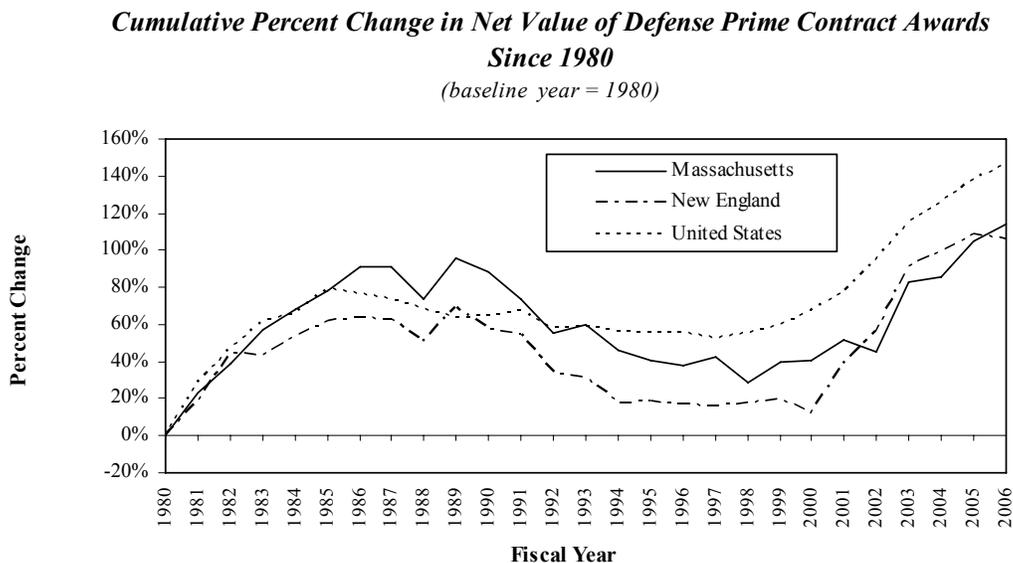
³ Unless otherwise specified, all of the data analysis in this document refers to procurements from Massachusetts contractors.

Massachusetts prime contracts: historical overview

Contracts from the Department of Defense generate significant annual inflow into the Massachusetts economy. Prime contracts – those worth at least \$25,000 – alone generated \$9.07 billion in revenues to Massachusetts businesses and institutions in 2006, an increase of \$744 million, or 8.9 percent, from 2005. While the proportion of contract dollars to total economic activity in the state is relatively small, this proportion has increased in recent years. In 2005, prime contracts accounted for 2.8 percent of Massachusetts GDP, which represents a jump from 2000, when prime contracts represented 1.7 percent of Massachusetts GDP.

Massachusetts DoD contract awards have increased every year since 1988 with the exception of 2002. The value of military prime contracts awarded to Massachusetts companies peaked in FY 2006 at \$9.1 billion and troughed in 1998 at \$4.3 billion. The FY 2006 peak was driven, in part, by a more than \$1 billion increase in U.S. Navy contracts with Massachusetts companies. The chart below illustrates the yearly changes in the value of Massachusetts military prime contracts from 1980 to 2006. Note that prime contract awards between 2000 and

Figure 1: Defense Prime Contract Awards, 1980-2006



Source: U.S. Department of Defense.

Prime contract is defined as \$10,000 or more before 1983 and as \$25,000 or more starting in 1983.

2005 increased by 91.6 percent - a far higher rate than the 18.5 percent growth rate in the Massachusetts GDP during that time.

From the early 1980s to 1993, the Commonwealth's share of national prime contract awards hovered at roughly 5 percent annually. In 2002, the Commonwealth's share of the national total reached its lowest point in more than two decades, 3.1 percent, before increasing slightly to 3.5 percent in 2005. Massachusetts was the eighth largest recipient of DoD awards in 2005 (see Appendix 16, p. 100).

The importance of the defense industry to the Massachusetts economy is reflected in Figure 2, which shows the value of Department of Defense prime contract awards from 1980 to 2006.

Figure 2: Net Value of Department of Defense Prime Contract Awards since 1980 (\$M)

Fiscal Year	MA	N.E.	U.S.	Massachusetts' Share (as a Percent)	
				of New England	of U.S.
1980*	\$3,743	\$8,775	\$68,070	42.7%	5.5%
1981*	4,605	10,372	87,761	44.4%	5.2%
1982*	5,317	13,037	103,858	40.8%	5.1%
1983	6,328	12,967	118,744	48.8%	5.3%
1984	7,029	14,249	123,995	49.3%	5.7%
1985	7,714	15,487	140,096	49.8%	5.5%
1986	8,735	15,748	136,026	55.5%	6.4%
1987	8,685	15,606	133,262	55.7%	6.5%
1988	7,212	13,673	125,767	52.7%	5.7%
1989	8,757	16,268	119,917	53.8%	7.3%
1990	8,166	14,271	121,254	57.2%	6.7%
1991	6,933	13,889	124,119	49.9%	5.6%
1992	5,686	11,033	112,285	51.5%	5.1%
1993	5,936	10,779	114,145	55.1%	5.2%
1994	5,106	9,329	110,316	54.7%	4.6%
1995	4,846	9,375	109,005	51.7%	4.4%
1996	4,675	9,237	109,408	50.6%	4.3%
1997	4,910	9,152	106,561	53.6%	4.6%
1998	4,245	9,284	109,386	45.7%	3.9%
1999	4,715	9,456	114,875	49.9%	4.1%
2000	4,737	8,745	123,295	54.2%	3.8%
2001	5,248	11,094	135,225	47.3%	3.9%
2002	4,929	13,029	158,737	37.8%	3.1%
2003	6,800	17,544	191,221	38.8%	3.6%
2004	6,961	19,062	212,740	36.5%	3.3%
2005	8,333	20,699	236,986	40.3%	3.5%
2006	9,077	20,243	257,456	44.8%	3.5%

Source: U.S. Department of Defense.

* Prime Contract is defined as at least \$10,000 for these years; beginning in 1983, a prime contract is defined as at least \$25,000.

Scale of contracting activities in Massachusetts

Analyzing the range of contracts from DoD and DHS, we find that FY2005 defense and security contracting activity in Massachusetts involved 13,391 contracts providing products and services worth \$9.8 billion, or the equivalent of 3.1 percent of Massachusetts state GDP.⁴ DoD makes the vast majority of defense-related procurements from Massachusetts contractors, which provided goods and services to DoD agencies through 12,202 contracts with action obligations (payments made) against these contracts worth \$9.6 billion in fiscal year 2005. The number and value of DHS procurements from Massachusetts was far lower. In federal fiscal year 2005, the various DHS agencies made procurements through 1,189 contracts with Massachusetts-based contractors worth \$141 million.

In many cases, Massachusetts companies received multiple defense contracts. In FY2005, DoD had contracts with 2,157 companies, and DHS had contracts with 440 companies. One-hundred-sixty-two companies had contracts with both departments. The figures below provide an overview of companies, contractors and contract values related to DoD and DHS purchasing in FY2005.

Figure 3: Massachusetts Defense Contractors, DoD and DHS, FY2005

	Total
Number of companies	2,435
Number of contractors*	2,627
Number of contracts**	13,391
Number of contract actions	30,568
Total value of contracts	\$9,772,312,746

* This count is based on unique contractor ID codes. A contractor is a business unit that has entered into a contract to supply supplies or services. One company may have multiple contractors.

** Based on unique contract ID code.

Sources: DoD Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>; DHS Procurements FY05, Federal Procurement Data System (FPDS), <http://www.fpds.gov/>

⁴ According to the U.S. Bureau of Economic Analysis, Massachusetts had a GDP in 2005 of \$320.1 billion. <http://www.bea.gov/regional/gsp/>

Figure 4: DoD Procurement from Massachusetts Contractors, FY2005

DoD Spending	
Number of companies	2,157
Number of contractors*	2,349
Number of contracts**	12,202
Total value of contracts	\$9,631,241,136

* Based on contractor ID code.

** Based on contract number.

Source: DoD Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>

Figure 5: DHS Procurement from Massachusetts Contractors, FY2005

DHS Spending	
Number of companies	440
Number of contracts*	1,189
Total value of contracts	\$141,071,610

* Based on contract ID numbers.

Source: DHS Procurements, FY2005, Federal Procurement Data System (FPDS), <https://www.fpds.gov/>

Principal place of performance

As the accompanying table shows, Massachusetts-based contractors perform most of their work – \$8.1 billion or 83 percent of it by dollar value – in Massachusetts itself.⁵ The remaining defense contracts with Massachusetts companies involve work that takes place out-of-state, in 48 states and 21 countries.

⁵ This total, rather than the full \$9.8 billion, is used in the economic impact analysis along with the dollar value of contract work performed in the state by non-MA companies.

Figure 6: Principal Place of Performance of DoD and DHS Procurements, FY 2005, All Massachusetts Contractors

Location	Value of Contracts (\$)	Percent of Total
Total	9,772,312,746	100%
<i>In U.S. States</i>	<i>9,018,283,352</i>	<i>92.3%</i>
Massachusetts	8,065,976,339	82.5%
Virginia	322,085,985	3.3%
n/a	94,117,947	1.0%
Florida	83,006,685	0.8%
District of Columbia	39,863,149	0.4%
California	36,737,461	0.4%
Alabama	34,861,652	0.4%
Maryland	33,648,007	0.3%
Oklahoma	32,109,868	0.3%
Ohio	29,181,180	0.3%
New Jersey	26,934,077	0.3%
Arkansas	23,993,710	0.2%
Texas	20,788,019	0.2%
Maine	19,804,264	0.2%
All Other States	155,175,009	1.6%
<i>In Other Countries:</i>	<i>754,029,394</i>	<i>7.7%</i>
Taiwan	349,754,200	3.6%
Iraq	187,523,732	1.9%
Germany	141,503,663	1.4%
Japan	30,497,595	0.3%
Bahamas	13,000,000	0.1%
Korea, Rep	9,453,468	0.1%
Afghanistan	7,795,391	0.1%
Philippines	3,961,300	0.04%
United Kingdom	2,561,184	0.03%
Belgium	2,089,753	0.02%
Marshall Islands	1,746,525	0.02%
Kuwait	1,377,931	0.01%
Bahrain	927,685	0.01%
Italy	807,285	0.01%
Egypt	538,765	0.01%
All Other Countries	490,917	0.01%

Sources: DoD Personnel & Procurement Statistics and Federal Procurement Data System (FPDS).

Types of firms receiving defense industry contracts

Defense contractors in Massachusetts include small businesses, disadvantaged small businesses, businesses, nonprofit organizations, and educational institutions. The largest proportion of contract awards (\$6.5 billion or 67 percent) goes to what the DoD defines as “large U.S. businesses” while more than \$1.2 billion in contracts (13 percent) goes to small businesses.

Figure 7: Massachusetts Contractors by Type of Business, DoD, FY2005

Business Type	Count of Contract Actions	Dollar Value
Unknown	62	\$1,859,968
Small Disadvantaged Business (SDB) performing in the U.S.	1,063	\$211,473,895
Other Small Business (SB) performing in the U.S.	12,983	\$1,083,466,486
Large business performing in the U.S.	13,881	\$6,548,802,537
Javits–Wagner–O’Day (JWOD) program participating nonprofit agency*	113	\$3,662,814
Hospital	7	\$90,436,109
Foreign concern or entity	24	\$673,230
Domestic firm performing outside of U.S.	373	\$750,275,538
Other educational	388	\$384,125,504
Other nonprofit	226	\$556,465,055
Total	29,120	\$9,631,241,136

Sources: DoD Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>

* The JWOD program provides employment opportunities for Americans who are blind or who have other severe disabilities.

Major defense technology sectors

Having established the scale of defense procurements in Massachusetts, we analyzed data on Massachusetts contractors providing products and services to the defense industry in FY2005 from federal procurement databases as well as from D&B MarketPlace™ and Harris Infosource™. This analysis helps to identify primary sectors of the Massachusetts defense technology industry.⁶

⁶ In this section we analyze Massachusetts defense and homeland security contractors using the NAICS industry code assigned to them in the contract. NAICS codes provide a way to identify the firm’s most dominant, ‘primary’ business activity.

The Massachusetts defense technology industry includes four primary sectors of activity: professional and technical services; computer and electronic product manufacturing; transportation equipment manufacturing; and telecommunications manufacturing. About 70 percent of FY2005 defense and homeland security contract dollars went to these four industry sectors. The predominant industry sectors, the top-ranked sub-sectors within them, and associated industry codes are outlined in Figure 8.

Figure 8: Primary Defense Technology Industry Sectors in Massachusetts

Professional and technical services (NAICS 541)	
o	Research and development in the physical, engineering and life sciences (541710)
o	Engineering services (541330)
o	R&D in the social sciences and humanities (541720)
o	Custom computer programming (541511)
o	Computer systems design (541512)
Computer and electronic product manufacturing (NAICS 334)	
o	Search, detection, navigation, guidance, aeronautical, and nautical system and instrument manufacturing (3345111)
o	Broadcasting and wireless communication manufacturing (334220)
o	Navigational, measuring, electro medical and control instruments (334510)
o	Irradiation apparatus manufacturing (334517)
Transportation equipment manufacturing (NAICS 336)	
o	Aircraft engine and engine parts manufacturing (336412)
o	Guided missile and space vehicle manufacturing (336414)
Telecommunications manufacturing (NAICS 517)	
o	Other telecommunications (517910)

Professional and technical services (NAICS 541)

The top-ranked defense industry sector in terms of contract values is the professional, scientific and technical services sector. This sector received nearly 26 percent of all defense and homeland security contracts in FY05, a total of more than \$2.5 billion. Major sub-sectors of activity in this area include research and development in the physical, engineering and life sciences; engineering services; R&D in the social sciences and humanities; custom computer programming; and computer systems design.

Many Massachusetts firms provide professional, scientific and technical services to DoD and DHS. Nearly 500 Massachusetts professional, scientific and technical service companies had active contracts in FY05. Four organizations received, however, more than 50 percent of total FY05 funding: Raytheon, the Charles Stark Draper Laboratories, the Mitre Corporation and L3 Communications.

Educational services organizations ranked fifth in terms of overall contract values. The vast majority of funding goes to the Massachusetts Institute of Technology, which received \$511 million, or more than 95 percent, of these contract dollars in FY05.

Computer and electronic product manufacturing (NAICS 334)

Another powerful defense technology sector in Massachusetts is the computer and electronics manufacturing sector, which received \$2.2 billion or nearly 23 percent of total defense and security contracts in FY2005. Major sub-sectors include search, detection, navigation, guidance, aeronautical, and nautical system and instrument manufacturing; broadcasting and wireless communication manufacturing; navigational, measuring, electro medical and control instruments; and irradiation apparatus manufacturing.

Two contractors dominate this sector: Raytheon and General Dynamics. Raytheon, which received more than \$1 billion in contracts, provides a wide range of products including microcircuits and electronics; electronic boards; cards and hardware; communication equipment and systems and related maintenance and repair; guided missile components and remote control systems; and engineering technical services. General Dynamics, which received \$684 million, provides automated data processing equipment and hardware; telephone and communications equipment; and related technical assistance, maintenance and repair services.

Transportation equipment manufacturing (NAICS 336)

The transportation equipment manufacturing sector in Massachusetts is another large segment of the defense technology industry. This sector received \$1.4 billion or 14.5 percent of total defense and security contracts in FY05, the vast majority of which went to aircraft engine and engine parts manufacturing. Another powerful activity is guided missile and space vehicle manufacturing.

Two contractors dominate this sector as well: General Electric (\$1.18 billion) for aircraft engines and components manufacturing and Raytheon Integrated Defense Systems (\$210 million) for advanced technology research and development services including weapons R&D; engineering technical services; math and computer science R&D; advanced technology development research; and electronics and communications R&D.

Telecommunications manufacturing (NAICS 517)

Telecommunications manufacturing is the fourth largest defense technology industry sector in Massachusetts, receiving 9.8 percent of all contracts in FY2005, or \$954,514,967. The major contractor in this sector is General Dynamics Network Systems, which received more than \$951 million in contracts for products and services including communications equipment, engineering technical services, and ADP and communications equipment maintenance services.

Figure 9: Massachusetts Defense Contractors: Top Industry Sectors by Total Value of DoD and DHS Contracts, FY2005

NAICS Description	Percent of Total Value	Value of Contracts	Number of Contract Actions	Number of Contractors
Professional and technical services	25.8%	2,522,003,801	5,250	498
Computer and electronic product manufacturing	22.6%	2,207,708,121	4,916	254
Transportation equipment manufacturing	14.5%	1,416,931,589	1,650	23
Telecommunications	9.8%	954,514,967	1,902	17
Educational services	5.5%	537,495,583	436	63
Electrical equipment and appliance manufacturing	2.9%	286,092,753	773	39
Construction of buildings	2.5%	243,941,214	401	44
Water transportation	2.3%	227,794,934	86	5
Merchant wholesalers, nondurable goods	1.4%	131,938,675	1,678	47
Machinery manufacturing	1.2%	118,424,970	1,093	84
Fabricated metal product manufacturing	0.9%	84,795,607	1,152	80
Merchant wholesalers, durable goods	0.7%	68,079,096	2,119	260
Waste management and remediation services	0.5%	45,396,714	1,031	31
Repair and maintenance	0.4%	37,916,676	204	48
Miscellaneous manufacturing	0.4%	36,925,955	1,644	63
Support activities for transportation	0.3%	33,439,540	66	8
Ambulatory health care services	0.3%	33,236,106	40	16
Food manufacturing	0.3%	33,220,411	43	9
Performing arts and spectator sports	0.3%	32,952,016	120	15
Administrative and support services	0.3%	31,157,436	440	108
Others (includes n/a)	7.0%	688,346,582	5,524	915
Total		9,772,312,746	30,568	2,627

Sources: DoD Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>; DHS Procurements FY05, Federal Procurement Data System (FPDS), <https://www.fpds.gov/>

Top defense and homeland security contractors

A relatively small number of companies in Massachusetts earn a large portion of defense and security contracts. In FY2005, for example, 80 percent of defense and security-related contracts from DoD and DHS went

to the top 20 largest Massachusetts defense contractors. Fifty-three percent of FY05 defense and security contracts went to three companies: Raytheon (\$2.2 billion), General Dynamics (\$1.7 billion) and General Electric (\$1.2 billion). Two non-profit institutions – MIT (\$611 million) and the Charles Stark Draper Laboratory (\$281 million) – earned the next largest shares of total defense and security contract dollars. The remaining 15 of the top 20 contractors collectively earned 18 percent of contracts in FY2005.

Figure 10: Top Massachusetts Defense Contractors by Value of Contracts, FY2005

Rank	Company	Contract Value	Percent of Total
1	Raytheon	\$2,214,049,532	23%
2	General Dynamics	\$1,747,023,761	18%
3	General Electric	\$1,194,523,334	12%
4	Massachusetts Institute of Technology	\$611,338,833	6%
5	The Charles Stark Draper Laboratory	\$281,119,452	3%
6	The Mitre Corporation	\$275,321,546	3%
7	Perini Corporation	\$193,310,808	2%
8	Textron Systems Corporation	\$165,446,638	2%
9	American Overseas Marine Corporation	\$159,685,793	2%
10	L-3 Communications Corporation	\$157,726,787	2%
11	BAE Systems	\$94,963,289	1.0%
12	Brighton Marine Health Center	\$85,415,110	0.9%
13	Kollmorgen Corporation	\$79,119,881	0.8%
14	American Science and Engineering	\$72,923,908	0.7%
15	Foster-Miller, Inc	\$72,276,578	0.7%
16	BBN Technologies	\$71,518,554	0.7%
17	Science Applications International	\$69,342,817	0.7%
18	Dynamics Research Corporation	\$68,895,437	0.7%
19	Sencom Corporation	\$56,260,722	0.6%
20	Schafer Corporation	\$46,334,753	0.5%
	<i>Others</i>	<i>\$2,055,715,214</i>	<i>21%</i>
	Total	\$9,772,312,746	

Sources: DoD Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>; DHS Procurements, FY2005: Federal Procurement Data System (FPDS), <https://www.fpds.gov/>

Defense products and services produced by Massachusetts firms

Going beyond an industry sector analysis of defense industry contracts in Massachusetts, the following section contains an analysis of the products and services purchased from Massachusetts companies in order to discern the Commonwealth’s specific sectoral strengths as a defense industry supplier. We employ the detailed product coding system used by DoD and DHS that provides specific information on products and services. The

procurements database classifies the principal product or service acquired by each contract action within a contract. We can thus analyze the exact nature of each defense purchase from Massachusetts contractors.

Product and service codes are grouped in three major categories for this analysis:

- Manufacturing (Supplies)
- Services
- Research, Development, Test and Evaluation services

Within these major categories, products are arranged within major product groups. We next analyze sales by both more detailed product sectors⁷ as well as individual product codes.

Defense industry products and services produced by Massachusetts suppliers vary widely, ranging from highly technical production and consulting activities to basic services and production activities. An analysis of FY2005 procurements reveals that a large proportion of Massachusetts defense and security products is highly technical in nature and can be grouped into distinct defense technology sub-sectors. At the same time, a significant proportion of defense products is not high-tech in nature and does not involve a knowledge-intensive production process. Our analysis includes all defense-related products, not just those classified as high-tech or knowledge-intensive. Product codes enable the separation of high- and low-tech products; time limitations prevented us, however, from analyzing high- and low-tech products separately. Instead, we focused on major product groups and more detailed product sectors. A full breakdown of product and service procurements by product sector and code appears in the appendices to this report.

Massachusetts defense products by major category

A broad analysis of defense and homeland security procurements shows some significant differences in spending patterns by the two departments. As noted earlier, Department of Defense procurement spending far exceeds Department of Homeland Security spending in terms of both total contracts and dollar value. DoD also procures more supplies (material products) and research and development services than DHS. Forty-one percent of DoD procurements were for the purchase of supplies, 31 percent for services and 27 percent for research,

⁷ See appendices for methodology keys.

development, test and evaluation services. In contrast, nearly sixty percent of DHS procurements were for services (many not highly technical in nature), and only 24 percent for products.

Figure 11: Contracts by Major Category of Product, DoD, FY 2005

Major Category	Count of Contract Actions	Contract Value	Percent of Contract Value
Supplies	17,641	\$3,982,091,542	41.3
Services	8,916	\$3,028,379,745	31.4
Research, Development, Test and Evaluation services	2,563	\$2,620,769,849	27.2
Total	29,120	\$9,631,241,136	100*

Sources: DoD Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>

* May not total to 100% due to rounding.

Figure 12: Contracts by Major Category of Product, DHS, FY2005

Major Category	Count of Contract Actions	Contract Value	Percent of Contract Value
Services	606	\$83,445,624	60
Supplies	354	\$33,157,160	24
Research, Development, Test and Evaluation services	65	\$22,768,463	16
N/A	414	\$1,700,363	>1
Total	1,439	\$141,071,610	100

Source: Federal Procurement Data System (FPDS), <https://www.fpds.gov/>

A third major difference between DoD procurements and DHS procurements has to do with the nature of the products and services procured. The analysis that follows shows that the DoD is the major consumer of high-technology products and services from Massachusetts companies. Defense technology and services procurements by DHS are far smaller in scale. These differences result from the fact that DHS' budget is far smaller than DoD's and perhaps also because DHS' programmatic priorities differ from DoD's.

Defense sales by major product group

We organized the more detailed product sectors within major product groups.⁸ Within the wide range of manufactured defense products, major product groups in the Commonwealth include transportation equipment manufacturing (\$1.3 billion in sales), communications equipment manufacturing (\$1.0 billion) and weapons manufacturing (\$928 million). Within the defense services category, major product groups include technical and

professional services (\$1.29 billion), and equipment maintenance and inspection (\$944 million). Finally, within defense-related research and development, top product groups include technical and professional R&D (\$993 million), other R&D (\$886 million) and weapons-related R&D (\$552 million).

Figure 13: Dollar Value of Contracts by Major Category and Product Group, 2005

Product or Service Description		Contract Value
Manufacturing		\$4,015,248,702
Transportation equipment	DoD	\$1,310,502,069
	DHS	\$1,306,825,419
Communications equipment	DHS	\$3,676,650
	DoD	\$1,031,224,338
Weapons	DHS	\$1,026,483,048
	DoD	\$4,741,290
Electronic equipment	DHS	\$928,451,776
	DoD	\$926,635,906
Miscellaneous manufacturing (office equipment, clothing and food supplies)	DHS	\$1,815,870
	DoD	\$334,413,097
Construction and materials	DHS	\$316,259,463
	DoD	\$18,153,634
Medical and scientific	DHS	\$233,088,797
	DoD	\$230,179,239
Services	DHS	\$2,909,558
	DoD	\$1,287,967,143
Technical and professional	DHS	\$1,263,392,328
	DoD	\$24,574,815
Equipment maintenance and inspection	DHS	\$944,354,375
	DoD	\$909,852,904
Facilities operations and maintenance	DHS	\$34,501,471
	DoD	\$530,250,576
Transportation	DHS	\$513,207,777
	DoD	\$17,042,799
Medical and scientific	DHS	\$245,327,324
	DoD	\$245,315,868
Medical and scientific	DHS	\$11,456
	DoD	\$92,337,832
Medical and scientific	DHS	\$91,678,171
	DoD	\$659,661

⁸ A technical appendix provides a key to DoD codes within the broad product groups.

Environmental		\$9,793,220
	DoD	\$3,473,649
	DHS	\$6,319,571
Social services		\$1,794,900
	DoD	\$1,459,048
	DHS	\$335,852
R&D		\$2,643,538,312
Technical and professional		\$992,741,050
	DoD	\$992,741,050
Other R&D		\$886,236,928
	DoD	\$883,794,873
	DHS	\$2,442,055
Weapons		\$551,986,573
	DoD	\$551,986,573
Medical and scientific		\$71,633,764
	DoD	\$68,616,123
	DHS	\$3,017,641
Social services		\$70,891,039
	DoD	\$61,397,683
	DHS	\$9,493,356
Transportation		\$66,246,721
	DoD	\$58,431,310
	DHS	\$7,815,411
Environmental		\$3,802,237
	DoD	\$3,802,237
Total N/A contracts		\$1,700,363
Subtotal DoD contracts		\$9,631,241,136
Subtotal DHS contracts		\$141,071,609
Total		\$9,772,312,746

Sources: DoD Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>. Groupings by the authors.

Defense manufacturing: product sectors

A look at manufacturing procurements by more detailed product sectors highlights the Commonwealth's strengths as a defense technology producer. Fourteen of 16 product types purchased by DoD involve highly complex, technology-based manufacturing. DoD procurements of defense technology products were worth \$3.7 billion in FY2005. Only two product sectors, miscellaneous personal and office supplies and materials (worth \$253 million in contracts), appear low tech in nature.

Figure 14: Supplies by Product Sector, DoD, FY2005

Product Sector	Count of Contract Actions	Contract Value
Engines and fuel systems	1,546	\$1,124,264,810
Communication equipment	1,345	\$960,464,624
Guided missiles and systems	147	\$476,949,342
Weapons, ammunition and systems	301	\$449,686,564
Electronics and optics	3,588	\$316,259,463
Miscellaneous personal and office supplies	2,854	\$230,179,239
Industrial machinery	2,487	\$104,762,389
Automated data processing equipment	1,117	\$66,018,424
Navigational and measuring instruments	1,251	\$63,009,902
Transportation equipment	143	\$58,011,480
Medical instruments and biologicals	1,830	\$42,917,089
Aircraft and equipment	229	\$28,391,562
Materials - fuel, plastics, glass, metal	634	\$23,734,811
Ships and equipment	106	\$22,884,078
Space equipment	25	\$10,263,587
Construction equipment	38	\$4,294,178
Total	17,641	\$3,982,091,542

Sources: DoD Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>

Several more detailed product codes exist within each supplies product sector. A review of the top-valued supplies by product code also illustrates the high-tech nature of DoD procurements from Massachusetts. Nineteen of the 20 highest valued products, all but food items for resale, are produced by technology-intensive industry sectors (see Figure 16). Jet engines, gas turbines and aircraft components brought in the largest amount of all products in FY05; contracting for these products brought in \$1.09 billion. Guided missile components, which brought in \$382 million in FY05, represented the second highest in value. Communications equipment, electronics equipment, radar equipment and specialized instruments of all types also represented large procurement areas in FY05.

Figure 15: Top Supplies by Product, DoD, FY2005

Description	Count of Contract Actions	Contract Value
Gas turbines and jet engines, aircraft & components	1372	\$1,099,685,427
Guided missile components	76	\$382,806,107
Miscellaneous communication equipment	682	\$334,922,651
Telephone and telegraph equipment	231	\$288,089,141
Radar equipment, except airborne	106	\$272,268,384
Food items for resale	218	\$132,272,858
Miscellaneous weapons	30	\$120,558,130
Fire control transmitting and receiving equipment.	2	\$112,471,300
Miscellaneous electrical and electronic components	330	\$107,371,370
Surface use explosive ordnance disposal tools & equipment.	31	\$101,554,809
Optical sighting and ranging equipment	39	\$71,685,419
Guided missiles	5	\$53,866,392
Trucks and truck tractors, wheeled	6	\$49,195,080
Electrical/elect boards, cards and assorted hardware	350	\$48,481,066
Antennas, waveguides and related equipment	437	\$40,450,611
Automated data processing software	614	\$31,001,143
Guns, through 30 mm	80	\$30,708,759
Medical and surgical instruments, equipment and supplies	1145	\$25,329,329
Night vision equipment	77	\$23,710,258
Specialized ammunition and ordnance machinery	2	\$23,490,000
Subtotal	5,833	\$3,349,918,234
All other products	11,808	\$632,173,308
Total	17,641	\$3,982,091,542

Sources: DoD Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>

Even though DHS spent far less on Massachusetts defense-related supplies than on services in FY05, supply procurements in Massachusetts were dominated by purchases of high-tech products. The most lucrative sector by far was electronics and optics, which brought in \$18 million in DHS contracts. ADP equipment; weapons, ammunition and systems; communications equipment; transportation equipment and navigational and measuring instruments represented more than \$8.9 million in DHS product procurements.

Figure 16: Supplies by Product Sector, DHS, FY2005

Product Sector	Count of Contract Actions	Contract Value
Electronics and optics	44	\$18,153,634
Automated data processing equipment	37	\$3,319,074
Miscellaneous personal and office supplies	105	\$2,909,558
Weapons, ammunition and systems	5	\$1,815,870
Communications equipment	8	\$1,422,216
Transportation equipment	5	\$1,384,598
Navigational and measuring instruments	34	\$1,162,186
Construction equipment	3	\$720,751
Industrial machinery	42	\$705,024
Ships and equipment	28	\$578,557
Engines and fuel systems	15	\$429,107
Medical instruments and biologicals	12	\$356,760
Aircraft and equipment	7	\$122,202
Materials - fuel, plastics, glass, metal	9	\$77,624
Total	354	\$33,157,160

Source: DHS Procurements FY05, Federal Procurement Data System (FPDS), <https://www.fpds.gov/>

Figure 17: Top Supplies by Product Type, DHS, FY2005

Product Code Description	Count of Contract Actions	Contract Value
Miscellaneous alarm, signal, security systems	20	\$12,932,181
Miscellaneous electronics and electronic components	3	\$5,035,657
Spec. test and handling equipment, nuclear equipment	2	\$1,793,328
Automated data processing software	17	\$1,691,513
Radar equipment, airborne	1	\$1,393,610
Miscellaneous items	9	\$1,259,377
Mini and micro computer cont. devices	1	\$992,964
Roofing and siding materials	2	\$710,239
Trailers	2	\$706,019
Trucks and truck tractors, wheeled	2	\$675,000
Outerwear, men's	8	\$461,350
Ship and boat propulsion components	16	\$430,518
Diesel engines and components	8	\$335,072
ADP system configuration	4	\$328,517
Office furniture	23	\$325,596
Chemical analysis instruments	6	\$311,821
Combination and miscellaneous instruments	1	\$257,684
Individual equipment	7	\$255,487
Medical sets kits and outfits	5	\$180,189
Armor, personal	9	\$168,989
Subtotal	146	\$30,245,111
All other products	208	\$2,912,049
Total	354	\$33,157,160

Source: DHS Procurements FY05, Federal Procurement Data System (FPDS), <https://www.fpds.gov/>

Defense services: product sectors

In FY05, five of the top ten service sectors (maintenance and repair of equipment; professional services; medical services; studies and analysis services; and technical and educational services), represented \$1.8 billion or 60 percent of the dollar value of all DoD service contracts. The strength of these sectors is an outgrowth of the critical mass of professional and/or technically-trained workers in Massachusetts.

Figure 18: Top Services by Product Sector, DoD, FY2005

Product Sector	Count of Contract Actions	Contract Value
Maintenance and repair	2,151	\$877,902,204
Professional	2,097	\$687,470,922
Automated data processing	654	\$419,051,786
Facilities and facilities maintenance	575	\$278,764,952
Transportation	192	\$245,315,868
Facilities operations	1,903	\$143,631,655
Medical	52	\$91,678,171
Operation of non-building facilities	54	\$85,955,864
Studies and analyses	174	\$70,118,086
Technical and educational	284	\$68,763,317
Architecture and engineering	178	\$16,976,775
Inspection services/other quality control	59	\$13,028,930
Technical repair	86	\$8,198,788
Quality control	10	\$6,722,652
Installation of equipment	64	\$3,382,552
Environmental services	72	\$3,232,922
Lease or rental	238	\$2,828,879
Facilities	19	\$2,026,427
Social services	30	\$1,459,048
Purchasing	4	\$1,011,442
Equipment and materials testing	7	\$413,776
Wildlife/lands management	5	\$240,727
Modification of equipment	8	\$204,002
Total	8,916	\$3,028,379,745

Sources: DoD Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>

An analysis of top services by the more detailed product code illustrates the importance of professional and technical services offered by Massachusetts contractors. Of the ten top-valued services provided by Massachusetts defense contractors all but marine charter services and industrial buildings facilities services require highly trained professional and technical workers.

Figure 19: Services by Product Type, DoD, FY2005

Code	Description	Count of Contract Actions	Contract Value
J070	Maintenance & repair of equipment/ADP equipment & supplies	1,165	\$540,402,090
V124	Marine charter for transport of things	49	\$243,800,021
R499	Other professional services	528	\$224,857,295
D399	Other ADP and telecommunication services	380	\$223,013,204
J014	Maintenance and repair of equipment/guided missiles	21	\$170,944,230
D315	Digitizing services	5	\$131,949,503
Y159	Other industrial buildings	14	\$123,236,423
R425	Engineering technical services	314	\$121,348,774
R408	Program management/support services	331	\$99,945,665
Q201	General health care services	7	\$85,429,152
	Subtotal, top services	2,814	\$1,964,926,357
	All other services	6,102	\$1,063,453,388
	Total	8,916	\$3,028,379,745

Sources: DoD Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>

Figure 20: Services by Product Sector, DHS, FY2005

Product Sector	Count of Contract Actions	Contract Value
Quality control	19	\$31,621,653
Professional	116	\$21,534,802
Facilities and facilities maintenance	106	\$9,513,589
Environmental services	35	\$6,317,949
Facilities operations	97	\$6,112,223
Installation of equipment	5	\$1,747,243
Automated data processing	20	\$1,358,887
Lease or rental	39	\$1,340,227
Architecture and engineering	48	\$1,244,008
Maintenance and repair	38	\$750,269
Medical	6	\$659,661
Technical repair	2	\$364,906
Social services	8	\$335,852
Technical and educational	29	\$331,892
Studies and analyses	10	\$105,226
Facilities	11	\$76,760
Modification of equipment	3	\$17,400
Transportation	11	\$11,456
Wildlife/lands management	3	\$1,622
Total	606	\$83,445,624

Source: DHS Procurements FY05, Federal Procurement Data System (FPDS), <https://www.fpds.gov/>

DHS procurements of services are different since they involve sectors with relatively lower skilled labor requirements. “Moderate skill” sectors include seven of the top ten product sectors in terms of dollar value of contracts: quality control services; facilities and facilities maintenance; environmental services; facilities operations; lease and rental services; and maintenance and repair.

Figure 21: Top Services by Product Type, DHS, FY2005

Product Description	Count of Contract Actions	Contract Value
Quality control services/miscellaneous equipment	4	\$27,367,807
Engineering and technical services	23	\$11,017,898
Oil spill response	31	\$6,311,784
Maintenance-repair-alt/miscellaneous buildings	27	\$5,030,485
Food services	3	\$4,584,593
Other management support services	22	\$4,430,210
Other quality control services/alarm & signal system	8	\$4,200,620
Maintenance-repair-alt/other admin buildings	27	\$2,709,787
Systems engineering services	6	\$1,687,446
Demolition of buildings	1	\$1,641,403
Personal property management services	4	\$1,300,000
Other ADP & telecommunications services	9	\$1,179,798
Maintenance-repair-alt/epg -geothermal	5	\$1,008,694
Technical assistance	2	\$953,623
Lease-rent of miscellaneous buildings	3	\$915,490
A/E services (including landscaping interiors)	16	\$807,715
Custodial janitorial services	21	\$687,612
Internal medicine services	1	\$650,850
Legal services	4	\$432,324
Other professional services	6	\$405,836

Source: DHS Procurements FY05, Federal Procurement Data System (FPDS), <https://www.fpds.gov/>

Defense research, development, test and evaluation services: product sectors

Twenty-seven percent (\$2.6 billion) of DoD procurements in FY05 were for research, development, test and evaluation-related procurements. Commonwealth companies operating in high-technology sectors predominantly provide RDTE services. Eight of the top ten product sectors (electronics and communications; missile and space systems; other defense; engineering sciences; weapons; aircraft; physical and computer sciences and medical sciences) involved scientific research and comprised 95 percent of RDTE spending in FY05.

Figure 22: Research, Development, Test & Evaluation by Product Sector, DoD, FY2005

Product Sector	Count of Contract Actions	Contract Value
Electronics and communications	392	\$805,412,684
Other R&D	317	\$658,205,378
Missile and space systems	206	\$468,748,908
Other defense	898	\$209,625,564
Engineering sciences	100	\$184,110,448
Weapons	63	\$83,237,665
Services and subsistence	144	\$61,397,683
Aircraft research	100	\$44,134,544
Physical, computer and environmental sciences	81	\$32,047,091
Medical sciences	67	\$23,343,983
Miscellaneous	33	\$15,963,931
Other sciences	47	\$10,737,720
Ships	63	\$7,661,939
Space	4	\$3,878,655
Energy and environment	17	\$3,802,237
Manufacturing technology	6	\$3,217,918
Tank-automotive	13	\$2,756,172
Life and psychological sciences	12	\$2,487,329
RDTE Subtotal	2,563	\$2,620,769,849
Total	29,120	\$9,631,241,136

Sources: DoD Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>

Figure 23: Top Research, Development, Test and Evaluation Services by Product Type, DoD, FY2005

Code	Product Description	Count of Contract Actions	Contract Value
AC65	Electronics and communication equipt-eng/manuf/dev	32	\$372,987,456
AZ13	Other research and development-adv tech dev	85	\$324,705,612
AC61	Electronics and communication equipment-basic research	198	\$317,905,016
AZ14	Other research and development-demo/valid	81	\$275,919,969
AC24	Missile and space systems-demo/valid	23	\$243,345,208
AJ43	Engineering sciences-adv tech dev	49	\$166,897,015
AC23	Missile and space systems-adv tech dev	64	\$152,291,858
AD92	Other defense-applied research	518	\$90,022,406
AC51	Weapons-basic research	24	\$71,597,837
AC64	Electronics and communication equipment-demo/valid	22	\$65,131,515
	Subtotal, top RDTE services	1,096	\$2,080,803,892
	All other RDTE	1,467	\$539,965,957
	Total	2,563	\$2,620,769,849

Sources: DoD Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>

RDTE purchasing by DHS in FY05 fell far short of DoD spending in this area. Rather than contracting for research related to ‘hard,’ technology-based systems for communications, electronics, weapons and defense-related equipment, DHS research contracts supported research and testing related to subsistence (such as food) and transportation.

Figure 24: Research, Development, Test & Evaluation by Product Sector, DHS, FY2005

Sector	Count of Contract Actions	Contract Value
Subsistence	35	\$9,468,486
Transportation	2	\$7,815,411
Other sciences	2	\$2,941,711
Other R&D	4	\$2,442,055
Life, psychological, social sciences	1	\$42,330
Medical sciences	9	\$33,600
Housing	7	\$24,870
Social services	5	n/a
Total	65	\$22,768,463

Source: DHS Procurements FY05, Federal Procurement Data System (FPDS), <https://www.fpds.gov/>

Figure 25: Top Research, Development, Test & Evaluation by Product Type, DHS, FY2005

Product Description	Count of Contract Actions	Contract Value
Air transportation (operational)	2	\$7,815,411
Services (basic)	22	\$6,281,162
R&D-other sciences-eng dev	2	\$2,941,711
R&D-other R&D-adv dev	4	\$2,442,055
Services (operational)	6	\$2,007,097
Services (management/support)	4	\$663,777
Services (engineering)	1	\$500,000
Life sciences (engineering)	1	\$42,330
Other medical (basic)	2	\$33,600
Housing (basic)	7	\$24,870
Construction (basic)	1	\$15,800
Fuels and lubricants (advanced)	1	\$650
Mental health (applied/exploratory)	2	-
Mental health (operational)	5	-
Other social services (advanced)	5	-
Total	65	\$22,768,463

Source: DHS Procurements FY05, Federal Procurement Data System (FPDS), <https://www.fpds.gov/>

SBIR and STTR research awards

Defense-related SBIR/STTR funding

An analysis of recent defense-related R&D awards to Massachusetts illustrates the strong role that small businesses play in terms of developing new defense technologies. The federal government created the Small Business Innovation Research (SBIR) Program and the Small Business Technology Transfer (STTR) Program to provide research and development assistance to small businesses (and allied non-profit research institutions in the case of the STTR program), and to support technology innovation. More specifically, the programs offer phased awards for the development of products related to technology, science, engineering or education. The awards fund product ideas during early stages to help small businesses develop and innovate when funding is most scarce.⁹

Eleven federal agencies and departments fund the awards. In recent years, awards from defense-related departments have accounted for more than half the total funding pool.

The Commonwealth's competitive position among states

Defense-related SBIR and STTR programs provide an important source of funding for Massachusetts small businesses and institutions, especially for early-stage, high risk, innovative projects. In 2005, defense agencies awarded \$1,088,856,550 to U.S. small business through the SBIR and STTR programs.¹⁰ Defense-related awards accounted for more than half of total SBIR and STTR funding in both 2004 and 2005.

Only California competes with the Commonwealth in garnering defense-related SBIR and STTR projects. In 2005, Massachusetts ranked first in the nation in defense-related STTR awards and behind only California in SBIR awards, receiving more than \$137 million from both programs. This total accounted for nearly 17 percent of STTR defense funding and more than 12 percent of SBIR defense funding for 2005. The accompanying table summarizes the awards values for the top ten states in 2005.¹¹

⁹ Once selected, the small businesses that qualify enter a three-phase program. Phase One, the start-up phase, awards the business with up to \$100,000 to explore an idea or technology for six months. Phase Two extends this research into an R&D phase with the potential for \$750,000 in additional funding for up to two years. SBIR does not fund Phase Three, the market phase. Small businesses fortunate enough to get to Phase Three must find their own funding for this phase of innovation.

¹⁰ U.S. Small Business Administration Technology Resources Network: <http://www.sba.gov/sbir/indexsbir-sttr.html>

¹¹ 2005 is the latest year for which data are available.

Figure 26: State Ranking of SBIR Defense**State Ranking of STTR Defense****Awards by \$ Value – 2005****Awards by \$ Value - 2005**

STATE	\$ Value Awarded	STATE	\$ Value Awarded
California	\$206,081,121	Massachusetts	\$19,608,699
Massachusetts	\$117,990,106	California	\$17,210,498
Virginia	\$70,164,406	Texas	\$8,195,305
Ohio	\$52,370,241	New York	\$7,515,388
Maryland	\$51,187,361	Colorado	\$7,360,888
New York	\$49,202,846	Ohio	\$6,726,142
Texas	\$47,030,269	Virginia	\$6,142,149
Colorado	\$44,042,639	Pennsylvania	\$6,110,240
Pennsylvania	\$38,972,860	Arizona	\$3,876,393
Other 40 States, DC,PR	\$283,688,290	Other 40 States, DC,PR	\$33,995,423
Total	\$960,730,139	Total	\$116,741,125

Source: U.S. Small Business Administration Technology Resources Network.

Massachusetts defense technology funding

The majority of SBIR and STTR contracts to Massachusetts are related to defense or homeland security.¹² In 2004, more than half of all SBIR awards to Massachusetts came from DoD and DHS. The same held true for Massachusetts STTR funding. Awards in 2005 showed equally impressive numbers, with nearly 50 percent of SBIR funding and nearly 60 percent of STTR funding coming from one of these two departments.

Massachusetts received nearly \$158 million in SBIR and STTR defense awards in 2004. From 2004 to 2005, the number of SBIR and STTR contracts awarded to Massachusetts dropped 4.7 percent, from 528 to 503; total funding during this period dropped, however, by 13 percent. This drop primarily resulted from a decline in Phase II SBIR awards combined with 23 percent less funding for the remaining Phase II SBIR projects. Phase II of SBIR received more than \$116 million in 2004 but just less than \$90 million in 2005. In contrast, Phase II STTR awards grew considerably from \$8.5 million in funding in 2004 to more than \$15 million in 2005. Phase I STTR and SBIR project numbers remained relatively stable between 2004 and 2005.

¹² This section analyzes combined Massachusetts SBIR and STTR awards from the Department of Defense and the Department of Homeland Security for the latest years available, 2004 and 2005.

Figure 27: Massachusetts SBIR and STTR Defense Awards & Grants, Fiscal Years 2004 & 2005

Grant Value	2004	2005
SBIR		
Phase 1	\$27,667,455	\$28,133,813
Phase 2	\$116,275,804	\$89,856,293
Total	\$143,943,259	\$117,990,106
STTR		
Phase 1	\$5,363,895	\$4,469,694
Phase 2	\$8,516,822	\$15,139,005
Total	\$13,880,717	\$19,608,699
Total	\$157,823,976	\$137,598,805
Grants Awarded	2004	2005
SBIR		
Phase 1	303	306
Phase 2	154	122
Total	457	428
STTR		
Phase 1	58	52
Phase 2	13	23
Total	71	75
Total	528	503

Source: U.S. Small Business Administration Technology Resources Network.

Defense technology strengths

The significant number of SBIR and STTR awards to Massachusetts businesses and institutions reflects the presence of the advanced capacity for technology production within the state. An analysis of these awards to Massachusetts powerfully illustrates the state’s particular defense-technology strengths. In 2004 and 2005, Massachusetts companies received SBIR and STTR funding in all 12 of DoD’s key technology areas.¹³ Four technology areas appear to be particular strengths for the Commonwealth’s small businesses: information systems technology; materials/processes; sensors, electronics and electronic warfare; and weapons.

¹³ Appendix 12 outlines and provides sub-sector detail for each of the DoD’s key technology areas.

SBIR awards: technology strengths

While in 2004 and 2005 Massachusetts companies received SBIR awards in all 12 of the DoD key technology areas, in both years products related to Sensors, Electronics and Electronic Warfare received the highest level of SBIR awards and funding, though funding increased from roughly \$30 million for 103 grants in 2004 to more than \$37 million for 91 grants in 2005. This category was the only technology area in which funding significantly increased between 2004 and 2005.

Figure 28: Massachusetts SBIR DOD Grant \$ Value by Technology, Fiscal Years 2004 & 2005

Category	2004	2005
Sensors, electronics & electronic warfare	\$30,823,342	\$37,463,882
Information systems technology	\$23,533,368	\$19,226,295
Weapons	\$22,992,232	\$10,932,385
Materials/processes	\$17,939,735	\$14,715,347
Human systems	\$8,377,177	\$11,794,649
Air platforms	\$12,441,284	\$3,395,808
Biomedical	\$8,899,133	\$3,466,510
Space platforms	\$9,080,035	\$2,248,758
Ground and sea vehicles	\$3,008,469	\$6,949,437
Chemical/biological defense	\$4,428,946	\$2,716,613
Nuclear technology	\$949,872	\$982,348
Battlespace environments	\$869,938	\$1,049,403
Total	\$143,343,531	\$114,941,435

Sources: U.S. Small Business Administration Technology Resources Network and Defense Technology Area Plan 2005: <http://www.dodsbir.net/solicitation/pdf/techareas.pdf>.

Note: DOD Categories were grouped by the author into technology areas.

Other significant defense technology sectors in Massachusetts, defined by larger numbers of awards and higher funding, include Information Systems Technology, Weapons, and Materials and Processes. Funding declined across these three categories, however, between 2004 and 2005.¹⁴

While DoD SBIR spending in Massachusetts decreased almost 20 percent between 2004 and 2005, DHS spending in the Commonwealth dramatically increased – from \$599,000 to more than \$3 million. Due to programmatic differences, the projects that DHS supports differ in nature from DOD projects. DHS divides its priorities according to six different programmatic divisions: Explosives; Chemical and Biological; Border and Maritime; Command, Control and Interoperability; Human Factors and Infrastructure/Geophysical.¹⁵ DHS

¹⁴ Refer to appendices for further details on grant numbers and values.

¹⁵ Department of Homeland Security: <https://www.sbir.dhs.gov/SBIRresearchAreas.asp#Infrastructure>

funding increased most dramatically in three divisions: Human Factors; Chemical and Biological; and Explosives.

Figure 29: Massachusetts SBIR DHS Grant \$ Value by Division, Fiscal Years 2004 & 2005

DHS	2004	2005
Human factors	\$199,970	\$949,107
Chemical and biological	\$100,000	\$950,000
Explosives	\$0	\$749,798
Border and maritime security	\$199,835	\$299,992
Infrastructure/geophysical	\$99,923	\$99,774
Command, control, & interoperability	\$0	\$0
Total	\$599,728	\$3,048,671

Sources: U.S. Small Business Administration Technology Resources Network and Department of Homeland Security: <http://www.sbir.dhs.gov/SBIRresearchAreas.asp#Infrastructure>.

Note: DOD Categories were grouped by the author into category divisions.

STTR awards: technology strengths

While DoD's funding for SBIR awards in Massachusetts declined from 2004 to 2005, money allocated to STTR projects increased from just less than \$14 million to nearly \$20 million. In 2004, projects related to Information Systems Technology received more than \$5 million, the most funding from STTR. Sensors, Electronics and Electronic Warfare and Materials and Processes rounded out the majority of grants and funding that year. Funding allocations shifted slightly in 2005 as projects related to Sensors, Electronics and Electronic Warfare received the most awards but the majority of funding to Massachusetts went to projects related to Materials and Processes. The Information Systems Technology category remained strong in 2005 with more than \$4.5 million designated to its projects.

From 2004 to 2005, several defense technology categories received little funding from either program. These included Nuclear Technology and Battlespace Environments. Support for certain categories in both the SBIR and STTR programs (most significantly Air Platforms, Weapons and Space Platforms) declined significantly from 2004 to 2005, in both funding and the number of awards granted.

Figure 30: Massachusetts STTR DOD Grant \$ Value by Technology, Fiscal Years 2004 & 2005

Category	2004	2005
Information systems technology	\$5,381,694	\$4,877,834
Materials/processes	\$1,461,697	\$6,194,473
Sensors, electronics and electronic warfare	\$2,928,104	\$4,158,706
Biomedical	\$466,144	\$2,649,631
Weapons	\$1,799,196	\$850,000
Air platforms	\$1,304,555	\$100,000
Human systems	\$299,711	\$538,082
Nuclear technology	\$169,637	\$99,999
Ground and sea vehicles	\$69,979	\$139,974
Battlespace environments	\$0	\$0
Chemical/biological defense	\$0	\$0
Space platforms	\$0	\$0
Total	\$13,880,717	\$19,608,699

Sources: U.S. Small Business Administration Technology Resources Network and Defense Technology Area Plan 2005: <http://www.dodsbir.net/solicitation/pdf/techareas.pdf>.

Note: DOD Categories were grouped by the author into technology areas.

Uncertainty of future funding

Currently, the SBIR and STTR programs are in jeopardy of having all DoD funding suspended. To maintain funding levels for the war effort in Iraq and Afghanistan, DOD is evaluating the funding of all non-critical programs, including SBIR and STTR. Although possible funding suspensions could prove temporary, many SBIR and STTR proponents fear that setting this type of precedent could result in permanent redirection of DoD funds from these programs.¹⁶

Department of Homeland Security grants to Massachusetts

In addition to the SBIR and STTR programs administered through DoD and DHS, Massachusetts competes for several types of grants administered through DHS. In 2005, Massachusetts received more than \$60 million in grants from DHS through its Citizens Corps Program, Law Enforcement Terrorism Prevention Program, Emergency Management Performance Grant, State Homeland Security Program, Metropolitan Medical Response System, and Urban Areas Security Initiative (UASI). The UASI includes the Urban Areas Program, Transit Security Program, Port Security Grant Program (PSGP) and the Intercity Bus Program (IBP).¹⁷ Note that

¹⁶ SBIR Insider Newsletter, March 26, 2007: <http://www.zyn.com/sbir/insider/sb-insider03-26-07.htm#one>.

¹⁷ U.S. Census Bureau, Statistical Abstract of the United States: 2007.

these 2005 numbers do not include PSGP and IBP grants because the funds had yet to be awarded when this data set was compiled in May 2005.

Though Massachusetts in 2005 ranked twelfth among the states and the District of Columbia, its \$62 million in grant funds accounted for only 2.5 percent of the nation’s total allocation. New York and California both received nearly \$300 million that year.

Figure 31: Massachusetts Homeland Security Grants - 2005

	Grant Amount
Massachusetts	\$62,436,000
United States	\$2,475,567,000

Source: U.S. Census Bureau, Statistical Abstract of the United States: 2007.

This section concludes Part I, a description of the nature of the defense industry in the Commonwealth and the state’s strengths in attracting defense funding through various federal defense and homeland security programs. Part II quantifies the downstream effects of defense contracts and other spending in the Commonwealth through an economic impact analysis of defense-related spending.

Part II: Economic impact analysis

Introduction

This section measures the contributions of two major areas of defense-related spending within the state: defense contract work performed in Massachusetts, and spending in Massachusetts by military personnel and retirees. In the impact analysis of defense contracts, we use the total dollar value of contract activities performed in Massachusetts. As a result, this total dollar value – \$8.4 billion – is different from the dollar value of contracts to Massachusetts companies as a whole (\$9.8 billion), which the industry analysis reported.¹⁸

The first section of the economic impact analysis calculates employment and output impacts generated by these defense contracts. The second section quantifies economic impacts generated by Massachusetts military personnel and retirees within the state.

Economic impact analysis

An economic impact analysis software program¹⁹ measured economic impacts of defense industry spending across Massachusetts, allowing us to model and predict how this spending affects economic relationships throughout the state. The sections that follow quantify three different types of effects resulting from defense-related production and employment in Massachusetts: direct, indirect, and induced.

The three effects come into play as defense-related production activities flow through the economy resulting in a multiplier effect. Direct impacts are inputs into the state economy – in this case, we express them as the total dollar value of the defense contracting activity. Indirect impacts are the ripple effects on supporting economic activity in other sectors that the defense contracting activity generates. For example, a \$300,000 defense contract to a manufacturer (a direct impact of \$300,000) would lead to additional spending on goods and

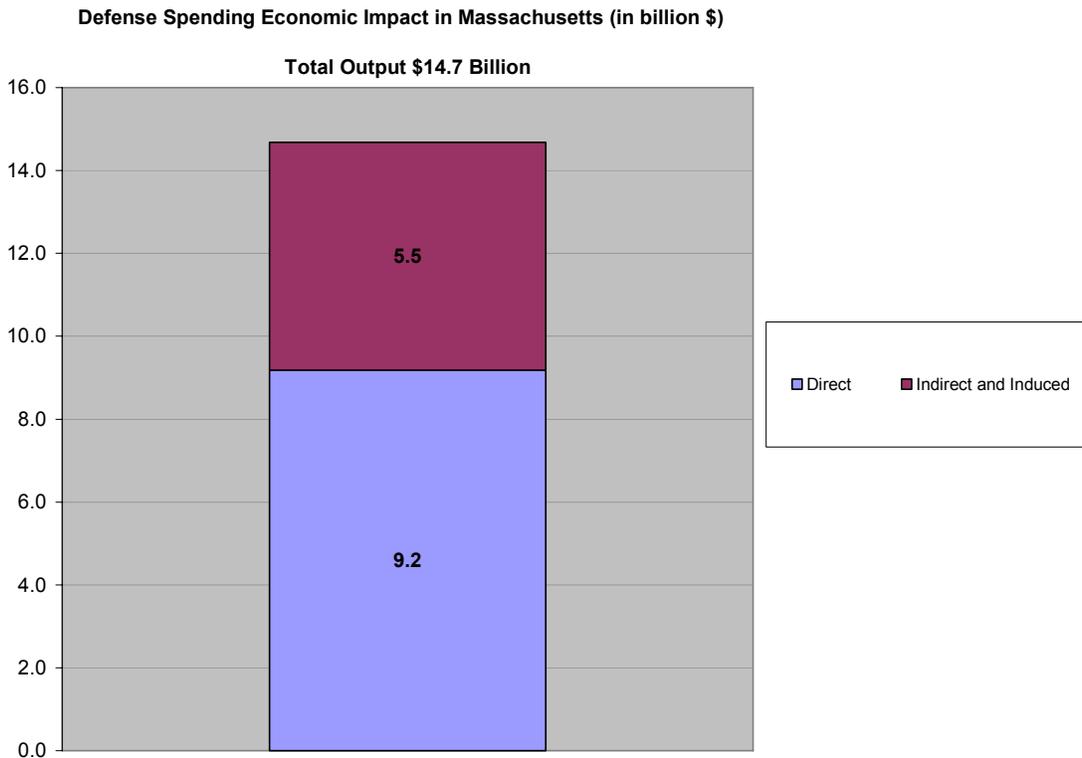
¹⁸ The total value of contract activities performed in Massachusetts - \$8.4 billion - includes \$8.1 billion in contracts to Massachusetts companies and \$367 million in work performed by out-of-state contractors. We do not include in this total the \$1.7 billion to Massachusetts companies that performed the contracted work out-of-state.

¹⁹ Minnesota IMPLAN Group, Inc., IMPLAN System (data and software), 1725 Tower Drive West, Suite 140, Stillwater, MN 55082 <www.implan.com>

services from other sectors, thus generating additional revenue in the economy. Finally, induced effects are the impacts of household expenditures from wages and salaries that result in new business activity and new, higher levels of production. New income generates more spending, which, in turn, necessitates more production.²⁰

Our analysis estimates direct, indirect, and induced impacts generated by the two primary components of defense and homeland security spending in Massachusetts: defense industry production and spending on salaries of military personnel and retirees. Combining impacts generated by both of these areas, we can estimate total impacts on the Massachusetts economy. In 2005, these two areas of federal spending generated \$9.2 billion in direct impacts within the state – \$8.4 billion in contracts and another \$746 million in salaries and retirement benefits. As the figure below illustrates, this combined spending generated an additional \$5.5 billion in indirect and induced impacts within Massachusetts. The following analysis breaks this model down to illustrate the impacts generated by the two distinct areas of spending.

Figure 32: Economic Impacts of Defense Spending in Massachusetts, 2005



²⁰ ERS/USDA Data – Agricultural Trade Multipliers Glossary; <www.ers.usda.gov/Data/TradeMultiplier/Glossary.aspx>

Economic impacts of defense industry production

The economic impacts generated by defense industry production in Massachusetts total \$13.6 billion: \$8.4 billion in federal procurement contracts (direct effects) with \$5.2 billion in secondary impacts (indirect and induced effects). The figure below illustrates that the primary input to our economic impact model was the total dollar value of federal defense contract work conducted within the Commonwealth.²¹ Of the \$8.4 billion of contracts, \$8.1 billion went to 2,121 Massachusetts companies and \$366.8 million went to out-of-state companies. Through the multiplier effect, every dollar spent on defense-contract work in the state generated an additional 61 cents. Thus, the \$8.4 billion in defense contracts generated an additional \$5.2 billion of indirect and induced activities in the state.

Figure 33: Massachusetts Defense Industry: Economic Impacts, 2005

	Direct	Indirect	Induced	Total	Multiplier
Output	\$8,432,802,709	\$2,544,421,944	\$2,603,991,465	\$13,581,216,106	1.61
Employment	32,240	15,518	23,669	71,427	2.22

In addition to generating output impacts, defense production activity also generates employment impacts. This work in Massachusetts has a strong impact on job creation. The model illustrates that the multiplier effect for defense-related activity is 2.22, which means that for every job attributable to defense-related contracting 1.22 additional jobs are created in state. In 2005, Massachusetts defense contracts directly supported more than 32,000 jobs in the state. Through the multiplier effect, defense-related economic activity generated an additional 39,187 jobs in the state, yielding a sum total of 71,427 jobs generated by defense production activities in the Commonwealth.

Economic impacts of top defense industry sectors

This section illustrates the economic impact of work performed in Massachusetts in various defense industry sectors. The value of contracts for work in-state totals \$8.4 billion and includes Massachusetts companies as well as non-Massachusetts companies.

²¹ This study does not include or quantify the impacts of contracted work to Massachusetts companies that was conducted outside the Commonwealth.

The summary table below illustrates the defense industry sectors that have the greatest total economic impact on the Massachusetts economy. Science and technology-based industry sectors dominate. The search, detection and navigation instruments sector generates the highest level of economic impact within the state. This sector alone generates more than \$1.2 billion in annual economic activity in the Commonwealth. Contracts to the next top-ranked industry sectors – aircraft engine and engine parts; manufacturing and scientific research; and development services – together contribute another \$1.9 billion annually. In total, contracts to the four top-ranked industry sectors account for more than one-quarter of all defense-related impact within the Commonwealth.

Figure 34: Economic Impacts of the Top Ten Defense Industry Sectors (\$), 2006

IMPLAN Sector	Direct	Indirect	Induced	Total
Search-detection-navigation instruments	1,217,909,248	3,786,880	63,991	1,221,760,128
Aircraft engine and engine parts manufacturing	921,548,928	187,307,776	156,706	1,109,013,376
Scientific research and development services	772,577,536	52,693,568	4,547,370	829,818,496
Wholesale trade	201,083,520	206,826,304	141,856,384	549,766,208
Telecommunications	366,205,504	80,965,248	45,857,156	493,027,904
Colleges-universities-junior colleges	428,536,736	3,265,312	39,573,080	471,375,136
Broadcast and wireless communications equipment	392,625,088	19,289,952	233,324	412,148,352
Architectural and engineering services	317,304,672	77,627,584	7,152,753	402,085,024
Semiconductors and related device manufacturing	38,180,652	287,130,848	5,937,424	331,248,896
Owner-occupied dwellings	0	0	319,294,432	319,294,432
Other	3,776,830,423	1,625,528,480	2,039,318,866	7,441,677,756
Total	8,432,802,709	2,544,421,944	2,603,991,465	13,581,216,106

Economic impacts of Massachusetts military personnel

An additional round of economic impacts comes through the household purchasing activities of Massachusetts military personnel and retirees. While the impacts of these are smaller than the impacts generated by defense industry production activities, the state still gains significant benefits from military household spending activities. These personnel, along with their annual payroll, comprise a primary input to our economic impact analysis model.

Massachusetts military personnel, 2005

While Massachusetts is not among the top states in terms of total personnel, military operations in the state still employ a significant number of active duty and civilian personnel. The numbers discussed in this section include payroll amounts and personnel numbers for the four U.S. armed services within the Department of Defense: the Army, Navy, Air Force and Marines. Due to data limitations, we could not fully quantify Department of Homeland Security employment and payroll in the Commonwealth.

Possibly the most significant DHS operation in the Commonwealth is the fifth armed service, the Coast Guard. The Coast Guard is the smallest of the U.S. armed services, patrolling all maritime waterways that might be at risk, from inland waterways to international waters. Massachusetts is one of eight states comprising the First Coast Guard District. As the First District is a region, First District personnel and payroll numbers are not typically broken down by state and thus are not included in this report. We know, however, that the district as a whole has 7,266 active and reserve duty personnel along with 772 civilian personnel and 8,423 auxiliary members.²²

Active duty personnel

The Department of Defense reports employment and payroll numbers related to Massachusetts active duty and civilian personnel in the Army, Navy, Air Force and Marines, as well as civilians within other defense agencies. In a comparison across states, Massachusetts operations are a relatively small proportion of total defense employment. In 2005, the United States employed more than 1.1 million military personnel and nearly 640,000 civilians. In the same year, Massachusetts hosted only 2.3 percent of military and civilian personnel. In contrast, the three top-ranked states in terms of defense employment numbers in 2005 (Virginia, California and Texas) employed more than 564,000 military and civilians combined, nearly one-third of the U.S. total.

In 2005, military operations – aside from Reserve/National Guard components – in Massachusetts employed 2,243 military personnel, ranking the Commonwealth forty-first nationwide. Active military personnel in the state earned nearly \$150 million in payroll in 2005. Military operations in the Commonwealth involved an

²² U.S. Coast Guard's First District Snapshot, a summary of facts and figures about America's First Coast Guard District: <<http://www.uscgnewengland.com/posted/778/CGFirstDistrictFactfile.126670.pdf>>.

additional 6,556 civilian employees in 2005, a number that ranks Massachusetts thirtieth nationally. These civilian employees earned nearly \$446 million in 2005.

Figure 35: Massachusetts Payroll (\$) by Military Division, 2005

	Active Duty	Civilian	Retired	Total
Army	\$10,701,000	\$165,743,000	\$100,043,000	\$276,487,000.00
Navy & Marines	\$21,317,000	\$20,210,000	\$100,462,000	\$141,989,000.00
Air Force	\$116,967,000	\$178,579,000	\$107,791,000	\$403,337,000.00
Other defense activities	n/a	\$81,319,000	n/a	\$81,319,000.00
Total	\$148,985,000	\$445,851,000	\$308,296,000	\$903,132,000.00

Source: Department of Defense (SIAD) <http://siadapp.dior.whs.mil/personnel/M02/fy05/05top.htm>.

Major operations in Massachusetts

Air Force operations generate the largest numbers of defense-related employees in Massachusetts mainly due to activities at Hanscom Air Force Base and the Natick Soldiers Systems Center. In 2005, Hanscom alone employed 1,243 active personnel as well as 1,419 civilian. These employees accounted for more than 60 percent of the combined active duty and civilian Air Force presence in the state that year, and more than 30 percent of the entire combined active duty military and civilian personnel. Westover Air Reserve Base in Chicopee is the largest reserve base in the United States and the home to Air Force, Army, Marine and Navy reserves. Currently, 2,500 reservists are assigned to Westover, where they train one weekend monthly and serve a 15-day annual tour of duty.²³ Many civilians also work at the facility.

Massachusetts National Guard

According to the 2005 Massachusetts National Guard Annual Report, the Commonwealth is home to 7,500 national guardsmen -- soldiers and airmen serving in Army and Air National Guard units. Payroll for this group totaled more than \$80 million in 2005. In addition to serving in a wide variety of military operations, Massachusetts National Guardsmen serve in-state in a variety of ways. For example, 1,400 soldiers and airmen served on state active duty during 2005, including during the winter storm season and at the Massachusetts Military Reservation during the Hurricane Katrina relief effort. National Guard operations also provide employment to Massachusetts civilians.

²³ Westover Air Reserve Base, fact sheets, <<http://www.westover.afrc.af.mil/units/>>

Figure 36: Massachusetts National Guard Personnel and Payroll (\$) - 2005

Activity	Full-Time		Part-Time		Civilian	
	Personnel	Payroll	Personnel	Payroll	Personnel	Payroll
Massachusetts Army National Guard	941	\$42,635,030	5,803**	\$1,006,330*	200	\$26,404,400
Massachusetts Air National Guard	756	\$37,561,808				\$50,602,677
Massachusetts Military Division: state payroll	N/A		N/A		61	\$2,674,890
Total		\$80,196,838		\$1,006,330*		\$79,681,967

Sources: Massachusetts National Guard: http://www.mass.gov/guard/PAO/Press_Resources.htm;

Massachusetts National Guard 2005 Annual Report, pp. 6, 9, 11.

* State funding for active duty service to 1,400 soldiers and airmen who served on state active duty during 2005, including during the winter and when assisting with Hurricane Katrina relief efforts on Cape Cod.

** In 2005, 7,500 soldiers and airmen in the Massachusetts National Guard served in Air Force and Army units. This number minus 1,697 full-time personnel equals 5,803.

Massachusetts military retirees

The Commonwealth is home to more than 19,000 retired military personnel, 57 percent of whom are older than 65. Massachusetts military retirees received more than \$300 million in retirement payments in 2005.

Figure 37: Massachusetts Retired Military Personnel - 2005

Officers	Enlisted	Total
6,243	13,122	19,365

Source: Military Officers Association of America at:

www.moaa.org/lac/lac_getting_involved/lac_factsheets_tips/lac_factsheets_tips_4.htm.

Economic impacts of military personnel spending

Spending by military personnel and retirees constitutes the second major component of defense spending in the state. While the impacts generated by this spending are smaller than those driven by defense industry production, active and retired personnel spending generated more than \$1 billion in estimated economic activity within the Commonwealth in 2005. As noted above, the Commonwealth hosts 2,243 active duty military personnel and an additional 6,556 civilian employees in the Army, Navy, Air Force and Marines.²⁴ An additional 7,500 Reserve and National Guardsmen are active in the state along with 261 civilian staff.²⁵ In addition to these service members and staff, another 19,365 retired military veterans live in the Commonwealth.²⁶ In 2005, these Massachusetts residents received more than \$787 million in payroll and \$308 million in retirement benefits. Note

²⁴ Department of Defense (SIAD) at <http://siadapp.dior.whs.mil/personnel/M02/fy05/05top.htm>.

²⁵ Massachusetts National Guard 2005 Annual Report at www.mass.gov/guard/PAO/PAO_Pages_Current_Publications/annual_report.pdf.

²⁶ The Military Officers Association of America at www.moaa.org/lac/lac_getting_involved/lac_factsheets_tips/lac_factsheets_tips_4.htm.

that this analysis only considers DoD-related personnel and retirees. DHS personnel work in a variety of settings in Massachusetts but data on the numbers of these personnel and their salaries are incomplete.²⁷

Figure 38: Massachusetts Military Personnel

	Personnel	Payroll	Disposable Income
Active	2,243	\$148,985,000	\$97,486,249
Civilian	6,556	\$445,851,000	\$291,736,360
Reserve/National Guard	7,761	\$192,535,000	\$131,057,997
Retired	19,365	\$308,296,000	\$236,700,112
Total	35,925	\$1,095,667,000	\$745,817,240*

Sources: Department of Defense (SIAD): siadapp.dior.whs.mil/personnel/M02/fy05/05top.htm; The Military Officers Association of America: http://www.moaa.org/lac/lac_getting_involved/lac_factsheets_tips/lac_factsheets_tips_4.htm; Massachusetts National Guard 2005 Annual Report: www.mass.gov/guard/PAO/PAO_Pages_Current_Publications/annual_report.pdf.

* In order to calculate disposable income, a disposable income ratio is multiplied by the total payroll. This ratio varies, however, by personnel category. Therefore, the total disposable income is not the sum of disposable income for each personnel category.

Output impacts

To calculate output impacts, the payroll data summarized above was used to determine disposable income for military personnel and retirees. Disposable income is the share actually spent by individuals but excludes the portion of income saved for other purposes. The estimated disposable income for the 16,550 active duty, reserve, National Guard, and civilian personnel and the 19,365 retirees totaled more than \$745 million in 2005. We estimate that disposable income from these groups combined generates an additional \$161 million in indirect impacts and \$193 million in induced impacts. Thus, military personnel and veteran retirees in Massachusetts generate \$1.1 billion in economic impacts. The multiplier for the spending is 1.47, which indicates that for every dollar spent by military personnel and retired veterans in Massachusetts, an additional 47 cents in economic activity results.

²⁷ Data on DoD personnel came from several sources, but some are incomplete due to data suppression.

Figure 39: Military Personnel Spending: Economic Impact, FY 2005

	Direct	Indirect	Induced	Total
Output*	\$745,817,240	\$160,969,369	\$193,106,827	\$1,099,893,409
Employment	4,484	1,119	1,605	7,208

* Direct impacts represent disposable income rather than total income.

Employment impacts

Spending by military personnel and retirees directly supports the equivalent of 4,484 additional jobs in the state. Indirect and induced employment generated by military household spending supports more than 2,700 jobs, bringing the total number of jobs generated to more than 7,200.

Appendix 1. Methodology: data, fields and codes

Overview:

In Phase I of the study, we analyze FY05 procurements to Massachusetts contractors made by the Department of Defense and the Department of Homeland Security. The data encompass information on all contracts entered into with Massachusetts-based organizations. The analysis summarizes information according to the following parameters:

- All ‘prime contracts’ - those worth \$25,000 or more – as well as contracts of lesser amounts.
- Procurements from contracts signed in FY05 as well as procurements from contracts spanning multiple years that may have been signed in other years.
- All work performed in Massachusetts as well as work performed in other states by Massachusetts-based organizations.

Base data:

The data sets are publicly available and include a wide range of information. Department of Defense FY05 procurement data was obtained through the Department of Defense Personnel and Procurement Reports and Data Files at <http://siadapp.dior.mhs.mil/index.html>. We acquired FY05 procurement data for the Department of Homeland Security through the Federal Procurement Data System using interface built into fpds.gov. The interface organizes the data slightly differently than DoD does. We were able, however, to create a closely parallel set of data for both Departments.

Inputs to both the DoD and DHS databases take the form of individual reports made by the contracting agency related to each contract action related to an identifiable contract. Many contracts involve multiple contract actions, each obligating a specific dollar cost called an ‘action obligation.’ The reports provide a variety of detailed information about the contractor (as well as the types of products and services) according to specific codes.

Fields and codes:

The fields and the related codes in the report are organized and defined in accordance with the DD350, the DoD's Individual Contracting Action Reports that are supplied to the Federal Procurement Data Center, which collects, processes and distributes official data on federal contracting. We obtained base data according to the following coded fields supplied by DD350 reports:

- B1B Origin of contract
- B3 Action date 'yyyymmdd'
- B4 Completion date
- B5A Contractor identification code – contractor's 9-position DUNS number
- B5B Government agency (contracting agency)
- B5D Contractor name
- B5E Contractor address
- B6 Principal place of performance
- B6B City, state and county name
- B8 Dollars
- B9 Foreign military sale
- B10 Multiyear contract
- B11 Multiyear contract cost
- B12A Product/service code
- B12E Product/service description
- B12B DOD claimant program code – claimant program description
- B12C Weapon system code; weapon system name
- B12D NAICS code
- B15 Information technology products or services
- D1A Type of business
- D7 Small business innovative research program (all sub codes)
- D10 Size of small business (all sub codes)

Technical manual:

The data sets were analyzed using the MN02, the Department of Defense Procurement Coding Manual, available at http://siadapp.dior.whs.mil/procurement/historical_reports/guidance/MN02/MN02.htm.

Appendix 2. Defense product sectors with product code groups

Supplies: Major Sectors
Weapons, ammunition and systems (10-13)
Guided missiles and systems (14)
Aircraft and equipment (15-17)
Space vehicles (18)
Ships and equipment (19-20)
Transportation equipment (22-26)
Engines and fuel systems (28-29)
Industrial machinery (30-53)
Construction equipment (54-56)
Communications equipment (58)
Electronics and optics (59-63)
Medical instruments and biologicals (65)
Navigational and measuring instruments (66,67)
Automated data processing (ADP) equipment (69-70)
Materials - fuel, plastics, glass, metal (91-96)
Miscellaneous personal and office supplies (68, 71-89, 99)

Research, Development, Test and Evaluation: Major Sectors
Aircraft research (AC1)
Missile and space systems (AC2)
Ships (AC3)
Automobile (AC4)
Weapons (AC5)
Electronics and communications (AC6)
Miscellaneous (AF11, AF16, AA11, AB22, AC9s, AT86)
Services and subsistence (AD2, 3, 4, 5)
Other defense (AD91)
Manufacturing technology (AE3)
Energy and environment (AG, AH)
Physical, computer and environmental sciences (AJ1, 2, 3; AP)
Engineering sciences (AJ4)
Life, psychological, social sciences (AJ5, AJ6, AJ7)
Other sciences (AJ9)
Housing (AK)
Medical sciences (AN)
Social services (AQ)
Space (AR)
Transportation (AS)
Other R&D (AZ)

Services: Major Sectors
Studies and analyses (B)
Facilities (C1)

Architecture and engineering (C2)
Automated data processing (D3)
Purchasing (E1, E2)
Wildlife/lands management (F0)
Environmental services (F1)
Social services (G0)
Quality control (H1)
Equipment and materials testing (H2)
Inspection services/other quality control (H3)
Maintenance and repair (J0)
Modification of equipment (KO)
Technical repair (L0)
Installation of equipment (N-P)
Professional (R0)
Facilities and facilities maintenance (Y, Z)
Transportation (V)
Facilities operations (S)
Medical (Q1)
Operation of non-building facilities (M1-M2)
Technical and educational (T, U)
Lease or rental (W, X)

Source: MN02 Department of Defense Procurement Coding Manual;
 Commodities and Services Reported on DD Form 350.
http://siadapp.dior.whs.mil/procurement/historical_reports/guidance/MN02/MN02.htm

Appendix 3. Service procurements by product sector and code, DoD, FY2005

Service Procurements by Sector and Code, MA Contractors, Department of Defense, FY 2005			
Product or Service Code	Product or Service Description	Count of Contract Actions	Dollar Value of Contracts
Studies and Analyses		174	70,118,086
B502	Air quality analyses	2	6,619,552
B504	Chemical/biological studies & analyses	6	58,361
B505	Cost benefit analyses	6	873,381
B507	Economic studies	1	121,481
B510	Environmental studies & assessments	36	3,779,799
B516	Animal & fisheries studies	2	(12,710)
B518	Geophysical studies	4	391,833
B519	Geotechnical studies	2	6,055
B522	Legal studies	1	3,910
B526	Oceanological studies	1	(909)
B529	Scientific data studies	7	5,608,028
B532	Soils studies	8	7,355
B533	Water quality studies	4	52,500
B537	Medical & health studies	15	14,446,796
B539	Aeronautic/space studies	2	39,003
B541	Defense studies	2	35,288
B542	Educational studies & analyses	2	220,000
B543	Energy studies	13	6,330,590
B544	Technology studies	2	736,000
B550	Organization/administrative/personnel studies	2	199,874
B553	Communications studies	2	2,972,755
B599	Other special studies & analyses	54	27,629,144
Facilities		19	2,026,427
C111	Administrative & service buildings	4	369,909
C118	Research & development facilities	2	82,591
C124	Utilities	4	1,136,170
C129	Other non-building structures	1	(1,530)
C130	Restoration	8	439,287
Architecture and engineering		178	16,976,775
C211	Architect-engineering services	114	11,174,124
C212	Engineering drafting services	1	11,300
C213	A&E inspection services (non-construction)	3	459,973
C214	A&E management engineering services	2	1,354,322
C219	Other architect & engineering services	58	3,977,056

	Automated data processing	654	419,051,786
D301	ADP facility operation & maintenance services	35	4,937,804
D302	ADP systems development services	24	7,421,132
D303	ADP data entry services	4	14,460
D304	ADP telecommunications & transmission services	31	2,510,367
D306	ADP systems analysis services	70	35,503,347
D307	Automated info system design & integration services	21	3,004,133
D308	Programming services	22	1,240,845
D309	Info & data broadcasting or data distribution services	3	108,175
D310	ADP backup & security services	4	1,148,981
D311	ADP data conversion services	1	5,767
D313	Computer aided design/computer aided manufacturing services	4	1,523,995
D314	ADP system acquisition support services	34	6,335,453
D315	Digitizing services	5	131,949,503
D316	Telecommunication network management services	5	100,236
D317	Automated news services, data services, or other info services	11	234,384
D399	Other ADP & telecommunication services	380	223,013,204
	Purchasing	4	1,011,442
E162	Purchase/recreational buildings	1	1,480
E174	Purchase/open storage facilities	2	9,962
E239	Purchase/EPG - other, including transmission	1	1,000,000
	Wildlife/lands management	5	240,727
F015	Well drilling/exploratory services	3	225,557
F099	Other natural resources & conservation services	2	15,170
	Environmental services	72	3,232,922
F101	Air quality support services	3	3,075
F103	Water quality support services	12	29,663
F105	Pesticides support services	1	(209)
F106	Toxic substances support services	3	28,750
F107	Hazardous substance analysis	1	17,000
F108	Hazardous substance removal/cleanup/disposal services	10	261,301
F109	Leaking underground storage tank support services	2	42,876
F112	Oil spill cleanup, removal, disposal & support	1	7,175
F999	Other environmental services, studies, & analytical support	39	2,843,291
	Social services	30	1,459,048
G002	Chaplain services	21	47,215
G003	Recreational services	5	80,249
G099	Other social services	4	1,331,584
	Quality control	10	6,722,652
H112	Quality control services/fire control equipment	1	(1,343)
H142	Quality control services/fire, rescue & safety equipment	1	7,500
H149	Quality control services/maintenance & repair shop equipment	1	11,095
H159	Quality control services/electrical & electronic equipment comps	3	6,672,240

H165	Quality control services/medical & dental equipment	1	3,900
H170	Quality control services/ADP equip & supplies	2	17,428
H176	Quality control services/books-maps-pubs	1	11,832
Equipment and materials testing		7	413,776
H210	Equipment & materials testing/weapons	1	2,870
H217	Equipment & materials testing/aircraft and handling equipment	1	329,534
H226	Equipment & materials testing/tires & tubes	4	85,052
H252	Equipment & materials testing/measuring tools	1	(3,680)
Inspection services/other quality control		59	13,028,930
H323	Inspection services/vehicles-trailers-cycles	1	5,700
H328	Inspection services/engines, turbines & comps	1	92,000
H339	Inspection services/materials handling equipment	1	5,600
H345	Inspection services/plumbing & heating equipment	1	(100)
H399	Inspection services/miscellaneous equipment	4	23,795
H914	Other quality control services/guided missiles	2	1,840,013
H935	Other quality control services/service & trade equipment	40	10,880,122
H963	Other quality control services/alarm & signal systems	1	105,250
H966	Other quality control services/instruments & lab equipment	2	1,765
H984	Other quality control services/clothing - individual	1	29,995
H999	Other quality control, testing & inspection services	5	44,790
Maintenance and repair		2,151	877,902,204
J010	Maintenance & repair of equipment/weapons	1	6,000
J012	Maintenance & repair of equipment/fire control equipment	24	1,407,199
J014	Maintenance & repair of equipment/guided missiles	21	170,944,230
J015	Maintenance & repair of equipment/aircraft structural comps	2	367,721
J016	Maintenance & repair of equipment/aircraft comps & accys	5	35,702,677
J019	Maintenance & repair of equipment/ships-small craft-docks	18	31,653,739
J020	Maintenance & repair of equipment/ship & marine equipment	15	95,426
J023	Maintenance & repair of equipment/vehicles-trailers-cycles	11	1,361,690
J024	Maintenance & repair of equipment/tractors	6	51,165
J028	Maintenance & repair of equipment/engines, turbines & comps	7	2,575,929
J030	Maintenance & repair of equipment/mech power trans equipment	1	30,000
J034	Maintenance & repair of equipment/metalworking machinery	2	11,082
J035	Maintenance & repair of equipment/service & trade equipment	12	267,178
J036	Maintenance & repair of equipment/special industry machinery	6	287,626
J038	Maintenance & repair of equipment/construction equipment	3	111,325
J039	Maintenance & repair of equipment/materials handling equipment	4	15,986

J041	Maintenance & repair of equipment/refrigeration, air cond equipment	8	155,972
J042	Maintenance & repair of equipment/fire, rescue & safety equipment	3	43,782
J043	Maintenance & repair of equipment/pumps & compressors	8	247,365
J045	Maintenance & repair of equipment/plumbing & heating equipment	14	317,644
J046	Maintenance & repair of equipment/water purification equipment	6	113,147
J049	Maintenance & repair of equipment/maintenance & repair shop equipment	17	270,962
J052	Maintenance & repair of equipment/measuring tools	6	8,407
J054	Maintenance & repair of equipment/prefab structures	1	6,059
J058	Maintenance & repair of equipment/communication equipment	257	69,855,988
J059	Maintenance & repair of equipment/electrical & elect equipment comp	61	1,598,926
J061	Maintenance & repair of equipment/power distribution equipment	16	250,566
J062	Maintenance & repair of equipment/lighting fixtures & lamps	1	842
J063	Maintenance & repair of equipment/alarm & signal systems	15	385,808
J065	Maintenance & repair of equipment/medical & dental equipment	72	1,435,264
J066	Maintenance & repair of equipment/instruments & lab equipment	179	4,993,744
J067	Maintenance & repair of equipment/photographic equipment	12	86,589
J068	Maintenance & repair of equipment/chemical products	2	12,980
J069	Maintenance & repair of equipment/training aids & devices	1	7,000
J070	Maintenance & repair of equipment/ADP equipment & supplies	1,165	540,402,090
J073	Maintenance & repair of equipment/food prep & serving equipment	2	148,600
J074	Maintenance & repair of equipment/office machines	11	82,721
J078	Maintenance & repair of equipment/recreational equipment	1	1,595
J084	Maintenance & repair of equipment/clothing - individual	1	(2,395)
J099	Maintenance & repair of equipment/miscellaneous equipment	119	11,581,741
J998	Non-nuclear ship repair (east)	11	383,763
J999	Non-nuclear ship repair (west)	24	624,071
	Modification of equipment	8	204,002
K030	Modification of equipment/mech power trans equipment	1	1,259
K036	Modification of equipment/special industry machinery	1	5,330
K038	Modification of equipment/construction equipment	1	4,392
K045	Modification of equipment/plumbing & heating equipment	1	124,933
K066	Modification of equipment/instruments & lab equipment	1	23,400
K070	Modification of equipment/ADP equipment & supplies	1	19,150
K073	Modification of equipment/food prep & serving	1	3,900

	equipment		
K089	Modification of equipment/subsistence	1	21,638
	Technical repair	86	8,198,788
L010	Technical repair/weapons	2	1,089,016
L012	Technical repair/fire control equipment	2	13,900
L014	Technical repair/guided missiles	3	(2,705,543)
L019	Technical repair/ships-small craft-docks	3	(1,136,978)
L042	Technical repair/fire, rescue & safety equipment	2	4,521
L055	Technical repair/lumber & millwork	1	47,152
L058	Technical repair/communication equipment	20	3,686,282
L059	Technical repair/electrical & elect equipment comps	6	1,410,796
L065	Technical repair/medical & dental equipment	2	11,843
L066	Technical repair/instruments & lab equipment	2	6,985
L069	Technical repair/training aids & devices	1	10,000
L070	Technical repair/ADP equipment & supplies	20	1,929,348
L071	Technical repair/furniture	1	3,250
L074	Technical repair/office machines	1	4,668
L083	Technical repair/textiles-leather-furs	1	(3,511)
L099	Technical repair/miscellaneous equipment	19	3,827,059
	Operation of non-building	54	85,955,864
M111	Operation/office buildings	1	166,419
M127	Operation/electronic & communication facilities	14	3,245,763
M142	Operation/laboratories & clinics	2	1,213,035
M164	Operation/dining facilities	2	20,374
M173	Operation/fuel storage buildings	7	757,601
M181	Operation/government-owned contractor-operated R&D facilities	2	13,000,000
M299	Operation/all other non-building facilities	26	67,552,672
	Installation of equipment	64	3,382,552
N020	Installation of equipment/ship & marine equipment	1	83,203
N041	Installation of equipment/refrigeration, air cond equipment	1	5,121
N046	Installation of equipment/water purification equipment	1	5,567
N056	Installation of equipment/construction materials	1	11,941
N058	Installation of equipment/communication equipment	8	1,557,673
N059	Installation of equipment/electrical & elect equipment comps	9	274,625
N063	Installation of equipment/alarm & signal systems	3	83,482
N066	Installation of equipment/instruments & lab equipment	3	11,460
N067	Installation of equipment/photographic equipment	4	20,829
N068	Installation of equipment/chemical products	1	3,500
N070	Installation of equipment/ADP equipment & supplies	5	175,485
N071	Installation of equipment/furniture	8	250,398
N073	Installation of equipment/food prep & serving equipment	2	13,525
N077	Installation of equipment/musical instruments-radio	1	579,574
N099	Installation of equipment/miscellaneous equipment	8	189,350
P100	Prep & disposal of excess & surplus property	2	7,140
P500	Demolition of structures or fac (other than buildings)	4	99,991
P999	Other salvage services	2	9,688

	Medical	52	91,678,171
Q101	Dependent Medicare services	1	190,849
Q201	General health care services	7	85,429,152
Q301	Laboratory testing services	14	321,762
Q401	Nursing services	3	3,569,214
Q503	Dentistry services	3	36,456
Q505	Gastroenterology services	2	23,602
Q508	Hematology services	1	123,019
Q512	Optometry services	2	50,137
Q515	Pathology services	1	(2,575)
Q516	Pediatric services	1	1,501
Q522	Radiology services	1	7,554
Q526	Medical/psychiatric consultation services	1	5,300
Q999	Other medical services	15	1,922,200
	Professional	2,097	687,470,922
R401	Personal care services	28	1,949,753
R404	Land surveys, cadastral services (non-const)	1	11,622
R405	Operations research and quantitative analysis services	1	24,000
R407	Program evaluation services	6	230,322
R408	Program management/support services	331	99,945,665
R409	Program review/development services	13	1,192,946
R411	Real property appraisal services	14	274,099
R412	Simulation	4	15,904,059
R413	Specifications development services	6	459,448
R414	Systems engineering services	125	30,309,895
R415	Technology sharing/utilization services	8	632,240
R416	Veterinary/animal care services	4	2,226,253
R418	Legal services	12	127,861
R419	Educational services	55	3,630,767
R421	Technical assistance	168	28,537,613
R422	Market research and public opinion services	3	1,634,884
R423	Intelligence services	41	43,647,017
R424	Expert witness	2	128,469
R425	Engineering technical services	314	121,348,774
R426	Communications services	27	7,862,368
R427	Weather reporting/observation services	5	23,986
R497	Personal services contracts	5	21,503
R498	Patent and trademark services	104	7,450,592
R499	Other professional services	528	224,857,295
R603	Transcription services	4	24,520
R604	Mailing & distribution services	2	9,852
R605	Library services	3	84,218
R606	Court reporting services	9	11,881
R607	Word processing/typing services	1	15,706
R608	Translation & interpreting services	7	193,596
R610	Personal property management services	1	68,553
R612	Information retrieval	7	1,207,517
R614	Paper shredding services	7	28,539
R699	Other administrative support services	34	2,532,132

R701	Advertising services	15	13,787,585
R702	Data collection services	11	3,042,459
R703	Accounting services	2	402,446
R704	Auditing services	1	5,150
R706	Logistics support services	31	2,488,467
R707	Contract, procurement & acquisition support services	8	452,022
R708	Public relations services	3	9,621
R710	Financial services	2	3,798,573
R712	Coin minting	1	5,379
R799	Other management support services	143	66,871,275
	Facilities operations	1,903	143,631,655
S111	Gas services	11	682,357
S112	Electric services	30	8,834,046
S113	Telephone and/or communications services	29	844,565
S114	Water services	21	216,548
S119	Other utilities	36	7,355,577
S201	Custodial - janitorial services	88	4,489,643
S202	Fire protection services	2	56,994
S203	Food services	84	32,619,926
S204	Fueling & other petroleum services-excluding storage	2	36,190
S205	Trash/garbage collection services-including port san services	49	1,445,611
S206	Guard services	6	210,851
S207	Insect & rodent control services	6	75,743
S208	Landscaping/groundskeeping services	44	521,665
S209	Laundry & dry cleaning services	72	932,177
S211	Surveillance services	5	125,960
S212	Solid fuel handling services	15	147,211
S214	Carpet laying & cleaning services	5	32,856
S215	Warehousing & storage services	3	49,950
S216	Facilities operations support services	433	76,479,991
S218	Snow removal/salt services	45	646,355
S222	Waste treatment & storage	878	5,308,736
S299	Other housekeeping services	39	2,518,703
	Technical and educational	284	68,763,317
T001	Arts/graphics services	3	14,815
T003	Cataloging services	2	19,750
T005	Film processing services	1	(5,372)
T006	Film/video tape production services	1	1,122,968
T009	Aerial photographic services	4	448,156
T010	General photographic services - still	9	7,870
T011	Print/binding services	3	17,986
T012	Reproduction services	4	39,894
T015	General photographic services - motion	1	500
T016	Audio/visual services	3	40,142
T099	Other photographic mapping, printing & pub services	4	30,278
U001	Lectures for training	14	1,285,592
U002	Personnel testing	1	40,471
U003	Reserve training (military)	1	17,060

U004	Scientific & management education	3	75,521
U005	Tuition, registration & membership fees	116	7,117,984
U006	Vocational/technical	3	80,850
U008	Training/curriculum development	16	5,897,678
U009	Education services	25	18,731,048
U012	ADP software, equipment, and tele training	16	596,061
U099	Other education & training services	54	33,184,065
	Transportation	192	245,315,868
V003	Packing/crating services	5	341,201
V112	Motor freight	1	12,490
V119	Other cargo & freight services	86	109,137
V124	Marine charter for things	49	243,800,021
V125	Vessel towing service	1	36,850
V212	Motor passenger service	10	325,831
V222	Passenger motor charter service	1	11,970
V226	Taxicab services	1	9,800
V227	Navigational aid and pilotage services	1	22,445
V231	Lodging - hotel/motel	24	325,184
V251	Civilian personnel recruitment	9	305,277
V301	Relocation services	2	8,644
V999	Other transportation travel & relocation services	2	7,018
	Lease or rental	238	2,828,879
W015	Lease or rental/aircraft structural comps	1	560
W023	Lease or rental/vehicles-trailers-cycles	4	16,725
W035	Lease or rental/service & trade equipment	3	78,740
W036	Lease or rental/special industry machinery	5	37,638
W038	Lease or rental/construction equipment	4	57,000
W039	Lease or rental/materials handling equipment	29	197,120
W041	Lease or rental/refrigeration, air cond equipment	34	97,836
W043	Lease or rental/pumps & compressors	2	5,711
W044	Lease or rental/furnace-steam plant-reac	2	6,500
W045	Lease or rental/plumbing & heating equipment	8	88,400
W046	Lease or rental/water purification equipment	3	25,485
W052	Lease or rental/measuring tools	1	48,011
W056	Lease or rental/construction materials	4	1,592
W058	Lease or rental/communication equipment	31	265,769
W059	Lease or rental/electrical & elect equipment comps	1	20,550
W065	Lease or rental/medical & dental equipment	3	74,519
W066	Lease or rental/instruments & lab equipment	49	441,727
W067	Lease or rental/photographic equipment	4	13,931
W070	Lease or rental/ADP equipment & supplies	1	825
W071	Lease or rental/furniture	6	92,278
W072	Lease or rental/household furnishings	1	1,500
W074	Lease or rental/office machines	10	51,193
W081	Lease or rental/containers-packaging	4	26,263
W084	Lease or rental/clothing-individual	1	1,895
W099	Lease or rental/miscellaneous equipment	7	219,971
X111	Lease/office buildings	6	116,626
X112	Lease/conference space & facilities	5	102,460

X119	Lease/other administrative & service buildings	2	8,400
X173	Lease/fuel storage buildings	2	712,443
X199	Lease/other miscellaneous buildings	3	7,554
X243	Lease/pollution abatement & control facilities	1	8,357
X292	Lease/exhibit design (non-building)	1	1,300
	Facilities and facilities maintenance	575	278,764,952
Y111	Office buildings	6	(6,605,143)
Y112	Conference space & facilities	3	13,726
Y119	Other administrative & service buildings	4	3,302,376
Y127	Electronic & communication facilities	4	22,098
Y129	Other airfield structures	2	203,065
Y152	Maintenance buildings	1	21,815
Y155	Tank-automotive facilities	1	662,500
Y159	Other industrial buildings	14	123,236,423
Y181	Government-owned contractor-operated R&D facilities	2	708,994
Y199	Other miscellaneous buildings	27	74,319,864
Y211	Dams	5	6,332,307
Y216	Dredging, excl. dustpan and sea-going hoppers	5	2,017,337
Y222	Highways, roads, streets, bridges and railways	7	472,872
Y224	Parking facilities construction	1	55,077
Y242	Heating & cooling plants	6	974,433
Y249	Other utilities	1	120,000
Y291	Recreation facilities (non-building)	2	14,400
Y293	Unimproved real property (land)	1	621,635
Y299	All other non-building facilities	13	2,006,280
Z111	Maintenance/office buildings	151	6,314,048
Z112	Maintenance/conference space & facilities	1	82,389
Z119	Maintenance/other administrative & service buildings	63	5,565,622
Z124	Maintenance/airport runways	2	38,264
Z126	Maintenance/missile system facilities	1	-
Z127	Maintenance/electronic & communication facilities	2	397,178
Z129	Maintenance/other airfield structures	2	256,100
Z131	Maintenance/schools	2	52,509
Z141	Maintenance/hospitals & infirmaries	2	3,797
Z151	Maintenance/ammunition facilities	1	258,000
Z152	Maintenance/maintenance buildings	1	5,173
Z159	Maintenance/other industrial buildings	30	2,519,882
Z161	Maintenance/family housing facilities	15	9,582,072
Z162	Maintenance/recreational buildings	3	(358,044)
Z163	Maintenance/troop housing facilities	4	79,353
Z179	Maintenance/other warehouse buildings	4	1,885
Z182	Maintenance/government-owned government-operated (GOGO) R&D facilities	6	347,540
Z184	Maintenance/GOGO environmental laboratories	2	(350,579)
Z192	Maintenance/testing & measurement buildings	1	3,875
Z199	Maintenance/other miscellaneous buildings	39	3,441,500
Z211	Maintenance/dams	8	951,948
Z212	Maintenance/canals	1	5,000
Z216	Dredging, excl. dustpan and sea-going hoppers	16	4,906,597
Z222	Maintenance/highways, roads, streets, & bridges	7	687,307

Z224	Maintenance/parking facilities construction	2	98,000
Z241	Maintenance/fuel supply facilities	1	2,979
Z242	Maintenance/heating & cooling plants	4	1,931,524
Z243	Maintenance/pollution abatement & control facilities	2	39,840
Z244	Maintenance/sewage & waste facilities	1	14,502
Z245	Maintenance/water supply facilities	2	11,737
Z249	Maintenance/other utilities	13	572,557
Z291	Maintenance/recreation facilities (non-building)	1	14,378
Z292	Maintenance/exhibit design (non-building)	1	2,500
Z293	Maintenance/unimproved real property (land)	1	(44,219)
Z299	Maintenance/all other non-building facilities	36	8,942,472
Z300	Maintenance/restoration activities	42	23,887,207
Other Services Total		8,916	3,028,379,745
Total		29,120	9,631,241,136

Source: Department of Defense Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <<http://siadapp.dior.mhs.mil/index.html>>

Appendix 4. Supplies procurements by product sector and code, DoD, FY2005

Product or Service Code	Product or Service Description	Count of contract actions	Dollar value of contracts
Weapons, ammunition and systems (10-13)		301	449,686,564
1005	Guns, through 30 mm	80	30,708,759
1010	Guns, over 30 mm up to 75 mm	5	131,576
1015	Guns, 75 mm through 125 mm	15	166,597
1025	Guns, over 150 mm through 200 mm	13	3,717,792
1030	Guns, over 200 mm through 300 mm	1	11,966
1045	Launchers, Torpedo and Depth Charge	1	8,088
1055	Launchers, Rocket and Pyrotechnic	3	110,000
1075	Degaussing and Mine Sweeping Equipment	11	1,464,517
1090	Assy Intrcng Btwn Wpns In 2 or More Class	5	764,183
1095	Miscellaneous Weapons	30	120,558,130
1220	Fire Control Computing Sights & Devices	8	38,879
1240	Optical Sighting and Ranging Equipment	39	71,685,419
1265	Fire Control Transmitting & Receiving Eq	2	112,471,300
1270	Aircraft Gunnery Fire Control Components	7	1,044,599
1280	Aircraft Bombing Fire Control Components	1	7,575
1285	Fire Control Radar Equip, Except Airborne	12	(104,950)
1290	Miscellaneous Fire Control Equipment	6	292,088
1336	Guided Msl Warheads and Explosive Comps	4	3,332,004
1338	Guide Msl and Sp Veh Inert Un, Fuel, Comp	2	1,120,913
1340	Rockets, Rocket Ammunition & Rocket Comps	8	237,234
1351	Underwater Mine Explosive Components	1	12,180
1375	Demolition Materials	1	32,267
1377	Cartridge & Propellant Actuated Dv & Comps	9	262,649
1385	Surface Use Explo Ord Disposal Tools & Eq	31	101,554,809
1386	Undwtr Use Explo Ord Disposal Tools & Eq	5	44,792
1398	Specilized Ammo Handling and Svcing Equip	1	13,198
Guided missiles and systems (14)		147	476,949,342
1410	Guided Missiles	5	53,866,392
1420	Guided Missile Components	76	382,806,107
1425	Guided Missile Systems, Complete	5	2,870,216
1427	Guided Missile Subsystems	9	11,233,883
1430	Guided Missile Remote Control Systems	29	16,629,979
1440	Launchers, Guided Missile	9	88,522
1450	Guided Missile Handling & Servicing Equip	14	9,454,243
Aircraft and equipment (15-17)		229	28,391,562
1510	Aircraft Fixed Wing	1	(789)
1560	Airframe Structural Components	77	11,321,451
1615	Helicopter Rotor Blades, Drive Mechanisms & Compon	11	378,308
1620	Aircraft Landing Gear Components	5	202,709
1630	Aircraft Wheel and Brake Systems	1	2,760
1640	Aircraft Control Cable Products	2	51,590
1650	Acft Hydraulic, Vacuum & De-icing Sys Comp	29	8,017,055
1660	Aircraft AC, Heating, and Pressurizing Equipment	6	19,020
1670	Parachutes and Cargo Tie Down Equipment	4	45,492
1680	Msl Aircraft Accessories and Components	56	5,415,918
1710	Aircraft Landing Equipment	6	(46,442)
1720	Aircraft Launching Equipment	11	2,358,691
1730	Aircraft Ground Servicing Equipment	17	610,508
1740	Airfield Specialized Trucks and Trailers	3	15,291

Space equipment (18)		25	10,263,587
1860	Space Survival Equipment	25	10,263,587
Ships and equipment (19, 20)		106	22,884,078
1904	Submarines	20	620,610
1906	Minelayers and Minesweepers	2	567,087
1940	Small Craft	2	83,910
1990	Miscellaneous Vessels	2	42,158
2010	Ship and Boat Propulsion Components	26	10,505,900
2020	Rigging and Rigging Gear	2	19,597
2030	Deck Machinery	6	75,377
2040	Marine Hardware and Hull Items	14	635,287
2050	Buoys	4	233,119
2090	Miscellaneous Ship and Marine Equipment	28	10,101,033
Transportation equipment (22-26)		143	58,011,480
2210	Locomotives	1	74,590
2250	Track Material, Railroad	1	15,204
2305	Ground Effect Vehicles	7	3,980,708
2310	Passenger Motor Vehicles	1	736,086
2320	Trucks and Truck Tractors, Wheeled	6	49,195,080
2330	Trailers	1	3,321
2350	Combat Assault & Tactical Veh, Tracked	6	661,510
2420	Tractors, Wheeled	1	9,799
2510	Vehicular Cab, Body, Frame Structural Comp	19	109,870
2520	Vehicular Power Transmission Components	9	385,853
2530	Vehicular Brake, Steering, Axle Wheel Comp	22	1,119,964
2540	Vehicular Furniture and Accessories	21	308,304
2541	Weapons Systems Specific Vehicular Accessories	1	66,520
2590	Miscellaneous Vehicular Components	38	1,096,116
2610	Tires & Tubes, Pneumatic, Except Aircraft	7	155,565
2630	Tires, Solid and Cushion	1	90,000
2640	Tire Rebuilding & Tire & Tube Repair Mats	1	2,990
Engines and fuel systems (28-29)		1,546	1,124,264,810
2805	Gas Reciprocating Eng, Excl Acft, & Components	7	125,763
2810	Gas Reciprocating Eng, Aircraft & Prime Move;Comps	2	22,105
2815	Diesel Engines and Components	11	285,225
2825	Steam Turbines and Components	13	108,495
2835	Gas Turbines and Jet Eng, Non Acft; and Comps	31	5,952,842
2840	Gas Turbines and Jet Engines, Acft & Comps	1,372	1,099,685,427
2895	Miscellaneous Engines and Components	8	624,607
2910	Engine Fuel Sys Components, Nonaircraft	14	144,816
2915	Engine Fuel System Components, Aircraft & Missile	30	8,404,461
2920	Engine Electrical Sys Comps, Nonaircraft	6	28,031
2925	Engine Electrical Sys Comps, Aircraft Prime Moving	6	615,088
2930	Engine Cooling Sys Comps, Nonaircraft	5	4,521,731
2940	Eng Air & Oil Fil, Strainers, & Cleaners, Nonacft	8	54,460
2945	Eng Air & Oil Filters, Cleaners, Acft Prime Moving	1	39,350
2990	Misc Engine Accessories, Nonaircraft	9	765,432
2995	Miscellaneous Engine Accessories, Aircraft	23	2,886,977

Industrial Machinery (30-53)		2,487	104,762,389
3010	Torque Converters and Speed Changers	36	308,315
3020	Gears, Pulleys, Sprockets and Trans Chain	27	417,874
3030	Belting, Drive Belts, Fan Belts & Accys	1	37,800
3040	Miscellaneous Power Transmission Equip	61	1,421,005
3110	Bearings, Antifriction, Unmounted	32	431,839
3120	Bearings, Plain, Unmounted	57	562,070
3130	Bearings, Mounted	2	11,976
3220	Woodworking Machines	2	28,249
3230	Tools & Attachments for Woodworking Mach	1	2,479
3408	Machining Centers & Way-type Machines	1	4,979
3410	Electrical & Ultrasonic Erosion Machines	1	2,612
3413	Drilling and Tapping Machines	1	12,276
3416	Lathes	10	200,177
3417	Milling Machines	2	5,033
3419	Miscellaneous Machine Tools	10	484,741
3424	Metal Heat Treating & Non-thermal Equip	1	269,500
3432	Electric Resistance Welding Equipment	1	36,350
3436	Welding Positioners and Manipulators	4	38,796
3438	Miscellaneous Welding Equipment	1	6,723
3439	Misc Welding, Soldering & Brazing Supply	18	107,851
3443	Mechanical Presses, Power Driven	1	171,281
3445	Punching and Shearing Machines	2	75,703
3449	Msc Secondary Metal Forming & Cutting Mach	1	3,862
3450	Machine Tools, Portable	3	35,088
3455	Cutting Tools for Machine Tools	1	14,388
3460	Machine Tool Accessories	6	141,180
3461	Accessories for Secondary Metal Machinery	1	11,694
3465	Production Jigs, Fixtures and Templates	2	68,284
3470	Machine Shop Sets, Kits, and Outfits	1	(467)
3510	Laundry and Dry Cleaning Equipment	14	301,603
3540	Wrapping and Packaging Machinery	2	32,508
3550	Vending and Coin Operated Machines	3	13,669
3590	Misc Service and Trade Equipment	13	226,665
3610	Printing, Duplicating & Bookbinding Equip	4	42,337
3615	Pulp and Paper Industries Machinery	12	147,726
3620	Rubber & Plastic Working Machinery	1	150
3625	Textile Industries Machinery	1	4,760
3630	Clay & Concrete Products Industries Mach	1	13,148
3650	Chemical and Pharmaceutical Machinery	2	162,920
3655	Gas Generating and Dispensing Systems	7	56,104
3660	Industrial Size Reduction Machinery	1	4,698
3670	Specilized Circuit Board Manufacturing Mach	1	3,054
3680	Foundry Machinery, Related Equip & Sup	1	2,500
3690	Specialized Ammunition and Ordnance Mach	2	23,490,000
3695	Miscellaneous Special Industry Machinery	20	1,517,794
3740	Pest, Disease, and Frost Control Equipment	2	18,995
3750	Gardening Implements and Tools	1	21,247
3810	Cranes and Crane-shovels	2	15,754
3815	Crane and Crane-shovel Attachments	1	2,950
3820	Mining, Rock Drilling, Earth Boring Equip, Related	1	113,974
3825	Road Clearing, Cleaning, and Marking Equipment	3	66,058
3830	Truck and Tractor Attachments	2	21,813
3835	Petroleum Production & Distribution Equip	3	136,946
3895	Miscellaneous Construction Equipment	5	15,352
3910	Conveyors	1	165,811
3920	Mat Handling Equip, Nonself-propelled	9	1,019,251
3930	Warehouse Trks & Tractors, Self-propelled	6	65,532
3940	Blocks Tackle Rigging and Slings	8	107,865
3950	Winches, Hoists, Cranes, and Derricks	6	31,394

3990	Miscellaneous Materials Handling Equip	17	195,363
4010	Chain and Wire Rope	3	57,145
4020	Fiber Rope, Cordage, and Twine	6	65,763
4030	Fittings for Rope, Cable, and Chain	11	174,708
4110	Refrigeration Equip	32	616,767
4120	Air Conditioning Equip	9	1,890,271
4130	Refrigeration and Air Conditioning Comps	9	529,181
4140	Fans, Air Circulators, & Blower Equip	8	80,058
4210	Fire Fighting Equipment	15	501,982
4220	Marine Lifesaving and Diving Equipment	2	9,699
4235	Hazardous Mat Spill Cont & Clean-up Eq & Mat	7	109,564
4240	Safety and Rescue Equipment	14	2,541,395
4250	Recycling and Reclamation Equipment	5	58,338
4310	Compressors and Vacuum Pumps	26	479,426
4320	Power and Hand Pumps	348	6,592,776
4330	Centrifugals, Separators, and Press and Vac Filt	22	115,414
4420	Heat Exchangers and Steam Condensers	5	301,586
4430	Industrial Furnaces, Kilns, Lehrs, & Ovens	1	12,717
4440	Driers, Dehydrators, and Anhydrators	10	108,178
4460	Air Purification Equipment	2	180,360
4470	Nuclear Reactors	1	18,370
4510	Plumbing Fixtures and Accessories	1	11,393
4520	Space Heating Equipment & Domestic Water Heaters	11	167,437
4530	Fuel Burning Equipment Units	1	3,645
4540	Misc Plumbing, Heating, & Sanitation Equipment	14	558,834
4610	Water Purification Equipment	21	378,531
4620	Water Distillation Equip, Marine & Indust	4	24,153
4710	Pipe and Tube	59	1,388,573
4720	Hose and Tubing, Flexible	36	333,383
4730	Fittings and Specialties; Hose, Pipe, Tube	75	5,225,180
4810	Valves, Powered	37	18,233,251
4820	Valves, Nonpowered	176	4,229,201
4910	Motor Veh Maint & Repr Shop Specilized Eq	15	281,690
4920	Acft Maint & Repair Shop Specilized Equip	99	7,302,070
4921	Torpedo Maint, Repair, & Checkout Spec Eq	1	7,794
4930	Lubrication & Fuel Dispensing Equipment	4	37,931
4931	Fire Control Maint & Repair Shop Spec Eq	6	85,263
4933	Weapons Maint & Repair Shop Spec Eq	15	385,657
4935	Guided Missile Maint, Rpr, & Chkout Specilized Eq	1	8,982
4940	Miscellaneous Maint & Repair Shop Specilized Eq	18	696,400
5110	Hand Tools, Edged, Nonpowered	6	75,446
5120	Hand Tools, Nonedged, Nonpowered	37	868,579
5130	Hand Tools, Power Driven	17	231,572
5140	Tool and Hardware Boxes	25	295,390
5180	Sets, Kits, and Outfits of Hand Tools	15	708,025
5210	Measuring Tools, Craftsmen's	13	80,952
5220	Inspection Gages & Precision Layout Tools	11	71,104
5280	Sets, Kits, and Outfits of Measuring Tools	5	36,944
5305	Screws	39	97,171
5306	Bolts	30	449,683
5307	Studs	6	11,769
5310	Nuts and Washers	42	329,129
5315	Nails, Keys, and Pins	54	435,834
5320	Rivets	10	53,199
5325	Fastening Devices	22	286,816
5330	Packing and Gasket Materials	156	4,652,343
5331	O-Ring	4	59,580
5340	Miscellaneous Hardware	260	7,064,054
5341	Brackets	2	29,055
5342	Hardware, Weapon System	74	1,011,061
5345	Disks and Stones, Abrasive	3	20,703
5350	Abrasive Materials	2	31,963
5355	Knobs and Pointers	13	231,271
5360	Coil, Flat, and Wire Springs	24	98,835
5365	Rings, Shims, and Spacers	48	799,246

Construction equipment (54-56)		38	4,294,178
5410	Prefabricated and Portable Buildings	2	39,733
5411	Rigid Wall Shelters	1	6,390
5419	Collective Modular Support System	1	3,726,166
5430	Storage Tanks	5	100,133
5440	Scaffolding Equipment and Concrete Forms	7	201,079
5450	Miscellaneous Prefabricated Structures	7	66,403
5510	Lumber and Related Basic Wood Materials	3	24,030
5530	Plywood and Veneer	1	25
5630	Pipe and Conduit, Nonmetallic	1	4,756
5640	Wallboard, Bldg Paper, & Thermal Insulation Mat	2	11,881
5660	Fencing, Fences, and Gates	2	10,066
5675	Nonwood Construction Lumber and Related Materials	1	35,548
5680	Miscellaneous Construction Materials	5	67,968
Communication equipment (58)		1,345	960,464,624
5805	Telephone and Telegraph Equipment	231	288,089,141
5810	Communications Security Equip and Comps	109	6,949,348
5811	Other Cryptologic Equipment & Components	3	54,750
5815	Teletype and Facsimile Equipment	2	103,172
5820	Radio & TV Comm Equipment, Except Airborne	36	3,905,122
5821	Radio and TV Comm Equipment, Airborne	5	192,905
5825	Radio Navigation Equip, Except Airborne	6	87,100
5826	Radio Navigation Equipment, Airborne	8	5,683,341
5830	Intercomm & Public Address Sys, Ex Airborne	11	480,094
5831	Intercomm & Public Address Sys, Airborne	3	188,046
5835	Sound Recording & Reproducing Equipment	2	21,202
5836	Video Recording and Reproducing Equipment	9	261,595
5840	Radar Equipment, Except Airborne	106	272,268,384
5841	Radar Equipment, Airborne	14	3,925,177
5845	Underwater Sound Equipment	25	3,640,325
5850	Visible & Invisible Light Comm Equipment	6	36,286
5855	Night Vision Equipment, Emitted and Reflect Radia	77	23,710,258
5860	Stimulated Coherent Radiation Devices, Comps & Acc	5	15,885,540
5865	Elet Cntrmsrs, Cntr-Cntr-Msrs & Qck Rctn Cpblty Eq	5	60,187
5895	Miscellaneous Communication Equipment	682	334,922,651
Electronics and optics (59-63)		3,588	316,259,463
5905	Resistors	33	228,547
5910	Capacitors	14	107,897
5915	Filters and Networks	33	4,464,063
5920	Fuses, Arrestors, Absorbers, & Protectors	30	382,907
5925	Circuit Breakers	13	141,155
5930	Switches	130	1,765,599
5935	Connectors, Electrical	347	3,179,672
5940	Lugs, Terminals, and Terminal Strips	6	114,993
5945	Relays and Solenoids	29	312,252
5950	Coils and Transformers	108	1,195,356
5955	Oscillators & Piezoelectric Crystals	11	152,311
5960	Electron Tubes & Assoc Hardware	105	8,613,966
5961	Semiconductor Devices & Assoc Hardware	28	431,649
5962	Microcircuits, Electronic	216	3,700,617
5963	Electronic Modules	20	1,614,487
5965	Headsets, Handsets, Microphones & Speakers	208	9,691,993
5970	Elec Insulators and Insulating Material	2	9,642
5975	Electrical Hardware and Supplies	79	5,267,915
5977	Electrical Contact Brushes & Electrodes	12	163,327
5980	Optoelectronic Devices & Assoc Hardware	8	149,477
5985	Antennas, Waveguides & Related Equipment	437	40,450,611
5990	Synchros and Resolvers	17	367,107
5995	Cable, Cord, Wire Assemblies: Comm Equip	177	9,500,087
5996	Amplifiers	36	17,487,580

5998	Electrical & Elct Boards, Cards & Asscted Hrdwre	350	48,481,066
5999	Misc Electrical & Electronic Components	330	107,371,370
6010	Fiber Optic Conductors	2	135,020
6015	Fiber Optic Cables	8	148,554
6020	Fiber Optic Cable Assemblies and Harnesses	5	104,879
6030	Fiber Optic Devices	5	1,110,548
6032	Fiber Optic Light Sources	1	4,750
6060	Fiber Optic Interconnectors and Supplies	2	31,378
6070	Fiber Optic Accessories and Supplies	1	3,581
6099	Miscellaneous Fiber Optic Components	6	578,409
6105	Motors, Electrical	18	4,915,103
6110	Electrical Control Equipment	52	8,336,713
6115	Generators and Generator Sets, Electrical	15	242,846
6116	Fuel Cell Power Units, Components, & Accys	1	15,200
6120	Transformers: Distribution & Power Station	6	109,172
6125	Converters, Electrical, Rotating	5	46,695
6130	Converters, Electrical, Nonrotating	76	11,601,914
6135	Batteries, Nonrechargeable	5	1,812,747
6140	Batteries, Rechargeable	6	85,311
6145	Wire and Cable, Electrical	37	456,174
6150	Misc Electric Power & Distribution Eq	96	5,587,382
6160	Miscellaneous Battery Retaining Fixtures & Liners	3	53,150
6210	Indoor & Outdoor Electric Lighting Fixtures	34	321,067
6220	Electric Vehicular Lights and Fixtures	28	872,237
6230	Electric Portable & Hand Lighting Equip	7	132,460
6240	Electric Lamps	8	60,374
6250	Ballasts, Lampholders, and Starters	6	25,819
6260	Nonelectrical Lighting Fixtures	313	7,608,793
6310	Traffic and Transit Signal Systems	1	60,000
6320	Shipboard Alarm and Signal Systems	7	102,084
6340	Aircraft Alarm and Signal Systems	8	136,516
6350	Misc Alarm, Signal and Security Detection Systems	47	6,214,941
Medical instruments and biologicals (65)		1,830	42,917,089
6505	Drugs & Biologicals	40	567,237
6507	Blood Derivatives	1	36,692
6510	Surgical Dressing Materials	3	22,197
6515	Medical & Surgical Instruments, Equip & Supplies	1,145	25,329,329
6520	Dental Instruments, Equip, and Supplies	9	138,227
6525	X-ray Equip & Sup: Medical, Dental, & Vet	114	11,618,464
6530	Hospital Furniture, Equip, Utensils, & Sup	34	1,076,266
6532	Hospital & Surgical Clthng & Rltd Spl Purpse Items	14	76,731
6540	Ophthalmic Instruments, Equip, & Supplies	403	2,533,188
6545	Replenishable Field Medical Sets, Kits, and Outfits	15	207,381
6550	In Vitro Dgnstc Sbstncs, Reagents, Tst Kts, & Sts	52	1,311,377

Navigational and measuring instruments (66, 67)		1,251	63,009,902
6605	Navigational Instruments	33	2,384,577
6610	Flight Instruments	7	164,759
6615	Automatic Pilot Mechanisms & Airborne Gyro Comps	19	832,492
6620	Engine Instruments	64	4,797,932
6625	Electrical & Elct Properties Meas & Tst Instrumnts	215	8,080,165
6630	Chemical Analysis Instruments	43	2,169,423
6635	Physical Properties Testing Equipment	45	5,406,493
6636	Environmental Chambers and Related Equipment	11	1,502,115
6640	Laboratory Equipment & Supplies	444	8,397,533
6645	Time Measuring Instruments	3	13,101
6650	Optical Instruments, Test Equip, Comps & Accys	65	7,293,650
6655	Geophysical Instruments	67	2,105,865
6660	Meteorological Instruments and Apparatus	13	870,282
6665	Hazard-Detecting Instruments & Apparatus	53	10,670,001
6670	Scales and Balances	2	45,633
6675	Drafting, Surveying, & Mapping Instruments	1	26,429
6680	Liq & Gas Flow, Liq Lvl, & Mech Motion Meas Instru	22	762,584
6685	Pressure, Temp, & Humidity Meas & Contrling Instru	54	1,671,459
6695	Combination & Miscellaneous Instruments	47	886,065
6710	Cameras, Motion Picture	6	771,225
6720	Cameras, Still Picture	13	2,763,513
6730	Photographic Projection Equipment	9	101,615
6740	Photo Developing and Finishing Equip	1	(6,800)
6750	Photographic Supplies	2	32,551
6760	Photographic Equipment and Accessories	10	1,259,366
6780	Photographic Sets, Kits, and Outfits	2	7,874

Automated data processing equipment (69-70)		1,117	66,018,424
6910	Training Aids	30	1,325,257
6920	Armament Training Devices	2	10,969
6930	Operational Training Devices	9	1,290,595
6940	Communication Training Devices	12	258,298
7010	ADPE System Configuration	88	10,578,211
7020	ADP Centrl Processing Unit (CPU, Computer), Analog	15	561,347
7021	ADP Centrl Processing Unit (CPU Computer), Digital	26	954,646
7022	ADP Centrl Processing Unit (CPU, Computer), Hybrid	6	552,349
7025	ADP Input/Output and Storage Devices	95	13,645,034
7030	ADP Software	614	31,001,143
7035	ADP Support Equip	108	2,827,684
7042	Mini & Micro Computer Control Devices	4	103,993
7045	ADP Supplies	19	631,011
7050	ADP Components	89	2,277,887

Misc. Personal and Office Supplies (68, 71-89, 99)		2,854	230,179,239
6810	Chemicals	13	151,041
6820	Dyes	1	106,540
6830	Gases, Compressed and Liquefied	16	149,468
6840	Pest Control Agents and Disinfectants	4	17,534
6850	Miscellaneous Chemical Specialties	26	168,425
7105	Household Furniture	5	123,372
7110	Office Furniture	569	18,814,492
7125	Cabinets, Lockers, Bins, and Shelving	132	2,136,813
7195	Miscellaneous Furniture and Fixtures	41	977,183
7210	Household Furnishings	7	413,279
7220	Floor Coverings	3	13,696
7230	Draperies, Awnings, and Shades	5	40,484
7290	Misc Household & Coml Furnishings & Appliances	23	619,758
7310	Food Cooking, Baking, and Serving Equip	11	93,958
7320	Kitchen Equipment and Appliances	16	345,531
7330	Kitchen Hand Tools and Utensils	1	4,486
7360	Sets, Kits, Outfits, & Modules, Food Prep & Servng	10	223,350
7420	Accounting and Calculating Machines	1	22,245
7430	Typewriters & Office Type Composing Mach	1	5,960
7435	Office Information System Equipment	13	75,334
7450	Office Type Sound Recording & Repro Mach	1	9,800
7460	Visible Record Equipment	3	38,966
7490	Miscellaneous Office Machines	142	1,726,476
7510	Office Supplies	35	460,157
7520	Office Devices and Accessories	26	192,400
7530	Stationery and Record Forms	7	31,002
7610	Books and Pamphlets	103	1,532,641
7630	Newspapers and Periodicals	25	754,335
7640	Maps, Atlases, Charts, and Globes	9	46,231
7642	Hydrographic Maps, Charts and Geodesic Products	2	11,392
7690	Miscellaneous Printed Matter	15	200,192
7710	Musical Instruments	11	108,826
7720	Musical Instrument Parts and Accessories	3	22,965
7730	Phonographs, Radio and TV Sets: Home Type	3	281,467
7740	Phonograph Records	1	3,414
7810	Athletic and Sporting Equipment	34	302,487
7830	Recreational and Gymnastic Equipment	20	462,442
7910	Floor Polishers and Vacuum Cleaners Equipment	8	63,519
7930	Cleaning & Polishing Compounds & Preps	3	27,414
8010	Paints, Dopes, Varnishes, & Related Product	12	112,403
8030	Preservative and Sealing Compounds	20	256,898
8040	Adhesives	23	194,686
8105	Bags and Sacks	6	120,821
8110	Drums and Cans	1	5,749
8115	Boxes, Cartons, and Crates	23	308,182
8120	Commercial & Industrial Gas Cylinders	2	83,820
8130	Reels and Spools	1	6,756
8135	Packaging and Packing Bulk Materials	7	36,950
8140	Ammun & Nuclr Ordnce Bxs, Pkgs & Spl Containers	3	128,740
8145	Specialized Shipping & Storage Containers	143	4,747,444
8305	Textile Fabrics	30	386,692
8340	Tents and Tarpaulins	10	72,824
8345	Flags and Pennants	2	8,461
8405	Outerwear, Men's	19	3,114,267
8410	Outerwear, Women's	8	984,930
8415	Clothing, Special Purpose	46	8,292,626
8425	Underwear and Nightwear, Women's	2	15,240
8430	Footwear, Men's	8	6,144,804
8455	Badges and Insignia	8	44,474
8460	Luggage	7	4,213,688
8465	Individual Equipment	25	22,964,783
8470	Armor, Personal	18	412,799
8475	Specilized Flight Clothing & Accessories	1	6,400
8520	Toilet Soap, Shaving Prep & Dentifrices	1	3,208
8730	Seeds and Nursery Stock	1	9,040
8820	Live Animals, Not Raised for Food	9	89,118
8900	Perishable Subsistence 10K to 25K	1	6,975
8910	Dairy Foods and Eggs	7	617,675
8915	Fruits and Vegetables	538	2,690,817
8940	Special Dietary Foods & Food Specialty Prep	6	82,151
8960	Beverages, Nonalcoholic	4	148
8970	Composite Food Packages	1	320
8999	Food Items for Resale	218	132,272,858
9905	Signs, Advertizing Displays, and Ident Plates	20	330,254
9915	Collectors and/or Historical Items	3	10,588
9925	Ecclesiastical Equip, Furnishings & Sup	24	592,969
9998	Nonfood Items for Resale	4	16,327
9999	Miscellaneous Items	243	10,013,279

Materials - fuel, plastics, glass, metal (91-96)		634	23,734,811
9110	Fuels, Solid	3	19,617
9130	Liquid Propellants & Fuel, Petroleum Base	10	3,882,796
9135	Liquid Propellant Fuels, & Oxidizers Chemical Base	8	150,787
9140	Fuel Oils	20	10,698,693
9150	Oils & Greases: Cutting, Lubr, & Hydraulic	22	510,580
9310	Paper and Paperboard	4	28,234
9320	Rubber Fabricated Materials	8	38,525
9330	Plastics Fabricated Materials	26	214,016
9340	Glass Fabricated Materials	12	1,948,060
9350	Refractories & Fire Surfacing Materials	1	5,000
9390	Misc Fabricated Nonmetallic Materials	17	153,818
9505	Wire, Nonelectrical, Iron & Steel	47	518,277
9510	Bars and Rods, Iron & Steel	43	753,238
9515	Plate, Sheet, Strip, Foil; Iron and Steel	27	289,366
9520	Structural Shapes, Iron and Steel	3	2,837
9525	Wire, Nonelectrical, Nonferrous Base Metal	6	10,238
9530	Bars and Rods, Nonferrous Base Metal	97	813,826
9535	Plate, Sheet, Strip, & Foil: Nonferrous Base Metal	247	3,310,659
9540	Structural Shapes, Nonferrous Base Metal	28	286,160
9545	Plate, Sheet, Strip, Foil, & Wire: Precious Metal	2	3,876
9610	Ores	1	4,200
9630	Additive Metal Materials & Master Alloys	2	92,008
Supply Total	(blank)	34,981	7,514,496,520
Grand Total		29,120	9,631,241,136

Source: Department of Defense Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <<http://siadapp.dior.mhs.mil/index.html>>

Appendix 5. Research, development, test and evaluation procurements by product sector and code, DoD, FY2005

Product or Service Code	Product or Service Description	Count of contract actions	Dollar value of contracts
Aircraft research		100	44,134,544
AC11	RDTE/Aircraft-Basic Research	30	14,392,364
AC12	RDTE/Aircraft-Applied Research	10	3,965,610
AC13	RDTE/Aircraft-Adv Tech Dev	7	4,347,326
AC14	RDTE/Aircraft-Demo/Valid	6	1,195,291
AC15	RDTE/Aircraft-Eng/Manuf Develop	7	7,766,736
AC16	RDTE/Aircraft-Management Support	21	4,689,310
AC17	RDTE/Aircraft-Operational System Development	19	7,777,907
Missile and Space Systems		206	468,748,908
AC21	RDTE/Missile and Space Systems-Basic Research	84	22,388,901
AC22	RDTE/Missile and Space Systems-Applied Research	17	15,684,184
AC23	RDTE/Missile and Space Systems-Adv Tech Dev	64	152,291,858
AC24	RDTE/Missile and Space Systems-Demo/Valid	23	243,345,208
AC25	RDTE/Missile and Space Systems-Eng/Manuf Devel	10	1,943,199
AC26	RDTE/Missile and Space Systems-Mgmt Support	5	3,610,478
AC27	RDTE/Missile and Space Systems-Op System Develop	3	29,485,080
Ships		63	7,661,939
AC31	RDTE/Ships-Basic Research	17	2,081,487
AC33	RDTE/Ships-Adv Tech Dev	45	5,100,429
AC34	RDTE/Ships-Demo/Valid	1	480,023
Automobile		13	2,756,172
AC41	RDTE/Tank - Automotive-Basic Research	3	497,257
AC42	RDTE/Tank - Automotive-Applied Research	2	595,509
AC43	RDTE/Tank - Automotive-Adv Tech Dev	3	1,213,455
AC44	RDTE/Tank - Automotive-Demo/Valid	1	81,956
AC45	RDTE/Tank - Automotive-Eng/Manuf Devel	4	367,995
Weapons		63	83,237,665
AC51	RDTE/Weapons-Basic Research	24	71,597,837
AC52	RDTE/Weapons-Applied Research	11	2,255,859
AC53	RDTE/Weapons-Adv Tech Dev	19	6,786,063
AC54	RDTE/Weapons-Demo/Valid	1	480,000
AC55	RDTE/Weapons-Eng/Manuf Develop	1	748,878
AC56	RDTE/Weapons-Management Support	7	1,369,028
Electronics and Communications		392	805,412,684
AC61	RDTE/Electronics & Communication Eq-Basic Research	198	317,905,016
AC62	RDTE/Electronics & Communication Eq-Applied Resea	70	15,925,659
AC63	RDTE/Electronics & Communication Eq-Adv Tech Dev	45	21,155,852
AC64	RDTE/Electronics & Communication Eq-Demo/Valid	22	65,131,515
AC65	RDTE/Electronics & Communication Eq-Eng/Manuf Dev	32	372,987,456
AC66	RDTE/Electronics & Communication Eq-Mgmt Support	25	12,307,186
Misc.		33	15,963,931
AF11	RDTE/Education-Basic Research	2	107,992
AF16	RDTE/Education-Management Support	1	5,750
AA11	RDTE/Agr-Insect & Disease Cntl-Basic Research	3	9,075,037
AB22	RDTE/Fire Prevention & Control-Applied Research	2	256,925
AC91	RDTE/Misc Hard Goods-Basic Research	8	1,722,518
AC93	RDTE/Misc Hard Goods-Adv Tech Dev	13	4,647,169
AC95	RDTE/Misc Hard Goods-Eng/Manuf Devel	3	78,540
AT86	RDTE/Trans - Hazardous Mats - Mgmt Support	1	70,000

Services and subsistence		144	61,397,683
AD21	RDTE/Services-Basic Research	43	10,214,543
AD22	RDTE/Services-Applied Research	19	3,907,194
AD23	RDTE/Services-Adv Tech Dev	21	23,483,809
AD24	RDTE/Services-Demo/Valid	6	3,708,004
AD25	RDTE/Services-Eng/Manuf Develop	34	12,636,863
AD26	RDTE/Services-Management Support	4	2,482,756
AD27	RDTE/Services-Operational System Development	10	1,036,436
AD36	RDTE/Subsistence-Management Support	1	4,000
AD41	RDTE/Textiles, Clothing, Equipage-Basic Research	2	3,470,497
AD42	RDTE/Textiles, Clothing, Equipage-Applied Researc	3	423,588
AD51	RDTE/Fuels and Lubricants-Basic Research	1	29,993
Other Defense		898	209,625,564
AD91	RDTE/Other Defense-Basic Research	169	49,690,270
AD92	RDTE/Other Defense-Applied Research	518	90,022,406
AD93	RDTE/Other Defense-Adv Tech Dev	51	44,816,838
AD94	RDTE/Other Defense-Demo/Valid	32	1,753,401
AD95	RDTE/Other Defense-Eng/Manuf Develop	97	18,333,287
AD96	RDTE/Other Defense-Management Support	24	4,637,208
AD97	RDTE/Other Defense-Operational System Development	7	372,154
Manufacturing Technology		6	3,217,918
AE32	RDTE/Manufacturing Technology-Applied Research	1	300,000
AE33	RDTE/Manufacturing Technology-Adv Tech Dev	1	(16,156)
AE34	RDTE/Manufacturing Technology-Demo/Valid	1	30,000
AE35	RDTE/Manufacturing Technology-Eng/Manuf Devel	2	600,000
AE36	RDTE/Manufacturing Technology-Mgmt Support	1	2,304,074
Energy and Environment		17	3,802,237
AG84	RDTE/Conservation of Energy - Demo/Valid	1	18,000
AG93	RDTE/Other Energy - Adv Tech Dev	1	149,878
AH11	RDTE/Pollution Cntl & Abatement-Basic Research	1	69,965
AH31	RDTE/Water Pollution-Basic Research	3	788,392
AH91	RDTE/Other Environmental Protection-Basic Research	6	1,345,523
AH92	RDTE/Other Environmental Protection-Applied Reseah	2	816,470
AH93	RDTE/Other Environmental Protection-Adv Tech Dev	1	206,000
AH94	RDTE/Other Environmental Protection-Demo/Valid	1	23,000
AH96	RDTE/Other Environmental Protection-Mgmt Support	1	385,009
Physical, Computer and Environmental Sciences		81	32,047,091
AJ11	RDTE/Physical Sciences - Basic Research	19	7,071,220
AJ12	RDTE/Physical Sciences - Applied Research	18	12,140,051
AJ13	RDTE/Physical Sciences - Adv Tech Dev	2	170,000
AJ15	RDTE/Physical Sciences - Eng/Manuf Develop	1	69,969
AJ16	RDTE/Physical Sciences - Management Support	22	7,801,276
AJ17	RDTE/Physical Sciences - Operational System Dev	1	95,000
AJ21	RDTE/Math & Computer Sciences - Basic Research	5	663,274
AJ22	RDTE/Math & Computer Sciences - Applied Research	6	2,731,055
AJ23	RDTE/Math & Computer Sciences - Adv Tech Dev	2	465,000
AJ31	RDTE/Environmental Sciences - Basic Research	1	99,742
AP91	RDTE/Natural Resources-Other-Basic Research	3	649,739
AP92	RDTE/Natural Resources-Other-Applied Research	1	90,765

Engineering Sciences		100	184,110,448
AJ41	RDTE/Engineering Sciences - Basic Research	1	375,000
AJ42	RDTE/Engineering Sciences - Applied Research	2	157,464
AJ43	RDTE/Engineering Sciences - Adv Tech Dev	49	166,897,015
AJ45	RDTE/Engineering Sciences - Eng/Manuf Develop	48	16,680,969
Life and Psychological Sciences		12	2,487,329
AJ51	RDTE/Life Sciences - Basic Research	2	315,058
AJ52	RDTE/Life Sciences - Applied Research	1	568,830
AJ53	RDTE/Life Sciences - Adv Tech Dev	1	39,000
AJ54	RDTE/Life Sciences - Demo/Valid	1	10,000
AJ61	RDTE/Psychological Sciences - Basic Research	4	240,000
AJ62	RDTE/Psychological Sciences - Applied Research	1	29,021
AJ63	RDTE/Psychological Sciences - Adv Tech Dev	1	910,420
AJ66	RDTE/Psychological Sciences - Management Support	1	375,000
Other Sciences		47	10,737,720
AJ91	RDTE/Other Sciences - Basic Research	46	10,595,543
AJ92	RDTE/Other Sciences - Applied Research	1	142,177
Medical sciences		67	23,343,983
AN11	RDTE/Biomedical - Basic Research	15	5,622,842
AN12	RDTE/Biomedical - Applied Research	2	2,821,194
AN22	RDTE/Dependency - Drugs - Applied Research	24	6,048,379
AN74	RDTE/Specialized Services - Demo/Valid	2	3,694,032
AN91	RDTE/Other Medical - Basic Research	20	4,476,695
AN92	RDTE/Other Medical - Applied Research	1	69,932
AN93	RDTE/Other Medical - Adv Tech Dev	1	410,918
AN95	RDTE/Other Medical - Eng/Manuf Develop	2	199,991
Space		4	3,878,655
AR23	RDTE/Space-Science Applications-Adv Tech Dev	2	3,447,234
AR52	RDTE/Sp & Terrestrial Application-Applied Research	1	67,565
AR91	RDTE/Space - Other - Basic Research	1	363,856
Other R&D		317	658,205,378
AZ11	RDTE/Other Research & Development-Basic Research	106	39,593,671
AZ12	RDTE/Other Research & Development-Applied Researc	28	7,680,742
AZ13	RDTE/Other Research & Development-Adv Tech Dev	85	324,705,612
AZ14	RDTE/Other Research & Development-Demo/Valid	81	275,919,969
AZ15	RDTE/Other Research & Development-Eng/Manuf Devel	4	5,564,282
AZ16	RDTE/Other Research & Development-Mgmt Support	13	4,741,102
RDT&E Total		2,563	2,620,769,849
Grand Total		29,120	9,631,241,136

Source: Department of Defense Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <<http://siadapp.dior.mhs.mil/index.html>>

Appendix 6. Service procurements by product sector and code, DHS, FY2005

Service Procurements by Sector and Code, MA Contractors, Department of Homeland Security, FY 2005			
Product or Service Code	Product or Service Description	Count of Contract Actions	\$ Value of Contracts
	Studies and analyses (B)	10	105,226
B505	Cost benefit analyses	1	-
B519	Geotechnical studies	1	5,953
B532	Soil studies	3	87,223
B533	Water quality studies	1	1,050
B546	Study/security (physical & personal)	3	-
B599	Other special studies and analyses	1	11,000
	Facilities (C1)	11	76,760
C111	Buildings & facilities/admin & service buildings	1	7,500
C113	Educational buildings	2	500
C115	Industrial buildings	2	2,200
C122	Highway, roads, streets, bridges	2	44,988
C124	Utilities	1	-
C129	Other non-building structures	3	21,572
	Architecture and engineering (C2)	48	1,244,008
C211	A & E services (incl. landscaping)	16	807,715
C214	A & E management engineering services	6	46,252
C215	A & E prod engineering services (incl. design)	1	2,385
C216	A & E - marine engineering	13	255,583
C219	Other architects & engineering general	12	132,074
	Automated data processing (D3)	20	1,358,887
D301	ADP facility management	1	99,929
D306	ADP systems analysis services	1	38,562
D307	Automated information system services	3	-
D310	ADP backup and security services	4	17,998
D313	Computer aided design/manufacturing services	1	19,000
D316	Telecommunication network management services	1	3,600
D399	Other ADP & telecommunications services	9	1,179,798
	Wildlife/lands management (F0)	3	1,622
F006	Land treatment practices	3	1,622
	Environmental services (F1)	35	6,317,949
F105	Pesticides support services	2	-
F108	Hazardous removal/clean-up/disp./ OP	1	3,100

F112	Oil spill response	31	6,311,784
F999	Other environmental services/studies/ support	1	3,065
	Social services (G0)	8	335,852
G099	Other social services	8	335,852
	Quality control (H1)	19	31,621,653
H119	Quality control/ships-crafts-docks	1	80
H199	Quality control/miscellaneous equipment	4	27,367,807
H254	Equipment test services/prefab structures	1	9,946
H320	Inspection services/ship & marine equipment	3	43,200
H391	Inspection services/fuels-lubricants-oils	1	-
H958	Other quality control/communication equipment	1	-
H963	Other quality control/alarm & signal system	8	4,200,620
	Maintenance and repair (J0)	38	750,269
J016	Maintenance and repair of aircraft components	3	47,957
J020	Maintenance and repair of ship & marine equipment	4	67,278
J023	Maintenance and repair of vehicles-trailers-CYC	1	8,953
J035	Maintenance and repair of service & trade equipment	4	36,142
J041	Maintenance and repair of refrigeration - AC equipment	1	29,000
J042	Maintenance and repair of fire-rescue-safety equipment	2	7,128
J058	Maintenance and repair of communications equipment	1	4,100
J059	Maintenance and repair of elect-elect equipment	3	14,021
J060	Maintenance and repair of fiber optics materials	1	6,500
J063	Maintenance and repair of alarm & signal system	3	173,081
J066	Maintenance and repair of instruments & lab equipment	1	11,744
J067	Maintenance and repair of photographic equipment	1	5,737
J068	Maintenance and repair of chemical products	1	25,000
J070	Maintenance and repair of ADP equipment and supplies	2	6,250
J074	Maintenance and repair of office machines	1	23,786
J075	Maintenance and repair of office supplies	1	10,800
J078	Maintenance and repair of recreational equipment	1	1,133
J998	Non-nuclear ship repair (east)	6	202,658
J999	Non-nuclear ship repair (west)	1	69,000
	Modification of equipment (KO)	3	17,400
K020	Modification of ship & marine equipment	3	17,400
	Technical repair (L0)	2	364,906
L076	Technical repair/books-maps-pubs.	1	352,756
L099	Technical repair/miscellaneous equipment	1	12,150
	Installation of equipment (N-P)	5	1,747,243
N036	Installation of SP industry machinery	1	-
N045	Installation of plumbing-heating equipment	1	13,950
N059	Installation of elect-elect equipment	1	21,348
N065	Installation of medical-dental-vet equipment	1	70,542
P400	Demolition of buildings	1	1,641,403
	Medical (Q1)	6	659,661
Q201	General health care services	2	5,108

Q301	Laboratory testing services	1	3,703
Q509	Internal medical services	1	650,850
Q999	Other medical services	2	-
	Professional (R0)	116	21,534,802
R406	Policy review/development services	2	9,000
R408	Program management/support services	2	359,974
R414	Systems engineering services	6	1,687,446
R418	Legal services	4	432,324
R419	Educational services	3	21,015
R421	Technical assistance	2	953,623
R423	Intelligence services	1	340,810
R425	Engineering and technical services	23	11,017,898
R426	Communications services	9	184,397
R427	Professional services/weather RPT-observation	4	38,776
R499	Other professional services	6	405,836
R605	Library services	1	2,000
R608	Admin services/translation-sign language	8	1,783
R610	Personal property management services	4	1,300,000
R699	Other administrative support services	1	1,283
R701	Advertising services	17	260,225
R708	Public relations services	1	88,201
R799	Other management support services	22	4,430,210
	Facilities operations (s)	97	6,112,223
S111	Gas services	1	1,250
S112	Electric services	3	75,000
S113	Telephone and/or communications services	6	18,385
S114	Water services	1	2,880
S119	Other services	1	-
S201	Custodial and janitorial services	21	687,612
S202	Fire protection services	1	20,732
S203	Food services	3	4,584,593
S205	Trash/garbage collection	16	239,609
S206	Guard services	4	230,401
S208	Landscaping/groundskeeping services	15	155,919
S209	Laundry and dry cleaning services	5	26,934
S214	Carpet laying and cleaning	2	11,788
S215	Warehousing and storage services	6	48,707
S216	Facilities operations support services	2	4,998
S218	Snow removal/salt service	2	-
S222	Waste treatment and storage	2	-
S299	Other housekeeping services	6	3,415
	Technical and educational (T, U)	29	331,892
T001	Arts/graphics services	2	1,610
U001	Lectures for training	4	46,800
U008	Training/curriculum development	14	137,335
U010	Certification & accreditations for educational	1	3,152
U012	Information training	6	133,195
U099	Other educational and training services	2	9,800

	Transportation (V)	11	11,456
V125	Vessel towing service	6	4,672
V129	Other vehicle charter for things	1	9,935
V211	Air passenger service	1	(28,138)
V227	Navigational aid and pilotage services	1	1,197
V301	Relocation services	1	20,910
V999	Other travel services	1	2,880
	Lease or rental (W, X)	39	1,340,227
W099	Lease or rental of miscellaneous equipment	21	144,047
X112	Lease or rental of conference space and facilities	2	10,000
X174	Lease or rental of open storage facilities	3	23,850
X179	Lease or rental of other warehouse buildings	4	13,875
X199	Lease or rental of miscellaneous buildings	3	915,490
X224	Lease or rental of parking facilities	6	232,965
	Facilities and facilities maintenance (Y, Z)	106	9,513,589
Y162	Construction/recreational buildings	1	12,800
Z111	Main-rep-ALT/office buildings	4	27,000
Z119	Main-rep-ALT/other admin buildings	27	2,709,787
Z123	Main-rep-ALT/radar & navigational facilities	3	9,360
Z152	Main-rep-ALT/maintenance buildings	3	160,798
Z154	Main-rep-ALT/ship construction and repair facilities	2	24,948
Z159	Main-rep-ALT/other industrial buildings	1	151,061
Z161	Main-rep-ALT/family housing	13	195,166
Z169	Main-rep-ALT/other residential buildings	1	-
Z179	Main-rep-ALT/other warehouse buildings	1	-
Z199	Main-rep-ALT/miscellaneous buildings	27	5,030,485
Z219	Main-rep-ALT/other consv structure	2	27,919
Z222	Main-rep-ALT/hwys-rds-sts-brdgs-ra	3	111,050
Z224	Main-rep-ALT/parking facilities	1	8,738
Z233	Main-rep-ALT/epg-geothermal	5	1,008,694
Z239	Main-rep-ALT/epg-other	1	-
Z241	Main-rep-ALT/fuels supply	1	-
Z242	Main-rep-ALT/heating & cooling plants	1	-
Z245	Main-rep-ALT/water supply	2	11,200
Z249	Main-rep-ALT/other utilities	2	17,243
Z299	Main-rep-ALT/all other	5	7,340
	Services subtotal	606	83,445,624
	N/A subtotal	414	1,469,460
Total		1,439	140,840,707

Source: Department of Defense Personnel & Procurement Statistics, <<http://siadapp.dior.mhs.mil/index.html>>

Appendix 7. Supplies procurements by product sector and code, DHS, FY2005

Product Procurements by Sector and Code, MA Contractors, Department of Homeland Security, FY 2005

Product or Service Code	Product or Service Description	Number of Contracts	\$ Value of Contracts
	Weapons, ammunition and systems (10-13)	5	1,815,870
1005	Guns, through 30 mm	1	22,375
1015	Guns, 75 mm through 125 mm	1	-
1190	Spec test & handling equipment, nuclear equipment	2	1,793,328
1220	Fire cont computing sights and devices	1	167
	Aircraft and equipment (15-17)	7	122,202
1560	Airframe structural components	1	28
1610	Aircraft propellers and components	6	122,174
	Ships and equipment (19-20)	28	578,557
1921	Tugs and towboats	1	1,197
1925	Special service vessels	1	32,981
1940	Small craft	2	41,989
2010	Ship and boat propulsion components	16	430,518
2020	Rigging and rigging gear	1	2,775
2040	Marine hardware and hull items	1	5,025
2050	Buoys	1	2,113
2090	Miscellaneous ship and marine equipment	5	61,958
	Transportation equipment (22-26)	5	1,384,598
2320	Trucks and truck tractors, wheeled	2	675,000
2330	Trailers	2	706,019
2630	Tires, solid and cushion	1	3,579
	Engines and fuel systems (28-29)	15	429,107
2815	Diesel engines and components	8	335,072
2850	Gasoline rotary engines and components	1	13,813
2895	Miscellaneous engines and components	1	16,960
2950	Turbosuperchargers and components	1	30,600
2990	Miscellaneous engine accessories – no air	4	32,662
	Industrial machinery (30-53)	42	705,024
3040	Miscellaneous power transmission equipment	2	11,040
3230	Tools-attachments for woodworking machinery	1	2,997
3426	Metal finishing equipment	2	65,740
3590	Miscellaneous service & trade equipment	1	9,500
3610	Printing, duplicating and bookbinding equipment	14	129,813
3615	Pulp and paper industries machinery	1	17,612
3695	Miscellaneous special industry machine	2	135,230
4110	Refrigeration equipment	2	16,371
4210	Fire fighting equipment	1	18,501
4240	Safety and rescue equipment	2	22,279
4320	Power and hand pumps	4	68,004

4540	Waste disposal equipment	1	4,273
4810	Valves, powered	1	119,455
5120	Hand tools, non-edged, non-powered	6	81,834
5340	Hardware	1	-
5365	Bushings, rings, shims and spacers	1	2,375
	Construction equipment (54-56)	3	720,751
5450	Miscellaneous prefabricated structures	1	10,512
5650	Roofing and siding materials	2	710,239
	Communications equipment (58)	8	1,422,216
5820	Radio tv equipment, except airborne	1	11,244
5825	Radio navigation equipment, except airborne	4	15,600
5836	Video recording and reproducing equipment	1	1,763
5840	Radar equipment, except airborne	1	-
5841	Radar equipment, airborne	1	1,393,610
	Electronics and optics (59-63)	44	18,153,634
5930	Switches	1	2,222
5940	Lugs terminals & terminal strips	1	13,371
5963	Electronic modules	1	574
5965	Headset, handset, microphone, and speaker	2	19,563
5975	Electrical hardware and supplies	5	12,625
5985	Antennas waveguides and related equipment	2	54,150
5998	Elect assemb-bds cards-assoc. hardware	4	27,690
5999	Miscellaneous elect & electronic components	3	5,035,657
6010	Fiber optic conductors	1	13,373
6035	Fiber optic light/image transfer	2	27,450
6150	Miscellaneous electrical power & distribution equipment	2	14,778
6350	Miscellaneous alarm, signal, and security systems	20	12,932,181
	Medical instruments and biologicals (65)	12	356,760
6515	Medical & surgical instruments, equipment & support	4	110,368
6525	X-ray equipment supplies - medical, dental & vet	1	6,500
6530	Hospital furniture, equipment, utensils, & supplies	2	59,703
6545	Medical sets kits & outfits	5	180,189
	Navigational and measuring instruments (66, 67)	34	1,162,186
6605	Navigational instruments	8	133,739
6620	Engine instruments	2	16,895
6630	Chemical analysis instruments	6	311,821
6635	Physical properties test equipment	2	53,509
6640	Laboratory equipment and supplies	4	31,621
6645	Time measuring instruments	1	4,489
6650	Optical instruments	1	44,184
6665	Hazard-detecting instruments and apparatus	7	152,322
6695	Combination and miscellaneous instruments	1	257,684
6710	Cameras, motion picture	1	149,999
6760	Photographic equipment and accessories	1	5,923
	Automated data processing equipment (69-70)	37	3,319,074
6910	Training aids	4	83,478
6920	Armament training devices	1	6,200
6930	Operation training devices	1	2,590
7010	ADP system configuration	4	328,517

7020	ADP central processing unit-analog	1	48,480
7021	ADP central processing unit-digital	1	7,620
7022	ADP central processing unit-hybrid	1	30,000
7025	ADP input/output & storage devices	2	27,332
7030	ADP software	17	1,691,513
7035	ADP support equipment	1	35,280
7042	Mini & micro computer cont. devices	1	992,964
7045	ADP supplies	2	29,819
7050	ADP components	1	35,280
	Miscellaneous personal and office supplies (68, 71-89, 99)	105	2,909,558
7105	Household furniture	1	6,371
7110	Office furniture	23	325,596
7125	Cabinets, lockers, bins & shelving	10	126,285
7195	Miscellaneous furniture & fixtures	1	44,280
7220	Floor coverings	2	7,859
7290	Miscellaneous household furnishings and appliances	1	7,578
7310	Food cooking and baking equipment	1	5,389
7320	Kitchen equipment and appliances	2	6,862
7490	Miscellaneous office machines	2	22,581
7510	Office supplies	4	25,709
7610	Books and pamphlets	5	58,955
7630	Newspapers and periodicals	1	250
7640	Maps, atlases, charts, and globes	3	18,747
7830	Recreational & gymnastic equipment	3	23,411
8105	Bags and sacks	2	192
8145	Special shipping and storage containers	3	6,385
8405	Outerwear, men's	8	461,350
8415	Clothing, special purpose	4	10,485
8450	Children and infants apparel and accessories	2	450
8455	Badges and insignia	1	40,324
8465	Individual equipment	7	255,487
8470	Armor, personal	9	168,989
8530	Personal toiletry articles	1	26,646
9999	Miscellaneous items	9	1,259,377
	Materials - fuel, plastics, glass, metal (91-96)	9	77,624
9140	Fuel oils	6	44,500
9540	Structural shapes nonferrous metal	1	32,904
9545	Plate, sheet, strip & wire prec. metal	2	220
Supplies Subtotal		354	33,157,160

Source: Department of Defense Personnel & Procurement Statistics, <<http://siadapp.dior.mhs.mil/index.html>>

Appendix 8. Research, development, test and evaluation procurements by product sector and code, DHS, FY2005

Research, Development, Test and Evaluation Procurements by Sector and Code, MA Contractors, Department of Homeland Security, FY 2005

Product or Service Code	Product or Service Description	Count of Contract Actions	\$ Value of Contracts
	Subsistence	35	9,468,486
AD21	Services (basic)	22	6,281,162
AD24	Services (engineering)	1	500,000
AD25	Services (operational)	6	2,007,097
AD26	Services (management/support)	4	663,777
AD53	Fuels and lubricants (advanced)	1	650
AD61	Construction (basic)	1	15,800
	Life, psychological, social sciences (AJ5, AJ6, AJ7)	1	42,330
AJ54	Life sciences (engineering)	1	42,330
	Other sciences (AJ9)	2	2,941,711
AJ94	R&D-other sciences-engineering dev.	2	2,941,711
	Housing (AK)	7	24,870
AK11	Housing (basic)	7	24,870
	Medical sciences (AN)	9	33,600
AN52	Mental health (applied/exploratory)	2	-
AN55	Mental health (operational)	5	-
AN91	Other medical (basic)	2	33,600
	Social services (AQ)	5	-
AQ93	Other social services (advanced)	5	-
	Transportation (AS)	2	7,815,411
AS15	Air transportation (operational)	2	7,815,411
	Other R&D (AZ)	4	2,442,055
AZ13	R&D-other r&d-adv dev	4	2,442,055
	RDTE Subtotal	65	22,768,463

Source: Federal Procurement Data System (FPDS), <<https://www.fpds.gov/>>

Appendix 9. SBIR defense award amounts (\$) by state - 2005 (DOD & DHS)

SBIR Defense Award Amount (\$) by State - 2005 DOD & DHS	
State	Award Amount
California	\$206,081,121
Massachusetts	\$117,990,106
Virginia	\$70,164,406
Ohio	\$52,370,241
Maryland	\$51,187,361
New York	\$49,202,846
Texas	\$47,030,269
Colorado	\$44,042,639
Pennsylvania	\$38,972,860
Florida	\$26,366,903
New Jersey	\$23,604,015
Arizona	\$21,158,516
Michigan	\$20,565,957
Washington	\$17,863,028
Alabama	\$17,488,913
Illinois	\$13,488,258
Connecticut	\$13,363,599
New Mexico	\$13,029,689
North Carolina	\$9,161,044
Minnesota	\$8,984,253
Georgia	\$8,946,956
Oregon	\$8,647,054
New Hampshire	\$8,633,239
Utah	\$7,606,552
Tennessee	\$7,537,343
Oklahoma	\$6,542,301
Indiana	\$6,052,765
South Carolina	\$4,483,393
Hawaii	\$4,227,807
West Virginia	\$4,006,586
Montana	\$3,842,145
Mississippi	\$3,617,849
Maine	\$3,132,306
Idaho	\$2,956,791
Missouri	\$2,532,307
Nevada	\$2,428,106
Wisconsin	\$2,201,221
Delaware	\$2,105,370
Louisiana	\$2,011,457
Arkansas	\$1,454,074
Vermont	\$1,167,526

Rhode Island	\$940,636
Iowa	\$927,691
South Dakota	\$849,788
District of Columbia	\$538,855
Kansas	\$419,077
Nebraska	\$265,273
Wyoming	\$239,648
Alaska	\$200,000
Kentucky	\$100,000
North Dakota	\$0
Puerto Rico	\$0
Total	\$960,730,139

Source: U.S. Small Business Administration
Technology Resources Network.

Appendix 10. STTR defense award amount (\$) by state - 2005

STTR Defense Award Amount (\$) by State – 2005	
State	Award Amount
Massachusetts	\$19,608,699
California	\$17,210,498
Texas	\$8,195,305
New York	\$7,515,388
Colorado	\$7,360,888
Ohio	\$6,726,142
Virginia	\$6,142,149
Pennsylvania	\$6,110,240
Arizona	\$3,876,393
New Mexico	\$2,966,610
Georgia	\$2,742,085
Maryland	\$2,566,260
Connecticut	\$2,376,747
Florida	\$2,178,711
Illinois	\$2,058,266
New Jersey	\$1,997,127
North Carolina	\$1,797,312
South Carolina	\$1,404,976
Minnesota	\$1,326,678
Alabama	\$1,249,906
Michigan	\$1,018,990
West Virginia	\$917,682
Delaware	\$849,823
Tennessee	\$849,272
New Hampshire	\$847,576
Indiana	\$814,895
Nevada	\$750,000
South Dakota	\$749,992
Mississippi	\$749,988
Idaho	\$749,942
Louisiana	\$591,555
Washington	\$508,706
Rhode Island	\$499,999
Utah	\$464,654
Oregon	\$268,980
Missouri	\$199,991
Oklahoma	\$199,000
Arkansas	\$100,000
Kansas	\$100,000
Maine	\$99,700
Alaska	\$0
District of Columbia	\$0

Hawaii	\$0
Iowa	\$0
Kentucky	\$0
Montana	\$0
Nebraska	\$0
North Dakota	\$0
Puerto Rico	\$0
Vermont	\$0
Wisconsin	\$0
Wyoming	\$0
TOTAL	\$116,741,125
Source: U.S. Small Business Administration Technology Resources Network.	

Appendix 11. Massachusetts SBIR and STTR grants, \$ value by technology, fiscal years 2004 and 2005 (DOD/DHS)

\$ Value of Grants	2005	2004
SBIR		
DOD		
Sensors, Electronics and Electronic Warfare	\$37,463,882	\$30,823,342
Information Systems Technology	\$19,226,295	\$23,533,368
Weapons	\$10,932,385	\$22,992,232
Materials/Processes	\$14,715,347	\$17,939,735
Human Systems	\$11,794,649	\$8,377,177
Air Platforms	\$3,395,808	\$12,441,284
Biomedical	\$3,466,510	\$8,899,133
Space Platforms	\$2,248,758	\$9,080,035
Ground and Sea Vehicles	\$6,949,437	\$3,008,469
Chemical/Biological Defense	\$2,716,613	\$4,428,946
Nuclear Technology	\$982,348	\$949,872
Battlespace Environments	\$1,049,403	\$869,938
DHS		
Human Factors Division	\$949,107	\$199,970
Chemical And Biological Division	\$950,000	\$100,000
Explosives Division	\$749,798	\$0
Border and Maritime Security Division	\$299,992	\$199,835
Infrastructure/Geophysical Division	\$99,774	\$99,923
Command, Control, & Interoperability Division	\$0	\$0
Total	\$117,990,106	\$143,943,259
STTR		
Information Systems Technology	\$4,877,834	\$5,381,694
Materials/Processes	\$6,194,473	\$1,461,697
Sensors, Electronics and Electronic Warfare	\$4,158,706	\$2,928,104
Biomedical	\$2,649,631	\$466,144
Weapons	\$850,000	\$1,799,196
Air Platforms	\$100,000	\$1,304,555
Human Systems	\$538,082	\$299,711
Nuclear Technology	\$99,999	\$169,637
Ground and Sea Vehicles	\$139,974	\$69,979
Battlespace Environments	\$0	\$0
Chemical/Biological Defense	\$0	\$0
Space Platforms	\$0	\$0
Total	\$19,608,699	\$13,880,717
SBIR & STTR Total Amount	\$137,598,805	\$157,823,976

Number of Grants	2005	2004
SBIR		
DOD		
Sensors, Electronics and Electronic Warfare	91	103
Materials/Processes	85	68
Information Systems Technology	87	61
Weapons	35	74
Human Systems	38	33
Biomedical	20	27
Air Platforms	16	28
Ground and Sea Vehicles	18	18
Chemical/Biological Defense	16	13
Space Platforms	3	21
Nuclear Technology	4	3
Battlespace Environments	4	2
DHS		
Border and Maritime Security Division	3	2
Human Factors Division	3	2
Chemical And Biological Division	3	1
Infrastructure/Geophysical Division	1	1
Explosives Division	1	0
Command, Control, & Interoperability Division	0	0
Total	428	457
STTR		
Sensors, Electronics and Electronic Warfare	21	16
Information Systems Technology	16	18
Materials/Processes	19	15
Biomedical	7	5
Human Systems	6	3
Air Platforms	1	6
Weapons	2	5
Ground and Sea Vehicles	2	1
Nuclear Technology	1	2
Battlespace Environments	0	0
Chemical/Biological Defense	0	0
Space Platforms	0	0
Total	75	71
SBIR and STTR Total Grants	503	528
Source: US Small Business Administration Technology Resources Network		
Note: DOD & DHS Categories were grouped by the author into technology areas		

Appendix 12. Department of Defense major technology areas and sub-sector detail

Air Platforms	
	Fixed wing vehicles
	Rotary wing vehicles
	Integrated high performance turbine technology/versatile affordable turbine engines
	Aircraft power
	High speed population
Chemical/Biological Defense	
	Pretreatments
	Diagnostics
	Therapeutics
	Emerging threats and special projects
	CB modeling and simulation/battlespace management
	CB detection
	CB protection
	CB decontamination
	CB supporting science and technology
Information Systems Technology	
	Knowledge and information management
	Information security
	Communications and networking
	Modeling and simulation technology
	Computing and software technology
Ground and Sea Vehicles	
	Ground vehicles
	Surface ship combatants
	Submarines
Materials/Processes	
	Materials and processes for survivability
	Life extension and affordability
	Manufacturing technology
	Civil engineering
	Environmental quality
Biomedical	
	Infectious diseases of military importance
	Combat casualty care
	Military operational medicine
	Medical radiological defense
Sensors, Electronics and Electronic Warfare	
	Radar sensors
	Electro-Optical sensors

	Acoustic sensors
	Automatic target recognition
	Integrated platform electronics
	RF Components
	Electro-Optical technology
	Microelectronics
	Electronic materials
	Electronics integration technology
	EW RF
	EW EO/IR
	EW Integrated Technologies
Space Platforms	
	Space launch vehicles
	Space propulsion
Human Systems	
	Systems interfaces and cognitive processing
	Protection, sustainment and physical performance
	Personnel, training and leader development
Weapons	
	Countermine/mines
	Guidance and control
	Guns
	Missiles
	Ordnance
	Undersea weapons
	Weapons lethality/vulnerability
	Lasers
	High-Power microwave
Nuclear Technology	
	Warfighter consequences management technology
	Systems effects and survivability technology
	Test and simulation technology
	Lethality and effects
	Threat reduction and detection technology
Battlespace Environments	
	Terrestrial environments
	Ocean battlespace environments
	Lower atmosphere environments
	Space/Upper atmosphere environments
Source: Defense Technology Area Plan 2005; http://www.dodsbir.net/solicitation/pdf/techareas.pdf	

Appendix 13. Economic impact analysis: definitions

The method used in this study to calculate economic impacts is an input-output analysis, conducted using IMPLAN Professional software.²⁸ Input-output models estimate the level of economic exchange between various industries in a local economy, in this case, in the Massachusetts economy. This analysis measures the importance of economic activity primarily in terms of output impacts and employment impacts:

- *Output* is the value (sales) of goods and services produced.
- *Employment* is the number of people employed in the industry including wage and salary employees; full-time and part-time employees; and self-employed individuals.

Types of Impacts

Economic impacts are measured by quantifying three different types of effects: direct, indirect, and induced. The sum total of these effects is the total economic impact. More specifically, *direct impacts* are the economic activities carried out at a business establishment or construction project and are therefore an immediate consequence of the economic activity that would not have occurred in the absence of those business establishments.

Indirect impacts derive primarily from off-site economic activities that are attributable to the identified business establishment. These economic activities occur mainly as a result of non-payroll expenditures by the business within a defined local area (e.g. town, city, county, or metropolitan statistical area). Local expenditures include a range of operating expenses such as maintenance and repairs, and business machines. Indirect impacts differ in that they originate entirely off-site, although the indirect impacts would not have occurred in the absence of the identified business establishment. *Induced impacts* are the multiplier effects of the direct and indirect impacts created by successive rounds of spending by employees and proprietors. *Total impacts* are the sum of direct, indirect and induced impacts.

²⁸ Minnesota IMPLAN Group, Inc., IMPLAN System (data and software).

Multipliers

The economic impact of new spending in an industry is typically a multiple of the actual investment because a portion of the dollars that are spent locally are then re-spent locally. Dollars that are not spent locally, but on goods and services produced elsewhere, are said to have “leaked” out of the local economy. These dollars do not have an opportunity to be locally re-spent and to create a “ripple” effect in the local economy.

In non-technical terms, “multipliers are ...estimators of the 'ripple' effect.” In more technical terms, “they are numerical coefficients that relate a change in (a component of aggregate) demand (or employment) to a consequent change in total income (or total employment).”²⁹ The ratio of each dollar of income and spending generated within the region to each initial new dollar of spending in the region is used to calculate a *multiplier*. A multiplier is a quantitative expression of the total amount of new spending generated in a local economy from each initial new dollar of spending. For example, in an industry sector with a multiplier of 1.38, \$1.38 in new spending is generated from each initial new dollar spent in the industry.

Two types of multipliers exist: *income multipliers* and *employment multipliers*. The employment multiplier works the same way as the income multiplier. If the number of new jobs created by an industry sector is multiplied by the employment multiplier, then the result is the total new employment generated in the local economy.³⁰

²⁹ Analysis of Interdependence Structures: Input-Output, <<http://faculty.washington.edu/~krumme/207/inputoutput.html#multiplier>.

³⁰ Dr. Michael L. Walden. *Measuring How Much Economic Change Will Come to Your Community*. North Carolina State Cooperative Extension, <http://www.ces.ncsu.edu/resources/economics/change/>.

Appendix 14. DOD key to product codes in functional categories

Links between Federal Supply Description Codes (FSC) and Functional Categories (New Code)*

DOD Product Codes

Construction equipment (54-56)
 Industrial machinery (30-53)
 Materials - fuel, plastics, glass, metal (91-96)
 Energy and environment (AG, AH)
 Environmental services (F1)
 Wildlife/lands management (F0)
 Equipment and materials testing (H2)
 Inspection services/other quality control (H3)
 Installation of equipment (N-P)
 Maintenance and repair (J0)
 Modification of equipment (KO)
 Quality control (H1)
 Technical repair (L0)
 Facilities (C1)
 Facilities and facilities maintenance (Y, Z)
 Facilities operations (S)
 Lease or rental (W, X)
 Operation of non-building facilities (M1-M2)
 Medical instruments and biologicals (65)
 Life, psychological, social sciences (AJ5, 6, 7)
 Medical sciences (AN)
 Other sciences (AJ9)
 Physical, computer and environmental sciences (AJ1, 2, 3; AP)
 Medical (Q1)
 Miscellaneous (AF11, AF16, AA11, AB22, AC9s, AT86)
 Other defense (AD91)
 Other R&D (AZ)
 Social services (G0)
 Services and subsistence (AD2, 3, 4, 5)
 Social services (AQ)
 Subsistence (AD)
 Housing (AK)
 Automated data processing equipment (69-70)
 Communications equipment (58)
 Electronics and optics (59-63)
 Miscellaneous personal and office supplies (68, 71-89, 99)
 Electronics and communications (AC6)
 Engineering sciences (AJ4)
 Manufacturing technology (AE3)
 Architecture and engineering (C2)
 Automated data processing (D3)
 Professional (R0)
 Purchasing (E1, E2)

New Code

Construction and materials manufacturing
 Construction and materials manufacturing
 Construction and materials manufacturing
 Environmental R&D
 Environmental services
 Environmental services
 Equipment maintenance and inspection
 Facilities operations and maintenance
 Medical and scientific manufacturing
 Medical and scientific R&D
 Medical and scientific R&D
 Medical and scientific R&D

 Medical and scientific R&D
 Medical and scientific services

 Other R&D
 Other R&D
 Other R&D
 Social services
 Social services R&D
 Social services R&D
 Social services R&D
 Social services R&D
 Communications equipment manufacturing
 Communications equipment manufacturing
 Electronic equipment manufacturing
 Miscellaneous manufacturing (office equipment, clothing and food supplies)
 Engineering and technical professional R&D
 Engineering and technical professional R&D
 Engineering and technical professional R&D
 Engineering and technical professional services
 Engineering and technical professional services
 Engineering and technical professional services
 Engineering and technical professional services

Studies and analyses (B)	Engineering and technical professional services
Technical and educational (T, U)	Engineering and technical professional services
Aircraft and equipment (15-17)	Transportation manufacturing
Engines and fuel systems (28-29)	Transportation manufacturing
Navigational and measuring instruments (66, 67)	Transportation manufacturing
Ships and equipment (19, 20)	Transportation manufacturing
Space equipment (18)	Transportation manufacturing
Transportation equipment (22-26)	Transportation manufacturing
Aircraft research (AC1)	Transportation R&D
Automobile (AC4)	Transportation R&D
Ships (AC3)	Transportation R&D
Space (AR)	Transportation R&D
Transportation (AS)	Transportation R&D
Transportation (V)	Transportation services
Guided missiles and systems (14)	Weapons manufacturing
Weapons, ammunition and systems (10-13)	Weapons manufacturing
Missile and space systems (AC2)	Weapons R&D
Weapons (AC5)	Weapons R&D

**The Functional Categories were created by the UMDI. They provide a new analytic category from which to view the distribution of defense contracts across sectors.*

Appendix 15. Value of defense contracts by functional categories in Massachusetts, FY 2005

Product or Service Description	Count of Contract Actions	Contract Value
Engineering and technical professional services	4,112	\$2,280,708,193
<i>Research and Development</i>	498	\$992,741,050
DoD	498	\$992,741,050
<i>Services</i>	3,614	\$1,287,967,143
DoD	3,391	\$1,263,392,328
DHS	223	\$24,574,815
Transportation	3,774	\$1,622,076,113
<i>Research and Development</i>	182	\$66,246,721
DoD	180	\$58,431,310
DHS	2	\$7,815,411
<i>Services</i>	203	\$245,327,324
DoD	192	\$245,315,868
DHS	11	\$11,456
<i>Manufacturing</i>	3,389	\$1,310,502,069
DoD	3,300	\$1,306,825,419
DHS	89	\$3,676,650
Weapons	722	\$1,480,438,349
<i>Research and Development</i>	269	\$551,986,573
DoD	269	\$551,986,573
<i>Manufacturing</i>	453	\$928,451,776
DoD	448	\$926,635,906
DHS	5	\$1,815,870
Communications equipment manufacturing	2,507	\$1,031,224,338
<i>Manufacturing</i>	2,507	\$1,031,224,338
DoD	2,462	\$1,026,483,048
DHS	45	\$4,741,290
Equipment maintenance and inspection	2,452	\$944,354,375
<i>Services</i>	2,452	\$944,354,375
DoD	2,385	\$909,852,904
DHS	67	\$34,501,471
Other R&D	1,252	\$886,236,928
<i>Research and Development</i>	1,252	\$886,236,928
DoD	1,248	\$883,794,873
DHS	4	\$2,442,055
Facilities operations and maintenance	3,042	\$530,250,576
<i>Services</i>	3,042	\$530,250,576
DoD	2,789	\$513,207,777
DHS	253	\$17,042,799
Electronic equipment manufacturing	3,632	\$334,413,097
<i>Manufacturing</i>	3,632	\$334,413,097
DoD	3,588	\$316,259,463
DHS	44	\$18,153,634

Miscellaneous manufacturing (office equipment, clothing and food supplies)	2,959	\$233,088,797
<i>Manufacturing</i>	2,959	\$233,088,797
DoD	2,854	\$230,179,239
DHS	105	\$2,909,558
Medical and scientific	2,119	\$207,245,445
<i>Research and Development</i>	219	\$71,633,764
DoD	207	\$68,616,123
DHS	12	\$3,017,641
<i>Services</i>	58	\$92,337,832
DoD	52	\$91,678,171
DHS	6	\$659,661
<i>Manufacturing</i>	1,842	\$43,273,849
DoD	1,830	\$42,917,089
DHS	12	\$356,760
Construction and materials	3,213	\$134,294,777
<i>Manufacturing</i>	3,213	\$134,294,777
DoD	3,159	\$132,791,378
DHS	54	\$1,503,399
Social services	229	\$72,685,939
<i>Research and Development</i>	191	\$70,891,039
DoD	144	\$61,397,683
DHS	47	\$9,493,356
<i>Services</i>	38	\$1,794,900
DoD	30	\$1,459,048
DHS	8	\$335,852
Environmental	132	\$13,595,457
<i>Research and Development</i>	17	\$3,802,237
DoD	17	\$3,802,237
<i>Services</i>	115	\$9,793,220
DoD	77	\$3,473,649
DHS	38	\$6,319,571
Subtotal N/A	9	N/A
Subtotal DoD contracts	29,120	\$9,631,241,136
Subtotal DHS contracts	1,439	\$141,071,610
Total	30,568	\$9,772,312,746

Source: Department of Defense Personnel & Procurement Statistics, Personnel & Procurement Reports and Data Files, <http://siadapp.dior.mhs.mil/index.html>.

Appendix 16. Department of Defense prime contract awards by state rank - FY2005

State	FY	Rank	Total Dollars	2005 Workforce	Census Population
California	2005	1	\$31,064,642,107	14,797,700	36,154,147
Virginia	2005	2	\$26,809,778,660	3,664,400	7,564,327
Texas	2005	3	\$20,696,563,815	9,740,500	22,928,508
Maryland	2005	4	\$10,863,496,393	2,555,700	5,589,599
Florida	2005	5	\$10,317,531,391	7,799,900	17,768,191
Arizona	2005	6	\$9,354,635,557	2,508,800	5,953,007
Connecticut	2005	7	\$8,753,062,611	1,662,000	3,500,701
Massachusetts	2005	8	\$8,332,647,081	3,211,600	6,433,367
Pennsylvania	2005	9	\$7,483,342,441	5,702,200	12,405,348
Alabama	2005	10	\$7,069,163,834	1,944,900	4,548,327
Missouri	2005	11	\$6,981,281,883	2,735,300	5,797,703
New Jersey	2005	12	\$6,101,128,664	4,039,100	8,703,150
New York	2005	13	\$5,961,800,423	8,533,300	19,315,721
Georgia	2005	14	\$5,740,593,312	4,003,200	9,132,553
Ohio	2005	15	\$5,460,279,070	5,426,700	11,470,685
Washington	2005	16	\$4,452,521,393	2,777,100	6,291,899
Indiana	2005	17	\$4,428,469,362	2,955,200	6,266,019
Kentucky	2005	18	\$4,299,757,008	1,824,500	4,172,608
Michigan	2005	19	\$3,961,911,259	4,390,300	10,100,833
Colorado	2005	20	\$3,689,869,057	2,226,000	4,663,295
Illinois	2005	21	\$3,571,591,200	5,861,900	12,765,427
District of Columbia	2005	22	\$3,485,726,214	682,200	582,049
Mississippi	2005	23	\$3,293,577,231	1,130,200	2,908,496
Louisiana	2005	24	\$3,029,051,972	1,891,800	4,507,331
North Carolina	2005	25	\$2,948,582,828	3,914,800	8,672,459
Tennessee	2005	26	\$2,803,623,829	2,743,100	5,955,745
Wisconsin	2005	27	\$2,563,234,749	2,842,100	5,527,644
Utah	2005	28	\$2,180,589,837	1,148,000	2,490,334
South Carolina	2005	29	\$2,001,335,652	1,866,500	4,246,933
Oklahoma	2005	30	\$1,993,817,413	1,512,400	3,543,442
Hawaii	2005	31	\$1,990,795,989	601,600	1,273,278
Alaska	2005	32	\$1,923,979,434	309,800	663,253
Kansas	2005	33	\$1,880,541,407	1,333,100	2,748,172
Maine	2005	34	\$1,744,038,456	611,700	1,318,220
Minnesota	2005	35	\$1,703,251,661	2,723,300	5,126,739
New Mexico	2005	36	\$1,154,138,826	808,700	1,925,985
New Hampshire	2005	37	\$1,048,365,940	636,300	1,306,819
Iowa	2005	38	\$867,364,837	1,480,500	2,965,524
Arkansas	2005	39	\$797,144,053	1,177,900	2,775,708
Oregon	2005	40	\$589,050,738	1,654,500	3,638,871
Nevada	2005	41	\$514,360,631	1,223,000	2,412,301
Nebraska	2005	42	\$479,328,117	935,000	1,758,163
Rhode Island	2005	43	\$417,873,043	491,000	1,073,579
Vermont	2005	44	\$403,262,477	305,500	622,387

West Virginia	2005	45	\$393,902,208	746,500	1,814,083
South Dakota	2005	46	\$368,423,531	389,800	774,883
North Dakota	2005	47	\$270,210,916	344,700	634,605
Montana	2005	48	\$232,709,251	420,900	934,737
Wyoming	2005	49	\$184,392,223	263,900	508,798
Delaware	2005	50	\$174,384,995	431,100	841,741
Idaho	2005	51	\$154,640,904	611,300	1,429,367

Sources: DoD <(http://siadapp.dmdc.osd.mil/procurement/historical_reports/geographic/P06-P09/

FY2005/P06-P09-State-Rank-2005.pdf)>

CES 2005 Non-Seasonally Adjusted Annual Data by State - Non-Farm Workforce

U.S. Census Bureau Annual Population Estimate by State, 2005 <(http://www.census.gov/

popest/states/NST-ann-est.html)>