United States General Accounting Office

GAO

Report to the Honorable
William V. Roth, Jr.,
U.S. Senate

December 1990

COMMAND AND CONTROL

Defense's Use of Engineering Contractors for Acquiring Automated Systems

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United States
General Accounting Office
Washington, D.C. 20548

Information Management and
Technology Division

B-242025

December 27, 1990

The Honorable William V. Roth, Jr.
United States Senate

Dear Senator Roth:

The Department of Defense depends on in-house and outside technical expertise to design and develop highly complex command, control, communications, and intelligence (C^3I) systems. Defense relies on engineering support contractors for advice and direction on automated data processing software engineering, system architecture, and hardware design and development. In November 1989 you asked us to determine the extent to which Defense uses engineering support contractors. As agreed in later discussions with your office, this report describes the kinds of services these contractors perform and the cost of the contracts.

Defense did not know the overall extent to which its components use outside engineering and technical support services. To obtain this information, we developed and gave a data collection instrument to Defense components that acquire C^3I systems. Appendix I details our objective, scope, and methodology. As used in this report, engineering and technical support services include (1) systems engineering, which often includes system integration functions; (2) task engineering, which usually deals with specific areas of responsibility, such as preparing test specifications and documents; and (3) technical support services, which support different functions, such as acquisition support and data management. (See app. II.)

Results in Brief

Defense provided data showing that from fiscal years 1985 through 1989 it spent about $3.4 billion for engineering and technical services in support of C^3I acquisitions. The Air Force was by far the largest user, accounting for over $2 billion of the $3.4 billion spent. Defense's annual expenditures went from $494.5 million in fiscal year 1985 to $891.7 million in fiscal year 1989, an 80-percent increase.

Background

Defense supplements its own efforts to develop and acquire automated C^3I systems by relying on engineering support contractors for advice and direction. The support contractors are for-profit companies, and non-

profit entities including federally-funded research and development centers such as the Mitre Corporation in Massachusetts and the Oak Ridge National Laboratory in Tennessee. These centers are government-sponsored institutions set up to meet a special long-term need that neither government agencies nor the private sector can meet.

Support contractors offer a wide range of engineering and technical services. Mitre, for example, serves most often as general systems engineer and integrator for the Air Force's Electronic Systems Division's major C^{3}I systems acquisitions and, as such, assumes full technical responsibility for program success. The Electronic Systems Division uses for-profit contractors for task engineering and technical support services—only rarely does the Division use them in the role of systems engineer.

Defense officials responsible for acquiring C^{3}I systems differed on how they defined engineering and technical support services. In order to establish a common definition, we met with Defense officials and agreed on the following support categories: (1) systems engineering, (2) task engineering, and (3) technical support services.

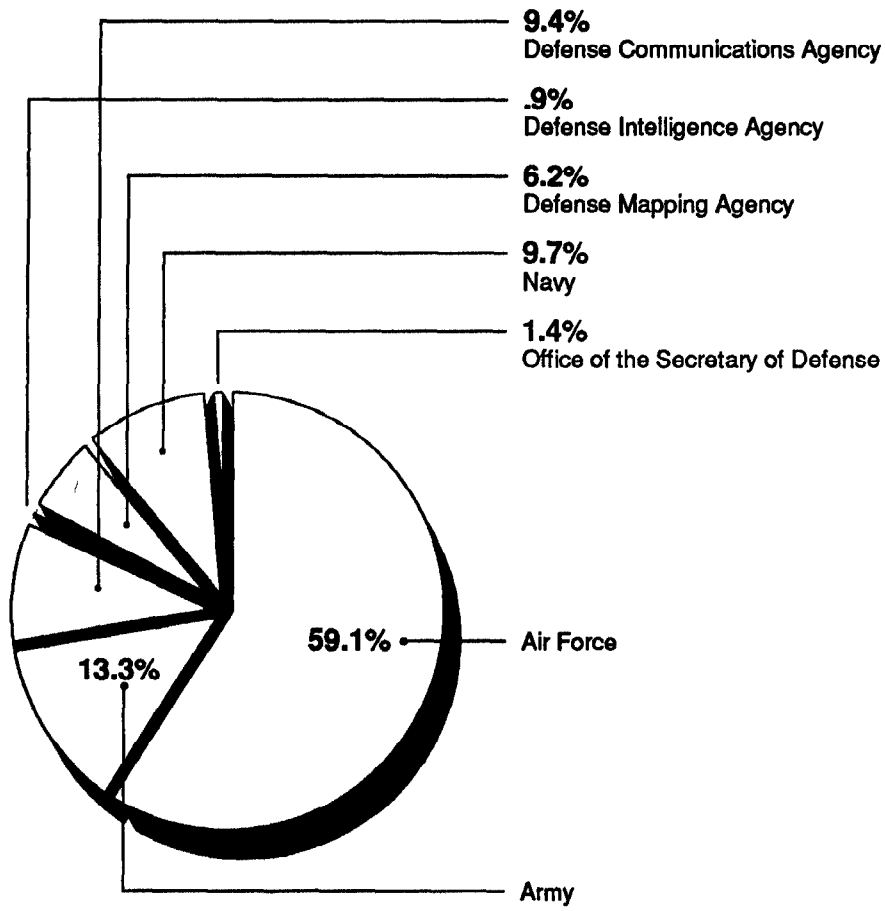
Typically, Defense's accounting systems do not capture the costs for engineering and technical support services for C^{3}I system acquisitions. Consequently, we designed a data collection instrument to obtain cost data on a contract-by-contract basis from each component. The Office of the Assistant Secretary of Defense distributed it to Defense components that acquire C^{3}I systems.

Defense's Use of Engineering and Technical Support Services

For fiscal years 1985 through 1989, Defense had active engineering and technical support service contracts totaling about $4.7 billion.[1] Defense spent over $3.4 billion to support C^{3}I acquisitions during these 5 years. As figure 1 shows, the Air Force accounted for over 59 percent of these expenditures.

[1]This total includes a small amount for non-C^{3}I acquisitions. Further, because some contracts cover several years, the total includes some engineering and technical support services that may have occurred before fiscal year 1985, or after fiscal year 1989.

Figure 1: Percentage of C³I Support Expenditures by Defense Component
(Fiscal Years 1985-1989)



As appendix III shows, Defense expenditures for engineering and technical support increased by about $397 million, or 80 percent, from fiscal year 1985 to fiscal year 1989. The Navy showed the largest increase, up 308 percent, from $27.7 million in fiscal year 1985 to $113 million in fiscal year 1989. The Defense Communications Agency increased the least, up about 15 percent, from $61.4 million to $70.3 million over the same period.

Within the specific support categories, systems engineering expenditures far exceeded the sum of the other two support categories—task engineering and technical support. Defense reported expenditures for systems engineering, task engineering, and technical support services separately and in various combinations. For support that was reported

exclusively as systems engineering, Defense expended almost $2.3 billion (66 percent of total expenditures). Similarly, technical support and task engineering accounted for about $388.3 million and about $40.4 million, respectively. Defense also reported $728.3 million of support expenditures as some combination of the three categories. (See app. IV.)

Nonprofit contractors accounted for almost $2 billion (58 percent of total expenditures), with over 99 percent of the money going to the Mitre and Aerospace corporations. For-profit contractors accounted for the remaining 42 percent (about $1.45 billion), with General Electric Co., International Telephone and Telegraph Corp., Analytic Sciences Corp., and Planning Research Corporation among the largest recipients. More specific details can be found in appendixes IV and V.

Our review was conducted from January through November 1990, in accordance with generally accepted government auditing standards. We did not obtain official agency comments; however, we discussed the contents of the report with Defense officials, and made changes where appropriate.

As arranged with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the date of this letter. At that time, we will send copies of this report to the Secretary of Defense; the Secretaries of the Air Force, Army, and Navy; the Director of the Office of Management and Budget; and the heads of the other Defense components discussed in this report. Copies will also be made available to others upon request. If you have any questions about this report or require additional information, please contact me at (202) 275-4649. Major contributors to this report are listed in appendix VII.

Sincerely yours,

Samuel W. Bowlin
Director, Defense and Security
Information Systems

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Abbreviations

C³I	command, control, communications and intelligence
GAO	General Accounting Office
IMTEC	Information Management and Technology Division

Objective, Scope, and Methodology

In November 1989, Senator William V. Roth, Jr., asked us to determine the extent to which Defense relies on engineering support contractors to provide advice and direction on automated data processing software engineering, system architecture, and hardware design and development. In subsequent discussions with his office, we agreed that this report would describe contract costs and types of services provided during fiscal years 1985 through 1989 (October 1, 1984, through September 30, 1989).

Our primary objective was to obtain and analyze engineering support contract data in support of the acquisition of automated C^3I systems. C^3I systems are significant users of automated data processing hardware and software, and it is during system development that engineering support has the most impact on system requirements and technical performance. To identify appropriate contracts, we asked Defense officials to define engineering support. However, Defense officials did not have a generally accepted definition of engineering support. Often what is engineering support to one official is technical support to another. Working with Defense officials, we developed definitions of systems engineering, task engineering, and technical support. (See app. II.)

We sought to obtain from Defense officials the contract data, including total expenditures for systems engineering, task engineering, and technical support services, for each Defense component from fiscal years 1985 through 1989. However, Defense procuring components do not capture overall expenditure data. Instead, information was only available on a contract-by-contract basis. Consequently, we developed a data collection instrument to gather data on the cost of engineering support contracts and the types of services provided. Officials from the Defense Inspector General's Office coordinated data collection and designated individuals to serve as points-of-contact for each reporting component.

Defense tasked its components to collect the data and report it to us by July 31, 1990. As of November 6, 1990, we had not received contract data from the Defense Advanced Research Projects Agency and the Navy laboratories that provide engineering support to Navy programs. A Navy official said that because accounting for the laboratories' work is documented only by thousands of hard-copy military interdepartmental procurement requests, the Navy could not devote the necessary resources to the effort. Total contract value information provided by the National Security Agency for fiscal years 1988 and 1989 is included in the $4.7 billion total contract value discussed in the letter. Further, the Defense Intelligence Agency submitted several contract data sheets, one

of which is classified. More specific information about these contracts is classified and has not been included in the report.

In addition, the Air Force submitted incomplete information. Air Force officials said they did not have fiscal year 1985 and 1986 support contract expenditures because they did not keep summary records during that time. Also, only aggregate totals of all support contracts were available for fiscal years 1987 and 1988. Air Force officials said that their data bases were inadvertently destroyed and individual contract data were lost. To estimate contract expenditures for each year, we multiplied Air Force's average staff year cost for these services by the actual staff years used.

We did not independently validate the information, nor did we evaluate any documentation related to individual Defense contracts. While we did not obtain official agency comments, we checked responses for consistency with the instructions we provided, discussed the submissions with Defense points-of-contact, and made changes where appropriate.

Department of Defense Agreed-upon Definitions for Engineering and Technical Support Services

Systems Engineering	Systems engineering, which often includes system integration functions, can also include (1) overall system and program definition; (2) specification of technical performance requirements; (3) analysis and verification of system and subsystem design; (4) assessment of design compromises and tradeoffs; (5) definition of system interfaces; (6) reviews of hardware and software specifications, tests, and test results; (7) appraisal of contractors' technical performance; and (8) integration within a system or within associated systems or subsystems.
Task Engineering	Task engineering involves less than overall engineering responsibility. It defines specific areas of responsibility such as (1) preparing plans or specifications; (2) serving as non-government advisers in the evaluation of technical proposals, plans, or system development progress; (3) preparing test specifications and test documents; (4) supervising or directing tests; (5) analyzing and evaluating technical problems or deficiencies; and (6) monitoring and preparing guidance for specified contractor activities.
Technical Support	Technical support services include (1) development planning (e.g., requirements analysis and baseline development); (2) acquisition support (e.g., source selection advice and contractor monitoring); (3) specialty engineering (e.g., systems safety, human factors, reliability and maintainability, and electromagnetic compatibility); (4) manufacturing engineering (e.g., various productivity and producibility analyses); (5) program control (e.g., program and budget analysis, and schedule assessments); (6) logistics support; (7) configuration and data management; (8) cost estimating services, and (9) independent verification and validation.

Engineering and Technical Support Contract Expenditures

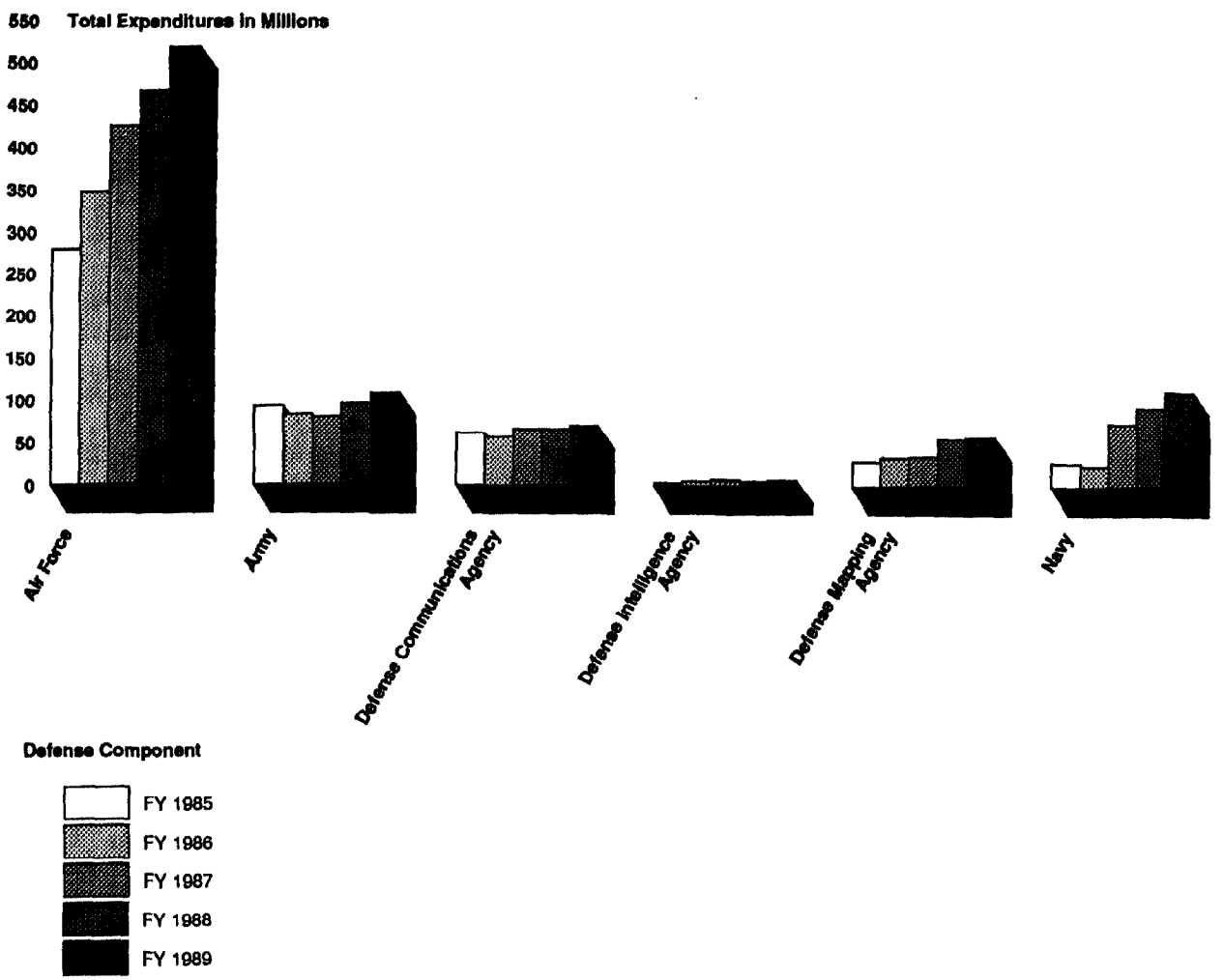
Table III.1: Engineering and Technical Support Contract Expenditures by Defense Component

Dollars in millions[a]

Defense component	Fiscal Year 1985	1986	1987	1988	1989	Total	Percent of total expenditures	Percent increase, fiscal 1985-1989
Air Force	279.1	346.7	425.0	465.9	518.8	**2,035.4**	59.1	85.9
Army	93.1	82.6	79.6	95.7	108.4	**459.5**	13.3	16.4
Defense Communications Agency	61.4	57.4	66.9	66.9	70.3	**322.9**	9.4	14.5
Defense Intelligence Agency	3.8	5.8	7.9	5.7	7.4	**30.6**	0.9	94.7
Defense Mapping Agency	29.3	33.8	34.9	56.2	58.6	**212.8**	6.2	100.0
Navy	27.7	25.1	75.0	93.6	113.0	**334.4**	9.7	308.0
Office of Secretary of Defense	0	0	18.6	14.5	15.2	**48.3**	1.4	N/A
Total	**494.5**	**551.3**	**707.9**	**798.5**	**891.7**	**3,443.9**	**100.0**	**80.3**

[a]Figures may not add due to rounding.

Figure III.1: Trends in Engineering and Technical Support Contract Expenditures by Defense Component for Fiscal Years 1985 Through 1989



Types of Support Services Available

Table IV.1: System Engineering, Task Engineering, and Technical Support Service Expenditures

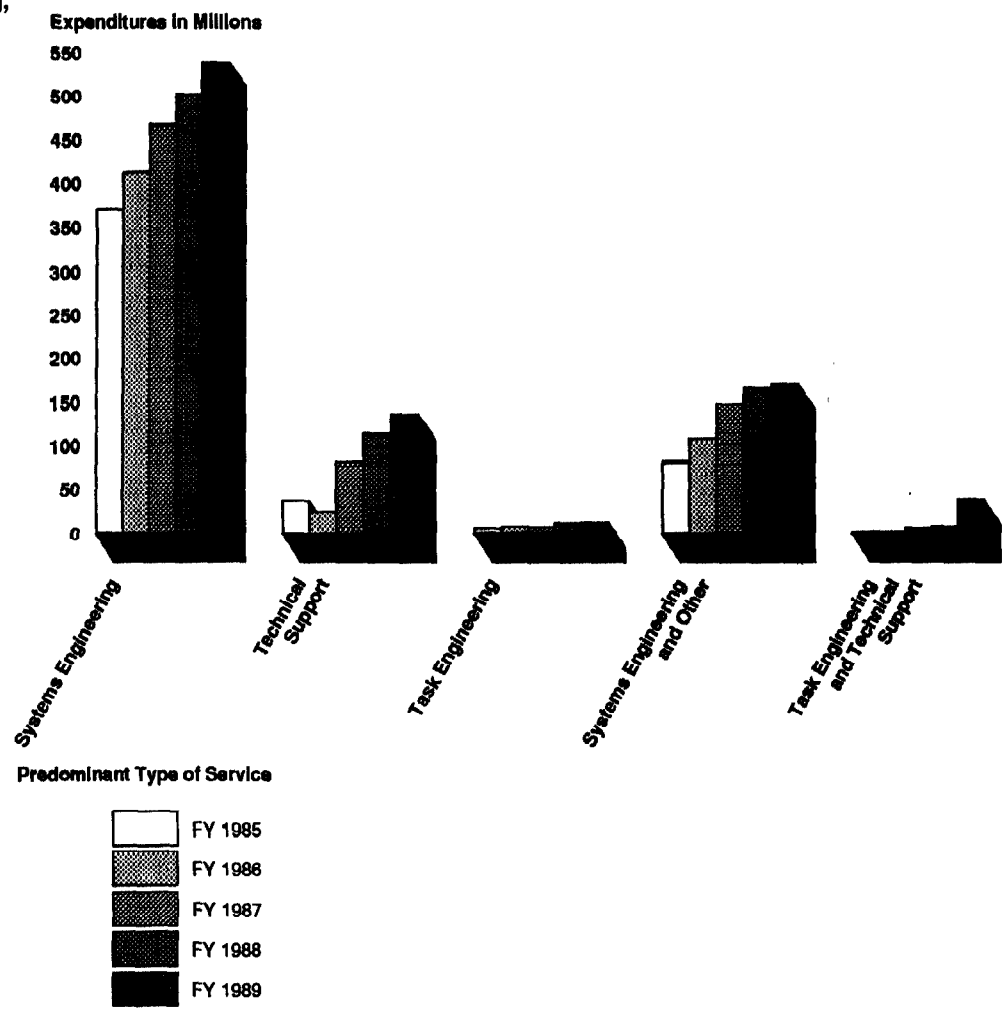
Dollars in millions[a]

Type of support[b]	Fiscal Year 1985	1986	1987	1988	1989	Total	Percent of total expenditures	Percent increase, fiscal 1985-1989
Systems engineering	370.2	411.6	466.9	500.6	537.6	**2,286.9**	66.4	45.2
Task engineering	4.8	6.8	6.3	10.9	11.6	**40.4**	1.2	140.0
Technical support services	36.2	23.6	81.6	112.9	133.9	**388.3**	11.3	269.6
Subtotal	**411.2**	**442.0**	**554.8**	**624.4**	**683.1**	**2,715.6**		
Systems engineering and task engineering	4.6	5.5	9.6	12.9	15.7	**48.4**	1.4	239.0
Systems engineering and technical support services	25.5	29.9	26.9	43.4	50.7	**176.4**	5.1	99.2
Task engineering and technical support services	1.8	1.7	5.6	7.6	38.0	**54.7**	1.6	2068.6
Systems engineering, task engineering, and technical support services	51.4	72.2	111.1	110.2	104.0	**448.8**	13.0	102.5
Subtotal	**83.3**	**109.3**	**153.2**	**174.1**	**208.4**	**728.3**		
Total	**494.5**	**551.3**	**708.0**	**798.5**	**891.7**	**3,443.9**	**100.0**	

[a]Figures may not add due to rounding.

[b]While we requested that information be reported separately as either systems engineering, task engineering, or technical support services, some Defense components reported this information as some combination of the three categories.

Figure IV.1:Trends in Expenditures for Systems Engineering, Task Engineering, and Technical Support Services for Fiscal Years 1985 Through 1989



For-Profit and Nonprofit Expenditures

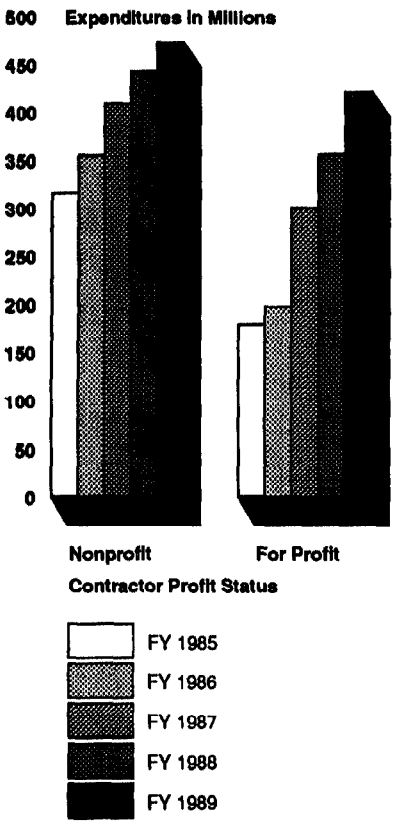
Table V.1: Engineering and Technical Support Contract Expenditures by For-Profit and Nonprofit Status

Dollars in millions[a]

	Fiscal Year						
Profit Status	**1985**	**1986**	**1987**	**1988**	**1989**	**Total**	**Percent**
For-Profit	178.8	197.2	300.4	356.2	420.0	1,452.6	42.2
Nonprofit	315.7	354.2	407.5	442.3	471.6	1,991.3	57.8
Total	**494.5**	**551.3**	**707.9**	**798.5**	**891.7**	**3,443.9**	**100.0**

[a]Figures may not add due to rounding.

Figure V.1:Trends in Engineering and Technical Support Contract Expenditures by For-Profit and Nonprofit Entities for Fiscal Years 1985 Through 1989



Engineering and Technical Support Contract Expenditures by Contractor

Dollars in millions[a]

Contractor	Total expenditures	Percent of total
Top 5 Nonprofit Contractors		
Mitre Corp.	$1,403.9	70.5
Aerospace Corp.	581.1	29.2
Lincoln Laboratories	2.4	0.1
Oak Ridge National Laboratory	1.0	0.1
SRI International	0.8	0.0
Others	2.0	0.1
Total	**$1,991.3**	**100.0**
Top 20 For-Profit Contractors		
General Electric Co.	$191.8	13.2
International Telephone and Telegraph Corp.	183.1	12.6
Analytic Sciences Corp.	53.6	3.7
Planning Research Corp.	50.7	3.5
Harris Corp.	44.4	3.1
Telos Corp.	36.6	2.5
American Telephone and Telegraph Technologies, Inc.	31.8	2.2
Booz, Allen & Hamilton, Inc.	25.2	1.7
Teledyne Brown Engineering	22.8	1.6
Infotec Development, Inc.	20.2	1.4
General Telephone & Electronics, Inc.	19.8	1.4
Emerson Electric	17.7	1.2
Analytics, Inc.	17.5	1.2
RMS Technologies	17.3	1.2
ESL, Inc.	16.2	1.1
Horizons Technology, Inc.	15.5	1.1
Computer Sciences Corp.	14.2	1.0
Ford Aerospace and Communications Corp.	11.0	0.8
EG&G Washington Analytical Services Center	10.6	0.7
Atlantic Research Corp.	10.3	0.7
Others	642.4	44.2
Total	**$1,452.6**	**100.0**

[a]Figures do not add due to rounding.

Major Contributors to This Report

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