HIGH-PERFORMANCE COMPUTING

IN THE FEDERAL MARKET

INPUT

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Federal Information Technology Market Program
(FITMP)

High-Performance Computing in the Federal Market

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FSHPC • 499 • 1992

Abstract

This report examines high-performance computing in the federal market. It identifies federal agency requirements and application areas supported by existing and planned high-performance computing systems.

INPUT believes that the federal high-performance computing market will grow from $750 million in FY 1992 to $1.52 billion in FY 1997, at a compound annual growth rate of 15%. In addition to providing a market forecast, this report describes the major market issues and trends impacting the industry.

This report contains 116 pages, including 39 exhibits.

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High performance computing in the federal market FSHPC 1992 I.C

AUTHOR

TITLE

DATE LOANED	BORROWER'S NAME

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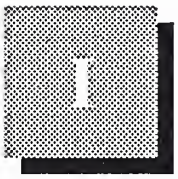

Introduction

Due to the passage of the High-Performance Computing Act, which was signed into law in December 1991, the federal high-performance computing market is receiving a great deal of attention. The President's High-Performance Computing and Communications (HPCC) program aims to keep the U.S. ahead of Japan in the information technology industry. Supporters of the HPCC program claim that it will increase the nation's Gross National Product (GNP) and assure its position as the most technologically advanced nation in the world.

As part of INPUT's Federal Information Technology Market Program, this report addresses the growing demand for high-performance computing systems and related services within the federal government. The purpose of this report is to assist federal contractors in analyzing the current and future federal high-performance computing market.

A
Purpose and Scope

With Japanese firms eroding the U.S. portion of the worldwide supercomputer market and the increased need for faster, more powerful computers, the federal government is actively pushing industry and federal agencies to develop new high-performance computing equipment, networks, and technology.

The purposes of this report are to assess the federal market for high-performance computing and to identify opportunities for federal vendors.

This report addresses a number of questions, such as:

- What are the current and anticipated effects of the HPCC Act on the market?
- What funding is available for procuring high-performance computing equipment and services?

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- On which agencies should vendors focus their marketing efforts?
- Who will participate in the National Research and Education Network?
- To what extent do standards exist and how are they affecting the federal market?
- Do certain applications dominate the market? What are they?
- Who are the leading vendors?
- What strategies are required to succeed in this market?

B
Methodology

In developing this report, INPUT used a variety of sources and methods. The report's findings are based on research and analyses of the following sources:

- INPUT's Procurement Analysis Reports (PARs)
- OMB/GSA/NBS Five-Year Information Technology Plans for 1992-1997
- Interviews with various federal agencies that currently use high-performance computing systems
- Federal agency FY 1992 information technology budgets
- OMB's Five-Year Plan for Meeting the ADP and Telecommunications Needs of the Federal Government
- Supplement to the President's FY 1993 Budget, entitled "Grand Challenges 1993: High-Performance Computing and Communications"
- *Commerce Business Daily*, 1989-present

First, INPUT researched agency long-range plans and budget submissions for FY 1992-FY 1993 for major systems replacements and new acquisitions. Based on this research, INPUT pinpointed agencies and programs that related to high-performance computing systems.

INPUT also reviewed the Procurement Analysis Reports (PARs) to develop further insights into agency activities. Many PARs cover programs that, for one reason or another, do not appear in the agencies' budget submissions. This situation yields possibilities for further research.

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Other data for the report was derived from primary and secondary research.

- Primary data was collected from agency officials through a questionnaire developed by INPUT to acquire information about current experiences and future plans for high-performance computing systems (see Appendix F).
- Secondary data was used to develop an understanding of the types of hardware and software available and to assess trends in technology development.

C
Report Organization

In addition to the introduction and appendixes, this report consists of four chapters:

- Chapter II contains an executive overview describing the major points and findings of the report.
- Chapter III provides the market forecast and analysis and describes the major market issues and trends impacting the industry.
- Chapter IV summarizes federal agencies' requirements for high-performance computing systems and the application areas supported by existing and planned systems.
- Chapter V provides a sample of business opportunities for programs and initiatives in the federal market involving high-performance computing systems.

The following appendixes are also provided:

- Interview Profiles
- Definitions
- Glossary of Federal Acronyms
- Policies, Regulations, and Standards
- Related INPUT Reports
- Policy Questionnaire

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II

Executive Overview

A
Technology Description

For purposes of this report, INPUT defines a high-performance computer as any computer considered Class VII or above. This includes traditional vector computers as well as new massively parallel systems. High-performance computers and supercomputers are high-powered processors with numerical processing throughput significantly greater than the fastest general-purpose computers. On-line storage should consist of four gigabytes or more. Constant technological advances make it increasingly difficult to define high-performance computing.

Exhibit II-1 describes the technological components and issues involved in the federal high-performance computing market.

EXHIBIT II-1

High-Performance Computing Technology

- Traditional supercomputers
- Massively parallel computers
- High-speed networks
- HPCC program

Traditional vector supercomputers still play a role in the high-performance computing marketplace, even though massively parallel systems presently hold the spotlight. Some applications will remain better suited for vector processing than for parallel processing.

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Massively parallel computing is a major part of high-performance computing and the President's High-Performance Computing and Communication (HPCC) initiative. Parallel computers use multiple microprocessors to approach the computing power of traditional vector computers.

Another key element of high-performance computing and the President's HPCC initiative is the use of high-speed networks to share information generated from these computer systems. Many believe supercomputers' potential is not being realized because of the lack of a proper infrastructure to transmit data and information. Part of the HPCC initiative involves advancing the Internet into a high-speed National Research and Education Network (NREN).

The High-Performance Computing and Communication (HPCC) program, also referred to as the HPCC initiative, is guiding the federal high-performance computing market. The program was set up by President Bush in FY 1991 to significantly accelerate the availability and utilization of the next generation of high-performance computers and networks.

B

HPCC Goals

The High-Performance Computing Act was signed into law in December 1991. The Act did not change the program, but added OMB reporting requirements for the HPCC participating agencies.

Exhibit II-2 lists the goals of the HPCC program.

EXHIBIT II-2

Goals of the HPCC Initiative

- Extend U.S. HPCC leadership
- Provide wide technology dissemination
- Spur U.S. productivity gains

Source: "Grand Challenges 1993: High-Performance Computing and Communications" Supplement to the President's FY 1993 Budget.

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One way these goals will be realized is by achieving computational performance of one trillion operations per second (teraops or teraflops). Secondly, associated systems software, tools, and improved algorithms will need to be developed.

A national research network capable of one billion bits per second (gigabits) will be developed for wide dissemination of the technology and applications. This will speed the pace of innovation and serve the national economy, national security, education, and the global environment.

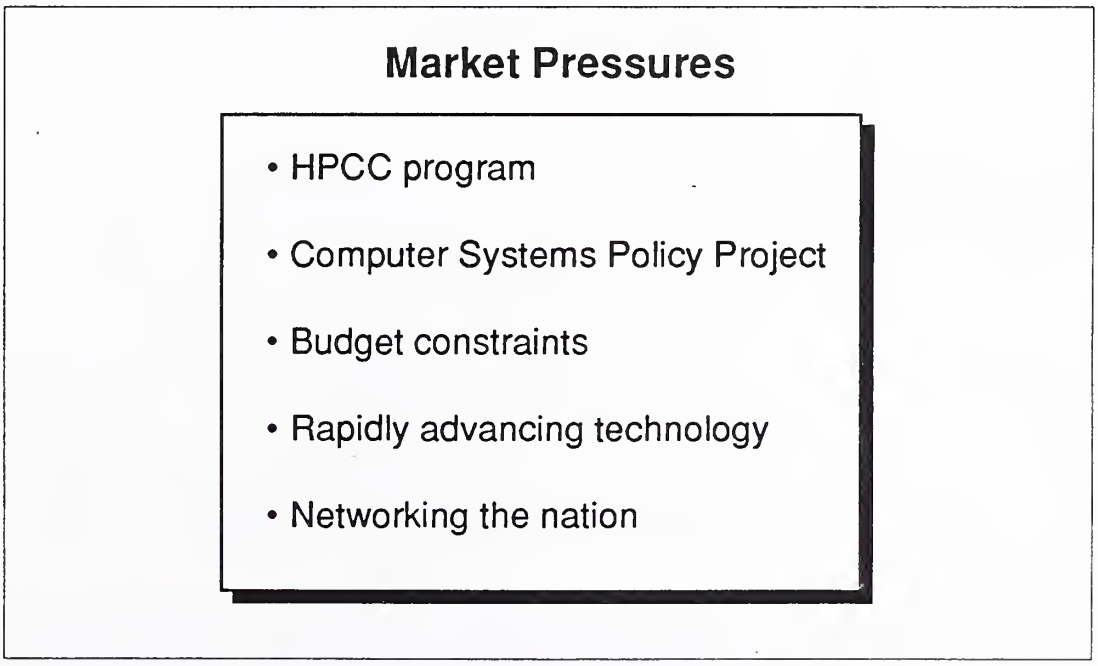
Sufficient production of Ph.D.s and other trained professionals each year in computational science and engineering will permit effective use and application of these new technologies. This will spur gains in U.S. productivity and industrial competitiveness by making high-performance computing technologies an integral part of U.S. design and production processes.

C

Federal Market Pressures

Exhibit II-3 shows the pressures facing government agencies and vendors regarding the federal high-performance computing market.

EXHIBIT II-3



Many of INPUT's agency respondents feel the HPCC initiative has increased their ability to purchase high-performance computing equipment, software, networking, or services. Also, the HPCC program has made high-performance computing more visible and its benefits more recognizable, causing Congress to grant more funding for high-performance computing purchases within agencies' information technology budgets.

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The Computer Systems Policy Project (CSPP), a consortium of leading U.S. computer companies, is helping to shape the president's HPCC initiative by offering advice and voicing concerns. CSPP is urging that the initiative be broadened and further strengthened so that the U.S. more quickly realizes the benefits of high-performance computing technology. The group asked the Bush administration to collaborate more closely with the computer industry on its initiative.

Another pressure facing federal agencies using high-performance computing is budget constraints. Even though the HPCC initiative is providing funding in this area, it is not enough. Agencies claim budget constraints are still hindering them from expanding their purchases and use of supercomputers.

A key driving force in the high-performance computing marketplace is the need to rapidly advance U.S. computer technology. The entire HPCC program is an attempt to stay ahead of Japan in the supercomputer market and to use new high-performance computing technology to better the U.S.

The last pressure facing the high-performance computing agency and vendor community is networking the nation. Experts believe that with more powerful computers and faster networks, researchers will be able to solve previously unsolvable scientific and engineering problems. The HPCC initiative proposes to build a National Research and Education Network (NREN) that will revolutionize the way research is done in the U.S.

D
Market Forecast

Funding for high-performance computing systems and the supporting professional services and software is expected to come from several sources, as noted in the HPCC initiative. The primary source will be agency acquisitions described in OMB Circular A-11 budget requests. The funding under the HPCC initiative represents only the expenditures authorized by the Act, and does not include cooperative contributions of participants in academia and industry.

The forecast in Exhibit II-4 indicates the funding expected from the two main sources, OMB A-11 Section 43 Budget Requests, and the HPCC initiative. Both projections for the fiscal years 1993 through 1997 are based on current documentation, federal agency spending patterns, and projection of the outyear effects of inflation. Expenditures are given in current-year dollars.

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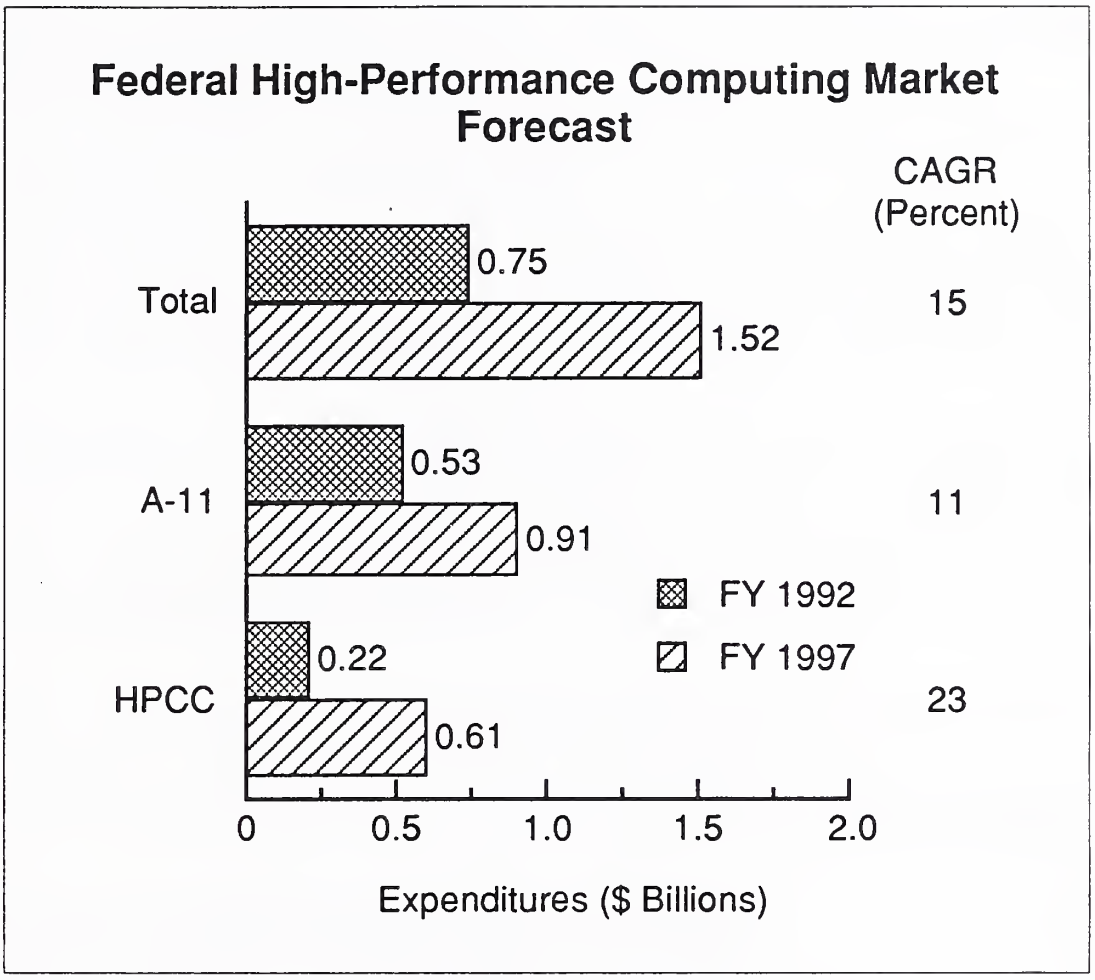
EXHIBIT II-4



INPUT expects the HPCC initiative to expand its spending at nearly twice the compound annual growth rate (CAGR) of the federal information technology expenditures proposed in the affected agency Five-Year IT Plans. The details of equipment and services expenditures are discussed in Chapter III.

E

Participating Agencies

Exhibit II-5 lists the agencies participating in the President's HPCC program.

All of the agencies listed above, except the Education Department, are responsible for a portion of the research to be conducted under the HPCC program. Eight hundred and three million dollars is proposed for FY 1993 to fund HPCC research and development (R&D) within these agencies. Most of the HPCC opportunities are in the eight agencies that are receiving funding. The Department of Education is not currently receiving funding.

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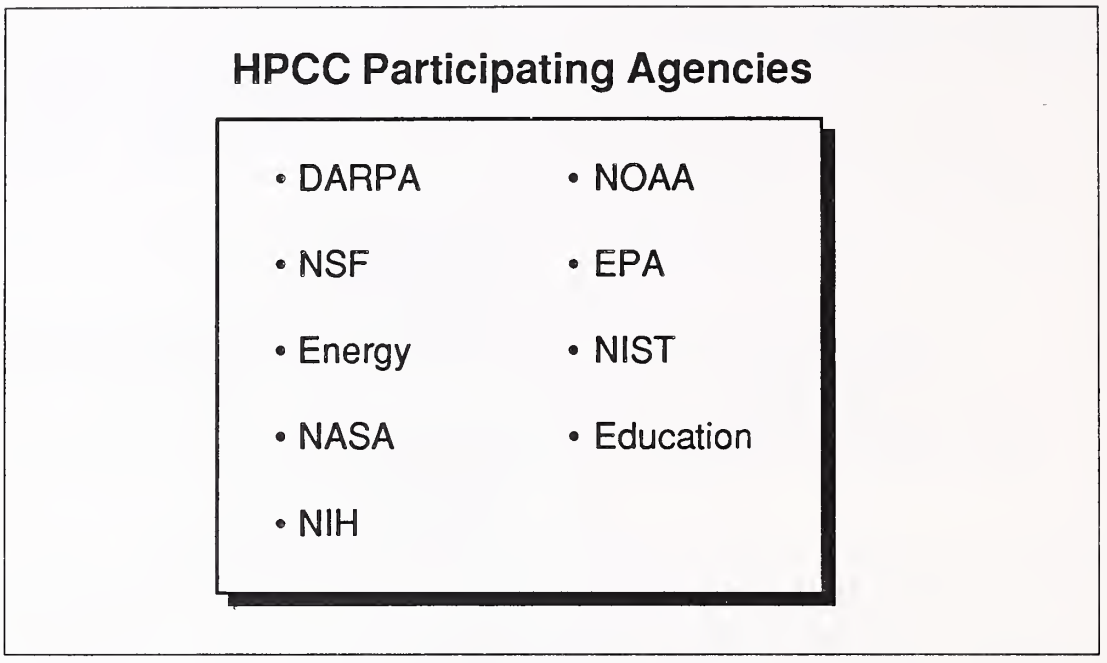
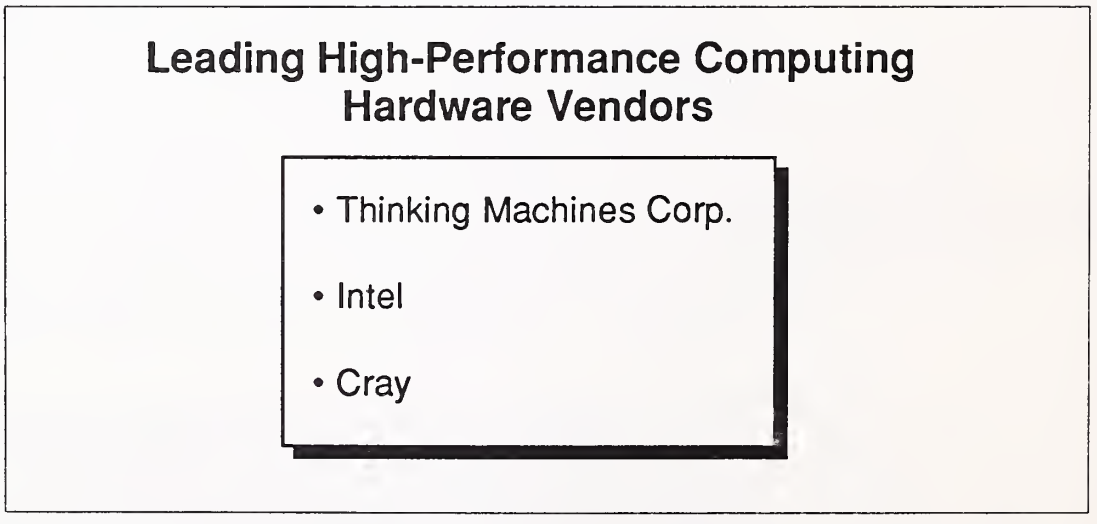
EXHIBIT II-5



F
Leading Vendors

Exhibit II-6 lists the top high-performance computing hardware vendors as perceived by agency respondents. The true leaders in the federal high-performance computing market are difficult to identify, because of the ever-changing definitions of supercomputers and high-performance computers.

EXHIBIT II-6



Thinking Machines Corp. is the world's leading manufacturer of highly parallel supercomputers and a major design center for parallel software. One hundred percent of the respondents named Thinking Machines Corp. as one of the top high-performance computing vendors. Thinking Machines holds only 3% of the worldwide supercomputer market by

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installed base, but it holds 33% of the worldwide massively parallel supercomputer market.

Intel was named as one of the top high-performance computing vendors by 88% of INPUT's agency respondents. Intel holds a very minute portion of the worldwide supercomputer market. However, of the agencies surveyed, Intel showed a base of 12%, according to the number of systems currently installed. Intel is in close competition with Thinking Machines in the worldwide massively parallel market, holding 34%. This represents $90 million in sales for 1991.

Cray Research was named one of the top high-performance computing systems vendors by 63% of INPUT's agency respondents. Cray is the top worldwide supercomputer vendor, with a 42% market share, according to its installed base of systems. Some experts believe Cray's lack of a massively parallel system offering will hinder its ability to maintain its current market share.

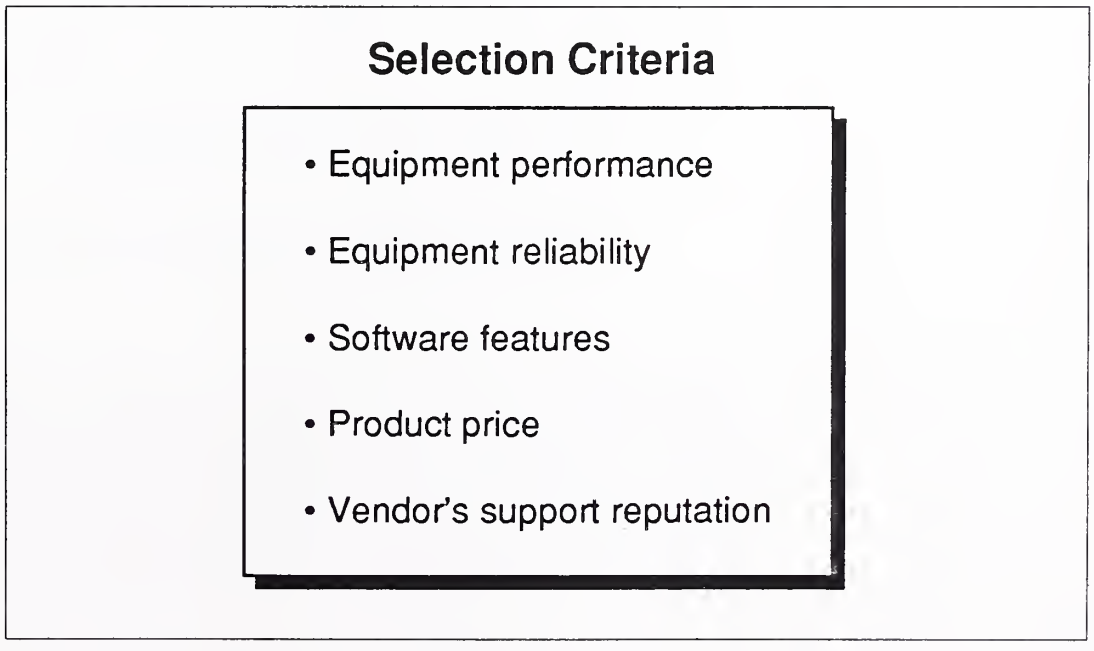
INPUT predicts that Thinking Machines, Cray, and Intel will remain the top industry leaders for high-performance computing systems manufacturing. Most federal vendors who wish to enter this marketplace should look for opportunities in professional services and networking.

G

Selection Criteria

Exhibit II-7 lists the top selection criteria used by respondent agencies in evaluating high-performance computing system purchases.

EXHIBIT II-7



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Equipment performance ranks highest among selection criteria. This finding seems logical, considering the main reason for purchasing a high-performance computing system is for its speed, computational power, and performance.

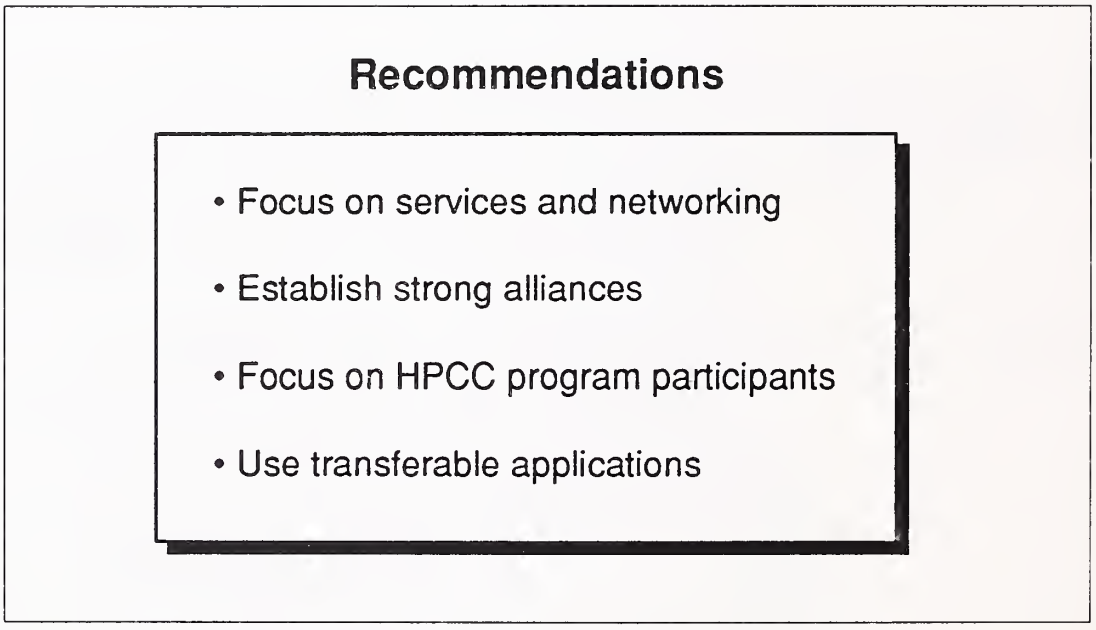
Equipment reliability ranks second among the selection criteria. Because these systems are so powerful and house valuable, complex data, system reliability is critical.

Agencies will use the criteria listed above in evaluating potential vendors. Vendors need to choose solutions and develop proposals that will score high in these criteria. Team building will be important for vendors lacking high-performance computing experience.

H
Recommendations

In the federal high-performance computing market, vendors need to adopt various strategies to succeed. INPUT's recommended strategies are set forth in Exhibit II-8.

EXHIBIT II-8



Most agencies buy high-performance computers directly from the manufacturer. This leaves little opportunity for many vendors. However, there are a relatively large number of opportunities for high-performance computing-related services and high-performance computing networking. These service-oriented opportunities will continue to grow with the expansion of the President's HPCC program.

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As mentioned earlier, almost all of the R&D contracts for equipment or processing speed research will be given to the top supercomputer manufacturers. Another way of entering the high-performance computing marketplace would be to form alliances with the top supercomputer manufacturers, or team with universities and laboratories for research contracts.

INPUT believes that vendors should target the eight agencies receiving HPCC program funding for high-performance computing opportunities. These agencies already own and operate high-performance computing systems, so there is potential for services contracts related to the existing systems.

Finally, INPUT recommends focusing on transferable high-performance computing applications. For some vendors, current commercial high-performance computing experience may be transferable to the federal marketplace. Applying federal high-performance computing applications to industry is also feasible. When choosing focuses for HPCC applications, vendors should consider applications that can be leveraged in both marketplaces.

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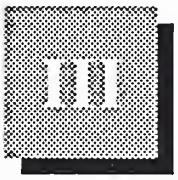

Market Analysis and Forecast

A
Legislative Initiative

The High-Performance Computing Act, signed into law in December 1991 (P.L. 102-194), is the result of several years of effort on the part of senior government, industry, and academic scientists and managers. The goal of the High-Performance Computing and Communications (HPCC) initiative is to significantly accelerate the availability and utilization of the next generation of high-performance computers and networks. The HPCC initiative research agenda is designed to extend U.S. leadership in high-performance computing (HPC) and networking technologies. The program is planned, funded, and managed with close cooperation among federal agencies and laboratories, private industry, and academe.

For FY 1993, the HPCC initiative proposes to invest $803 million in high-performance computing research and development. This represents a $148 million (23%) increase over the FY 1992 enacted level.

1. Goals

The HPCC program began in FY 1992. In the first year of operation, the program realized several notable technical and programmatic achievements:

- Major new salable high-performance computing systems were announced and delivered.
- New software applications were developed for emerging high-performance systems.
- Traffic on the evolving high-speed, high-performance computing network doubled.

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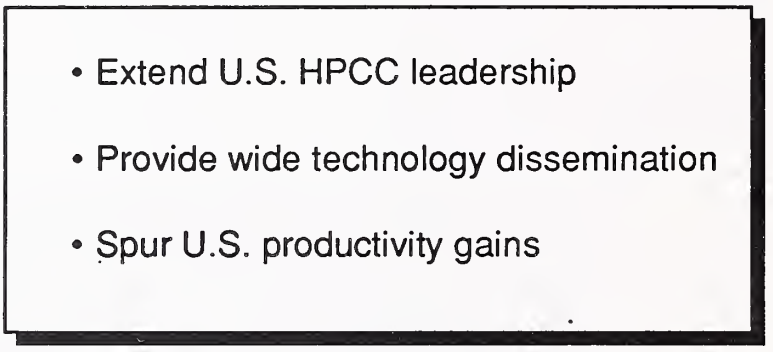
- Participating federal agencies began solicitations to fund high-performance computing research groups, centers, and consortia on various applications and problems.

- A large number of researchers, professors, students, scientists, and engineers were trained to use these emerging technologies.

Exhibit III-1 lists the goals of the HPCC initiative.

EXHIBIT III-1

Goals of the HPCC Initiative



Source: "Grand Challenges 1993: High-Performance Computing and Communications" Supplement to the President's FY 1993 Budget.

One way these goals can be realized is by achieving computational performance of one trillion operations per second (teraops or teraflops). Secondly, associated systems software, tools, and improved algorithms must be developed. A national research network capable of one billion bits per second (gigabits) will be developed for wide dissemination of the technology and applications. This will speed the pace of innovation and serve the national economy, national security, education, and the global environment.

Sufficient production of Ph.D.s and other trained professionals each year in computational science and engineering will permit effective use and application of these new technologies. This application will spur gains in U.S. productivity and industrial competitiveness by making high-performance computing technologies an integral part of U.S. design and production processes.

2. Components

The HPCC initiative consists of four integrated components representing the key areas of high-performance computing and communications. Exhibit III-2 lists the program components.

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EXHIBIT III-2

HPCC Components

- High-Performance Computing Systems (HPCS)
- Advanced Software Technology and Algorithms (ASTA)
- National Research and Education Network (NREN)
- Basic Research and Human Resources (BRHR)

Source: "Grand Challenges 1993: High-Performance Computing and Communications" Supplement to the President's FY 1993 Budget.

High-performance computing systems (HPCS) pertain to the development of the underlying technology required for salable high-performance computing systems capable of sustaining trillions of operations per second on large problems. Research in very high-performance systems is focusing both on increasing the absolute level of performance attainable and on reducing the cost and size of these very high-performance systems in order to make them accessible to a broader range of applications.

Advanced software technology and algorithms (ASTA) involves the development of generic software technology and algorithms and the deployment of the most innovative systems for research applications in a networked environment.

The National Research and Education Network (NREN) will involve the development of a national high-speed network to provide distributed computing capability to research and educational institutions and to further advance research on very high-speed networks and applications.

Basic research and human resources (BRHR) will provide support for individual investigators and multidisciplinary long-term research drawn from diverse disciplines, including computer science, computer engineering, and computational science and engineering. This component of the program also includes the initiation of activities to significantly increase the pool of trained personnel, and support for efforts leading to accelerated technology transition.

The HPCC initiative is not intended to include national security applications, but the technology produced will have an important impact on areas of national security.

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3. Management

The HPCC initiative is implemented as a partnership among federal agencies and other organizations. Major portions of the program are cost-shared and leveraged by the participation of industry and universities.

Leadership for the program is provided by the Office of Science and Technology Policy, through the Federal Coordinating Council on Science, Engineering, and Technology (FCCSET) Committee on Physical, Mathematical, and Engineering Sciences (PMES). The membership of PMES includes senior executives of many federal agencies. Planning for the HPCC program is coordinated by the PMES High-Performance Computing, Communications, and Information Technology (HPCCIT) Subcommittee. The HPCCIT, currently led by the Energy Department, meets regularly to coordinate agency high-performance computing programs through information exchanges, the common development of interagency programs, and the review of individual agency plans and budgets.

The participating agencies have altered their organization or management structure to facilitate participation in the high-performance computing initiative. Each agency has established a focal point for matters related to the HPCC initiative.

4. Agency Involvement

Nine federal agencies are participating in the HPCC program. Eight agencies are responsible for a portion of the research to be conducted under each of the HPCC program components. HPCC funding for each agency was determined using formal evaluation criteria during the budgeting and planning process. Exhibit III-3 shows each agency's funding for each of the program components

The Department of Education recently joined the HPCC program, but is not involved in direct high-performance computing research and is not receiving HPCC program funding.

Eight hundred and three million dollars is being proposed for FY 1993, a twenty-three percent (23%) increase over the FY 1992 enacted level. The funds from federal sources are not intended to carry out the entire HPCC initiative. Portions of this program will be cost-shared by organizations from the participating sectors.

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EXHIBIT III-3

HPCC Budgets by Agency and Program Component
($ Millions)

	Total FY 1992	Total FY 1993	FY 1993 HPCC Component			
			HPCS	ASTA	NREN	BRHR
DARPA	232.2	275.0	119.5	49.7	43.6	62.2
NSF	200.9	261.9	28.6	125.6	45.1	62.6
DOE	92.3	109.1	10.9	69.2	14.0	15.0
NASA	71.2	89.1	14.1	61.4	9.8	3.8
HHS/NIH	41.3	44.9	4.2	22.6	7.2	10.9
DOC/NOAA	9.8	10.8	0.0	10.4	.4	0.0
EPA	5.0	8.0	0.0	6.1	.4	1.5
DOC/NIST	2.1	4.1	1.1	1.0	2.0	0.0
Total	654.8	802.9	178.4	346.0	122.5	156.0

Source: "Grand Challenges 1993: High-Performance Computing and Communications" Supplement to the President's FY 1993 Budget.

According to NSF and NIST high-performance computing officials, HPCC program funding is part of the agencies' research and development (R&D) budgets. This funding does not appear as part of the agencies' information technology budgets, nor do the agencies submit these HPCC program plans as part of their A-11 submissions to OMB.

However, according to these same NSF and NIST officials, these funds will be used for R&D, as well as high-performance computing equipment and other high-performance computing services.

Vendors should not be discouraged that the only available funding for high-performance computing is for R&D. This is not true. A large portion of the funding allocated under the president's high-performance computing initiative *is* for R&D; however, some of this funding will be used for purchases of equipment, software, and services. Also, the eight agencies and a few other agencies, such as the Air Force and the Navy,

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have plans for high-performance computing procurements that are included in their information technology budgets and their A-11 submissions. Section C of this chapter will discuss high-performance computing budgets and funding in more detail.

5. Responsibilities

The eight agencies participating in the HPCC program have certain responsibilities in fulfilling the program's goals. Exhibit III-4 shows specific agency responsibilities within each program component.

EXHIBIT III-4

HPCC Program: Agency Responsibilities

Activity / Agency	High-Performance Computing Systems	Advanced Software Technology & Algorithms
DARPA	• Technology development and coordination for affordable teraops systems	• Technology development for parallel algorithms and software tools
NSF	• Basic architecture research • Prototyping experimental systems	• Research in: - Software tools, data bases - Grand challenge • Computer access
DOE	• Technology development • Systems evaluation	• Energy applications research centers • Energy grand challenge and computation research • Software tools
NASA	• Aeronautics and space application testbeds	• Software coordination • Computational research in: - Aerosciences - Earth and space sciences
HHS/NIH	• System evaluation and performance analysis	• Medical application testbeds for medical computation research
DOC/NOAA		• Ocean and atmospheric computation research • Software tools • Computational techniques
EPA		• Research in environmental computations, data bases, and application testbeds
DOC/NIST	• Research in systems instrumentation and performance measurement • Research in interfaces and standards	• Research in: - Software indexing and exchange - Scalable parallel algorithms

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EXHIBIT III-4 (CONT.)

HPCC Program: Agency Responsibilities

Activity / Agency	National Research and Education Network	Basic Research and Human Resources
DARPA	• Technology development and coordination for gigabits networks	• University programs
■●E	• Facilities coordination and deployment • Gigabits research	• Programs in: - Basic research - Education/training/curricula - Infrastructure
DOE	• Gigabits applications research • Access to energy research facilities and data bases	• Basic research and education programs
NASA	• Access to aeronautic and spaceflight research centers	• Research institutes and university block grants
HHS/NIH	• Development of intelligent gateways • Access for academic medical center	• Basic research • Internships for parallel algorithm development • Training and career development
DOC/NOAA	• Ocean and atmospheric mission facilities • Access to environmental data bases	
EPA	• Environmental mission assimilation by the States	• Technology transfer to states • University programs
DOC/NIST	• Coordinate performance assessment and standards • Programs in protocols and security	

Source: "Grand Challenges 1993: High-Performance Computing and Communications" Supplement to the President's FY 1993 Budget.

Several agencies have been assigned coordinating responsibility in specific technical areas. The Department of Energy and NASA will coordinate activities in high-performance computing system evaluation, testbed development, and applications software capabilities.

NASA will coordinate accumulation of and access to the high-performance computing software base. This will be facilitated by the wide-area file system technology currently being deployed for early experimental use by DARPA, which will be extended to include the NREN as it matures and is deployed by NSF.

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DARPA will coordinate activities in the development of high-performance computing systems and associated operating systems software. NASA and DARPA will coordinate the development of associated software tools. DARPA will also coordinate activities in gigabit network technology research.

NSF will coordinate the broad deployment of the Interagency Interim NREN, working with universities, industry, and agencies having mission-specific requirements. NSF will also coordinate basic research and infrastructure activities to foster balance in research participation and training.

The National Institute of Health (NIH) will coordinate educational activities.

The National Institute of Standards and Technology (NIST) will coordinate standards, network security, and systems instrumentation and methodology for performance measurement.

Each agency participates in all of the identified activities to ensure that the resulting capabilities are a good match to user needs. NOAA, NIH, and EPA contribute distinctive application areas of broad interest and network user bases.

6. Activities

Many of theses agencies have released solicitations for research and development (R&D) activities in the areas listed. Vendors that have R&D expertise and wish to participate in the high-performance computing effort should focus on agencies whose high-performance computing responsibilities correspond to the vendor's particular performance capabilities.

In January 1992, the Department of Energy opened two high-performance computing research centers in Los Alamos, NM, and Oak Ridge, TN. The Los Alamos National Lab will buy an early prototype of a Connection Machine Model CM-5 from Thinking Machines Corp. to be used for global climate modeling and other research into the behavior of liquids in reservoirs.

The Oak Ridge National Lab will acquire a prototype of a Paragon supercomputer from Intel Corp. to model pollution in groundwater, and will work on the design of new materials and alloys.

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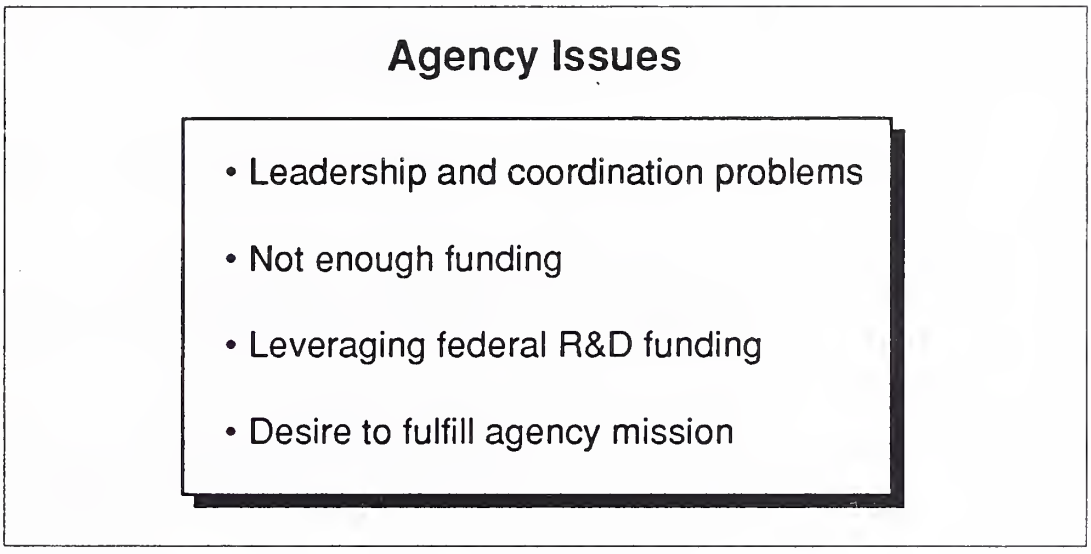
NASA will use high-performance computing to develop more effective tools for building better, more economical, and safer aerospace vehicles. The agency can now model aspects of the design process, such as fluid-flow structures. Using high-performance computing systems, NASA researchers have been able to model flow fields and temperatures around powered-lift vehicles.

7. Issues

INPUT asked several high-performance computing policy officials which issues are facing the agencies participating in the HPCC program. Exhibit III-5 lists their responses.

EXHIBIT III-5



When interagency committees run federal programs involving efforts from several different agencies, leadership and coordination problems tend to surface. Because the HPCC initiative involves eight different agencies it is hard to prevent overlap of efforts and to coordinate the research activities of each agency in detail. The agencies are attempting to overcome these problems by holding committee meetings regularly and keeping communication lines open between themselves and the committees.

All of the agencies INPUT interviewed expressed the desire for more funding. According to one respondent, there will always be a need for more cycles and more memory. Then the task becomes how to leverage the federal funding received. One way to accomplish this is through joint research and development projects with industry.

The last issue that has surfaced among the participating agencies is the desire to fulfill the individual agency mission rather than further the HPCC initiative as a whole. Many agencies naturally want to use the funding they receive to conduct high-performance computing R&D that

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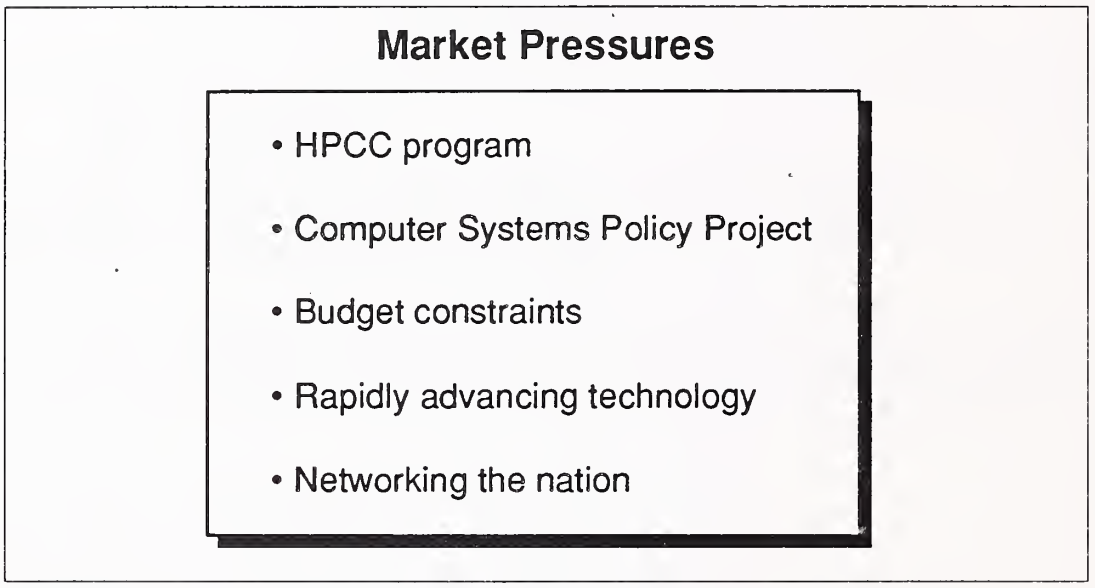
will accomplish part of their agency's mission. In some cases, R&D of this nature may not be applicable to other agencies' missions or useful to industry. It is important that agencies remain focused on the strategic goals of the HPCC program.

B

Market Pressures

Exhibit III-6 shows the pressures facing government agencies and vendors regarding the federal high-performance computing market.

EXHIBIT III-6



1. Agencies

INPUT interviewed agencies currently using high-performance computing and asked them how the HPCC program has affected them so far. The answers to this question appear in Exhibit III-7.

EXHIBIT III-7

Impact of the HPCC Program

Impact	Percent of Respondents
Increased Purchasing Ability	45
No Impact at this Point	37
Encouraged Planning	9
Increased HPCC Research	9

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Many of the agency respondents felt that the HPCC initiative had increased their ability to purchase high-performance computing equipment, software, networking, or services. Although most of the money granted through the program is meant for R&D, portions of the grants are going to purchases of equipment. Also, the HPCC program has made high-performance computing more visible and its benefits more recognizable, causing Congress to grant more funding for high-performance computing purchases within agencies' information technology budgets.

A number of agencies stated that the HPCC program has so far had no impact on them. This seems unusual, because the majority of the agencies surveyed are part of the HPCC program. But these same agencies also stated that they hope the funding from the HPCC program will allow them to make more high-performance computing equipment purchases in the near future.

2. Vendors

The Computer Systems Policy Project (CSPP) represents leading U.S. computer companies. It is helping to shape the president's HPCC initiative by offering advice and voicing concerns.

CSPP members are as follows:

- Apple
- AT&T
- Compaq
- Control Data
- Cray
- Data General
- Digital Equipment
- Hewlett-Packard
- IBM
- Sun Microsystems
- Tandem
- Unisys

The CSPP has noted that the HPCC program is a significant, critical, and necessary undertaking. However, CSPP is urging that the initiative be broadened and further strengthened so that the U.S. realizes more quickly the benefits of high-performance computing technology. The group asked the Bush administration to collaborate more closely with the computer industry on its initiative and to widen its vision beyond scientific and engineering applications so that more Americans can benefit from the services available through high-speed networks.

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Exhibit III-8 lists four specific recommendations made by the CSPP for the HPCC program.

EXHIBIT III-8

CSPP HPCC Program Recommendations

- Expand the HPCC vision
- Establish technology foundation
- Improve HPCC program management
- Reorder HPCC budget priorities

Source: President's Budget, FY 1993

CSPP urges that the HPCC program be expanded to include research on generic, enabling technologies to support a wider range of applications such as better health care, lifelong learning, improved services for senior citizens, enhanced industrial design, and broad access to public and private data bases.

The CSPP also suggests that the HPCC program establish a technology and policy foundation for an information and communications infrastructure for the future. The Federal Networking Council, which is overseeing the development of NREN, has formed a policy committee to address critical network issues such as security and privacy, intellectual property rights, and network access, interoperability, and technology transfer.

CSPP also advises improved management of the HPCC program and increased opportunities for industry participation.

Finally, CSPP believes the HPCC budget priorities should be reordered to achieve a more balanced program. In response to this recommendation, the Bush administration proposed a larger dollar increase ($68 million) for software research than for any other program component.

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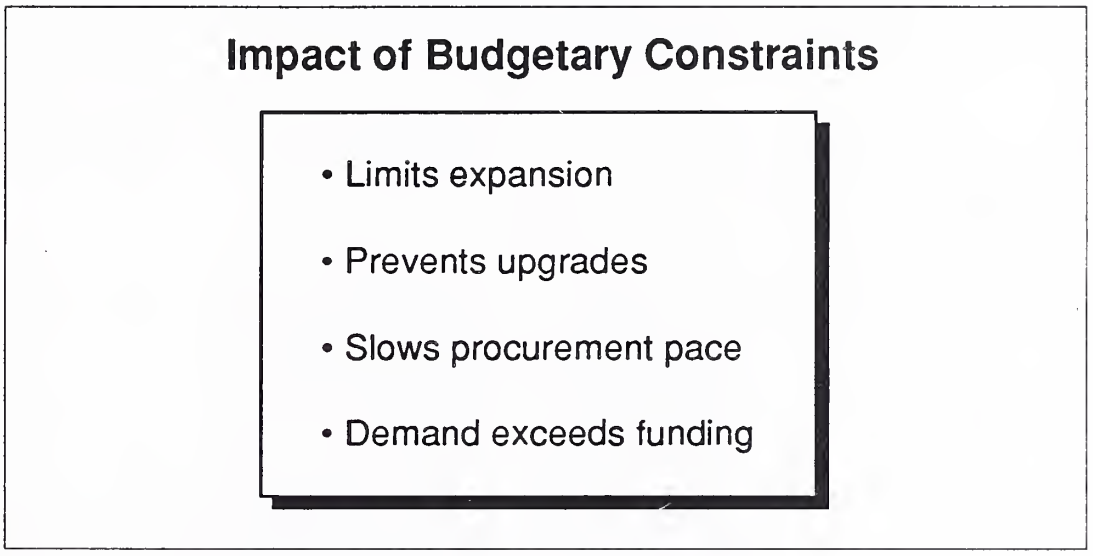
3. Budget

Another pressure facing federal agencies using high-performance computing is budget constraints. INPUT asked agency respondents what impact budget constraints are having on the use of high-performance computing in their agencies. Exhibit III-9 lists agency responses in order of frequency of mention.

EXHIBIT III-9



Even though the HPCC initiative is providing funding, it is not enough. Agencies claim budget constraints are still hindering them from expanding their purchases and use of supercomputers. Budget constraints are also preventing upgrades of older supercomputers. Most agencies are anxious to purchase massively parallel systems, but limited funding is preventing them from upgrading their existing traditional vector computer systems.

Budget constraints are also slowing the procurement process. High-performance computer purchases are typically very expensive. Acquiring funding approval can take significantly more time than for smaller information technology purchases. Soliciting a delegation of procurement authority (DPA) from GSA for a purchase of this magnitude is much more time-consuming and difficult than for less expensive and less complex systems. One way to speed this process is by urging agency procurement officials to participate in GSA's Trail Boss program. This may help speed the DPA process.

4. Technology

Another driving force in the high-performance computing marketplace is the need to rapidly advance technology. The entire HPCC program is an attempt to stay ahead of Japan in the supercomputer market and to use new high-performance computing technology to better the nation. According to a report written by Los Alamos Lab, the HPCC program

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could generate over $10 billion in revenues for the U.S. high-performance computing industry over the current decade. Extending this estimate to the economy, the Gross National Product would be increased by 0.6 to 1.7 percent by the year 2000.

Advancing high-performance computing technology involves massive parallelism. Many experts feel that this will be the key architecture for the 1990s. However, Cray Research believes that the predicted rate of acceptance for this technology is optimistic, considering the slow rate at which general-purpose software is progressing for these machines. Nonetheless, massively parallel machines are receiving a lot of attention and will remain a large part of the focus of the HPCC program.

5. Networking

The last pressure facing the high-performance computing agency and vendor community is networking the nation. Experts believe that with more powerful computers and faster networks, researchers will be able to solve previously unsolvable scientific and engineering problems.

The HPCC initiative proposes to build the National Research and Education Network (NREN) from the existing Internet NSFnet. The new high-speed network will revolutionize the way research is done in the U.S. Agencies are under pressure to move forward in enhancing and developing this network, yet funding is not adequate to support this effort. Also, current U.S. telecommunications policies, which were developed for copper wire networks, are hindering the deployment of the new fiber optic technology needed for NREN.

There is also controversy over whether such a high-speed network is really necessary. Although researchers in the aerospace, automobile, chemical, oil, pharmaceutical, and semiconductor industries are dependent on high-speed networks, a recent GAO report concludes that most companies do not need transmission capacity beyond the current commercially available T3 speeds. According to the report, only a fraction of the supercomputing market requires high-speed networks—usually for applications such as videoconferencing or data base queries.

Supporters of NREN argue that the program will pay huge dividends by improving productivity and enabling industries to share information.

Nevertheless, the HPCC supports the development of NREN. Vendors should be aware of this controversy and the effect it may have on funding of HPCC program components.

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C

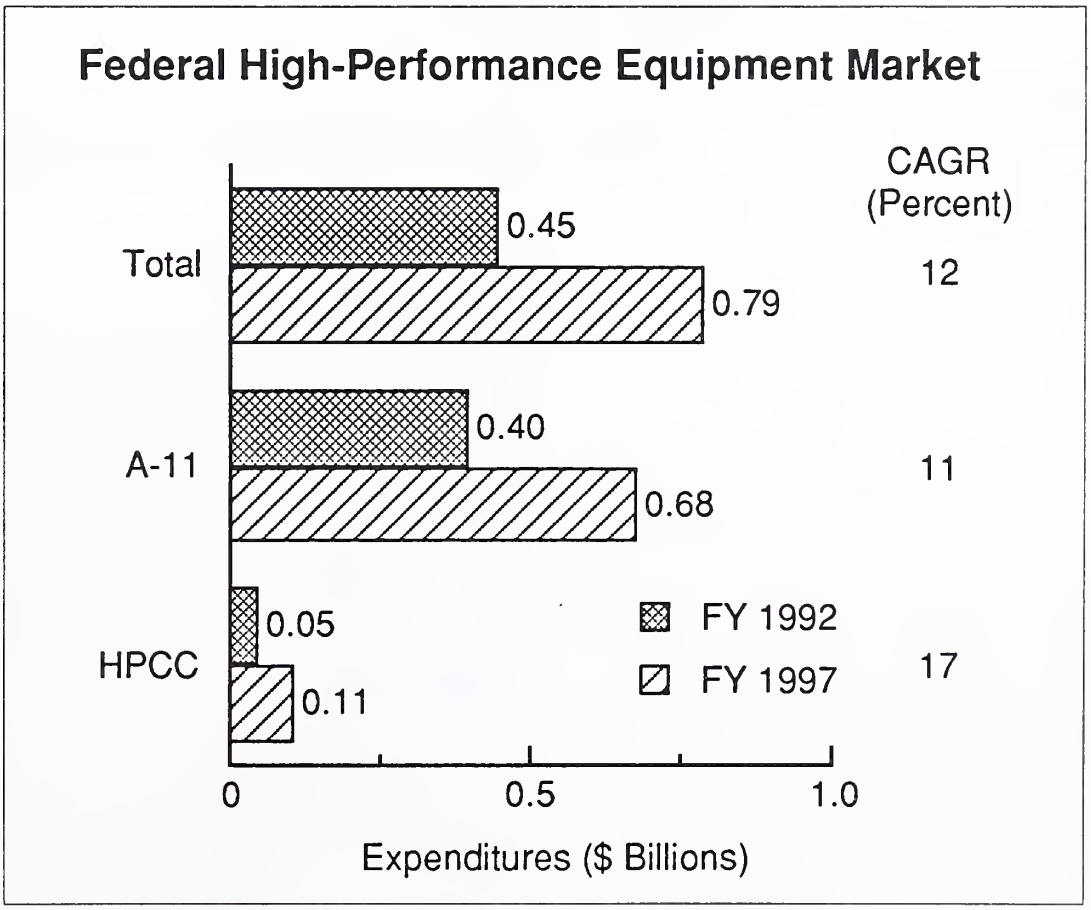
Market Forecast

The most significant difficulty facing industry in the federal high-performance computing market is identification of opportunities and the realism of the funding requests. As noted earlier, the high-performance computer market has been growing steadily for more than a decade, but the funding has been difficult to identify. Acquisition of traditional vector computers by Defense and high-technology agencies gave this specialized market a strong start.

Funding for the effort through the next five years will still come principally from agency information technology budgets, but is expected to be slowly overtaken by HPCC initiative expenditures, if the economy does not take a downward plunge after the upcoming presidential election. The forecast has been divided into two segments: equipment and services.

INPUT's projection of expenditures for high-performance computing equipment is shown in Exhibit III-10. The two key sources of funding will be agency information technology expenditures, covered in their OMB A-11 Section 43 B exhibits, and diverted HPCC initiative research and development project funds. The out-year projections are based on several estimates by the agencies and the administration.

EXHIBIT III-10



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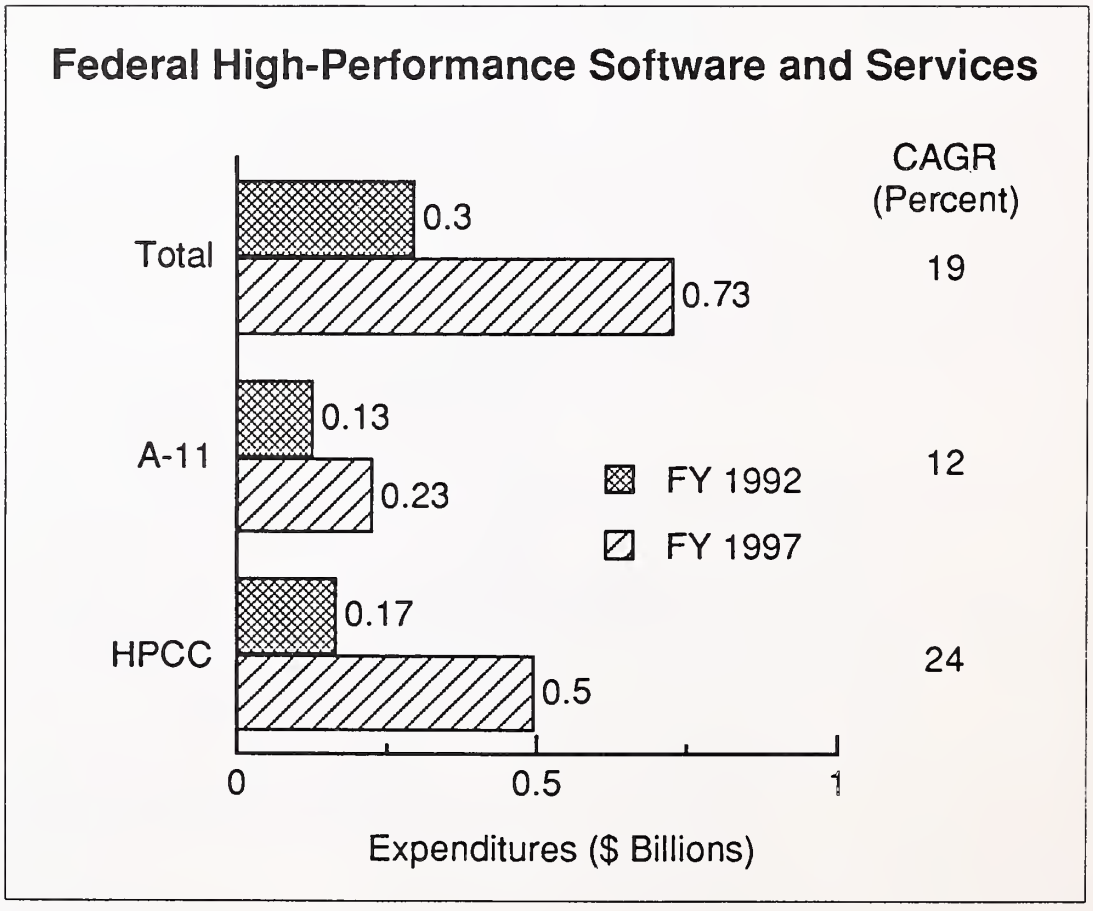
The compound annual growth rate of 17% for HPCC expenditures roughly coincides with the increase in initiative funding between FY 1992 and FY 1993, which is expected to reach $5 billion over the next five years of the legislative life of the HPCC Act.

Identification of current and projected expenditures for software development and maintenance, and supporting professional services is more difficult. Several of the agencies will turn support functions over to in-house technical staffs or in-place facilities operators (for example, Martin Marietta at DOE Oak Ridge). Agencies like NASA, on the other hand, are using contractors to specifically support high-performance computers.

Research by INPUT indicates that the expenditures are likely to follow the pattern displayed in Exhibit III-11. The elements of proposed programs in the information technology budget are subparts of other contracts, or planned procurements listed in Section 43B. The $2 million A-11 reporting threshold tends to conceal a number of planned acquisitions. The non-R&D elements of software development in the HPCC initiative appear to support the numbers shown in the exhibit, excluding any funding by non-government participants. Again, the growth rate shown for the HPCC initiative funding segment follows the pattern of the 1992 to 1993 increase, and projected future expenditures. Some of the support will be contracted to equipment suppliers that have intimate familiarity with the systems' features.

EXHIBIT III-11



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operations per second (teraflops). The CM-5 is an outgrowth of technology developed under Thinking Machines' five-year, $12 million research contract with the Defense Advanced Research Projects Agency (DARPA). Although the CM-5's architecture can be scaled to reach teraflops speeds, it still is prohibitively expensive to do so. Such a system would require 16,000 processors and cost upwards of $300 million.

Thinking Machines has sold several smaller CM-5s to federal sites involved in the HPCC initiative. A 544-node system is installed at the Army High-Performance Computing Research Center in Minneapolis. Los Alamos National Lab signed a contract to purchase two CM-5s. The decision to purchase from Thinking Machines ended the lab's long-term relationship with Cray and signaled an increasing interest in parallel processing.

The CM-5 ranges in price from $1.4 million for a 32-node system capable of 4 gigaflops of peak performance to $30 million for a 1,000-node system capable of 100 gigaflops.

2. Intel

Intel was named by 88% of INPUT's agency respondents as one of the top high-performance computing vendors. Intel holds a very minute portion of the worldwide supercomputer market. However, of the agencies surveyed, Intel showed a base of 12%, according to the number of systems currently installed. Intel is running head to head with Thinking Machines in the worldwide massively parallel market, holding 34%. This represents $90 million in sales for 1991.

Intel high-performance computing systems are installed at the Sandia National Lab, Ames Research Center, Naval Ocean Systems Center, and the National Institute of Health.

3. Cray

Cray research was named by 63% of INPUT's agency respondents as one of the top high-performance computing system vendors. Cray is the top worldwide supercomputer vendor, with a 42% market share, according to its installed base of systems. However, to date Cray does not offer a massively parallel computer system. Companies such as Thinking Machines and Intel are slowly eroding Cray's market share. In an effort to maintain its market and address the demand for parallelism, Cray recently entered into a technology-sharing and marketing agreement with Sun Microsystems. This agreement will allow Cray to use Sun's Sparc architecture in upcoming supercomputers.

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In May 1992, Cray Research claimed victory over Japanese supercomputer vendor NEC. Cray won a $43 million contract with the EPA to provide a two-processor Cray Y-MP for EPA's National Environmental Supercomputing Center, opening in July 1992 in Bay City, MI. The eight-year contract includes an option for another supercomputer for the EPA's Research Triangle Park facility. EPA researchers will use the new supercomputers to study problems such as acid rain, ozone depletion, and water pollution.

These same supercomputer vendors are battling in another contest for a contract with NASA's Ames Research Center. Cray and NEC submitted bids in March 1992 and an award is expected in October 1992. The procurement is entitled "High-Speed Processor 3 (HSP-3)" and could be worth up to $92.6 million over its seven-year life. Cray bid the procurement directly, but NEC bid through Control Data Corp. The resulting supercomputer will be the focal point of Ames' Numerical Aerodynamic Simulation (NAS) facility, which is used to design next-generation aerospace vehicles.

4. Convex

Convex is the leader in the minisupercomputer market. From the installed base of the agencies surveyed, Convex holds 13% of this portion of the high-performance computing market. Convex is experiencing market pressure and competition from both ends of the marketplace. It is being squeezed by Cray from above and by powerful RISC workstation vendors from below.

INPUT predicts that Thinking Machines, Cray, and Intel will remain the top industry leaders for high-performance computing systems manufacturing. Most federal vendors that wish to enter this marketplace should look to opportunities for professional services and networking. As discussed in Chapter IV, most of the recent *Commerce Business Daily* solicitation announcements have been for services and networking.

E
Recommendations

In the federal high-performance computing market, vendors need to adopt various strategies to succeed. INPUT's recommended strategies are set forth in Exhibit III-13.

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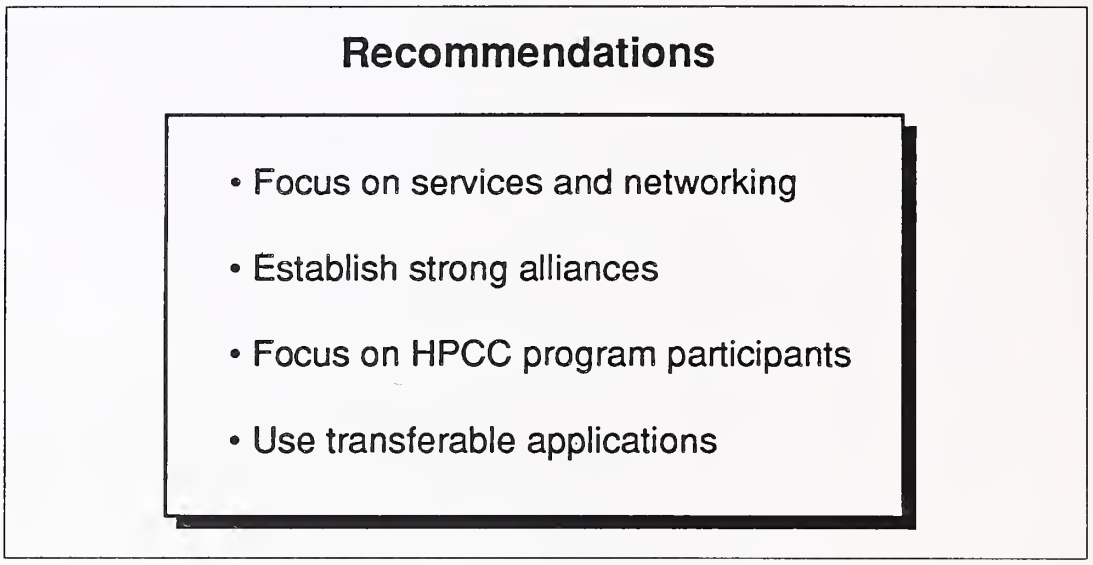
EXHIBIT III-13



1. Services and Networking

Most agencies buy high-performance computers directly from the manufacturer. This leaves little opportunity for many vendors. The supercomputer equipment market will continue to be dominated by a small group of companies, such as Cray and Thinking Machines. However, there are a relatively large number of opportunities for high-performance computing-related services and high-performance computing networking. These service-oriented opportunities will continue to grow with the expansion of the President's HPCC program. Many of the R&D opportunities will also go to the top supercomputer manufacturers, but others—such as R&D for software—will be viable opportunities for other federal contractors. Other types of professional services opportunities include facilities maintenance, computer operations, scientific data processing, education and training, and software engineering.

One example of a high-performance computing services contract is a Unisys contract for facilities maintenance at the EPA's National Environmental Supercomputing Center. Unisys will be responsible for integrating the new equipment being acquired under a contract recently awarded to Cray Research.

Most of the agencies INPUT interviewed acquire equipment maintenance as part of the contract for the equipment purchase, leaving most of the equipment maintenance contracts in the hands of only a few manufacturers. However, when the contracts expire, the equipment maintenance portion of the original contract is usually recompeted through full and open competition. Many of these recompete contracts are then awarded to a broader group of federal contractors. Recompetions for services may be another source of contracting opportunities.

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Education and training will become increasingly important as more high-performance computing systems come on-line. The pool of U.S. federal and commercial computer specialists that have the knowledge base necessary to operate and use high-performance computing systems is small, and dwindling. Also, scientists and researchers who need to use the information contained on these machines for the most part do not possess the computer expertise necessary to retrieve or process information on these systems. Vendors will find many opportunities for high-performance computing education and training in the near future.

Software engineering is an area of great importance, especially in the massively parallel arena. The main problem with massively parallel computing today is the lack of software. Vendors will find contracting opportunities in software engineering, development, and conversion.

2. Alliances

As mentioned earlier, almost all of the R&D contracts for equipment or teraflops research will be given to the top supercomputer manufacturers. One way of entering the high-performance computing marketplace will be by forming alliances with the top supercomputer manufacturers.

For example, IBM has joined forces with Thinking Machines to combine massively parallel processing with high-performance mainframe systems. IBM mainframe customers have indicated that massively parallel computing is an important technology of the future and they would like to take advantage of it.

Cray Research and Sun Microsystems have also launched a technology-sharing project. The agreement allows Cray to use Sun's Sparc architecture in supercomputers currently under development. For Sun, the contract will provide the technology necessary to improve on the Sparc chip's performance, which has been overtaken by faster chips from HP and IBM.

Forming alliances may also mean teaming possibilities for federal vendors. By teaming with companies such as Cray, Intel, or Convex, vendors will gain recognition in this marketplace. Some agency respondents interviewed by INPUT for this report stated that they perform most of their high-performance computing services in house or have the manufacturer perform them, because there are no other vendors with the experience or expertise necessary to perform high-performance computing-related services. Forming alliances and teaming arrangements will be one way for vendors to overcome this lack.

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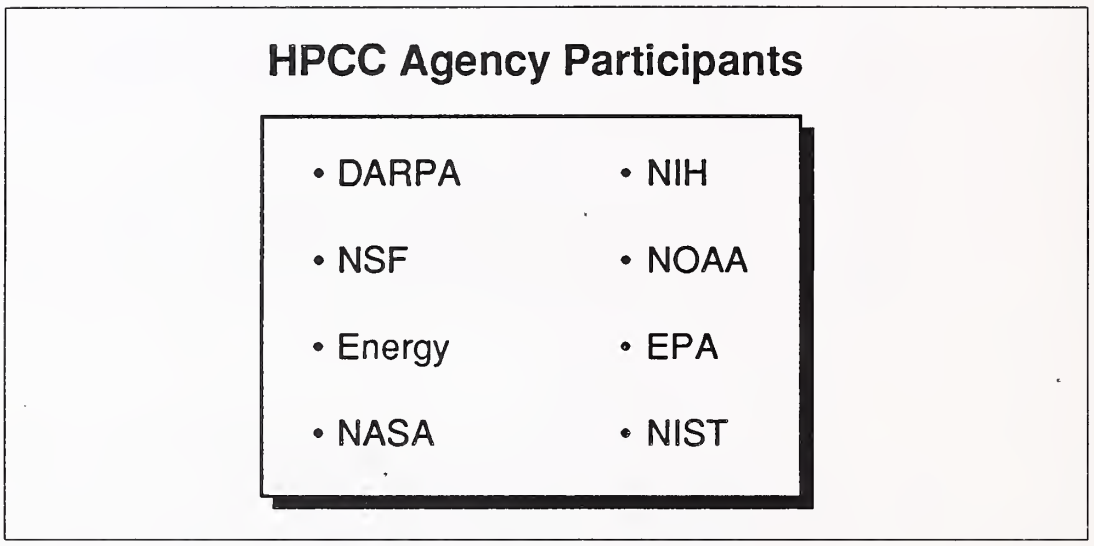
3. HPCC Program Participants

Most of the high-performance computing opportunities are with the eight agencies receiving funding from the President's HPCC initiative. These agencies are listed in Exhibit III-14.

EXHIBIT III-14



INPUT believes that vendors should target these agencies for high-performance computing opportunities. These agencies already own and operate high-performance computing systems, which creates potential for services contracts related to the existing systems. Also, these are the only agencies receiving funding from the HPCC program. Much of the HPCC funding these agencies receive is for R&D and is not included in their information technology budgets. But portions of this R&D funding will be used for purchases of equipment and services, such as R&D for software development. Other agencies that are prime targets are the Defense agencies. The Army, Navy, and Air Force are likely candidates for high-performance computing contracting opportunities.

Once the HPCC program moves forward and NREN is in its final stages, agencies that are not part of the initiative will begin to solicit networking services. The Department of Education expressed the desire to have a node on NREN, but has no desire now to purchase a high-performance computing system.

4. Transferable Applications

Finally, INPUT recommends focusing on transferable high-performance computing applications. For some vendors, current commercial high-performance computing experience may be transferable to the federal marketplace. For example, vendors that currently operate or maintain commercial supercomputing facilities for oil field modeling for a petroleum company may be able to transfer this experience to an agency

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such as the Department of Energy, which also performs high-performance computing applications in this area. Applying federal high-performance computing applications to commercial industry is also feasible. Some of the same modeling techniques used by NASA to design space craft can be used for automobile and commercial aircraft design. When choosing applications to focus on, look at those that can be leveraged in both government and industry. Chapter IV discusses high-performance computing applications in greater detail.

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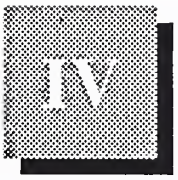

Agency Issues

INPUT surveyed 11 federal government information technology professionals and two federal high-performance computing policy executives. The survey respondents are involved in planning and purchasing of high-performance computing systems. This chapter presents the agencies' responses to questions regarding the environment, applications, installations, acquisition plans, and standards pertaining to high-performance computing systems within the agencies.

A
Technical Environment

1. Background

For purposes of this report, INPUT defines a high-performance computer as any computer considered Class VII or above. This includes traditional vector supercomputers as well as new massively parallel systems. High-performance computers and supercomputers are high-powered processors with numerical processing throughput significantly greater than the fastest general-purpose computers. On-line storage should consist of four gigabytes or more. Constant technological advances make it increasingly difficult to define high-performance computing.

A report commissioned by the Department of Energy through a contract with Los Alamos National Laboratory finally spurred Congress to pass the High-Performance Computing Act. The report, entitled "High-Performance Computing and Communications: Investment in American Competitiveness," concluded that the Japanese supercomputer industry has mounted a strong challenge to the U.S. in the race to build the fastest machines. According to the report, Cray Research lost half of its supercomputer market share from 1980 to 1990, while Japan's market share climbed from zero to 28% in the same time period. The goal of the report was to provide Congress with a quantitative analysis of how federal expenditures on high-performance computing will benefit the U.S. The major technology issue of the report was parallel versus vector supercomputers, with massively parallel machines in the position held by vector machines almost twelve years ago.

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2. Parallel Computers

Massively parallel computers are quickly becoming essential to high-performance computing. Some experts believe massively parallel processing is driving conventional supercomputers toward extinction. But Cray Research executives think the trend will evolve slowly and they see a place for traditional supercomputing machines.

Parallel computers use multiple microprocessors to approach the computing power of Cray supercomputers. There are two major approaches to massively parallel computing:

- Single Interaction/Multiple Data (SIMD)
- Multiple Interaction/Multiple Data (MIMD)

SIMD is the method traditionally used by computers from Thinking Machines Corp. SIMD applications require data that can be split evenly across all the processors for maximum efficiency because each processor executes the same instruction at the same time on different data.

The MIMD architecture is used in parallel machines from Intel and others. MIMD systems are more difficult to program because the application code must be broken into multiple parallel streams of logic. The vast majority of existing applications are serial, and porting them to MIMD introduced a hybrid SIMD/MIMD architecture that has a new control network for broadcasting the same instruction to all processors and synchronizing execution when possible.

As described above, the major problem with massively parallel machines is their difficulty to program. Software development will determine the pace of market expansion. Few applications that exploit massive parallelism have moved into commercial applications. Languages and compilers have been developed that ease the task of expressing algorithms that already rely on parallel approaches, but compilers that convert a conventional program into a form suitable for massively parallel computing are far from suitable.

3. High-Speed Networks

Another key element of high-performance computing and the President's HPCC initiative is the use of high-speed networks to share information generated from these computer systems. Many observers believe that supercomputers' potential is not being realized because of the lack of a proper infrastructure to transmit data and information. Because collaboration is essential to research, data stored in supercomputers must be made accessible not only to multiple researchers, but to other supercomputers. Unfortunately, traditional computer networks are too primitive to carry the elaborate three-dimensional moving graphic images that make supercomputers useful. These visualization techniques require high data transmission rates that most networks cannot handle.

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Part of the HPCC initiative involves advancing the National Science Foundation's NSFnet into a high-speed National Research and Education Network (NREN). The Federal Networking Council will be managing the evolution of NREN. The council was established by the Office of Science and Technology, and contains representatives from the National Security Agency, the Defense Communications Agency, the National Oceanic and Atmospheric Administration, the Department of Energy, the DoD, Health and Human Services, the National Institute of Standards and Technology, the U.S. Geological Survey, the General Services Administration, NASA, the National Telecommunications Administration, and NSF.

4. Grand Challenge Applications

The HPCC initiative is meant to address specific "Grand Challenge" applications. Examples of these grand challenges are listed in Exhibit IV-1. The complete list of grand challenges is too long to allow an example from each possible area.

EXHIBIT IV-1

HPCC Grand Challenge Applications

- Magnetic Recording Technology
- Rational Drug Design
- High-Speed Civil Transports
- Catalysis
- Fuel Combustion
- Ocean Modeling
- Ozone Depletion
- Digital Anatomy
- Air Pollution
- Design of Protein Structures
- Venus Imaging
- Technology Linking Research to Education

Source: "Grand Challenges 1993: High-Performance Computing and Communications" Supplement to the President's FY 1993 Budget.

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• Magnetic Recording Technology

One goal of HPCC is to enhance magnetic recording technology. Today's society demands increasing requirements for efficient information storage. Currently, the dominant methods for information storage employ magnetic recording media. By researching magnetic media, ways of packing more information onto available media may be discovered. Researchers can use high-performance computing to study magnetization patterns, and magnetostatic and exchange magnetic interactions.

• Rational Drug Design

High-performance computers have also provided rapid progress in understanding three-dimensional structure determinations of biological macromolecules. This provides the basis for rational drug design. Drug design can be facilitated by an improved understanding of molecular structure and function.

• High-Speed Civil Transports

The U.S. has initiated a research program to examine the feasibility of a new High-Speed Civil Transport (HSCT) aircraft. Significant technological challenges must be addressed to assure environmental compatibility and to realize the commercial potential. High-performance computing is essential to the HSCT program in order to study aerodynamic efficiency, advanced materials, and engines with acceptable environmental impact.

• Catalysis

Catalysts for chemical reactions are currently used in one-third of all manufacturing processes, producing hundreds of billions of dollars worth of products each year. High-performance computing is being used to develop a computer design and analysis capability for commercially important catalytic processes. The goal is to reduce the time required to design catalysts and to optimize their properties. Important catalysis applications include enzymes, biomimetic catalysts, microporous solids, and metals.

• Fuel Combustion

HPC can be used in studying fuel combustion. A computer model of the engine allows design changes to be effected numerically on a scale of hours at a fraction of the usual cost. These improvements are critical for the effective development of clean, efficient engines.

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- Ocean Modeling

Ocean modeling is a key element in climate and weather prediction. Oceanic phenomena evolved over periods from years to centuries to profoundly influence the climate. The ocean is particularly important in maintaining the climate of the Northern Hemisphere through an organized system of currents. The HPCC initiative aims to develop a teraflops machine that can be used for ocean simulation, archiving, visualization, and communication in support of climate prediction.

- Ozone Depletion

The HPCC initiative is also aimed at finding a remedy for the earth's ozone depletion. The depletion of the earth's ozone has an important impact on animal and plant life, including higher incidence of skin cancer in humans. The chemical and dynamic mechanisms that control the ozone depletion process are extremely complex. Because of this complexity, an essential element in this investigation is the use of comprehensive global, high-resolution computer models to simulate the ozone chemistry and associated dynamics that occur in the earth's atmosphere.

- Digital Anatomy

New computer-based imaging techniques are making it possible to explore the structured function of the human body with unprecedented accuracy. High-speed networks will allow researchers and medical professionals to access this digital anatomy and browse these collections interactively. High-performance computing and network tools promise a new era of insight into human anatomy and physiology.

- Air Pollution

The reduction of air pollution is currently costing billions of dollars. Computational models are powerful and necessary tools to study the transport and transformation of pollutants and to provide guidance on the expected effectiveness of emission control strategies. High-performance computing will allow these air quality models to incorporate descriptions of physical, chemical and meteorological processes to adequately represent the production of pollutants.

- Protein Structure Design

The design of protein structures is important in biomedical research. An understanding of protein folding could help to design new proteins for a specific need, or perhaps to catalyze a biochemical reaction. Computational biologists are looking to massively parallel computing to overcome current problems in simulating protein activity.

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• Venus Imaging

NASA is using high-performance computing to process the large volumes of data about Venus. The Magellan spacecraft has been mapping the surface of Venus since September 1990. Magellan has provided topographic information and images of over 90% of Venus' surface. The total volume of data returned by Magellan exceeds three terabits. The large volume of data associated with Magellan has necessitated new and increasingly complex methods of data processing, handling and storage that will be significant to future data-intensive projects such as NASA's Mission to Planet Earth. Magellan images provide insight into the physics of volcanism and its significance to planetary evolution. Using large parallel supercomputers for producing rendered images dramatically increases scientific capabilities.

• Linking Research to Education

Finally, the HPCC initiative plans to extend the existing network links to researchers, educators, and students for information regarding advances in science and technology. The tools of high-performance computers and workstations, computer networks, and software make it possible for researchers to share their current research activities with some high school teachers and students. Communication networks enable students and teachers to access the very large and computationally intensive simulation software and data bases operating at a remote university or research centers. The network also makes it feasible for teachers and students to interact with scientific research teams located at remote sites. Through the HPCC initiative, this network will be expanded to allow greater access.

B
Current Installed Base

1. Agency Installation Profile

Because supercomputers and massively parallel systems provide such a great amount of computing power, fewer agencies use or own high-performance computers than own smaller systems. However, more and more agencies are gaining access to this computing power through timesharing or interagency procurements.

a. Traditional Supercomputers

According to a special report conducted for INPUT by Computer Intelligence, the federal government possesses 180 supercomputers. These figures do not include massively parallel systems. Exhibit IV-2 shows the current installed base of supercomputer systems by agency.

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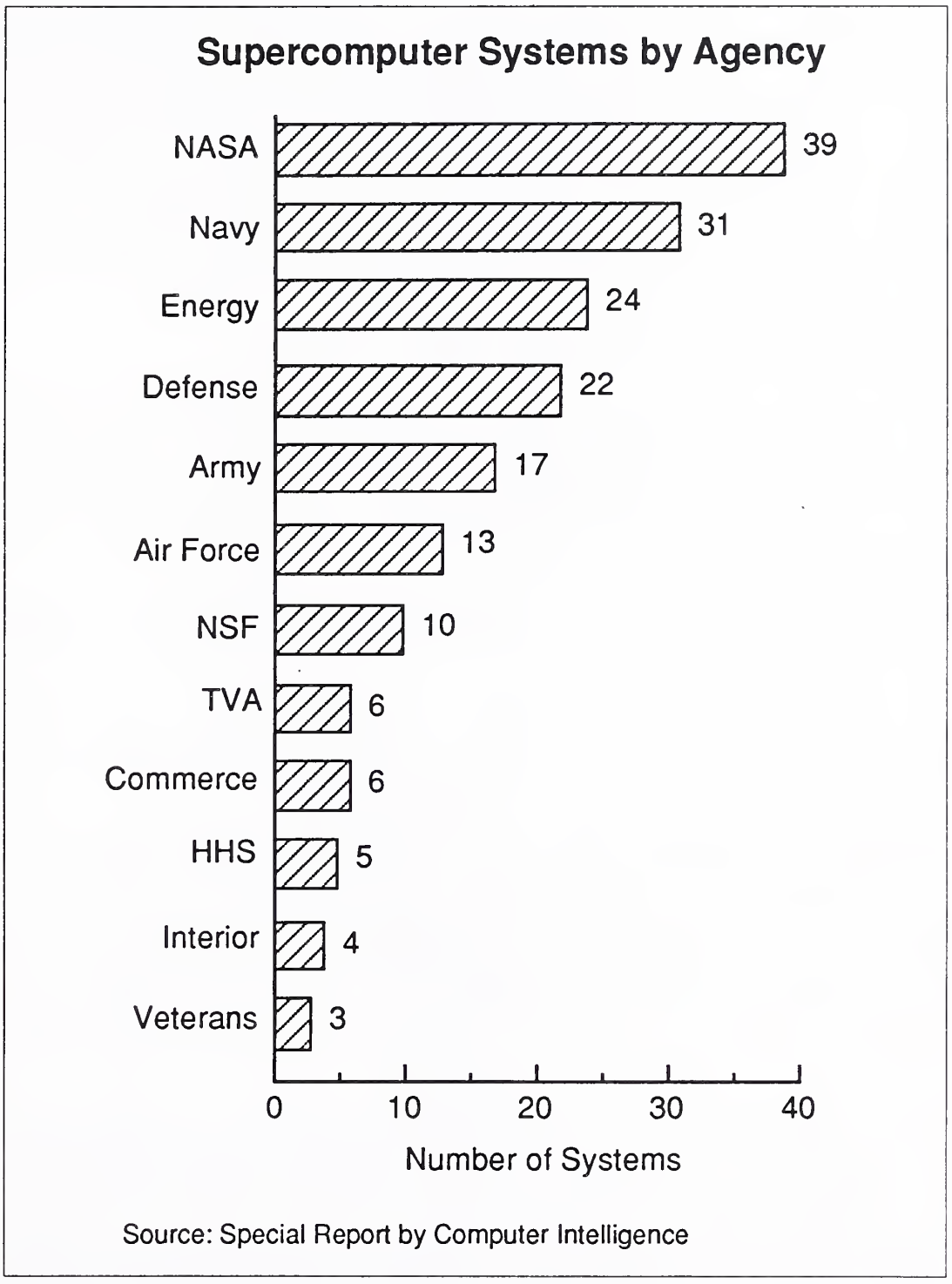
EXHIBIT IV-2



INPUT surveyed eleven respondents from five agencies. INPUT was able to identify sixteen high-performance computing systems within the agencies surveyed. These systems included massively parallel machines as well as traditional supercomputers. Among these agencies, the Department of Energy possessed the most high-performance computing systems, with a total of 32. The Naval Ocean System Center and the Naval Research Lab came in second, with a combined total of sixteen systems.

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As high-performance computing technology progresses, much of the current installed base—especially traditional vector supercomputers—will require replacements or upgrades. With massively parallel computing currently receiving most of the attention, agencies are clamoring to take advantage of this technology. Also, increased high-speed network technology and the HPCC initiative are pushing many of the agencies that own high-performance computing systems to develop networks. This creates the potential for contracting opportunities pertaining to networking and network services.

b. Market Share

According to the Computer Intelligence data, Cray Research maintains the largest market share in the federal government among the traditional supercomputer vendors. Exhibit IV-3 shows the top traditional supercomputer manufacturers by percentage of installed federal systems.

EXHIBIT IV-3

Traditional Supercomputer Market Share

Manufacturer	Percentage of Systems
Cray Research	33
FPS-Computing	26
Convex	12
Encore	4
Other	25

Source: Special Report by Computer Intelligence

Cray holds the top position among the installed base of traditional vector computers. The "other" category includes companies such as Alliant, Control Data, Star, and Analogic. Computer Intelligence had no information regarding the installed base of massively parallel systems.

c. High-Performance Computing Hardware Brands

INPUT asked survey respondents to identify the brands of high-performance computing hardware currently in use in their agency. These include traditional vector supercomputers as well as massively parallel systems. Exhibit IV-4 shows the installed base of high-performance computing hardware by manufacturer within the agencies surveyed.

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EXHIBIT IV-4

Sample of High-Performance Computing Brands

Manufacturer	Number of Systems
Cray Research	34
Thinking Machines	8
Intel	8
Convex	8
nCube	7
Encore	2
Alliant	1

Among the agencies listed in Exhibit IV-2, Cray holds 50% of the total number of supercomputers installed. Cray was cited as the top high-performance computing manufacturer in both Exhibits IV-3 and IV-4. Exhibit IV-3 does not include massively parallel systems. The majority of the agencies surveyed own at least one massively parallel computer. Thus, Thinking Machines, Intel, and N Cube appear as top manufacturers in this list derived from the respondents' installed base.

Cray remains at the top of the combined federal high-performance computing (traditional and massively parallel supercomputers) market, even though it does not offer a massively parallel system at this time. Massively parallel computer manufacturers are gaining federal market share, but INPUT does not foresee them overtaking Cray's position as the leading vendor in the next five years. Companies such as Thinking Machines and Intel, which produce massively parallel systems, will erode a portion of Cray's current market share, but will not completely engulf the marketplace.

In May 1992, Cray Research won its first battle against a Japanese supercomputer vendor, NEC. Cray won a $43 million contract to supply a two-processor Cray Y-MP to the EPA's National Environmental Supercomputing Center, which will open in July 1992 in Michigan. Because this will be EPA's first supercomputer, Cray considers this a major victory.

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In the massively parallel high-performance computing market, Thinking Machines appears to be neck and neck with Intel. Los Alamos National Laboratory recently signed a contract with Thinking Machines for two CM-5s. This decision ended the lab's long-term relationship with Cray and signaled an increasing interest in massively parallel processing.

Cray holds 42% of the $4 billion worldwide supercomputer market. Thinking Machines only claims 3% of this market. However, in the massively parallel arena, Thinking Machines holds top billing with Intel, each with 33% of the worldwide market.

Massively parallel systems are gaining much publicity, but the need for traditional vector computers should not be underestimated. Some applications are better suited for traditional vector processing.

2. Buying Trends

In order to identify HPCC buying trends, INPUT analyzed the *Commerce Business Daily* (CBD) from the past three years. INPUT found 1,406 CBD announcements from 1989 to 1991 that pertained to high-performance computing equipment, high-performance computing software, high-performance computing networking, high-performance computing services, and high-performance computing R&D. From January 1992 to April 1992, there have been 107 CBD announcements related to HPC.

a. 1991 CBD Announcements

In 1991, there were 488 high-performance computing announcements. Exhibit IV-5 shows the breakdown of the 1991 announcements among the larger agencies.

The findings in Exhibit IV-5 correspond to the installed base of supercomputers shown in Exhibit IV-2. For instance, NASA possesses the largest installed base of supercomputers and consequently required the most equipment services for high-performance computing in 1991. The two exhibits do not correspond precisely. In many cases, this is due to in-house availability of needed resources. For example, the Energy Department performs many of its own high-performance computing-related support services, and so has fewer high-performance computing-related CBD announcements.

Vendors should look to these agencies for high-performance computing contracting opportunities such as equipment maintenance, high-speed networking, and high-performance software.

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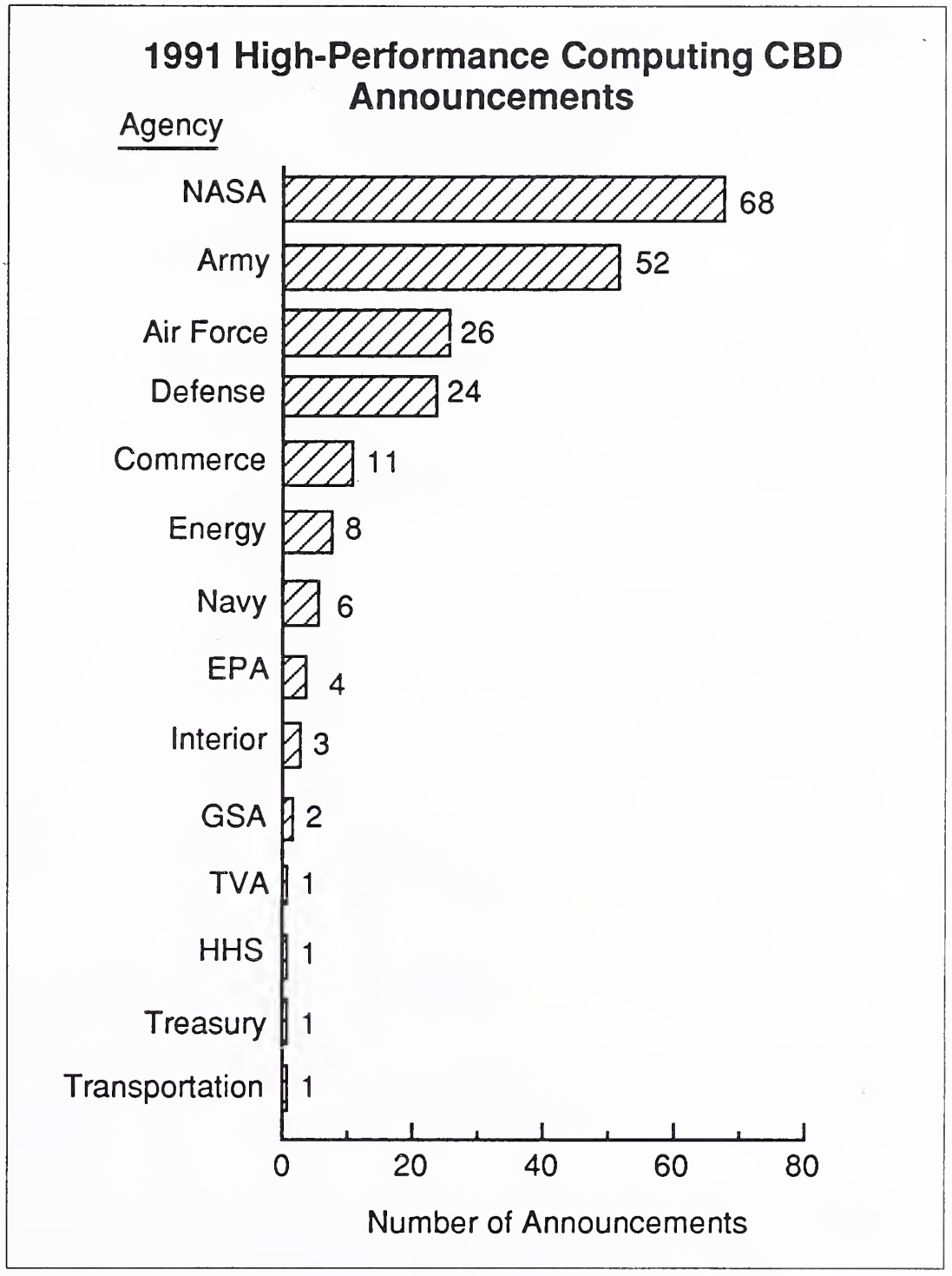
EXHIBIT IV-5



b. 1992 CBD Announcements

To further explore buying trends, INPUT looked at 1992 high-performance computing-related CBD announcements to date. Many of the 107 announcements pertained to R&D or contract awards. Exhibit IV-6 shows the number of announcements made in 1992 pertaining to the acquisition of high-performance computing equipment, software, high-speed networks, or related services.

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EXHIBIT IV-6

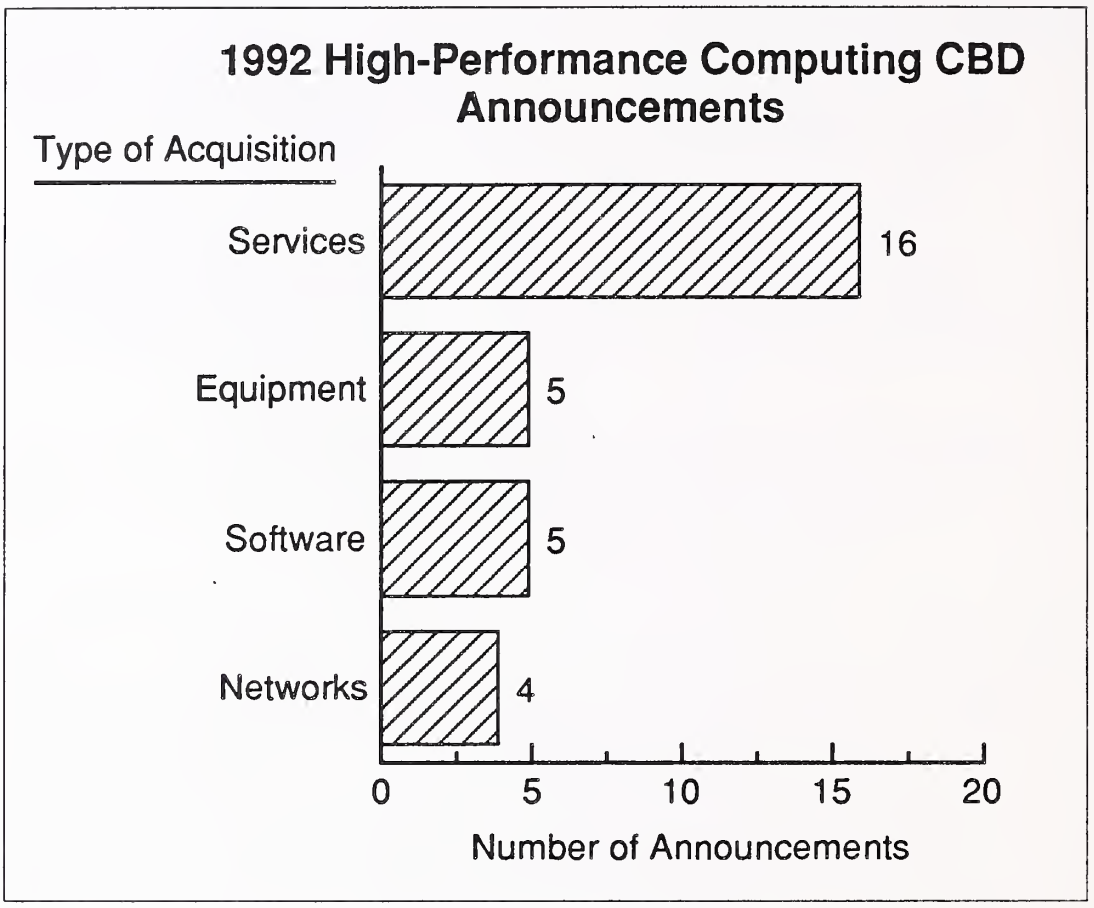

Exhibit IV-7 lists the agencies soliciting these services. Agencies are listed in order of the number of announcements placed.

EXHIBIT IV-7

Agencies Soliciting High-Performance Computing Services

Services	Equipment	Software	Networks
Navy	Army	Navy	NASA
Air Force	Energy	Army	Commerce
DARPA	Treasury	NASA	
NASA	Air Force		

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The greatest demand in the high-performance computing market appears to be for high-performance computing services. These services include SETA, equipment maintenance, software engineering, software maintenance, technical support services, etc. This is a market in which more vendors have the capabilities to compete. Vendors should target the agencies with an installed base of high-performance computing systems.

c. Major Agency Activities

The DoD is a major player in the high-performance computing market. One effort that is now in the spotlight is DoD's plan to consolidate its supercomputing resources at fewer sites. The supercomputing plan places strong emphasis on cost-effective computing. The plan will establish high-speed networks to provide supercomputer access to remote DoD labs. It also provides a migration path from traditional vector computers to massively parallel architectures.

The five-year plan seeks $1.3 billion for supercomputers and high-speed networks. The plan arrived on Capitol Hill in May 1992. It arrived three years too late, and was too late for inclusion in the FY 1993 budget. Congress also felt that the plan provided insufficient information; it did not describe how many supercomputers DoD wanted to purchase or where the machines would be installed. However, DoD and industry officials say the following sites with newer supercomputers are likely to remain open, while others will be closed:

- Naval Oceanographic Office
- Munitions Systems Division at Eglin AFB
- Phillips Laboratory in New Mexico
- Army Corps of Engineers Waterways Experiment Station

Despite Congress' current disappointment with DoD's consolidation plan, INPUT believes DoD will remain a powerful force in the supercomputing arena.

In February 1992, DARPA invested $34 million in two supercomputer research projects. Intel will receive $21 million over the next five years and Cray Research will receive $12.7 million. In conjunction with the HPCC initiative, DARPA is providing funds to accelerate development of computer systems capable of sustaining up to one trillion floating-point operations per second (teraflops).

The Army Intelligence Center awarded the Center for High-Performance Computing at Worchester Polytechnic Institute a $10.6 million contract to develop a shared memory multiprocessor architecture capable of scalable performance into the tera-operation-per-second range. This research effort is also sponsored by DARPA.

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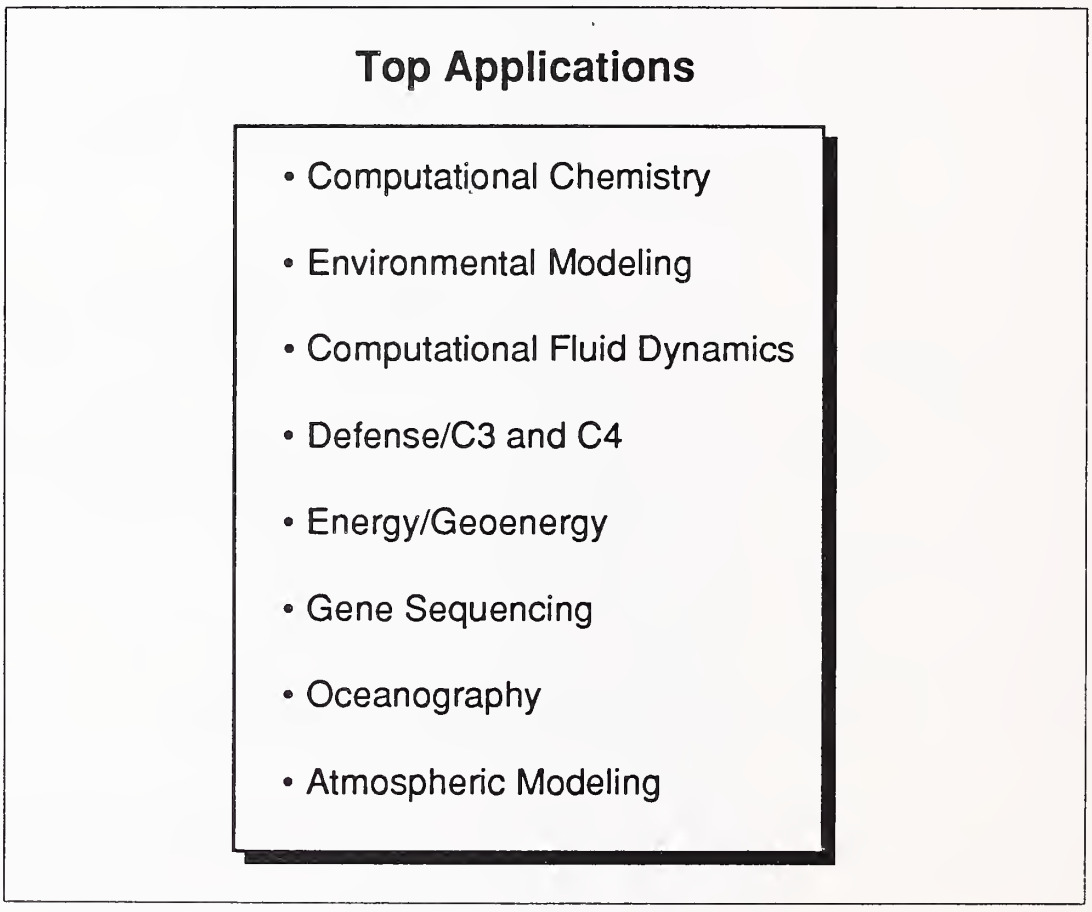
C
Leading Applications

1. Current Applications

Ninety-one percent (91%) of the agency respondents use HPC. These respondents were asked to identify applications for existing high-performance computing systems. Exhibit IV-8 lists these applications in order of frequency of mention.

EXHIBIT IV- 8



Computational chemistry ranked highest among current high-performance computing applications. Forty percent (40%) of the respondent agencies are using high-performance computing systems to perform computational chemistry. These agencies include the Energy Department, the Naval Research Lab, and the Environmental Protection Agency. The ability to perform advanced computational chemistry and biology aids in processes such as drug design, protein structuring, and the study of catalysts.

Twenty percent (20%) of the respondent agencies use high-performance computing systems for each of the remaining applications. For example, environmental modeling, such as to study air pollution and ozone depletion, is performed by NOAA and EPA. Computational models are

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necessary to provide guidance on the expected effectiveness of emission control strategies. High-performance computing systems allow simulation of the physical and chemical processes that take place during air pollution.

HPC is also used for other environmental modeling, such as ozone depletion. These computer systems provide a means of simulating ozone chemistry and associated dynamics in the earth's atmosphere for developing a solution to the problem.

HPC equipment and services vendors need to be aware of which applications will be performed on their equipment or which applications their professional services will be supporting. Vendors can demonstrate an expertise associated with the application being performed will have a competitive edge.

INPUT was unable to identify a correlation between high-performance computing applications and supercomputer hardware brands. With the advent of the HPCC initiative, massively parallel computing is receiving most of the attention in this marketplace. INPUT believes that purchases of massively parallel computers will be seen for many of the applications listed. However, the need for existing brands of traditional vector computers will not disappear.

2. Future Applications

One hundred percent (100%) of the respondents currently using high-performance computing systems also plan to purchase an additional system(s) in the next five years. Eighty percent (80%) of these respondents plan to use the new high-performance computing systems for the same applications. These agencies believe the new systems or networks will provide them with more computational capability and faster computers to use within their current disciplines.

Twenty percent (20%) of the agencies do not have a specific application planned for new equipment at this time. They believe that with new computing capability the current problem set will change and it is not possible to predict what applications will be developed in the future.

As part of the HPCC initiative, a National Research and Education Network (NREN) will be developed that will expand and enhance the U.S. portion of the existing Internet. The new network will link high-performance computing systems and allow access to the information stored on these systems by researchers in universities, medical centers, science laboratories, corporations, and local governments.

The NREN will lead to new high-performance computing applications by allowing scientists to conduct experiments requiring input from different types of supercomputers. NREN will also expand the capabilities of existing applications. For instance, meteorologists will be able to use

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supercomputers to track thunderstorms, hurricanes, and other weather systems. Atmospheric variables such as temperature, pressure, wind speed, and moisture will be calculated every few seconds at several hundred thousand locations in the area of a developing storm. The mathematical equations will then be used to simulate the storm's evolution, and the results will be transmitted to National Weather Service bureaus around the country.

Future high-performance computing applications that will be made possible by NREN are listed in Exhibit IV-9.

EXHIBIT IV-9

NREN Future High-Performance Computing Applications

- Composite Imaging
- Distributed Computing
- Interactive Visualization
- Collaboration Technology
- Image Transfer
- Videoconferencing
- Multimedia data bases

HPC systems possess great capabilities individually, but they can do even more when linked together by a network such as NREN. Other applications will also be made more efficient with NREN. One application NREN will facilitate is composite imaging: taking different images from the same model and fusing them into a single picture. Distributed computing conducts a single experiment using different types of supercomputers. Each machine performs a different facet of the calculation and communicates the results. Interactive visualization simulates all facets of scientific experiments and displays the results visually.

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The NREN will provide a model for development of a broader, privately operated national information system for consumers, businesses, schools, and governments. By minimizing the impediments of geographic isolation, NREN will allow scientists, researchers, and students to share access to libraries, data bases, supercomputers, telescopes, and particle accelerators.

D

Acquisition Plans and Preferences

This section describes agency respondents' acquisition plans, system justifications and benefits, acquisition methods, selection criteria, and vendor preferences.

1. Acquisition Plans

INPUT asked agency respondents to identify plans for procuring high-performance computing systems, networks, or related services.

a. Agencies

One hundred percent of the agencies currently using high-performance computing systems plan to purchase related equipment or services in the next five years. Exhibit IV-10 lists the respondent agencies planning high-performance computing purchases.

EXHIBIT IV-10

Agencies Planning Purchases

- NASA - Langley
- NASA - Ames
- NASA - Goddard
- Energy - Sandia National Labs
- Energy
- Commerce - NOAA
- Navy - Naval Research Lab
- Navy - Naval Ocean Systems Center
- EPA
- Health and Human Services - National Institute of Health

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INPUT's survey indicates that there is a large demand for high-performance computing systems and services among agencies currently using HPC. All of the agencies listed are part of the HPCC initiative except for the Navy. This may indicate that funds provided by the initiative will increase agency ability to purchase additional high-performance computing equipment and services.

b. Specific Plans

Exhibit IV-11 lists some of the specifically planned high-performance computing procurements.

EXHIBIT IV-11

Planned High-Performance Computing Procurements

- Intel Paragon
- Kendall Square
- Thinking Machines
- HPCC Test beds
- Networking services and equipment
- Cray replacement

Judging from the procurement plans listed in Exhibit IV-11, agencies expect to take advantage of massively parallel systems in their short-term high-performance computing purchases, as suggested earlier. Ames Research Center plans to implement two high-performance computing test beds, and the Naval Research Lab plans to network its existing installed base of supercomputers.

Agency respondents were asked if these planned high-performance computing acquisitions represent an increase over past high-performance computing acquisitions in terms of dollar value. Exhibit IV-12 shows the results of this inquiry.

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EXHIBIT IV-12

Comparison to Past Purchases

	Percent
Increase	73
No Change	27

The majority of the respondent agencies claimed that these anticipated acquisitions represent an increase over past spending for high-performance computing needs. They give most of the credit to the visibility given to high-performance computing by the President's HPCC initiative. This initiative has made Congress and agency IRM officials more aware of the benefits and the necessity of high-performance computing in this country. As discussed in Section III, forty-five (45%) of the respondents claim that the HPCC initiative has given them increased purchasing ability. Most of the funding provided to agencies directly from the initiative is for research and development, but the initiative has shed light on the subject of high-performance computing and indirectly caused information technology funding for high-performance computing purchases in certain agencies to increase.

Agency respondents were asked how much they planned to spend on high-performance computing equipment and services in the next year (FY 1993). The answers ranged from approximately $1 million at Langley Space Flight Center to $61.5 million throughout the Department of Energy. Because the spending plans vary dramatically, it would be misleading to suggest an average high-performance computing expenditure for even a segment of agencies.

2. Methods of Acquisition

The majority of agencies surveyed prefer to acquire high-performance computing equipment and services through Requests for Proposal (RFPs). Exhibit IV-13 shows the percentage of respondents that acquire high-performance computing equipment and services through the acquisition methods listed.

According to most agency respondents, equipment and related services are procured at the same time, and the resulting contract contains equipment requirements as well as maintenance and other services.

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EXHIBIT IV-13

Acquisition Methods

	Percent
RFP	90
RFQ	10
Grants	10
DARPA Contract	10

Note: More than one response allowed.

HPC experience will play a key role in agencies' vendor selection process. Joining teams with vendors experienced in this area of technology may lead to future high-performance computing contracts. Obviously, high-performance computing system manufacturing is a niche market, but there is room for vendors to provide software, maintenance, networking, and other services related to high-performance computing in the federal arena.

Cooperative research may also lead to acquisition of high-performance computing equipment and services in the near future. In April 1992, a model agreement was developed by the Computer Systems Policy Project and the Department of Energy. Los Alamos National Lab and Cray Research are using this agreement to conduct cooperative research in three high-performance computing areas: advanced software for electromagnetic wave simulation, global climate change, and computational chemistry. The Cooperative Research and Development Agreements (CRADAs) allow Cray to commercialize the core technologies developed at Los Alamos; the other national labs will have the right to use the commercial products developed in the collaboration.

3. Selection Criteria

Agency respondents were asked to rate the importance of several selection criteria used in the evaluation of high-performance computing equipment purchases. Exhibit IV-14 lists the average ratings for each of the selection criteria.

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EXHIBIT IV-14

Selection Criteria

Criteria	Avg. Rating
Equipment performance	4.9
Equipment reliability	4.3
Software features	4.2
Product price	4.2
Vendor's support reputation	3.9
Ease of implementation	3.6
Vendor's federal experience	2.5

Rating: 1-5, with 5 being most important

All of the selection criteria ranked high in importance among agency respondents except "vendor's federal experience." Respondents expressed the importance of experience in the high-performance computing market, but not the federal market. Many respondents feel that there are only a few companies with proven high-performance computing experience: the manufacturers.

Equipment performance ranks highest among selection criteria. This finding seems logical, considering that the main reason for purchasing a high-performance computing system is for its speed, computational power, and performance.

Equipment reliability ranks second among the selection criteria. Because these systems are so powerful and house valuable, complex data, the system's reliability is critical.

Agencies will evaluate potential vendors on the criteria listed above. Vendors must choose solutions and develop proposals that meet these criteria. Team building, again, will be important for those vendors lacking high-performance computing experience.

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4. Preference for Type of Vendor

INPUT asked agency respondents if they preferred a certain type of vendor for high-performance computing system hardware, networking, or services. Agency answers to this question appear in Exhibit IV-15.

EXHIBIT IV-15

Vendor Preference

System Component	Percent of Respondents	Vendor Type
Hardware	50	Manufacturer
Networking	14	Manufacturer
Service	33	Manufacturer

Many of the respondents feel that no vendors have the expertise necessary to provide high-performance computing equipment and services, other than the high-performance computing hardware manufacturers. Other respondents feel that they have more expertise in-house for networking and services than is available from the vendor community. The respondents who claimed no preference stated that procurement guidelines prevent them from expressing any type of vendor preference for high-performance computing equipment and services. However, these same agencies purchased their existing high-performance computing hardware from a manufacturer and perform services in house, or the services are provided by the manufacturer under the same contract.

E
High-Performance Computing Standards

Ninety percent of INPUT's agency respondents use standards for HPC. Most of the standards in use apply to networking. Because massively parallel systems are a new and emerging technology, the companies conducting research and developing these systems are setting standards for the industry as the systems are developed.

Exhibit IV-16 lists some of the standards being used for high-performance computing by the respondent agencies. The standards are listed in order of frequency of mention.

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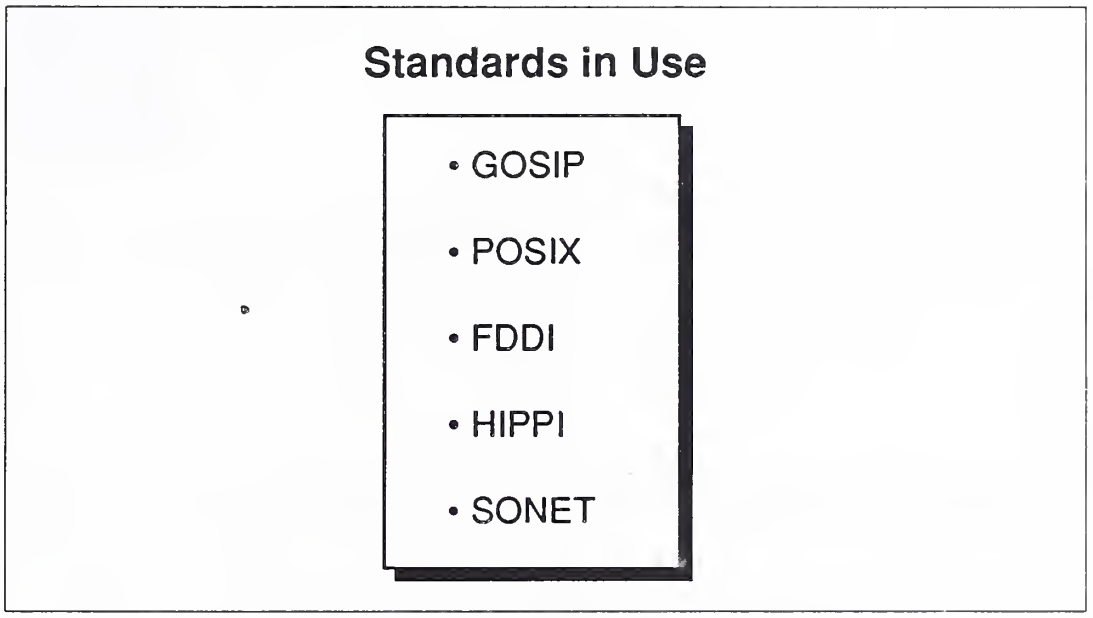
EXHIBIT IV-16



Many of the agencies interviewed are moving toward GOSIP and POSIX compliance. Fiber Distributed Data Interface (FDDI) is being used by NASA and the Energy Department. The High-Performance Parallel (HIPPI) protocol for 1G-bps networking is claimed to provide an essential element for connecting supercomputers. HIPPI boosts network transmission speeds compatible with internal supercomputer processing speeds. NASA, Energy, and the Navy are currently using HIPPI.

Synchronous Optical Network (SONET) is designed for the integration of voice, video, and data. Ames Research Center is currently using SONET.

The standards currently in use were developed by industry and the government. Because the technology is still evolving, standards are lacking in many areas, but vendors need to remain aware of GOSIP and POSIX compliance and other standards that may develop.

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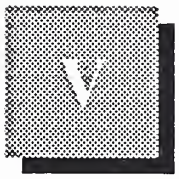

Key Opportunities

This section describes specific opportunities in the federal information technology market.

Although this opportunity list is not exhaustive, it includes major programs typical of the federal market.

This list of opportunities becomes smaller after FY 1993 because new programs have not yet been identified or initially approved by the responsible agency. Subsequent issues of this report and the INPUT Procurement Analysis Reports will include additional program information for FY 1992-FY 1997.

A
Present and Future Programs

New information technology programs larger than $1-2 million are listed in at least one of the following federal government documents:

- OMB/GSA Five-Year Plan, which is developed from agency budget requests submitted in compliance with OMB Circular A-11
- Agency long-range information resource plans developed to meet the reporting requirements of the Paperwork Reduction Reauthorization Act of 1986
- Agency annual operating budget requests submitted to congressional oversight and appropriations committees based on the OMB A-11 information
- *Commerce Business Daily* for specific opportunities for qualifications as a bidder, and invitations to submit a bid in response to an RFP or RFQ
- Five-Year Defense Plan, which is not publicly available, and the supporting documentation of the separate military departments and agencies

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- Classified program documentation available only to qualified DoD contractors

Opportunities related to high-performance computing may not be specifically identified as such in these documents. Information technology planning documents usually identify mission requirements to be met by specific programs, rather than methods for meeting those requirements.

All funding proposals are based on cost data of the year submitted, with inflation factors dictated by the administration as part of its fiscal policy, and are subject to revision, reduction, or spread to future years in response to congressional direction. Some additional reductions will be likely in FY 1992 and beyond, due to the tightening of the Department of Defense budget.

B

High-Performance Computing Opportunities by Agency

Opportunities by Agency

Agency	Program	PAR Reference	RFP Date	Funding
Army	Army Intelligence	Unlisted	6/92	16,000
Commerce	NWS-NMC	VI-06-020	FY 1993	9,000
	NOAA	Unlisted	FY93	19,500
	NIST	Unlisted	FY 1993	7,300
Energy	LANC-ICS Phase II	VI-07-091	3/92 (partial)	45,000
	NRD	VI-07-048	7/92	25,000
	NER	Unlisted	FY 1993	33,000
EPA	NCC	VIII-17-017	FY 1994	22,000
HHS	HCFA Data Center	VII—08-042	10/92	30,000
	NIH	Unlisted	FY 1993	30,000
	PHS	VII-08-049	FY 1997	81,500
NASA	SCOPAS	VIII-15-090	1/93	55,000
	NHT-1	VIII-15-098	9/92	20,000
	LAMPS	VIII-15-108	7/92	20,000
	High-Performance Mass Storage	VIII-15-109	7/92	10,000
	MSPC EADS II	VIII-15-071	FY 1993	150,000
	WVA IV&V Center	VIII-15-105	FY 1993	12,000
Navy	China Lake OMNIBUS	V-03-116	10/92	105,000
NSF	National Test Bed	Unlisted	6/92	16,600

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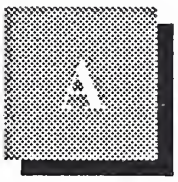

Interview Profiles

A

Federal Agency Respondent Profile

Contacts with agencies were made by telephone. The majority of the agency interviews were conducted at the department level with officials in the office of Information Resources Management who are responsible for computer systems policy and planning. All interviews were conducted with agencies that are currently using or plan to use high-performance computing.

The distribution of job classifications among individual agency respondents for the analysis is as follows:

Policy	Buyers	Users	Total
Respondents	11	0	11

Respondents interviewed represented the agencies listed below, with the numbers in parentheses indicating the number of different contacts within the agency.

- Department of Defense
  - Navy (2)
- Civilian Agencies
  - Commerce (1)
  - Education (1)
  - Energy (2)
  - Environmental Protection Agency (1)
  - Health and Human Services (1)
  - NASA (3)

INPUT also surveyed agencies involved in determining high-performance computing policy as it pertains to the HPCC program.

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The distribution of job classifications among individual agency respondents for the analysis is as follows:

Policy	Buyers	Users	Total
Respondents	2	0	2

The policy respondents interviewed represented the agencies listed below, with the numbers in parentheses indicating the number of different contacts with the agency.

National Science Foundation (1)
National Institute of Standards and Technology (1)

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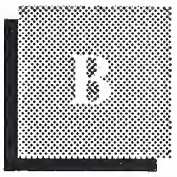

Definition of Terms

A Introduction

INPUT's *Definition of Terms* provides the framework for all of INPUT's market analyses and forecasts of the information services industry. It is used for all U.S. programs. The structure defined in Exhibit B-1 is also used in Europe and for the worldwide forecast.

One of the strengths of INPUT's market analysis services is the consistency of the underlying market sizing and forecast data. Each year INPUT reviews its industry structure and makes changes if they are required. When changes are made they are carefully documented and the new definitions and forecasts reconciled to the prior definitions and forecasts. INPUT clients have the benefit of being able to track market forecast data from year to year against a proven and consistent foundation of definitions.

For 1992 INPUT has incorporated customer services (hardware maintenance) into the information services industry structure. Equipment service becomes the ninth delivery mode used by INPUT to segment and analyze this industry.

In addition, some new areas are being researched during 1992 as part of the outsourcing area and may result in future changes to the industry structure. These areas of research are discussed in Section B 5 of this document.

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B
Overall Definitions and Analytical Framework

1. Information Services

Information Services are computer/telecommunications-related products and services that are oriented toward the development or use of information systems. Information services typically involve one or more of the following:

- Processing of specific applications using vendor-provided systems (called *Processing Services*)
- A combination of hardware, packaged software and associated support services which will meet a specific application processing need (called *Turnkey Systems*)
- Packaged software products, either systems software or applications software products (called *Software Products*)
- People services that support users in developing and operating their own information systems (called *Professional Services*)
- Bundled combinations of products and services where the vendor assumes total responsibility for the development of a custom solution to an information systems problem (called *Systems Integration*)
- Services that provide operation and management of all or a significant part of a user's information systems functions under a long-term contract (called *Systems Operations*)
- Services associated with the delivery of information in electronic form—typically network-oriented services such as value-added networks, electronic mail and document interchange, on-line data bases, on-line news and data feeds, etc. (called *Network Services*)
- Services that support the operation of computer hardware and resident systems software (called *Equipment Services*)

In general, the market for information services does not involve providing equipment to users. The exception is where the equipment is bundled as part of an overall service offering such as a turnkey system, a systems operations contract, or a systems integration project.

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The information services market also excludes pure data transport services (i.e., data or voice communications circuits). However, where information transport is associated with a network-based service (e.g., EDI or VAN services), or cannot be feasibly separated from other bundled services (e.g., some systems operations contracts), the transport costs are included as part of the services market.

The analytical framework of the information services industry consists of the following interacting factors: overall and industry-specific business environment (trends, events and issues); technology environment; user information system requirements; size and structure of information services markets; vendors and their products, services and revenues; distribution channels; and competitive issues.

2. Market Forecasts/User Expenditures

All information services market forecasts are estimates of *User Expenditures* for information services. When questions arise about the proper place to count these expenditures, INPUT addresses them from the user's viewpoint: expenditures are categorized according to what users perceive they are buying.

By focusing on user expenditures, INPUT avoids two problems which are related to the distribution channels for various categories of services:

- Double counting, which can occur by estimating total vendor revenues when there is significant reselling within the industry (e.g., software sales to turnkey vendors for repackaging and resale to end users)

- Missed counting, which can occur when sales to end users go through indirect channels such as mail order retailers

Captive Information Services User Expenditures are expenditures for products and services provided by a vendor that is part of the same parent corporation as the user. These expenditures are not included in INPUT forecasts.

Non-captive Information Services User Expenditures are expenditures that go to vendors that have a different parent corporation than the user. It is these expenditures which constitute the information services market analyzed by INPUT and that are included in INPUT forecasts.

3. Delivery Modes

Delivery Modes are defined as specific products and services that satisfy a given user need. While *Market Sectors* specify *who* the buyer is, *Delivery Modes* specify *what* the user is buying.

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Of the nine delivery modes defined by INPUT, six are considered primary products or services:

- *Processing Services*
- *Network Services*
- *Professional Services*
- *Applications Software Products*
- *Systems Software Products*
- *Equipment Services*

The remaining three delivery modes represent combinations of these products and services, bundled together with equipment, management and/or other services:

- *Turnkey Systems*
- *Systems Operations*
- *Systems Integration*

Section C describes the delivery modes and their structure in more detail.

4. Market Sectors

Market Sectors or markets are groupings or categories of the users who purchase information services. There are three types of user markets:

- *Vertical Industry* markets, such as Banking, Transportation, Utilities, etc. These are called "industry-specific" markets.

- *Functional Application* markets, such as Human Resources, Accounting, etc. These are called "cross-industry" markets.

- *Other* markets, which are neither industry- nor application-specific, such as the market for systems software products and much of the on-line data base market.

Specific market sectors used by INPUT are defined in Section E, below.

5. Outsourcing

The changes in the information services area towards longer term client-vendor relationships has created a number of new types of *outsourcing* relationships. In addition to the nine delivery modes, INPUT will be conducting research during 1992 in each of the areas defined below. Based on this research, INPUT will review and may change its information services industry structure for 1992.

- Outsourcing - The contracting of all or a major part of an information systems process to an external vendor on a long-term basis. The vendor takes responsibility for the performance of the process.

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- Outsourcing can include any or all of the following elements:
  - Processing Operations - The vendor is responsible for managing and operating the client's computer systems.
  - Network Operations - The vendor assumes full responsibility for the client's data communications systems. This may also include the voice communications of the client.
  - Applications Maintenance - The vendor has full responsibility for maintaining the applications software that the vendor uses as part of its business operations.
  - Applications Management - Not only does the vendor maintain and upgrade the applications software for the client, but also develops and implements new software as the need arises.
  - Desktop Services - The vendor assumes responsibility for the deployment, maintenance and connectivity between the PCs in the client organization. The service may also include performing the help desk function.

C
Delivery Modes and Submodes

Exhibit B-1 provides the overall structure of the information services industry as defined and used by INPUT. This section of *Definition of Terms* provides definitions for each of the delivery modes and their submodes or components.

1. Software Products

INPUT divides the software products market into two delivery modes: systems software and applications software.

The two delivery modes have many similarities. Both involve user purchases of software packages for in-house computer systems. Included are both lease and purchase expenditures, as well as expenditures for work performed by the vendor to implement or maintain the package at the user's sites. Vendor-provided training or support in operation and use of the package, if bundled in the software pricing, is also included here.

Expenditures for work performed by organizations other than the package vendor are counted in the professional services delivery mode. Fees for work related to education, consulting, and/or custom modification of software products are counted as professional services, provided such fees are charged separately from the price of the software product itself.

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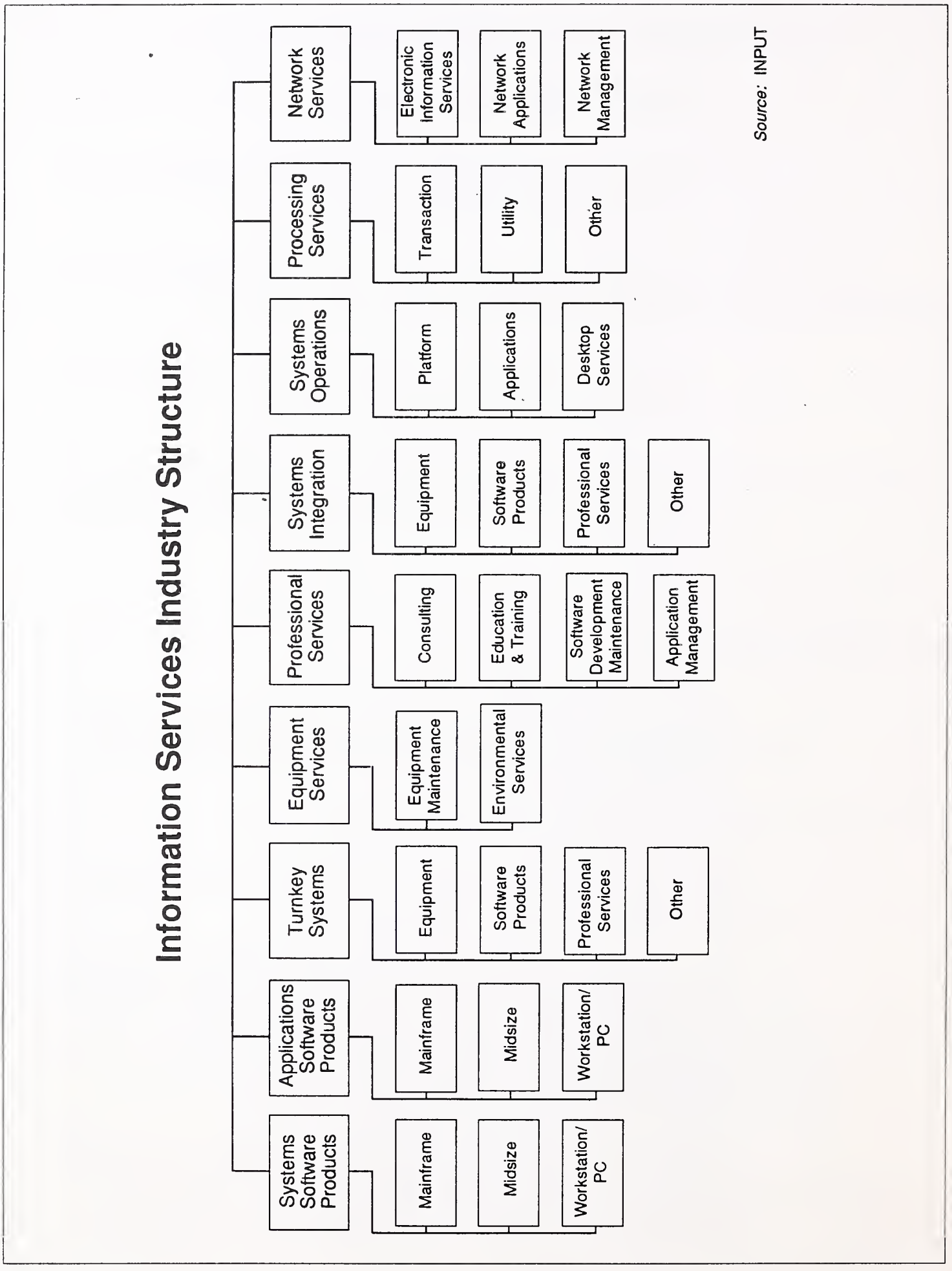
EXHIBIT B-1



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a. Systems Software Products

Systems software products enable the computer/communications system to perform basic machine-oriented or user interface functions. INPUT divides systems software products into three submodes.

- *Systems Control Products* - Software programs that function during application program execution to manage computer system resources and control the execution of the application program. These products include operating systems, emulators, network control, library control, windowing, access control, and spoolers.

- *Operations Management Tools* - Software programs used by operations personnel to manage the computer system and/or network resources and personnel more effectively. Included are performance measurement, job accounting, computer operation scheduling, disk management utilities, and capacity management.

- *Applications Development Tools* - Software programs used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Included are traditional programming languages, 4GLs, data dictionaries, data base management systems, report writers, project control systems, CASE systems and other development productivity aids. Also included are system utilities (e.g., sorts) which are directly invoked by an applications program.

INPUT also forecasts the systems software products delivery mode by platform level: mainframe, minicomputer and workstation/PC.

b. Applications Software Products

Applications software products enable a user or group of users to support an operational or administrative process within an organization. Examples include accounts payable, order entry, project management and office systems. INPUT categorizes applications software products into two submodes.

- *Industry-Specific Applications Software Products* - Software products that perform functions related to fulfilling business or organizational needs unique to a specific industry (vertical) market and sold to that market only. Examples include demand deposit accounting, MRPII, medical record keeping, automobile dealer parts inventory, etc.

- *Cross-Industry Applications Software Products* - Software products that perform a specific function that is applicable to a wide range of industry sectors. Examples include payroll and human resource systems, accounting systems, word processing and graphics systems, spreadsheets, etc.

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INPUT also forecasts the applications software products delivery mode by platform level: mainframe, minicomputer and workstation/PC.

2. Turnkey Systems

A turnkey system is an integration of equipment (CPU, peripherals, etc.), systems software, and packaged or custom application software into a single product developed to meet a specific set of user requirements. Value added by the turnkey system vendor is primarily in the software and support services provided. Most CAD/CAM systems and many small business systems are turnkey systems. Turnkey systems utilize standard computers and do not include specialized hardware such as word processors, cash registers, process control systems, or embedded computer systems for military applications.

Computer manufacturers (e.g., IBM or DEC) that combine software with their own general-purpose hardware are not classified by INPUT as turnkey vendors. Their software revenues are included in the appropriate software category.

Most turnkey systems are sold through channels known as value-added resellers.

- *Value-Added Reseller (VAR):* A VAR adds value to computer hardware and/or software and then resells it to an end user. The major value added is usually applications software for a vertical or cross-industry market, but also includes many of the other components of a turnkey systems solution, such as professional services.

Turnkey systems have three components:

- Equipment - computer hardware supplied as part of the turnkey system
- Software products - prepackaged systems and applications software products
- Professional services - services to install or customize the system or train the user, provided as part of the turnkey system sale

3. Processing Services

This delivery mode includes three submodes: transaction processing, utility processing, and "other" processing services.

- *Transaction Processing* - Client uses vendor-provided information systems—including hardware, software and/or data networks—at the vendor site or customer site to process transactions and update client data bases. Transactions may be entered in one of four modes:

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- *Interactive* - Characterized by the interaction of the user with the system for data entry, transaction processing, problem solving and report preparation: the user is on-line to the programs/files stored on the vendor's system.

- *Remote Batch* - Where the user transmits batches of transaction data to the vendor's system, allowing the vendor to schedule job execution according to overall client priorities and resource requirements.

- *Distributed Services* - Where users maintain portions of an application data base and enter or process some transaction data at their own site, while also being connected through communications networks to the vendor's central systems for processing other parts of the application.

- *Carry-in Batch* - Where users physically deliver work to a processing services vendor.

• *Utility Processing* - Vendor provides basic software tools (language compilers, assemblers, DBMSs, graphics packages, mathematical models, scientific library routines, etc.), generic applications programs and/or data bases, enabling clients to develop their own programs or process data on the vendor's system.

• *Other Processing Services* - Vendor provides service—usually at the vendor site—such as scanning and other data entry services, laser printing, computer output microfilm (COM), CD preparation and other data output services, backup and disaster recovery, etc.

4. Systems Operations

Systems operations was a new delivery mode introduced in the 1990 Market Analysis and Systems Operations programs. It was created by taking the Systems Operations submode out of both Processing Services and Professional Services. For 1992 the submodes have been defined as follows.

Systems operations involves the operation and management of all or a significant part of the user's information systems functions under a long-term contract. These services can be provided in either of two distinct submodes where the difference is whether the support of applications, as well as data center operations, is included.

• *Platform systems operations* - The vendor manages and operates the computer systems, often including telecommunications networks, without taking responsibility for the user's application systems.

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- *Applications systems operations* - The vendor manages and operates the computer systems, often including telecommunications networks, and is also responsible for maintaining, or developing and maintaining, the user's application systems.

In the federal government market, systems operation services are also defined by equipment ownership with the terms "COCO" (Contractor-Owned, Contractor-Operated), and "GOCO" (Government-Owned, Contractor-Operated).

The ownership of the equipment, which was the previous basis for the systems operations submodes, is no longer considered critical to the commercial market. Most of the market consists of systems operations relationships using vendor-owned hardware. What is now critical is the breadth of the vendor/client relationship as it expands beyond data center management to applications management.

Systems operations vendors now provide a wide variety of services in support of existing information systems. The vendor can plan, control, provide, operate, maintain and manage any or all components of the user's information systems (equipment, networks, systems and/or applications software), either at the client's site or the vendor's site. Systems operations can also be referred to as "resource management" or "facilities management."

5. Systems Integration (SI)

Systems integration is a vendor service that provides a complete solution to an information system, networking or automation requirement through the custom selection and implementation of a variety of information system products and services. A systems integrator is responsible for the overall management of a systems integration contract and is the single point of contact and responsibility to the buyer for the delivery of the specified system function, on schedule and at the contracted price.

To be included in the information services market, systems integration projects must involve some application processing component. In addition, the majority of cost must be associated with information systems products and/or services.

- *Equipment* - Information processing and communications equipment required to build the systems solution. This component may include custom as well as off-the-shelf equipment to meet the unique needs of the project. The systems integration equipment category excludes turnkey systems by definition.

- *Software products* - Prepackaged applications and systems software products.

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- *Professional services* - The value-added component that adapts the equipment and develops, assembles, or modifies the software and hardware to meet the system's requirements. It includes all of the professional services activities required to develop, and if included in the contract, operate an information system, including consulting, program/project management, design and integration, software development, education and training, documentation, and systems operations and maintenance.

- *Other services* - Most systems integration contracts include other services and product expenditures that are not easily classified elsewhere. This category includes miscellaneous items such as engineering services, automation equipment, computer supplies, business support services and supplies, and other items required for a smooth development effort.

Systems integrators perform, or manage others who perform, most or all of the following functions:

- Program management, including subcontractor management
- Needs analysis
- Specification development
- Conceptual and detailed systems design and architecture
- System component selection, modification, integration and customization
- Custom software design and development
- Custom hardware design and development
- Systems implementation, including testing, conversion and post-implementation evaluation and tuning
- Life cycle support, including
  - System documentation and user training
  - Systems operations during development
  - Systems maintenance

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6. Professional Services

This category includes three submodes: consulting, education and training, and software development.

- *Consulting:* Services include management consulting (related to information systems), information systems consulting, feasibility analysis and cost-effectiveness studies, and project management assistance. Services may be related to any aspect of the information system, including equipment, software, networks and systems operations.

- *Education and Training:* Products and services related to information systems and services for the professional and end user, including computer-aided instruction, computer-based education, and vendor instruction of user personnel in operations, design, programming, and documentation.

- *Software Development:* Services include user requirements definition, systems design, contract programming, documentation, and implementation of software performed on a custom basis. Conversion and maintenance services are also included.

7. Network Services

Network services typically include a wide variety of network-based functions and operations. Their common thread is that most of these functions could not be performed without network involvement. Network services is divided into two submodes: *Electronic Information Services,* which involve selling information to the user, and *Network Applications,* which involve providing some form of enhanced transport service in support of a user's information processing needs.

a. Electronic Information Services

Electronic information services are data bases that provide specific information via terminal- or computer-based inquiry, including items such as stock prices, legal precedents, economic indicators, periodical literature, medical diagnosis, airline schedules, automobile valuations, etc. The terminals used may be computers themselves, such as communications servers or personal computers. Users typically inquire into and extract information from the data bases. Although users may load extracted data into their own computer systems, the electronic information vendor provides no data processing or manipulation capability and the users cannot update the vendor's data bases.

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The two kinds of electronic information services are:

- *On-line Data Bases* - Structured, primarily numerical data on economic and demographic trends, financial instruments, companies, products, materials, etc.

- *News Services* - Unstructured, primarily textual information on people, companies, events, etc.

While electronic information services have traditionally been delivered via networks, there is a growing trend toward the use of CD ROM optical disks to support or supplant on-line services, and these optical disk-based systems are included in the definition of this delivery mode.

b. Network Applications

Value-Added Network Services (VAN Services) - VAN services are enhanced transport services which involve adding such functions as automatic error detection and correction, protocol conversion, and store-and-forward message switching to the provision of basic network circuits.

While VAN services were originally provided only by specialized VAN carriers (Tymnet, Telenet, etc.), today these services are also offered by traditional common carriers (AT&T, Sprint, etc.). Meanwhile, the VAN carriers have also branched into the traditional common carriers' markets and are offering unenhanced basic network circuits as well.

INPUT's market definition covers VAN services only, but includes the VAN revenues of all types of carriers. The following are examples of VAN services.

- *Electronic Data Interchange (EDI)* - Application-to-application exchange of standardized business documents between trade partners or facilitators. This exchange is commonly performed using VAN services. Specialized translation software is typically employed to convert data from organizations' internal file formats to EDI interchange standards. This software may be provided as part of the VAN service or may be resident on the organization's own computers.

- *Electronic Information Exchange (EIE)* - Also known as electronic mail (E-mail), EIE involves the transmission of messages across an electronic network managed by a services vendor, including facsimile transmission (FAX), voice mail, voice messaging, and access to Telex, TWX, and other messaging services. This also includes bulletin board services.

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- *Other Network Services* - This segment contains videotex and pure network management services. Videotex is actually more a delivery mode than an application. Its prime focus is on the individual as a consumer or in business. These services provide interactive access to data bases and offer the inquirer the ability to send as well as receive information for such purposes as home shopping, home banking, travel reservations, and more.

  Network management services included here must involve the vendor's network and network management systems as well as people. People-only services are included in professional services that involve the management of networks as part of the broader task of managing a user's information processing functions are included in systems operations.

8. Equipment Services

The equipment services delivery mode includes two submodes. Each deals with the support and maintenance of computer equipment operations.

- *Equipment Maintenance* - Services provided to repair, diagnose problems and provide preventive maintenance both on-site and off-site. The costs of parts, media and other supplies are excluded. These services are typically provided on a contract basis.

- *Environmental Services* - Composed of equipment- and data center-related special services such as cabling, air conditioning and power supply, equipment relocation and similar services.

D
Hardware/Hardware Systems

Hardware - Includes all computer and telecommunications equipment that can be separately acquired with or without installation by the vendor and not acquired as part of an integrated system.

- *Peripherals* - Includes all input, output, communications, and storage devices (other than main memory) that can be connected locally to the main processor, and generally cannot be included in other categories such as terminals.

- *Input Devices* - Includes keyboards, numeric pads, card readers, light pens and track balls, tape readers, position and motion sensors, and analog-to-digital converters.

- *Output Devices* - Includes printers, CRTs, projection television screens, micrographics processors, digital graphics, and plotters

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- *Communication Devices* - Includes modem, encryption equipment, special interfaces, and error control

- *Storage Devices* - Includes magnetic tape (reel, cartridge, and cassette), floppy and hard disks, solid state (integrated circuits), and bubble and optical memories

Terminals - Three types of terminals are described below:

- *User Programmable* - Also called intelligent terminals, including the following:

  - Single-station or standalone
  - Multistation, shared processor
  - Teleprinter
  - Remote batch

- *User Nonprogrammable*

  - Single-station
  - Multistation, shared processor
  - Teleprinter

- *Limited Function* - Originally developed for specific needs, such as point-of-sale (POS), inventory data collection, controlled access, and other applications

Hardware Systems - Includes all processors from microcomputers to supercomputers. Hardware systems may require type- or model-unique operating software to be functional, but this category excludes applications software and peripheral devices, other than main memory and processors or CPUs not provided as part of an integrated (turnkey) system.

- *Microcomputer* - Combines all of the CPU, memory, and peripheral functions of an 8-, 16-, or 32-bit computer on a chip in various forms including:

  - Integrated circuit package

  - Plug-in boards with increased memory and peripheral circuits

  - Console including keyboard and interfacing connectors

  - Personal computer with at least one external storage device directly addressable by the CPU

  - An embedded computer which may take a number of shapes or configurations

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- *Workstations* - High-performance, desktop, single-user computers employing (mostly) Reduced Instruction Set Computing (RISC). Workstations provide integrated, high-speed, local network-based services such as data base access, file storage and back-up, remote communications, and peripheral support. Typical workstation products are provided by Apollo (now a unit of Hewlett-Packard), Sun, Altos, DEC (the MicroVAX) and IBM. These products usually cost more than $15,000. However, at this writing many companies have recently announced sizable price cuts.

- *Midsize Systems* - Describe superminicomputers and the more traditional business minicomputers. Due to steadily improving design and technology, the latter have outgrown traditional definitions (which defined small systems as providing 32-bit to 64-bit word lengths at prices ranging from $15,000 to $350,000). Increasingly, minicomputers and workstations meet the 32-bit definition, and may go beneath the $15,000 lower price limit. Typical midrange systems include IBM System/3X, 43XX, AS/400, and 937X product lines, DEC PDP and VAX families (excluding MicroVAX families), and competitive products from a wide range of vendors, including HP, Data General, Wang, AT&T, Prime Concurrent, Gould, Unisys, NCR, Bull, Harris, Tandem, Stratus, and many others.

- *Large Computer* - Presently centered on storage controllers, but likely to become bus-oriented and to consist of multiple processors or parallel processor. Intended for structured mathematical and signal processing and typically used with general purpose, Von Neumann-type processors for system control. This term usually refers to traditional mainframes and supercomputers.

- *Supercomputer* - High-powered processors with numerical processing throughput that is significantly greater than the fastest general purpose computers, with capacities in the 100-500 million floating point operations per second (MFLOPS) range. Newer supercomputers, with burst modes over 500 MFLOPS, main storage size up to 10 million words, and on-line storage in the one-to-four gigabyte class, are labeled Class V to Class VII in agency long-range plans. Supercomputers fit in one of two categories:

  - Real Time - Generally used for signal processing in military applications

  - Non-Real Time - For scientific use in one of three configurations:

    · Parallel processors
    · Pipeline processor
    · Vector processor

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- *Supercomputer* - Is also applied to micro, mini, and large mainframe computers with performance substantially higher than attainable by Von Neumann architectures.

- *Embedded Computer* - Dedicated computer system designed and implemented as an integral part of a weapon, weapon system, or platform; critical to a military or intelligence mission such as command and control, cryptological activities, or intelligence activities. Characterized by military specifications (MIL SPEC) appearance and operation, limited but reprogrammable applications software, and permanent or semipermanent interfaces. These systems may vary in capacity from microcomputers to parallel processor computer systems.

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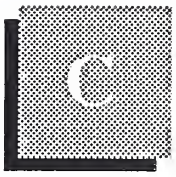

Glossary of Federal Acronyms

The federal government's procurement language uses a combination of acronyms, phrases, and words that is complicated by different agency definitions and interpretations. The government also uses terms of accounting, business, economics, engineering, and law with new applications and technology.

Acronyms and contract terms that INPUT encountered most often in program documentation and interviews for this report are included here, but this glossary should not be considered all-inclusive. Federal procurement regulations (DAR, FPR, FAR, FIRMR, FPMR) and contract terms listed in RFIs, RFPs, and RFQs provide applicable terms and definitions.

Federal agency acronyms have been included to the extent they are employed in this report.

A

Federal Acronyms

AAS	Automatic Addressing System.
AATMS	Advanced Air Traffic Management System.
ACS	Advanced Communications Satellite (formerly NASA 30/20 GHz Satellite Program).
ACT-1	Advanced Computer Techniques (Air Force).
Ada	DoD High-Order Language.
ADA	Airborne Data Acquisition.
ADL	Authorized Data List.
ADNET	Anti-Drug Network.
ADS	Automatic Digital Switches (DCS).
AFA	Air Force Association.
AFCEA	Armed Forces Communications Electronics Association.
AGE	Aerospace Ground Equipment.
AIP	Array Information Processing.

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AIS	Automated Information System.
AMD	Acquisition Management Directorate.
AMPE	Automated Message Processing Equipment.
AMPS	Automated Message Processing System.
AMSL	Acquisition Management Systems List.
ANG	Army National Guard
AP(P)	Advance Procurement Plan.
Appropriation	Congressionally approved funding for authorized programs and activities of the Executive Branch.
APR	Agency Procurement Request.
ARC	Acquisition Review Council.
ARPANET	DARPA network of scientific computers.
ASP	Aggregated Switch Procurement
ASTA	Advanced Software Technology and Algorithims.
ATLAS	Abbreviated Test Language for All Systems (for ATE-Automated Test Equipment).
Authorization	In the legislative process programs, staffing, and other routine activities must be approved by Oversight Committees before the Appropriations Committee will approve the money from the budget.
AUSA	Association of the U.S. Army.
AUTODIN	AUTOmatic DIgital Network of the Defense Communications System.
AUTOSEVOCOM	AUTOmatic SEcure VOice COMmunications Network
AUTOVON	AUTOmatic VOice Network of the Defense Communications System.
BA	Basic Agreement.
BAFO	Best And Final Offer.
Base level	Procurement, purchasing, and contracting at the military installation level.
BCA	Board of Contract Appeals.
Benchmark	Method of evaluating ability of a candidate computer system to meet user requirements.
Bid protest	Objection (in writing, before or after contract award) to some aspect of a solicitation by a valid bidder.
BML	Bidders Mailing List—qualified vendor information filed annually with federal agencies to automatically receive RFPs and RFQs in areas of claimed competence.
BOA	Basic Ordering Agreement.
B&P	Bid and Proposal—vendor activities in response to government solicitation/specific overhead allowance.
BPA	Blanked Purchase Agreement.
BRHR	Basic Research and Human Resources.
Budget	Federal Budget, proposed by the President and subject to Congressional review.
C^2	Command and Control.
C^3	Command, Control, and Communications.
C^4	Command, Control, Communications, and Computers.
C^3I	Command, Control, Communications, and Intelligence.
CAB	Contract Adjustment Board or Contract Appeals Board.

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CADE	Computer-Aided Design and Engineering.
CADS	Computer-Assisted Display Systems.
CAIS	Computer-Assisted Instruction System.
CALS	Computer-Aided Logistics Support.
CAPS	Command Automation Procurement Systems.
CAS	Contract Administration Services or Cost Accounting Standards.
CASB	Cost Accounting Standards Board.
CASP	Computer-Assisted Search Planning.
CBD	*Commerce Business Daily*—U.S. Department of Commerce publication listing government contract opportunities and awards.
CBO	Congressional Budget Office.
CCEP	Commercial Comsec Endorsement Program
CCDR	Contractor Cost Data Reporting.
CCN	Contract Change Notice.
CCPDS	Command Center Processing and Display Systems.
CCPO	Central Civilian Personnel Office.
CDR	Critical Design Review.
CDRL	Contractor Data Requirement List.
CFE	Contractor-Furnished Equipment.
CFR	Code of Federal Regulations.
CICA	Competition in Contracting Act
CIG	Computerized Interactive Graphics.
CIM	Corporate Information Management or Center for Information Management.
CINCs	Commanders-in-Chief.
CIR	Cost Information Reports.
CM	Configuration Management.
CMI	Computer-Managed Instruction.
CNI	Communications, Navigation, and Identification.
CO	Contracting Office, Contract Offices, or Change Order.
COC	Certificate of Competency (administered by the Small Business Administration).
COCO	Contractor-Owned, Contractor-Operated.
CODSIA	Council of Defense and Space Industry Associations.
COMSTAT	Communications Satellite Corporation.
CONUS	CONtinental United States.
COP	Capability Objective Package.
COTR	Contracting Officer's Technical Representative.
COTS	Commercial Off-the-Shelf (Commodities).
CP	Communications Processor.
CPAF	Cost-Plus-Award-Fee Contract.
CPFF	Cost-Plus-Fixed-Fee Contract.
CPIF	Cost-Plus-Incentive-Fee Contract.
CPR	Cost Performance Reports.
CPSR	Contractor Procurement System Review.
CR	Cost Reimbursement (Cost Plus Contract).
CSA	Combat or Computer Systems Architecture.
CSIF	Communications Services Industrial Fund.

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C/SCSC	Cost/Schedule Control System Criteria (also called "C-Spec").
CSPP	Computer Systems Policy Project.
CWAS	Contractor Weighted Average Share in Cost Risk.
DAB	Defense Acquisition Board.
DABBS	Defense Acquisition Bulletin Board System.
DAL	Data Accession List.
DAR	Defense Acquisition Regulations.
DARPA	Defense Advanced Research Projects Agency.
DAS	Data Acquisition System.
DBHS	Data Base Handling System.
DBOF	Defense Business Operating Fund.
DCA	Defense Communications Agency (see DISA).
DCAA	Defense Contract Audit Agency.
DCAS	Defense Contract Administration Services.
DCASR	DCAS Region.
DCC	Digital Control Computer.
DCP	Development Concept Paper (DoD).
DCS	Defense Communications System.
DCTN	Defense Commercial Telecommunications Network.
DDA	Dynamic Demand Assessment (Delta Modulation).
DDC	Defense Documentation Center.
DDI	Director of Defense Information.
DDL	Digital Data Link—A segment of a communications network used for data transmission in digital form.
DDN	Defense Data Network.
DDS	Defense Distribution System.
DECCO	DEfense Commercial Communications Office.
DECEO	DEfense Communications Engineering Office.
D&F	Determination and Findings—required documentation for approval of a negotiated procurement.
DFAS	Defense Finance and Accounting Service.
DIA	Defense Intelligence Agency.
DIF	Document Interchange Format, Navy-sponsored word processing standard.
DISA	Defense Information Systems Agency (Formerly DCA).
DHHS	Department of Health and Human Services.
DIDS	Defense Integrated Data Systems.
DISC	Defense Industrial Supply Center.
DLA	Defense Logistics Agency.
DMA	Defense Mapping Agency.
DMR	Defense Management Review.
DMRD	Defense Management Review Decision.
DNA	Defense Nuclear Agency.
DO	Delivery Order.
DOA	Department of Agriculture (also USDA).
DOC	Department of Commerce.
DOE	Department of Energy.
DOI	Department of Interior.

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DOJ	Department of Justice.
DOS	Department of State.
DOT	Department of Transportation.
DPA	Delegation of Procurement Authority (granted by GSA under FPRs).
DPC	Defense Procurement Circular.
DQ	Definite Quantity Contract.
DQ/PL	Definite Quantity Price List Contract.
DR	Deficiency Report.
DRFP	Draft Request For Proposal.
DSCS	Defense Satellite Communication System.
DSN	Defense Switched Network.
DSP	Defense Support Program (WWMCCS).
DSS	Defense Supply Service.
DTC	Design-To-Cost.
DTN	Defense Transmission Network.
ECP	Engineering Change Proposal.
ED	Department of Education.
EEO	Equal Employment Opportunity.
8(a) Set-Aside	Agency awards direct to Small Business Administration for direct placement with a socially/economically disadvantaged company.
EMC	Electro-Magnetic Compatibility.
EMCS	Energy Monitoring and Control System.
EO	Executive Order—Order issued by the President.
EOQ	Economic Ordering Quantity.
EPA	Economic Price Adjustment.
EPA	Environmental Protection Agency.
EPMR	Estimated Peak Monthly Requirement.
EPS	Emergency Procurement Service (GSA) or Emergency Power System.
EUC	End User Computing, especially in DoD.
FA	Formal Advertising.
FAC	Facility Contract.
FAR	Federal Acquisition Regulations.
FCA	Functional Configuration Audit.
FCC	Federal Communications Commission.
FCCSET	Federal Coordinating Council on Science, Engineering and Technology.
FCDC	Federal Contract Data Center.
FCRC	Federal Contract Research Center.
FDDI	Fiber Distributed Data Interface.
FDPC	Federal Data Processing Center.
FEDSIM	Federal (Computer) Simulation Center (GSA).
FEMA	Federal Emergency Management Agency.
FFP	Firm Fixed-Price Contract (also Lump Sum Contract).
FIPR	Federal Information Processing Resource.
FIPS	NBS Federal Information Processing Standard.
FIPS PUBS	FIPS Publications.
FIRMR	Federal Information Resource Management Regulations.

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FMS	Foreign Military Sales.
FOC	Final Operating Capability.
FOIA	Freedom of Information Act.
FP	Fixed-Price Contract.
FP-L/H	Fixed-Price—Labor/Hour Contract.
FP-LOE	Fixed-Price—Level-Of-Effort Contract.
FPMR	Federal Property Management Regulations.
FPR	Federal Procurement Regulations.
FSC	Federal Supply Classification.
FSG	Federal Supply Group.
FSN	Federal Supply Number.
FSS	Federal Supply Schedule or Federal Supply Service (GSA).
FSTS	Federal Secure Telecommunications System.
FT Fund	A revolving fund, designated as the Federal Telecommunications Fund, used by GSA to pay for GSA-provided common-user services, specifically including the current FTS and proposed FTS 2000 services.
FTSP	Federal Telecommunications Standards Program administered by NCS; Standards are published by GSA.
FTS	Federal Telecommunications System.
FTS 2000	Replacement of the Federal Telecommunications System.
FY	Fiscal Year.
FYDP	Five-Year Defense Plan.
GAO	General Accounting Office.
GFE	Government-Furnished Equipment.
GFM	Government-Furnished Material.
GFY	Government Fiscal Year (October to September).
GIDEP	Government-Industry Data Exchange Program.
GOCO	Government Owned—Contractor Operated.
GOGO	Government Owned—Government Operated.
GOSIP	Government Open Systems Interconnection Profile.
GPO	Government Printing Office.
GPS	Global Positioning System.
GRH	Gramm-Rudman-Hollings Act (1985), also called Gramm-Rudman Deficit Control.
GS	General Schedule.
GSA	General Services Administration.
GSBCA	General Services Administration Board of Contract Appeals.
HCFA	Health Care Financing Administration.
HHS	(Department of) Health and Human Services.
HIPPI	High-Performance Parallel Protocol Interface.
HPA	Head of Procuring Activity.
HPCC	High-Performance Computing and Communications.
HPCCIT	High-Performance Computing and Communications Information Technology Subcommittee.
HPCS	High-Performance Computing Systems.

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HSDP	High-Speed Data Processors.
HUD	(Department of) Housing and Urban Development.
I-CASE	Integrated Computer-Aided Software Engineering.
IAR	Senior IRM Official.
ICA	Independent Cost Analysis.
ICAM	Integrated Computer-Aided Manufacturing.
ICE	Independent Cost Estimate.
ICP	Inventory Control Point.
ICST	Institute for Computer Sciences and Technology, National Bureau of Standards, Department of Commerce.
IDAMS	Image Display And Manipulation System.
IDEP	Interservice Data Exchange Program.
IDIQ	Indefinite Delivery-Indefinite Quantity.
IDN	Integrated Data Network.
IFB	Invitation For Bids.
IOC	Initial Operating Capability.
IOI	Internal Operating Instructions.
IPS	Integrated Procurement System.
IQ	Indefinite Quantity Contract.
IR&D	Independent Research & Development.
IRM	Information Resources Management.
IXS	Information Exchange System.
JCS	Joint Chiefs of Staff.
JCALS	Joint Computer-Aided Logistics Support.
JFMIP	Joint Financial Management Improvement Program.
JOCIT	Jovial Compiler Implementation Tool.
JSIPS	Joint Systems Integration Planning Staff.
JSOP	Joint Strategic Objectives Plan.
JSOR	Joint Service Operational Requirement.
JUMPS	Joint Uniform Military Pay System.
JWAM	Joint WWMCCS ADP Modernization (Program).
LC	Letter Contract.
LCC	Life Cycle Costing.
LCMP	Life Cycle Management Procedures (DD7920.1).
LCMS	Life Cycle Management System.
L-H	Labor-Hour Contract.
LOI	Letter of Interest.
LRPE	Long-Range Procurement Estimate.
LRIRP	Long-Range Information Resource Plan.
LTD	Live Test Demonstration.
MAISRC	Major Automated Information Systems Review Council (DoD).
MANTECH	MANufacturing TECHnology.
MAPS	Multiple Address Processing System.
MAP/TOP	Manufacturing Automation Protocol/Technical and Office Protocol.

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MASC	Multiple Award Schedule Contract.
MDA	Multiplexed Data Accumulator.
MENS	Mission Element Need Statement or Mission Essential Need Statement (see DD-5000.1 Major Systems Acquisition).
MILSCAP	Military Standard Contract Administration Procedures.
MIL SPEC	Military Specification.
MIL STD	Military Standard.
MIPR	Military Interdepartmental Purchase Request.
MLS	Multilevel Security.
MNF	Multi-National Force.
MOD	Modification.
MOL	Maximum Ordering Limit (Federal Supply Service).
MPC	Military Procurement Code.
MYP	Multi-Year Procurement.
NARDIC	Navy Research and Development Information Center.
NASA	National Aeronautics and Space Administration.
NBS	National Bureau of Standards.
NCA	National Command Authorities.
NCMA	National Contract Management Association.
NCS	National Communications System (evolving to DISN).
NICRAD	Navy-Industry Cooperative Research and Development.
NIP	Notice of Intent to Purchase.
NMCS	National Military Command System.
NREN	National Research and Education Network.
NSA	National Security Agency.
NSEP	National Security and Emergency Preparedness.
NSF	National Science Foundation.
NSIA	National Security Industrial Association.
NTIA	National Telecommunications and Information Administration of the Department of Commerce; (replaced the Office of Telecommunications Policy in 1970).
NTIS	National Technical Information Service.
Obligation	"Earmarking" of specific funding for a contract from committed agency funds.
OCS	Office of Contract Settlement.
OFCC	Office of Federal Contract Compliance.
Off-Site	Services to be provided near but not in government facilities.
OFMP	Office of Federal Management Policy (GSA).
OFPP	Office of Federal Procurement Policy.
OIRM	Office of Information Resources Management.
O&M	Operations & Maintenance.
OMB	Office of Management and Budget.
O,M&R	Operations, Maintenance, and Readiness.
On-Site	Services to be performed on a government installation or in a specified building.
OPM	Office of Procurement Management (GSA) or Office of Personnel Management.
Options	Sole-source additions to the base contract for services or goods to be exercised at the government's discretion.

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OSADBU	Office of Small and Disadvantaged Businesses.
OSHA	Occupational Safety and Health Act.
OSI	Open System Interconnect.
OSP	Offshore Procurement.
OTA	Office of Technology Assessment (Congress).
Out-Year	Proposed funding for fiscal years beyond the Budget Year (next fiscal year).
P-1	FY Defense Production Budget.
P3I	Pre-Planned Product Improvement (program in DoD).
PAR	Procurement Authorization Request or Procurement Action Report.
PAS	Pre-Award Survey.
PASS	Procurement Automated Source System.
PCO	Procurement Contracting Officer.
PDA	Principal Development Agency.
PDM	Program Decision Memorandum.
PDR	Preliminary Design Review.
PIR	Procurement Information Reporting.
PME	Performance Monitoring Equipment.
PMES	Physical, Mathematical and Engineering Sciences.
PMP	Purchase Management Plan.
PO	Purchase Order or Program Office.
POE	Panel Of Experts.
POM	Program Objective Memorandum.
POSIX	Portable Open System Interconnection Exchange.
POTS	Purchase of Telephone Systems.
PPBS	Planning, Programming, Budgeting System.
PR	Purchase Request or Procurement Requisition.
PRA	Paperwork Reduction Act.
PS	Performance Specification—alternative to a Statement of Work, when work to be performed can be clearly specified.
QA	Quality Assurance.
QAO	Quality Assurance Office.
QMCS	Quality Monitoring and Control System (DoD software).
QMR	Qualitative Material Requirement (Army).
QPL	Qualified Products List.
QRC	Quick Reaction Capability.
QRI	Quick Reaction Inquiry.
R-1	FY Defense RDT&E Budget.
RAM	Reliability, Availability, and Maintainability.
RC	Requirements Contract.
R&D	Research and Development.
RDA	Research, Development, and Acquisition.
RDD	Required Delivery Date.
RD&E	Research, Development, and Engineering.
RDF	Rapid Deployment Force.
RDT&E	Research, Development, Test, and Engineering.

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RFI	Request For Information.
RFP	Request For Proposal.
RFQ	Request For Quotation.
RFTP	Request For Technical Proposals (Two-Step).
ROC	Required Operational Capability.
ROI	Return On Investment.
RTAS	Real Time Analysis System.
RTDS	Real Time Display System.
SA	Supplemental Agreement.
SADBU	Small and Disadvantaged Business Utilization.
SBA	Small Business Administration.
SB Set-Aside	Small Business Set-Aside contract opportunities with bidders limited to certified small businesses.
SCA	Service Contract Act (1964 as amended).
SCN	Specification Change Notice.
SDN	Secure Data Network.
SEC	Securities and Exchange Commission.
SE&I	Systems Engineering and Integration.
SETA	Systems Engineering/Technical Assistance.
SETS	Systems Engineering/Technical Support.
SIBAC	Simplified Intragovernmental Billing and Collection System.
SIMP	Systems Integration Master Plan.
SIOP	Single Integrated Operations Plan.
Sole Source	Contract award without competition.
Solicitation	Invitation to submit a bid.
SONET	Synchronous Optical Network.
SOR	Specific Operational Requirement.
SOW	Statement of Work.
SSA	Source Selection Authority (DoD).
SSAC	Source Selection Advisory Council.
SSEB	Source Selection Evaluation Board.
SSO	Source Selection Official (NASA).
STINFO	Scientific and Technical INFOrmation Program—Air Force/NASA.
STU	Secure Telephone Unit.
SWO	Stop-Work Order.
Synopsis	Brief Description of contract opportunity in CBD after D&F and before release of solicitation.
TA/AS	Technical Assistance/Analysis Services.
TCP/IP	Transmission Control Protocol/Internet Protocol.
TEMPEST	Studies, inspections, and tests of unintentional electromagnetic radiation from computer, communication, command, and control equipment that may cause unauthorized disclosure of information; usually applied to DoD and security agency testing programs.
TILO	Technical and Industrial Liason Office—Qualified Requirement Information Program—Army.
TM	Time and Materials contract.

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TOA	Total Obligational Authority (Defense).
TOD	Technical Objective Document.
TQM	Total Quality Management.
TR	Temporary Regulation (added to FPR, FAR).
TRACE	Total Risk Assessing Cost Estimate.
TRCO	Technical Representative of the Contracting Offices.
TREAS	Department of Treasury.
TRP	Technical Resources Plan.
TSP	GSA's Teleprocessing Services Program.
TVA	Tennessee Valley Authority.
UCAS	Uniform Cost Accounting System.
USA	U.S. Army.
USAF	U.S. Air Force.
USCG	U.S. Coast Guard.
USMC	U.S. Marine Corps.
USN	U.S. Navy.
U.S.C.	United States Code.
USPS	United States Postal Service.
USRRB	United States Railroad Retirement Board.
VA	Veterans Affairs Department.
VE	Value Engineering.
VHSIC	Very High Speed Integrated Circuits.
VIABLE	Vertical Installation Automation BaseLine (Army).
VICI	Voice Input Code Identifier.
VTC	Video Teleconferencing.
WAM	WWMCCS ADP Modernization Program.
WBS	Work Breakdown Structure.
WGM	Weighted Guidelines Method.
WIN	WWMCCS Intercomputer Network.
WITS	Washington Interagency Telecommunications System.
WIS	WWMCCS Information Systems.
WS	Work Statement—Offerer's description of the work to be done (proposal or contract).
WWMCCS	World-Wide Military Command and Control System.

B

General and Industry Acronyms

ADAPSO	Association of Data Processing Service Organization, now the Computer Software and Services Industry Association. (See ITAA).
ADP	Automatic Data Processing.
ADPE	Automatic Data Processing Equipment.
ANSI	American National Standards Institute.

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BOC	Bell Operating Company.
CAD	Computer-Aided Design.
CAM	Computer-Aided Manufacturing.
CASE	Computer-Aided Software Engineering.
CBEMA	Computer and Business Equipment Manufacturers Association.
CCIA	Computers and Communications Industry Association.
CCITT	Comite Consultatif Internationale de Télégraphique et Téléphonique; Committee of the International Telecommunication Union.
COBOL	COmmon Business-Oriented Language.
COS	Corporation for Open Systems.
CPU	Central Processor Unit.
DMBS	Data Base Management System.
DRAM	Dynamic Random Access Memory.
EIA	Electronic Industries Association.
EPROM	Erasible Programmable Read-Only Memory.
IEEE	Institute of Electrical and Electronics Engineers.
ISDN	Integrated Services Digital Networks.
ISO	International Organization for Standardization; voluntary international standards organization and member of CCITT.
ITAA	Information Technology Association of America (Formerly ADAPSO).
ITU	International Telecommunication Union.
LSI	Large-Scale Integration.
MFJ	Modified Final Judgement.
PROM	Programmable Read-Only Memory.
RBOC	Regional Bell Operating Company.
UNIX	AT&T Proprietary Operating System.
UPS	Uninterruptable Power Source.
VAR	Value-Added Reseller.
VLSI	Very Large-Scale Integration.
WORM	Write-Once-Read-Many-Times.

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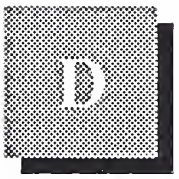

Policies, Regulations, and Standards

A

OMB Circulars

A-11	Preparation and Submission of Budget Estimates.
A-49	Use of Management and Operating Contracts.
A-71	Responsibilities for the Administration and Management of Automatic Data Processing Activities.
A-109	Major Systems Acquisitions.
A-120	Guidelines for the Use of Consulting Services.
A-121	Cost Accounting, Cost Recovery, and Integrated Sharing of Data Processing Facilities.
A-123	Internal Control Systems.
A-127	Financial Management Systems.
A-130	Management of Federal Information Resources.
A-131	Value Engineering.

B

GSA Publications

The FIRMR as published by GSA is the primary regulation for use by federal agencies in the management, acquisition, and use of both ADP and telecommunications information resources.

C

DoD Directives

DD-5000.1	Major System Acquisitions.
DD-5000.2	Major System Acquisition Process.
DD-5000.11	DoD Data Administration (C3I).
DD-5000.31	Interim List of DoD-Approved, High-Order Languages.
DD-5000.35	Defense Acquisition Regulatory Systems.
DD-5200.1	DoD Information Security Program.

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DD-5200.28	Security Requirements for Automatic Data Processing (ADP) Systems.
DD-5200.28-M	Manual of Techniques and Procedures for Implementing, Deactivating, Testing, and Evaluating Secure Resource Sharing ADP Systems.
DD-7920.2	Major Automated Information Systems Approval Process.
DD-7935	Automated Data Systems (ADS) Documentation.
DoDD 3405.1	Computer Programming Language Policy
DoDD 5000.11	DoD Data administration (C31)
DoDI 5000.12	Data Elements and Data Codes Standardization Procedure
DoDI 5000.18	Implementation of Standard Data Elements and Related Features
DoDD 5105.19	Defense Information Systems Agency
DoDD 5110.4	Washington Headquarters Services
DoDD 5118.3	Comptroller of the Department of Defense
DoDD 5137.1	Assistant Secretary of Defense (Command, Control, Communications, and Intelligence)
DoDD 7740.1	DoD Information Resources Management Program
DoD 7740.1-G	DoD ADP Internal Control Guideline
DoDD 7740.2	Automated Information System (AIS) Strategic Planning
DoDI 7740.3	Information Resources Management (IRM) Review Program
DoDD 7750.5	Management and Control of Information Requirements
DoDI 7750.7	DoD Forms Management Program
DoDI 7920.2-M	Automated Information Systems (AIS) Life-Cycle Manual
DoDI 7920.4	Baselining of Automated Information Systems (AISs)
DoDI 7920.5	Management of End User Computing (EUC)
DoDI 7930.1	Information Technology Users Group Program
DoDI 7930.2	ADP Software Exchange and Release
DoDD 7950.1	Automated Data Processing Resources Management
DoD 7950.1-M	Defense Automated Resources Management Manual of Information Requirements

D
Standards

ADCCP	Advanced Data Communications Control Procedures; ANSI Standard X3.66 of 1979; also NIST FIPS 71.
CCITT G.711	International PCM standard.
CCITT T.0	International standard for classification of facsimile apparatus for document transmission over telephone-type circuits.

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DEA-1	Proposed ISO standard for data encryption based on the NIST DES.
EIA RS-170	Monochrome video standard.
EIA RS-170A	Color video standard.
EIA RS-464	EIA PBX standards.
EIA RS-465	Standard for Group III facsimile.
EIA RS-466	Facsimile standard; procedures for document transmission in the General Switched Telephone Network.
EIA RS-232-C	EIA DCE to DTE interface standard using a 25-Pin connector; similar to CCITT V-24.
EIA RS-449	New EIA standard DTE to DCE interface which re places RS-232-C.
FED-STD 1000	Proposed Federal Standard for adoption of the full OSI reference model.
FED-STD 1026	Federal Data Encryption Standard (DES) adopted in 1983; also FIPS 46.
FED-STD 1041	Equivalent to FIPS 100.
FED-STD 1061	Group II Facsimile Standard (1981).
FED-STD 1062	Federal standard for Group III facsimile; equivalent to EIA RS-465.
FED-STD 1063	Federal facsimile standard; equivalent to EIA RS-466.
FED-STDs 1005, 1005A-1008	Federal Standards for DCE Coding and Modulation.
FIPS 46	NIST Data Encryption Standard (DES).
FIPS 81	DES Modes of Operation.
FIPS 100	NIST Standard for packet-switched networks; subset of 1980 CCITT X.25.
FIPS 107	NIST Standard for local-area networks, similar to IEEE 802.2 and 802.3.
FIPS 146	Government Open Systems Interconnection (OSI) Profile (GOSIP).
FIPS 151	NIST POSIX (Portable Operating System Interface for UNIX) standard.
IEEE 802.2	OSI-Compatible IEEE standard for data-link control in local-area networks.
IEEE 802.3	Local-area network standard similar to Ethernet.
IEEE 802.4	OSI-compatible standard for token bus local-area networks.
IEEE 802.5	Local-area networks standard for token ring networks.
IEEE P1003.1	POSIX standard, similar to FIPS 151.

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MIL-STD-188-114C	Physical interface protocol similar to RS-232 and RS-449.
MIL-STD-1777	IP-Internet Protocol.
MIL-STD-1778	TCP - Transmission Control Protocol.
MIL-STD-1780	File Transfer Protocol.
MIL-STD-1781	Simple Mail Transfer Protocol (electronic mail).
MIL-STD-1782	TELNET - virtual terminal protocol.
MIL-STD-1815A	Ada Programming Language Standard.
SVID	UNIX System Interface Definition.
X.12	ANSI standard for Electronic Data Interchange
X.21	CCITT standard for interface between DTE and DCE for synchronous operation on public data networks.
X.25	CCITT standard for interface between DTE and DCE for terminals operating in the packet mode on public data networks.
X.75	CCITT standard for links that interface different packet networks.
X.400	ISO application-level standard for the electronic transfer of messages (electronic mail).

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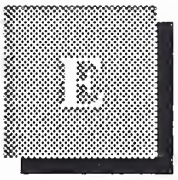

Related INPUT Reports

- *Federal Computer Equipment Market, 1991-1996*
- *Federal Systems Integration Market, 1991-1996*
- *Federal Professional Services Market, 1990-1995*
- *NASA Information Systems Market, 1991-1996*

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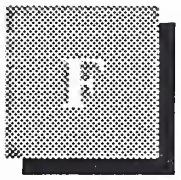

Policy Questionnaire

CONFIDENTIAL

INPUT Questionnaire—Federal Policy Agencies

Study Title: High-Performance Computing in the Federal Market

Interviewer: _____

Respondent Name: _____

Title: _____

Phone: _____

Department: _____

Agency: _____

Address: _____

_____

_____

_____

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Federal Policy Agency Questionnaire

High-Performance Computing in the Federal Market

This questionnaire is directed toward the federal government's acquisition of high-performance computers, software, networks, and services. The questionnaire is divided into two parts:

Part I addresses funding for high-performance computing.

Part II addresses agency issues and perceptions of the federal market for high-performance products and services.

Funding Information

1. Is funding appropriated by the High-Performance Computing (HPC) Act part of the research and development (R&D) budgets of the agencies named in the Act?

Is it included as part of their information technology budgets?

2. Do the agencies have to report these planned expenditures in their A-11 submissions to OMB?

3. Will the funding from the Act be used for R&D or actual purchases of HPC equipment or services?

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4. Who mandates how they can use this money? Are there separate guidelines for each agency to prevent overlap of R&D efforts in this area?

5. Will other agencies have access to funding for HPC other than those named in the Act?

How do they obtain it?

In your opinion, which other agencies will seek to use funding under this Act?

6. How will products and services for HPC be acquired by the agencies in the Act? If more than one, then what percentage of each?

Open competition for contracts ___
Sole-source contracts ___
Research grants ___
Other What?_____ ___

7. In general, do you expect agencies to request more funding for purchases of HPC products and services in the next five years (other than R&D)?

Why or why not?

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Which agencies?

8. In terms of the HPC Act, do you expect funding to increase or decrease?

Why?

9. In your opinion, what percentage of FY 1992 HPC funding will be used for contracted equipment or services?

Proposed FY 1993 funding?

Agency Issues

10. Are there any guidelines for high-performance computers (supercomputers) and their software now?

Who developed the guidelines?

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Will there be new guidelines for the President's HPCC Initiative?

Who will develop these?

11. What issues are facing prospective agency supercomputer buyers not in the Initiative?

12. What issues are facing the agencies in the HPCC Initiative?

13. When did the President implement the HPCC Program?

14. What did the initial program involve (initiatives)?

15. How has that changed with the passage of the HPC Act?

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16. Who governs the HPCC Program? The Office of Science and Technology Policy or the Federal Coordinating Council on Science, Engineering and Technology (FCCSET)?

17. What effect has the HPCC Program had on purchases of supercomputers by federal agencies, to date?

In five years?

The nine agencies involved?

18. How has the HPCC Program affected the federal contracting community?

19. Will the HPCC Program cause more contracting opportunities for federal vendors? What type?

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20. What are the leading applications for supercomputers and high-speed networks?

_____

_____

_____

Thank you for your cooperation and assistance.

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CONFIDENTIAL

INPUT Questionnnaire—Federal Agencies

Study Title: High-Performance Computing in the Federal Market

Interviewer: _____

Respondent Name: _____

Title: _____

Phone: _____

Department: _____

Agency: _____

Address: _____

_____

_____

_____

Federal Agency Questionnaire

High-Performance Computing in the Federal Market

This questionnaire is directed toward the federal government's acquisition of high-performance computers, software, networks, and services. The questionnaire is divided into three parts:

Part I addresses agency past buying and current installed systems.

Part II addresses agency buying intentions.

Part III addresses agency opinions and perceptions of the federal market for computer equipment.

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Agency Environment

1. Do you currently use or plan to use high-performance computing (supercomputers)?

Current		Future	
Yes	____	Yes	____
No	____	No	____

(If no, please close the interview.)

2. What high-performance computing applications are used or planned for use in your agency?

_____

_____

_____

3. What brand of hardware does your agency use for high-performance computing?

Alliant	____
Analogic	____
Control Data	____
Convex	____
Cray	____
FPS Computing	____
Intergraph	____
Encore	____
Other (Please specify)	_____

4. What type of operating system software does your high-performance computer(s) use?

UNIX	____
MVS	____
DOS/VSE	____
VM	____
VSE	____
Other (Please specify)	_____

5. How do you acquire high-performance computers and services (please check all that apply)?

Requirements contract	____
RFPs for a specific purpose	____
Other (Please specify)	____

_____

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6. What impact have federal budgetary constraints had on your purchase of high-performance computers?

_____

_____

_____

7. What impact has the President's High-Performance Computing Initiative had on your purchases of high-performance computers?

_____

_____

_____

Agency Buying Intentions

8. Does your agency plan to buy a high-performance computer, a network, or services in the next five years?

Yes ____
No ____

(If no, go to question # 11.)

If yes, what specifically are you planning to acquire?

_____

_____

Do these acquisitions represent an increase in high-performance computer or service purchases from past years?

Yes ____
No ____

9. About how much do you expect to spend on these acquisitions in the next year? Over five years?

_____

_____

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10. For what applications will the new equipment or services be used?

_____

_____

_____

Agency Perceptions

11. On a scale of 1-5, 5 being most important, please rate the following selection criteria for high-performance equipment purchases:

Criteria	Rating				
Equipment Performance	1	2	3	4	5
Software Features	1	2	3	4	5
Vendor's Federal Experience	1	2	3	4	5
Ease of Implementation	1	2	3	4	5
Vendor's Support Reputation	1	2	3	4	5
Product Price	1	2	3	4	5
Equipment Reliability	1	2	3	4	5
Other (Please specify)	1	2	3	4	5

_____

12. Do you have a preference for the type of vendor you would choose to provide high-performance equipment for your agency?

Yes ____
No ____

(If no, go to question #14.)

If yes, which of the following would you prefer:

Manufacturers	___	Professional services firms	___
Systems integrators	___	Suppliers	___
Aerospace divisions	___	Other	___

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13. Do you have any preference for the type of vendor you would choose to provide networking?

Yes ____
No ____

(If no, go to question #15.)

If yes, which of the following would you prefer:

Manufacturers	___	Professional services firms	___
Systems integrators	___	Suppliers	___
Aerospace divisions	___	Network services firms	___
		Other	___

14. Do you have any preference for the type of firm you would choose to provide services?

Yes ____
No ____

(If no, go to question #16.)

If yes, which of the following would you prefer:

Manufacturers	___	Professional services firms	___
Systems integrators	___	Suppliers	___
Aerospace divisions	___	Other	___

15. Do you have a preference for the type of acquisition method used to acquire high-performance equipment, networking, or services?

Yes ____
No ____

(If no, go to question #17.)

If yes, which type of acquisition method(s) do you prefer for each?

Equipment:_____

Networking:_____

Services:_____

16. Is your agency using high-performance computing standards for equipment or networking?

Yes ____
No ____

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If yes, what are the standards?

_____

_____

_____

How are they being developed?

Agency in-house _____

Interagency groups _____

Vendor-developed _____

Other (Please specify)_____

17. In your opinion, who are the leading high-performance computer vendors?

_____

_____

High-speed network vendors?

_____

_____

Related services vendors?

_____

_____

Thank you for your cooperation and assistance.

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