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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense Wide/BA 3	**R-1 ITEM NOMENCLATURE** High Performance Computing Modernization **PE 0603755D8Z**

COST *(In Millions)*	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	Cost to Complete	Total Cost
Total Program Element (PE) Cost	171.727	183.524	188.642	189.073	190.266	196.949	199.306	Continuing	Continuing
HPCM/P507	171.727	183.524	188.642	189.073	190.266	196.949	199.306	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification

(U) BRIEF DESCRIPTION OF ELEMENT

(U)The Department of Defense (DoD) High Performance Computing (HPC) Modernization Program (HPCMP) supports the needs of the warfighter for technological superiority and military dominance on the battlefield by providing advanced computational services to U.S. weapons system scientists and engineers. By exploiting continuous advances in high performance computing technology, the defense research, development, test and evaluation (RDT&E) community is able to resolve critical scientific and engineering problems more quickly and with more precision than any potential adversary threatening national security. The results of these efforts feed directly into the acquisition process by improving weapons system designs through increased fundamental understanding of materials, aerodynamics, chemistry, fuels, acoustics, signal image recognition, electromagnetics, and other areas of basic and applied research as well as enabling advanced test and evaluation environments that allow synthetic scene generation, automatic control systems and virtual test environments. As such, high performance computing (HPC) has been identified as a key enabling technology essential to achieving the objectives of the DoD's Science and Technology (S&T) and Test and Evaluation (T&E) programs.

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(U)The HPCMP has established and supports four major shared resource supercomputing centers as well as several smaller, special-purpose distributed supercomputing centers. These centers directly support the DoD S&T and T&E laboratories and centers and are accessible to local and remote scientists and engineers via high-speed network access. Providing for the adaptation of broadband, widely used applications and algorithms to address S&T and T&E requirements, along with continued training of users as new system designs and concepts evolve, is an integral part of the program. The program pursues continuous interaction with the national HPC infrastructure, including academia, industry, and other government agencies to facilitate the sharing of knowledge, tools, and expertise.

(U) The HPCMP user base includes approximately 5,000 computational scientists and engineers and over 60 DoD laboratories and test and evaluation facilities. The integrated HPCM program consists of Shared Resource Centers - four large Major Shared Resources Centers (MSRCs) and seventeen Distributed Centers (DCs); the Defense Research and Engineering Network; and Software Application Support. The MSRCs are responsible for as large a fraction of DoD`s S&T and DT&E computational workload as feasible. These MSRCs provide extensive capabilities to address user requirements for hardware, software, and programming environments. A limited set of smaller shared resource centers, Distributed Centers (DCs), augment the MSRCs to form the total HPCMP computational capability. Distributed Centers address critical HPC requirements that cannot be met at MSRCs, such as real-time, and near real-time computing requirements, and leverage significant HPC and mission expertise located at these remote sites. The MSRCs and DCs are currently interconnected with all S&T and DT&E user sites via the Defense Research and Engineering Network (DREN). Additionally, the Software Application Support Initiative develops critical common DoD applications programs that run efficiently on advanced HPC systems through the Common HPC Software Support Initiative (CHSSI). In addition to CHSSI, software activities build technology transition activities with academic institutions, train users, and build collaborative through Programming Environment and Training (PET). Also technology is being developed to protect high value HPC application codes through a Software Protection effort.

(U) True modernization of DoD`s HPC capability and fulfillment of the program's vision and goals requires an on-going program strategy that addresses all aspects of HPC. While advancing the level of hardware performance is critical to success, the higher objective is to enable better scientific research, test and evaluation environments, and technology development for superior weapons, warfighting and related support systems. The goals of the HPCMP are to:

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- Provide the best commercially available high-end HPC capability.
- Acquire and develop joint-need HPC applications, software tools and programming environments.
- Educate and train DoD's scientists and engineers to effectively use advanced computational environments.
- Link users and computer sites via high-capacity networks, facilitating user access and distributed computing environments.
- Promote collaborative relationships among the DoD HPC community, the National HPC community and MSIs in network, computer and computational science.

(U) Four major contracts to support each of the MSRCs were competitively awarded during FY 1996. These contracts provide comprehensive support services for up to eight years. The four MSRCs and their location are:

• Aeronautical Systems Center (ASC), Wright-Patterson Air Force Base, OH
• Corps of Engineers Research and Development Center (ERDC), Vicksburg, MS
• Army Research Laboratory (ARL), Aberdeen Proving Ground, MD
• Naval Oceanographic Office (NAVO), Stennis Space Center, MS

(U) Computer Science Corporation of Huntsville, AL was awarded contracts to support both the ASC and ERDC MSRCs. Logicon of Herndon, VA was awarded the contract to support the NAVO MSRC. Finally, Raytheon E-Systems of Garland, TX was awarded the contract to support the ARL MSRC

(U) There are currently 17 distributed centers. In FY 2001 three existing centers were upgraded. Currently funding exists in the 2002 budget to upgrade or establish approximately five distributed centers. Currently identified distributed centers and their locations are as follows:

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- Air Armaments Center (AAC), Eglin AFB, FL
- Air Force Flight Test Center (AFFTC), Edwards AFB, CA
- Air Force Research Laboratory/ Information Directorate (AFRL/SN), Rome, NY
- Air Force Research Laboratory/ Sensors Directorate (AFRL/IF), Wright-Patterson AFB, OH
- Army High Performance Computing Research Center (AHPCRC), Minneapolis, MN
- Arnold Engineering Development Center (AEDC), Arnold AFB, TN
- Arctic Region Supercomputing Center (ARSC), Fairbanks, AK
- Joint National Test Facility (JNTF), Schriever AFB, CO
- Maui High Performance Computing Center (MHPCC), Maui, HI
- Naval Air Warfare Center - Aircraft Division (NAWC-AD), Patuxent River NAS, MD
- Naval Air Warfare Center - Weapons Division (NAWC-WD), China Lake, CA
- Naval Research Laboratory (NRL-DC), Washington, DC
- Redstone Technical Test Center (RTTC), Huntsville, AL
- Space and Missile Defense Command (SMDC), Huntsville, AL
- Space and Naval Warfare Systems Center (SSCSD), San Diego, CA
- Tank-Automotive Research, Development and Engineering Center (TARDEC), Warren, MI
- White Sands Missile Range (WSMR), NM

(U)The Defense Research and Engineering Network (DREN) provides wide area network (WAN) connectivity among the Department's High Performance Computing resources (high performance computing systems and the HPC user base of scientist and engineers in the research, development test and evaluation community). The DREN is implemented through the DREN Intersite Services Contract (DISC) awarded to American Telephone and Telegraph (AT&T) in FY 1996. This contract allows the government to purchase high-speed network service to anywhere in the United States at bandwidths ranging from 3.0 megabits per second to 622 megabits per second (OC-12), with upgrade potential to 2.4 gigabits per second (OC-48). A follow-on contract will be awarded in FY2002.

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(U) Given the international availability of high performance computer hardware, the protection of DoD software investments has become increasingly critical. Beginning in FY 2002 and continuing into the out-years, technologies and methodologies will be developed to protect and limit end-use of software while minimizing the burden on an authorized end-user. New PET contracts have been awarded to Mississippi State University, Mississippi State, MS and High performance Technologies, Inc., Arlington, VA.

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HPCM/P507	171.727	183.524	188.642	189.073	190.266	196.949	199.306	Continuing	Continuing

(U) Project Number and Title: P507 HPCM

(U) PROGRAM ACCOMPLISHMENTS AND PLANS

(U) FY 2001 Accomplishments:

(U) Congressional adds as follows: ($9.300 million)
High Performance Visualization Center ($3.0 million)
MHPCC Operations ($1.6 million)
Multi Threat Architecture System ($2 million)
SMDC Simulation Center Upgrade ($2.7 million)

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(U) Shared Resource Centers: The program sustained the existing capability and continued the modernization process by acquiring additional HPC systems, storage, and scientific visualization capabilities to populate and upgrade the established MSRCs to fulfill the FY2001 HPC requirements of the laboratories and R&D centers. The program identified evaluated and prioritized HPC requirements for DCs, began acquisition of an updated system at the Arctic Region Supercomputing Center and upgraded systems at the Naval Research Laboratory DC. Additionally upgrades were accomplished at the Army High Performance Computing Research Center and the Space and Missile Defense Command DCs. The PET aspect of the program was re-competed and transitioned to Software Applications Support for FY 2002 execution.

(U) MSRC Sustainment: The program sustained and supported the integration, operation and use of HPC computational resources at the MSRCs. Partial year sustainment and operations for systems purchased and deployed in FY 2001 and cost saving resulting in the retirement of older HPC systems are included in the total FY 2001 funding requested. Funding was provided to support scientific visualization efforts. ($ 88.231 million)

(U) Distributed Center Sustainment: The program funded sustainment and operations at the Maui High Performance Computing Center and the Arctic Region Supercomputer Center in FY 2001. Acquisition of a Multi Threat Architecture System for the Naval Research Laboratory and system upgrades for the Space and Missile Defense Command were provided. Due to program funding limitations recognized in 1996, a decision was made to typically only support investments in HPC systems at new or existing DCs (except for the Maui High Performance Computing Center and the Arctic Region Supercomputer Center) with HPCMP procurement funding. In return for the HPCMP investment, the DC organization agrees to appropriately fund the sustainment and operations of the HPCMP equipment located at the site. The support to the Maui High Performance Computing Center and the Arctic Region Supercomputer Center in FY 2001 was made possible by a DoD decision to provide additional funding in FY 2001.
($ 27.146 million)

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(U) DREN: Planned upgraded services to increase bandwidth were accomplished at selected HPCMP sites. Low end users continued to be connected at 3 Mbps, mid range users at 155 Mbps and high range users at 622 Mbps. Operation of security systems and enhancements continued as planned. Collaborative work continued with the Federal networking community and standards associations to assure DREN remains compatible with future technology changes. A follow-on DREN commercial services contract is in acquisition with an award date expected by 2nd Quarter FY 2002. ($ 34.481 million)

(U) Software Applications Support: Development efforts in the CHSSI program continued to mature as some CHSSI projects were completed, and others begun. The CHSSI projects continued developing shared scalable applications supporting software to exploit scalable HPC assets. The Programming Environments and Training element of the program, currently contained within the MSRC support initiative was recompeted and realigned under the Software Applications Support Initiative area for FY 2002 execution. ($ 21.869 million)

(U) FY 2002 Plans:

(U) Shared Resource Centers: The program will sustain the existing capability and continue modernizing HPC systems, storage, and scientific visualization capabilities to fulfill a significant portion of the projected the R&D & laboratory and center HPC requirements. Acquisition activities will begin for follow-on support at the MSRCs.

(U) MSRC Sustainment: The program will sustain and support the integration, operation and use of HPC computational resources at the four MSRCs. FY 2002 funding reductions will delay program wide initiatives and operations tempo at each of the four centers. ($ 74.968 million)

(U) Distributed Center Sustainment: Due to program funding limitations recognized in 1996, a decision was made to typically only support investments in HPC systems at new or existing DCs with HPCMP procurement funding. In return for the HPCMP investment, the DC organization agrees to appropriately fund the sustainment and operations of the HPCMP equipment located at the site. There are two exceptions. The program has budgeted $8M each for the Maui High Performance Computing Center and the Arctic Region Supercomputer Center in FY 2002. (16.846 million)

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(U) DREN: Network services provided under DISC will transition to the follow-on service provider. Operation of security systems and enhancements will continue. Collaborative work will continue with the Federal networking community and standards associations to assure DREN remains compatible with future technology change. FY 2002 funding reductions will delay implementation of VPN technology. ($ 31.245 million)

(U) Software Applications Support: Development efforts in the CHSSI program will continue to mature as some CHSSI projects are completed, and others are begun. The CHSSI projects will continue developing shared scalable applications supporting software to exploit scalable HPC assets. The Programming Environments and Training effort will continue to provide computational and computer science support to the DoD HPC user community through interaction and collaborative projects with academic and industrial partners. A program will be established to develop technologies and methodologies to protect and limit end-use of high performance computing applications software while minimizing the burden on authorized end-users. This effort is intended to strengthen DoD's protection mechanisms thus reducing the risk that these high value applications could be employed by an unauthorized user. FY 2002 funding reductions will delay software development and protection efforts. ($ 60.465 million)

(U) FY 2003 Plans:

(U) Shared Resource Centers: The program will sustain the existing capability and continue modernizing HPC systems, storage, and scientific visualization capabilities to fulfill a significant portion of the projected the R&D & laboratory and center HPC requirements.

(U) MSRC Sustainment: The program will sustain and support the integration, operation and use of HPC computational resources at the four MSRCs. ($ 78.504 million)

(U) Distributed Center Sustainment: Due to program funding limitations recognized in 1996, a decision was made to typically only support investments in HPC systems at new or existing DCs with HPCMP procurement funding. In return for the HPCMP investment, the DC organization agrees to appropriately fund the sustainment and operations of the HPCMP equipment located at the site. There are two exceptions. The program has budgeted for sustainment and operations at the Maui High Performance Computing Center and the Arctic Region Supercomputer Center. ($ 22.461 million)

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(U) Networking: Network services will be provided. Operation of security systems and enhancements will continue. Collaborative work will continue with the Federal networking community and standards associations to assure DREN remains compatible with future technology change.
($ 32.912 million)

(U) Software Applications Support: Development efforts in the CHSSI program will continue to mature as some CHSSI projects are completed, and others are begun. The CHSSI projects will continue developing shared scalable applications supporting software to exploit scalable HPC assets. The Programming Environments and Training effort will continue to provide computational and computer science support to the DoD HPC user community through interaction and collaborative projects with academic and industrial partners. Efforts will continue to develop technologies and methodologies to protect and limit end-use of high performance computing applications software while minimizing the burden on authorized end-users. ($ 54.765 million)

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(U) B. Program Change Summary	FY 2001	FY 2002	FY 2003
Previous President's Budget Submission	164.027	137.988	162.290
Delta	7.700	50.388	0.000
FY 2002 Amended President's Budget Submission	171.727	188.376	162.290
Appropriated Value	173.327	185.600	0.000
Adjustments to Appropriated Value			
a. Congressionally Directed Undistributed Reduction	0.000	-2.076	0.000
b. Rescission/BTR, Inflation Adj	-1.600	0.000	0.000
c. Other	0.000	0.000	26.352
Current FY 2003 Budget Submission	171.727	183.524	188.642

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Change Summary Explanation:

(U) Funding: FY 2001 and FY 2002 reductions reflect congressional adjustments and program budget decisions. Adjustments for FY 2003 are due to program budget decisions

(U) Schedule: N/A

(U) Technical: N/A

(U) C. Other Program Funding Summary Cost

FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY2007
95.376	79.418	75.311	49.457	50.421	51.917	53.060	54.161

To Complete Total Cost
Continuing Continuing

MILESTONE SCHEDULE:Fiscal Years
Milestone II Decision Review1Q 1996
Awards for MSRC Contracts (Performance Level 1) 2Q, 3Q, 4Q 1996
Award for DREN (DISC) 4Q 1996
MSRC Performance Level 1 Capability Installed 1Q 1997 - 4Q 1997
In-Process Review 3Q 1997
MSRC Performance Level 2 Capability Installed 2Q 1997 - 3Q 1998
DREN Initial Performance Capability 3Q 1997
IDREN to DREN Transition Complete 4Q 1998

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MSRC Performance Level 3 Capability Installed 2Q 1999 - 3Q 2000
Program Review 2000 3Q 2000
Establish Basic Purchase Agreement With Major Vendors Through GSA Contract) 1Q - 2Q 2001
PET Follow-on Contract(s) (Recompete) 3Q 2001
DREN Follow-on Contract (Recompete) 2Q 2002
MSRC Technology Insertion-01 Capability Installed 2Q 2001 - 1Q 2002
MSRC Technology Insertion-02 Capability Installed 2Q 2002 - 1Q 2003
Program Review 2002 3Q 2002

(U) D. Acquisition Strategy:

(U) Program Environments and Training (PET): A full and open competition has been completed for follow-on PET activity in FY 2002.

(U) Defense Research and Engineering Network (DREN): A full and open competition is ongoing for the follow-on to DREN. A contract extension has been negotiated to allow for a 12 - 18 month transition. Award of the new contract is planned for the no later than the end of the 2nd quarter FY 2002.

(U) Major Shared Resource Centers: Technology Insertion – 2002 is ongoing. Each year the program collect benchmark performance information in the form of DoD relevant application benchmarks and specific performance-based quotes from the HPC vendors in order to formulate specific procurement plans.

(U) E. Schedule Profile: N/A