RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)									DATE June 2001	
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense Wide/BA 3							R-1 ITEM NOMENCLATURE High Performance Computing Modernization **PE 0603755D8Z**			
COST *(In Millions)*	FY2000	FY2001	FY2002						Cost to Complete	Total Cost
Total Program Element (PE) Cost	163.677	171.727	188.376						Continuing	Continuing
HPCM/P507	163.677	171.727	188.376						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 academe, 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 a set of four large Major Shared Resources Centers (MSRCs), seventeen Distributed Centers (DCs), the Defense Research and Engineering Network and the Common High Performance Computing Software Support Initiative (CHSSI). 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, programming environments, and training. 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 expertise located at the 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 Common HPC Software Support Initiative (CHSSI) develops a set of critical common DoD applications programs that run efficiently on advanced HPC systems at the MSRCs and Distributed Centers.

(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:

- Provide the best commercially available high-end HPC capability.
- Acquire and develop joint-need HPC applications, software tools and programming environments.

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- 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 2000 three existing centers were upgraded; and four new centers were added. Currently only limited funding exists in the 2001 budget for consideration of upgrades to existing centers or establish new ones. Currently identified distributed centers and their locations are listed below:

• Air Armaments Center (AAC), Eglin AFB, FL
• Air Force Flight Test Center (AFFTC), Edwards AFB, CA

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- 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 FY2001.

(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, t echnologies and methodologies will be developed to protect and limit end-use of software while minimizing the burden on an authorized end-user.

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HPCM/P507	163.677	171.727	188.376						Continuing	Continuing

(U) Project Number and Title: P507 HPCM

(U) PROGRAM ACCOMPLISHMENTS AND PLANS

(U) FY 2000 Accomplishments:

(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 projected HPC requirements of the laboratories and R&D centers. During FY 1999 and FY 2000, contract options were executed to meet the required performance levels at the four MSRCs, minimally tripling their computing capabilities from the previous performance levels. The program continued to identify evaluate and prioritize HPC requirements for DCs and acquired and deployed new systems or upgrades to existing systems as needed to accomplish RDT&E mission needs. Basic purchase agreements through existing GSA contracts were established with each major vendor to support FY 2000 and out equipment acquisitions.

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(U)Networking: Researchers were able to take greater advantage of their connectivity to high performance computing systems and other researchers causing the bandwidth demands on DREN to continue to grow. More user sites were able to take full advantage of the DREN ATM fabric. The majority of the effort in FY 2000 centered on upgrading services to selected sites and increasing bandwidth. Low end users continued to be connected at 3 Mbps, while mid and high range users were connected at 155 Mbps and high range users at 622 Mbps. Previously planned upgrades were accomplished. Additional security enhancements were implemented. Collaborative work continued with the Federal networking community and standards associations to assure DREN remained compatible with future technology changes. Formal acquisition planning for the DREN follow-on contract continued and a request for information was issued to industry to assure new contracts are in place in FY 2001.($ 28.620 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.($ 20.520 million)

(U) MSRC Sustainment: The program sustained and supported the integration, operation and use of HPC computational resources at the four MSRCs. Acquisition planning for the program environments and training (PET) aspect of the program was completed. Partial year sustainment and operations for systems purchased and deployed in FY 2001 and cost saving resulting from the retirement of older HPC systems are included in the total FY 2001 funding requested. ($ 87.276 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 2000. 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. The support to the Maui High Performance Computing Center and the Arctic Region Supercomputer Center in FY 2000 was made possible by a DoD decision to provide additional funding in FY 2000. ($ 26.461 million)

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(U) FY 2001 Plans:

(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)

(U) Shared Resource Centers: The program will sustain the existing capability and continue the modernization process by acquiring additional HPC systems, storage, and scientific visualization capabilities to populate and upgrade the established MSRCs to fulfill the projected HPC requirements of the laboratories and R&D centers. The program will continue to identify evaluate and prioritize HPC requirements for DCs and will acquire and deploy new systems or upgrades to existing systems as needed to accomplish RDT&E mission needs. The PET aspect of the program will be re-competed and transitioned to Software Applications Support for FY 2002 execution.

(U) Networking: The majority of the effort in FY 2001 will be to upgrade services to all sites and increase bandwidth. Low end users will continue to be connected at 3 Mbps, mid range users will be connected at 155 Mbps and high range users will be connected at 622 Mbps. 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 changes. A follow-on DREN commercial services contract will be recompeted and awarded.($ 32.191 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 element of the program, currently contained within the MSRC support initiative will be recompeted and realigned under the Software Applications Support Initiative area for FY 2002 execution. ($ 22.204 million)

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(U) MSRC Sustainment: The program will sustain and support 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 is provided to support scientific visualization efforts. ($ 90.186 million)

(U) Distributed Center Sustainment: The program will fund 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 will be 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. The Maui High Performance Computing Center and the Arctic Region Supercomputer Center are programmed to receive $ 5.0 Million each per year in sustainment and operations funding in the out years. ($ 27.146 million)

(U) FY 2002 Plans:

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

(U) Networking: 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.
($ 32.884 million)

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(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.
($ 62.553 million)

(U) MSRC Sustainment: The program will sustain and support the integration, operation and use of HPC computational resources at the four MSRCs. $18.0 million in funding will be realigned to Software Applications Support for Programming Environments and Training effort ($ 76.093 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) B. Program Change Summary	**FY2000**	**FY2001**	**FY2002**	**Total Cost**
Previous President's Budget Submit	164.262	164.027	137.988	Continuing
Appropriated Value	0.000	173.327	0.000	Continuing
Adjustments to Appropriated Value				
a. Congressionally Directed Undistributed Reduction	0.000	-1.213	0.000	
b. Rescission/Below-threshold Reprogramming, Inflation Adjustment	-.585	-0.387	0.000	
c. Other	0.000	0.000	50.388	
Current President's Budget	163.677	171.727	188.376	Continuing

Change Summary Explanation

(U) Funding: The funding adjustments in FY 2000 are based program budget decisions. FY 2001 reductions reflect Section 8086 adjustments and program budget decisions.

(U) Schedule: N/A

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(U) Technical: N/A

(U) C. Other Program Funding Summary Cost

FY 2000	FY 2001	FY 2002
95.376	79.418	50.763

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
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) 3Q 2001
MSRC Technology Insertion-01 Capability Installed 2Q 2001 - 1Q 2002

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(U) D. Acquisition Strategy: (U)Program Environments and Training (PET): A full and open competition is ongoing for the follow-on PET activity. This will be coupled with a six month contract extension to insure a smooth transition. Award of the new contract is planned for the summer of 2001.

(U) Defense Research and Engineering Network (DREN): A full and open competition is ongoing for the follow-on to DREN. A contract extension is also being negotiated to allow for a 12- 18 month transition. Award of the new contract is planned for the summer of 2001.

(U) Major Shared Resource Centers: Technology Insertion – 01 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