Exhibit R-2, RDT&E Budget Item Justification							Date: February 2005	
Appropriation/Budget Activity RDT&E, DW BA3				R-1 Item Nomenclature: High Performance Computing Modernization Program PE 0603755D8Z				
Cost ($ in millions)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Total PE Cost	197.526	222.927	189.747	192.101	201.127	200.471	204.635	209.272

A. Mission Description and Budget Item Justification:

BRIEF DESCRIPTION OF ELEMENT

The Department of Defense (DoD) High Performance Computing (HPC) Modernization Program 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. The results of these efforts feed directly into the acquisition process by improving weapons system designs through an 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, 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.

The HPC Modernization Program has established and supports four major shared resource supercomputing centers (MSRCs) as well as several smaller, special-purpose distributed supercomputing centers (DCs). These centers directly support the DoD S&T and T&E laboratories and test centers and are accessible to local and remote scientists and engineers via high-speed network access. An integral part of the program is 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. 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.

The HPC Modernization Program user base includes 4,572 Scientists and Engineers at about 180 (Department of Defense Laboratories and Test Centers, academic institutions and commercial businesses). The integrated HPC program consists of Shared Resource Centers; 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 T&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 HPC Modernization Program 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 T&E user sites via the Defense Research and Engineering Network (DREN). Additionally, the Software Application Support component develops critical common DoD applications programs that run efficiently on advanced HPC systems, supports technology transition activities with academic and commercial institutions, trains users, builds collaborative programming environment, and develops mechanisms to protect high value HPC application codes.

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 Program goals are to:

- 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.

There are currently 16 distributed centers. In FY 2004 five existing centers were upgraded, and funding exists in the 2005 Procurement budget to upgrade or establish approximately five distributed centers. Currently supported distributed centers and their locations are as follows:

- Aberdeen Test Center, Aberdeen, MD
- Aeronautical Systems Center Simulation and Analysis Facility, Wright-Patterson AFB, OH
- Air Force Research Laboratory/ Information Directorate (AFRL/IF), Rome, NY
- Air Force Weather Agency, Offutt AFB, NE
- Army High Performance Computing Research Center (AHPCRC), Minneapolis, MN
- Arnold Engineering Development Center (AEDC), Arnold AFB, TN
- Arctic Region Supercomputing Center (ARSC), Fairbanks, AK
- Fleet Numerical Meteorology and Oceanography Center, Monterey, CA
- Joint Forces Command (J9), Wright-Patterson AFB, OH and Maui, HI
- Maui High Performance Computing Center (MHPCC), Maui, HI
- Naval Air Warfare Center - Aircraft Division (NAWC-AD), Patuxent River NAS, MD
- Naval Research Laboratory (NRL-DC), Washington, DC
- Redstone Technical Test Center, Huntsville, AL
- Space and Missile Defense Command (SMDC), Huntsville, AL

- Space and Naval Warfare Systems Center, San Diego, San Diego, CA
- White Sands Missile Range, White Sands Missile Range, NM

In FY 2004 two MSRCs were upgraded and funding exists in the FY 2005 Procurement budget to upgrade 2 centers. The four MSRCs are:

- Army Research Laboratory (ARL), Aberdeen Proving Grounds, MD
- Aeronautical Systems Center (ASC), Wright-Patterson AFB, OH
- US Army Engineer Research and Development Center, Vicksburg, MS
- Naval Oceanographic Office, Stennis Space Center, MS

The Defense Research and Engineering Network (DREN) provides wide area network (WAN) connectivity among the Department's S&T and T&E communities. The DREN is implemented through an Intersite Services Contract awarded to MCI (WORLDCOM) during FY 2002. DREN currently provides services to sites throughout the continental United States, Alaska, Hawaii, and can be extended overseas where necessary. Minimal access is DS-3 (45 Mbps) with potential high-end access of OC-768 (40 Gbps) over the next 9 years. Current site connectivity ranges from DS-3 to OC-48 (2 Gbps). A Secret DREN using common Secret systems high key with NSA certified Type-1 encryptors that can transport classified traffic at OC-3 (155 Mbps) has also been deployed.

The HPC Modernization Program employs state-of-the-art WAN security as well as strong host and user security creating a defense-in-depth security architecture.

B. Program Change Summary: The Program was transferred by direction of Congress from the Department of the Air Force to the Department of Defense for FY 2004 execution.

	FY 2004	FY 2005	FY 2006	FY 2007
Previous President's Budget:	202.492	186.666	191.114	193.090
Current FY 2006 President's Budget Submission:	197.526	222.927	189.747	192.101
Adjustments to Appropriated Value:	-4.966	+36.261	-1.367	-0.989
Congressional Program Reductions:	-1.370	-15.289		
Congressional Rescissions:				
Congressional Increases:		+51.550		
Reprogrammings				
SBIR/STTR Transfers:	-3.596			
Program Adjustment:			-1.367	-0.989

C. Other Program Funding Summary:

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
0902198D8Z Major Equipment OSD	48.428	52.369	49.501	50.582	51.958	53.332	54.687	57.322

D. Acquisition Strategy: N/A

E. Performance Metrics:

The HPC Modernization Program supports a cross-Service virtual community of computational scientists and engineers who work together to solve DoD's most challenging problems. Ten computational technology areas have been established to categorize computational projects: Computational Structural Mechanics; Computational Fluid Dynamics; Computational Electromagnetics and Acoustics; Environmental Quality Modeling and Simulation; Climate/Weather/Ocean Modeling and Simulation; Signal and Image Processing; Computational Chemistry and Materials Science; Computational Electronics and Nanoelectronics; Forces Modeling and Simulation/C4I; and Integrated Modeling and Test Environments. These Computational Technology areas were established as fully integrated cross Service entities. Hence DoD's top scientists are working together to solve DoD's most challenging problems. The vast majority of data used on the HPC systems is created on these systems through modeling and simulation efforts associated with specific research and development efforts.
The bulk of program funding is used for operations and maintenance; therefore most costs at a given point in time are fixed rather than variable. When new contracts are awarded variance is limited to the year in which the work is transitioned from the old to the new provider. Based upon work accomplished to date, performance goals will be achieved if funding remains sufficient to satisfy minimum requirements. The HPC Modernization Program is a modernization effort that must attempt to provide the best commercially available supercomputing capability to the DoD laboratories and test centers. Requirements are projected to exceed funding available for the foreseeable future. The program develops projects in the most efficient manner possible based upon funding available.

Performance Metrics Table

Fiscal Year	Strategic Goals Supported	Existing Baseline	Planned Performance Improvement Goal	Actual Performance Improvement Results	Planned Performance Metric	Actual Performance Metric
2004	Provide the best commercially available high-end HPC capability	37.9 Habu Equivalents	Add 50% more capability	TBD	Add 19.0 Habu Equivalents	TBD

2004	Link users and computer sites via high-capacity networks, facilitating user access and distributed computing environments.	Virtual Private Network on shared Infrastructure - 0% links encrypted	Add encryption to further secure communications	TBD	95% links encrypted by end of FY	TBD

Fiscal Year	Measurement Area	Measurement Category	Measurement Indicator	Baseline	Planned Improvements to Baseline	Actual Results
2005	Networking	Total Aggregate Bandwidth Delivered to the User Community	Gigabits per Second (Gbps)	14.3 Gbps	4.7 Gbps	TBD
2005	Networking	Customer Satisfaction: Users / Customers Rating DREN Above Average	1 to 5 scale	4	4	TBD
2005	Security	Cat 1 & Cat 2 Security Incidents as Percent of Number of events	Percent of Total Security Events	0.02%	0.02%	TBD
2005	HPC Capability	Percent of non-real-time Systems' Requirements (Projected) Satisfied (Actual)	Habu Equivalents	72.4 Habus	43.4 Habus	TBD
2006	Networking	Total Aggregate Bandwidth Delivered to the User Community	Gigabits per Second (Gbps)	19.0 Gbps	1.0 Gbps	TBD
2006	Networking	Customer Satisfaction: Users / Customers Rating DREN Above Average	1 to 5 scale	4	4	TBD

2006	Security	Cat 1 & Cat 2 Security Incidents as Percent of Number of events	Percent of Total Security Events	.02%	.02%	TBD
2006	HPC Capability	Percent of non-real-time Systems' Requirements (Projected) Satisfied (Actual)	Habu Equivalents	115.8 Habus	69.4 Habus	TBD
2007	Networking	Total Aggregate Bandwidth Delivered to the User Community	Gigabits per Second (Gbps)	20.0 Gbps	1.0 Gbps	TBD
2007	Networking	Customer Satisfaction: Users / Customers Rating DREN Above Average	1 to 5 scale	4	4	TBD
2007	Security	Cat 1 & Cat 2 Security Incidents as Percent of Number of events	Percent of Total Security Events	.02%	.02%	TBD
2007	HPC Capability	Percent of non-real-time Systems' Requirements (Projected) Satisfied (Actual)	Habu Equivalents	185.2 Habus	111.1 Habus	TBD

Generally, the HPC Modernization Program management team evaluates the effectiveness of each program component by measuring actual cost and schedule performance versus planned cost and schedule performance and through the measurement of actual outcomes verses planned outcomes. The financial manager conducts in-depth semi-annual reviews with each major component manager and major field activity to review actual cost performance against budgeted cost goals in a tailored WBS format with special attention on variance analysis. Significant variances are reported to the program director and corrective actions taken. Prior to each review, each major component provides data in a standardized format provided by the program office

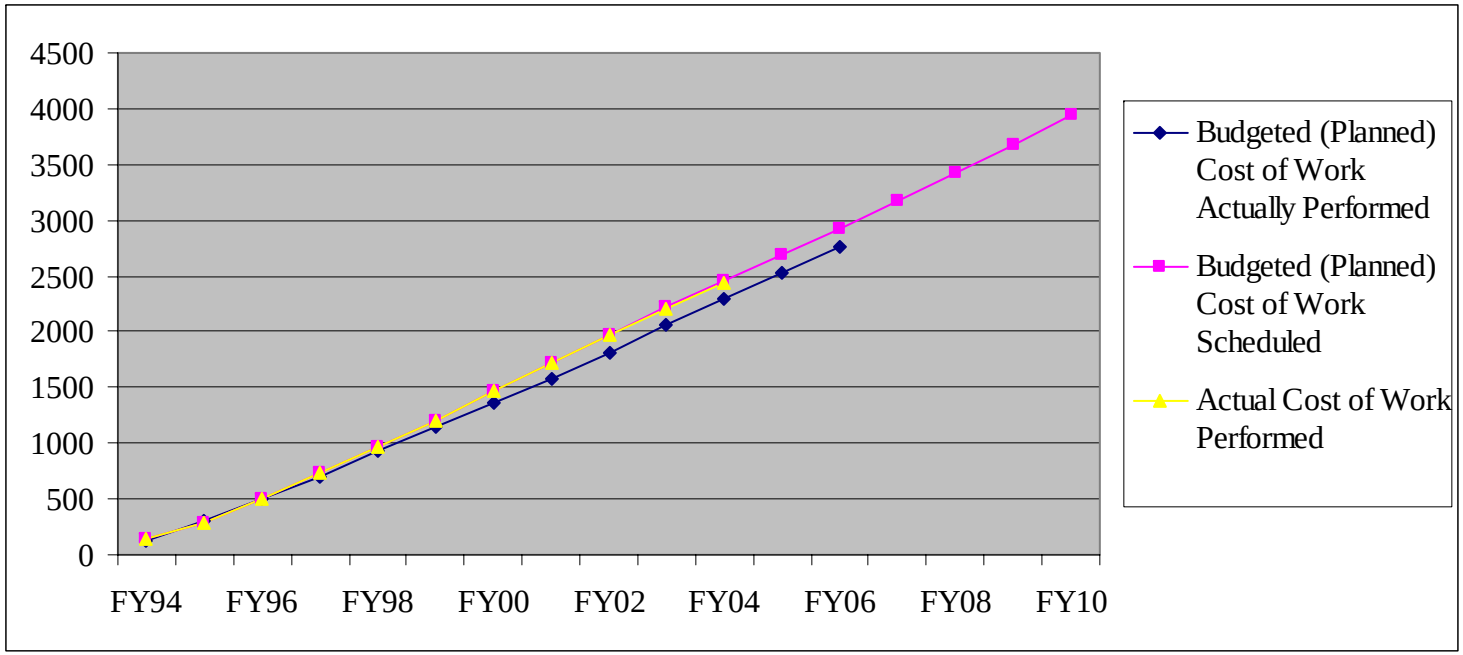
HPC Centers: Operations and maintenance activities are tracked through weekly teleconferences, monthly reports and semi-annual budget reviews. The MSRC contractors submit several reports on a regularly scheduled basis including a monthly financial summary report (FSR) and

a quarterly contract funds status report (CFSR). Each contract specifies as a deliverable a work breakdown structure (WBS) to facilitate on-going review of smaller task components. Cost/schedule status reports are one of the primary tools used for oversight management of Major Shared Resource Centers. Extensive cost variance analysis is used to compare costs across the centers and to compare current and projected operating & maintenance costs to historical records and approved operating plans. All sites report on a common work break down structure facilitating this level of review. Extensive Excel spreadsheets have been developed to facilitate comparisons. Sites report monthly operating performance against established performance metrics. Cumulative and site specific performance is analyzed and summarized in an Oracle database and presented on a set of standard reports.

Networking: Near-real-time tracking of key performance measures is available through a browser interface. Monthly reports are provided that track performance and assess any incurred penalty credits. Subprojects (e.g. IPv6 transition) are reviewed monthly against cost schedule and performance goals.

Software Applications Support: The Programming Environments and Training contractors submit several reports on a regularly scheduled basis including a monthly financial summary report (FSR) and a quarterly contract funds status report (CFSR). Each contract specifies as a deliverable a work breakdown structure (WBS) to facilitate on-going review of smaller task components. Cost/schedule status reports are one of the primary tools used SAS program manager. Extensive cost variance analysis is used to compare current and projected costs to historical records and approved plans. All software projects establish a baseline that includes project technical, cost, and schedule goals and requirements for protection of government intellectual property rights and national security assets, which might result from the software development.

Performance Summary Table ($ in millions)


4500
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FY10
Budgeted (Planned) Cost of Work Actually Performed
Budgeted (Planned) Cost of Work Scheduled
Actual Cost of Work Performed

Exhibit R-2a, RDT&E Project Justification								Date: February 2005
Appropriation/Budget Activity RDT&E, DW BA3				R-1 Item Nomenclature: High Performance Computing Modernization Program PE 0603755D8Z				
Cost ($ in millions)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Total PE Cost	197.526	222.927	189.747	192.101	201.127	200.471	204.635	209.272

A. Brief Description Of Element

The Department of Defense (DoD) High Performance Computing (HPC) Modernization Program 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.

The HPC Modernization Program has established and supports four major shared resource supercomputing centers (MSRCs) as well as several smaller, special-purpose distributed supercomputing centers (DCs).

The HPC Modernization Program user base includes 4,572 Scientists and Engineers at about 180 sites (Department of Defense Laboratories and Test Centers, academic institutions and commercial businesses). The integrated HPC program consists of shared resource centers, networking and software initiatives.

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.

In FY 2004 two of 4 MSRCs were upgraded and funding exists in the FY 2005 Procurement budget to upgrade 2 centers.

There are currently 16 distributed centers. In FY 2004 five existing centers were upgraded, and funding exists in the 2005 Procurement budget to upgrade or establish approximately five distributed centers.

The Defense Research and Engineering Network (DREN) provides wide area network (WAN) connectivity among the Department's S&T and T&E communities.

The HPC Modernization Program employs state-of-the-art WAN security as well as strong host and user security creating a defense-in-depth security architecture.

B. Accomplishments/Planned Program

Shared Resource Centers	FY 2004	FY 2005	FY 2006	FY 2007
Accomplishment/ Effort/Subtotal Cost	118.673	139.517	93.806	97.766

FY 2004 Accomplishments:

Shared Resource Centers: The program sustained existing capability and continued modernizing HPC systems, storage, and scientific date analysis and visualization capabilities to fulfill a significant portion of the science and technology (S&T) and test and evaluation (T&E) community HPC requirements.

MSRC Sustainment: The program sustained and supported the integration, operation, and use of HPC computational resources at the four MSRCs. ($79.962 million)

Distributed Center Sustainment: Due to program funding limitations recognized in 1996, a decision was made to only support investments in HPC systems at new or existing DCs with HPC Modernization Program procurement funding. In return for the HPC Modernization Program investment, the DC organization agrees to appropriately fund the sustainment and operations of the HPC equipment located at the site. There are two exceptions. The program partially funded sustainment and operations at the Maui High Performance Computing Center and the Arctic Region Supercomputer Center. FY 2004 funding was increased $18.100 million by Congress.
($38.711 million)

FY 2005 Plans:

Shared Resource Centers: The program will sustain existing capability and continued modernizing HPC systems, storage, and scientific date analysis and visualization capabilities to fulfill a significant portion of the science and technology (S&T) and test and evaluation (T&E) community HPC requirements.

MSRC Sustainment: The program will sustain and support the integration, operation and use of HPC computational resources at the four MSRCs. ($76.491 million)

Distributed Center Sustainment: Due to program funding limitations recognized in 1996, a decision was made to only support investments in HPC systems at new or existing DCs with HPC Modernization Program procurement funding. In return for the HPC Modernization Program investment, the DC organization agrees to appropriately fund the sustainment and operations of the HPC Modernization Program equipment located at the site. There are two exceptions. The program budget includes funds for partial sustainment and operations at the Maui High Performance Computing Center and the Arctic Region Supercomputer Center. The FY2005 Defense Appropriation Acts included an additional

$46.6 million for Distributed Centers. ($63.026 million)

FY 2006 Plans:

Shared Resource Centers: The program will sustain existing capability and continued modernizing HPC systems, storage, and scientific date analysis and visualization capabilities to fulfill a significant portion of the science and technology (S&T) and test and evaluation (T&E) community HPC requirements.

MSRC Sustainment: The program will sustain and support the integration, operation and use of HPC computational resources at the four MSRCs. ($70.237 million)

Distributed Center Sustainment: Due to program funding limitations recognized in 1996, a decision was made to only support investments in HPC systems at new or existing DCs with HPC Modernization Program procurement funding. In return for the HPC Modernization Program investment, the DC organization agrees to appropriately fund the sustainment and operations of the HPC Modernization Program equipment located at the site. There are two exceptions. The program budget includes funds for partial sustainment and operations at the Maui High Performance Computing Center and the Arctic Region Supercomputer Center. ($23.569 million)

FY 2007 Plans:

Shared Resource Centers: The program will sustain existing capability and continued modernizing HPC systems, storage, and scientific date analysis and visualization capabilities to fulfill a significant portion of the science and technology (S&T) and test and evaluation (T&E) community HPC requirements.

MSRC Sustainment: The program will sustain and support the integration, operation and use of HPC computational resources at the four MSRCs. ($73.745 million)

Distributed Center Sustainment: Due to program funding limitations recognized in 1996, a decision was made to only support investments in HPC systems at new or existing DCs with HPC Modernization Program procurement funding. In return for the HPC Modernization Program investment, the DC organization agrees to appropriately fund the sustainment and operations of the HPC Modernization Program equipment located at the site. There are two exceptions. The program budget includes funds for partial sustainment and operations at the Maui High Performance Computing Center and the Arctic Region Supercomputer Center. ($24.021 million)

Defense Research and Engineering Network	FY 2004	FY 2005	FY 2006	FY 2007
Accomplishment/ Effort/Subtotal Cost	32.317	28.399	32.766	31.570

FY 2004 Accomplishments:

Network services continued to be provided. Operation of security systems and enhancements continued. The DREN expanded internet protocol (IPv-6) testing for the Department of Defense and upgrade to full point-to-point encryption of the network. Collaborative work continued with the Federal networking community and standards associations to assure DREN remains compatible with future technology change.

FY 2005 Plans:

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.

FY 2006 Plans:

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.

FY 2007 Plans:

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.

Software Applications Support	FY 2004	FY 2005	FY 2006	FY 2007
Accomplishment/ Effort/Subtotal Cost	46.536	55.011	63.175	62.765

FY 2004 Accomplishments:

Development efforts in software programs continued to mature as projects were completed, and others begun. A new Academic Outreach Program was implemented to encourage and support computational science in universities across the United States. New Software Institutes were created to better develop shared scalable applications to exploit scalable HPC assets. The Programming Environments and Training effort continued to provide computational and computer science support to the DoD HPC user community through interaction and collaborative projects with academic and industrial partners. Efforts continued 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.

FY 2005 Plans:

Development efforts in software programs will continue to mature as projects are completed, and others begin. The Software Institutes will be fully implemented. Software projects will continue developing shared scalable applications 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.

FY 2006 Plans:

Development efforts in software programs will continue to mature as projects are completed, and others begin. Software projects will continue developing shared scalable applications 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.

FY 2007 Plans:

Development efforts in software programs will continue to mature as projects are completed, and others begin. Software projects will continue developing shared scalable applications 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.

C. Other Program Funding Summary:

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
0902198D8Z Major Equipment OSD	48.428	52.369	49.501	50.582	51.958	53.332	54.687	57.322

D. Acquisition Strategy: N/A

E. Performance Metrics:

Major Performers:

Four major contracts to support the MSRCs were competitively awarded between fourth quarter FY 2002 and first quarter FY 2003**.** These contracts provide comprehensive support services for up to eight years.
• Computer Science Corporation, Huntsville, AL (awarded two contracts)
• Lockeed Martin of Herndon, VA
• Raytheon E-Systems, Garland, TX

The DREN is implemented through the follow-on DREN Intersite Services Contract (DISC) awarded in FY 2002 and fully transitioned in FY 2003

• MCI WorldCom Communications, Inc, McLean, VA (FY 2002 – 2012)

Two contracts to provide programming environment and training services were awarded in FY 2001.

• Mississippi State University, Starkville, MS

• High Performance Technologies, Inc. (HPTi), Arlington, VA.

Other Major Contracts.

• Instrumental, Inc., Garland, TX (FY 2003)
• University of Alaska., Fairbanks, AK (FY 2002)

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Computational Structural Mechanics; Computational Fluid Dynamics; Computational Electromagnetics and Acoustics; Environmental Quality Modeling and Simulation; Climate/Weather/Ocean Modeling and Simulation; Signal and Image Processing; Computational Chemistry and Materials Science; Computational Electronics and Nanoelectronics; Forces Modeling and Simulation/C4I; and Integrated Modeling and Test Environments. These Computational Technology areas were established as fully integrated cross Service entities. Hence DoD's top scientists are working together to solve DoD's most challenging problems. The vast majority of data used on the HPC systems is created on these systems through modeling and simulation efforts associated with specific research and development efforts.

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2005	Networking	Customer Satisfaction: Users / Customers Rating DREN Above Average	1 to 5 scale	4	4	TBD
2005	Security	Cat 1 & Cat 2 Security Incidents as Percent of Number of events	Percent of Total Security Events	0.02%	0.02%	TBD
2005	HPC Capability	Percent of non-real-time Systems' Requirements (Projected) Satisfied (Actual)	Habu Equivalents	72.4 Habus	43.4 Habus	TBD
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2007	Networking	Total Aggregate Bandwidth Delivered to the User Community	Gigabits per Second (Gbps)	20.0 Gbps	1.0 Gbps	TBD	
2007	Networking	Customer Satisfaction: Users / Customers Rating DREN Above Average	1 to 5 scale	4	4	TBD	
2007	Security	Cat 1 & Cat 2 Security Incidents as Percent of Number of events	Percent of Total Security Events	.02%	.02%	TBD	
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Performance Summary Table ($ in millions)