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OSD RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

Date: February 2006

APPROPRIATION/ BUDGET ACTIVITY
RDT&E/ Defense Wide BA# 3

PE NUMBER AND TITLE

0603755D8Z - High Performance Computing Modernization Program

Cost (\$ in Millions)	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Total Program Element (PE) Cost	216.598	217.489	175.313	183.009	204.048	208.248	194.730
P507 High Performance Computing Modernization Program	216.598	217.489	175.313	183.009	204.048	208.248	194.730

A. Mission Description and Budget Item Justification: 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 established and supports four major shared resource supercomputing centers (MSRCs). The program also partially supports operations at two allocated distributed centers (ADCs) established by congressional direction. These centers are the Arctic Region Supercomputing Center (ARSC), Fairbanks, AK and the Maui High Performance Computing Center (MHPCC), Maui, HI. Two other ADCs, also congressionally established, do not receive programmed support through HPC Modernization Program funding, but provide supercomputing services to the DoD. These centers are the Army High Performance Computing Research Center (AHPCRC), Minneapolis, MN and the Space and Missile Defense Command (SMDC), Huntsville, AL and receive their support for operations through the Army. During FY2005 and prior years, there were also several smaller, special-purpose dedicated distributed centers (DDCs) that were annually established or upgraded based through a competitive selection process. However, these other centers will be retired as their systems become obsolete and funding for specialized programs will be provided through dedicated HPC project investments (DHPCPIs) beginning in FY2006. DHPCPIs will support a one-time need and have no legacy within the HPC Modernization Program. Centers and DHPCPIs 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 (DoD 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. ADCs, existing DDCs (until they are retired), and DHPCPIs augment the MSRCs to form the total HPC Modernization Program computational capability. DDCs (until retired) and DHPCPIs 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. All elements of the HPC Modernization Program are 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 environments, and develops mechanisms to protect high value HPC application codes.

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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 (1) Provide the best commercially available high-end HPC capability; (2) Acquire and develop joint-need HPC applications, software tools and programming environments; (3) Educate and train DoD's scientists and engineers to effectively use advanced computational environments; (4) Link users and computer sites via high-capacity networks, facilitating user access and distributed computing environments; and (5) Promote collaborative relationships among the DoD HPC community, the National HPC community and MSIs in network, computer and computational science.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	222.927	189.747	192.101
Current BES/President's Budget (FY 2007)	216.598	217.489	175.313
Total Adjustments	-6.329	27.742	-16.788
Congressional Program Reductions		-3.508	
Congressional Rescissions			
Congressional Increases		31.250	
Reprogrammings			
SBIR/STTR Transfer	-6.018		
Other	-0.311		-16.788

C. Other Program Funding Summary	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	To Compl	Total Cost
0902198DZ Major Equipment OSD	0.052	0.049	0.050	0.052	0.053	0.054	0.057	Continuing	Continuing

Comment: Funding exists in the 2006 Procurement budget to provide for approximately five Dedicated High Performance Computing Project Investments. In FY 2005, the MHPCC competed as a DDC and received an upgrade award. The AHPCRC and the SMDC received congressionally added funds for both operations and upgrades. The following DDCs were also provided upgrades through the annual competitive process mentioned earlier: Arnold Engineering Development Center (AEDC), Arnold AFB, TN; Air Force Seek Eagle Office, Eglin AFB, FL; Naval Surface Warfare Center, Carderock Division, W. Bethesda, MD; and Naval Undersea Warfare Center, Newport, RI.

In FY 2005 two MSRCs were upgraded and funding exists in the FY 2006 Procurement budget to upgrade 2 centers. The four MSRCs are: Army Research Laboratory (ARL), Aberdeen

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

D. Acquisition Strategy: Not Applicable.**E. Performance Metrics:**

FY	Strategic Goals Supported	Existing Baseline	Planned Performance Improvement / Requirement Goal	Actual Performance Improvement	Planned Performance Metric / Methods of Measurement	Actual Performance Metric / Methods of Measurement
05	Selected Resource Centers	72.4	43.4	65.6	Habus	Habus
05	Networking	14.3	4.7	6	Gbps	Gbps
05	Software Applications	4	4	4.2	Customer Satisfaction (0-5 scale)	Customer Satisfaction (0-5 scale)
06	Selected Resource Centers	138	69.4	TBD	Habus	Habus
06	Networking	20.3	1	TBD	Gbps	Gbps
06	Software Applications	4.2	4.2	TBD	Customer Satisfaction (0-5 scale)	Customer Satisfaction (0-5 scale)
07	Selected Resource Centers	207.4	111.1	TBD	Habus	Habus
07	Networking	21.3	1	TBD	Gbps	Gbps
07	Software Applications	4.2	4.2	TBD	Customer Satisfaction (0-5 scale)	Customer Satisfaction (0-5 scale)

Comment: All FY 2005 actual performance metrics exceeded those planned.

Significant funding reductions in FY 2007 will cause program changing adjustments beginning in FY 2006. Three courses of actions to compensate for these reductions have been briefed to the Director Defense Research and Engineering with an expected decision during the second quarter of FY2006. Performance Metrics could also be adjusted depending on the course of action chosen to compensate for budget reductions.

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OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)							Date: February 2006		
APPROPRIATION/ BUDGET ACTIVITY RDT&E/ Defense Wide BA# 3			PE NUMBER AND TITLE 0603755D8Z - High Performance Computing Modernization Program				PROJECT P507		
Cost (\$ in Millions)			FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
P507	High Performance Computing Modernization Program		216.598	217.489	175.313	183.009	204.048	208.248	194.730

A. Mission Description and Project Justification: 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.

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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. ADCs, existing DDCs (until they are retired), and DHPCPIs augment the MSRCs to form the total HPC Modernization Program computational capability. DDCs (until retired) and DHPCPIs 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. All elements of the HPC Modernization Program are 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 environments, and develops mechanisms to protect high value HPC application codes.

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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 (1) Provide the best commercially available high-end HPC capability; (2) Acquire and develop joint-need HPC applications, software tools and programming environments; (3) Educate and train DOD's scientists and engineers to effectively use advanced computational environments; (4) Link users and computer sites via high-capacity networks, facilitating user access and distributed computing environments; and (5) Promote collaborative relationships among the DoD HPC community, the National HPC community and MSIs in network, computer and computational science.

Funding exists in the FY 2006 Procurement budget to provide for approximately five DHPCPIs. In FY 2005, the MHPCC competed as a DDC and received an upgrade award. The AHPCRC and the SMDC received congressionally added funds for both operations and upgrades. The following DDCs were also provided upgrades through the annual competitive process mentioned earlier: Arnold Engineering Development Center (AEDC), Arnold AFB, TN; Air Force Seek Eagle Office, Eglin AFB, FL; Naval Surface Warfare Center, Carderock Division, W. Bethesda, MD; and Naval Undersea Warfare Center, Newport, RI.

In FY 2005 two MSRCs were upgraded and funding exists in the FY 2006 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; and Naval Oceanographic Office, Stennis Space Center, MS.

The 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 (WORLD COM) 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 7 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 and strong host and user security creating a defense-in-depth security architecture.

B. Accomplishments/Planned Program:

Accomplishment/Planned Program Title	FY 2005	FY 2006	FY 2007
Selected Resource Centers:	137.261	123.821	85.492

Since 1994, the program has sustained and regularly modernized HPC systems, storage, and scientific data 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. These efforts are planned to continue into future years with no set completion date. The program fully sustains and supports the integration, operation and use of HPC computational resources at four Major Shared Resource Centers. The program partially sustains and supports the integration, operation and use of HPC computational resources at two Allocated Distributed Centers. For several years two other Allocated Distributed Centers, sustained and supported by the Army have received modernization funding through congressional adjustments to the program's annual budget request. The program also makes other specialized systems investments that are sustained and supported by sponsoring Service organizations. Significant funding reductions in FY 2007 will cause program changing adjustments beginning in FY 2006. Three courses of action to compensate for these reductions have been briefed to the Director

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Defense Research and Engineering with an expected decision during the second quarter of FY 2006. Upon a final decision, funds will be transferred between the program's initiatives to support the final plan.										
Accomplishment/Planned Program Title							FY 2005	FY 2006	FY 2007	
Networking:							27.052	33.148	31.014	
Network services to link all elements of the program are provided by the Defense Research and Engineering Network (DREN) and operation of security systems and enhancements is continuous. The DREN has expanded internet protocol (IPv-6) testing for the Department of Defense and upgraded full point-to-point encryption of the network. Collaborative work with the Federal networking community and standards associations assures that the DREN will remain compatible with future technology change. These efforts are planned to continue into future years with no set completion date. However, significant funding reductions in FY 2007 will cause program changing adjustments beginning in FY 2006. Three courses of action to compensate for these reductions have been briefed to the Director Defense Research and Engineering with an expected decision during the second quarter of FY 2006. Upon a final decision, funds will be transferred between the program's initiatives to support the final plan. Depending on the course of action chosen, required reductions to network service and bandwidth to the community will further limit the support provided DoD laboratories and test centers.										
Accomplishment/Planned Program Title							FY 2005	FY 2006	FY 2007	
Software Applications:							52.285	60.520	58.807	
Development efforts in software programs continue to mature as projects are completed, and others begun. An Academic Outreach Program is supported to encourage and support computational science in universities across the United States. Software Institutes and portfolios develop shared scalable applications to exploit scalable HPC assets. The Programming Environments and Training effort provides computational and computer science support to the DoD HPC user community through interaction and collaborative projects with academic and industrial partners. On-going efforts are maintained 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. These efforts are planned to continue into future years with no set completion date. However, significant funding reductions in FY 2007 will cause program changing adjustments beginning in FY 2006. Three courses of action to compensate for these reductions have been briefed to the Director Defense Research and Engineering with an expected decision during the second quarter of FY 2006. Upon a final decision, funds will be transferred between the program's initiatives to support the final plan. Depending on the course of action chosen, the program could have to reduce Software Protection activities by 10% in FY 2007 and future years.										
C. Other Program Funding Summary		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	To Compl	Total Cost
0902198DZ Major Equipment OSD		51.962	49.500	50.600	52.000	53.300	54.700	57.300	Continuing	Continuing
<p>Comment: Funding exists in the FY 2006 Procurement budget to provide for approximately five Dedicated High Performance Computing Project Investments. In FY 2005, the MHPCC competed as a DDC and received an upgrade award. The AHPCRC and the SMDC received congressionally added funds for both operations and upgrades. The following DDCs were also provided upgrades through the annual competitive process mentioned earlier: Arnold Engineering Development Center (AEDC), Arnold AFB, TN; Air Force Seek Eagle Office, Eglin AFB, FL; Naval Surface Warfare Center, Carderock Division, W. Bethesda, MD; and Naval Undersea Warfare Center, Newport, RI.</p> <p>In FY 2005 two MSRCs were upgraded and funding exists in the FY 2006 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; and Naval Oceanographic Office, Stennis Space Center, MS.</p>										

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D. Acquisition Strategy: Not Applicable.

E. Major Performers Not Applicable.

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