OSD RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE
RDT&E/ Defense Wide BA# 3	**0603755D8Z - High Performance Computing Modernization Program**

Cost ($ in Millions)		FY 2006 Actual	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Total Program Element (PE) Cost		211.920	208.463	187.587	208.488	217.323	202.921	213.416	220.622
P507	High Performance Computing Modernization Program	211.920	208.463	187.587	208.488	217.323	202.921	213.416	220.622

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 HPC 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. 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 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, Fairbanks, AK and the Maui High Performance Computing Center, Maui, HI. Two other ADCs, also congressionally established, do not receive programmed support through the HPC Modernization Program, but provide supercomputing services to the DoD. The Army High Performance Computing Research Center, Minneapolis, MN and the Space and Missile Defense Command, Huntsville, AL receive their operational support from the Army. During FY2006 and prior years, there were also several smaller, special-purpose dedicated distributed centers (DDCs) that were annually established or upgraded based upon a competitive selection process. However, these centers will be retired as their systems become obsolete and funding for specialized programs is now provided through dedicated HPC project investments (DHPCPIs). DHPCPIs 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 sharing of knowledge, tools, and expertise.

HPC Modernization Program users include 5,275 Scientists and Engineers at approximately 180 locations (DoD Laboratories, 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. MSRCs are responsible for as large a fraction of DoD`s S&T and T&E computational workload as feasible and provide extensive capabilities to address user requirements for hardware, software, and programming environments. ADCs, existing DDCs (until retired), and DHPCPIs augment the MSRCs to form the program's total 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

OSD RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

Date: February 2007

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

PE NUMBER AND TITLE
0603755D8Z - High Performance Computing Modernization Program

value HPC application codes. Additional funding for Computational Research and Engineering Acquisition Tools and Environments (CREATE) has been provided by the DoD, beginning in FY2008. CREATE will produce supercomputer-based engineering design and test tools to improve the acquisition process for major weapons systems across the Department.

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) Acquire, deploy, operate and maintain best-value supercomputers; 2) Acquire, develop, deploy and support software applications and computational work environments that enable critical DoD research, development and test challenges to be analyzed and solved; 3) Acquire, deploy, operate and maintain a communications network that enables effective access to supercomputers and to distributed S&T/T&E computing environments; 4) Continuously educate the RDT&E workforce with the knowledge needed to employ computational modeling effectively and efficiently; and 5) Promote collaborative relationships among the DoD computational science community, the national computational science community and minority serving institutes.

As reported last year, FY2007 and FY2008 funding reductions caused major program adjustments. Each of the four MSRCs will reduce or relocate staff in FY2007 as help desk and scientific visualization functions are removed from the four centers and consolidated at three locations, each of which will serve the entire DoD community. While some hard to replace, qualified technical personnel from a very limited pool of highly talented people will be lost to the program, it is hoped that the consolidations will be invisible to the customer from a service perspective. In addition to consolidation savings, each of the MSRCs and the two partially supported ADCs adjusted core activities downward to operate within lower annual funding allocations. It is anticipated that overall staff reductions will equal approximately 25. Funding will be reduced for high bandwidth connects at two major sites. The bandwidths will either drop from OC48 to OC12 or other DoD components utilizing these links will fund the cost difference. Some bandwidth adjustments will also occur at lower bandwidth sites. The number of site specific security assessments conducted during FY07 and the out-years will be reduced. Efforts are underway to augment and replace some site specific security assessments with automated and remote security tools. The Programming Environments and Training component of the program will remove five management/administrative positions. Eleven technical projects that would have transferred important technologies from universities to DoD users will be cancelled.

B. Program Change Summary	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)	217.489	175.313	183.009	204.048
Current BES/President's Budget (FY 2008/2009)	211.920	208.463	187.587	208.488
Total Adjustments	-5.569	33.150	4.578	4.440
Congressional Program Reductions		-1.204		
Congressional Rescissions				
Congressional Increases		34.350		
Reprogrammings				
SBIR/STTR Transfer	-5.569			

OSD RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE
RDT&E/ Defense Wide BA# 3	**0603755D8Z - High Performance Computing Modernization Program**

Other		0.004	4.578	4.440

C. Other Program Funding Summary: Not Applicable.

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
06	Selected Resource Centers	138.0	69.4	169	Habus	Habus
06	Networking	20.3	1.0	3.2	Gbps	Gbps
06	Software Applications	4.2	4.2	4.2	Customer Satisfaction (0-5 scale)	Customer Satisfaction (0-5 scale)
07	Selected Resource Centers	307.0	154.0	TBD	Habus	Habus
07	Networking	23.5	1.0	TBD	Gbps	Gbps
07	Software Applications	4.2	4.2	TBD	Customer Satisfaction (0-5 scale)	Customer Satisfaction (0-5 scale)
08	Selected Resource Centers	461.0	191.1	TBD	Habus	Habus
08	Networking	24.5	1.0	TBD	Gbps	Gbps
08	Software Applications	4.2	4.2	TBD	Customer Satisfaction (0-5 scale)	Customer Satisfaction (0-5 scale)

Comment: All FY2006 actual performance metrics met or exceed those planned.

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 3	**0603755D8Z - High Performance Computing Modernization Program**	**P507**

Cost ($ in Millions)		FY 2006 Actual	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
P507	High Performance Computing Modernization Program	211.920	208.463	187.587	208.488	217.323	202.921	213.416	220.622

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 HPC 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 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, 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. The Army High Performance Computing Research Center (AHPCRC), Minneapolis, MN and the Space and Missile Defense Command, Huntsville, AL, receive their support for operations through the Army. During FY2006 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 are being be retired as their systems become obsolete and funding for specialized programs is currently provided through dedicated HPC project investments (DHPCPIs). DHPCPIs 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 5,275 Scientists and Engineers at approximately 180 locations (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. MSRCs are responsible for as large a fraction of DoD`s S&T and T&E computational workload as feasible. 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

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 3	**0603755D8Z - High Performance Computing Modernization Program**	**P507**

programming environments, 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 (1) Acquire, deploy, operate and maintain best-value supercomputers; (2) Acquire, develop, deploy and support software applications and computational work environments that enable critical DoD research, development and test challenges to be analyzed and solved; (3) Acquire, deploy, operate and maintain a communications network that enables effective access to supercomputers and to distributed S&T/T&E computing environments; (4) Continuously educate the RDT&E workforce with the knowledge needed to employ computational modeling effectively and efficiently; and (5) Promote collaborative relationships among the DoD computational science community, the national computational science community and minority serving institutes.

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 (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 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 2006	FY 2007	FY 2008	FY 2009
Selected Resource Centers:	122.692	107.689	90.418	102.049

FY2006 Accomplishments: The program sustained and supported the integration, operation and use of HPC computational resources at four Major Shared Resource Centers. The program also partially sustained and supported the integration, operation and use of HPC computational resources at two Allocated Distributed Centers. Also during FY2006, the program made other specialized systems investments that were sustained and supported by sponsoring Service organizations.

FY 2007/2008/2009 Plan: 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. 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. These efforts are planned to continue into future years with no set completion date.

As reported in last year's exhibits, funding reductions assessed for FY2007 and FY2008 caused major program adjustments beginning in FY2007. Each of the four MSRCs will reduce or relocate staff in FY2007 as help desk and scientific visualization functions are removed as separate functions at all four centers and consolidated at three locations, each of which will serve the entire HPC Modernization Program community. While some qualified technical personnel from a very limited pool of highly talented people will be lost to the program, it is hoped that the consolidations will be invisible to the customer from a service perspective. It will be very difficult to replace these personnel as shown by difficulties in recruitment over the last several years. In addition to consolidation savings, each of the MSRCs and the two partially Allocated Distributed Centers adjusted core activities downward to operate within lower annual funding allocations. It is anticipated that overall staff reductions will equal approximately 25 personnel.

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 3	**0603755D8Z - High Performance Computing Modernization Program**	**P507**

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
Networking:	30.544	41.477	29.561	32.507

FY2006 Accomplishments: The DREN provided high speed wide area network services to over 130 locations throughout the United States. Also, the DREN expanded internet protocol version 6 (IPv-6) testing for the Department of Defense and upgraded full point-to-point encryption of the network. DREN continued collaborative work with the federal networking community and standards associations.

FY 2007/2008/2009 Plan: Network services to link all elements of the program will provided by the Defense Research and Engineering Network (DREN) as well as operation of security systems and enhancements. Collaborative work with the federal networking community and standards associations will continue to assure that the DREN will remain compatible with future technology change. These efforts are planned to continue into future years with no set completion date.

Again as reported in last year's exhibits, funding reductions assessed for FY2007 and FY2008 caused program adjustments. In FY2007 the program will reduce funding for high bandwidth connects at two major sites. The connection bandwidths will either drop from OC48 to OC12 or other DoD components that utilize these links will fund the cost difference Some bandwidth adjustments will also occur at lower bandwidth sites. The number of site specific security assessments conducted during FY2007 and the out-years will be reduced. Efforts are underway to augment and replace some site specific security assessments with automated and remote security tools.

Accomplishment/Planned Program Title	FY 2006	FY 2007	FY 2008	FY 2009
Software Applications:	58.684	59.297	67.608	73.932

FY2006 Accomplishments: Development efforts in software programs continued to mature as other projects were completed, and others begun. Software Institutes and portfolios developed shared scalable applications to exploit scalable HPC assets. An Academic Outreach Program was supported to encourage and support computational science in universities across the United States. The Programming Environments and Training effort provided computational and computer science support to the DoD HPC user community through interaction and collaborative projects with academic and industrial partners. Efforts were maintained in 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 2007/2008/2009 Plan: Additional program funding for Computational Research and Engineering Acquisition Tools and Environments (CREATE) has been provided by the DoD, beginning in FY2008. CREATE will produce supercomputer-based engineering design and test tools to improve the acquisition process for major weapons systems across the Department. Development efforts in software programs will continue to mature as other projects are completed, and others begun with a greater emphasis on engineering applications. Software Institutes and portfolios will continue to develop shared scalable applications to exploit scalable HPC assets. An Academic Outreach Program will continue be supported to encourage and support computational science in universities across the United States. The Programming Environments and Training effort will provide computational and computer science support to the DoD HPC user community through interaction and collaborative projects with academic and industrial partners. On-going efforts will be 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.

Also as reported in last year's exhibits, funding reductions assessed for FY2007 and FY2008 caused major program adjustments. The Programming Environments and Training component of the HPC Modernization Program will remove five management/administrative positions. Eleven technical projects that would have transferred important technologies from universities to DoD users will be cancelled.

C. Other Program Funding Summary	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	To Compl	Total Cost

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2007

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 3	**0603755D8Z - High Performance Computing Modernization Program**	**P507**

0902198DZ Major Equipment OSD	52.767	50.089	51.132	52.651	54.429	56.790	57.536	58.345	Continuing	Continuing

Comment: In 2006, the AHPCRC received congressionally added funds for upgrades and the ARSC was also provided procurement funding for limited upgrades. The following DHPCPIs were also provided upgrades through the annual competitive process mentioned earlier: Massachusetts Institute of Technology Lincoln Laboratory, Lexington, MA; Dugway Proving Ground, Dugway, UT; Army Communications-Electronics Research Development and Engineering Command (CERDC), Fort Monmouth, NJ. Funding exists in the 2007 Procurement budget to provide for approximately five DHPCPIs.

In FY 2006 two MSRCs were upgraded and funding exists in the FY 2007 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.

D. Acquisition Strategy: Not Applicable.

E. Major Performers Not Applicable.