Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Office of Secretary Of Defense										DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*				R-1 ITEM NOMENCLATURE PE 0603755D8Z: *High Performance Computing Modernization Program*							
COST ($ in Millions)	**FY 2009 Actual**	**FY 2010 Estimate**	**FY 2011 Base Estimate**	**FY 2011 OCO Estimate**	**FY 2011 Total Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	209.164	235.486	200.986	0.000	200.986	210.217	216.449	219.770	223.515	Continuing	Continuing
P507: *High Performance Computing Modernization Program*	209.164	235.486	200.986	0.000	200.986	210.217	216.449	219.770	223.515	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Department of Defense (DoD) High Performance Computing (HPC) Modernization Program (HPCMP) supports warfighter needs for technological superiority and military dominance on the battlefield by providing advanced computational services to U.S. weapons system scientists and engineers. Exploiting continuous HPC technology advances, the DoD research, development, test and evaluation (RDT&E) community is able to resolve critical scientific and engineering problems more quickly and with more precision. This feeds 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 (T&E) 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 DoD's science and technology (S&T) and T&E objectives. To emphasize the common missions and responsibilities of DoD high performance computing centers, the Department of Defense undertook administrative actions to designate the Major Shared Resources Centers (Air Force Research Laboratory, Army Research Laboratory, Engineering Research and Development Center, and Naval Oceanographic Office) together with the Maui High Performance Computing Center and the Arctic Region Supercomputing Center collectively as DoD Supercomputing Resource Centers (DSRCs). One center, established by congress does not receive programmed support through HPC Modernization Program funding, but provides supercomputing services to the DoD. The Space and Missile Defense Command, Huntsville, AL, receives support for operations through the Army. Additionally, funding for specialized programs is provided through dedicated HPC project investments (DHPCPIs). DHPCPIs support a one-time need and have no legacy within the HPC Modernization Program. DSRCs 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. In FY2009 and continuing into FY2010, significant investments will be made in mass data storage systems to replace systems reaching the end of their useful life. 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 in new system designs and concepts. The HPCMP pursues continuous interaction with the national HPC infrastructure, including academia, industry, and other government agencies to facilitate sharing of knowledge, tools, and expertise. HPCMP users average 5,000 scientists and engineers at approximately 180 locations (DoD Laboratories, Test Centers, academic institutions and commercial businesses). The integrated HPCMP consists of Supercompting Resource Centers; the Defense Research and Engineering Network; and Software Application Support. SRCs are responsible for as large a part of DoD`s S&T and T&E computational workload as feasible. SRCs provide extensive capabilities to address user requirements for hardware, software, and programming environments. DHPCPIs augment the SRCs to form total HPCMP computational capability. DHPCPIs address critical HPC requirements that cannot be met at DSRCs, 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 HPCMP are interconnected with all S&T and T&E user sites via the Defense Research and Engineering Network. 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. The Computational Research and Engineering Acquisition Tools and Environments (CREATE) will produce supercomputer-based engineering design and test tools, improving the acquisition process for major weapons systems across the DoD. Modernization of DoD HPC capability and fulfillment of the program's vision and goals requires an on-going strategy that addresses all HPC aspects. While advancing the level of hardware performance is critical to success, the higher objective is enabling better scientific research, test and evaluation environments, and technology development for superior weapons, warfighting, and related support systems. Program goals are to acquire, deploy, operate and maintain best-value supercomputers; 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; acquire, deploy, operate and maintain a communications network that enables effective access to supercomputers and to distributed S&T/T&E computing environments; continuously educate the RDT&E workforce with the knowledge needed to employ computational modeling effectively and efficiently; and promote collaborative relationships among the DoD computational science community, the national computational science community and minority serving institutes.

HPCMP RDT&E funding primarily supports government and contractor labor. Due to a general, multi-year reduction to the HPCMP Budget of ~$5,000,000, it is anticipated that the program will reduce staff positions by 40 to 50 full-time equivalents beginning in FY2011.

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	220.345	221.286	0.000	0.000	0.000
Current President's Budget	209.164	235.486	200.986	0.000	200.986
Total Adjustments	-11.181	14.200	200.986	0.000	200.986
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds		14.200			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-5.602	0.000			
• Other Program Adjustments	-5.579	0.000	200.986	0.000	200.986

Exhibit R-2A, RDT&E Project Justification: PB 2011 Office of Secretary Of Defense			DATE: February 2010
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COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
P507: *High Performance Computing Modernization Program*	209.164	235.486	200.986	0.000	200.986	210.217	216.449	219.770	223.515	Continuing	Continuing

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. 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 program supports six DoD Supercomputing Resource Centers (DSRCs). One center, established by congress does not receive programmed support through HPC Modernization Program funding, but provides supercomputing services to the DoD. The Space and Missile Defense Command, Huntsville, AL, receives support for operations through the Army. Additionally, funding for specialized programs is 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.

HPCMP users average 5,000 scientists and engineers at approximately 180 locations (DoD Laboratories and Test Centers, academic institutions and commercial businesses). The integrated HPC program consists of Supercomputing Resource Centers; the Defense Research and Engineering Network; and Software Application Support. DSRCs are responsible for as large a fraction of DoD`s S&T and T&E computational workload as feasible. SRCs provide extensive capabilities to address user requirements for hardware, software, and programming environments. DHPCPIs augment the DSRCs to form the total HPC Modernization Program computational capability. DHPCPIs address critical HPC requirements that cannot be met at DSRCs, 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.

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 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. 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 ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Department of Defense Supercomputing Resource Centers	102.922	116.198	100.828	0.000	100.828
The program supports six DoD Supercomputing Resource Centers that are responsible for as large a fraction of DoD's S&T and T&E computational workload as feasible. Dedicated HPC project investments (DHPCPIs) support a one-time need and have no legacy within the HPC Modernization Program.					
FY 2009 Accomplishments: The program sustained and 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					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
evaluation (T&E) community HPC requirements. Six DRSCs were fully supported. DHPCPIs were made at NSWC Carderock, MD; Air Force SEEK EAGLE Tullahoma, TN; AFRL, Sensors Dir WPAFB, OH; and RTTC Huntsville, AL. Also, the program began significant investments in mass data storage systems to replace systems reaching the end of their life cycle. DSRCs and DHPCPIs are planned to continue into future years with no set completion date. Status of FY 2009 Congressional adjustments: $2,800 Naval Research Lab Supercomputing Information Prototype – Distributed and Obligated $3,200 Arctic Regional Supercomputer – Distributed and Obligated $2,480 High Performance Computational Design of Novel Materials – Distributed and Obligated $5,000 MHPCC – Distributed and Obligated *FY 2010 Plans:* 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. Six DSRCs will be supported in FY 2010 and two to five competitively awarded DHPCPIs are planned. Also, continuing in FY 2010, the program will make significant investments in mass data storage systems to replace systems that will reach the end of their life cycle. These efforts are planned to continue into future years with no set completion date. Status of FY 2010 Congressional adjustments: $3,120 Naval Research Lab prototype - Pending final obligation authority $13,000 HPC Program Adjustments - Pending final obligation authority					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 Base Plans: 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. Six DSRCs are programmed for support in FY2011 and two to five competitively awarded DHPCPIs are planned. HPCMP RDT&E funding primarily supports government and contractor labor. These efforts are planned to continue into future years with no set completion date. Due to a general, multi-year reduction to the HPCMP Budget of ~$5,000,000, it is anticipated that the program will reduce staff positions by 40 to 50 full-time equivalents beginning in FY2011. A portion of these reductions will be applied to DSRCs.					
Networking The Defense Research and Engineering Network (DREN) provides wide area network (WAN) connectivity among the Department's S&T and T&E communities. *FY 2009 Accomplishments:* The DREN provided high speed wide area network services to over 130 locations throughout the United States. DREN continued collaborative work with the federal networking community and standards associations. As result of prior year funding reductions the number site specific security assessments declined with more fully automated and remote security tools providing some augmentation. These efforts are planned to continue into future years with no set completion date. *FY 2010 Plans:* Network services to link all elements of the program will be provided by the Defense Research and Engineering Network (DREN) as well as operation of security systems and enhancements. The DREN network services contract is scheduled to be re-competed in FY 2010. Collaborative work with the federal networking community and standards associations will continue to assure that the DREN will	29.847	31.488	29.522	0.000	29.522

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
remain compatible with future technology change. These efforts are planned to continue into future years with no set completion date. *FY 2011 Base Plans:* Network services to link all elements of the program will be 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. Due to a general, multi-year reduction to the HPCMP Budget of ~$5,000,000, it is anticipated that the program will reduce staff positions by 40 to 50 full-time equivalents beginning in FY 2011. A portion of these reductions may be applied to DREN.					
Software Applications Software Applications provide for the adaptation of broadband, widely used applications and algorithms to address S&T and T&E requirements, continued training of users as new system designs and concepts evolve, and continuous interaction with the national HPC infrastructure, including academia, industry, and other government agencies to facilitate the sharing of knowledge, tools, and expertise. *FY 2009 Accomplishments:* Development efforts in software programs continued to mature as other projects were completed, and others begun. The HPCMP through the Computational Research and Engineering Acquisition Tools and Environments (CREATE) initiative expanded HPC to the development of supercomputer-based engineering design and test tools to improve the acquisition process for major weapons systems across the Department. Software Institutes and portfolios developed shared scalable applications to exploit scalable HPC assets. Departmental reductions to FY2009 RDT&E funding were partially offset by $1.4M in FY2009 Quick Reaction funding. These funds were used compensate for HPC Modernization Program funds that were unavailable for application to the CREATE initiative.	76.395	87.800	70.636	0.000	70.636

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
An Academic Outreach Program was supported to encourage and support computational science in universities across the United States. The User Productivity Enhancement and Technology Transfer effort provided computational and computer science support to the DoD HPC user community through both interaction and collaborative projects with academic and industrial partners. Existing contracts supporting the User Productivity Enhancement and Technology Transfer effort was re-competed and a new award made to High Performance Computing Technologies, Inc. in FY2009. Efforts were 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.					
FY 2010 Plans: Computational Research and Engineering Acquisition Tools and Environments (CREATE) will continue development of 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 U.S. 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.					
FY 2011 Base Plans: Computational Research and Engineering Acquisition Tools and Environments (CREATE) will continue development of supercomputer-based engineering design and test tools to improve the					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
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. Due to a general, multi-year reduction to the HPCMP Budget of ~$5,000,000, it is anticipated that the program will reduce staff positions by 40 to 50 full-time equivalents beginning in FY 2011. A portion of these reductions will be applied to Software Applications.					
Accomplishments/Planned Programs Subtotals	209.164	235.486	200.986	0.000	200.986

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• 0902198D8Z: *Major Equipment OSD*	52.410	53.105	53.839		53.839	54.400	55.069	56.098	57.184	Continuing	Continuing

D. Acquisition Strategy

Not applicable for this item.

E. Performance Metrics

Strategic Goals supported are as follows:

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Defense Supercomputing Resource Centers - Method of Measurement: Habus (HPCMP standard measurement of computational performance)

FY2009: Existing Baseline – 975.4/ Planned Performance Improvement - Requirement Goal – 585.2/ Actual Performance Improvement – 1048.6
FY2010: Existing Baseline – 2024.0/ Planned Performance Improvement - Requirement Goal – 2000.0
FY2011: Existing Baseline – 4024.0/ Planned Performance Improvement - Requirement Goal – 2100.0

Networking - Method of Measurement: Gigabits per second

FY2009: Existing Baseline – 26.2/ Planned Performance Improvement - Requirement Goal – 1.0/ Requirement Goal/ Actual Performance Improvement – 4.4
FY2010: Existing Baseline – 30.6/ Planned Performance Improvement - Requirement Goal – 1.0
FY2011: Existing Baseline – 31.6/ Planned Performance Improvement - Requirement Goal – 1.0

Software Applications - Methods of Measurement: Customer Satisfaction on a 0-5 scale

FY2009: Existing Baseline – 4.2/ Planned Performance Improvement - Requirement Goal – 4.2/ Actual Performance Improvement – 4.2
FY2010: Existing Baseline – 4.2/ Planned Performance Improvement - Requirement Goal – 4.2
FY2011: Existing Baseline – 4.2/ Planned Performance Improvement - Requirement Goal – 4.2

Comment: All FY2009 actual performance metrics met or exceeded those planned.