Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army											Date: March 2014	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603461A *I High Performance Computing Modernization Program*							
COST ($ in Millions)	**Prior Years**	**FY 2013**	**FY 2014**	**FY 2015 Base**	**FY 2015 OCO #**	**FY 2015 Total**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**	**Cost To Complete**	**Total Cost**
Total Program Element	-	202.969	220.565	181.609	-	181.609	178.460	178.523	183.707	184.684	-	-
DS7: *High Performance Computing Modernization Program*	-	174.872	180.565	181.609	-	181.609	178.460	178.523	183.707	184.684	-	-
DW5: *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*	-	28.097	40.000	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

The High Performance Computing Modernization Program (HPCMP) supports the requirements of the DoD's scientists and engineers in three major areas of effort: supercomputing resource centers, the Defense Research and Engineering Network (DREN), and support for software applications. DoD Supercomputing Resource Centers (DSRCs) provide extensive capabilities and demonstrate new technologies that address user requirements for hardware, software, and programming environments. Efforts of the DSRCs are augmented by dedicated HPC project investments (DHPIs) that address near real-time and real-time HPC requirements. All sites in the HPC Modernization Program are interconnected to one another, the user community, and major defense sites via the DREN, a research network which matures and demonstrates state of the art computer network technologies. The DREN interconnects 45 user and center sites at network speeds of up to 3 gigabits per second. The Software Application Support (SAS) effort optimizes and improves the performance of critical common DoD applications programs to run efficiently on advanced HPC systems, matures and demonstrates leading-edge computational technology from academic and commercial partners, and provides collaborative programming environments.

Work in this project supports the Army S&T Innovation Enablers Portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Army					Date: March 2014
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*			R-1 Program Element (Number/Name) PE 0603461A *I High Performance Computing Modernization Program*		
B. Program Change Summary ($ in Millions)	**FY 2013**	**FY 2014**	**FY 2015 Base**	**FY 2015 OCO**	**FY 2015 Total**
Previous President's Budget	180.582	180.662	181.609	-	181.609
Current President's Budget	202.969	220.565	181.609	-	181.609
Total Adjustments	22.387	39.903	-	-	-
• Congressional General Reductions	-0.302	-0.097			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	47.600	40.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-6.354	-			
• Other Adjustments 1	-18.557	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2015 Army												Date: March 2014
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603461A / *High Performance Computing Modernization Program*				Project (Number/Name) DS7 / *High Performance Computing Modernization Program*			
COST ($ in Millions)	**Prior Years**	**FY 2013**	**FY 2014**	**FY 2015 Base**	**FY 2015 OCO #**	**FY 2015 Total**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**	**Cost To Complete**	**Total Cost**
DS7: *High Performance Computing Modernization Program*	-	174.872	180.565	181.609	-	181.609	178.460	178.523	183.707	184.684	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

The High Performance Computing Modernization Program (HPCMP) supports the requirements of the DoD's scientists and engineers in three major areas of effort: supercomputing resource centers, the Defense Research and Engineering Network (DREN), and support for software applications. DoD Supercomputing Resource Centers (DSRCs) provide extensive capabilities and demonstrate new technologies that address user requirements for hardware, software, and programming environments. Efforts of the DSRCs are augmented by dedicated HPC project investments (DHPIs) that address near real-time and real-time HPC requirements. All sites in the HPC Modernization Program are interconnected to one another, the user community, and major defense sites via the DREN, a research network which matures and demonstrates state of the art computer network technologies. The DREN interconnects 45 user and center sites at network speeds of up to 3 gigabits per second. The Software Application Support (SAS) effort optimizes and improves the performance of critical common DoD applications programs to run efficiently on advanced HPC systems, matures and demonstrates leading-edge computational technology from academic and commercial partners, and provides collaborative programming environments.

Work in this project supports the Army S&T Innovation Enablers (formerly named Enduring Technologies) Portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2013	FY 2014	FY 2015
Title: Department of Defense (DoD) Supercomputing Resource Centers (DSRCs)	89.504	91.329	97.020
Description: Investigates and demonstrates general and special-purpose supercomputing systems and expertise that enables the DoD RDT&E community to accomplish its tasks. Dedicated HPC project investments (DHPIs) support a short-term research need that cannot be met at the DoD Supercomputing Resource Centers (DSRCs), such as real-time, and near real-time computing requirements, and leverage significant HPC and mission expertise located at these remote sites.			
FY 2013 Accomplishments: In collaboration with industrial and academic partners provided an expanded computational hardware and software environment to support the DoD S&T community, including newly developed hardware targeted specifically at DoD needs. The five DoD Supercomputing Resource Centers (DSRCs) and 7 competitively awarded dedicated HPC project investments (DHPIs), together			

Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2013	FY 2014	FY 2015
with newly developed enabling and DoD application software, delivered approximately 3.2 billion processor hours and over 3.5 quadrillion floating point operations per second in aggregate to DoD. This expansion in computational capacity was supported by advanced computational expertise that ensured the resources were available and configured to support the DoD's most challenging problems, provide analysis of the massive and complex datasets resulting from the simulations, and develop optimized applications for rapidly evolving computer technology. ***FY 2014 Plans:*** In collaboration with industrial and academic partners provided an expanded computational hardware and software environment to support DoD S&T community, including newly developed hardware targeted specifically at DoD needs. The software environment at all DoD Supercomputing Resource Centers (DSRCs) is expanded with newly developed system, support, and application software designed specifically to deliver newly acquired supercomputing capability directly to DoD users. These enhancements, together with one or more competitively awarded dedicated HPC project investments (DHPIs), will deliver an expected capability over 4 billion processor hours to DoD users. This expansion in computational capacity is supported by advanced computational expertise that ensures the resources are available and configured to support the DoD's most challenging problems, provide analysis of the massive and complex datasets resulting from the simulations, and develop optimized applications for rapidly evolving computer technology. ***FY 2015 Plans:*** Technology development and expertise investments will expand the DoD's advanced computational environment, including the development and demonstration of emerging computational and system interconnect technologies to DoD's highest priority computational decision support, scientific, engineering, and test and evaluation challenges. Will award one or more competitively dedicated HPC project investments (DHPIs) to address one or more high priority DoD problems that requires the support of HPC computational resources with specific rapid turnaround or protection of sensitive data requirements. These funds will also support the advanced computational expertise that ensures that the HPC resources are available and configured to support the DoD's most challenging problems, provides analysis of the massive and complex datasets resulting from the simulations, and develops and optimizes applications for rapidly evolving computer technology.			
Title: Networking ***Description:*** The Defense Research and Engineering Network (DREN) provides wide area network (WAN) connectivity among the Department's science and technology (S&T) and test and evaluation (T&E) communities via a research network. 20 of 23 DoD T&E centers have a presence on the DREN, as do 54 of the DoD's 67 S&T centers. This interconnection enables T&E events that would be impractical to accomplish otherwise, and form the discovery fabric of the S&T community. The DREN matures and demonstrates new communications technologies of relevance to DoD users, and provides the computer and network security for the HPCMP.	30.541	29.894	31.443

Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2013	FY 2014	FY 2015
FY 2013 Accomplishments: Provided an advanced network platform (DREN II) and matured new high performance communications and data security technologies that enabled advanced computational simulations and data analysis for users in both the Science and Technology (S&T) and Test and Evaluation (T&E) communities with new capabilities demonstrated on DREN III in excess of 10 Gbps network bandwidth provided on the highest bandwidth links. Initiated transition to new network backbone technologies that will permit development and demonstration of a new capability to achieve 100 Gbps speeds in the network core, dramatically increasing the quantity and nature of the investigations the network can support for the DoD's RDT&E community. Led and partnered in efforts within the federal networking community that ensured DoD users remained ready to take advantage of anticipated technology change. ***FY 2014 Plans:*** Complete transition to the newly developed DREN III advanced network platform and mature new high performance communications and data security technologies; enable advanced computational simulations and data analysis for users in both the Science & Technology and Test & Evaluation communities with new capabilities leading to demonstration of up to 50 Gbps network bandwidth provided on the highest bandwidth links for emerging applications in test and evaluation and big data management. Lead and partner in efforts within the federal networking community, including development of tools to transition the DoD's networks to a more proactive security posture. ***FY 2015 Plans:*** Will mature and demonstrate new high performance communications and data security technologies over the existing DREN as we work to transition DoD RDT&E users to emerging 100 Gbps capabilities; will establish both technical foundations and identify emerging groups and requirements that will be enabled by these technologies.			
Title: Software Applications	54.827	59.342	53.146
Description: Software Applications provide for the adaptation of broadband, widely used applications and algorithms to address research, development, test and evaluation (RDT&E) requirements; continued training of users as new system designs and concepts evolve. Continue interaction with the national high performance computing (HPC) infrastructure, including academia, industry, and other government agencies to facilitate the sharing of knowledge, tools, and expertise. ***FY 2013 Accomplishments:*** Computational Research for Engineering and Science (CRES): provided focused resources to accelerate S&T results in high-priority DoD mission areas through development of advanced software applications, algorithms, and computational technology supporting development of next generation ships, submarines, helicopters and fixed wing aircraft, radio frequency antennas, and unmanned aerial vehicles. Initiated a new effort to support advanced computational modeling of ground vehicles in support of Marine and Army requirements. Software Institutes: developed shared scalable applications of critical mission importance to			

Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2013	FY 2014	FY 2015
exploit scalable HPC assets; examples include the Blast Protection for Platforms and Personnel effort requested by the Secretary of Defense, simulation of high power microwave devices that supported the successful counter-electronics high-powered microwave advanced missile project (CHAMP) JCTD, mobile network modeling for novel radio design, and multi-scale reactive modeling for development of insensitive munitions. Programming Environments and Training (PETTT): invested in competitively-selected computational and computer science activities supporting critical DoD applications with academic and industrial partners. Examples included training in the latest computational technologies and techniques for the DoD scientific computing community, demonstration of novel software and techniques to enable effective computational performance for large physical problems using more than 100,000 cores, demonstration of novel techniques for calculation of properties in magnetic materials, and evaluation of novel computational techniques to enable reliable calculation of viscosities and diffusivities of complex alloys. ***FY 2014 Plans:*** Computational Research and Engineering Acquisition Tools and Environments (CREATE)/ Computational Research for Engineering and Science (CRES): Provide focused resources to accelerate Science and Technology (S&T) results in ships, rotary and fixed wing aircraft, radio frequency antennas, and ground vehicles as development on these advanced multiphysics applications add new physics and workflow features and development continues on novel computational approaches to enable performance to scale to problem sizes of interest to the DoD (e.g., complete aircraft carriers). Software Institutes: Develop shared scalable applications of critical mission importance to exploit scalable HPC assets; examples include the Blast Protection for Platforms and Personnel, mobile network modeling, and multi-scale reactive modeling for development of insensitive munitions. The high power microwave effort will transition to a related effort supporting computational investigation of high energy lasers. Programming Environments and Training (PETTT): Pursue targeted, competitively-selected computational and computer science activities on behalf of the DoD HPC user community with academic and industrial partners that support DoD mission needs. Selections are made on relevance to service and DoD mission areas, computational feasibility, and resources available. Invest in development and demonstration of computational techniques and execution models to support effective scaling of DoD's applications to next-generation and extreme-scale supercomputers, with specific application to representative applications of interest in blast effects. ***FY 2015 Plans:*** Will develop novel system software, algorithms, libraries, and computational approaches to meet challenges of emerging extreme scale systems. Computational Research and Engineering Acquisition Tools and Environments (CREATE)/ Computational Research for Engineering and Science (CRES): will develop advanced software applications, algorithms, and computational technology to address high priority DoD needs in rotary and fixed-wing aircraft, ships, radio frequency antennas, and ground vehicles. Software Institutes: will continue to develop shared scalable software applications of critical mission importance to exploit scalable HPC assets in support of high energy lasers, and Blast Protection for Platforms and Personnel. New projects may be selected competitively based on then-current DoD needs. Programming Environments and Training (PETTT): will pursue targeted, competitively-selected computational and computer science activities in support of the DoD HPC user community with academic			

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Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2013	FY 2014	FY 2015
and industrial partners that support DoD mission needs. Selections will be made based on mission relevance, computational feasibility, and available resources. Examples include training in the latest computational technologies and techniques for the DoD scientific computing community as well as projects focused on transition of newly-developed technologies out of the university environment into the DoD RDT&E community. Develop and demonstration of computational techniques and execution models to support effective scaling of DoD's applications to next-generation and extreme-scale supercomputers, with specific application to representative applications.			
Accomplishments/Planned Programs Subtotals	174.872	180.565	181.609

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2015 Army												Date: March 2014
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603461A / *High Performance Computing Modernization Program*				Project (Number/Name) DW5 / *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*			
COST ($ in Millions)	**Prior Years**	**FY 2013**	**FY 2014**	**FY 2015 Base**	**FY 2015 OCO #**	**FY 2015 Total**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**	**Cost To Complete**	**Total Cost**
DW5: *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*	-	28.097	40.000	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

This is a Congressional increase to the High Performance Computing Modernization Program.

This project enables the Defense research, development, test and evaluation (RDT&E) community to resolve critical scientific and engineering problems more quickly, and with more precision, using advanced, physics-based computer simulation supported by high performance computing (HPC) technology. The computational expertise and resources enable DoD personnel to analyze phenomena that are often impossible, not cost effective, too time-consuming, or too dangerous to study any other way. The High Performance Modernization Program (HPCMP) supports the requirements of the DoD's scientists and engineers in three major areas of effort: supercomputing resource centers, the Defense Research and Engineering Network (DREN), and support for software applications. DoD Supercomputing Resource Centers (DSRCs) provide extensive capabilities and demonstrate new technologies that address user requirements for hardware, software, and programming environments. Efforts of the DSRCs are augmented by dedicated HPC project investments (DHPIs) that address near real-time and real-time HPC requirements. The total aggregate computational capability is roughly 1.7 quadrillion floating point operations per second (1.7 petaFLOPS); this capability is expected to double by 2013. All sites in the HPC Modernization Program are interconnected to one another, the user community, and major defense sites via the DREN, a research network which matures and demonstrates state of the art computer network technologies. The DREN interconnects 45 user and center sites at network speeds of up to 3 gigabits per second. The Software Application Support (SAS) effort optimizes and improves the performance of critical common DoD applications programs to run efficiently on advanced HPC systems, matures and demonstrates leading-edge computational technology from academic and commercial partners, and provides collaborative programming environments.

Work in this project supports the Army S&T Innovation Enablers (formerly named Enduring Technologies) Portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2013	FY 2014	FY 2015
Title: Congressional Increase	28.097	40.000	-
Description: Congressional increase for the High Performance Computing Modernization Program.			
FY 2013 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2015 Army		Date: March 2014
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DW5 / *HIGH PERF COMP MODERN (HPCM) CONGR ADDS (CAS)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2013	FY 2014	FY 2015
Congressional increase for the High Performance Computing Modernization Program. ***FY 2014 Plans:*** Congressional increase for the High Performance Computing Modernization Program.			
Accomplishments/Planned Programs Subtotals	28.097	40.000	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A