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Exhibit R-2, PB 2010 Army RDT&E Budget Item Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE					
2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research					PE 0602308A Advanced Concepts and Simulation					
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	18.489	21.778	17.473						Continuing	Continuing
C90: Advanced Distributed Simulation	10.561	11.085	11.465						Continuing	Continuing
D01: PHOTONICS RESEARCH	.000	3.189	.000						Continuing	Continuing
D02: MODELING & SIMULATION FOR TRAINING AND DESIGN	5.609	5.908	6.008						Continuing	Continuing
D14: Advanced Modeling and Simulation Initiatives (CA)	2.319	1.596	.000						Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) designs and develops enabling technologies to create effective training capabilities for the Warfighter. The PE supports the underpinning technologies and understanding to establish architecture standards and interfaces necessary for realizing the Army vision of creating a realistic synthetic "electronic battlefield" environment for use across the spectrum of doctrine, organization, training, leader development, materiel, personnel, and facilities (DOTLM-PF). The Advanced Distributed Simulation (project C90), focuses on advancing component technologies required for real time interactive linking within and among constructive, virtual, and live simulation and training by refining technologies for advanced distributed interactive simulation. The Modeling and Simulation for Training and Design (project D02), further develops concepts for immersive training and learning environments with the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California.

Photonics Research, and Advanced Modeling and Simulation Initiatives (projects D01 and D14) fund congressional special interest items.

Work in this PE is related to and fully coordinated with efforts in PE 0603015A (Next Generation Training & Simulation Systems), PE 0601104A (University and Industry Research Centers), and PE 0603007A (Manpower, Personnel and Training Advance Technology).

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this PE is performed by the Research, Development, and Engineering Command (RDECOM), Simulation and Training Technology Center (STTC), Orlando, FL.

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2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research		PE 0602308A Advanced Concepts and Simulation			
<u>B. Program Change Summary (\$ in Millions)</u>					
	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	
Previous President's Budget	22.903	17.048	17.603		
Current BES/President's Budget	18.489	21.778	17.473		
Total Adjustments	-4.414	4.730	-.130		
Congressional Program Reductions	.000	-.070			
Congressional Rescissions	.000	.000			
Total Congressional Increases	.000	4.800			
Total Reprogrammings	-3.853	.000			
SBIR/STTR Transfer	-.561	.000			
<u>Change Summary Explanation</u>					
FY08 funding decrease was due to the transfer of congressional interest items for proper execution.					
FY09 funding increase is due to congressional adds.					

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Exhibit R-2a, PB 2010 Army RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				R-1 ITEM NOMENCLATURE PE 0602308A Advanced Concepts and Simulation					PROJECT NUMBER C90	
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
C90: Advanced Distributed Simulation	10.561	11.085	11.465						Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops enabling technologies for advancing distributed interactive simulation in synthetic environments such as networking of models, complex data interchange, and collaborative training. The project provides the ability to create a virtual representation of a lethal combined arms environment with the Warfighter-in-the-loop that constructive (event driven) simulation cannot provide. This project leverages and coordinates efforts with work at the Army Research Institute, the Army Research Laboratory, and the Medical Research Materiel Command.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Research, Development, and Engineering Command (RDECOM), Simulation and Training Technology Center (STTC), Orlando, FL.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011
<p>Live, Virtual, Constructive (LVC) Simulations: This effort investigates the combination of Live, Virtual and Constructive (LVC) training technologies into a seamless event. Live training refers to personnel and systems performing an exercise mission; virtual training refers to personnel using simulators; and constructive training refers to computer-aided simulations that introduce a wider control of virtual forces. Developed methods and technologies are transitioned for maturation and demonstration to PE 0603015A/project S29.</p> <p>In FY08, investigated feasibility of using the Defense Threat Reduction Agency's model of an improvised explosive device (IED) detonation that provides calculations and visualization in a physics-based real time dynamic situation for LVC resulting to realistic virtual training environments (lethality, causality assessment, mobility, etc.) for mounted and dismounted soldier embedded software to improve terrain representation, user interfaces, and adding after-action review capability. Completed component technology development and conducted laboratory experiments with small, accurate, low cost, low power tactical engagement simulation sensors (i.e. Weapons Orientation Sensor which enables technique of geometric pairing (geo-pairing) to couple a countermeasure with potential target); completed tests in live training environments to support embedded training on small footprint computers used on current force combat vehicles. Demonstrated LVC embedded training functionality capability for future transition into next generation live training programs and for embedded dismounted Soldier systems.</p>	3.608	.000	.000	

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APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602308A Advanced Concepts and Simulation		PROJECT NUMBER C90	
B. Accomplishments/Planned Program (\$ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
<p>Collaborative and Immersive Environment Technologies: This effort investigates adaptive learning environments with social simulations to conduct non-kinetic asymmetric warfare training.</p> <p>In FY08, extended Joint, Interagency, Intergovernmental Multi-National (JIIM) simulation environment for mission planning/rehearsal; investigated component enhancements for adaptive learning environments that provide geo-specific surroundings, virtual human agents, and representative cultural behaviors/effects; conducted experiments using multi-sensory environments, virtual humans, and cultural effects for the development of enhanced leader and critical thinking social simulations.</p> <p>In FY09, conduct experiments utilizing game based technologies to evaluate training methods and mission planning/rehearsal tools in a JIIM simulation environment; expand multi-sensory capabilities in adaptive learning environments to enable virtual human and intelligent decision components to incorporate awareness of trainee actions; expand training development tools to rapidly portray additional representative cultures; and expand non-kinetic simulation capability to squad/team level for training.</p> <p>In FY10, will continue development of JIIM environment for squad team level training using distributed simulations and after action reviews; will develop immersive environments to support infantry training and mission rehearsal; will investigate the algorithms and methodologies to enhance the realism of simulation environments for battle command training and decision making.</p>	3.628	2.153	4.409	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.218	.000	
<p>Modeling and Simulation Training Technologies: This effort investigates and evaluates combat medic training technologies and their effectiveness. The effort also conducts applied research to develop training technologies and techniques for Soldiers with unmanned systems.</p> <p>In FY08, completed design and construction of patient trauma simulators utilizing advances in material sciences (realistic skin, flesh, blood, bone, fluids and organs), sensory technologies, and simulated fluid loss technologies. Conducted experiments using autonomous systems to enhance the human intelligent agent team training; designed and conducted experiments with man-worn immersive systems (man-wearable training system integrates a binocular helmet mounted display with a head/body/weapon motion tracker system, and a training weapon onto a load-bearing vest) and reconfigurable mobile immersive systems to conduct training with unmanned systems using augmented reality approach.</p> <p>In FY09, conduct experiments with patient trauma demonstrators to assess Army medical training effectiveness; design and develop a mobile immersive training environment that includes the appropriate combination of man-worn systems,</p>	3.325	4.003	3.908	

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B. Accomplishments/Planned Program (\$ in Millions)			FY 2008	FY 2009	FY 2010	FY 2011
locomotion systems, intelligent tutors, human computer interfaces, and the ability to control autonomous systems for team training. In FY10, will investigate methods and technologies to increase medical simulation capabilities for surgical training to include initial designs for a surgical simulator. Will develop simulations to support the safe operations of unmanned systems in complex environments.						
In FY09, develop physics-based real time dynamic situations for LVC training to provide realistic environments (lethality, causality assessment, mobility, etc.) by integrating live sensor components to enable live training and a virtual/constructive mission rehearsal capability onto both Soldier and combat vehicle embedded training devices; conduct laboratory experiments in an operational environment with an embedded training device to develop display technology for combat vehicles embedded training. In FY10, will investigate use of predictive technologies and artificial intelligence in constructive training to provide behaviors and reasoning for computer generated forces in asymmetric warfare simulations. Continue technology improvements of sensor components for physics-based real time dynamic environments for LVC training.			.000	4.711	3.148	
Total			10.561	11.085	11.465	
C. Other Program Funding Summary (\$ in Millions) N/A						
D. Acquisition Strategy N/A						
E. Performance Metrics Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.						

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Exhibit R-2a, PB 2010 Army RDT&E Project Justification									DATE: May 2009	
APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				R-1 ITEM NOMENCLATURE PE 0602308A Advanced Concepts and Simulation					PROJECT NUMBER D01	
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
D01: PHOTONICS RESEARCH	.000	3.189	.000						Continuing	Continuing
A. Mission Description and Budget Item Justification Congressional Interest Item funding for applied research in Photonics.										
B. Accomplishments/Planned Program (\$ in Millions)							FY 2008	FY 2009	FY 2010	FY 2011
Boston University Photonics Center							.000	3.099	.000	
SBIR/STTR							.000	.090	.000	
Total							.000	3.189	.000	
C. Other Program Funding Summary (\$ in Millions) N/A										
D. Acquisition Strategy N/A										
E. Performance Metrics Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.										

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APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				R-1 ITEM NOMENCLATURE PE 0602308A Advanced Concepts and Simulation					PROJECT NUMBER D02	
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
D02: MODELING & SIMULATION FOR TRAINING AND DESIGN	5.609	5.908	6.008						Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops training applications that enable the Army's to train any time and any place. Efforts include designing virtual humans that embody natural language, speech recognition in noisy environments, gesture, gaze, and conversational speech and then assess techniques and methods for integrating different sensory cues into virtual environments that result in enhanced training and leader development. The project leverages the capabilities of industry and the research and development (R&D) community through the synthesis of creativity and technology including work at the Army Research Institute and the Army Research Laboratory.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

Work in this project is performed by the Research, Development, and Engineering Command (RDECOM), Simulation and Training Technology Center (STTC), Orlando, FL.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011
Immersive Technology Techniques: This effort develops tools, techniques and technologies for improving the immersion of human senses within simulation environments, creating enhanced realism. In FY08, developed intelligent tutoring, computer coaching, and rapid simulation development tools; incorporated virtual humans with large-scale social simulations; created a simulation environment in which social and anthropology data/knowledge was used to affect virtual human behavior in order to tailor/enhance the educational experience for a trainee to achieve the defined learning objectives established for a program of instruction. In FY09, explore techniques for developing distributed asymmetric warfare tutoring and coaching methods to support team training, performance assessment, and team after action reviews; and investigate/develop methods and technologies to expand single student tutoring capabilities to distributed multi-student team assessments and after action reviews. In FY10, will develop software tools for rapidly creating automated tutoring systems that can be tailored to multiple training applications/needs and support team training, performance assessment, and team after action reviews.	2.946	3.042	3.124	
Small Business Innovative Research/Small Business Technology Transfer Programs	.000	.164	.000	
	2.663	2.702	2.884	

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B. Accomplishments/Planned Program (\$ in Millions)			FY 2008	FY 2009	FY 2010
<p>Immersive Technology Environments: This effort develops technologies that enable responsive and reconfigurable simulations that immerse human senses such as sight, sound, and touch in mixed reality environments (consist of physical elements you can touch and feel (such as walls and obstacles) combined with virtual imagery). Developed technologies and techniques are transitioned for maturation and demonstration to PE 0603015A/project S28.</p> <p>In FY08, developed and evaluated methods for portraying dynamic effects in mixed reality environments and assessed the use of new and emerging display technologies. Investigated methods to capture trainee physical and emotional responses in mixed reality environment.</p> <p>In FY09, create a mixed-reality immersive environment that uses sensors to provide near real-time perspective of the surrounding real world allowing a user and the world model to share a high fidelity and more realistic common view of the training environment; design and develop new, flexible display technologies to advance future training environments.</p> <p>In FY10, will investigate and develop multiple display, tracking, and audio system technologies for rapidly inserting virtual content into large-scale, real-world training environments that can be rapidly reconfigured.</p>					
Total			5.609	5.908	6.008
C. Other Program Funding Summary (\$ in Millions)					
N/A					
D. Acquisition Strategy					
N/A					
E. Performance Metrics					
Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.					

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APPROPRIATION/BUDGET ACTIVITY 2040 - Research, Development, Test & Evaluation, Army/BA 2 - Applied Research				R-1 ITEM NOMENCLATURE PE 0602308A Advanced Concepts and Simulation					PROJECT NUMBER D14	
COST (\$ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
D14: Advanced Modeling and Simulation Initiatives (CA)	2.319	1.596	.000						Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for applied research in Advanced Modeling and Simulation.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011
Advanced Live, Virtual and Constructive (LWC) Training Systems	.000	1.551	.000	
SBIR/STTR	.000	.045	.000	
Development and Simulation for Advanced Troop Protection Concepts in Urban Warfare	.774	.000	.000	
Mobile Medic Training Program	1.545	.000	.000	
Total	2.319	1.596	.000	

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

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