ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602308A - Advanced Concepts and Simulation

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		28453	30431	15041	16144	16662	16888	17260
C90	ADVANCED DISTRIBUTED SIMULATION	13953	10309	10204	10717	10840	10943	11196
D01	PHOTONICS RESEARCH	2381	4841	0	0	0	0	0
D02	MODELING & SIMULATION FOR TRAINING AND DESIGN	7120	5115	4837	5427	5822	5945	6064
D03	JOINT MODELING & SIMULATION SYSTEM (JMASS)	1000	0	0	0	0	0	0
D14	ADVANCED MODELING AND SIMULATION INITIATIVES (CA)	3999	7745	0	0	0	0	0
HB4	IMMERSIVE ENVIRONMENT APPLIED RSCH INITIATIVE (CA)	0	2421	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element conducts applied research in modeling and simulation technologies for application to training and evaluation of the Future Combat Systems (FCS), the Future Force (FF), and where feasible, the Current Force. It establishes standards, architecture, and interfaces essential to realizing the Army vision of creating a verified, validated, and accredited synthetic "electronic battlefield" environment as an acquisition and training evaluation tool. The creation of this electronic battlefield environment requires advanced distributed simulation technologies, such as networking of models, complex data interchange, and collaborative training. The application of this electronic battlefield environment to support training requires applied research in modeling, simulation, and training technologies, such as immersive training, leadership development, and concept exploration. This environment will help the Army to investigate and refine new warfighting concepts, including the generation of tactics, doctrine, training techniques, soldier support systems, and system upgrades. This program directs and stimulates advances in those technologies required for real time interactive linking within and among constructive, virtual, and live simulation and training by maturing technologies for advanced distributed interactive simulation. This program provides applied research in immersive training at the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California, to leverage the entertainment and game industries in advancing the Army's modeling and simulation technology and applications. This project will ensure the transition of the research results of the ICT into the Army technology base and future Army training products. These programs are fully coordinated with other Army applied research programs, the Defense Advanced Research Projects Agency (DARPA), and the Defense Modeling and Simulation Office. Results from this applied research will feed PE 0603015A (Next Generation Training & Simulation Systems). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and the Defense Technology Area Plan (DTAP). Work in this PE is performed by the Research Development and Engineering Command (RDE Command), Orlando, FL.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	30150	15941	15643
Current Budget (FY 2005 PB)	28453	30431	15041
Total Adjustments	-1697	14490	-602
Congressional program reductions		-277	
Congressional rescissions			
Congressional increases		15500	
Reprogrammings	-1697	-733	
SBIR/STTR Transfer			
Adjustments to Budget Years			-602

Significant Change Explanation:
FY04 - Five FY04 Congressional adds totaling $15500 were added to this PE.

FY04 Congressional Adds with no R-2A:
($3757) Combat Trauma Patient Simulator, Project D14: The purpose of this one year Congressional add is to enhance the Combat Trauma Patient Simulation system functionality and to establish a third site to support continued test and evaluation. No additional funding is required to complete this project.

($2630) Joint Unmanned Systems Test and Research Center, Project D14: The purpose of this one year Congressional add is to establish and operate the Unmanned Systems Controlled Experimental, Test and Research Facility at the Virginia Polytechnic Institute to support the cost effective and timely evaluation and development of military autonomous vehicle systems. No additional funding is required to complete this project.

($1127) On-Line Contract Data Management, Project D14: The purpose of this one year Congressional add is to mature the On-Line Contract Data Management project and to provide demonstration of prototype development efforts. No additional funding is required to complete this project.

($4697) Photonics Research, D01: The purpose of this one year Congressional add is to manufacture, assemble and characterize optical components and laser output for a unique fiber laser combiner. No additional funding is required to complete this project.

($2349) Institute for Creative Technologies, Project HB4: The purpose of this one year Congressional add is to fund technology supporting an enhanced simulation capability at Fort Sill. No additional funding is required to complete this project.

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February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602308A - Advanced Concepts and Simulation**	**C90**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
C90	ADVANCED DISTRIBUTED SIMULATION	13953	10309	10204	10717	10840	10943	11196

A. Mission Description and Budget Item Justification: This project develops enabling technologies for advancing distributed interactive simulation in a synthetic environment by maturing advanced distributed simulation technologies, such as networking of models, complex data interchange, and collaborative training. It will enhance the use of modeling and simulation as an acquisition and training evaluation tool by providing that 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. Such environments permit the evaluation of new system concepts, tactics and doctrine, and test requirements with a warfighter-in-the-loop throughout the acquisition life cycle at a reduced cost and in less time. This project develops technologies to support embedded simulation, intelligent forces representation, rapid and cost-effective generation of synthetic environments, simulation interface and linkage technologies, and complex data modeling. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Research Development and Engineering Command (RDE Command), Orlando, FL.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Collaborative and Immersive Environment Technologies. In FY03, evaluated approaches to provide training assessment and student performance feedback in distance learning courseware and simulations as well as embedded training. Investigated simulation technologies to support a persistent, interactive simulation environment to support training with unconventional threats. Researched on 3-dimensional graphics, and photorealistic rendering of human features and behaviors to support virtual training environments. In FY04, mature advanced distributed learning environments to provide anytime, anywhere training. Prototype test-beds for distributed component simulations to support the training missions of the Future Force (FF) to include Future Combat Systems (FCS) and dismounted warrior systems. Investigate concepts for an embedded training decision aid utilizing 3-dimensional virtual environments. In FY05, will assess expanded learning environment to support the development and evaluation of a reach-back capability. Will expand high performance and large-scale robotic simulations. Will validate and evaluate 3-dimensional and human features modeling simulations in an interactive training environment.	3006	2803	4878
Modeling and Simulation Training Technologies. In FY03, established a medical training capability in the Multiple Integrated Laser Engagement System XXI (MILES XXI) system with research into laptop and personal digital assistant (PDA) platforms. Created medical behaviors in ONE Semi-Automated Forces Test-Bed (OTB). Researched augmented reality with advanced medical modeling and visualization technology. Extended the composable robotics simulation test-bed through the addition of higher level mission behaviors and prototype man/machine interfaces allowing a single user to control multiple unmanned systems. In FY04, research and develop proof of principle portions of ruggedized, portable patient simulators that provide increased realism and fidelity. Demonstrate ad hoc wireless networks, performance tracking systems, and centralized command and control in a simulator. Conduct team performance assessment for multiple unmanned robotic systems and enhance robotic behavior interaction with use of intelligent agents. In FY05, will demonstrate a prototype patient simulator with advances in material sciences, including realistic skin and physiologically accurate injuries, sensor technologies, miniaturization/packaging technology and Ad Hoc wireless networking for use in the Current and Future Force. Will develop advanced techniques that support the creation of digital libraries for scenario based simulation.	1989	1902	920

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Embedded Training for Dismounted Soldiers. In FY03, extended test-bed functionality and conducted experiments to evaluate concepts for a mobile training network for dismounted soldiers. Investigated concepts for technologies to precisely track a soldier's location and weapon orientation inside/outside of buildings in order to support Military Operations in Urban Terrain (MOUT) at the FCS and dismounted warrior systems cell level. Completed requirements analysis, experiments, and initial tracking technology platform. In FY04, extend test-bed functionality to include augmented reality (virtual targets, weapon effects, threats, and friendlies) for a mobile training network for dismounted soldiers. Mature embedded training through augmented reality. Prototype test-beds and algorithms to support assessment of tracking technologies. Mature advanced sensor for live simulation of non-line-of-sight weapons and improved urban tracking resolution. In FY05, will prototype mobile range and conduct experiments to evaluate an augmented reality training environment for the dismounted warrior systems cell level at Fort Benning, Georgia. Will conduct experiments with advanced tracking test-bed to validate/improve MOUT training.	2500	2729	1332
RDEC Federation. In FY03 established a Joint Virtual Battlespace (JVB)/RDEC Federation reference implementation architecture for interfacing with the FCS Advanced Collaborative Environment. Conducted analysis of interface requirements and identified human performance modeling requirements. Incorporated engineering-level M&S, virtual prototypes, and distributed requirements. Matured a concept of operations for reference implementation to support FF experimentation. Identified technologies from the Institute for Creative Technologies (ICT) for incorporation into reference implementation. In FY04 and beyond, this effort is funded in PE 0603015A, Project S31 (RDEC Federation).	3000	0	0
Rapid Generation of Synthetic Natural Environments. In FY03, investigated and developed environmental data model representation of urban terrain structures (building components: windows, floors, rubble, etc.) and improved realism of virtual urban training environments. In FY04, investigate toolsets to rapidly generate additional terrain structures in existing databases. Prototype simulation engine that will support persistent interactive simulation over the internet and allow users to create unconventional threats. In FY05, will assess performance of rapid generation technologies and recommend a standard toolset for FF training environments. Will evaluate simulation engine that will support persistent interactive simulation over the internet and allow users to create unconventional threats.	2500	2632	3074
Online Contract Document Management. This one year Congressional Add matured integrated prototype tools with external legacy acquisition systems and an enterprise management system. No additional funding is required to complete this project.	958	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Small Business Innovative Research/Small Business Technology Transfer Programs	0	243	0
Totals	13953	10309	10204

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February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602308A - Advanced Concepts and Simulation**	**D02**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
D02	MODELING & SIMULATION FOR TRAINING AND DESIGN	7120	5115	4837	5427	5822	5945	6064

A. Mission Description and Budget Item Justification: This project enables the rapid transfer and maturation of simulation and training research results to the Army from the Institute for Creative Technologies (ICT). The ICT provides research in modeling, simulation, and training technologies, such as immersive training, leadership development, and concept exploration. This project creates a true synthesis of creativity and technology by leveraging the capabilities of industry and the R&D community. It revolutionizes military training and mission rehearsal by making it more effective in terms of cost, time, types of experiences that can be trained or rehearsed, and the quality of the result. This project accomplishes this by maturing research in virtual humans to enable them to embody natural language, speech recognition in noisy environments, gesture, gaze, and conversational speech. This will make training applications widely available and enhance the Army's ability to train any time and any place. This project also investigates and matures techniques and methods for integrating different sensory cues into virtual environments to enhance training and leader development. This project investigates and matures the application of emerging photo-realistic rendering algorithms and 3-dimensional signal processing techniques to advanced experience learning applications. These efforts will mature the efficiency of 3-dimensional sound techniques in virtual environments. The environments will vary from medium sized immersive environment rooms with high-end graphics and computing systems to low-cost, game console applications using commercial off the shelf speakers. These techniques and environments will impact education and training systems for the Future Force (FF) and enhance Army Transformation. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Research Development and Engineering Command (RDE Command), Orlando, FL.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Immersive Technology Environments. In FY03, matured the architecture structure for integrating speech, gesture, gaze and speech synthesis into a virtual human, and identified research shortfalls for human to virtual human interactions. Matured the concept of use of virtual humans in advanced leader development environments. In FY04, create solutions for shortfalls in human to virtual human interactions where feasible. Mature research approach for additional study to solve the more complex phenomena. In FY05, will integrate virtual humans into leader training exercises and advanced technology demonstrations in collaboration with TRADOC. Will mature virtual humans research based on feedback from exercise and demonstration evaluations to support self-guided and self-directed training.	1366	2241	2274
Immersive Technology Techniques. In FY03, incorporated photo-realistic rendering algorithms matured by ICT into the next generation of personal computer graphics cards to make recent advances in computer graphics commercially available. Investigated and matured techniques for using low-cost training platforms like game-based consoles and emerging high-speed hardware. Completed maturation of personal computer based proof-of-principle and worked on evaluation of proof-of-principle with TRADOC and Army Research Institute (ARI). Conducted preliminary Sensory Environment Evaluations (SEE). In FY04, provide concept demonstration of photo-realistic rendering of human faces and integrate into SEE and Mentoring Prototype (MP). Integrate audio and sensing cues implemented in algorithms and techniques into the SEE and MP. In FY05, will mature and demonstrate next generation global illumination algorithms and facilitate their adoption into military training applications. Will develop advanced techniques that support the creation of digital libraries for scenario based simulation.	2418	2722	2563
Institute for Creative Technologies (Simulations for Capabilities for the Warfighter). In FY03, this one-year Congressional Add matured research in immersive environments to provide an enhanced simulation capability at Fort Sill. No additional funding is required to complete this project.	3336	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	152	0
Totals	7120	5115	4837