ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)

February 2002

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

	COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
	Total Program Element (PE) Cost	35334	31333	20634	23000	23298	19788	20358
C90	ADVANCED DISTRIBUTED SIMULATION	13463	16232	13866	12048	12952	13181	13647
C99	ADVANCED CONCEPTS & TECH II (ACT II)	4338	0	0	0	0	0	0
D01	PHOTONICS RESEARCH	4807	2481	0	0	0	0	0
D02	MODELING & SIMULATION FOR TRAINING AND DESIGN	12726	6931	3974	9952	9927	6179	6264
D03	JOINT MODELING & SIMULATION SYSTEM (JMASS)	0	2689	2794	1000	419	428	447
MC8	THREE DIMENSIONAL ULTRASOUND IMAGING	0	3000	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element (PE) funds modeling and simulation technology research and applies it to the development, testing and training of the Future Combat Systems and the Objective Force. It develops standards, architecture and interfaces essential to realizing the DoD/Army vision of creating a verified, validated and accredited synthetic "electronic battlefield" environment which can be used to investigate and refine new warfighting concepts, including generation of tactics, doctrine, training techniques, soldier support, systems and system upgrades. It directs and stimulates advances in those technologies required for real time interactive linking within and among constructive, virtual and live simulation and training. U.S. Army Simulation Training and Instrumentation Command (STRICOM), located at Orlando, FL is responsible for Projects AC90, D02 and D03. Project AC90 develops technologies for advanced distributed interactive simulation. Work is performed by the broadest range of the nation's industrial and academic communities. Project DO2 represents a restructure from Project AC90 starting in FY01. This project enables the rapid transfer and development of simulation and training technology research results to the Army from the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California. In August, 1999, ICT was designated as a University Affiliated Research Center (UARC) 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 results of the basic research component of the UARC, sponsored through PE 0601104A/Project J08, into the Army tech base and future Army training products. In Project D03, STRICOM will develop components for the Joint Modeling and Simulation system, which is a flexible simulation system that assists model developers, engineers, and analysts in the development of digital models, configuration and execution of simulations, and analysis of simulation results - all at the engineering and engagement levels. These programs are fully coordinated with other Army applied research programs, Defense Advanced Research Projects Agency (DARPA), Defense Modeling and Simulation Office, TRADOC and DoD Project Reliance, with oversight provided by the Joint Directors of Laboratories.

Work in these projects is related to and fully coordinated with efforts in PE 0604715A (Non-System Training Devices - Engineering Development).
The cited work is consistent with the Army Science and Technology Master Plan (ASTAMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Simulation, Training, and Instrumentation Command (STRICOM). The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

B. Program Change Summary	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	36144	20579	17743
Appropriated Value	36479	31579	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-246	0
b. SBIR / STTR	-1041	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	231	0	0
e. Rescissions	-335	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	2891
Current Budget Submit (FY 2003 PB)	35334	31333	20634

Change Summary Explanation:

FY03 ($2891) added to Project C90 to prototype virtual team member/instructors to support collaborative training, and to experiment and evaluate computer generated forces technology and robotics simulation networks in support of Future Combat System.

FY02 - Congressional adds were made for Photonics Research, Project D01 ($2500); for STRICOM On-line Contract Document Management, Project C90 ($1000); Three Dimensional Ultrasound Imaging Project MC8 ($3000); and for Modeling, Simulation, and Training Infrastructure and Community Development

Project C90 ($4500).

Projects with no R2-A:

Project D01
- FY02 funding= $2500 Photonics Research : The objective of this one year Congressional add is to fund research in technology for night vision and imaging equipment, devices to enable communications while on the move, address Army needs in bio-agent detection and sensitive sensors for imaging and laser sources. No additional funding is required to complete this project.

Project MC8:
FY 02 Funding = $3000 Three Dimensional Ultrasound Imaging : The object of this one year Congressional add is to improve survival of battlefield trauma through ultrasound telemedicine, including ultrasound miniaturization and wireless connectivity and remotely guided therapeutics. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
C90	ADVANCED DISTRIBUTED SIMULATION	13463	16232	13866	12048	12952	13181	13647

A. Mission Description and Budget Item Justification: This program researches and applies enabling technologies for advancing distributed interactive simulation in the synthetic environment. C90 provides the representation of the battlefield needed to support the use of modeling and simulation as an acquisition and training evaluation tool. C90 provides a virtual representation of a lethal combined arms environment with the warfighter-in-the-loop that closed-form analysis cannot provide. The environment permits new system concepts, tactics and doctrine and test requirements to be evaluated with a warfighter-in-the-loop in a combined arms battlefield throughout the acquisition life cycle at a reduced cost and time compared to the traditional approach. The research being conducted includes embedded simulation, intelligent forces representation, rapid and cost-effective generation of synthetic environments, simulation interface and linkage technologies, and complex data modeling and interchange. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Simulation, Training and Instrumentation Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 4531
  - Enhanced the Advanced Tactical Engagement Simulations (A-TES) virtual integration testbed with hybrid simulation and hardware-in-the-loop experiments.
  - Established an Embedded Simulation System (ESS) using a Mobile Crew Station Surrogate (MCSSL) at Ft Knox.
  - Established a testbed for Embedded Training for Future Combat Systems (FCS) in the areas of Synthetic Natural Environments (SNE), intelligent tutoring and robotics behavioral simulation.
  - Studied intelligent behavioral approaches related to FCS robotics. Evaluate prototype capabilities and address technology transfer and implementation issues.
  - Extended the distributed architecture to promote interoperability of Army simulation systems including Close Combat Tactical Trainer (CCTT), Warfighters' Simulation (WARSIM), and One Semi-Automated Force (OneSAF).
- 4432
  - Prototyped dismounted soldier virtual environment gesture recognition system. Evaluate effectiveness of night operations simulation.
  - Tested and evaluated reduced development time/cost for an interoperable SNE.

FY 2001 Accomplishments: (Continued)

- 3500 - Constructed Medical Simulations to evaluate an Advanced Trauma Patient Simulation (ATPS) system triage and After Action Review (AAR) to promote improved readiness for Army medics.

  - Prototyped a web-based, distributed simulation capability to support training of Field Artillery Officers in the employment of indirect fire assets as part of a combined arms team or as a stand-alone training tool using Advanced Distributed Learning (ADL).

  - Demonstrated embedded training technology on multiple combat vehicles interoperating with Close Combat Tactical Trainer (CCTT).

- 1000 - The objective of this one-year Congressional special interest effort is to implement an online contract document management system for STRICOM.

Total 13463

FY 2002 Planned Program

- 4200 - Synthesize data from research and field tests to develop affordable system solutions and minimize impact of force modernization on communications bandwidth, system weight and power packaging requirements of test and training systems (i.e. Combat Training Centers).

  - Validate tools and improve synthetic natural environment development process; test methodology to assess interoperability of linked virtual, constructive, and live systems.

  - Prototype Intelligent Tutoring Systems to provide student "individualized' instructional support of cognitive training tasks in the web-based environment.

  - Complete prototype of the Advanced Trauma Patient Simulator (ATPS) and create an experiment to substantiate that the improved system increases core competency levels. Establish metrics to assess system functionality and the methodology to assess the system's interoperability.

- 3000 - Construct/extend the distributed simulation environment for FCS to promote improved Course of Action Analysis (COAA) and Force Projection Logistics (FPL) capabilities.

  - Advanced Robotics Simulation. Construct/extend computer generated forces technology and prototype robotics simulation and training testbed for Future Combat System (FCS)

- 3532 - Construct/extend immersive simulation technology for distributed simulation networks in support of Objective Force training.

  - Modeling and Simulation for MOUT, Communication and Control (C2), and Human Behavior representation in support of Objective Force training

FY 2002 Planned Program (Continued)

- Identify Embedded Training issues and assess tasks and skills appropriate for embedded training; integrate COTS and Government furnished state-of-the-art hardware components to establish a surrogate Objective Force Warrior (OFW) Embedded Training test bed; begin development and demonstration of advanced simulation software to include web-based interactive simulation and training courseware applications.

• 1000 The objective of this one-year Congressional special interest effort is to implement an online contract document management system for STRICOM.

• 4500 The objective of this one-year Congressional special interest effort is to develop the infrastructure for a Distributed, Networked Modeling and Simulation Community.

Total 16232

FY 2003 Planned Program

• 5834 - Prototype virtual team members/instructors to support collaborative training "anytime-anywhere".

- Complete the test metrics, incorporate a medical simulator, and test the complete system to verify interoperability.
- Experiment and evaluate a distributed simulation environment for FCS models and concepts related to Course of Action Analysis (COAA).
- Experiment and evaluate computer generated forces technology and robotics simulation and training system for Future Combat System (FCS)

• 4967 - Experiment and evaluate a fully immersive simulation technology for distributed simulation networks in support of Objective Force training.

- Modeling and Simulation for MOUT, C2, and Human Behavior representation in support of Objective Force training
- Enhance live simulation capabilities to support improved training and testing at the Combat Training Centers, Homestation and Test Ranges.

• 3065 - Increase capabilities to develop and evaluate synthetic environment interoperability for a variety of virtual simulation environments to support SMART concept development, testing and training applications.

- Integrate state-of-the-art hardware and simulation models into surrogate OFW embedded training testbed.

Total 13866

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
D02	MODELING & SIMULATION FOR TRAINING AND DESIGN	12726	6931	3974	9952	9927	6179	6264

A. Mission Description and Budget Item Justification: This project is a restructure from Project AC90 and enables the rapid transfer and development of simulation and training technology research results to the Army from the Institute for Creative Technologies (ICT) at the University of Southern California, Los Angeles, California. ICT was designated in August 1999 by DDR&E as a University Affiliated Research Center (UARC) to support Army training and readiness through research into simulation and training technology such as mission rehearsal, leadership development, and distance learning. ICT actively engages industry (multimedia, location-based simulation, interactive gaming) to exploit dual-use technology. ICT serves as a means for the military to learn about, and benefit from entertainment technologies, and enable their transfer into military systems. ICT works with creative talent from industry in order to adapt their concepts of story and character to increasing the degree of immersion experienced by participants in synthetic experiences, and to improving the utility of the outcomes of these experiences. In return, industry leverages the DoD sponsored research being done by the advanced Modeling and Simulation UARC. This project ensures the transition of the research into the Army tech base and future Army training products. Creating a true synthesis of creativity and technology and harnessing 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, the types of experiences that can be trained or rehearsed, and the quality of the result. It allows the United States to maintain dominance in simulation and training technologies. The US Army Simulation Training and Instrumentation Command (STRICOM) in Orlando, Florida, develops new Army training systems from the transitioned technology. STRICOM is collaborating with TRADOC to help crystallize requirements for next generation training solutions for Army Transformation. Funding for this program was enhanced in FY 2001 to support applied research on more effective and immersive synthetic environments. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 8811 Developed large-scale virtual environment technology to create a photo-realistic environment, advance the emotion and speech synthesis algorithms to create more realistic virtual humans to populate the virtual environment.

  Developed algorithms and techniques for lighting virtual environments and objects that are later placed in the environments.

  Integrated all these technologies into a concept demonstration to establish areas needing additional research. These virtual worlds directly support training and mission planning and rehearsal for Army Transformation and preparing the Objective Force for future operations.

FY 2001 Accomplishments: (Continued)

Developed a multi-sensory environment with a curved projections screen and a one of 2-10.2 sound systems.

Advanced Virtual Humans in this environment with natural language and emotions.

Created a general-purpose lighting apparatus for acquiring the reflectance properties and 3D geometry of objective and faces. Developed a Photoshop-like image manipulation program based on high dynamic range imagery.

- 3915 Developed a training solution using PC-Game technology for commanders and low cost game console for Squad Leaders to create virtual worlds that directly support training and mission planning and rehearsal for Army Transformation and preparing the Objective Force for future operations.

Initiated PC-Game and Game Console efforts for training and mission planning.

Total 12726

FY 2002 Planned Program

- 2967 Develop techniques and methods for integrating different sensory cues like smell and sound into virtual environments. Provide concept demonstrations to enhance the education and learning experiences possible through advanced immersive techniques. These environments will impact education and training systems for the legacy and Objective Force.
- 3964 - Accelerate at the University of Southern California's Institute for Creative Technologies (ICT) the exploitation of products from partnership with academia and the entertainment industry, with emphasis on low-cost training platforms using game-based consoles and development techniques.

- Accelerate at the ICT the development of mission rehearsal technologies for Stability and Support Operations (SASO).

Total 6931

FY 2003 Planned Program

- 3974 Apply emerging photo-realistic rendering algorithms and 3D signal processing techniques to advanced experience learning applications for Army training challenges.

Examine computational hardware such as low-cost, ultra-fast, 128-bit computing platforms for possible scalability for the military training and education domain.

FY 2003 Planned Program (Continued)

Incorporate 3D sound techniques into several virtual environments. The environments will vary from medium sized rooms with high-end graphics and computing systems to low-cost, game console applications using commercial off the shelf speakers. The maturity of these initial techniques will enable training approaches to enhance Army readiness.

Total 3974

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602308A - Advanced Concepts and Simulation**	**D03**

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
D03	JOINT MODELING & SIMULATION SYSTEM (JMASS)	0	2689	2794	1000	419	428	447

A. Mission Description and Budget Item Justification: This program element provides for STRICOM development of the Army-specific components for the Joint Modeling and Simulation System (JMASS) for use in modeling and simulation and application in advanced concepts, research and development, test and evaluation, and analysis. JMASS threat models are developed and validated by the intelligence community. DoD testers and decision makers will be able to use the same JMASS models for system evaluation and milestone decisions, as were used during system development. This will reduce the time required for milestone preparation and will increase the probability of a successful milestone decision by eliminating the inconsistent results often obtained when different models are used for development and testing. JMASS models are modular and can easily be modified to meet specific user requirements, thus reducing the need to develop new models. STRICOM will create a Synthetic Environment that supports analysis and real-time simulation. Currently there is no real-time implementation of the JMASS. Establish a real-time simulation framework using the building blocks and toolkits provided by the JMASS with its collection of defined, documented interface standards to which a model should be built. This framework uses real-time distributed standards - Institute for Electrical and Electronic Engineers (IEEE) distributed simulation standards and draft International Standards Organization (ISO) Modeling and Simulation Data Representation Standards. This flexible entity based framework supports correlated multi-sensor real-time environment allowing simulations, which can sustain acquisition; as well as the development of tactics, techniques and procedures for the Future Combat System. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the Army Simulation, Training and Instrumentation Command. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- Program not funded in 2001

FY 2002 Planned Program

- 2689 - Research and develop baseline for real-time simulation using JMASS models and prior basic research to ensure compatibility and interoperability for multi-sensor real-time simulations.

Total 2689

FY 2003 Planned Program

- 2794 - Demonstrate and evaluate the baseline for real-time simulation. Test and evolve the baseline to demonstrate that it is interoperable with real-time simulations such as the Close Combat Tactical Trainer (CCTT) and the Objective One Semi-Automated Force (OneSAF) simulation.

Total 2794