Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army											Date: May 2017	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603015A *I Next Generation Training & Simulation Systems*							
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	16.735	18.969	16.434	-	16.434	20.672	21.087	21.512	21.982	-	-
S28: *Immersive Learning Environments*	-	2.997	3.254	0.483	-	0.483	0.000	0.000	0.000	0.000	-	-
S29: *Modeling & Simulation - Adv Tech Dev*	-	8.848	6.172	6.273	-	6.273	9.953	10.195	10.443	10.687	-	-
S31: *Modeling And Simulation Infrastructure Technology*	-	4.890	9.543	9.678	-	9.678	10.719	10.892	11.069	11.295	-	-

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and demonstrates tools to enable effective training capability for the Warfighter. Project S28 matures and demonstrates simulation technologies developed by the Institute for Creative Technologies (ICT) at the University of Southern California. Project S29 incorporates advanced modeling and simulation (M&S), training, and leader development technology into immersive training demonstrations as well as demonstrates a framework for future embedded training and simulation systems for future force combat and tactical vehicles, and dismounted Soldier systems. Project S31 develops, integrates and demonstrates an overarching M&S architecture that incorporates multi-resolution, entity-based models, simulations, and tools to enable Network-Centric Warfare M&S capability.

Work in this PE complements and is fully coordinated with efforts in PE 0602308A (Advanced Concepts and Simulation), PE 0602785A (Manpower/Personnel/Training Technology), PE 0602787A (Medical Technology) and PE 0603007A (Manpower, Personnel and Training Advanced Technology).

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

Work in this PE is performed by the Army Research Laboratory, Human Research and Engineering Directorate, Simulation and Training Technology Center (STTC), Orlando, FL.

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Army					Date: May 2017
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*			R-1 Program Element (Number/Name) PE 0603015A *I Next Generation Training & Simulation Systems*		
B. Program Change Summary ($ in Millions)	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**
Previous President's Budget	17.425	18.969	19.053	-	19.053
Current President's Budget	16.735	18.969	16.434	-	16.434
Total Adjustments	-0.690	0.000	-2.619	-	-2.619
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.690	-			
• Adjustments to Budget Years	0.000	0.000	-2.619	-	-2.619

Change Summary Explanation

Fiscal Year (FY) 2018 funding decreased to support higher priority efforts.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army											Date: May 2017	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603015A / *Next Generation Training & Simulation Systems*				Project (Number/Name) S28 / *Immersive Learning Environments*			
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
S28: *Immersive Learning Environments*	-	2.997	3.254	0.483	-	0.483	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

This Project matures and demonstrates immersive technologies that include the application of photorealistic synthetic environments, multi-sensory interfaces, virtual humans, and training applications on low-cost game platforms for Soldier training applications using simulation technologies. This Project uses advanced modeling, simulation, and leadership development techniques to leverage the emerging immersive technologies that are created at the Institute for Creative Technologies (ICT) University Affiliated Research Center (UARC) at the University of Southern California to develop training demonstrators. These demonstrators focus on urban operations, asymmetric warfare, resilience and rehabilitation to support Warfighting units and Army Institutions (Army Training and Doctrine Command (TRADOC) and Army Medical Command (MEDCOM)). Resilience and rehabilitation research will focus on Post Traumatic Stress Disorder (PTSD). The ICT's collaboration with its entertainment partners creates a true synthesis of creativity and technology that harnesses the capabilities of industry, and the research and development community to advance the Army's capabilities.

Efforts in this Project support the Army Science and Technology Soldier/Squad portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the Army Research Laboratory (ARL), Human Research and Engineering Directorate, Simulation and Training Technology Center (STTC), Orlando, Florida.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Immersive Techniques for Training Applications	2.997	3.254	0.483
Description: This effort demonstrates and matures technological advancements from PE 0602308A/Project D02 into complex state-of-the-art simulation environments in support of multi-student and team training applications.			
FY 2016 Accomplishments: Matured collaborative virtual environments through the incorporation of live objects to enhance user's immersion experience and improve user's performance; and optimized simulation techniques such as redirected walking (creates real time virtual environment adjustments to allow user to walk through large scale environment while remaining in a smaller physical space) by expanding capability to support multiple users moving within a single virtual reality training environment.			
FY 2017 Plans:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S28 / *Immersive Learning Environments*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Demonstrate methodologies for extending multi-user redirected walking to support four or more simultaneous users; expand the advancement of new techniques and platforms for capturing real world data, including three-dimensional geometry, imagery, environmental sensor readings, and data from social networks, as applied to generating narrative systems for training; advance new approaches for creating rich, mixed reality environments by effectively combining virtual world and real world elements; determine how near-term mixed reality environment capabilities can inform future Army requirements related to immersive training; and integrate emerging commercial off the shelf (COTS) technologies with advanced research capabilities to lower the cost and increase the quality of realistic and effective virtual humans. ***FY 2018 Plans:*** Will research new interaction techniques and develop technologies that will enable more effective face-to-face communication and collaboration in multi-user virtual reality, augmented reality, and mixed reality environments; expand the integrated pipelines and virtual asset creation tools for virtual humans to support multiple platforms, including web, mobile and desktop, in a semi-automated fashion; conduct evaluations and assessments of dL courseware developed and transition the developed dL courseware to government agencies such as Program Executive Office Simulation, Training, and Instrumentation (PEO STRI); collaborate with government agencies to promote the use of the improved dL methods, techniques and technologies on the Army Learning Management System (ALMS); Improve capabilities for incorporating previously unavailable/unused open-source and government-provided environmental data sources (i.e., geospatial source data such as satellite imagery) for use in the next generation game/simulation platforms.			
Accomplishments/Planned Programs Subtotals	2.997	3.254	0.483

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: FY 2018 Army			Date: May 2017
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603015A / *Next Generation Training & Simulation Systems*	Project (Number/Name) S29 / *Modeling & Simulation - Adv Tech Dev*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
S29: *Modeling & Simulation - Adv Tech Dev*	-	8.848	6.172	6.273	-	6.273	9.953	10.195	10.443	10.687	-	-

A. Mission Description and Budget Item Justification

This Project matures and demonstrates next generation training and simulation systems that integrate virtual threats, asymmetric warfare concepts, network-centric operations, and embedding training capabilities as well as technologies into operational go-to-war future force systems to include dismounted warrior systems. The synergy between these embedded training capabilities and the immersive training advanced technology development in Project S28 provides Army units with a set of complementary embedded as well as deploy-on-demand systems that provide just-in-time, dynamic, realistic training, and mission rehearsal capabilities. Demonstrations include technologies that form a framework for future training applications for the range of future force operations such as robotic control and other sensor operations; mission planning and rehearsal; maneuver; Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) network analysis to support distributed simulations; and vehicle system interface requirements. This project creates a joint environment by synchronizing virtual and constructive simulated forces with the next generation and current training systems from the Army, Navy, Air Force, and Marine Corps forces.

Efforts in this Project support the Army science and technology Soldier/Squad portfolio.

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

Work in this project is performed by the Army Research Laboratory (ARL), Human Research and Engineering Directorate, Simulation and Training Technology Center (STTC), Orlando, Florida.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Embedded Techniques	7.696	4.872	-
Description: This effort matures and demonstrates capabilities (most provided from PE 0602308A/Project C90) built into or added onto operational systems, subsystems, or equipment, to enhance as well as maintain the skill proficiency of Soldiers, and maximizes component commonality among Soldier computer systems. This effort has been refocused and renamed Mixed and Augmented Reality.			
FY 2016 Accomplishments: Completed Fiscal Year (FY) 2015 component designs for embedded training on current and future command and control systems; developed prototype systems of advanced sensor technology for locomotion, gesturing and tactile feedback technologies			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S29 / *Modeling & Simulation - Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
for computer generated forces to simulate dismounted squads; and matured, demonstrated and assessed effectiveness of augmented reality training systems for dismounted Soldier training. ***FY 2017 Plans:*** Will mature virtual, mixed and augmented reality components. Components include, but are not limited to, sensors, communication devices, software algorithms, and vision systems, like helmet mounted displays. Matured components will be integrated to demonstrate the state of the art in augmented reality training systems for dismounted Soldiers.			
Title: Training Effectiveness ***Description:*** This research addresses the effectiveness of training Soldiers and teams in immersive environments. This effort will research and develop simulations to determine the interaction of realism, immersion, acceptance, and training effectiveness. A baseline of the key dimensions of realism and immersion for current training systems will be developed and will be extended to generate guidelines for the development of future training technologies. Cost effectiveness of these training components will also be considered. ***FY 2016 Accomplishments:*** Provided a baseline of measures and methods for use in assessing training effectiveness for a subset of technologies used in various training environments (simulated and live); began to develop comparative assessment strategies needed to measure effectiveness of future virtual, mixed, and augmented reality training technologies and identify gaps in measurement techniques. ***FY 2017 Plans:*** Will mature validated measurement techniques for assessing training effectiveness in simulated and live environments; conduct demonstrations with augmented reality training simulations for individual training applications, and identify gaps in measurement technologies. ***FY 2018 Plans:*** Will mature and demonstrate performance measurement technologies that facilitate optimization of training efficiency and effectiveness. Will improve predictive models for training outcomes in live and simulated training environments for both individual and team tasks. Will demonstrate methods for effectively blending training across classroom, computer-based, simulation-based, and live environments.	1.152	1.300	1.300
Title: Mixed and Augmented Reality ***Description:*** This effort matures and demonstrates mixed and augmented reality technologies that seamlessly blend synthetic and real environments to provide a more realistic training environment for Soldiers. Efforts matured by this effort transition to PEO-STRI.	-	-	4.973

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S29 / *Modeling & Simulation - Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
FY 2018 Plans: Will mature mixed and augmented reality components such as advanced optics and occlusion, and increase computation of the man-wearable computer for future integration into prototype soldier squad or team trainer to increase Soldier readiness.			
Accomplishments/Planned Programs Subtotals	8.848	6.172	6.273

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: FY 2018 Army			Date: May 2017
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603015A / *Next Generation Training & Simulation Systems*	Project (Number/Name) S31 / *Modeling And Simulation Infrastructure Technology*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
S31: *Modeling And Simulation Infrastructure Technology*	-	4.890	9.543	9.678	-	9.678	10.719	10.892	11.069	11.295	-	-

A. Mission Description and Budget Item Justification

This Project matures and demonstrates a distributed modeling and simulation (M&S) environment that integrates a collection of multi-fidelity models and simulations and tools that map to an evolving architecture and M&S activities to support decisions throughout the acquisition life-cycle. This provides a unifying M&S architecture that synchronizes and integrates multi-resolution modeling applications such as Live, Virtual, and Constructive (LVC) experimentation. This effort focuses on researching cutting-edge M&S methods to enable the Army and the Department of Defense (DoD) to perform critical System of Systems (SoS) analysis, experimentation, technology tradeoffs, capability assessments, concept development, and training that saves time and resources while increasing the effectiveness of acquisition and training activities.

Efforts in this Project support the Army science and technology Soldier/Squad portfolio.

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

Work in this Project is performed by the Army Research Laboratory (ARL), Human Research and Engineering Directorate, Florida.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Simulation Tools and Models	4.890	7.543	7.678
Description: This effort matures and demonstrates M&S technologies and techniques that support training and experimentation to assess and support system acquisition and military planning decision-making and SoS architecture, technology tradeoffs, etc. This research transitions to the U.S Army Program Executive Office for Simulation, Training and Instrumentation (PEO STRI).			
FY 2016 Accomplishments: Exploited current simulation architecture technologies to demonstrate utility for use in a future robust, single simulation architecture (Future Holistic Training Environment-Live/Synthetic (FHTE-LS)) and identified associated technology gaps; refined and demonstrated distributed Soldier simulation for use in training and analysis applications; matured and demonstrated M&S as a cloud-based service that supports experimentation and testing across geographically distributed areas; and demonstrated the potential of current training simulation technologies for use in areas such as cyber training in support of PEO STRI simulation technology gaps.			
FY 2017 Plans:			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S31 / *Modeling And Simulation Infrastructure Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Will mature and demonstrate future simulation architecture in support of the convergence of virtual, constructive, and gaming technologies into a single synthetic environment; refine and demonstrate authoring tools that support a variety of user types ranging from simulation expert to exercise developer to the "player"; demonstrate computational and performance capabilities that are required to represent a synthetic force at various levels in real time; and refine data distribution methodologies in support of use of simulation in traditional, hybrid cloud and cloud computing environments. ***FY 2018 Plans:*** Will mature simulation architecture technologies for a single synthetic environment that supports multiple M&S Communities (Training, Experimentation and Acquisition targeted); will optimize authoring tools that support a variety of user types ranging from simulation expert to exercise developer in support of advancing simulation execution; will refine composable modeling methods that are required to represent a synthetic force at various levels in real time; and will mature repeatable measurement methodologies for human behavior modeling to enhance training intervention or simulation technologies.			
Title: Early Human Systems Integration Demonstrations ***Description:*** This effort will mature and demonstrate state of the art methods, tools and techniques to integrate human systems integration (HSI) early in the science and technology (S&T) and requirements analysis process to ensure effective and efficient design and development of future Soldier systems. The goal of this effort is to demonstrate the effect early HSI can have on developing the most effective, efficient, and affordable design and on predicting and improving total system performance. This effort is coordinated with the U.S. Army Human Systems Integration Directorate, G1. ***FY 2017 Plans:*** Will identify gaps in available assessment tools and develop methodologies required to support HSI in the early concept development phases of Joint Capabilities Integration and Development System (JCIDS) process; and conduct initial HSI assessment(s) to determine how developed methodologies influence requirements development and early system design. ***FY 2018 Plans:*** Will develop tools and methods for early HSI based on gaps determined in Fiscal Year (FY) 17. Will mature concepts and metrics to establish return on investment (ROI) for early HSI in acquisition. Analytic approaches that bridge disciplines and analysis communities will be linked.	-	2.000	2.000
Accomplishments/Planned Programs Subtotals	4.890	9.543	9.678

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: FY 2018 Army		Date: May 2017
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S31 / *Modeling And Simulation Infrastructure Technology*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A