Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army											Date: February 2018	
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	18.238	16.434	25.682	-	25.682	26.471	21.978	21.148	22.422	0.000	152.373
S28: *Immersive Learning Environments*	-	3.129	0.483	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.612
S29: *Modeling & Simulation - Adv Tech Dev*	-	5.934	6.273	17.143	-	17.143	17.802	13.166	12.167	10.901	0.000	83.386
S31: *Modeling And Simulation Infrastructure Technology*	-	9.175	9.678	8.539	-	8.539	8.669	8.812	8.981	11.521	0.000	65.375

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, Development, and Engineering Command (RDECOM).

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army				**Date:** February 2018	

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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	18.969	16.434	20.672	-	20.672
Current President's Budget	18.238	16.434	25.682	-	25.682
Total Adjustments	-0.731	0.000	5.010	-	5.010
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.721	-			
• Adjustments to Budget Years	-0.010	-	5.010	-	5.010

Change Summary Explanation

Changes in FY19 funding in order to support the acceleration of Synthetic Training Environment efforts in order to meet senior leader priorities for Soldier Lethality.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army											Date: February 2018	
Appropriation/Budget Activity 2040 I 3				**R-1 Program Element (Number/Name)** PE 0603015A I *Next Generation Training &* *Simulation Systems*					**Project (Number/Name)** S28 I *Immersive Learning Environments*			

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
S28: *Immersive Learning Environments*	-	3.129	0.483	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.612

Note
This project completed in FY18.

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 portfolio.

The cited work is consistent with the S&T priorities of the U.S. Army Chief of Staff, Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Research in this project will be completed in FY18.

B. Accomplishments/Planned Programs ($ in Millions)

	FY 2017	FY 2018	FY 2019
Title: Immersive Techniques for Training Applications	3.129	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. Research in this effort will be completed in FY18. This effort completes in FY18. *FY 2018 Plans:*			

Exhibit R-2A, **RDT&E Project Justification:** PB 2019 Army		**Date:** February 2018
Appropriation/Budget Activity 2040 *I* 3	**R-1 Program Element (Number/Name)** PE 0603015A *I Next Generation Training & Simulation Systems*	**Project (Number/Name)** S28 *I Immersive Learning Environments*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2017**	**FY 2018**	**FY 2019**
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 courseware developed and transition the developed 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. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Effort ends in FY18.			
Accomplishments/Planned Programs Subtotals	3.129	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: PB 2019 Army										Date: February 2018	
Appropriation/Budget Activity 2040 I 3				**R-1 Program Element (Number/Name)** PE 0603015A I *Next Generation Training &* *Simulation Systems*					**Project (Number/Name)** S29 I *Modeling & Simulation - Adv Tech Dev*		

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
S29: *Modeling & Simulation - Adv Tech Dev*	-	5.934	6.273	17.143	-	17.143	17.802	13.166	12.167	10.901	0.000	83.386

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 portfolio.

The cited work is consistent with the S&T priorities of the U.S. Army Chief of Staff, Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Embedded Techniques	4.634	-	-
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.			
Title: Training Effectiveness	1.300	1.300	1.300
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 2018 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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 2017	FY 2018	FY 2019
Mature and demonstrate performance measurement technologies that facilitate optimization of training efficiency and effectiveness. Improve predictive models for training outcomes in live and simulated training environments for both individual and team tasks. Demonstrate methods for effectively blending training across classroom, computer-based, simulation-based, and live environments. *FY 2019 Plans:* Will mature and demonstrate automated training performance assessment algorithms for individuals in virtual training environments; provide a baseline of measures and methods for use in assessing effectiveness of collective training for a subset of technologies used in various training environments (mixed reality and live); identify impacts and tradeoffs associated with effectiveness of collective training using current (training) simulation architectures and the expected effectiveness of collective training associated with using future training technologies (mixed reality and live).			
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. *FY 2018 Plans:* 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. *FY 2019 Plans:* Will mature and begin internal demonstrations of Augmented Reality subcomponents such as advanced optics for the helmet mounted display, occlusion, and increased computational of the man-wearable computer to reduce size, weight, power, and cooling while also reducing logistics to enable a future augmented reality training environment that can represent the complexities of the future operational environment within which soldiers must operate. *FY 2018 to FY 2019 Increase/Decrease Statement:* Reduction in Augmented Reality demonstrations in order to support the acceleration of Synthetic Training Environment efforts.	-	4.973	4.799
Title: Mixed and Augmented Reality for Complex Environments *Description:* This effort matures and demonstrates the models and simulations that enable immersive training in future complex operational environments involving megacity terrain and unmanned autonomous systems. These technologies support the Army capability needs for the soldier to have better asymmetric vision and decide faster for dismounted soldiers in a complex urban environment.	-	-	1.144

Exhibit R-2A, **RDT&E Project Justification:** PB 2019 Army		**Date:** February 2018
Appropriation/Budget Activity 2040 I 3	**R-1 Program Element (Number/Name)** PE 0603015A I *Next Generation Training &* *Simulation Systems*	**Project (Number/Name)** S29 I *Modeling & Simulation - Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2017**	**FY 2018**	**FY 2019**
FY 2019 Plans: Will mature modeling and simulations for megacities environments that will be used for urban interactive immersive training capability, components will include the simulated terrain environment representing complex and dense urban environments as well as manned/unmanned teaming models; mature the components of the dismounted soldier augmented reality visual system and occlusion algorithms for manned/unmanned teaming training operations. *FY 2018 to FY 2019 Increase/Decrease Statement:* Investment supports senior leader priorities for Soldier Lethality and Synthetic Training Environment.			
Title: Synthetic Training Environment Acceleration *Description:* This effort matures and demonstrates technologies to enable a Synthetic Training Environment which is a single, interconnected training system in which units from squad through ASCC can train in the most appropriate domain - live, virtual, constructive, and gaming, or in all four simultaneously. *FY 2019 Plans:* Will mature and demonstrate training simulation software technologies, which enable the representation of a relevant Multi Domain Battle (MDB) within a global terrain, in direct support of the Army?s synthetic training environment; optimize the use of distributed computing and cloud infrastructures to demonstrate dynamic content updates (e.g. terrain) and point-of-need training, including the maturation of human-machine interfaces; exploit the maturations in fidelity of the global terrain, the increase in simulated entities and increase concurrent role-players for demonstration in a relevant collective training exercise. *FY 2018 to FY 2019 Increase/Decrease Statement:* Effort to support the acceleration of Synthetic Training Environment research in support of Soldier Lethality senior leader priorities.	-	-	9.900
Accomplishments/Planned Programs Subtotals	5.934	6.273	17.143

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 2019 Army										Date: February 2018	

Appropriation/Budget Activity 2040 I 3				R-1 Program Element (Number/Name) PE 0603015A I Next Generation Training & Simulation Systems						Project (Number/Name) S31 I Modeling And Simulation Infrastructure Technology	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
S31: Modeling And Simulation Infrastructure Technology	-	9.175	9.678	8.539	-	8.539	8.669	8.812	8.981	11.521	0.000	65.375

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 portfolio.

The cited work is consistent with the S&T priorities of the U.S. Army Chief of Staff, Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Simulation Tools and Models	7.175	7.678	6.539

Description: This effort matures and demonstrates modeling & simulation (M&S) technologies and techniques that support training and experimentation to assess and support system acquisition and military planning decision-making and System of Systems (SoS) architecture, technology tradeoffs, etc. This research transitions to the U.S Army Program Executive Office for Simulation, Training and Instrumentation (PEO STRI).

FY 2018 Plans:
Mature simulation architecture technologies for a single synthetic environment that supports multiple M&S Communities (Training, Experimentation and Acquisition targeted); optimize authoring tools that support a variety of user types ranging from simulation expert to exercise developer in support of advancing simulation execution; refine composable modeling methods that are required to represent a synthetic force at various levels in real time; and mature repeatable measurement methodologies for human behavior modeling to enhance training intervention or simulation technologies.

FY 2019 Plans:
Will demonstrate simulation architecture technologies for a single synthetic environment that supports multiple M&S Communities in a relevant context; optimize composable modeling methods focused on broad model reuse; improve repeatable measurement

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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 2017	FY 2018	FY 2019
methodologies for human behavior modeling; refine visualization and interaction technologies that improve human-computer interaction for training simulation; mature cyber data exchange models to enhance synthetic and live integrated training. *FY 2018 to FY 2019 Increase/Decrease Statement:* Investments in the development of human behavior modeling tools is being reduced.			
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 2018 Plans:* Develop tools and methods for early HSI based on gaps determined in Fiscal Year (FY) 17; mature concepts and metrics to establish return on investment (ROI) for early HSI in acquisition; link analytic approaches that bridge disciplines and analysis communities. *FY 2019 Plans:* Will develop enhanced Soldier performance metrics and training development tools; identify technologies to improve early system design using Soldier-centered design tools and systems engineering architecture.	2.000	2.000	2.000
Accomplishments/Planned Programs Subtotals	9.175	9.678	8.539

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

E. Performance Metrics
 N/A