Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army											Date: February 2018	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602709A / *Night Vision 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**
Total Program Element	-	34.762	34.723	29.582	-	29.582	36.267	37.536	38.823	39.599	0.000	251.292
H95: *Night Vision And Electro-Optic Technology*	-	34.762	34.723	29.582	-	29.582	36.267	37.536	38.823	39.599	0.000	251.292

A. Mission Description and Budget Item Justification

This Program Element (PE) conducts applied research and investigates core night vision and electronic sensor components and software to improve the Army's capability to operate in all battlefield conditions. Technologies pursued in this PE have the potential to provide the Army with new, or enhanced, capabilities to detect and identify targets farther on the battlefield, operate in obscured conditions, maintain a higher degree of situational understanding (SU), and operate autonomously. Project H95 advances infrared (IR) sensor technologies, investigates sensor materials, designs advanced multi-function lasers for marking, targeting, designation, wind-sensing, and range finding, and develops models and simulations for validating advanced sensor technologies. Project K90 funds Congressional special interest items.

Work in this PE is fully coordinated with PE 0602120A (Sensors and Electronic Survivability), PE 0602705A (Electronics and Electronic Devices), PE 0602712A (Countermine Technology), PE 0603606A (Landmine Warfare and Barrier Advanced Technology), PE 0603710A (Night Vision Advanced Technology), and PE 060708045 (End Item Industrial Preparedness Activities).

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 United States (U.S.) Army Research, Development, and Engineering Command (RDECOM).

B. Program Change Summary ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	36.079	34.723	35.005	-	35.005
Current President's Budget	34.762	34.723	29.582	-	29.582
Total Adjustments	-1.317	0.000	-5.423	-	-5.423
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.300	-			
• Adjustments to Budget Years	-	-	-5.423	-	-5.423
• FFRDC	-0.017	-	-	-	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army	Date: February 2018
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602709A / *Night Vision Technology*

Change Summary Explanation

Reduce Three dimensional micro-electronics for Night Vision Sensors in H95 to fund higher Army priorities in communications and networks.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602709A / *Night Vision Technology*	Project (Number/Name) H95 / *Night Vision And Electro-Optic 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
H95: *Night Vision And Electro-Optic Technology*	-	34.762	34.723	29.582	-	29.582	36.267	37.536	38.823	39.599	0.000	251.292

A. Mission Description and Budget Item Justification

This Project conducts applied research and develops component technologies that enable improved Reconnaissance, Surveillance, Target Acquisition (RSTA), and situational understanding (SU). Technologies include novel focal plane arrays (FPAs), lasers, and electronics. It also includes modeling and simulation to predict performance and to determine operational effectiveness of these technologies. Research focuses on infrared (IR) FPAs necessary to search, identify and track targets in all day/night visibility and battlefield conditions and to improve standoff detection in all operational environments. This Project designs, fabricates, and validates large format IR FPAs for sensors to simultaneously provide wide area viewing and the high resolution imagery for situational understanding, persistent surveillance, and hostile fire detection. This Project investigates and designs novel sensor electronics such as Digital Read Out Integrated Circuits (DROICs) to enable multifunction sensing. This Project also investigates and matures new semiconductor materials formed by a combination of elements from the periodic table. In addition, this Project develops algorithms for enhanced IR functionality, which provides the ability to perform detection and identification at extended ranges, as well as the ability to detect deeply buried targets. The reduction of size, weight and power - Cost (SWaP-C) is a key research objective for all efforts.

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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Distributed Aided Target Recognition (AiTR) Evaluation Center of Excellence	2.486	2.586	-
Description: This effort investigates a virtual, distributed capability to interactively process both real and simulated three-dimensional (3D) multispectral scenes for Defense-wide applications. Automatic target recognition (ATR) and AiTR algorithms are evaluated against realistic operational scenarios, to include roadside threats/explosively formed projectiles, in aided or fully autonomous Reconnaissance, Surveillance, Target Acquisition (RSTA) missions.			
FY 2018 Plans: Investigate new algorithms for situational understanding and threat awareness in all environments through hostile fire detection and location and obstacle avoidance; validate framework for image processing techniques that ingest multiple types of data from networks to increase Pd/FAR rates on multiple targets; assess algorithm performance against realistic operational scenarios and validate correlation processing of multiple types of multispectral two-dimensional (2D) and three-dimensional (3D) data of multiple targets to increase Pd while reducing the FAR using a cognitive image processing frame work.			
FY 2018 to FY 2019 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602709A / *Night Vision Technology*	**Project (Number/Name)** H95 / *Night Vision And Electro-Optic Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
This program ended in FY18			
Title: Sensor Modeling and Simulation Technology ***Description:*** This effort investigates, verifies, and validates sensor engineering models, measurement techniques, and simulations. The goal is to improve the fidelity and adaptability of modeling and simulation capabilities for Warfighter training, sensor system analysis, and identification and assessment of phenomenology associated with imaging technologies and the calibration of imaging technologies. ***FY 2018 Plans:*** Research, develop, and validate Electro-optic/Infrared (EO/IR) sensor performance models and simulations for computer-aided prototyping and augmented reality applications through field data collection, lab measurements, human signature exploitation, and algorithm development; research and develop robust and comprehensive measures of target acquisition performance; validate with lab measurements; leverage commercial gaming simulation technologies and augmented reality as a means to increase situational understanding. ***FY 2019 Plans:*** Will continue to research and validate methods to model and simulate Electro-optic/Infrared (EO/IR) system performance for computer-aided prototyping and augmented reality applications through field data collection, lab measurements, simulation, signature, and algorithm research; will research methods to model emerging active and passive EO/IR technologies, applications, and threats such as hostile fire and unattended aerial systems to contribute to sensor system design; will investigate and validate target acquisition performance measures to address EO/IR sensor signature countermeasures; will investigate the application of commercial gaming technologies and augmented reality for modeling and simulation tools to create a rapid ability to assess EO/IR system designs. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** FY19 funding decrease to meet decreased objectives in FY2019 Base Plans which includes less field tests.	4.931	5.110	4.829
Title: Advanced Multifunction Laser Technology ***Description:*** This effort investigates technologies for a new class of multi-wavelength laser modules which will have the ability to replace multiple laser targeting systems and reduce the size, weight, and power (SWaP) of current devices. The goal is to achieve a single housing, electronics board, power supply, and telescope for all applications to provide a reduction in the SWaP of multi-function laser systems. The objective is to develop a laser with higher efficiency and lower volume than existing pulsed Mid-wave Infrared (MWIR) and Long-wave Infrared (LWIR) lasers, which will be used for threat sensor detection and active imaging in degraded visual environments. ***FY 2018 Plans:***	4.446	5.037	5.192

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Conduct investigations of various MWIR laser configurations for threat sensor detection; validate and compare performance of different laser breadboards, including bulk solid state and fiber based pump lasers for frequency conversion, compare different frequency conversion techniques for efficient generation of MWIR; and perform trade studies of LWIR laser designs, and select best approach for implementation and further evaluation. ***FY 2019 Plans:*** Will complete investigation and perform down select of a MWIR laser configuration for threat sensor detection based on performance by different selected laser breadboards; will identify the highest performing frequency conversion techniques for electrical efficiency; will design and develop a lightweight and low power brass-board laser with greater than five Watts of power. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Increase due to inflation adjustment			
Title: Advanced Structures for Cooled Infrared Sensors ***Description:*** This effort researches detector materials and substrates for infrared (IR) sensors. This effort investigates and improves III-V materials (materials formed by a combination of elements from Groups III and V of the periodic table) and II-VI material (materials formed by a combination of elements from Groups II and VI of the periodic table), to provide low cost, large format, high quality imaging sensors. The emphasis of this effort is on reducing material defects and increasing reliability by developing new ways to prepare and treat the substrates, new designs, and new methods of growing the structures. The goal of this effort is to develop cost effective components for high definition Army IR sensors.	5.520	-	-
Title: Three-Dimensional Micro-Electronics for Night Vision Sensors ***Description:*** The goal of this effort is to investigate new, microelectronics, reconfigurable optics, and display technologies to interface with emerging 3D electronics processing. The ability to actively reconfigure optical elements will require investigation of new materials and lens designs to enable real time optical refocusing and extended fields of view. Micro-display technology will benefit from new integrated microelectronics by use of new and improved display materials which operate at lower powers and enable all weather, day/night visualization. ***FY 2018 Plans:*** Validate range performance of reconfigurable optical elements in sensor objectives and augmented reality display optics while maintaining optimized overlay of display and real scene; conduct investigation of suitability of novel optical element surface treatments for high optical throughput; mature high resolution displays for targeting and maneuver; validate optical components through bench top end-to-end testing. ***FY 2018 to FY 2019 Increase/Decrease Statement:***	5.836	6.076	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Eliminate in FY19 in order to align funds to meet higher Army priorities.			
Title: Multi-Function Digital Readout Integrated Circuits for Cooled and Uncooled Focal Plane Arrays ***Description:*** The objective of this effort is the development of advanced 2-Dimensional (2D) and 3-Dimensional (3D) Digital Readout Integrated Circuits (DROICs) to replace legacy 2D analog ROICs. This effort will investigate and design a digital readout architecture optimized for large format, high resolution infrared (IR) focal plane arrays (FPAs) through the use of modeling, analysis, and simulations. This enabling technology will bring substantial advancements to IR imaging capabilities. ***FY 2018 Plans:*** Fabricate multi-layer Readout Integrated Circuits (ROIC) to significantly increase ability to storage of charge in a very small pixel area; validate new ROICs and arrays with increased dynamic range capability over legacy cooled imaging sensors; refine designs of digital ROIC circuitry for uncooled sensors; produce initial test structures for laboratory validation of designs. ***FY 2019 Plans:*** Will investigate and conduct experiments to validate real-time processing that will put multiple functions into a small package, while allowing for an on-the-move capability; will develop an on-chip non-uniformity correction (NUC) that demonstrates high frame rate dynamic motion compensation and on-chip stabilization IR imagery for improved dynamic range in a compact package. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Funding increased to FY19 in order to meet Army priority of multifunction sensors	6.645	6.334	7.445
Title: Computational Imaging ***Description:*** This effort develops component technology designed to increase battle space awareness, threat detection, and target identification (ID) by using a methodology of computation algorithms and optics combined with display and vision processing. The objective is to provide extended range, multi-spectral imaging capability, with reductions to the size, weight and cost (SWaC), for the individual warfighter. This effort will leverage work accomplished under Multi-Function Digital Readout Integrated Circuits (DROICs) for Cooled and Uncooled Focal Plane Arrays (FPAs) to provide improved mounted and dismounted Soldier situational understanding in urban and complex terrain under low light and visibility conditions. In FY19 a portion of funding is realigned to support a new effort in Embedded Processing for Autonomous Systems to meet Chief Staff of the Army (CSA) priorities. ***FY 2018 Plans:***	4.898	4.413	2.210

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Investigate novel optics, sensors, and processing approaches for day/night visualization; conduct experiments in 3D scene visualization with compact infrared sensors; validate predicted algorithm performance for threat detection and sensor localization; begin development of new optic for performing real-time detection and localization operations ***FY 2019 Plans:*** Will design novel optics, sensors, and processing approaches for day/night visualization; will conduct experiments of computational algorithms and optics combined with display and vision processing to identify improvements in target discrimination and visualization; will validate new optics for performing real-time detection. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** FY19 funding decrease to increase efforts in embedded processing for autonomous sensors			
Title: High Sensitivity High Speed Uncooled Longwave Infrared (UCIR) Technology ***Description:*** This effort develops a new class of uncooled high sensitivity/high speed infrared (IR) imaging sensors to enable applications such as Hostile Fire Indication (HFI), Improvised Explosive Device (IED) and disturbed earth detection, driving/ pilotage guidance, and 360? situational awareness on all platforms. ***FY 2018 Plans:*** Conduct experiments on new materials and structure designs; produce initial test arrays based on the new materials; incorporate advances in Digital Read Out Integrated Circuits (DROICs) designs to enable sensitivity and dynamic range increases over currently available uncooled Long-wave Infrared (LWIR) technology. ***FY 2019 Plans:*** Will continue to conduct experiments and validate new class of highly sensitive uncooled infrared imaging arrays; will design high-dynamic range speed Readout Integrated Circuits (ROIC) and leverage advancing commercial foundry processes. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Minor change in FY19 funding decrease for personnel	-	5.167	5.135
Title: Embedded Processing for Autonomous Sensors ***Description:*** This effort develops signal and image processing algorithms at the sensor to provide actionable information in contextually relevant manner to the decision maker. ***FY 2019 Plans:*** Will conduct market research on signal and image processing algorithms for autonomous applications; will investigate novel techniques for improving signal and image processing algorithms to perform functions such as scene labeling, and data	-	-	4.771

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
association to enable autonomous functions; will research innovative approaches for data management and fusion which reduce information processing time. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** This is a new effort that is started in FY19			
Accomplishments/Planned Programs Subtotals	34.762	34.723	29.582

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A