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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2020 Army **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army / BA 2: Applied Research</i>					<b>R-1 Program Element (Number/Name)</b> PE 0602709A / <i>Night Vision Technology</i>							
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
Total Program Element	-	38.243	33.573	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	71.816
H95: <i>Night Vision And Electro-Optic Technology</i>	-	34.243	29.573	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	63.816
K90: <i>NIGHT VISION COMPONENT TECHNOLOGY (CA)</i>	-	4.000	4.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.000

**Note**

In Fiscal Year (FY) 2020, this Program Element (PE) is realigned with continuity of effort to the following PEs:

- \* PE 0602143A Soldier Lethality Technology
- \* PE 0602145A Next Generation Combat Vehicle Technology
- \* PE 0602148A Future Vertical Lift Technology

**A. Mission Description and Budget Item Justification**

This 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 0708045A (End Item Industrial Preparedness Activities).

All FY20 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

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

Work in this Project is performed by the United States Army Futures Command (AFC).

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<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>
Previous President's Budget	34.723	29.582	36.267	-	36.267
Current President's Budget	38.243	33.573	0.000	-	0.000
Total Adjustments	3.520	3.991	-36.267	-	-36.267
• Congressional General Reductions	-0.010	-0.009			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	4.000	4.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.470	-			
• Adjustments to Budget Years	-	-	-36.267	-	-36.267

**Congressional Add Details (\$ in Millions, and Includes General Reductions)**

**Project:** K90: *NIGHT VISION COMPONENT TECHNOLOGY (CA)*

Congressional Add: *Night Vision Component Technology*

	<b>FY 2018</b>	<b>FY 2019</b>
	4.000	4.000
Congressional Add Subtotals for Project: K90	4.000	4.000
Congressional Add Totals for all Projects	4.000	4.000

**Change Summary Explanation**

FY19 increase related to congressional add of \$4 Million

FY20 decrease related to Science and Technology financial restructuring

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**Exhibit R-2A, RDT&E Project Justification:** PB 2020 Army **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602709A / <i>Night Vision Technology</i>				<b>Project (Number/Name)</b> H95 / <i>Night Vision And Electro-Optic Technology</i>			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
<i>H95: Night Vision And Electro-Optic Technology</i>	-	34.243	29.573	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	63.816

**Note**

In Fiscal Year (FY) 2020 this Project is being realigned to:  
 Program Element (PE) 0602143A Soldier Lethality Technology  
 \* Project BD1 Adv Soldier Sensors/Displays Tech for Dismounts  
 PE 0602145A Next Generation Combat Vehicle Technology  
 \* Project BF9 Sensors for Autonomous Operations and Surv Tech  
 \* Project BJ2 Tactical and Navigation Lasers Sensors Technology  
 \* Project BH2 C4ISR Modular Autonomy Technology  
 PE 0602148A Future Vertical Lift Technology  
 \* Project AK2 Aviation Survivability Technology

**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.

All FY20 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

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

Work in this Project is performed by the United States Army Futures Command (AFC).

**B. Accomplishments/Planned Programs (\$ in Millions)**

	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b>Title:</b> Distributed Aided Target Recognition (AiTR) Evaluation Center of Excellence	2.106	-	-

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602709A / <i>Night Vision Technology</i>	<b>Project (Number/Name)</b> H95 / <i>Night Vision And Electro-Optic Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<p><b>Description:</b> 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 ATR algorithms are evaluated against realistic operational scenarios, to include roadside threats/explosively formed projectiles, in aided or fully autonomous RSTA missions.</p>				
<p><b>Title:</b> Sensor Modeling and Simulation Technology</p> <p><b>Description:</b> 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.</p> <p><b>FY 2019 Plans:</b> 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; 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; 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.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> This research effort was realigned to PE 0602143A (Soldier Lethality Technology) / Project BD1 (Adv Soldier Sensors/Displays Tech for Dismounts) in FY20 as part of the financial restructuring.</p>		5.110	4.769	-
<p><b>Title:</b> Advanced Multifunction Laser Technology</p> <p><b>Description:</b> 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.</p> <p><b>FY 2019 Plans:</b></p>		5.037	5.128	-

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<p>Complete investigation and perform down select of a MWIR laser configuration for threat sensor detection based on performance by different selected laser breadboards; identify the highest performing frequency conversion techniques for electrical efficiency; design and develop a lightweight and low power brass-board laser with greater than five Watts of power.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> This research effort was realigned to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BJ2 (Tactical and Navigation Lasers Sensors Technology) in FY20 as part of the financial restructuring.</p>				
<p><b>Title:</b> Three-Dimensional Micro-Electronics for Night Vision Sensors</p> <p><b>Description:</b> The goal of this effort is to investigate new, microelectronics, reconfigurable optics, and display technologies to interface with emerging three-dimensional (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.</p>		6.076	-	-
<p><b>Title:</b> Multi-Function Digital Readout Integrated Circuits for Cooled and Uncooled Focal Plane Arrays</p> <p><b>Description:</b> The objective of this effort is the development of advanced two-Dimensional (2D) and 3D DROICs to replace legacy 2D analog ROICs. This effort will investigate and design a digital readout architecture optimized for large format, high resolution IR FPAs through the use of modeling, analysis, and simulations. This enabling technology will bring substantial advancements to IR imaging capabilities.</p> <p><b>FY 2019 Plans:</b> 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.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> This research effort was realigned to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BF9 (Sensors for Autonomous Operations and Surv Tech) in FY20 as part of the financial restructuring.</p>		6.334	7.356	-
<p><b>Title:</b> Computational Imaging</p> <p><b>Description:</b> 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 DROICs for Cooled</p>		4.413	2.182	-

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
and Uncooled FPAs to provide improved mounted and dismounted Soldier situational understanding in urban and complex terrain under low light and visibility conditions.				
<p><b>FY 2019 Plans:</b> 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.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> This effort realigned to PE 0602145A Next Generation Combat Vehicle Technology/Project BF9 Sensors for Autonomous Operations and Surv Tech in FY20 due to financial restructure in support of Army Modernization Priorities.</p>				
<p><b>Title:</b> High Sensitivity High Speed Uncooled Longwave Infrared (UCIR) Technology</p> <p><b>Description:</b> This effort develops a new class of uncooled high sensitivity/high speed 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.</p> <p><b>FY 2019 Plans:</b> Will continue to conduct experiments and validate new class of highly sensitive uncooled infrared imaging arrays; will design high-dynamic range speed ROIC and leverage advancing commercial foundry processes.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> This research effort was realigned to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BF9 (Sensors for Autonomous Operations and Surv Tech) in FY20 as part of the financial restructuring.</p>		5.167	5.071	-
<p><b>Title:</b> Embedded Processing for Autonomous Sensors</p> <p><b>Description:</b> This effort develops signal and image processing algorithms at the sensor to provide actionable information in contextually relevant manner to the decision maker.</p> <p><b>FY 2019 Plans:</b> 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 association to enable autonomous functions; will research innovative approaches for data management and fusion which reduce information processing time.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b></p>		-	4.712	-

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
This research effort was realigned to PE 0602145A (Next Generation Combat Vehicle Technology) / Project BH2 (C4ISR Modular Autonomy Technology) in FY20 as part of the financial restructuring.				
<b>Title:</b> FY 2019 SBIR / STTR Transfer		-	0.355	-
<b>Description:</b> FY 2019 SBIR / STTR Transfer				
<b>FY 2019 Plans:</b> FY 2019 SBIR / STTR Transfer				
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> FY 2019 SBIR / STTR Transfer				
<b>Accomplishments/Planned Programs Subtotals</b>		34.243	29.573	-
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b>				
N/A				
<b>E. Performance Metrics</b>				
N/A				

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<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
K90: <i>NIGHT VISION COMPONENT TECHNOLOGY (CA)</i>	-	4.000	4.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.000

**A. Mission Description and Budget Item Justification**

Congressional Interest Item funding for Night Vision Component Technology applied research.

**B. Accomplishments/Planned Programs (\$ in Millions)**

	<b>FY 2018</b>	<b>FY 2019</b>
<b>Congressional Add:</b> Night Vision Component Technology	4.000	4.000
<b>FY 2018 Accomplishments:</b> Night Vision Component Technology		
<b>FY 2019 Plans:</b> Night Vision Component Technology		
<b>Congressional Adds Subtotals</b>	4.000	4.000

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

N/A

**E. Performance Metrics**

N/A