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Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army	Date: February 2015
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Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)					R-1 Program Element (Number/Name) PE 0603710A / Night Vision Advanced Technology							
COST (\$ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
Total Program Element	-	43.459	44.119	40.929	-	40.929	44.968	40.135	44.000	44.872	-	-
K70: Night Vision Adv Tech	-	19.867	27.331	26.740	-	26.740	27.793	22.802	26.657	27.186	-	-
K73: NIGHT VISION SENSOR DEMONSTRATIONS (CA)	-	8.000	-	-	-	-	-	-	-	-	-	-
K86: Night Vision, Abn Sys	-	15.592	16.788	14.189	-	14.189	17.175	17.333	17.343	17.686	-	-

A. Mission Description and Budget Item Justification

This program element (PE) matures and demonstrates sensor technologies that increase Warfighter situational awareness, survivability and lethality by providing sensor capabilities to acquire and engage targets at longer ranges in complex environments and operational conditions (e.g. day/night, obscured, smoke, adverse weather and other degraded visual environments). Project K70 pursues technologies that improve the Soldier's ability to see at night, provide rapid wide area search, multispectral aided target detection (AiTD), integrate disparate sensor architectures, and enable passive long range target identification (ID beyond threat detection) in ground test-beds. Project K86 matures and evaluates sensors and algorithms designed to detect targets (vehicles and personnel) in camouflage, concealment and deception from airborne platforms, and provides pilotage and situational awareness imagery to multiple pilots/crew members independently for enhanced crew/aircraft operations in day/night/adverse weather conditions.

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 fully coordinated with efforts in PE 0602120A (Sensors and Electronic Survivability), PE 0602270A (Electronic Warfare Technology), PE 0602709A (Night Vision and Electro-Optics Technology), PE 0602712A (Countermining Systems), PE 0603001A (Warfighter Advanced Technology), PE 0602211A (Aviation Technology), PE 0603003A (Aviation Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603606A (Landmine Warfare and Barrier Advanced Technology), PE 0603774A (Night Vision Systems Advanced Development) and PE 0604710A (Night Vision Systems Engineering Development).

Work in this PE is performed by the U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC)/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

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Appropriation/Budget Activity		R-1 Program Element (Number/Name)			
2040: Research, Development, Test & Evaluation, Army / BA 3: Advanced Technology Development (ATD)		PE 0603710A / Night Vision Advanced Technology			
B. Program Change Summary (\$ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	44.387	44.138	44.228	-	44.228
Current President's Budget	43.459	44.119	40.929	-	40.929
Total Adjustments	-0.928	-0.019	-3.299	-	-3.299
• Congressional General Reductions	-	-0.019			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.928	-			
• Adjustments to Budget Years	-	-	-3.299	-	-3.299
Congressional Add Details (\$ in Millions, and Includes General Reductions)					
Project: K73: NIGHT VISION SENSOR DEMONSTRATIONS (CA)					
Congressional Add: Program Increase					
Congressional Add Subtotals for Project: K73					
Congressional Add Totals for all Projects					
		FY 2014	FY 2015		
		8.000	-		
		8.000	-		
		8.000	-		

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Exhibit R-2A, RDT&E Project Justification: PB 2016 Army										Date: February 2015		
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>				Project (Number/Name) K70 / <i>Night Vision Adv Tech</i>			
COST (\$ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
K70: <i>Night Vision Adv Tech</i>	-	19.867	27.331	26.740	-	26.740	27.793	22.802	26.657	27.186	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates high-performance integrated sensor/multi-sensor technologies to increase target detection range, extend target identification range, and reduce target acquisition (TA) timelines for dismounted Soldiers and tactical vehicles against threats that are beyond today's detection ranges or are partially obscured by terrain, weather or other features.

This project supports Army science and technology efforts in the Command, Control, Communications and Intelligence, Air and Soldier Portfolios.

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

Work in this project is performed by the U.S. Army Communications-Electronics Research, Development, and Engineering Center (CERDEC) /Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

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

	FY 2014	FY 2015	FY 2016
Title: Weapon Sight Technology	6.102	6.186	-
Description: This effort develops, integrates and demonstrates critical components for the next generation of weapon sight systems for mounted and dismounted Soldier use to provide improved actionable intelligence and the tools to assist in recognizing and identifying friend or foe.			
FY 2014 Accomplishments: Integrated and evaluated an integrated sensor fusion kit (combines situational awareness and target handoff) and existing fielded equipment and improved algorithms to reduce false alarms for an affordable ultra violet (UV)/virtual pointer (VP) and hand-held targeting technology; leveraged and integrated latest generation of high performance Focal Plane Arrays (FPAs), displays, advanced optics, direction finding and wireless data component technologies for lighter weight, lower power, clip-on weapon sight with improved range performance.			
FY 2015 Plans: Improve sensor processing efficiency and demonstrate crew served weapon sight with increased range, ID capability and reduced Size, Weight, and Power (SWaP); leverage new optical design and high performance uncooled infrared detector to complete			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2014	FY 2015	FY 2016
design of next generation sniper weapon sight with reduced SWaP; begin design studies of conformal head mounted composite waveguide displays with day/night usability and wireless interface for remote display of weapon sight imagery.				
Title: Tactical Ground Persistent Surveillance and Targeting Description: This effort matures and demonstrates high-performance integrated sensor/multi-sensor technologies to increase local situational awareness and target discrimination capabilities and reduce target acquisition (TA) timelines for dismounted Soldiers, combat vehicles, tactical robots, ground and urban sensors against threats that are beyond today's ranges or discrimination capabilities or are partially obscured by terrain. FY 2014 Accomplishments: Increased sensor resolution with large format focal plane arrays and improved active illumination coverage to demonstrate long range, rapid and positive target recognition; improved gimbal performance through a combination of mechanical and electrical techniques to provide stabilized imagery for the sensor surveillance suite; demonstrated improved moving target indicator software capable of human and small unmanned aerial vehicle target recognition with improved system performance by leveraging laser range finder, cross-cueing with radars and advanced real-time signal processing of infrared imagery. FY 2015 Plans: Mature and validate algorithms for ground to air infrared search and track capabilities; optimize techniques to include rotating camera(s), stacked prisms, and staring arrays to improve 360 degree coverage and increase affordability; demonstrate high resolution target tracking and identification for target handoff and engagement.		6.108	5.443	-
Title: Advanced Sensors for Precision Description: This effort matures and demonstrates technologies that allow combat vehicle commanders and crewmen to detect more rapidly, identify and geo-locate threat targets to enable fire control for platform weaponry. The effort leverages advanced Infrared (IR) imaging technology, 3-Dimensional (3D) imaging sensor techniques, emerging multispectral laser technologies and precise far target location technology to increase target detection range, extended target and reduce target acquisition timelines. This effort supports the Army's Active Protection System (APS) program to mature and demonstrate APS technologies to reduce vehicle weight while reducing reliance on armor through the use of other means such as sensing, warning, hostile fire detection, and active countermeasures to achieve increased protection against current and emerging threats. FY 2014 Accomplishments: Integrated next generation, high definition component technologies to rapidly detect and identify threats while on-the-move for vehicle sights; demonstrated flash detection capability coupled with acoustics for cueing and bullet tracking; developed hardware and software for detection and negation of sniper optics. FY 2015 Plans:		7.657	10.688	11.573

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Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603710A / Night Vision Advanced Technology	Project (Number/Name) K70 / Night Vision Adv Tech		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2014	FY 2015	FY 2016
Validate low cost integrated uncooled IR sensors for Situational Awareness (SA) and muzzle flash detection; improve design for active threat sensor detection of uncooled and cooled IR sensors; mature clutter rejection techniques for reduced false alarms and threat sensor point of origin determination; exploit existing and emerging laser technologies and determine limitations for suppression of threat night vision and electro-optic imaging sensors; begin development of concept demonstrator hardware to demonstrate detection/suppression in a single waveband. FY 2016 Plans: Will demonstrate uncooled IR for SA and muzzle flash detection and on the move performance of ground hostile fire detection and algorithms; optimize design for pre-shot threat sensor detection of uncooled and cooled IR sensors; demonstrate hostile fire clutter rejection techniques for reduced false alarms and threat sensor point of origin determination and assess performance for an expanded threat set; validate laser technologies and limitations for pre-shot suppression of threat sensors; demonstrate stationary pre-shot detection/suppression of threat imaging sensors at objective ranges; perform perception experiments on pre-shot suppression to determine metrics and system requirements.				
Title: Sensor Interoperability Description: This effort is developing and demonstrating an interoperability architecture that allows a system to dynamically discover and leverage other systems on a network without any specific or prior knowledge. The goal is to develop standards, data models, and protocols that provide a common language for sensor systems to connect, publish their capabilities and needs, and interact with other systems even on disadvantaged networks. The benefits are increased sensor collaboration, more rapid time to decision, reduced soldier load, and lowered integration costs. FY 2015 Plans: Model and simulate the sensor portion of the Computing Environment (CE); mature and evaluate sensor to network standards including implementation specifications and guides; implement standards, demonstrate, evaluate and refine interoperability of Electro-optic/Infrared, radar sensors, chemical, biological, radioactive, nuclear, explosive (CBRNE) systems, biometric sensors; mature and demonstrate sensor imagery and metadata products as well as Dynamic, Distributed, Discover (D3) configuration capability. FY 2016 Plans: Will develop methodologies for sensor interoperability and appropriate data flow across security classification domains; develop approaches to tailoring data request results that minimize network bandwidth requirements; improve the architecture and framework using distributed networked resources such as storage, processing, bandwidth to provide redundancy, robustness, and fault tolerance in both Enterprise and Tactical networks.		-	4.000	3.500
Title: Soldier System Architecture		-	1.014	1.018

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2014	FY 2015	FY 2016
Description: This effort designs, develops and matures soldier sensor, optics, displays and electronic system interfaces that will be incorporated into the larger Soldier system architecture to improve the individual Soldier's effectiveness / efficiency, reducing burden while reducing total operational costs. This effort is coordinated with PE 0603001A/Project J50, PE 0602716A/Project H70, PE 0602786A/Project H98, 060315A/Project S28, and 0603004A/Project 232. FY 2015 Plans: Develop Measures of Effectiveness / Measures of Performance (MOE/MOP) for the sensor, optics, displays and electronic systems used by the individual Soldier and integrate these MOE/MOPs into the overall Soldier System Architecture. FY 2016 Plans: Will evaluate MOE/MOP for the sensor, optics, displays and electronic systems used by the individual Soldier and refine MOE/MOPs as part of the overall Soldier System Architecture.				
Title: Ground Based Sensors and Integration for Degraded Visual Environments (DVE) Description: This effort provides uncooled Infrared (IR) sensor technologies to improve survivability through increased Situational Awareness (SA) in all conditions and environments, to include (DVE), for manned and unmanned ground vehicle systems. Current uncooled IR requires improvement in sensitivity and development of signal processing techniques to penetrate obscurants. Integration of improved sensors, signal processing algorithms, and data fusion will maintain mission capabilities in DVE (e.g. smoke, dust, fog). Demonstration of scalable, multi-function (360 degree SA, Hostile Fire Detection (HFD), Aided Driving), low cost SA systems with in-vehicle displays that can be tailored to the ground platform and mission requirements will bring timely and useful information to the vehicle crew and squad. Joint effort with TARDEC under PE 0602601, PROJ C05 and 0603005, PROJ 221. Fully coordinated with PE 0602709, PROJ H95. FY 2016 Plans: Will evaluate technologies that support ground SA in DVE to include optimized uncooled IR sensors with optical filtering or signal processing techniques, integration of sensor combinations and modalities, and fusion of sensor data; evaluate concepts for scalability and multi-function sensor capability that can be applied to tactical vehicles and combat platforms; explore industry approaches for automotive driving aids for automated personnel and obstacle detection and applicability to military environments.		-	-	4.840
Title: Soldier Maneuver and Lethality Sensors Description: This effort matures and demonstrates dismounted Soldier capabilities that improve Soldier mobility, maneuver, situational awareness, threat detection, targeting and lethality. Innovative technologies for Soldier weapon or head mounted sensors, head mounted displays, and tactical lasers will be provided for user evaluation. These technologies address human factors / human dimension and lower weight, reduce cost, and improve performance of Soldier based sensor systems.		-	-	5.809

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2014	FY 2015
<i>FY 2016 Plans:</i> Will design head mounted High Definition (HD) color waveguide displays to replace heavier and larger prism based devices to enable use with protective eyewear; incorporate improved display components for injection node and holograms to increase brightness and reduce image distortion for day/night usability; improve Soldier target engagement by evaluating crosswind profile measurement, self boresighting reticle, and thru sight situational awareness technologies.			
Accomplishments/Planned Programs Subtotals		19.867	27.331
C. Other Program Funding Summary (\$ in Millions)			
N/A			
Remarks			
D. Acquisition Strategy			
N/A			
E. Performance Metrics			
N/A			

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Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603710A / <i>Night Vision Advanced Technology</i>				Project (Number/Name) K73 / <i>NIGHT VISION SENSOR DEMONSTRATIONS (CA)</i>			
COST (\$ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
K73: <i>NIGHT VISION SENSOR DEMONSTRATIONS (CA)</i>	-	8.000	-	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification
 Congressional Interest Item funding for Night Vision advanced technology development.

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

	FY 2014	FY 2015
<i>Congressional Add:</i> Program Increase	8.000	-
<i>FY 2014 Accomplishments:</i> Demonstrated Night Vision Electro-Optical and Infrared (EO/IR) technology to address Warfighter needs in the areas of situational awareness, operations in degraded visual environments (DVE) and Soldier/Squad mobility.		
Congressional Adds Subtotals	8.000	-

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

Remarks

D. Acquisition Strategy
 N/A

E. Performance Metrics
 N/A

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Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603710A / Night Vision Advanced Technology				Project (Number/Name) K86 / Night Vision, Abn Sys			
COST (\$ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
K86: Night Vision, Abn Sys	-	15.592	16.788	14.189	-	14.189	17.175	17.333	17.343	17.686	-	-

A. Mission Description and Budget Item Justification

This project matures and demonstrates intelligence, surveillance, reconnaissance, targeting and pilotage technologies in support of the Army's aviation and networked systems. This effort focuses on improved reconnaissance, surveillance and target acquisition and night pilotage sensors, high-resolution heads-up displays, sensor fusion, and aided target recognition (AiTR) capabilities for Army vertical lift aircraft and utility helicopters and unmanned aerial systems (UAS). UAS payload efforts mature and demonstrate small, lightweight, modular, payloads (electro-optical/infrared, laser radar, designator) to support target detection, identification, location, tracking and targeting of tactical targets for the Brigade Combat Team.

The project supports Army science and technology efforts for the Air and Command, Control, Communications and Intelligence portfolios.

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 fully coordinated with PE 0602211A (Aviation Technology) PE 0603003A (Aviation Advanced Technology).

Work in this project is performed by the U.S. Army Communications-Electronics Research, Development, and Engineering Center (CERDEC) /Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2014	FY 2015	FY 2016
Title: Airborne Unmanned Persistent Imaging Description: This effort demonstrates day and night persistent surveillance imaging and enhanced reconnaissance, surveillance and target acquisition (RSTA) capabilities from a single payload on the Grey Eagle Unmanned Aerial System (UAS). The technology will be applied to smaller/lighter UASs as miniaturized large format sensors mature. FY 2014 Accomplishments: Completed system flight testing; matured Step-Stare capability, demonstrated local-area persistent surveillance for small unit situational awareness; demonstrated automated target cueing, vehicle and dismount tracking, image mosaicing and mapping, and provided imagery and target report products to the small unit network; demonstrated high definition (HD) dual band 720 pixel format Mid Wave Infrared (MWIR) and Long Wave Infrared (LWIR) imagery to determine best band for battlefield conditions and improved performance in adverse weather.	4.730	-	-
Title: High Definition Aviation Displays	6.665	-	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2014	FY 2015	FY 2016
Description: This effort develops and demonstrates an advanced monocular, see-through, high definition, digital, helmet mounted display (HMD) to replace Apache's analog, cathode ray tube-based Integrated Helmet and Display Sight System (IHADSS) and provides a baseline for future aviation HMDs. FY 2014 Accomplishments: Completed fabrication of wide field of view system demonstrators; conducted laboratory performance characterization of complete HMD system and aero-medical human factors conformance; finalized platform integration activities; conducted ground and flight test demonstrations and user evaluation.				
Title: Multifunction Imagers for Rotary Wing Description: This effort matures and demonstrates an economical sensor capability by developing multifunction sensor modules for increased performance of pilotage capability in a Degraded Visual Environment (DVE) at lower total life cycle cost than separate sensor systems. Work in this effort is coordinated with DVE efforts in PE 0602211A, Aviation Technology, Project 47A. FY 2014 Accomplishments: Developed a dual-speed 60/1000 Hz Readout Integrated Circuit (ROIC) that enables a single infrared (IR) sensor to provide simultaneous day/night imagery for applications such as pilotage; integrated the dual-purpose IR sensor into a multifunction sensor module with other low-light night vision technology to provide a multi-spectral capability; conducted trade studies to optimize sensor placement for multiple applications performance over the entire flight envelope, including degraded visual environments. FY 2015 Plans: Fabricate a dual-purpose IR sensor with the dual speed ROIC; continue integration of dual-purpose IR sensors with other low-light night vision technology; develop pilotage image processing algorithms in the dual purpose IR sensor; develop threat warning algorithms for use with IR sensor operating at 1000 Hz frame rate; begin flight testing to validate pilotage sensor and processing technologies for performance in degraded visual environments. FY 2016 Plans: Will complete integration of dual-purpose IR sensors with other low-light night vision technology; characterize performance of threat warning algorithms and pilotage sensor under brownout and rain DVE through a series of laboratory, field and flight test measurements; identify performance issues and optimize threat warning algorithms and pilotage sensors.		4.197	10.042	9.982
Title: Local Area ISR for Tactical Small Units		-	4.746	2.207

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2014	FY 2015
Description: This effort develops and demonstrates sensors enabling simultaneous display of wide and narrow field-of-view (FOV) infrared imagery for enhanced situational awareness/targeting and multi-band image fusion and the ability to image battlefield laser spot locations for improved targeting accuracy and reduced fratricide caused by laser misalignment. FY 2015 Plans: Conduct design trade study to retrofit existing turret with optical components to provide simultaneous wide FOV and independently steerable narrow FOV capability through optical beam splitting of the existing common sensor payload dual-band Mid Wave (MW)/ Long Wave (LW) Infrared (IR) camera; begins maturation of a compact, high definition, 3-band (visible, near infrared, shortwave infrared) camera module to enable imaging of battlefield lasers and multi-band image fusion. FY 2016 Plans: Will complete design to retrofit existing turret with optical components to provide simultaneous wide FOV and independently steerable narrow FOV capability; demonstrate compact, high definition, 3-band (visible, near infrared, shortwave infrared) camera module			
Title: Pilotage Sensor Fusion Description: This effort develops and matures sensor fusion utilizing combinations of sensing modalities (active and/or passive) and associated real-time processing algorithms and architectures to produce synthetic scene representations that provide increased information content as opposed to scenes produced from existing single mode sensor solutions. FY 2015 Plans: Collect field data from multiple sensor modalities (e.g. passive/active infrared, radar, shortwave light detection and ranging) under Degraded Visual Environment (DVE) conditions; identify exploitable features associated with each modality; begin development of algorithm approaches to produce synthetic scenes for presentation to the pilot. FY 2016 Plans: Will validate exploitable features associated with multiple sensing modalities to aid with operations under DVE; demonstrate algorithm approach for fusion of two sensor modalities that provides increased situational awareness to the pilot as compared to either single sensor modality.		-	2.000
Accomplishments/Planned Programs Subtotals		15.592	16.788
C. Other Program Funding Summary (\$ in Millions)			
N/A			
Remarks			

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D. Acquisition Strategy N/A		
E. Performance Metrics N/A		