

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

**February 2008**

BUDGET ACTIVITY		PE NUMBER AND TITLE					
<b>3 - Advanced technology development</b>		<b>0603710A - NIGHT VISION ADVANCED TECHNOLOGY</b>					
COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
Total Program Element (PE) Cost	73826	53910	39916	40595	43985	45653	46756
590 OVERWATCH ACTD	287						
C65 DC65	4415	394					
K70 NIGHT VISION ADV TECH	17161	22857	23556	26863	28344	28648	29368
K73 NIGHT VISION SENSOR DEMONSTRATIONS (CA)	31134	18283					
K86 NIGHT VISION, ABN SYS	20829	12376	16360	13732	15641	17005	17388

**A. Mission Description and Budget Item Justification:** This program element (PE) matures and demonstrates sensor technology that will provide the Army with the capability for reconnaissance, surveillance, and target acquisition beyond today's tactical lines-of-sight and enhance the Army's ability to operate in all battlefield conditions. Major efforts within this PE are designed to increase survivability and lethality by providing sensor capabilities to acquire and engage targets at longer ranges in complex environments and conditions (e.g. day/night, obscured, smoke, adverse weather) in support of the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. Project 590 focuses on assessing the military utility and maturing concepts of operation to address counter ambush operations. Project C65 supports classified activities. Properly accessed individuals can obtain further information from the ASA(ALT) Special Programs Office. Project K70 funds efforts related to night vision advanced technologies. This project will: develop technologies for networked, low-cost, distributed unmanned sensors for battlefield situational awareness, cost effective targeting (CET), and for autonomous target acquisition; demonstrate situational awareness for infantry carriers operating in close-in complex terrain; provide the vehicle commander, crew members, and dismounting infantry with an independent, simultaneous, multi-user close-hatched 360 degree by 90 degree hemispherical view of the area surrounding a stationary or moving vehicle during day and night operations; demonstrate the combat overmatch benefits of third Generation Infrared (IR) technology, including benefits such as rapid wide area search, multispectral aided target detection (AiTD), difficult target detection, and passive long range target identification (ID beyond threat detection) in both an air prototype and ground test-bed while on-the-move (OTM), and will support efforts to use standard components across multiple applications for cost savings; demonstrate the technical maturity of single-color, long wave infrared (LWIR), ground based Aided Target Recognition (AiTR) algorithms and Long Range Laser Target Identification (LRTID) utilizing gated Short Wave Infrared (SWIR) components; and insert third Generation IR assembly into a ground based long range sensor suite; demonstrate components to improve Soldier situational awareness. Project K86 funds efforts related to airborne night vision systems. This project demonstrates sensors and algorithms designed to detect targets (vehicles, personnel, mines) in camouflage, concealment, and deception; demonstrate sensors for Unmanned Aerial Systems (UAS) for beyond-line-of-sight targeting in areas shadowed by terrain features; demonstrate imaging, non-imaging, and active imaging sensors for UAS platforms; evaluate and demonstrate improved survivability and lethality by providing ID at enemy's detection ranges; and provide pilotage and situational awareness imagery to multiple pilots/crew members independently for enhanced crew/aircraft operations in day/night/adverse weather conditions. Project K73 funds congressional special interest items.

Work in this PE is related to and fully coordinated with efforts in PE 0602709A (Night Vision and Electro-Optics Technology), PE 0602270A (Electronic Warfare Technology), PE 0603774A (Night Vision Systems Advanced Development), and PE 0604710A (Night Vision Systems Engineering Development). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY

PE NUMBER AND TITLE

**3 - Advanced technology development**

**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**

Statement. This PE adheres to Tri-Service Reliance agreements on sensors and electronic devices, with oversight, and coordination provided by the Joint Directors of Laboratories. Work in this PE is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE		
<b>3 - Advanced technology development</b>	<b>0603710A - NIGHT VISION ADVANCED TECHNOLOGY</b>		

<u><b>B. Program Change Summary</b></u>	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	75615	35892	40114
Current BES/President's Budget (FY 2009)	73826	53910	39916
Total Adjustments	-1789	18018	-198
Congressional Program Reductions		-382	
Congressional Rescissions			
Congressional Increases		18400	
Reprogrammings	142		
SBIR/STTR Transfer	-1931		
Adjustments to Budget Years			-198

Eight FY08 congressional adds totaling \$18400 were added to this PE.

- (\$1200) Cable Warning and Obstacle Avoidance System
- (\$1600) Hyperspectral Sensors for Improved Force Protection (Hyper-IFP)
- (\$1600) Next Generation FPA Development (Transfer from Line 19)
- (\$2000) Advanced Night Vision Sensors
- (\$2400) Hand Launched Unmanned Aerial System High Performance Payload (SUAS HPP)
- (\$3200) Enhanced Digital Electronic Night-Vision (EDEN)
- (\$3200) FCS Short Range Electro Optic Sensor Technology
- (\$3200) UCXR System

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2008**

<b>BUDGET ACTIVITY</b> <b>3 - Advanced technology development</b>	<b>PE NUMBER AND TITLE</b> <b>0603710A - NIGHT VISION ADVANCED TECHNOLOGY</b>					<b>PROJECT</b> <b>K70</b>	
COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
K70 NIGHT VISION ADV TECH	17161	22857	23556	26863	28344	28648	29368

**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 ranges or are partially obscured by terrain features. This capability, linked to the limited situational awareness from the overhead/strategic available assets, is critical to the survivability, utility, and maneuver planning of the Army's Future Force, and where feasible, exploits opportunities to enhance Current Force capabilities. The maturation of distributed aperture sensors provides situational awareness imagery and target identification independently to the commander or multiple crew members for enhanced operations in day/night/adverse weather conditions. Third generation infrared (third Generation IR) technology efforts provide a combat overmatch capability for ground scouts and line of sight (LOS) shooters, ensuring passive, long range target detection, and identification (ID beyond threat detection) on ground platforms, through: collection of multispectral IR data sets for future Aided Target Detection (AiTD)/Aided Target Recognition (AiTR) algorithm development and third Generation IR performance model development and the development of a single 640x480 third Generation integrated Dewar/Cooler specification for air and ground platforms. The third Generation IR technology effort also includes the maturation of multispectral AiTR algorithms, and advanced Digital Signal Processing (DSP) algorithms to take advantage of third Generation IR imagers for insertion into medium range electro-optical systems. The Soldier mobility vision system matures a low power prototype system with full field-of-view (40 degree minimum) digitally-fused uncooled long wave IR and image intensified (I2) visible/near IR helmet mounted vision system for mobility, target detection, and situational awareness in complex terrain. It includes the ability to import alternate imagery/data (e.g. from a weapon sight) to the high resolution Helmet Mounted Display (HMD) in direct support of the PEO Soldier Digital Enhanced Night Vision Goggle (DENVG) program. The Miniature Target Acquisition, Far Target Locator System effort provides the dismounted Soldier with a miniature light weight, low power hand held, far-target locator system. The far target locator includes real-time adaptive Visible Near Infrared/Short Wave Infrared/Long Wave Infrared (VNIR/SWIR/LWIR) sensor fusion, a laser rangefinder/marker/illuminator, embedded global positioning system (GPS), target position determination, image and video transmission/reception/display, and electronic zoom with super-resolution (e.g., a method of increasing resolution by exploiting scanning anomalies like jitter/motion) capabilities.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

<b><u>Accomplishments/Planned Program:</u></b>	<b><u>FY 2007</u></b>	<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>
Third Generation IR Technology: In FY07, completed dual band, phenomenology study data collections with the third Generation prototype Long Range Advanced Scout Sensor System (LRAS3); completed design and fabrication of mini-LRAS3 brass-board optics; began integration and demonstration of slim-line (dual band focal plane array (FPA) dual F# dewar) and miniaturized electronics (i.e. Slim-line, prototype, third Generation sensor) into common electro optic system (CEOS) turret sensor and mini-LRAS3 brass-board demonstrator. In FY08, finalize common air and ground integrated detector/cooler assembly specifications and complete the integration of the dual band FPA, dual F# dewar and miniaturized electronics into the CEOS; conduct multi-spectral aided target recognition evaluation with dual band FPA, dual F# dewar.	12479	9154	

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2008**

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>3 - Advanced technology development</b>	<b>0603710A - NIGHT VISION ADVANCED TECHNOLOGY</b>	<b>K70</b>	
Soldier Mobility Vision System: In FY07, finalized system design; conducted critical design review of the system and Application Specific Integrated Circuit (ASIC) for a low power, full field-of-view, digitally fused prototype helmet mounted vision system. In FY08, complete ASIC fabrication and deliver working ASIC to the PEO Soldier digital enhanced night vision goggle (DENVG) program; begin system hardware maturation and integration. In FY09, will complete the integration of prototypes; will conduct technical testing and user evaluation and transition products to the DENVG program.	1787	4446	3429
Distributed Aperture System (DAS): In FY07, completed DAS-2 design consisting of integrated color TV, infrared, and image intensification sensors; integrated DAS-2 onto troop carrying demonstrator vehicle; conducted DAS-2 user experimentation in complex and urban terrain; transitioned to PM-NV/RSTA.	2895		
Dismounted Troop Carrier Closed Hatch Local Situational Awareness: This effort will leverage existing DAS architecture and demonstration hardware to develop and integrate the automated pop up target detection algorithms and a 360° x 90° digital video recording capability with gunfire detection and audible sensing onto a vehicle platform. Target information will be transmitted onto the tactical network for force situational awareness and possible multiple target engagements. In FY08, develop user approved vignettes to define requirements, define sensor capabilities and product transitions. In FY09, will conduct trade off analyses of sensor and system design approaches; will define system architecture and planned interfaces; will complete modeling and simulation of human factors and operator cognitive loading of information; will begin hardware development efforts to provide improved situational awareness, reconnaissance, surveillance, and actionable targeting information for the vehicle commander and crew in the urban fight.		474	1493
Miniature Target Acquisition, Far Target Locator System: In FY08, leverage the DARPA Multispectral Adaptive Networked Tactical Imaging System (MANTIS) Phase III program technologies of short wave infrared (SWIR), sensor fusion, and power management, and begin to integrate those technologies into the next generation of the PEO Soldier MRK VIIE program (formerly Theater-Application Launch-On Notice II program), a handheld multispectral (TV, NIR, LWIR) target locator that uses a digital magnetic compass and GPS to pinpoint and relay target coordinates; demonstrate day/night SWIR and improve laser capabilities with the MRK VIIE. In FY09, will conduct a series of field tests/data collections to demonstrate the required SWIR and laser phenomenology necessary for target detection capability of those hard to find targets; will develop an interface with existing/developmental dismounted Soldier communication systems for real time video/image transmission.		3000	3481
Dismounted Soldier Networked Situational Awareness with Sensor Imagery: Based on previous development of Soldier vision sensors, this effort will demonstrate the ability to display networked Situational Awareness (SA) information simultaneously with sensor imagery, through a Soldier display for weapon or head mounted sensors. In FY09, will define system architecture and planned interfaces; will complete modeling and simulation of system base performance along with human factors and operator cognitive loading of SA information; will begin hardware development efforts to provide improved SA, reconnaissance, and surveillance information which leverage recent component technology developments, in traditional and unused portions of the EO spectrum, to provide actionable targeting information for the dismounted Soldier in the urban fight.			4200
Advanced Lightweight Reconnaissance and Designation Sensor (ALWRDS): This effort leverages the significant investment by the industrial base in small pixel, mid-wave infrared (MWIR) focal plane arrays (FPAs), and the US Army applied research investment in extremely lightweight, low power laser designation technology from the Ultra-Lightweight Laser Designation effort to provide the individual dismounted Soldier and vehicle crews with an advanced lightweight target detection and call for fire capability. In FY08, complete performance modeling and trade off analyses of a modular, ultra lightweight, man portable, low power, multi-sensor system for individual dismounted Soldiers and vehicular missions that utilizes small pixel, MWIR thermal sensor technology, far target location capability, and clip-on laser designator; begin the fabrication of the small pixel, MWIR thermal imaging sensor. In FY09, will mature the		5273	8323

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2008**

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>3 - Advanced technology development</b>	<b>0603710A - NIGHT VISION ADVANCED TECHNOLOGY</b>	<b>K70</b>	
ALWRDS sensor suite; will continue the fabrication of the small pixel, MWIR thermal sensor; will begin the fabrication of the lightweight, clip-on laser designator and far target location capability; and will conduct initial field performance evaluation of the small pixel, MWIR thermal sensor.			
Unmanned Sensors for Urban Missions (USUM): This effort will leverage manportable robotic platform sensor development and urban unattended ground sensors efforts to mature and integrate multiple sensor modalities, i.e. imaging, acoustic, explosive detection, to provide a flexible multi-mission robotic capability and to provide enhanced low cost imager for urban Unattended Ground Sensor application. In FY09, will complete trade off analyses of sensor and system design approaches; will define system architecture and planned interfaces; will complete modeling and simulation of human factors and operator cognitive loading of information; will begin hardware development efforts to provide improved situational awareness, reconnaissance, surveillance, and actionable detection/situational awareness information for the Soldier.			2630
Small Business Innovative Research/Small Business Technology Transfer Programs		510	
<b>Total</b>	17161	22857	23556

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2008**

<b>BUDGET ACTIVITY</b> <b>3 - Advanced technology development</b>	<b>PE NUMBER AND TITLE</b> <b>0603710A - NIGHT VISION ADVANCED TECHNOLOGY</b>					<b>PROJECT</b> <b>K86</b>	
COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
K86 NIGHT VISION, ABN SYS	20829	12376	16360	13732	15641	17005	17388

**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. The goal is to provide the capability to detect and identify partially obscured targets from manned and unmanned air platforms and to perform reconnaissance, surveillance, and target acquisition (RSTA) and target designation beyond today's tactical line-of-sight. This capability is critical to the survivability of the brigade combat team (BCT) and future light maneuver forces. The technology efforts focus on improved RSTA and night pilotage sensors, high-resolution heads-up displays, sensor fusion, and aided target recognition (AiTR) capabilities for current and future helicopters (attack, scout, cargo, and utility) and unmanned aerial systems (UASs). 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 BCT. The third Generation Infrared Technology effort for aviation improves survivability and lethality by providing identification at enemy's detection ranges and standardized components across different applications for cost savings. Next generation pilotage efforts demonstrate an advanced, cost effective, light weight sensor system which provides simultaneous multi-pilot/user, view of immediate surroundings available to the entire crew for enhanced pilotage in degraded and brown out conditions, and constant wide field of regard coverage for visual alert to potential attack while on-the-move or in hover for Utility and Heavy Lift rotorcraft. Advanced Lasers and UAS Payloads demonstrate improved target ID and laser designation capabilities from small platforms such as Class I UASs; investigates and matures other promising active payload concepts based on lightweight multi-purpose laser components to provide obstacle avoidance, local area terrain/feature mapping and/or through foliage/camouflage sensing.

The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

<u>Accomplishments/Planned Program:</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Unmanned Aerial System (UAS) Electro-Optic (EO) Payloads: In FY07, completed maturation and integration of reconnaissance, surveillance, and target acquisition (RSTA)/ laser designation (LD) payload and conducted flight experiments from manned platform; began integration of RSTA/LD payload onto the organic air vehicle UAS platform; conducted a series of field experiments and data collections of multiple foliage penetration (FOPEN) technologies; and demonstrated active imaging FOPEN technologies system concepts and non-imaging FOPEN system concepts for small UASs.	11303		
Third Generation Infrared (IR) Technology: In FY07, conducted flight test of third generation infrared technology integrated into the surrogate AN/ZSQ-2 aviation turret and onto the Blackhawk testbed; analyzed results of flight test to demonstrate the enhanced target detection, and identification offered with a two-color target acquisition system; modified sensor software algorithms to improve range and automatic tracking performance based on the analysis. In FY08, complete demonstration of wide area search algorithms and integrate into the airborne control station; perform flight tests of the surrogate AN/ZSQ-2 aviation turrets wide area search capability; record third generation imagery to support dual color Aided Target Recognition (AiTR) maturation; and complete the fabrication and testing of the dual color, dual f# slim-line imagers optics.	7536	4387	

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2008**

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>3 - Advanced technology development</b>	<b>0603710A - NIGHT VISION ADVANCED TECHNOLOGY</b>	<b>K86</b>	
Objective Pilotage for Utility and Lift: In FY07, conducted sensor trade studies to determine the best low cost combination of distributed aperture pilotage sensors for lift and utility helicopters; selected an affordable combination of Long Wave Infrared (LWIR), Medium Wave Infrared (MWIR), Near Infrared (NIR), Image Intensified (I2), Low Light Level TV, Short Wave Infrared (SWIR) sensors; conducted assessment of processor requirements to provide sensor suite interface and image stitching, image fusion and threat warning techniques. In FY08, down-select sensor configurations, refine requirements and design specifications, assess and select available displays (helmet mounted display, panel mounted display); mature design and build sensor suite (including sensor pods, processors, displays, and required interface equipment). In FY09, will integrate sensor suite onto a helicopter testbed; conduct flight evaluation to perform engineering checkout, assess integration and sensor suite performance, and study human factors aspect of multi-sensor, multi-spectral, eye points, and their impact on mission performance; conduct limited user flight assessment.	1990	4790	7226
Advanced Lasers for Unmanned Aerial System (UAS) Payloads: In FY08, conduct design studies to investigate promising compact payload concepts, finalize payload performance goals, and establish laser component requirements; initiate development of 7 lb payload compatible with the Class 1 UASs with reconnaissance, surveillance, target acquisition (RSTA), and laser designation (LD) capabilities. In FY09, will validate performance of the laser designator/laser range finder components in a relevant environment and demonstrate proof-of-principle RSTA and LD payload breadboard; will finalize RSTA and LD payload system design; will conduct initial demonstrations of the laser, detector, and pointing/stabilization subsystems.		2893	9134
Small Business Innovative Research/Small Business Technology Transfer Programs		306	
<b>Total</b>	<b>20829</b>	<b>12376</b>	<b>16360</b>