ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**

	COST (In Thousands)	FY 2006 Actual	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	91213	75615	35892	40114	40800	44209	45872	46958
590	OVERWATCH ACTD	1194	296						
C65	DC65	5918	4509	397					
K70	NIGHT VISION ADV TECH	14098	17588	23003	23664	26993	28480	28775	29485
K73	NIGHT VISION SENSOR DEMONSTRATIONS (CA)	49264	31796						
K86	NIGHT VISION, ABN SYS	20739	21426	12492	16450	13807	15729	17097	17473

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 funds classified efforts. 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°x90° hemispherical view of the area surrounding a stationary or moving vehicle during day and night operations; demonstrate mission equipment packages (MEP) for unmanned air vehicles (UAVs) that enable small, lightweight, interchangeable payloads of varying sizes to support target detection, identification, and location; 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 UAV for beyond-line-of-sight targeting in areas shadowed by terrain features; demonstrate imaging, non-imaging, and active imaging sensors for UAV 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). 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 and the Army Space and Missile Defense Command, Huntsville, AL (the Overwatch ACTD).

B. Program Change Summary	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)	101690	44307	35808	41685
Current BES/President's Budget (FY 2008/2009)	91213	75615	35892	40114
Total Adjustments	-10477	31308	84	-1571
Congressional Program Reductions		-289		
Congressional Rescissions				
Congressional Increases		32150		
Reprogrammings	-10477	-553		
SBIR/STTR Transfer				
Adjustments to Budget Years			84	-1571

FY06 funds decreased to support higher priority efforts.

Twelve FY07 congressional adds totaling $30815 (after adjustment for Congressional Undistributed Reductions) were added to this PE.

($1533) Advanced Passive Millimeter Wave Imager
($4074) Buster Backpack Unmanned Aerial Vehicle
($6709) Camera Asisted Monitoring System (CAMS)
($1725) Cerberus Sensor Suite Program - K70
($1294) Cost Effective Targeting Sys Demo/Integ into Stryk
($3738) Enhanced Digital Electronic Night-Vision for UGVs
($2492) Real-Time Geospatial Video Sensor Intel-NVESD
($1390) Additive NV Capabilties for Deployed Systems
($1534) Collimated IR Weapon Sniper Sight/Spotter Scope
($3834) EO Sensor Technology for Suicide Bomber Detection
($1246) Electron Bombarded Active Pixel Sensor Camera
($1246) Ubiquitously Persistent Surveill for Force Protect

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**	**K70**

COST (In Thousands)	FY 2006 Actual	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	14098	17588	23003	23664	26993	28480	28775	29485

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; 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 system. 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) and to export Soldier borne sensor imagery and directly supports 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, 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 Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). 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.

Accomplishments/Planned Program:	FY 2006	FY 2007	FY 2008	FY 2009
Third Generation IR Technology: In FY06, completed integration of third Generation Long Range Advanced Scout Sensor System (LRAS3) prototype sensor and conducted lab and field testing and evaluation; completed vehicle integration of third Generation LRAS3 and conducted initial data collection of Dual Band imagery for multi-spectral (MS) AiTR development and training utilizing third Generation prototype sensor; began initial definition and system modeling for the insertion of MS AiTR coupled with 2-color AiTD processor development; completed fabrication of control station and integration of dual band focal plane array (FPA) and dewar into the surrogate AN/ZSQ-2 Aviation Turret; completed integration of dual band surrogate Aviation Turret into rotary wing aircraft. In FY07,	5840	12528	9456	

complete dual band, phenomenology study data collections with the third Generation prototype LRAS3; complete design and fabrication of mini-LRAS3 brass-board optics; begin integration and demonstration of slim-line dual band FPA Dual F# dewar and miniaturized electronics (i.e. Slim-line, prototype, third Generation sensor) into medium range electro optic (MREO) turret sensor and mini-LRAS3 brass-board demonstrator. In FY08, will finalize common air and ground integrated detector/cooler assembly specifications and complete the integration of the dual band focal plane array (FPA), dual F# dewar and miniaturized electronics into the medium range electro optics system; will conduct multi-spectral aided target recognition evaluation with dual band FPA, dual F# dewar.				
Soldier Mobility Vision System: In FY06, conducted trade studies to determine system components and preliminary system design definition with functionality, algorithms, and interface requirements analysis; conducted human factors experimentation using NVESD-fabricated head-mounted testbeds with Army Research Laboratory Human Research and Engineering Directorate in support of initial system design and functionality. In FY07, finalize system design; conduct 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, will complete ASIC fabrication and deliver working ASIC to the PEO Soldier digital enhanced night vision goggle (DENVG) program; will 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.	1890	1787	4720	3473
Target Acquisition Sensor Suite (TASS) Technology Maturity Demonstrator: In FY06, conducted field test and demonstrated performance of aided target recognition (AiTR) algorithms at three test sites Ft. Hunter-Liggett, Ft. McCoy, and Yuma Proving Grounds; demonstrated long range laser target identification capability of high powered laser-gated short wave infrared.	3534			
Distributed Aperture System (DAS): In FY06, incorporated lessons learned from DAS-1 prototype testing and integrated color TV, infrared (IR), and image intensification (I2) sensors into DAS-2 design; matured pixel level fusion enabling infrared/image intensification (IR/I2) or IR/color TV imager to be separately accessible for each crewmember; devised and evaluated initial software modifications for automatic cueing of pop-up/moving personnel targets. In FY07, complete DAS-2 design; integrate DAS-2 onto troop carrying demonstrator vehicle; conduct DAS-2 user experimentation in complex and urban terrain; transition to PM-NV/RSTA.	2834	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, will develop user approved vignettes to define requirements, will 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 initiate hardware development efforts to provide improved situational awareness, reconnaissance, surveillance, and actionable targeting information for the vehicle commander and crew in the urban fight.			327	3861
Miniature Target Acquisition, Far Target Locator System: In FY08, will 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 TALON II program), a handheld multispectral (TV, NIR, LWIR) target locator that uses a digital magnetic compass and GPS to pinpoint and relay target coordinates; will demonstrate day/night SWIR and additional 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, provided via an established Soldier communications architecture. 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 initiate 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.				4111
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, will 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; will begin the fabrication of the small pixel, MWIR thermal imaging sensor. In FY09, will mature the 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.			5500	6376
Unmanned Sensors for Urban Missions (USUM): This effort will leverage manportable robotic platform sensor development and urban unattended ground sensors efforts conducted under the Cave and Urban Assault ACTD to develop and integrate multiple sensor modalities, i.e. imaging, acoustic, explosive detection, on board a single manportable robotic platform to provide a flexible multi-mission capability and to provide enhanced low cost imager for urban UGS 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 initiate hardware development efforts to provide improved situational awareness, reconnaissance, surveillance, and actionable detection/situational awareness information for the Soldier.				2362
Small Business Innovative Research/Small Business Technology Transfer Programs		378		
Total	14098	17588	23003	23664

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3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**	**K86**

COST (In Thousands)	FY 2006 Actual	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	20739	21426	12492	16450	13807	15729	17097	17473

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 vehicles (UAVs). UAV 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 Active Payloads demonstrates improved target ID and laser designation capabilities from small platforms such as Class I UAVs; 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. Tactical Airborne Spectral Reconnaissance will develop and demonstrate passive spectral imaging payloads for tactical applications such as detection/identification of difficult targets, countermine detection, and battle damage assessment.

The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). 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.

Accomplishments/Planned Program:	FY 2006	FY 2007	FY 2008	FY 2009
Unmanned Aerial Vehicle (UAV) Electro-Optic (EO) Payloads: In FY06, maturated imaging and stabilization components for an active imaging foliage penetration (FOPEN) sensor; performed laboratory measurements and experiments of multiple active imaging FOPEN technologies; completed non-imaging FOPEN studies and evaluated approaches; completed the design and began fabrication of the reconnaissance, surveillance, and target acquisition (RSTA)/laser designation (LD) payload. In FY07, complete maturation and integration of reconnaissance, surveillance, and target acquisition (RSTA)/LD payload and conduct flight experiments from manned platform; begin integration of RSTA/LD payload onto UAV platform; conduct a series of field experiments and data collections of multiple FOPEN technologies; and demonstrate recommended active imaging FOPEN technologies system concepts and non-imaging FOPEN system concepts for small UAVs.	10413	11377		
Third Generation Infrared (IR) Technology: In FY06, completed modification of the aviation prototype third Generation IR sensor, with dual band focal plane arrays (FPAs) for long range target identification test and experimentation; completed Airborne third Generation IR	10326	7536	4589	

sensor control station fabrication; completed procurement and modification of surrogate AN/ZSQ-2 aviation turret with 640x480 dual band IR FPA; performed laboratory and ground system evaluation of the surrogate AN/ZSQ-2 aviation turret with 640x480 dual band IR FPA installed; modified Blackhawk testbed to accept the surrogate AN/ZSQ-2 aviation turret and completed integration of the surrogate AN/ZSQ-2 aviation turret; continued maturation of the third Generation integrated detector cooler assembly specifications. In FY07, conduct flight test of third generation infrared technology integrated into the surrogate AN/ZSQ-2 aviation turret and onto the Blackhawk testbed; analyze results of flight test to demonstrate the enhanced target detection, and identification offered with a two-color target acquisition system. In FY08, will complete demonstration of wide area search algorithms and integrate into the airborne control station; will perform flight tests of the surrogate AN/ZSQ-2 aviation turrets wide area search capability; will record third Generation imagery to support dual color Aided Target Recognition (AiTR) maturation; and will complete the fabrication and testing of the dual color, dual f# slim-line imagers optics.				
Objective Pilotage for Utility and Lift: In FY07, conduct sensor trade studies to determine the best low cost combination of distributed aperture pilotage sensors for lift and utility helicopters; select an affordable combination of Long Wave Infrared (LWIR), Medium Ware Infrared (MWIR), Near Infrared (NIR), Image Intensified (I2), Low Light Level TV, Short Wave Infrared (SWIR) sensors; conduct assessment of processor requirements to provide sensor suite interface and image stitching, image fusion and threat warning techniques. In FY08, will down-select sensors configurations, refine requirements and design specifications, assess and select available displays (helmet mounted display, panel mounted display); will 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	4903	7250
Active Imaging for Unmanned Aerial Systems: In FY08, will conduct design studies to investigate promising compact payload concepts, finalize payload performance goals, and establish laser component requirements; initiate development of 5 lb payload compatible with the Class 1 UAVs with reconnaissance, surveillance, target acquisition (RSTA), and laser designation (LD) capabilities. In FY09, will demonstrate proof-of-principle RSTA and LD payload breadboard; finalize RSTA and LD payload system design; conduct initial demonstrations of the laser, detector, and pointing/stabilization subsystems.			3000	5200
Tactical Airborne Spectral Reconnaissance: In FY09, will demonstrate passive spectral imaging payloads for tactical applications such as detection and identification of difficult targets, countermine detection and battle damage assessment; will evaluate passive spectral imaging sensors against active doppler vibrometer systems.				4000
Small Business Innovative Research/Small Business Technology Transfer Programs		523		
Total	20739	21426	12492	16450