ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603710A - NIGHT VISION ADVANCED TECHNOLOGY

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	77129	84066	50071	60779	60493	49593	47009
590	OVERWATCH ACTD	0	1844	5797	1350	482	0	0
C65	DC65	2737	9181	5966	6251	4467	3332	3406
C67	DC67	5616	0	0	0	0	0	0
K70	NIGHT VISION ADV TECH	44636	27326	19977	24279	27112	31165	31130
K73	NIGHT VISION SENSOR DEMONSTRATIONS (CA)	0	37586	0	0	0	0	0
K86	NIGHT VISION, ABN SYS	24140	8129	18331	28899	28432	15096	12473

A. Mission Description and Budget Item Justification: This Program Element (PE) matures and demonstrates critical 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 capabilities to acquire, engage, and destroy 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, exploits opportunities to enhance Current Force capabilities. The Networked Sensors for the Future Force program will provide a system of networked, low-cost, distributed unmanned sensors for close-in battlefield situational awareness, a cost effective targeting system (CETS) for autonomous target acquisition, and sensors for organic unmanned aerial vehicles for beyond-line-of-sight targeting in areas shadowed by terrain features. The Disposable Sensors program will demonstrate new lightweight low-cost unattended ground sensors that will provide increased situational awareness and force protection capabilities for the Future Combat Systems (FCS) and Objective Force Warrior (OFW). This program also demonstrates mission equipment packages for Class I and Class II unmanned air vehicles that enable small, lightweight, interchangeable payloads of varying sizes to support target detection, identification, and location for the Unit of Action. The Hyperspectral Airborne Multi-Mission Exploitation and Reconnaissance (HAMMER) effort demonstrates sensors and algorithms designed to detect mines and targets in camouflage, concealment and deception. The head tracked sensor suites program will demonstrate situational awareness for FCS infantry carriers operating in close-in complex terrain. The low power infrared (IR) sensors program demonstrated a lightweight, affordable day/night imaging capability. The Overwatch ACTD effort focuses on assessing the military utility and maturing concepts of operation to address counter ambush operations. This PE adheres to Tri-Service Reliance agreements on sensors and electronic devices, with oversight, and coordination provided by the Joint Directors of Laboratories. 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). The PE contains no duplication with any effort within the military departments. Work in this PE is performed by the Communications-Electronics Research, Development and Engineering Center, Night Vision & Electronic Sensors

Directorate (NVESD), Fort Belvoir, Virginia and the Army Space and Missile Defense Command, Huntsville, Alabama (the Overwatch ACTD).

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	73609	47088	54635
Current Budget (FY 2005 PB)	77129	84066	50071
Total Adjustments	3520	36978	-4564
Congressional program reductions		-755	
Congressional rescissions			
Congressional increases		38050	
Reprogrammings	3520	-317	
SBIR/STTR Transfer			
Adjustments to Budget Years			-4564

Significant Change Explanation.
FY04 - Eight FY04 Congressional Adds totaling $38050 were added to the PE.
FY05 - Funds realigned ($4564k) to higher priority requirements.

FY04 Congressional Adds with no R-2A:
($4700) Advanced Passive Millimeter Wave Imager, Project K73. The purpose of this one year Congressional add is to demonstrate an all weather penetrating alternative to shorter wavelength infrared (IR) thermal imaging cameras. No additional funding is required to complete this project.

($8056) Buster Backpack Unmanned Aerial Vehicle, Project K73. The purpose of this one year Congressional add is to mature a low maintenance, fixed wing, fully autonomous aerial platform capable of carrying sensor payloads. No additional funding is required to complete this effort.

($1630) Camera Assisted Monitoring System (CAMS), Project K73. The purpose of this one year Congressional add is to design, develop, fabricate, inegrate, experiment, and demonstrate robust suites of mobile and fixed security capabilities, processes, and procedures. No additional funding is required to complete this effort.

($2398) Digital Night Vision Fusion, Project K73. The purpose of this one year Congressional add is to refine the design and conduct tests and evaluations of a digitally fused system comprised of a halo-free, 16mm image intensified (I2) complementary metal oxide semiconductor (CMOS) camera and a long wave infrared (LWIR) uncooled microbolometer sensor. No additional funding is required to complete this project.

($1438) Personal Miniature Thermal Vision (PMTV) System, Project K73. The purpose of this one year Congressional add is to mature a VOx 320 x 240 25 micron pixel miniature uncooled weapon sight and a prototype 640 x 480 uncooled camera. No additional funding is required to complete this effort.

($3357) Wire Detection, Wind Sensor and Obstacle Avoidance, Project K73. The purpose of this one year Congressional add is to mature a proof-of-concept hazard detection and warning system, using active millimeter wave technology, for low flying Army helicopter applications. No additional funding is required to complete this project.

($12227) Sensor Technology for Force Protection, Project K73. The purpose of this one year Congressional add is to use multiple sensor modalities (electro-optical, radar, communications, etc.) integrated in a tactical package for force protection/counter terrorism. No additional funding is required to complete this project.

($2685) Warfighter/Firefighter Position, Location and Tracking, Project K73. The purpose of this one year Congressional add is to continue development of a system capable of guiding Fire and Rescue Personnel to within one meter (Search Sweep Radius) of their objective within and around a fire scene building, and to investigate the miniaturization of the electronics and extending the range for use as a military system to track individual Soldiers along with maneuver elements. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**	**590**

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
590 OVERWATCH ACTD	0	1844	5797	1350	482	0	0

A. Mission Description and Budget Item Justification: This project matures the technology and capability to provide real-time detection, location, and classification of small arms, mortars, and rocket propelled grenades (RPGs) in complex terrain and demonstrates the capability within an Advanced Concept Technology Demonstration (ACTD) by providing the information to the warfighter for action. This ACTD focuses on assessing the military utility and developing concepts of operation addressing mobile force protection for unit of action forces involved in operations across the spectrum of conflict, from close combat to peacekeeping operations by locating enemy activity and real-time reporting of counter targeting information. The ACTD will mature and integrate a sensor/processor suite containing mid-wave infrared sensor, long-wave infrared imaging sensor, laser ranger/designator on a HMMWV with the appropriate C4I interfaces to disseminate information. Final product for the ACTD is a technology demonstrator to determine operational utility and deliver system performance specifications in support of the Future Combat Systems and Future Force requirements. Work in this ACTD is performed by the Army Space and Missile Defense Command and the US Army CERDEC Night Vision and Electronic Sensors Directorate. Other agencies participating include the Office of the Secretary of Defense and the USMC.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
- In FY04, mature Overwatch ACTD threat signature database to support real time classification algorithms for small caliber weapons; mature infrared sensor data read-out performance and integrate sensor/processor/laser rangefinder/network interfaces for initial full scale functionality test on a HMMWV. In FY05, will complete real time operational software, sensor shooter interfaces and communications hardware integration and will demonstrate and evaluate the sensor/processor on a HMMWV. Will also continue hardware/software maturization and conduct initial full scale functionality tests, including capability to respond to threats from a full 360 degree region of concern.	0	1790	5797
Small Business Innovative Research/Small Business Technology Transfer Programs	0	54	0
Totals	0	1844	5797

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
K70	NIGHT VISION ADV TECH	44636	27326	19977	24279	27112	31165	31130

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 combat 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. Where feasible, this project also exploits opportunities to enhance Current Force capabilities. This project will demonstrate ground-based aided target detection/recognition and long range laser target identification utilizing short wave infrared components integrated into a surrogate target acquisition sensor suite including gimbaled-scanned, second generation forward looking infrared (FLIR), day TV and laser range finder. The Multi-function Staring Sensor Suite (MFS3) effort demonstrated a compact, affordable sensor suite for long-range non-cooperative target identification applicable to ground vehicles, amphibious assault vehicles and surface ships. The Networked Sensors for the Future Force (NSfFF) Advanced Technology Demonstration (ATD) will demonstrate beyond-line-of-sight day/night targeting and situational awareness by demonstrating sensors and software that complement higher echelon surveillance for the Future Force. The NSfFF effort will also demonstrate next-generation, distributed, unattended ground sensor systems (UGS) incorporating low-power infrared imaging and robust networking/communication technologies; a cost effective targeting sensor (CETS) for unmanned targeting, a new generation of low cost distributed unmanned networked sensor systems organic to the reconnaissance, surveillance and target acquisition (RSTA) team; and remote monitoring of an area of interest out to ~10km. The Third Generation Infrared Technology effort will demonstrate the combat overmatch benefits of third generation infrared technology; Rapid Wide Area Search, Multi-Spectral 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 horizontal technology integration (HTI) efforts to use standard components across multiple applications for cost savings. The Target Acquisition Sensor Suite (TASS) effort will demonstrate ground-based aided target detection/recognition utilizing active short wave infrared components for long range identification. The Disposable Sensors effort will mature and demonstrate a new class of lightweight, very low-cost, disposable UGS systems that can be remotely delivered or hand emplaced and utilize various sensor technologies (acoustic, seismic, magnetic, infrared, imaging, environmental, and electronic/radio frequency) and algorithms to improve target detection, target identification, multi-target tracking, and information management. The Head Tracked Sensor Suite effort will demonstrate a day/night 360 degree x 90 degree dome of situational awareness coverage, enabling connectivity with the dismounted infantry during closed hatch operations. The horizontal technology integration (HTI) forward looking infrared (FLIR) effort will mature the prototype 3rd Generation HTI FLIR system components as a form/fit/function of the Future Combat Systems Increment I, and long range line of sight combat vehicle sensor suites. 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 PE is performed by the Communications-Electronics Research, Development and Engineering Center, Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Network Sensors for the Future Force. In FY03, evaluated sensor cross-cueing through emerging command and control (C2) tools. Analyzed operational feedback and integrated into Program Manager-FCS system architecture. Collected field data to assess the technical readiness level for a small-UAV targeting sensor including Defense Advanced Research Project Agency (DARPA) Airborne Video Surveillance software. Demonstrated UGS/CETS/SUAV/FSCS cross cueing. Designed/fabricated and deployed mobile RSTA hub for command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) on-the-move. In FY04, complete hardware fabrication and integrate novel low-cost targeting sensor systems on the unmanned ground vehicle (the Cost Effective Targeting System (CETS)). Also in FY04, fabricate and install an advanced sensor package on a small unmanned aerial vehicle, and demonstrate a robust network of more than 50 unattended ground sensor nodes that is capable of sustaining partial damage or incapacitation by an enemy and reacting independently to ensure continuing flow of RSTA information to command and control points (i.e. is "self-healing"). In FY05, will complete integration of sensor management and acoustic/seismic planning tools into surrogate Future Combat System RSTA demonstrator platform, investigate dismounted reconnaissance team C2 configuration, conduct ATD demonstration, and finalize specifications for system transition.	8510	16006	9070
Head Tracked Sensor Suite (HTSS). In FY03, demonstrated capability of critical components used in the head tracked system for achieving closed hatch situational awareness (SA) and connectivity for coordinated fights. Conducted concept exploration phase demonstration to improve target handoff from dismounted soldier to mounted forces. In FY04, integrate laser coding, intrusion detection, situational awareness network interface, and high performance FLIR into the HTSS. Integrate HTSS onto a combat vehicle and demonstrate HTSS image fusion, coded laser pointing and SA network integration. In FY05, will conduct limited user test and perform analysis of results to verify operability and utility.	1991	4760	3160
Low Power Uncooled Infrared Sensor(LPUIR). In FY03, conducted integration and demonstration of large format uncooled thermal imaging cameras and weapon sights. Demonstrated live fire testing of LPUIR weapon sights on M2 (.50 cal) and M4 (5.56) weapons.	3856	0	0
Multi-Function Staring Sensor Suite (MFS3). In FY03, demonstrated 9X increase in search rate, 10X increase in azimuth field of regard and 2.8 X increase in identification range. Completed integration of MFS3 hardware into testbed platform.	1979	0	0
Joint Intelligence, Surveillance, and Reconnaissance (JISR) Program. In FY03, provided Sensor Interface and Management Support (SIAMS) simulation support to JISR demonstration and evaluation in warfighter exercises.	400	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Disposable Sensors. In FY04, establish disposable sensor testbed to explore novel unattended ground sensor system concepts and algorithms for detection, classification, and location of targets/events using techniques that can be ultra low cost. In FY05, will demonstrate novel system concepts and measure/predict performance parameters. Will conduct design and proof-of-principle hardware development for promising disposable sensor system concepts.	0	2390	3580
Target Acquisition Sensor Suite (TASS) Technology Maturity Demonstrator. In FY04, complete system modeling and design, sub-system interface definition, and forward looking infrared-aided target recognition (FLIR-AiTR) interface definition for FCS Reconnaissance, Surveillance, Target Acquisition (RSTA). In FY05, will complete system hardware integration and conduct imagery data collection at various test sites in order to exercise, optimize and test target recognition algorithms.	0	2590	2277
3rd Generation Infrared Technology. In FY04, begin modification to the original ground based Multifunction Staring Sensor Suite (MFS3) for insertion of a dual band manufacturing technology (Man Tech) dewar assembly and test MFS3 against low signature targets. In FY05, will integrate UAV detection and tracking and add the sensor to shooter linkage into network systems.	0	850	1890
Sensor Technology for Force Protection. This one-year Congressional add demonstrated an advanced mobile force protection system. No additional funding was required to complete this project.	10542	0	0
AN/TAS-4 Upgrade. This one-year Congressional add developed a new staring focal plane array for the AN/TAS-4. No additional funding was required to complete this project.	4055	0	0
Focal Plane Array (FPA) for Targeting and Fire Control. This one-year Congressional add demonstrated a multi-color, multi-functional, and multi-spectral FPA. No additional funding was required to complete this project.	2385	0	0
Warfighter/Firefighter Position, Location, and Tracking Project: This one-year Congressional add demonstrated a system to locate friendly units in military operations in urban terrain (MOUT) and complex urban terrain. No additional funding was required to complete this project.	2004	0	0
Personal Miniature Thermal Vision System. This one-year Congressional add matured and demonstrated a miniature 320x240 uncooled IR camera. No additional funding was required to complete this project.	954	0	0
Helmet Mounted Infrared Sensor System. This one-year Congressional add matured a system to provide Department of Defense firefighters with lightweight, low power multipurpose uncooled thermal imaging capabilities. No additional funding was required to complete this project.	954	0	0
Camera Assisted Monitoring System (CAMS). In FY03, this one year congressional add demonstrated a mobile sensor system that includes on-board sensors, unattended ground sensors, visible, and thermal imaging devices. No additonal funding was required to complete this project.	4000	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Digital Fusion. This one-year Congressional add matured a digitally-fused, halo-free 16mm image intensified (I2) complementary metal oxide semiconductor (CMOS) camera and a long wave infrared (LWIR) uncooled microbolometer. No additional funding was required to complete this project.	3006	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	730	0
Totals	44636	27326	19977

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February 2004

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603710A - NIGHT VISION ADVANCED TECHNOLOGY**	**K86**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
K86	NIGHT VISION, ABN SYS	24140	8129	18331	28899	28432	15096	12473

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) beyond today's tactical line-of-sight. This capability is critical to the survivability of the Future Forces' light maneuver forces. The technology efforts focus on improved targeting and night pilotage sensors, high-resolution heads-up displays, sensor fusion, and aided target recognition (ATR) capabilities for current and future helicopters (attack, scout, cargo, and utility). The Networked Sensors for the Future Force Advanced Technology Demonstration (ATD) project will mature multi mission (RSTA, Countermine) day/night targeting sensors and software for small unmanned aerial vehicles (UAV) for the Future Force. Technologies to be addressed include automated flight control and ultra-light payloads for UAVs. The mission equipment package for the Class II UAV will demonstrate small, lightweight, interchangeable payloads (electro-optical/infrared, laser radar) to support target detection, identification, and location of difficult targets for the Unit of Action. The mission equipment package for Class I UAVs will demonstrate very small, very lightweight, interchangeable payloads (electro-optic, thermal, acoustic, chemical) to support intelligence, surveillance, and reconnaissance requirements for the Unit of Action. The advanced night vision goggles (ANVG) ATD demonstrated a lightweight, low cost, very wide field of view, panoramic night pilotage capability and a fusion goggle capability for vehicle commanders increasing their target acquisition capability. The Hyperspectral Airborne Multi-Mission Exploitation and Reconnaissance (HAMMER) effort will conduct sensor and algorithm development to provide countermine and camouflage, concealment and deception (CC&D) detection and targeting. The Third Generation Infrared Technology effort will improve survivability and lethality by providing identification at detection ranges and will support horizontal technology integration (HTI) efforts to use standard components across different applications for cost savings. 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 PE is performed by the Communications-Electronics Research, Development and Engineering Center, Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Advanced Night Vision Goggle (ANVG). In FY03, demonstrated an integrated heads up display concept and optically fused infrared/image intensification for ground applications. Conducted field-of-view (FOV), weight, resolution, eye-relief and exit-pupil tradeoffs. Conducted lab, air and ground tests and evaluations, identified necessary refinements. Delivered prototype ANVGs for pilotage (2.3X FOV of current Aviators Night Vision Imaging System (ANVIS)).	2437	0	0
Hyperspectral Airborne Multi-Mission Exploitation and Reconnaissance (HAMMER) Program. In FY03, performed phenomenology analysis with long wave infrared (LWIR) data. Identified areas for improvement in algorithms used for minefield detection. Developed and improved algorithms to achieve better detection performance against camouflage, concealment and deception targets. In FY04, finalize design and build sensor. In FY05, will continue development and evaluation of countermine and target exploitation algorithms and implement in real time code.	819	950	1510
Network Sensors for the Future Force ATD. In FY03, integrated and demonstrated day/night targeting sensors on small UAVs and geo-registered imaging software. In FY04, integrate sensor prototypes, networked communication and sensor data management to form a network of distributed sensors. In FY05, will test the network system in an operational environment, conduct refinements based on test results, and demonstrate an optimized system.	5625	2250	5590
Mission Equipment Packages (MEP) for Class II Unmanned Aerial Vehicle (UAV). In FY04, establish sensor concepts and designs maximizing organic air vehicle utility. In FY05, will begin maturation of selected payload designs including ladar, TV and FLIR, and explore foliage penetration.	0	3307	8891
Third Generation Infrared Technology. In FY04, evaluate and quantify the applicability of advanced technologies based on visible, laser augmented short wave infrared (IR), mid wave (MW) IR and two-color Gen III thermal imaging for improved long range identification in airborne applications. In FY05, will conduct trade-offs and initiate detailed design work for most promising approaches based on the analyses conducted.	0	1420	2340
Passive Millimeter Wave Imager. This one year Congressional add demonstrated a passive see-through fog imaging capability to support a United States Special Operations Command (USSOCOM) aviation requirement. No additional funding was required to complete this project.	5722	0	0
Lightweight Man-portable Unmanned Aerial Vehicle. This one-year Congressional add matured a small UAV and miniaturized sensors, and conducted performance and reliability test and evaluations. No additional funding was required to complete this project.	9537	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	202	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Totals	24140	8129	18331