ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2005

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602709A - NIGHT VISION TECHNOLOGY**

COST (In Thousands)		FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		21255	26406	23823	26686	28309	29395	30227	30441
H95	NIGHT VISION & EO TECH	21255	22092	23823	26686	28309	29395	30227	30441
K90	NIGHT VISION COMPONENT TECHNOLOGY (CA)	0	4314	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) researches, designs, and applies core night vision and electronic sensor technologies to improve the Army's capability to operate in all battlefield conditions. The technologies funded in project H95 have potential to provide the Army with new, or enhanced, capabilities to see and target farther on the battlefield, operate in obscured conditions, and maintain a higher degree of situational awareness (SA). These technologies support Future Combat Systems (FCS), the Future Force, and, where feasible, exploit opportunities to enhance Current Force capabilities. Working in concert with Army Research Laboratory (ARL), this project will apply industry expertise in high volume, low cost electronic components and imaging systems to explore concepts for very low cost unattended ground sensors. This project will fund efforts that will determine the benefits of using fused long wave infrared (LWIR) and very near infrared (VNIR) imagery for the dismounted soldier in all day/night visibility conditions and research component technology for transition to future soldier systems. Techniques to be explored include: super resolution, non-uniformity correction, image fusion, analog to digital conversion, region of interest (windowing) and motion detection, all contained in a single chip, and low power electronics for both cooled and uncooled infrared. This project will fund efforts to perform research to dramatically reduce the time necessary to acquire targets, and collect intelligence data. Additional efforts include providing the capability to incorporate lightweight laser designators on small unmanned aerial vehicle (UAV) and unmanned ground vehicle (UGV) platforms and portable soldier systems, and research new infrared (IR) FPA technologies for both cooled, high performance IR FPAs and uncooled, low cost IR FPAs. Sensor models will be created to accomplish trade studies, performance predictions, and also support constructive simulation/wargaming for analysis of alternatives. In addition, this project will focus on sensor modeling and simulation technology maturation in critical areas such as; modeling target acquisition tasks of search, detection, recognition, and identification for currently inadequate representations in military operations in urban terrain, specific targets, and moving targets; modeling representations for advanced sensor technologies. Multispectral sensor simulations will support end-to-end predictive modeling and evaluation of new technologies in a virtual environment. This project will assess and evaluate laser materials to produce a covert ladar system. Project K90 funds Congressional special interest items.

Work in this PE is related to and is fully coordinated with PE 0602705A (Electronics and Electronic Devices), PE 0602712A (Countermine Technology), and PE 0603710A (Night Vision Advanced Technology). 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 Army Research, Development and Engineering Command/Communications-Electronics Research, Development and Engineering Center/Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2005)	22617	24488	27166
Current Budget (FY 2006/2007 PB)	26406	23823	26686
Total Adjustments	3789	-665	-480
Net of Program/Database Changes			
Congressional program reductions	-395		
Congressional rescissions			
Congressional increases	4500		
Reprogrammings			
SBIR/STTR Transfer	-316		
Adjustments to Budget Years		-665	-480

Change Summary Explanation:

Three FY05 Congressional Adds totaling $4500 were added to this PE.

FY05 Congressional adds with no R-2A:
($959) Enhanced Micro-Image Display Technology, Project K90: The purpose of this one year Congressional add is to evaluate the methods through which micro display wafers are processed, in order to investigate cost effective and viable components for enhanced micro-image display for future soldier-borne equipment. No additional funding is required to complete this project.

($959) Miniaturization Sensors for Small and Tactical Unmanned Aerial Vehicles, Project K90: The purpose of this one year Congressional add is to investigate existing or emerging sensor technologies and payload concepts necessary to satisfy mission requirements for small and tactical Unmanned Aerial Vehicles (UAVs). No additional funding is required to complete this project.

($2397) Third Generation Focal Plane Array (FPA) for Army Target Acquisition, Project K90: The purpose of this one year Congressional add is to develop a third generation Dual Color, Mid Wave and Long Wave 1280x720, small pixel infrared focal plane array for future joint combat systems. No ad

ditional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2005

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602709A - NIGHT VISION TECHNOLOGY**	**H95**

COST (In Thousands)		FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H95	NIGHT VISION & EO TECH	21255	22092	23823	26686	28309	29395	30227	30441

A. Mission Description and Budget Item Justification: This project funds efforts that researches, designs, and applies core night vision and electronic sensor technologies to improve the Army's capability to operate in all battlefield conditions. The technologies funded in project H95 have potential to provide the Army with new, or enhanced, capabilities to see and target farther on the battlefield, operate in obscured conditions, and maintain a higher degree of situational awareness (SA). These technologies support Future Combat Systems (FCS), the Future Force, and, where feasible, exploit opportunities to enhance Current Force capabilities. The Disposable Sensors effort, performed in concert with Army Research Laboratory (ARL), will apply industry expertise in high volume, low cost electronic components and imaging systems to explore concepts for very low cost unattended ground sensors. The Soldier Vision System Components effort will determine the benefits of using fused long wave infrared (LWIR) and very near infrared (VNIR) imagery for the dismounted soldier in all day/night visibility conditions and research component technology for transition to future soldier systems. Techniques to be explored include: super resolution, non-uniformity correction, image fusion, analog to digital conversion, region of interest (windowing) and motion detection, all contained in a single chip, and low power electronics for both cooled and uncooled infrared. The Distributed Aided Target Recognition (AiTR) effort will research to dramatically reduce the time necessary to acquire targets, and collect intelligence data. The Lightweight Laser Designators effort will provide the capability to incorporate lightweight laser designators on small unmanned aerial vehicle (UAV) and unmanned ground vehicle (UGV) platforms and portable soldier systems. The Low Cost High Resolution Focal Plane Array (FPA) effort researches new infrared (IR) FPA technologies for both cooled, high performance IR FPAs and uncooled, low cost IR FPAs. Sensor models will be created to accomplish trade studies, performance predictions, and also support constructive simulation/wargaming for analysis of alternatives using the Advanced Sensor Modeling and Simulation effort, and Sensor Modeling and Simulation Technology effort. In addition, this effort will focus on sensor modeling and simulation technology maturation in critical areas such as; modeling target acquisition tasks of search, detection, recognition, and identification for currently inadequate representations in military operations in urban terrain, specific targets, and moving targets; modeling representations for advanced sensor technologies. Multispectral sensor simulations will support end-to-end predictive modeling and evaluation of new technologies in a virtual environment. The Multifunction Laser effort will assess and evaluate laser materials to produce a covert ladar system.

Work in this PE is related to and is fully coordinated with PE 0602705A (Electronics and Electronic Devices), PE 0602712A (Countermine Technology), and PE 0603710A (Night Vision Advanced Technology). 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 Army Research, Development and Engineering Command/Communications-Electronics Research, Development and Engineering Center/Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2004	FY 2005	FY 2006	FY 2007
Disposable Sensors. In FY04, conducted design trade studies, determined initial sensor mix and studied exfiltration methodologies. In FY05, fabricate initial imaging and non-imaging data collection systems to collect and analyze multi-sensor modality data; devise and demonstrate initial embedded signal processing and fusion methodologies; investigate novel magnetic devices and signatures relevant to personnel detection in urban environments. In FY06, will identify and test new sensor modalities for personnel detection for use in urban and open environments and develop detection algorithms utilizing the new modalities; will investigate new uncooled imaging sensor modalities; will conduct research on miniaturization techniques for sensor electronics and component packaging designs. Will conduct research to reduce imaging sensor power consumption and optimize imaging techniques for low-bandwidth transmission. In FY07, will research and develop fusion algorithms incorporating the new sensor modalities to improve personnel detection; will develop and test miniaturized sensor components; will continue to identify and test new sensor modalities for personnel detection in urban and open environments and new uncooled imaging sensor modalities; will conduct research on increasing energy performance and reducing component size of sensor communications; will conduct research on imaging algorithms to develop aids to personnel discrimination.	1940	1906	3108	6377
Soldier Vision System Components. In FY04, fabricated imaging brass board helmet mounted 1280 x 1024 image intensifier and electron bombarded video-based mobility sensor and uncooled forward looking infrared (FLIR); fabricated a small pixel 1280 x1024 or larger color micro display and low power uncooled FLIR electronics; evaluated initial pixel fusion of multisensor imagery vision board sets with low light sensor and down selected the best design. In FY05, research 1280 x 1024 passive video-board low light sensors, miniature pixel fusion processor with advanced system control functions and low power 320 x 240 uncooled FLIR; investigate and evaluate large format (1600 x 1200/High Definition TV) low light video sensors for future soldier system efforts. In FY06, will evaluate first low power small pixel high dynamic range color microdisplays, dichroic (more than one color) combiner and variable density attenuator for see-through displays, and multi-spectral pixel-fusion processor. In FY07, will investigate low power high performance large format night imager and pixel fusion processor for multi-spectral fusion on a low power color head mounted display.	5314	5206	5702	4105

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
Distributed Aided Target Recognition (AiTR) Evaluation Center of Excellence. In FY04, evaluated and assessed automatic and aided target recognition (ATR/AiTR) algorithms using experimental sensor imagery, obtained from field collection in multiple wavebands, for evaluating 3rd generation cooled sensor algorithms designed for FCS. In FY05, investigate baseline algorithm against hard targets and urban/clutter environments. In FY06, will research multispectral and hyperspectral ATR algorithm against hard targets and urban/cluttered environments. In FY07, will conduct phenomenology study of fusing multiple sensors against highly cluttered environments.	206	850	1299	1272
Lightweight Laser Designators. In FY04, established critical designator system specifications through experimental measurements and standard models; constructed initial laser designs and performed initial tests in laboratory. In FY05, build selected brassboard solid-state laser designs and test in the laboratory to verify energy output, beam quality and operation over temperature. In FY06, will transition the best laser designs to laser manufacturers for brassboard fabrication. In FY07, will research brassboard compact lasers meeting requirements for lightweight designators.	2083	2403	2256	2380
Low Cost High Resolution Focal Plane Arrays (FPA). In FY04, researched long wave FPA of Mercury-Cadmium Telluride (MCT) on Silicon (Si) and evaluated shorter time constant uncooled arrays, which resulted in improved imagery. In FY05, evaluate multi-band pixel interconnect approach, patterned thin-film filters on CdZnTe, and 1280x720 uncooled read-out integrated circuit (ROIC) design and fabrication. In FY06, will mature on-chip processing of multi-color IR sensors for target discrimination and clutter rejection; will create a 3 dimensional ROIC using vertically integrated sensor array technology that stacks silicon chips, resulting in improved situational awareness; will test the circuits in the laboratory to determine their efficacy in certain scenarios. In FY07, will mature and fabricate large area two-color HgCdTe arrays grown on a silicon wafer with the appropriate lattice matched buffer layers; will mature and fabricate large area (mega-pixel) uncooled arrays with small pixels (<20 microns) with a short thermal time constant and better temperature resolution.	7420	7158	6803	6800

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
Advanced Sensor Modeling and Simulation. In FY04, delivered a new Field-of-View (FOV) search model for integration into the Combined Arms and Support Task Force Evaluation Model; completed construction and validation of a new performance model for emerging shortwave infrared sensor technology that enables US Forces to identify targets at the detection range of conventional electro-optical/infrared sensors, and delivered a networked sensors simulation testbed to Unit of Action Maneuver Battle Lab to support evaluation of Future Force/FCS technologies. In FY05, deliver new sensor and targeting task performance model that replaces current models, and complete beta version of "spectral" thermal sensor performance model to support 3rd Gen FLIR technology research program.	4292	4569	0	0
Sensor Modeling and Simulation Technology. In FY06, will mature advanced sensor performance and engineering models, and simulations to support technology assessments, acquisition decisions, and war-game simulations; will complete construction of performance model for fused infrared and image intensified sensors, and complete field of regard search model that includes performance in urban environments. In FY07, will complete and deliver performance model to evaluate sensors coupled with aided target recognition systems.	0	0	4655	4672
Multifunction Lasers. In FY07, will assess and evaluate laser materials to produce multiple wavelength bands and pulse modulation for covert ladar system	0	0	0	1080
Totals	21255	22092	23823	26686