

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)						February 2006	
BUDGET ACTIVITY 2 - Applied Research		PE NUMBER AND TITLE 0602709A - NIGHT VISION TECHNOLOGY					
COST (In Thousands)	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	26393	31664	23907	24904	26310	27655	27877
H95 NIGHT VISION & EO TECH	22081	23483	23907	24904	26310	27655	27877
K90 NIGHT VISION COMPONENT TECHNOLOGY (CA)	4312	8181	0	0	0	0	0
<p><b>A. Mission Description and Budget Item Justification:</b> 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. 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.</p> <p>Work in this PE is related to and is fully coordinated with PE 0602705A (Electronics and Electronic Devices), PE 0602712A (Countermeasure 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 &amp; Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.</p>							

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

February 2006

BUDGET ACTIVITY

PE NUMBER AND TITLE

**2 - Applied Research**

**0602709A - NIGHT VISION TECHNOLOGY**

	FY 2005	FY 2006	FY 2007
<b><u>B. Program Change Summary</u></b>			
Previous President's Budget (FY 2006)	26406	23823	26686
Current BES/President's Budget (FY 2007)	26393	31664	23907
Total Adjustments	-13	7841	-2779
Congressional program reductions		-149	
Congressional rescissions		-310	
Congressional increases		8300	
Reprogrammings	-13		
SBIR/STTR Transfer			
Adjustments to Budget Years			-2779

FY 07 decrease of -2.8 million attributed reprogramming to offset business re-engineering efficiencies.

Six FY06 Congressional adds totaling \$8300 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):

(\$1000) Compact Lightweight Solid State Glass Lasers for Military Applications

(\$1300) Crystal Materials for Electro-Optic Imaging and Communication

(\$1000) Diffractive Optics for Advanced Imaging

(\$1500) Enhanced Micro-Image Display Technology

(\$1000) Miniaturized Sensors for Small and Tactical Unmanned Aerial Vehicles (UAVs)

(\$2500) Next Generation Focal Plane Array (FPA)

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)						February 2006	
BUDGET ACTIVITY <b>2 - Applied Research</b>			PE NUMBER AND TITLE <b>0602709A - NIGHT VISION TECHNOLOGY</b>			PROJECT <b>H95</b>	
COST (In Thousands)	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	22081	23483	23907	24904	26310	27655	27877
<p><b>A. Mission Description and Budget Item Justification:</b> This project funds efforts that research, design, and apply 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 the Future Force, and, where feasible, exploit opportunities to enhance Current Force capabilities. The Soldier Vision System Components effort will determine the benefits of using fused long wave infrared (LWIR) and visible near infrared (VISNIR) 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 the ability 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. The Modeling, Measurements, and Simulation Applied Research for Sensor Design and Evaluation effort will develop new and evolve current sensor models, simulations, and measurement procedures to address new sensor technologies, new modalities and more robust urban and global war on terrorism threat environments. The High Performance Small Pixel Uncooled Infrared Focal Plane Array effort will demonstrate the feasibility of high performance, smaller pixel, low cost, uncooled technology for short range Future Combat Systems sensors, unmanned aerial vehicles, head mounted thermal imaging, thermal weapon sights, cost effective targeting system, distributed aperture systems, driver vision, and precision attack munition. Work in this PE is related to and is fully coordinated with PE 0602705A (Electronics and Electronic Devices), PE 0602712A (Countermining 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 &amp; Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.</p>							
<b>Accomplishments/Planned Program</b>				<u>FY 2005</u>	<u>FY 2006</u>	<u>FY 2007</u>	
Disposable Sensors. In FY05, fabricated initial imaging and non-imaging data collection systems to collect and analyze multi-sensor modality data; devised and demonstrated initial embedded signal processing and fusion methodologies; investigated novel magnetic devices and signatures relevant to personnel detection in urban environments.				1904	0	0	
Soldier Vision System Components (SVSC). In FY05, researched 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; investigated and evaluated large				5204	5702	4105	

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)			February 2006	
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602709A - NIGHT VISION TECHNOLOGY		PROJECT H95	
format (High Definition TV) low light video sensors for future soldier system efforts; evaluated first low-power, small-pixel, high dynamic range color micro displays. In FY06, complete development, deliver and evaluate final configuration prototype components: low power color micro displays, Micro Channel Plate Complementary Metal Oxide Semiconductor (MCPCMOS) visible near infra-red sensor, variable density dichroic combiner/attenuator, and multi-spectral pixel-fusion processor; design and fabricate SVSC test-bed to conduct system architecture human factors studies; continue multi-spectral fusion data collection for image fusion metric; perform video frame rate selection power/latency trade; select image fusion algorithm. 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; will provide components with integrated fusion architecture to PEO Soldier including: head mounted opto-mechanical configuration and interface definitions, low power electronic configuration and interface definitions, multi-spectral sensor, color display fusion algorithm implementation, and MCPCMOS/electron bombarded active pixel sensor system level performance comparison study.				
Distributed Aided Target Recognition (AiTR) Evaluation Center of Excellence. In FY05, investigated baseline algorithm against difficult targets and urban/clutter environments. In FY06, research multispectral and hyperspectral ATR algorithm against difficult targets and urban/cluttered environments. In FY07, will conduct phenomenology study of fusing multiple sensors against highly cluttered environments.	849	1225		1443
Lightweight Laser Designators. In FY05, built selected brassboard solid-state laser designs and tested in the laboratory to verify energy output, beam quality and operation over temperature. In FY06, conduct laboratory demonstrations with most promising designs, assess performance, harden and refine laser design in order to transition the best laser designs to laser manufacturers for brassboard fabrication. In FY07, will research and develop brassboard compact lasers meeting requirements for lightweight designators.	2401	2256		2380
Low Cost High Resolution Focal Plane Arrays (FPA). In FY05, evaluated multi-band pixel interconnect for making three dimensional readout circuits; demonstrated long wave Mercury Cadmium Telluride (HgCdTe) on silicon growth in a 256X256 format with greater than 90% operability; developed uncooled detector test structures with 8 milli-second (ms) time constant and 70 milli-Kelvin (mK) Noise Equivalent Temperature Difference (NETD). In FY06, demonstrate increased dynamic range readout circuits for the FPA in order to simultaneously observe contents of a dark cave in bright sunlight; demonstrate long-wave HgCdTe growth on silicon in a 640X480 format and greater than 93% operability; demonstrate advanced dual band high resolution HgCdTe FPA in a dual f-number configuration to see wide area field of view and high resolution long range identification in the same system; demonstrate a 640X480 uncooled array with a 5ms time constant and a 50mK NETD. In FY07, will demonstrate long-wave HgCdTe array in a 1280X720 format with greater than 96% operability; will demonstrate a 640X480 uncooled array, with a 5 ms time constant and a 35 mK NETD.	7156	8298		6800
Integrated Modeling and Simulation Applied Research for Sensor Design and Evaluation. In FY05, delivered new sensor and targeting task performance models that replace current models; completed beta version of "spectral" thermal sensor performance model to support 3rd Gen FLIR technology research program; transitioned active laser range gate sensor model for program manager/industry use; validated synthetic thermal target models transitioned to Program Executive Office for Simulation Training and Instrumentation for incorporation into trainers. In FY06, validate and publish human performance model for fused, multi-spectral (MWIR/LWIR or IR/Image Intensifier) imager; publish improved measurement procedures for under-sampled and "super-resolved" imagers. In FY07, will complete development of 3rd GEN FLIR simulation; will update Acquire family of models with metrics for the detection and discrimination of concealed weapons, and more robust detection and discrimination of personnel in urban environments.	4567	4389		4914
Multifunction Lasers. In FY07, will assess and evaluate laser materials to produce multiple wavelength bands and pulse modulation for future covert laser systems.	0	0		1390
High Performance Small Pixel Uncooled Focal Plane Array. In FY06, perform trade studies and do modeling and simulation to demonstrate feasibility of high performance small pixel uncooled focal plane array. In FY07, will design and fabricate pixel structures to	0	1613		2875

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)		February 2006		
BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT	
<b>2 - Applied Research</b>	<b>0602709A - NIGHT VISION TECHNOLOGY</b>		<b>H95</b>	
verify design parameters; will test and evaluate the pixel structures to verify sensitivity and noise predictions; will do the preliminary design of the read out integrated circuit (ROIC).				
Total		22081	23483	23907