ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - Applied Research	**0602709A - NIGHT VISION 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	30464	36203	24391	25662	26355	26877	26890	26917
H95	NIGHT VISION & EO TECH	22509	23643	24391	25662	26355	26877	26890	26917
K90	NIGHT VISION COMPONENT TECHNOLOGY (CA)	7955	12560						

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. 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 and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

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B. Program Change Summary	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)	31664	23907	24904	26310
Current BES/President's Budget (FY 2008/2009)	30464	36203	24391	25662
Total Adjustments	-1200	12296	-513	-648
Congressional program reductions		-138		
Congressional rescissions				
Congressional increases		12700		
Reprogrammings	-1200	-266		
SBIR/STTR Transfer				
Adjustments to Budget Years			-513	-648

Ten FY07 congressional adds totaling $12176 (after adjustment for Congressional Undistributed Reductions) were added to this PE.

($1294) Enhanced Micro-Image Display Technology
($959) Minaturization Sensors for Small & Tactical UAVs
($1055) Advanced Multi-Spectral Fusion Sensors
($1055) Eyesafe Pulsed Fiber Laser for LADAR
($1055) Mid-Wave Infrared Sensor Technologies
($1725) Millimeter/Terahertz Imaging Arrays
($1055) Multispectrum Sensor Protection
($1294) Power Efficient Microdisplay Dev for US Army NV
($959) Sensor Solutions for Unattended Surveillance
($1725) Small Bus Infrared Materials Mfg - Silicon Alt

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2007

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

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
H95	NIGHT VISION & EO TECH	22509	23643	24391	25662	26355	26877	26890	26917

A. Mission Description and Budget Item Justification: This project funds the design, and development of core night vision and electronic sensor technologies and components 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 Mobility Vision System 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 that enhance SA include: super resolution, non-uniformity correction, image fusion, analog to digital conversion, region, of interest (windowing) and motion detection, all contained on a single low power chip for both cooled and uncooled infrared. The Distributed Aided Target Recognition (AiTR) effort will develop the ability to dramatically reduce the time necessary to acquire targets and collect intelligence data. The Lightweight Laser Designator effort pursues technologies that enable the incorporation of lightweight laser designators on small unmanned aerial and ground vehicle platforms and portable Soldier systems. In an attempt to satisfy the Warfighter needs, for persistent surveillance and threat warning, increasingly complex sensors (e.g. large (2000 by 2000 pixel) single color FPAs, and multi-spectral) are required resulting in higher cost sensors systems. HgCdTe, the only mature material technology that can operate in the infrared from ~1-30 microns, is currently deposited on small-size, very costly CdZnTe substrates, which are solely available from one foreign source. Depositing HgCdTe on low cost substrates, e.g., silicon, will enable very large format FPAs, and multi-spectral sensors at costs not attainable with current technology. In addition efforts focus on sensor, modeling, and simulation technology maturation in the following critical areas: target acquisition tasks of search, detection, recognition, and identification in urban terrain; and accurate representations for advanced sensor technologies. Multispectral sensor simulations will support end-to-end predictive modeling and evaluation of new technologies in virtual combat simulations; advanced multifunction laser efforts assess and evaluate laser materials to produce a covert ladar technology. High Performance Small Pixel Uncooled Infrared Focal Plane Array efforts demonstrate the feasibility of smaller pixel, lower cost, uncooled technology for short range ground, and unmanned aerial vehicle sensors, head-mounted thermal imaging, and thermal weapon sights, cost effective targeting systems, distributed aperture sensor systems, driver vision sensors, and sensors for precision attack munitions.

Work in this program (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 and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program:	FY 2006	FY 2007	FY 2008	FY 2009
Soldier Vision System Components: In FY06, completed development, evaluated, and delivered 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; designed and fabricated a Soldier vision system components test-bed to conduct system architecture human factors studies; continued multi-spectral fusion data collection for image fusion metric; performed video frame rate selection power/latency trade: Selected and evaluated image fusion	5702	3953		

algorithm. In FY07, evaluate low power high performance large format night imager and pixel fusion processor for multi-spectral fusion on a head mounted low power color display; design and deliver prototype components with integrated fusion architecture 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 FY06, evaluated multispectral and hyperspectral AiTR algorithm against difficult targets and urban/cluttered environments. In FY07, conduct phenomenology study of fusing multiple sensors against highly cluttered environments. In FY08, will conduct field tests to collect data on multiple sensors for fusing capabilities against cluttered environments. In FY09, will complete data collection efforts (archive and ground truth data); will evaluate data collected to determine optimal sensor fusion techniques.	1180	1389	1277	1238
Lightweight Laser Designators: In FY06, conducted laboratory demonstrations, assessed performance, hardened and refined laser design in order to transition the designs to laser manufacturers for brassboard fabrication. In FY07, evaluate the brassboard compact lasers and assess their capability to meet lightweight designator requirements.	2256	3631		
Low Cost High Resolution Focal Plane Arrays (FPA): In FY06, demonstrated increased dynamic range readout circuits for the FPA to simultaneously observe contents of a dark cave while standing outside in bright sunlight; demonstrated long-wave HgCdTe growth on low cost substrates in a large format with greater than 93 percent operability (e.g. percentage of functioning pixels on a FPA); demonstrated dual band, dual f-number, high resolution HgCdTe FPA; demonstrated a 640X480 uncooled array with a reduction in time constant (e.g. to reduce image smear, especially for unstabilized systems and seeker applications) from the current capability of 12 millisecond (ms) to 5 ms and a 50mK noise equivalent temperature difference (NETD). In FY07, demonstrate long-wave HgCdTe array in a 640x480 format with greater than 96 percent operability; demonstrate a 640X480 uncooled array, with a 5 ms time constant and a 35 mK NETD (e.g. to improve image quality/crispness). In FY08, will develop and evaluate 2-color midwave infrared /longwave infrared (MWIR/LWIR) with joint operability of greater than 90 percent and 96 percent respectively for both threat warning and enhanced situational awareness. In FY09, will integrate and refine sensor development to achieve an operability of greater than 95 percent/98 percent; will design near infrared/shortwave infrared (NIR/SWIR) with wavelengths from 2.5 microns into the visible (550-760 microns) for mini-unmanned aerial vehicle (UAV) applications.	8298	6788	4979	4980
Modeling, Measurements and Simulation Applied Research for Sensor Design and Evaluation: In FY06, designed, developed, and validated engineering model for fused, multi-spectral (mid-wave infrared/long wave infrared or infrared/image intensifier) imager; designed, developed, and validated improved measurement procedures for under-sampled and "super-resolved" imagers. In FY07, complete development and validation of third generation forward looking infrared simulation; update acquire family of sensor design models with metrics for the detection and discrimination of concealed weapons, and develop more robust detection and discrimination of personnel in urban environments. In FY08, will design and deliver an aided target recognition performance model for use in combat simulations; will develop a flash signature library and discrimination model for sensor design and combat simulations. In FY09, will develop and validate sensor performance model improvements to more accurately address moving targets, environmental effects such as glint (reflective components), weather, and complex clutter (foliage and urban structures); begin design of performance models for distributed and networked imaging sensor systems.	4226	4820	5108	5055
Advanced Multifunction Laser Technology: In FY08, will assess and evaluate laser designs and materials for a multi-function laser system, including laser designation, range finding, explosive detection, eye-safe LIDAR, and signal transmission. In FY09, will select laser material and architectures to produce multiple wavelength bands and pulse modulation formats for future laser-based systems; will			3050	3182

build a breadboard version of a compact multifunction laser system.				
High Performance Small Pixel Uncooled Focal Plane Array: In FY06, performed trade studies, modeling, and simulation to demonstrate the feasibility of high performance small pixel uncooled focal plane arrays. In FY07, design and fabricate pixel structures to verify design parameters; test and evaluate the pixel structures to verify sensitivity and noise predictions. In FY08, will fabricate and test the read out integrated circuit (ROIC) and optimize the pixel structures; will test and evaluate the various components and verify results via modeling and simulation. In FY09, will integrate the pixel structure with the ROIC and perform validation test and evaluation.	847	2857	3645	3368
Soldier Sensor Component and Signal Processing: In FY08, will assess and evaluate co-location of sensor focal plane array and processing resources on the same chip; will assess and evaluate high resolution low power pixel mosaic structure display for infrared, hyperspectral, and visible sensors; will conduct evaluation and design trade study of advanced adaptive light weight optics. In FY09, will complete co-location of sensing and processing resources on same chip allowing for immediate feedback of processing results to enable real-time clutter rejection for hyperspectral and multispectral applications; will complete design and fabricate demonstrator of advanced pixel mosaic, high resolution, low light visible sensor display; will fabricate and evaluate prototype advanced adaptive optics.			6332	7839
Small Business Innovative Research/Small Business Technology Transfer Programs		205		
Total	22509	23643	24391	25662