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

February 2003

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

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H95	NIGHT VISION & EO TECH	22172	19696	22233	22420	24359	27155	28464	29997

A. Mission Description and Budget Item Justification: This Program Element (PE) researches, investigates and applies core night vision, and electronic sensor technologies to improve the Army's capability to operate in the dark, i.e., "Own the Night." The technologies covered in this PE have the potential to provide the Army with new, or enhanced, capabilities to see farther on the battlefield, operate in obscured conditions, and maintain a higher degree of situational awareness (SA). The Micro-Eyesafe Solid State Laser Sources program will have the potential to provide the individual soldier with high performance tactical laser range-finding, target designation, obstacle avoidance, and laser radar. Innovative near infrared (NIR) and short wavelength infrared (SWIR) sensors will provide increased range for target identification. Advanced focal plane array (FPA) components will be developed for cooled and uncooled infrared sensors. A Disposable Sensors Network project will be performed in concert with Army Research Laboratory (ARL) and will apply industry expertise in high volume, low cost electronic components and imaging systems to demonstrate prototypes. This program will focus on developing mature key technologies for very small, low cost multi-functional unattended ground sensors to be disbursed on the battlefield and fuse data to help detect & classify threats. In addition, imaging sensors will be designed and fabricated for the Anti-Personnel Landmine Alternative program. The Low Power Display Components program will reduce power consumption by >50 percent over existing helmet mounted miniature displays, enabling the warfighter to execute longer missions with less head-borne weight and logistics burden. The technology products will be miniature flat panel displays that consume less power, save weight and space, support both monochrome and full-color applications, have high-image fidelity, and integrate easily with current and next-generation sensors. Also, the design and fabrication of advanced electronics in order to improve the contrast and brightness of miniature head mounted flat-panel displays that will be used by infantry, armored, aviation, and field maintenance organizations will be researched. Aided/Automatic Target Recognition (ATR) technologies will be researched to dramatically reduce the time necessary to acquire targets, and collect intelligence data. 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 program. Multispectral sensor simulations will support end-to-end predictive modeling and evaluation of new technologies in a virtual environment. Third (3rd) Generation Forward Looking Infrared (FLIR) Technology will develop focal plane array technology for the next generation forward looking infrared sensors to provide target identification at current detection ranges and for high speed, on-the-move target recognition. Three dimensional (3D) imaging of military targets at tactical ranges using laser radar (LADAR) is expected to provide superior target identification capabilities for future Army vehicles using the Compact Lightweight 3D Sensors program. This effort will leverage the Defense Advanced Research Projects Agency (DARPA) 3D Flash Imaging Program that is currently developing integrated focal plane detector arrays and read out integrated circuits. The focus of the joint ARL/Communications and Electronics Command (CECOM), Warrior Extended Battlespace Sensors program is to develop the concepts and components for a family of affordable, unattended ground sensors that will improve situation awareness and targeting in complex terrain. Work in this PE contains no duplication with any effort within the Military Departments and is fully coordinated with PE 0602705A (Electronics and Electronic Devices), PE 0602712A (Countermine Technology), and PE 0603710A (Night Vision Advanced Technology). Work in this PE is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and adheres to Tri-Service Reliance Agreements on Sensors and Electronic Devices.

This program is managed by the Communications-Electronics Research, Development and Engineering Center, Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA. This program supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds were provided to the program/project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Disposable Sensors Network. In FY04, research low cost, throw away visible/near infrared active pixel imaging sensors and non-imaging sensors for increased situational awareness and survivability in open and complex terrain operations. Investigations of video sensor technology include low cost passive and actively augmented technologies for all weather, day/night capability and studies of multi-sensor network optimization for full spectrum operations. In FY05, conduct initial demonstration of low cost video sensor technology in a distributed aperture configuration. Determine practical limitations of power, footprint, and cost of passive and actively augmented video based CMOS technology for ground-based networks, consider feasibility of sensor architectures for micro air vehicles, and identify optimal suite of traditional and non-traditional sensor technologies to comprise Disposable Sensors Network.	0	0	1940	1904
Soldier Vision System Components. In FY03, research via trade studies, optimal head-mounted configurations for multispectral indirect view pixel fusion components and investigate a miniature 1280 x 1024 video-based low light level mobility sensor. Research pixel fusion processors with image registration, non-uniformity correction, and video optimization algorithms. In FY04, research imaging brass board helmet mounted 1280 x 1024 image intensifier and electron bombarded video-based mobility sensor and uncooled FLIR. Investigate a small pixel 1280 x1024 or larger color micro display and low power uncooled FLIR electronics. Research initial pixel fusion of multisensor imagery vision board set with low light sensor and down select. In FY05, investigate 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. Research development of large format (1600 x 1200/High Definition TV) low light video sensors for phase II Objective Force Warrior transition.	0	1149	5314	5204
Warrior Extended Battlespace Sensors. In FY02, demonstrated infrared micro camera technology. In FY03, develop and deliver affordable infrared micro-cameras for netted micro-sensor field applications; uncooled infrared sensor materials for stable low cost infrared cameras; and acoustic and infrared image sensor fusion algorithms for positive target identification and multiple target deconfliction.	3895	3666	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Overhead Sensor Technology for Battlefield Characterization. In FY02, this joint CECOM NVESD/Space and Missile Defense Command project researched advanced overhead sensor technologies for wide area battlefield event detection, discrimination, and identification in near real time. In FY03, NVESD will develop and deliver large format (1024x1024) long-wavelength and mid-wavelength infrared focal plane arrays for incorporation into hyper-spectral imaging systems.	770	621	0	0
The Micro-Eyesafe Solid State Laser Sources. This effort successfully developed several new ultra small, low cost, eyesafe lasers for Army applications. The "monoblock" laser has been transitioned to a compact, handheld, multifunction laser for the soldier and is also planned for the Cost Effective Targeting System, a Future Combat Systems (FCS) application. A diode pumped Er:glass micro-laser is being transitioned for use in the objective individual combat weapon (OICW) fire control system.	904	0	0	0
Low Power Display Components. In FY02, developed monochrome 1280x1024 active matrix liquid crystal display at 2,600 ft-Lambert, meeting Comanche requirements. Developed low power color 800x600 active matrix organic light emitting diode display for Land Warrior/Objective Force Warrior requirements. In FY03, research full color 1280x1024 display components for see-through and high-resolution applications. Complete development of ambient optical-channel attenuators and color optics to enhance display performance.	4873	4286	0	0
Distributed Aided Target Recognition (ATR) Evaluation Center of Excellence. In FY02, conducted Multi-Function Staring Sensor Suite (MFS3) data collection and assessed the performance of the sensor. In FY03, complete assessment and evaluation of MFS3 ATR algorithms and hardware for FCS. In FY04, evaluate and assess automatic and aided target recognition algorithms using experimental sensor imagery obtained from field collection in multiple wavebands for evaluating 3rd generation cooled sensor algorithms design and development for future FCS insertion. In FY05, extrapolate findings and expand evaluation and assessment of ATR algorithms.	1072	966	1184	1188
Dual Band Detector Imaging Technology. In FY02, this one-year Congressional add investigated dual band detector imaging technology. Specifically, it researched improved processes to fabricate small-pixel, two color, large format FPAs. No additional funding was required to complete this project.	2543	0	0	0
3rd Generation Forward Looking Infrared (FLIR) Technology. In FY02, investigated laser range finding and target profiling on the same array. In FY03, research integrated, multicolor, large area (1000x2000) focal plane array with parallel, optical readouts, active laser radar (LADAR), and 120K operating temperature.	4483	4948	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Advanced Sensor Modeling and Simulation. In FY02, established metric for sensor fusion and low observables. In FY03, implement "Paint the Night" image design tool onto computer hardware for static scenes. In FY04-05, research and deliver a new Field-of-View (FOV) search model for integration into the Combined Arms and Support Task Force Evaluation Model and OneSAF Testbed.	3632	4060	4292	4567
Compact Lightweight 3D Sensors. In FY04, design a low cost, lightweight, compact eyesafe laser transmitter for designators at 1.5 micron wavelength and a 256 x 256 3D flash LADAR FPA. Model the laser for optimum output power and range performance for short and long-range applications. In FY05, begin building a novel end-pumped solid state laser erbium yttrium aluminum garnet (Er: YAG) prototype compact laser (greater than 100 mj, 1 ns, 30 Hz) at 1.5 micron wavelength.	0	0	2148	2523
Low Cost High Resolution Focal Plane Array: In FY04, design a multispectral tunable array (1280 x 720) and read-out integrated circuit (ROIC). Model the multispectral tunable sensor configuration for narrow spectral resolution of 100 nm, range of spectral tunability (8-12 um) and photon collection efficiency, while maintaining a narrow band collection capability. Concurrently in FY04, design a multiband uncooled IR sensor (midwave/longwave) in high definition television format of 1280 x 720 array and readout. Model the sensor for 1/f noise, range and bandwidth. In FY05, build the detector array and ROIC to the modeled configurations and specifications. Begin building the micro-electronic mechanical structures (MEMS) prototype to size to demonstrate feasibility. Simultaneously in FY05, build the array and incorporate advanced photolithography techniques to demonstrate a 20-micron pitch for co-located materials with different spectral responses.	0	0	7355	7034
Totals	22172	19696	22233	22420

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B. Program Change Summary	FY 2002	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2003)	22993	22333	22434	23718
Current Budget (FY 2004/2005 PB)	22172	19696	22233	22420
Total Adjustments	-821	-2637	-201	-1298
Congressional program reductions				
Congressional rescissions		-2461		
Congressional increases				
Reprogrammings	-644	-113		
SBIR/STTR Transfer	-177	-63		
Adjustments to Budget Years			-201	-1298