

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)					February 2002				
BUDGET ACTIVITY 2 - Applied Research			PE NUMBER AND TITLE 0602709A - NIGHT VISION TECHNOLOGY				PROJECT H95		
COST (In Thousands)			FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H95	NIGHT VISION & EO TECH		24935	22993	22333	22434	23718	23594	24585
<u>A. Mission Description and Budget Item Justification:</u> 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). It also potentially provides cost savings, performance reliability, and reduction in the size and weight of sensor and data display systems. In addition, technologies are being investigated to reduce the power consumption of the electronics. The use of thermal, acoustic, magnetic, micro-sensors, and micro-laser sources also will be investigated. The micro-lasers 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 possibly provide increased range for target identification. Solid state SWIR sensors also have the potential to passively detect and image high velocity, kinetic energy munitions under low light conditions. In addition, imaging sensors will be designed and fabricated for the Anti-Personnel Landmine Alternative program. This PE will address the design and fabrication of advanced electronics in order to improve the contrast and brightness of miniature flat-panel displays that will be used by infantry, armored, aviation, and field maintenance organizations. Aided/Automatic Target Recognition (ATR) technologies will be researched to dramatically reduce the time necessary to acquire targets, detect landmines, 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. Multispectral sensor simulations will likely support end-to-end predictive modeling and evaluation of new technologies in a virtual environment. Work in this PE contains no duplication with any effort within the Military Departments and is fully coordinated with PE 0602712A (Countermines 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. Contractors include: Boeing, Anaheim, CA; EOIR, Spotsylvania, VA; Fermionic, Simi Valley, CA; Fibertek, Herndon, VA; Kaiser, San Jose, CA; Litton, Orlando, FL; Lockheed Martin, Lexington, MA; Planar Systems, Beaverton, OR; Raytheon, Dallas, TX; Rockwell, Thousand Oaks, CA; SAIC, San Diego, CA; Sarnoff, Princeton, NJ; TRW, Fairfax, VA; and VG Semicon, Beverly, MA. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).									

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<u>FY 2001 Accomplishments:</u> 4125 - Researched a prototype process for fabricating micro-lenses on focal planes to focus incident radiation on small pixel detectors. Provided improvements in detector sensitivity and sensor performance. - Investigated and tested prototype advanced lithography process in order to reduce the number of fabrication steps for infrared focal plane arrays (FPAs). - Fabricated and tested alpha-silicon wafer in-situ contacts using NVESD microfactory facilities. 1536 - Investigated a prototype semiconductor process for integrated circuits that will be required to simultaneously readout the response from high speed, large area (640x480 and 1024x1024 element) dual color FPAs. Limited capacity readout circuits are a major technical barrier to higher performing next generation infrared (IR) devices. - Designed next generation mid wavelength infrared and long wavelength infrared FPA devices to provide high performance at elevated operating temperatures (120K vs. current 77K). 4550 - Completed testing and evaluation of near IR solid state cameras based on alternative detector materials. Characterized performance and defined manufacturing yield issues for the alternative materials. - De fined design parameters for a low cost, uncooled near IR and far IR sensor for dismounted soldier applications. Provided a fused output of the two spectral bands to enhance the operator's perception of "color" contrast, shadows, and depth. 3370 - Extended development of search and target acquisition sensor predictive modeling. Transitioned algorithms to constructive modeling and wargaming community. - Completed performance prediction models of multispectral sensor systems and target acquisition for specific targets. - Improved model prediction for environmental effects impact on sensor performance. - Incorporated additional sensor simulation capabilities that better represent complex urban terrain and the battlefield environment. - Established initial simulation tool set to support maturation of systems which use advanced, integrated, distributed, and networked sensors. Transitioned tool set for use in Battle Lab experiments. - Performed sensor simulation validations. 863 - Constructed an open "heterogeneous" ATR processor architecture capable of hosting ATR software/algorithms designed for unique or propriety hardware. Reduced the time and cost required to integrate ATR capability into new platforms. - Established standardized methods and procedures for mine detection ATRs.		

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<u>FY 2001 Accomplishments: (Continued)</u> • 1490 - Investigated emerging sensor technologies and ATR performance evaluation technology and methods. • 1490 - Evaluated small scale integrated network of acoustic, seismic, and IR imaging micro-sensors in order to provide a significant unattended tactical sensing capability. Detected, tracked, and classified time critical mobile and stationary targets. • 1490 - Evaluated low power consumption micro-sensors and support electronics that permit unattended micro-sensor operation for up to 60 days. • 1490 - Performed experiments utilizing prototype micro-sensor nodes in various configurations. • 2100 - Completed full color, 640 x 512 pixel, flat panel display technology in order to enhance dismounted soldier performance through the use of color maps and symbology. • 2100 - Completed color, 800 x 600 pixel, flat panel display technology for mounted and aviation applications. • 1100 - Designed eyesafe micro-lasers capable of 2500 meter range performance and more than 5 shots per second. • 237 - Performed final demonstration in the Cooperative Eye-Safe Laser Radar Program. • 700 - Completed on-chip neomorphic processing, hyperspectral spatial and temporal signature processing for development of compact, high performance sensors. • 4864 - Constructed, analyzed, and evaluated, fully portable prototype of combustion driven eyesafe, self-powered laser, and its control electronics. This was a Congressional interest program. Total 24935 <u>FY 2002 Planned Program</u> • 4612 - Research alternate readout circuit electronic technology to achieve small pixel geometry without performance reductions. • 4612 - Investigate analog-to-digital conversion techniques suitable for incorporation on FPA to improve sensitivity and dynamic range. Enable target identification at current detection ranges. • 4612 - Investigate high operating temperature modes of IR FPAs against performance requirements. • 4612 - Establish new techniques for etching detector material for high aspect ratios in order to achieve larger collection efficiency in multi-color detector stacked photodiodes and better pixel-to-pixel isolation. • 4612 - Examine anti-reflection structures on micro-lenses for improved collection efficiency. • 1502 - Establish baseline ATR performance for multi and hyperspectral sensors including those having advanced filtering and processing capability. • 1502 - Investigate optimal human use of intelligent sensors for military applications.		

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<u>FY 2002 Planned Program (Continued)</u> - Research ATR hardware/software business plan to address the acquisition and life cycle support requirements associated with introduction of ATR technology into Army tactical systems. - Show real-time reconfiguration of adaptable processor hardware which could reduce the size, weight, and power requirements typical for ATR processors. - Host target cueing algorithms on real-time commercial-off-the-shelf (COTS) hardware. Evaluate performance. - Collect additional ATR problem set data to support algorithm maturation and evaluation. • 3632 - Leverage clutter metric and shape characterization efforts for maturation and evaluation of a performance predication capability useful for specific targets. - Complete modeling of multispectral sensor systems. - Integrate environmental effects into model. - Complete validation of 8-12 micron thermal sensor simulation. - Continue validation of other sensor simulation bands. - Advance state-of-the-art for simulation of distributed networked sensor simulation. Transfer improvements to battlelabs. - Complete sensor simulation for better representation of complex urban terrain and the dirty battlefield environment. Begin development of dynamic terrain representations. • 4048 - Research extremely low power IR imaging micro-camera with instant-on capability. - Investigate alternate components in a set of micro-sensors (acoustic, seismic, magnetic, IR tripwire, laser tripwire, etc.). Optimize ATR function in an isolated network of micro-sensors. - Investigate low power, compact micro-sensor network for field experimentation. - Research high frame rate (small time constant) material structures in alpha-silicon. • 4860 - Research 1920x1080 pixel, high-brightness, monochrome Active Matrix Liquid Crystal Display (AMLCD) for aviation platforms. - Investigate electrical optic attenuator for active sunglass tinting of helmet mounted displays. - Characterize performance of 640x512 pixel, full color, flat panel displays for the soldier. • 939 - Integrate micro eyesafe solid state laser devices with receiver. Evaluate 2500 meter ranging at 5 hertz, using low cost laser technology. • 800 - Investigate multispectral and polarization imaging phenomenology as part of a fused sensor suite, with an active laser ranging sensor.		

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<u>FY 2002 Planned Program (Continued)</u> 2600 - This one year Congressional add investigates dual band detector imaging technology. Specifically, research improved processes to fabricate small-pixel, two color, large format FPAs. No additional funding is required to complete this project. Total 22993 <u>FY 2003 Planned Program</u> 5248 - Show/evaluate multi-color, small pixel FPAs, with 16 bit digital read-outs. - Investigate optical interconnects for extremely high rate transfer of digital data off the FPA. 1540 - Extend ATR evaluation capability to smart focal plane sensor systems. - Evaluate real-time execution of target cueing algorithms in non-ruggedized COTS hardware in support of Army mission requirements. Evaluate performance. Integrate suitable cueing algorithms into real-time ruggedized hardware to support ATR technology insertion into Army tactical systems. 4360 - Complete search and specific target model developments. - Leverage metric effort and perform perception studies to support moving target modeling effort. - Incorporate model upgrades into Acquire for use in constructive simulation. - Complete dynamic terrain developments in the sensor simulation tool set. - Complete validation of 3-5 micron, thermal and monochrome, visible sensor simulation bands. - Transition distributed networked sensor simulation tool set to support the Army Transformation efforts. - Implement spectral based targets and hyperspectral sensor simulation capability. 3966 - Show/evaluate a deployable, integrated, network of micro-sensors with target identification at the node and low bandwidth alerting to command center at a distance. - Conduct field experimentation with the integrated microsensor network. 4586 - Research 1280x1024 pixel, full-color, flat-panel Active Matrix Electro-Luminescent, or AMLCD, prototype for the mounted warrior. - Research curved substrates for low power, visor displays for the dismounted soldier. - Complete testing and evaluation of full-color, 1280x1024 pixel, flat-panel displays. 1189 - Show/evaluate multispectral/polarization/laser radar sensor suite for high altitude UAV applications. 1444 - Investigate a high definition television format, uncooled FPA, with 15 micron pixels for navigation and vehicle self-protection and surveillance. Total 22333		

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H95**B. Program Change Summary**

	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	23746	20598	20340
Appropriated Value	23965	23198	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-205	0
b. SBIR / STTR	-310	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	1500	0	0
e. Rescissions	-220	0	0
f. OSD Realignment	0	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	1993
Current Budget Submit (FY 2003 PB)	24935	22993	22333

Change Summary Explanation:

FY02 - A Congressional add was made for Dual Band Detector Imaging Technology, Project H95 (\$2600).