

UNCLASSIFIED

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 2000
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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology
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<i>COST (In Thousands)</i>	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	25402	42262	33341	37741	37026	32905	32340	Continuing	Continuing
DK70 Night Vision Advanced Technology	9153	18493	18517	21159	18812	20702	20609	Continuing	Continuing
DK86 Night Vision, Airborne Systems	11203	18251	6154	4582	9457	9391	9259	Continuing	Continuing
DK89 Millimeter Wave Technology	3371	0	0	0	0	0	0	0	3371
DC63 DC63	0	0	0	0	0	0	0	0	3958
DC65 DC65	1675	2382	2360	2857	2870	2812	2472	Continuing	Continuing
DC67 DC67	0	3136	6310	9143	5887	0	0	0	25028

A. Mission Description and Budget Item Justification: This program element (PE) develops and demonstrates new and improved tactical night vision and electronic sensor technologies for surveillance, reconnaissance, target acquisition, air defense, pilotage, and driving technology to meet future Army requirements and applications. This technology will provide the capability to acquire and engage hostile targets at longer ranges during day/night, smoke, obscured weather and battlefield conditions, significantly enhancing the warfighting capability and survivability of US forces. Multisensor target acquisition suites will be demonstrated that provide rapid automatic target acquisition and generation of battlefield intelligence data. This will allow US forces to operate and react well within the operational timelines of threat forces. Multispectral and hyperspectral sensors will provide the capability to detect obscured, concealed, and reduced signature threats. Improved linkages between distributed sensors and command, control, communications, computers and intelligence (C4I) systems will enable timely and seamless transmission and understanding of sensor information across multiple battlefield users. Efforts also are directed toward technology for wide field-of-view (FOV) sensors to support dismounted soldier mobility and day/night nap-of-the-earth pilotage at high speeds. Advanced tactical reconnaissance and surveillance sensor technologies will provide improved real-time capabilities for imaging intelligence (IMINT) and measurement and signature intelligence (MASINT) applications. Technology advances achieved under this PE have tri-service applications.

Work in this program element is consistent with the resource-constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Tri-Service Reliance agreements on sensors and electronic devices with oversight and coordination provided by the Joint Directors of Laboratories. This work is related

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to and fully coordinated with efforts in PE 0602709A (Night Vision and Electro-Optics Technology), PE 0602270A (Electronic Warfare Technology), PE 0603774A (Night Vision Systems Advanced Development), and PE 0604710A (Night Vision Systems Engineering Development). Work in this PE is primarily managed by the US Army

Communications-Electronics Research, Development and Engineering Center (CERDEC), Ft. Monmouth, NJ. Contractors include: Raytheon., Dallas, TX; Raytheon, El Segundo, CA; Fibertek, Herndon, VA; Questech, Falls Church, VA; Northrop-Grumman, Linthicum, MD; Lockheed-Martin Corp., Orlando, FL; Lockheed-Martin, Lexington, MA; Alliant, Hopkins, MN; EOIR, Spotsylvania, VA; Booz-Allen, McLean, VA; Omar McCall, Beltsville, MD.; ThermoTrex Corporation.

<u>B. Program Change Summary</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>
Previous President's Budget (<u>FY 2000/2001</u> PB)	27273	36628	37035
Appropriated Value	27460	42628	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-187		
b. SBIR / STTR	-692		
c. Omnibus or Other Above Threshold Reductions		-161	
d. Below Threshold Reprogramming	-1069		
e. Rescissions	-110	-205	
Adjustments to Budget Years Since <u>FY 2000/2001</u> PB			+37
New Army Transformation Adjustment		TBD	-3731
Current Budget Submit (<u>FY 2001</u> PB)	25402	42262	33341

Change Summary Explanations: Funding – FY 2001 : Projects were adjusted to reflect the new Army Transformation.

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BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology				PROJECT DK70	
COST (In Thousands)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DK70 Night Vision Advanced Technology	9153	18493	18517	21159	18812	20702	20609	Continuing	Continuing
<p>Mission Description and Justification: This project will develop and demonstrate affordable and high performance, sensor/multisensor technologies that increase the probability of detection, extend the range, and reduce the target acquisition timelines. The multi-function staring sensor suite (MFS3) ATD will demonstrate a modular reconfigurable sensor suite that integrates an advanced, broad-band staring infrared sensor with multi-function laser and acoustic technologies for application to future scout, fire support, and air defense missions. This technology demonstration will provide ground combat and amphibious assault vehicles with compact affordable sensor options for long range non-cooperative target recognition and air defense against low signature unmanned aerial vehicles and long range helicopters. A next generation, low power, uncooled infrared sensor also will be developed to provide affordable technology upgrades to applications such as Thermal Weapons Sights (TWS), Objective Crew Served Weapon (OCSW), Objective Individual Combat Weapon (OICW), future Cost Effective Targeting Systems and the Javelin anti-tank weapon system. Sensor-to-C4I interface architectures will be demonstrated to enable timely and seamless transmission as well as visualization and understanding of sensor information across multiple battlefield users.</p> <p>FY 1999 Accomplishments:</p> <ul style="list-style-type: none"> • 9153 – Developed reconfigurable, open architecture sensor backplane that fully integrates aperture, power, and signal processing requirements for infrared, laser, and acoustic sensor components. <ul style="list-style-type: none"> – Developed and implemented risk reduction efforts for multifunction staring sensor suite infrared sensor components. – Completed design trade-offs and evaluations of broad-band (mid-wave and long-wave) staring infrared sensor technologies. – Conducted preliminary efforts to develop broad band high-speed infrared sensor for rapid wide area search and long range target identification. – Continued development of the multifunction staring sensor suite virtual prototype to facilitate design/performance trade-offs, user evaluations of operational modes and non-machine interfaces. <p>Total 9153</p> <p>FY 2000 Planned Program:</p> <ul style="list-style-type: none"> • 13234 Complete multifunction staring sensor suite system operation mode simulation with Mounted Maneuver Battlelab to optimize user interface. <ul style="list-style-type: none"> – Fabricate signal processing backplane, and sensor gimbal and stabilization assembly required to implement panoramic search capability – Complete fabrication of the multifunction staring sensor suite broad band staring thermal imaging sensor to satisfy the objective surveillance and target acquisition requirements of future scout, fire support, and air defense systems. – Conduct user demonstrations and evaluations of manually operated, 3-field of view broad band and mid wave sensors and characterize target recognition and identification performance. Specific emphasis will be placed on demonstrating the utility of the ultra narrow field of view for long-range target identification. – Transition performance and engineering data to support the future scout and cavalry system affordability in-process review. 									
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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology PROJECT DK70	
FY 2000 Planned Program: (continued)		
	<ul style="list-style-type: none"> - Complete the multi-function laser simulation, trade-off, and design analyses, and transition data to support requirements definition of Army laser horizontal technology integration. 	
	<ul style="list-style-type: none"> - Conduct multifunction staring sensor suite data collections, using the broad band thermal imaging sensor, to support training of the automatic target recognition software needed for high probability of detection/recognition, wide-area search modes. 	
<ul style="list-style-type: none"> • 2819 	<ul style="list-style-type: none"> - Complete performance and design requirements and system concept modeling and field experimentation for a modular sensor that incorporates an improved generation of uncooled infrared technology, and smart power management architecture to provide improved performance and reduce the weight and power burden for the individual soldier . 	
	<ul style="list-style-type: none"> - Conduct system design analysis and field data collection of Cost Effective Targeting Sensor with multi-sensor alternatives and flash laser illumination for target identification. 	
	<ul style="list-style-type: none"> - Define focal plane, image processing, and image stabilization requirements to meet or exceed the Javelin command launch unit range performance for multiple sensor applications to include TWS, OCSW, OICW, Javelin and future Cost Effective Targeting System. 	
	<ul style="list-style-type: none"> - Design power management architecture and low power electronics to reduce power consumption to a level such that a 72-hour operational mission can be executed using only one primary battery. 	
<ul style="list-style-type: none"> • 2000 	<ul style="list-style-type: none"> - This one year Congressional special interest effort will fabricate and demonstrate fire fighting and damage control systems consisting of helmet mounted infrared camera, power supply, image projection device, transmitter/receiver, and computer with interface and software to support complete voice activated system controls. 	
<ul style="list-style-type: none"> • 440 	<ul style="list-style-type: none"> - Funds reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Authorization Act of 1992. 	
Total	18493	
FY 2001 Planned Program:		
<ul style="list-style-type: none"> • 14200 	<ul style="list-style-type: none"> - Complete development of multifunction laser hardware and integration into the multifunction staring sensor suite. 	
	<ul style="list-style-type: none"> - Complete development of aided target detection/recognition algorithm hardware/software (multispectral detection, moving target indication, and mid wave spatial detection/recognition) and integration into the multifunction staring sensor suite. 	
<ul style="list-style-type: none"> • 3920 	<ul style="list-style-type: none"> - Develop 640x480 uncooled focal plane array with increased sensitivity. 	
	<ul style="list-style-type: none"> - Complete design of low power electronics and power management which reduces power consumption by 60% compared to currently fielded systems such as the Thermal Weapon Sight. 	
	<ul style="list-style-type: none"> - Complete design of lightweight optics, electronic, and mechanical interfaces to enable the low power uncooled infrared sensor technology to be readily reconfigured for applications such as the individual soldier thermal weapons sight, objective crew served weapon, or Javelin antitank weapon. 	
<ul style="list-style-type: none"> • 397 	<ul style="list-style-type: none"> - Complete definition and development of hardware and software modules required to demonstrate the sensor-to-C4I interface architecture in a scout platform and mine detection platform. 	
	<ul style="list-style-type: none"> - Complete development of data/image compression technology and techniques required to provide sensor data over limited bandwidth communications links. 	
Total	18517	
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BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology				PROJECT DK86				
COST (In Thousands)				FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DK86 Night Vision, Airborne Systems				11203	18251	6154	4582	9457	9391	9259	Continuing	Continuing
<p>Mission Description and Justification: This project develops and demonstrates surveillance, reconnaissance, and pilotage technology for Army airborne platforms. Specific technology efforts focus on improved night pilotage sensors, high resolution heads up displays, and obstacle warning technology to enhance the operational effectiveness and survivability of currently fielded and future attack, scout, cargo and utility helicopters. These technologies will significantly enhance the survivability of Army aviation assets during nap-of-the-earth flights and day/night/adverse weather conditions. Reduced exposure to air defense artillery, surveillance systems, and smart missiles will also be realized. Advanced helicopter pilotage (AHP) demonstrations will provide a high-quality dual-spectrum pilotage sensor and the displays needed to provide this imagery to the pilot. The air/land enhanced reconnaissance and targeting (ALERT) ATD continues efforts to develop a robust, affordable aided target recognition (ATR) capability for scout and attack helicopters and will demonstrate search on-the-move aided target acquisition using a forward looking infrared (FLIR)/laser sensor suite for PEO Aviation programs. In conjunction with PEO Aviation, the advanced integrated targeting suite (AITS) will demonstrate a millimeter wave electronically scanned antenna radar fused with the IR/EO targeting sensor to achieve automated detection, recognition, and identification at extended ranges for transition to Comanche. Advanced aviators night vision goggles (ANVG) ATD will demonstrate a lightweight wide field-of-view (FOV) (40 x 100 deg) low cost panoramic night pilotage capability for the air warrior. Multi-mission, unmanned aerial vehicle (UAV) sensor ATD will demonstrate affordable, high performance EO/IR payload for transition to PM TUAV/ PM NVRSTA. Ultra light weight, modular sensors will be developed for the Small Unit/Mini UAV. Technology developed under this project is also directly applicable to the night flying requirements of the other services and Special Operations Command's rotary wing aircraft. Complete design and fabrication of a Wire Obstacle and Detection System that will provide a much-needed military capability to pilots, given the hazardous conditions in which some military mission must be flown. Develop a mini class UAV platform with GFE sensor, launch system, ground station capability and automated flight control.</p> <p>FY 1999 Accomplishments:</p> <ul style="list-style-type: none"> • 3419 – Developed performance and design requirements for multi-mission electro-optic/infrared sensor payloads for tactical and short range unmanned aerial vehicles. <ul style="list-style-type: none"> – Completed design of high performance, lightweight staring infrared sensor for wide area reconnaissance, and precision targeting. – Completed design of lightweight multispectral/hyperspectral payload for measurement and signature intelligence. • 7784 – Established baseline performance of ATR algorithm probability of detection, classification, recognition, identification, probability of false alarm/false target reports. <ul style="list-style-type: none"> – Developed architecture for on-the-move multisensor aided target recognition algorithm that combines laser range mapping and laser target profile data with infrared imagery for automated air/land enhanced reconnaissance and targeting advance technology demonstration. – Defined design modifications for baseline laser rangefinder/designator and initiated fabrication to provide the increased pulse repetition rates necessary to operate in range mapping and target profiling modes during high-speed dynamic flight missions. <p>Total 11203</p>												
Project DK86				Page 5 of 8 Pages				Exhibit R-2A (PE 0603710A)				

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology	PROJECT DK86
FY 2000 Planned Program:		
• 2200	– Conduct initial developmental efforts of the ANVG program for demonstrating high resolution, wide field of view, helmet mounted sensor. – Conduct HTI sensor/system approach for application for both aviation and infantry to provide improved performance for pilotage, driving and dismounted operations under various battlefield conditions. – Perform human interface study for aviation and infantry applications. – Identify HTI design tradeoffs. – Develop image intensification (I2) tube enhancements for improved performance.	
• 5000	– Complete development and fabrication of high performance staring electro-optic/infrared (EO/IR) and multi/hyperspectral modular sensor payloads. – Complete environmental testing for shock, vibration, temperature, altitude, etc. to ensure the EO/IR UAV payloads are ready for aircraft integration and flight tests. – Develop and test mechanical interface for rapid and simple “plug in/plug out” modularity, electrical interface to include cables, connectors, power, and informational interface to include data links, command and control, mission planning, and ground checkout. – Develop mechanical mockups to demonstrate rapid interchangeability between high performance EO/IR, multi/hyperspectral and radar sensor payloads on a tactical UAV platform. – Integrate on manned platform and conduct instrumented flight-testing under dynamic flight conditions to verify functionality of the payloads and down links.	
• 4168	– Demonstrate FLIR performance upgrade and perform image data collections for algorithm enhancements. – Complete coding of algorithm modifications needed to achieve enhanced detection and classification performance against stationary and moving targets for search on the move. – Perform aircraft testbed system integration of multi-function laser with electro-optic target acquisition sensor for final airborne data collection trials and performance demonstrations – Demonstrate rapid target insertion / algorithm training process for achieving automatic detection and cueing performance against new/emerging target threats.	
• 3000	– This one year Congressional special interest project will develop and demonstrate a wire detection and obstacle avoidance system.	
• 1000	– This one year Congressional special interest project will develop and demonstrate a prototype Mini UAV platform with GFE sensor, launch system, ground station capability and automated flight control.	
• 2423	– Develop on-the-move FLIR/targeting radar sensor fusion algorithms to improve aircraft survivability during reconnaissance and attack missions.	
• 460	– Funds reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Authorization Act of 1992.	
Total	18251	
Project DK86		
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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology	PROJECT DK86
<p>FY 2001 Planned Program:</p> <ul style="list-style-type: none"> • 1514 - Fabricate sensor mockups for cockpit/equipment integration evaluations. <ul style="list-style-type: none"> - Complete critical design and initiate fabrication of air warrior version of the ANVG sensor package. • 2000 - Integrate high performance electro-optic/infrared and multi/hyperspectral sensor payloads on a tactical UAV/manned reconnaissance platforms and conduct operational demonstration and user warfighting experiments to support military assessments. <ul style="list-style-type: none"> - Develop and transition performance and technical design data to PM NVRSTA and PM TUAV to support final development of operational requirements and engineering development specifications for TUAV Block 2 procurement. • 2660 - Complete integration of air/land enhanced reconnaissance and targeting technologies with demonstration aircraft and conduct airborne flight evaluations to demonstrate increased operational benefits derived from multi-function laser and ATR algorithm enhancements when performing search on-the-move, acquiring targets in defilade or obscured, or at extended range. <ul style="list-style-type: none"> - Develop and transition performance and technical design data to support technology insertions decision by individual PEO Aviation platform managers (Comanche, Apache, and future scout cavalry vehicle). <p>Total 6174</p>		
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BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology				PROJECT DK89	
<i>COST (In Thousands)</i>	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DK89 Millimeter Wave Technology	3371	0	0	0	0	0	0	0	3371
<p><u>Mission Description and Justification:</u> This one year Congressional special interest project conducted passive millimeter wave imaging technology research, which will be used to demonstrate a potential all-weather, mission enabling capability on a helicopter platform. Flight tests were conducted to establish the feasibility of pilotage and targeting in adverse weather such as dense fog and medium rain. This program specifically addressed Special Operations Forces high priority capability. Other potential applications for the completed system include seeing through closed doors and walls in military operations in urban terrain.</p> <p>FY 1999 Accomplishments:</p> <ul style="list-style-type: none"> • 3371 - An upgraded passive millimeter wave camera (PMC) was completed and flight tests were conducted. Passive MMW images were obtained from various altitudes of areas in and around Mojave, CA at true video frame rates. <p>Total 3371</p> <p>FY 2000 Planned Program: This project is not funded in FY 2000.</p> <p>FY 2001 Planned Program: This project is not funded in FY 2001.</p>									
Project DK89			<i>Page 8 of 8 Pages</i>			Exhibit R-2A (PE 0603710A)			