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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)									DATE February 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology						
COST (In Thousands)	FY1998 Actual	FY 1999 Estimate	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	17628	27273	36628	37035	41416	37726	34348	32756	Continuing	Continuing
DK70 Night Vision Advanced Technology	4584	9633	16640	17892	19419	18965	20917	20870	Continuing	Continuing
DK86 Night Vision, Airborne Systems	7846	11779	14428	10419	9913	9935	10595	9391	Continuing	Continuing
DK87 Night Vision, Combat Vehicles	4603	0	0	0	0	0	0	0	0	4603
DK89 Millimeter Wave Technology	0	3477	0	0	0	0	0	0	0	3477
DC63 DC63	595	0	0	0	0	0	0	0	0	3958
DC65 DC65	0	2384	2400	2375	2877	2893	2836	2495	Continuing	Continuing
DC67 DC67	0	0	3160	6349	9207	5933	0	0	0	25028

A. Mission Description and Budget Item Justification: This program element (PE) develops 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 extended 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 to provide rapid automatic acquisition of targets and battlefield intelligence data to 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 are also 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. Passive millimeter wave imaging technology will be demonstrated for all weather mission capability for air platforms. 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 to and fully coordinated with efforts in PE 0602709A (Night Vision and Electro-Optics Technology), PE 0602270A (Electronic Warfare Technology), PE

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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; Booze-Allen, McLean, VA; Omar McCall, Beltsville, MD.; ThermoTrex Corporation.

B. Program Change Summary	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>
Previous President's Budget (<u>FY 1999</u> PB)	18705	23960	33487	31553
Appropriated Value	19299	27460		
Adjustments to Appropriated Value				
a. Congressional General Reductions	-594	-187		
b. SBIR / STTR	-354			
c. Omnibus or Other Above Threshold Reductions	-123			
d. Below Threshold Reprogramming	-600			
e. Rescissions				
Adjustments to Budget Years Since <u>FY 1999</u> PB			+3141	+5482
Current Budget Submit (<u>FY 2000/2001</u> PB)	17628	27273	36628	37035

Change Summary Explanation: Funding - FY 1999 – Congressional increase for new millimeter wave technology.
 DC67 – FY 2000 (+2466) and FY 2001 (+4755) funds reprogrammed to this project to support development of high priority classified technologies.
 DK70 – FY 2000 (+1000) and FY 2001 (+1000) reprogrammed for multisensor staring sensor suite.

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BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology				PROJECT DK70		
COST (In Thousands)	FY1998 Actual	FY 1999 Estimate	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	4584	9633	16640	17892	19419	18965	20917	20870	Continuing	Continuing
<p>Mission Description and Justification: This project will develop and demonstrate affordable and high performance, sensor/multisensor technologies, increase the probability of detection, extend the range, and reduce the timelines of target acquisitions systems. The multi-function staring sensor suite (MFS3) ATD will demonstrate a modular reconfigurable sensor suite that integrates an advanced, broad-band staring infrared with multi-function laser and acoustic technology 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, air defense against low signature unmanned aerial vehicles and long range helicopters. A next generation, low power, uncooled infrared sensor will be developed to provide affordable technology upgrades to Land Warrior, Thermal Weapons Sights (TWS), Objective Crew Served Weapon (OCSW), and the Javelin anti-tank weapon system. Sensor-to-C4I interface architectures will be demonstrated to enable timely and seamless transmission, visualization and understanding of sensor information across multiple battlefield users.</p> <p>FY 1998 Accomplishments:</p> <ul style="list-style-type: none"> • 4584 – Developed performance and design requirements for the multifunction staring sensor suite ATD to provide scout and reconnaissance forces with high speed, panoramic surveillance, long range detection and identification of low signature targets. – Demonstrated and evaluated large format staring mid wave and long wave infrared sensors with an ultra narrow field of view to quantify long range identification performance. – Designed multifunction sensor suite virtual prototype to facilitate design/performance trade-offs, user evaluations of operational modes, and man-machine interfaces.. <p>Total 4584</p> <p>FY 1999 Planned Program:</p> <ul style="list-style-type: none"> • 9387 – Complete multifunction sensor suite virtual prototype to facilitate design/performance trade-offs, user evaluations of operational modes and non-machine interfaces. – Developed reconfigurable, open architecture sensor back plane that fully integrates aperture, power, and signal processing requirements for infrared, laser, and acoustic sensor components. – Develop and implement risk reduction efforts for multifunction staring sensor suite infrared and laser sensor components. – Complete design trade-offs and evaluations of broad band (mid-wave and long-wave) staring infrared sensor technologies. – Develop broad band high-speed infrared sensor for rapid wide area search and long range target identification.. • 246 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs. <p>Total 9633</p>										
Project DK70			Page 3 of 10 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 DK70
<p>FY 2000 Planned Program:</p> <ul style="list-style-type: none"> • 13420 – Fabricate signal processing back plane, and sensor gimbal and stabilization assembly required to implement panoramic search capability <ul style="list-style-type: none"> – Complete fabrication of the multifunction staring sensor suite 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 mid wave sensor 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. – Complete the multi-function laser simulation, trade-off, and design analyses, and transition data to support requirements definition of Army laser horizontal technology integration. – 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. • 3220 – 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, smart power management architecture, and a next generation primary power source to provide improved performance and reduce the weight and power burden for the individual soldier . <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, and Javelin. – 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. <p>Total 16640</p> <p>FY 2001 Planned Program:</p> <ul style="list-style-type: none"> • 12545 – Complete development of multifunction laser hardware and integration into the multifunction staring sensor suite. <ul style="list-style-type: none"> – Demonstrate rapid wide area search and aided target recognition capability. – Demonstrate laser rangefinding, target designating capability and target profiling that will improve ATR and target identification performance in support of future Army reconnaissance, surveillance, and target acquisition missions. – Complete integration of the stabilized, panoramic electro-optics sensor assembly with the ATR processing architecture and demonstrate functionality of wide area search and recognition functions. – Complete hardware/software integration of multifunction staring sensor suite into the demonstration platform and perform end-to-end system functional tests and checkout. – Conduct field demonstrations of the multifunction staring sensor suite capability to conduct wide area search, automated target detection, recognition, and long range identification for future scout, fire support, and air defense missions. 		
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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology	PROJECT DK70
<p align="center">– Transition design, performance, and technical data for development of operational requirements and engineering development specifications for the future scout and cavalry system.</p> <p>FY 2001 Planned Program: (continued)</p> <ul style="list-style-type: none"> • 4250 – 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. – 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. • 1097 – 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. – Conduct virtual experiments to evaluate and refine capability to provide seamless transmission and understanding of sensor information across multiple battlefield users. – Conduct analyses and define requirements to implement the sensor-to-C4I interface architecture in the prototype brigade intelligence, surveillance, and reconnaissance platform. <p>Total 17892</p>		
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BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology				PROJECT DK86		
COST (In Thousands)	FY1998 Actual	FY 1999 Estimate	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	7846	11779	14428	10419	9913	9935	10595	9391	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 head's up displays, and automated obstacle warning technology to enhance the operational effectiveness and survivability of currently fielded and future attack, scout, cargo and utility helicopters. This technology will significantly enhance the survivability of Army aviation assets by permitting rotorcraft to fly at nap-of-the-earth altitudes and avoid obstacles in day/night/adverse weather conditions, and reduce exposure to air defense artillery, surveillance systems, and smart missiles. Advanced helicopter pilotage (AHP) demonstration will provide a high-quality dual-spectral pilotage sensor and the displays needed to provide this imagery to the pilot. An aerial scout sensor suite demonstration will evaluate airborne sensors for improved non-line-of-sight targeting for weapons systems in the rapid force projection initiative ACTD. An advanced integrated targeting suite (AITS) will demonstrate an affordable millimeter wave electrically scanned radar with fused electro-optical sensor processing to achieve automated detection, recognition, and identification at extended ranges for air platforms and could be applied to ground platforms. Advanced aviator's night vision goggles (AANVG) will demonstrate a lightweight wide 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 infrared and hyperspectral sensors to provide upgrade options for airborne surveillance applications, including future tactical and short range UAVs. 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 future aviation assets. 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.</p> <p>FY 1998 Accomplishments:</p> <ul style="list-style-type: none"> • 2475 – Completed helmet mounted display of fused near infrared and far infrared pilotage sensor data to provide a significant reduction in pilot cognitive and physical work load during high speed, nap of the earth flight operations. <ul style="list-style-type: none"> – Demonstrated wide field of view dual spectrum night pilotage system during real time flight maneuvers for user evaluation and feedback. • 2400 – Completed integration of aerial scout sensor aircraft, completed upgrades to ground station aided target recognition processor; conducted performance testing and delivered to the Rapid Force Projection Initiative (RFPI) ACTD for aerial reconnaissance and targeting missions. • 2971 – Collected target and background data in varying operational environments and developed search and target acquisition databases needed to establish the performance baseline for on-the-move air/land enhanced reconnaissance and targeting. <p>Total 7846</p> <p>FY 1999 Planned Program:</p> <ul style="list-style-type: none"> • 3265 – Develop 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"> – Complete design of high performance, lightweight staring infrared sensor for wide area reconnaissance, and precision targeting. 										
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BUDGET ACTIVITY 3 - Advanced Technology Development		February 1999
PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology		PROJECT DK86
<ul style="list-style-type: none"> - Complete design of lightweight multispectral/hyperspectral payload for measurement and signature intelligence. <p>FY 1999 Planned Program: (continued)</p> <ul style="list-style-type: none"> • 8219 - Develop 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. <ul style="list-style-type: none"> - Complete modifications to forward looking infrared target acquisition sensor suite, and continue test-fix-test evaluation baseline for on-the-move target detection and recognition performance. - Modify baseline laser rangefinder/designator to provide the increased pulse repetition rates necessary to operate in range mapping and target profiling modes during high-speed dynamic flight missions. - Complete evaluations and establish baseline performance of ATR algorithm probability of detection, classification, recognition, identification, probability of false alarm/false target reports. - Perform constructive virtual simulations to optimize sensor suite moding, field of regard, and scan rates for varying flight mission profiles. - Develop man-in-the loop virtual simulations to evaluate operational effectiveness of reduced false alarm / false target reports, extended range performance, increased acquisition probabilities over baseline system performance. - Evaluate and modify ATR processing based on feedback from virtual experiments. • 295 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs. <p>Total 11779</p> <p>FY 2000 Planned Program:</p> <ul style="list-style-type: none"> • 2245 - Define requirements for integrating advanced helmet mounted night vision technologies into the Army/Navy air warrior integrated system. <ul style="list-style-type: none"> - Provide technical support to the Air Force panoramic night vision goggle program and establish rotary wing unique requirements for evaluation of the technology. - Define joint Army and Air Force development and test program to provide advanced 100 degree panoramic goggle sensor for air warrior. - Develop preliminary design of modifications required to address integration issues among the panoramic goggle and the air warrior helmet, laser eye protection and nuclear, biological and chemical protective mask. • 5200 - Complete development and fabrication of high performance staring electro-optic/infrared (EO/IR) and multi/hyperspectral modular sensor payloads. <ul style="list-style-type: none"> - 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 datalinks, 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. 		
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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology	PROJECT DK86
<ul style="list-style-type: none"> • 4383 – Complete development and coding of algorithm modifications needed to achieve enhanced ATR acquisition capabilities at extended range, against obscured and defilade targets from both a hover and moving airborne platform. <p>FY 2000 Planned Program: (continued)</p> <ul style="list-style-type: none"> – 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. <ul style="list-style-type: none"> • 2600 – Develop performance and design requirements for the next generation electronically scanned target acquisition radar for Army aviation. This new radar will utilize advance radar materials, designs and electronics to provide superior performance with reduced size, weight, cost and power consumption. – Conduct trade-off analyses to establish size, weight, signature profile requirements, to define interfaces and modularity requirements, and develop data to support cost trade-offs for applying the electronically scanned radar technology to Comanche, Apache, and special operations rotary wing aircraft. – Define requirements for an on-the-move FLIR/ targeting radar sensor fusion algorithms to improve aircraft survivability during reconnaissance and attack flight missions. <p>Total 14428</p>		
<p>FY 2001 Planned Program:</p> <ul style="list-style-type: none"> • 2259 – Develop panoramic night vision sensor mockups for cockpit/equipment integration evaluations. – Complete critical design and initiate fabrication of air warrior version of the panoramic night vision sensor package. • 2000 – Integrate high performance electro-optic/infrared and multi/hyperspectral sensor payloads on a tactical UAV platform and conduct operational demonstration and user warfighting experiments to support military assessments. – Develop and transition performance and technical design data to support final development of operational requirements and engineering development specifications. • 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. – Develop and transition performance and technical design data to support technology insertions decision by individual platform managers (Comanche, Apache, and future scout cavalry vehicle). • 3500 – Develop on-the-move FLIR/ targeting radar sensor fusion algorithms to improve aircraft survivability during reconnaissance and attack flight missions. Analyze mast mount antenna assembly (designed under PE 0603772A), develop mock-ups, collect multispectral signature profiles, and make design refinements to minimize impact to reduced signature aircraft. – Develop and conduct man-in-the loop virtual simulations to optimize sensor suite moding, field of regard, and scan rates for varying flight mission profiles and surveillance/attack missions. 		
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BUDGET ACTIVITY
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PE NUMBER AND TITLE
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Total 10419

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology	PROJECT DK87
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COST (In Thousands)	FY1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DK87 Night Vision, Combat Vehicles	4603	0	0	0	0	0	0	0	0	4603

Mission Description and Justification: This project demonstrates target acquisition sensor technology to meet the stringent requirements of future combat vehicles. The target acquisition (TA) ATD is a sensor suite consisting of a second generation thermal imaging sight with automated wide area search, aided target recognition, low cost millimeter wave (MMW) ground radar, and a multifunction laser that will be demonstrated for future tank, cavalry, and scout vehicles. Multi-function staring sensor suite ATD will demonstrate an advance modular reconfigurable sensor suite that integrates on to multiple combat vehicles. Funding for this project in FY99 and beyond has been restructured to projects DK70 and DK86 to more accurately reflect mission applications.

FY 1998 Accomplishments:

- 3103 – Integrated a modified M1A2 commander’s independent thermal viewer, multifunction laser, and high-speed gimbal scan with aided target detection, recognition, and identification for automated wide-area search target acquisition.
- Integrated electro-optic target acquisition suite with a millimeter wave ground radar and demonstrated radar cueing and multisensor aided target search and acquisition for ground vehicles.
- 1500 – Defined multifunction staring sensor suite (MFS3) requirements and validated performance requirements through modeling and simulation.
- Total 4603

FY 1999 Planned Program: Project not funded in FY 1999

FY 2000 Planned Program: Project not funded in FY 2000

FY 2001 Planned Program: Project not funded in FY 2001

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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603710A Night Vision Advanced Technology	PROJECT DK89
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COST (In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
DK89 Millimeter Wave Technology	0	3477	0	0	0	0	0	0	0	3477

Mission Description and Justification: The objective of this one year Congressional special interest project is to conduct passive millimeter wave imaging technology research which will be utilized to demonstrate an all-weather, mission enabling capability on a helicopter platform. Flight tests will be conducted to establish the feasibility of pilotage and targeting in adverse weather such as dense fog and medium rain. This program specifically addresses a 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.

FY 1998 Accomplishments: This project not funded in FY 1998.

FY 1999 Planned Program:

- 3385 - Complete development of a passive millimeter wave-imaging camera compatible with UH-1 characteristics.
- Complete integration of the PMMWI camera aboard a UH-1 and establish flight worthiness of the UH-1/PMMWI camera system.
- Complete flight tests of the UH-1 mounted passive millimeter wave imaging camera in class III weather to demonstrate a new, mission enabling capability.
- 92 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 3477

FY 2000 Planned Program: This project is not funded in FY 2000.

FY 2001 Planned Program: This project is not funded in FY 2001.