ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**

COST (In Thousands)		FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total Program Element (PE) Cost		37246	30092	25554	28512	32490	32686	32920
608	COUNTERMINE & BAR DEV	21780	21728	22058	24034	27625	27725	27860
64C	COUNTERMINE DEMONSTRATIONS (CA)	12948	5126	0	0	0	0	0
683	Area Denial Sensors	2518	3238	3496	4478	4865	4961	5060

A. Mission Description and Budget Item Justification: This program element (PE) matures and demonstrates the sensor technologies required to detect mines, minefields, improvised explosive devices (IEDs) and obstacles to enable assured mobility for the high operational tempo (OPTEMPO) of the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. Project 608 focuses on concepts and technologies that will enable in-stride detection and breaching, close-in detection, area clearance, and neutralization of landmines. This project demonstrates the remote detection of minefields as well as individual landmine detection from handheld, ground, and aerial sensor systems; evaluates detection of both conventional and command detonated types of landmines (including IEDs), metallic and low/non-metallic; and emphasizes the use of wide-area multi-sensor fusion detection systems, coupled with small-area confirmation sensors. This multi-sensor approach has the potential to yield a high probability of mine/IED detection at very low false alarm rates. Efforts within this project assess airborne mine detectors for contingency applications and mature lightweight plug-and-play detectors for use in mission specific applications. Project 64C funds Congressional special interest items. Project 683 explores alternative systems for anti-personnel landmines and innovative concepts for minefield clearance. This PE will conduct modeling and simulation activities to assess the effectiveness of system concepts.

Work in this PE is related to and is fully coordinated with PE 0602712A (Countermine Systems), PE 0603710 (Night Vision Advanced Technology), and the US Marine Corps. 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). The PE contains no duplication with any effort within the military departments. Work in this PE is performed by the Army Research, Development and Engineering Command/Communications-Electronics Research, Development and Engineering Center/Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

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B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	33621	25327	29534
Current BES/President's Budget (FY 2007)	37246	30092	25554
Total Adjustments	3625	4765	-3980
Congressional Program Reductions		-131	
Congressional Rescissions		-304	
Congressional Increases		5200	
Reprogrammings	3625		
SBIR/STTR Transfer			
Adjustments to Budget Years			-3980

FY 05 increase of +$3.6 million (after adjustment for Congressional Undistributed Reductions) is attributed to reprogramming of Congressional Add for Advanced Demining Technology from PE 0603607A for proper execution.
FY 07 decrease of -4.0 million attributed to realignment of funding to higher priority requirements.

Two FY06 Congressional adds totaling $5200 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($4200) Advanced Demining Technology
($1000) Electromagnetic Detection and Imaging Transceiver (EDIT) Landmine Detector

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**	**608**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
608 COUNTERMINE & BAR DEV	21780	21728	22058	24034	27625	27725	27860

A. Mission Description and Budget Item Justification: This project matures countermine technologies for integration into future Army systems to enable assured mobility of the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. Specific activities include remote detection of minefields by aerial sensor systems and individual landmine detection by handheld and vehicle-based sensor systems and neutralization of individual mines and minefields. The landmines being addressed include conventional and command detonated, including improvised explosive devices (IEDs), metallic and low/non-metallic construction anti-tank and anti-personnel mines. This project will evaluate the potential for wide-area multi-sensor fusion detection systems, coupled with slower small-area confirmation sensors, to yield a high probability of mine detection (Pd) at very low false alarm rates (FAR). This project will evaluate airborne multispectral mine detection sensors and mature them for lightweight plug-and-play use on unmanned aerial vehicles (UAVs) in mission specific applications. The goal is for robust approaches to finding surface-laid and buried mines/IEDs in temporally and spatially varying vegetation, soil, weather, and diurnal conditions. This project has the potential to provide advanced countermine and counter-IED capabilities to the mounted and dismounted soldier by adapting commercial or emerging technologies for standoff detection and neutralization. Detection technologies include, but are not limited to, wide band radar, acoustic, laser, explosive detection sensors, infrared and visual imagery, and radio frequency. Neutralization technologies include chemical reactants, electromagnetic energy, and kinetic energy. The intent is to provide increased operational tempo and survivability for U.S. Forces prior to their entry into harm's way. Efforts are supported by modeling and simulation assessments and defines potential system effectiveness. The Future Combat System (FCS) Standoff Mine Detection System effort will provide standoff mine/IED detection capability for faster rate of advance (ROA) in high threat areas, using sensors on both a ground vehicle and a UAV. The Autonomous Mine Detection Sensors effort will provide the ability to detect anti-personnel mines at faster ROA, by integrating mine detection sensors onto a robotic platform thereby keeping the soldier away from danger. The Ground Penetrating Radar Countermine On The Move effort will provide faster ROA for on-route detection and provide off-route detection capability with high Pd and low FAR. The Airborne IED/Mine Detection effort will demonstrate automated processes and algorithms that improve upon the change detection process that detects mines and IEDs. The Aerial Buried Minefield Detection effort will develop sensors and algorithms for detection of mines that have been buried for a long time.

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). Minefield neutralization efforts are closely coordinated with Navy/USMC. Work in this PE is performed by the Army Research, Development and Engineering.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
FCS Standoff Mine Detection System. In FY05, demonstrated in an arid environment organic aerial vehicle (OAV) sized payload for detection of buried mines in roads; established baseline performance of bolt-on forward looking ground vehicle sensor and fusion aided target recognition (AiTR); initiated prototyping activities; improved fusion AiTR algorithms. In FY06, complete integration and fusion of forward looking sensors on a single platform; test and demo integrated ground vehicle sensor package and AiTR. In FY07, will finish development, testing and evaluation; will demonstrate performance of vehicle mounted forward looking sensors in relevant environment.	5491	4912	4943
Autonomous Mine Detection Sensors (AMDS). In FY05, completed sensor and Automated Target Recognition (ATR)/signal processing studies; demonstrated brassboard sensors and initial ATR/signal processing approach on surrogate platform. In FY06, refine sensor design based on initial studies and increase performance of ATR algorithms in off-road conditions; conduct blind test with improved	4964	4876	2917

sensor and ATR algorithms. In FY07, will complete prototype sensor build and ATR/signal processing implementation on surrogate platform; will conduct tests in relevant environments.			
Ground Penetrating Radar (GPR) Countermine On The Move. In FY05, continued maturation of a faster wideband GPR integrated on a surrogate UGV for use against anti-tank mines; increased antenna scan and data acquisition rates for on-route detection; improved the Automated Target Recognition (ATR) algorithms for improved clutter rejection and tracking of rough terrain; began mobility evaluation via a series of data collections with the improved GPR on rough terrain; began analysis to determine potential capability for off-route detection. In FY06, refine GPR hardware and ATR improvements; continue on and off route mobility demonstrations and evaluation. In FY07, will complete ATR development and GPR integration; will conduct a series of on and off route demonstrations in a variety of operational scenarios and under representative environmental conditions; will complete mobility evaluation.	4055	4344	5000
Mine Neutralization for Assured Mobility. In FY05, conducted industry trade studies of neutralizer darts and shape charges compatible with Army's guided multiple launch rocket system, to breach minefields from the broadest possible range of stand-off delivery; conducted limited physical tests in Army soil environments and developed a comprehensive model; leveraged Navy efforts in modeling and neutralizer dart testing. In FY06, conduct inert dart flight tests of selected approach to verify feasibility of destroying mines in soils other than sand.	2290	2000	0
Airborne IED/Mine Detection. In FY05, developed and validated automated algorithms for the change detection workstation (CDWS); evaluated multiple platforms and emerging sensor options. In FY06, continue algorithm and automation developments; integrate algorithms into the CDWS; integrate sensors for an improved IED/mine detection capability; conduct flight test. In FY07, will upgrade data collection assets to reduce the processing burden and to automate the CDWS to operate with high altitude payload; will complete algorithm development and sensor integration; will conduct flight tests; will perform system demonstrations in military like environments.	4980	5596	5536
Aerial Buried Minefield Detection. In FY07, will begin development of prototype(s) for detection of longer-term buried (greater than 3 days) anti-tank minefields from airborne platforms; will use results from 6.2 phenomenology studies, sensor evaluations, and algorithm development to guide selection of prototype configurations and platform options.	0	0	3662
Total	21780	21728	22058

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603606A - Landmine Warfare and Barrier Advanced Technology**	**683**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
683 Area Denial Sensors	2518	3238	3496	4478	4865	4961	5060

A. Mission Description and Budget Item Justification: This project provides demonstrations of surveillance, command, and control technology components for alternative systems that minimize the risk of injury or loss to non-combatants from exposure to anti-personnel landmines (APLs). The technology components will include distributed anti-personnel surveillance systems (autonomous seismic, acoustic, and day/night imaging sensor systems), command and control systems (ad hoc networked, wireless, sensor communications, and information management tools) to be used with man-in-the-loop overwatch fires. This project will use simulation to evaluate new concepts and modify doctrine. This project will also construct and evaluate components and system architectures at the system level in field tests.

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). The PE contains no duplication with any effort within the military departments. Work in this PE is performed by the Army Research, Development and Engineering Command/Communications-Electronics Research, Development and Engineering Center/Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Area Denial Sensors. In FY05, collected imager data; conducted radio and network capacity studies; began modeling study of standoff detection; completed the concept study; concluded an employment study for unmanned ground sensors via an unmanned ground vehicle. In FY06, complete standoff detection study, complete testbed and demonstrate initial personnel detection and discrimination capability. In FY07, will mature ground sensor discrimination algorithms; will demonstrate an unattended ground sensor field working with an intelligent mine system for discriminating combatant from noncombatant.	2518	3238	3496
Total	2518	3238	3496