

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE							
3 - Advanced technology development	0603606A - Landmine Warfare and Barrier Advanced Technology							
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
Total Program Element (PE) Cost	26915	30218	25315	30935	32686	32920	33650	34384
608 COUNTERMINE & BAR DEV	19283	21815	22360	27576	27725	27860	28473	29099
64C COUNTERMINE DEMONSTRATIONS (CA)	4984	4945						
683 Area Denial Sensors	2648	3458	2955	3359	4961	5060	5177	5285

A. Mission Description and Budget Item Justification: This program element (PE) matures and demonstrates sensor and neutralization technologies required to detect, identify, and then mitigate the effects of landmines, minefields, and obstacles. This work enables assured mobility for the high operational tempo (OPTEMPO) of the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. This PE also conducts modeling and simulation activities to assess the effectiveness of system concepts. Project 608 focuses on concepts and technologies that will enable in-stride detection and breaching, close-in detection, area clearance, and neutralization of threats. This project demonstrates the ability to detect landmines and booby traps from handheld, ground, and aerial sensor systems; evaluates detection of both conventional and command detonated types of threats, metallic, and low/non-metallic threats; 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 threat detection with very low false alarm rates. Efforts within this project also assess available airborne sensors for use in landmine and booby trap detection missions for the current force. This project 608 also demonstrates novel explosive, electronic, and kinetic energy techniques to neutralize individual threats and to breach minefields. Project 683 explores alternative systems for anti-personnel landmines and innovative concepts for minefield clearance. Project 64C funds congressional special interest items.

Work in this PE is related to and fully coordinated with PE 0602712A (Countermining 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 and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE			
3 - Advanced technology development	0603606A - Landmine Warfare and Barrier Advanced Technology			
<u>B. Program Change Summary</u>	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)	30092	25554	28512	32490
Current BES/President's Budget (FY 2008/2009)	26915	30218	25315	30935
Total Adjustments	-3177	4664	-3197	-1555
Congressional Program Reductions		-115		
Congressional Rescissions				
Congressional Increases		5000		
Reprogrammings	-3177	-221		
SBIR/STTR Transfer				
Adjustments to Budget Years			-3197	-1555
<p>FY06 funds decreased to support higher priority efforts. In FY08 funds decreased to support higher priority Army efforts.</p> <p>Two FY07 congressional adds totaling \$4792 (after adjustment for Congressional undistributed reductions) were added to this PE.</p> <p>(\$958) EDIT Advanced Landmine Detection (\$3834) Advanced Demining Technology</p>				

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2007

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603606A - Landmine Warfare and Barrier Advanced Technology						PROJECT 608		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
608 COUNTERMINE & BAR DEV	19283	21815	22360	27576	27725	27860	28473	29099	

A. Mission Description and Budget Item Justification: This project matures and demonstrates countermine technologies for integration into future Army systems, and where feasible, exploit opportunities to enhance Current Force capabilities. The projects goal is to mature and demonstrate robust approaches to finding surface-laid and buried threats in temporally and spatially varying vegetation, soil, weather, and diurnal conditions. This effort focuses on enabling assured mobility for the Future Force. Specific activities include remote detection of minefields by aerial sensor systems, detection of individual threats by handheld and vehicle-based sensor systems, and neutralization of individual booby traps, landmines, and minefields. The threats being addressed include conventional, command detonated, and metallic and low/non-metallic anti-tank and anti-personnel threats. This project evaluates the effectiveness of wide-area multi-sensor fusion detection systems, coupled with slower small-area confirmation sensors, to yield a high probability of detection (Pd) at very low false alarm rates (FAR). This project evaluates airborne multispectral threat detection sensors and matures them for lightweight plug-and-play use on unmanned aerial vehicles (UAVs) in mission specific applications. Efforts are supported by modeling and simulation assessments to define potential system effectiveness. Efforts in standoff mine detection provide mine detection capabilities for faster rate of advance (ROA) in high threat areas, using teamed sensors on both ground vehicles (at greater distances from the threat), and UAVs. Autonomous mine detection sensor efforts provide the ability to detect anti-personnel mines at faster rates of advance (ROA), by integrating mine detection sensors onto robotic platforms which precedes the Soldier thereby keeping the Soldier away from danger. Ground penetrating radar research efforts provide faster ROA for on-route and off-route mine detection capability with high probability of detection (Pd) and low false alarm rate (FAR). Airborne threat detection efforts demonstrate automated processes and algorithms that improve upon the current change detection process used to detects landmines and booby traps. The Standoff Detection and Neutralization for Convoy Escort and Route Clearance effort demonstrates vehicle mounted technologies for in-stride detection and neutralization of roadside and in-road threats. The Mine Detection Payload for UAVs effort demonstrates an airborne sensor payload and a threat detection algorithm suite.

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 Command/Communications-Electronics Research, Development, and Engineering Center/Night Vision and Electronic Sensors Directorate (NVESD), Ft. Belvoir, VA.

<u>Accomplishments/Planned Program:</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Standoff Mine Detection System: In FY06, completed integration and fusion of forward looking sensors on a single platform; demonstrated and analyzed system effectiveness of integrated ground vehicle sensor package and Aided Target Recognition (AiTR). In FY07, demonstrate and integrated forward looking sensor suite coupled with a ground penetrating radar then evaluate performance of vehicle mounted forward looking cueing sensors in relevant environment.	4801	4943		
Autonomous Mine Detection Sensors (AMDS): In FY06, refined ground penetrating radar (for detection of anti-personnel mines) design based on initial studies and increased performance of Automated Target Recognition (ATR) algorithms in off-road conditions; conducted blind test with improved sensor and ATR algorithms. In FY07, complete final prototype sensor build and ATR/signal processing implementation on surrogate platform; conduct field tests in relevant environments. Prepare for transition to PM-CCS.	4766	2806		

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT	
3 - Advanced technology development	0603606A - Landmine Warfare and Barrier Advanced Technology		608	
Ground Penetrating Radar (GPR) Countermine On The Move: In FY06, refined GPR hardware and Automated Target Recognition (ATR); continued on and off route mobility demonstrations and evaluation. In FY07, complete ATR development and GPR integration onto a UGV; conduct a series of on and off route demonstrations in a variety of operational scenarios and under representative environmental conditions; complete mobility evaluation. Transition to PM-CCS.	4246	4808		
Standoff Threat Detection and Neutralization for Convoy Escort and Route Clearance: In FY08, will mature vehicle mounted technologies and prototypes that provide standoff detection and neutralization of roadside and in-road threats to enable uninterrupted mobility and increase survivability for both convoy escort and route clearance mission. Detection sensors and sensor combinations may include conventional and non-linear radar, electromagnetic induction, and passive magnetometry, electro-optics, lasers, and chemical detection sensors. Neutralization techniques include directed energy and conventional ballistic approaches. In FY09, will continue development of detection and neutralization components; will conduct a series of component testing and select the most promising technologies/components for convoy escort and route clearance prototypes; will mature and demonstrate sensor fusion algorithms to reduce false alarm rates in high clutter/urban environments; will investigate directed energy and conventional ballistic approaches tailored to the full spectrum of the threats.			15247	19397
Airborne Mine Detection: In FY06, continued algorithm and automation (software that compares consecutive frames of imagery in order to detect changes) developments; integrated cueing algorithms into the Change Detection Work Station (CDWS); integrated sensors (IR and visible) for an improved threat detection capability; conducted flight test and data analysis. In FY07, upgrade data collection assets to reduce the processing burden and automate, via software, the change detection activities between consecutive frames from the high altitude payload; complete cueing algorithm development and sensor integration; conduct system flight demonstrations in military like environment and assess performance of the system.	5470	5324		
Mine and Minefield Detection Payload for Tactical Unmanned Aerial Vehicle (TUAV): In FY07, conduct trade studies and modeling of sensor candidates to meet size, weight, and power constraints of a medium altitude TUAV airborne payload; initiate sensor and algorithm development tailored to sensor selection and mission. In FY08, will complete sensor development and integration, perform flight testing/data collections on manned aircraft and mature algorithms through sensor data collections and analysis. In FY09, will finalize algorithm development and demonstrate system performance to achieve exit criteria in temperate and arid environments.		3484	7113	8179
Small Business Innovative Research/Small Business Technology Transfer Programs		450		
Total	19283	21815	22360	27576

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2007

BUDGET ACTIVITY 3 - Advanced technology development	PE NUMBER AND TITLE 0603606A - Landmine Warfare and Barrier Advanced Technology						PROJECT 683	
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
683 Area Denial Sensors	2648	3458	2955	3359	4961	5060	5177	5285

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 include distributed personnel surveillance systems (autonomous seismic, acoustic, and day/night imaging sensor systems), and 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 uses simulation to evaluate new concepts and modify doctrine. This project also constructs components, as well as, system architectures and conducts evaluations 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 and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

<u>Accomplishments/Planned Program:</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Area Denial Sensors: In FY06, completed standoff detection study, completed testbed and demonstrated initial personnel detection and discrimination capability. In FY07, mature ground sensor discrimination algorithms; demonstrate an unattended ground sensor working with an intelligent mine system concept of operations for discriminating combatant from noncombatant. In FY08, will continue maturation of discrimination algorithms; will incorporate advanced personnel detection sensors into testbed UGS; will demonstrate modeling and simulation of sensor and operator interface. In FY09, will demonstrate detection and combatant/noncombatant discrimination with testbed unattended ground sensor (UGS); will begin development of next generation sensor and discrimination system.	2648	3361	2955	3359
Small Business Innovative Research/Small Business Technology Transfer Programs		97		
Total	2648	3458	2955	3359