

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

BUDGET ACTIVITY		PE NUMBER AND TITLE						
2 - Applied Research		0602712A - Countermines Systems						
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	26698	27135	21795	21922	22160	22333	22824	23327
H24 COUNTERMINE TECH	15262	19087	18979	19055	19263	19414	19841	20278
H35 CAMOUFLAGE & COUNTER-RECON TECH	2523	2757	2816	2867	2897	2919	2983	3049
HB2 COUNTERMINE COMPONENT TECHNOLOGY (CA)	8913	5291						

A. Mission Description and Budget Item Justification: This program element (PE) studies and develops applied technologies to improve countermines, signature management, and counter-sensors capabilities for the Future Force and where feasible, exploits opportunities to enhance the Current Force. Project H24 focuses on concepts and technologies with potential to improve detection and neutralization of mines and other threats both conventionally and electronically triggered from a safe distance using ground and air platforms. The goal of this project is to increase mine detection search rates, reduce false alarm rates, and achieve precision neutralization capabilities in support of sustaining the high operational tempo needed in Future Force operations. Working in conjunction with the US Army Engineering, Research and Development Center (ERDC), this project examines countermines phenomenology of surface and buried mines and booby traps. In addition, this project matures wide area airborne countermines sensor concepts for higher altitude, wider area coverage, higher probability of detection, and lower false alarm rate for airborne minefield detection operations. Project H35 examines signature management techniques for tactical operation centers and counter sensor techniques to reduce the reconnaissance capabilities of our adversaries as well as techniques to harden our own sensors against laser exploitation and damage. Project HB2 funds congressional special interest items. This PE supports DoD's Center of Excellence for Unexploded Ordnance which coordinates and standardizes land mine signature models; maintains a catalogue of mine signatures; and supports the evaluation of mine detection sensors and algorithms.

Work in this PE is related to and is fully coordinated with PE 0602709A (Night Vision and Electro-Optics Technology), PE 0603606A (Countermines and Barrier Development), PE 0603710A (Night Vision Advanced Technology), ERDC, and the US Marine Corps. This PE contains no duplication of effort within the Army, other Services, or the Department of Defense. 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). Work in this PE will be 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; the Army Corps of Engineer, R&D Center, Vicksburg, MI; and the Armaments Research, Development, and Engineering Center, Picatinny, NJ.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE			
2 - Applied Research	0602712A - Countermine Systems			

<u>B. Program Change Summary</u>	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)	29171	22088	21965	21961
Current BES/President's Budget (FY 2008/2009)	26698	27135	21795	21922
Total Adjustments	-2473	5047	-170	-39
Congressional Program Reductions		-104		
Congressional Rescissions				
Congressional Increases		5350		
Reprogrammings	-2473	-199		
SBIR/STTR Transfer				
Adjustments to Budget Years			-170	-39

Three FY07 congressional adds totaling \$5128 (after adjustment for Congressional Undistributed Reductions) were added to this PE.

- (\$959) Small SAR Buried Mine Detection
- (\$3115) Biological Detection of UXO and Land Mines
- (\$1054) Mapping and Detection of Unexploded Ordnance

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2007

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602712A - Countermines Systems						PROJECT H24		
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	
H24 COUNTERMINE TECH	15262	19087	18979	19055	19263	19414	19841	20278	

A. Mission Description and Budget Item Justification: This project examines new countermines technologies that use man-portable, ground-vehicular, and airborne platforms for detection, discrimination, and neutralization of individual mines, minefields, and other threats. These technologies support the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. The goal of this project is to detect threats with a high probability, reduce false alarms, and increase operational tempo. This goal is achieved by performing data collection and evaluation of detection technologies to assess the effectiveness of various sensor combinations and signal processing/fusion algorithms. This project supports the Center of Excellence for Unexploded Ordnance, established to coordinate and standardize land mine signature modeling; maintain a catalogue of mine signatures; support the evaluation of mine detection sensors and algorithms; and support the work effort on the countermines environment with the Corps of Engineers. The Countermines Neutralization effort increases the potential for sustained rapid movement of tactical forces using stand-off neutralization technologies such as explosively formed projectiles (EFP), high power pulsed electro-optics for high order neutralization, or low order deflagration, high power focused microwaves, and other emerging technologies. Area Airborne Minefield Detection efforts characterize promising airborne sensor technologies, tested in a variety of environmental conditions, to support wide area minefield detection, and phenomenology studies provide the ability to predict and improve the performance of airborne and vehicular countermines systems across all operational environments using models that predict countermines sensor performance and Automatic Target Recognition (ATR) performance. Explosive Detection efforts provide short range standoff capabilities to detect explosives using chemical sensing methods in urban environments and route clearance scenarios.

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). Work in this PE is performed by the Army Research, Development, and Engineering Command/Communications-Electronics Research, Development, and Engineering Center (CERDEC)/Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, VA; the Corps of Engineers RD&E Center, Vicksburg, MI; the Armaments Research, Development, and Engineering Center, Picatinny, NJ; and the CERDEC Intelligence and Information Warfare Directorate, Fort Monmouth, NJ.

<u>Accomplishments/Planned Program:</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Center of Excellence for Unexploded Ordnance (UXO): In FY06, prepared report on "real-time" explosive specific detection technologies with recommendations on technologies for varying environments; coordinated requirements, integrated programs from different mission areas, and leveraged the capabilities in other government agencies, industry, academia, and the international community. In FY07, continue to establish standards for testing, modeling, and evaluating Counter UXO technologies and ensure that requirements are current and accurate, ensure that opportunities for leveraging technologies are identified and exercised, ensure that duplicative programs are identified and eliminated, and information on programs and progress is shared. In FY08, will coordinate programs across the joint services on the models being developed by respective DOD elements. In FY09, will review and evaluate standards for testing and modeling of UXO technologies.	500	478	500	500
Wide Area Airborne Minefield Detection: In FY06, modified and evaluated the brassboard sensor design against multiple backgrounds; performed additional data collections with modified sensors; continued refining mini clutter detection algorithms and modules. In FY07,	5670	7414		

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2007

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602712A - Countermine Systems

PROJECT
H24

research and complete brassboard sensor design and software development for a prototype UAV payload sensor; assess technical performance against an operational environment; develop sensor design/specifications, automatic target recognition (ATR) algorithms and performance models for subsequent system prototyping.				
Countermine Neutralization: In FY06, assembled cross-country acoustic-based mine confirmation and localization sensor data collection system(s); investigated landmine confirmation and localization signal processing and associated target recognition algorithms; conducted joint field data collections with precision mine neutralization breadboard systems and confirmation and localization sensor data collection systems. In FY07, integrate multiple standoff mine localization and neutralization technologies onto a platform; conduct field experiments against mines and other threats in realistic on- and off-route environments; and assess the effectiveness of the combined detection and neutralization technologies; evaluate high powered microwave technologies developed by the Army Research Laboratory as a neutralization candidate.	3837	4281		
Countermine Phenomenology Studies: In FY06, conducted site characterization and threat sensing field experiments to determine predictive capabilities of improved geo-environmental models; assembled signature database of mines and other targets of interest in desert and temperate backgrounds; integrated soil thermal/moisture models with vegetation and targeted models to create synthetic images to improve and accelerate automatic target recognition algorithm development; initiated computational test bed validation and developed operational parameter guidance on selected sensor modalities. In FY07, complete computational test bed validation for EO/IR sensor modality; develop an electromagnetic sensor modality simulation capability in the computational test bed.	3930	4528		
Sensors for Explosive Detection: In FY06, investigated field portable explosive detection sensor technology for data collection; focused on spectroscopic sensor development as well as signature studies of roadside and vehicle borne explosives. In FY07, conduct lab and field experiments of new Soldier-portable or vehicular mounted chemical detectors and evaluate performance. In FY08, will evaluate emerging technologies and compare results to sensor metrics (sensor sensitivity objectives, speed, explosive compound selectivity); will investigate and evaluate promising technologies e.g. (Ion Mobility, Laser Induced Breakdown Spectroscopy, and standoff explosive sensors operating in the terahertz spectrum region) for explosives and weapon cache detection.	1325	1934	2003	
Logistically Efficient Standoff Threat Neutralization: In FY08, will identify, conduct experiments, and evaluate technologies for the detection of surface, obscured, and buried threats. In FY09, will improve standoff capability for threat neutralization by investigating advanced directed energy techniques (burst lasers, focused high powered microwaves, plasma channel high voltage) and/or explosively formed munitions to achieve increased accuracy with reduced collateral damage and logistics burden.			6624	6175
Anti-personnel/Anti-Tank Mine False Alarm Reduction: In FY08, will investigate new sensor and signal processing component technology, such as low-cost, compact radar sensor, electro-optic sensors, and standoff acoustic technologies for ground based and airborne systems that will provide the warfighter inexpensive solutions to the standoff detection of the full spectrum of threats (artillery shells, explosively formed penetrators, underbody attacks, command detonated mines, traditional landmines) while on the move. In FY09, will investigate, integrate, and evaluate new low cost sensor products and phenomenologies including multispectral electro-optical sensors/detectors, scalar and vector magnetometers and ground penetrating radars for reducing false alarm rates and improving rate of advance.			7807	7151
Standoff Explosive Detection Systems: In FY09, will conduct studies in the areas of chemical, nuclear, and biosensors applied to the explosive detection problems; will investigate standoff chemical capabilities to selectively detect multiple explosives (RDX, TNT, C4, etc.) in both vehicle borne and stationary environments; will investigate non contact sensing techniques to extend standoff range to 30 meters (goal).				3200

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT		
2 - Applied Research	0602712A - Countermining Systems	H24		
Phenomenology Sensors: In FY08, will extend the electro-optic/infrared (EO/IR) models in the countermining computational test bed to cover full minefield sized images and selected urban areas; will complete large scale validation for the EO/IR models; will validate synthetic aperture radar electromagnetic model for small scale imagery. In FY09, will extend synthetic aperture radar (SAR) and the electromagnetic models to full minefield size images; will validate large scale model that includes ground penetrating radar (GPR), SAR, and EO/IR for countermining system performance predictions in a variety of real world environments.			2045	2029
Small Business Innovative Research/Small Business Technology Transfer Programs			452	
Total		15262	19087	18979 19055

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2007

BUDGET ACTIVITY 2 - Applied Research		PE NUMBER AND TITLE 0602712A - Countermine Systems					PROJECT H35		
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	
H35 CAMOUFLAGE & COUNTER-RECON TECH	2523	2757	2816	2867	2897	2919	2983	3049	

A. Mission Description and Budget Item Justification: This project designs, researches, and investigates advanced signature management and deception technologies for masking friendly force capabilities and intentions. These technologies support the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. Counter reconnaissance technology efforts will investigate advanced materials and processes for countering visual, infrared (IR), and spectral sensors; optical and electronic techniques for reducing the signatures of uncooled IR sensors used in the Future Force; modeling and simulation of the vulnerability of sensors to laser blinding; and new technologies to exploit or deny the enemy's use of reconnaissance sensors against friendly forces. Efforts for the protection for third generation sensors investigate new technologies to reduce the susceptibility of third generation dual band forward looking infrared (FLIR) to detection via optical augmentation. Technologies researched under this effort will include measures to reduce the optical cross section of the third generation dual band FLIR both intrinsically within the detector/dewar and externally in the sensor system and research appropriate threat sensing algorithms. Technologies to be investigated include the decentered field lens, wavefront coding, spectral filtering, and threat sensing algorithms.

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). Work in this program element 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.

<u>Accomplishments/Planned Program:</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Low Cost Counter Reconnaissance Technology: In FY06, integrated new focal plane arrays and optics into a prototype uncooled infrared sensor and fabricated advanced paints and patterns incorporating spectral signature reduction, performed field experiments to validate optical augmentation and spectral signature reductions.	2523			
Protection for Third Generation Sensors: In FY07, investigate available dual band FPA/dewar technologies for signature reduction and integrate into sensors to conduct experiments. In FY08, will conduct experiments to select dual band sensor technologies for threat sensing algorithm research. In FY09, will select algorithm based upon prior analysis and measure performance; will downselect technologies for investigation and fabrication of reduced signature breadboard.		2211	2316	2367
Camouflage: In FY07, collect ground-to-ground hyperspectral background data, including thermal and thermal spectra of coatings already in the Spectral Camouflage Optimization of Patterns (SCOOP) database; survey existing 3-D models (e.g. Paint Map Optimizer and MUSES) for compatibility with SCOOP. In FY08, will select 3-D target geometry model and generate or adapt first 3-D computer model for use in SCOOP optimizations; will make appropriate modifications to SCOOP to permit use of 3-D target geometry; will continue database development for backgrounds and coatings; will evaluate means of utilizing satellite spectral data in lieu of ground-to-ground data. In FY09, will generate 3-D camouflage patterns, including visible and near infrared/shortwave infrared/mid wave infrared/longwave infrared for at least one target; will test in a virtual environment; will continue database development for backgrounds and coatings.		481	500	500

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2007

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602712A - Countermine Systems			PROJECT H35
Small Business Innovative Research/Small Business Technology Transfer Programs		65		
Total	2523	2757	2816	2867

--	--	--	--	--