

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY		PE NUMBER AND TITLE					
<b>2 - Applied Research</b>		<b>0602712A - Countermine Systems</b>					
COST (In Thousands)	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	26332	30294	21815	22050	22223	22719	23232
H24 COUNTERMINE TECH	18467	18854	18962	19168	19319	19750	20195
H35 CAMOUFLAGE & COUNTER-RECON TECH	2684	2797	2853	2882	2904	2969	3037
HB2 COUNTERMINE COMPONENT TECHNOLOGY (CA)	5181	8643					

**A. Mission Description and Budget Item Justification:** This program element (PE) designs and develops applied technologies to improve countermine, 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 also examines countermine phenomenology of surface and buried mines and booby traps. In addition, this project matures wide area airborne countermine 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 (camouflage) 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 0602120A, (Sensors and Electronic Survivability), PE 0602624A, (Weapons and Munitions Technology), PE 0602709A, (Night Vision Technology), PE 0602784A (Military Engineering Technology), PE 0603606A, (Landmine Warfare and Barrier Advanced Technology), PE 0603710A (Night Vision Advanced Technology), and the US Marine Corps. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.

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, MS; and the Armaments Research, Development, and Engineering Center, Picatinny, NJ.

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<b>2 - Applied Research</b>	<b>0602712A - Countermine Systems</b>		
<b><u>B. Program Change Summary</u></b>	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	27135	21795	21922
Current BES/President's Budget (FY 2009)	26332	30294	21815
Total Adjustments	-803	8499	-107
Congressional Program Reductions		-201	
Congressional Rescissions			
Congressional Increases		8700	
Reprogrammings	-137		
SBIR/STTR Transfer	-666		
Adjustments to Budget Years			-107

Two FY08 congressional adds totaling \$8700 were added to this PE.

- (\$3200) Standoff Improvised Explosive Device Protection Program
- (\$5500) Hawaii Undersea Military Munitions Assessment

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2008**

<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>		<b>PE NUMBER AND TITLE</b> <b>0602712A - Countermines Systems</b>					<b>PROJECT</b> <b>H24</b>	
COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
H24 COUNTERMINE TECH	18467	18854	18962	19168	19319	19750	20195	

**A. Mission Description and Budget Item Justification:** This project develops 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, are exploited 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. Countermines neutralization efforts increase 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 the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. 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.

<b><u>Accomplishments/Planned Program:</u></b>	<b><u>FY 2007</u></b>	<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>
Center of Excellence for Unexploded Ordnance (UXO): In FY07, continued to establish standards for testing, modeling, and evaluating Counter UXO technologies and ensured that requirements are current and accurate, ensured that opportunities for leveraging technologies were identified and exercised, ensured that duplicative programs were identified and eliminated, and information on programs and progress was shared. In FY08, 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.	478	492	497
Wide Area Airborne Minefield Detection: In FY07, researched and completed brassboard sensor design and software development for a prototype unmanned aerial system payload sensor; assessed technical performance against an operational environment; developed sensor design/specifications, automatic target recognition algorithms, and performance models for subsequent system prototyping.	7221		
Countermines Neutralization: In FY07, integrated multiple standoff mine localization and neutralization technologies onto a platform; conducted field experiments against mines and other threats in realistic on- and off-route environments; assessed the effectiveness of the combined detection and neutralization technologies; and evaluated high powered microwave technologies developed by the Army	4281		

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>2 - Applied Research</b>	<b>0602712A - Countermining Systems</b>	<b>H24</b>	
Research Laboratory as a neutralization candidate.			
Countermining Phenomenology Studies: Countermining Phenomenology Studies identifies the key geo-environmental parameters such as weather conditions, soil composition, soil moisture, soil electromagnetic properties, ground cover, etc. that affect mine/minefield detection and false alarm rates for various sensor modes. The improved understanding of the geo-environmental effects transitioned to countermining sensor and aided target recognition (AiTR) developers and modelers to support improved clutter rejection. In FY07, completed computational test bed validation for electro-optic/infrared sensor modality; developed an electromagnetic sensor modality simulation capability in the computational test bed.	4528		
Sensors for Explosive Detection: In FY07, conducted lab and field experiments of new Soldier-portable or vehicular mounted chemical detectors and evaluated performance. In FY08, evaluate emerging technologies and compare results to sensor metrics (sensor sensitivity objectives, speed, explosive compound selectivity); 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.	1959	1985	
Standoff Mine/Threat Neutralization Technology: In FY08, assess and test the effects of high power long pulse drilling laser on mine and other threats; measure and develop the power, energy, and laser requirements for the drilling laser to determine its feasibility and practicality for use in neutralizing threats in varying surface, overburden, and buried conditions; design and begin enhancements to precision munitions that can be used for threat neutralization in existing and new developed weapon systems. In FY09, will improve standoff capability for threat neutralization by developing and demonstrating 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.		6741	6175
Anti-personnel/Anti-Tank Mine False Alarm Reduction: In FY08, investigate new sensor and signal processing component technology, such as low-cost, compact radar sensors, electro-optic sensors, and standoff acoustic technologies for ground based and airborne systems that provide the Warfighter inexpensive solutions for 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.		7153	7091
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).			3170
Phenomenology Sensors: In FY08, extend the electro-optic/infrared (EO/IR) models in the countermining computational test bed to cover full minefield-sized images and selected urban areas; complete large scale validation for the EO/IR models; 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		438	
<b>Total</b>	<b>18467</b>	<b>18854</b>	<b>18962</b>

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<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>		<b>PE NUMBER AND TITLE</b> <b>0602712A - Countermine Systems</b>					<b>PROJECT</b> <b>H35</b>	
COST (In Thousands)		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		2684	2797	2853	2882	2904	2969	3037

**A. Mission Description and Budget Item Justification:** This project designs and develops 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. 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 pursued under this effort 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. Technologies investigated include the decentered field lens, wavefront coding, spectral filtering, and threat sensing algorithms.

The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this program element 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.

<b><u>Accomplishments/Planned Program:</u></b>	<b><u>FY 2007</u></b>	<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>
Protection for Third Generation Sensors: In FY07, investigated available dual band FPA/dewar technologies for signature reduction and integration into sensors to conduct experiments. In FY08, conduct experiments to select dual band sensor technologies for threat sensing algorithm assessment. In FY09, will evaluate and select algorithm based upon prior analysis and measure performance; will analyze evaluation results and downselect technologies for investigation and fabrication of reduced signature third generation FLIR breadboard.	2203	2239	2356
Camouflage: In FY07, collected ground-to-ground hyperspectral background data, including thermal and thermal spectra of coatings already in the Spectral Camouflage Optimization of Patterns (SCOOP) database; surveyed existing 3-D models (e.g. Paint Map Optimizer and Multi-Service Electro-Optics Signature (MUSES)) for compatibility with SCOOP. In FY08, select 3-D target geometry model and generate or adapt first 3-D computer model for use in SCOOP optimizations; make appropriate modifications to SCOOP to permit use of 3-D target geometry; continue database development for backgrounds and coatings; 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	493	497
Small Business Innovative Research/Small Business Technology Transfer Programs		65	
<b>Total</b>	<b>2684</b>	<b>2797</b>	<b>2853</b>