ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2005

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

COST (In Thousands)		FY 2004 Actual	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		25507	26279	19293	23037	22662	22650	22846	23013
H24	COUNTERMINE TECH	17561	17230	16674	20348	19861	19817	19988	20134
H35	CAMOUFLAGE & COUNTER-RECON TECH	2493	2530	2619	2689	2801	2833	2858	2879
HB2	COUNTERMINE COMPONENT TECHNOLOGY (CA)	5453	6519	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) studies and examines applied technologies to improve countermine, signature management and counter sensors capabilities for the Army's transformation to Future Combat Systems (FCS), the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Project H24 focuses on concepts and technologies with potential to improve detection and neutralization of mines and improvised explosive devices (IEDs) while at a safe distance using ground and air platforms. The goal of this project is to increase mine and improvised explosive device detection search rates, reduce false alarm rates, and achieve precision neutralization capabilities in support of sustaining the high operational tempo needed in FCS and in Future Force operations. Working in conjunction with the US Army Engineering, Research and Development Center (ERDC), this project examines countermine phenomenology of booby-traps, improvised explosive devices, and surface and buried mines. 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. This PE addresses emerging mine threats in both the conventional and electronically activated categories, 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. Project H35 examines signature management techniques for tactical operation centers and counter sensor techniques to reduce the reconnaissance capabilities of our adversaries. Project HB2 funds Congressional special interest items.

Work in this PE is related to and is fully coordinated with PE 0602709A (Night Vision and Electro-Optics Technology), PE 0603606A (Countermine and Barrier Development), PE 0603710A (Night Vision Advanced Technology), ERDC, and the Marine Corps. Work in this PE adheres to Tri-Service/Project Reliance Agreements on conventional air/surface weapons and ground vehicles. 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 & Electronic Sensors Directorate (NVESD), Fort Belvoir, Virginia; the Army Corps of Engineer, R&D Center, Vicksburg, Mississippi; and the Armaments Research, Development, and Engineering Center, Picatinny, New Jersey.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2005

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

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2005)	20547	20064	26768
Current Budget (FY 2006/2007 PB)	26279	19293	23037
Total Adjustments	5732	-771	-3731
Net of Program/Database Changes			
Congressional Program Reductions	-392		
Congressional Rescissions			
Congressional Increases	6800		
Reprogrammings			
SBIR/STTR Transfer	-676		
Adjustments to Budget Years		-771	-3731

Change Summary Explanation:
FY07 - Funds realigned ($3731K) to higher priority requirements.

Two FY05 Congressional Adds totaling $6800 were added to this PE.

FY05 Congressional adds with no R-2A:
($2685) Acoustic Technology for Landmine Detection, Project HB2: The purpose of this one year Congressional add is to investigate linear/non-linear acoustics for landmine and Improvised Explosive Device (IED) detection-based technologies. No additional funding is required to complete this project.

($3836) Polymer Based Landmine Detection, Project HB2: The purpose of this one year Congressional add is for investigation of an amplified fluorescence-quenching polymer (AFP) based sensor technology and its application as a mine detecting device. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2005

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602712A - Countermine Systems**	**H24**

COST (In Thousands)		FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H24	COUNTERMINE TECH	17561	17230	16674	20348	19861	19817	19988	20134

A. Mission Description and Budget Item Justification: This project examines new countermine technologies using man-portable, ground-vehicular, and airborne platforms for detection, discrimination and neutralization of individual mines, minefields, and improvised explosive devices (IEDs). These technologies support Future Combat Systems (FCS), the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. The types of mines investigated include both conventional and electronically activated categories. This goal of this project is to detect mines with high probability, reduce false alarms, and increase operational tempo by performing data collection to assess the ability of various sensor combinations and signal processing/fusion algorithms. This project sponsors 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 countermine environment with the Corps of Engineers. The Wide Area Airborne Minefield Detection effort will characterize a variety of airborne sensor technologies, tested in a variety of environmental conditions, to support wide area minefield detection. The Precision Mine Neutralization with Confirmation and Localization effort will increase the potential for sustained rapid movement of tactical forces using stand-off neutralization technologies. The FCS Mine Detection and Neutralization effort will provide forward-looking mine detection and neutralization. The Off Route Mine Detection and Neutralization effort will provide forward-looking mine and IED detection and neutralization, including side-attack detection, in an off-route environment within required rate-of-advance for Unit of Action (UA) minefield reconnaissance missions. The Countermine Phenomenology Studies effort will provide the ability to predict and improve the performance of airborne and vehicular countermine systems across all operational environments using models that predict countermine sensor performance and Automatic Target Recognition (ATR) performance. The Sensors for Explosive Detection effort will provide short range standoff capability to detect explosives (such as IEDs, mines, and car bombs) 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 & Electronic Sensors Directorate (NVESD), Fort Belvoir, Virginia; the Corps of Engineers RD&E Center, Vicksburg, Mississippi; the Armaments Research, Development, and Engineering Center, Picatinny, New Jersey; and the CERDEC Intelligence and Information Warfare Directorate, Fort Monmouth, New Jersey.

Accomplishments/Planned Program	FY 2004	FY 2005	FY 2006	FY 2007
Center of Excellence for Unexploded Ordnance. In FY04, continued coordination effort within DoD for all unexploded ordnance (UXO) efforts to prevent duplication; continued update of the UXO database, which is a part of the JUXOCO website; conducted meetings, workshops, national and international symposiums for the purposes of sharing information and discussing UXO issues; conducted the UXO/Countermine Forum in March 04, which resulted in successful integration of efforts. In FY05, prepare the annual UXO Research and Development Plan, development of the UXO RDT&E Strategic Road Map, and conduct technology assessments; UXOCOE will incorporate Counter IED as the sixth mission area. In FY06, will coordinate requirements, integrate programs from the mission areas, and leverage the capabilities in other Government agencies, industry, academia, and the international community. In FY07, will continue to establish standards for testing, modeling, and evaluating Counter UXO technologies and ensure that requirements are current and accurate, opportunities for leveraging technologies are identified and exercised, duplicative programs are identified and eliminated, and information on programs and progress is shared.	475	486	500	500
Wide Area Airborne Minefield Detection. In FY04, held IPR for sensor selection, based on tests that characterized a variety of brassboard airborne sensors in terms of signal processing and clutter rejection in wide area minefield environments; continued test and characterization of modified sensors; pacing technologies included multi-spectral Long Wave IR/Short Wave IR (LWIR/SWIR), ultra wideband ground penetrating synthetic aperture radar, high resolution synthetic aperture radar (for scatterable mines), and creation of autonomous target recognition algorithms for clutter rejection. In FY05, obtain and analyze measurements in a wider variety of environmental conditions (soil conditions, temperature, humidity, ambient lighting, etc.) and collect extensive clutter data for building, testing and refining algorithms. In FY06, will evaluate the modified brassboard sensor design on multiple backgrounds; perform additional data collections with modified sensors; continue maturing optimized mini clutter detection algorithms and modules. In FY07, will assess technical and operational performance of prototype design after analyzing flight test data; provide recommended sensor design/specification, automatic target recognition algorithms and performance models for subsequent system prototype; transition to 6.3 system's program.	4936	5080	5670	7547

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
Precision Mine Neutralization with Confirmation and Localization. In FY04, evaluated and selected neutralization technology options and performed mine neutralization study. In FY05, design and build precision neutralization breadboard components and subsystems, perform initial field experiments, and conduct analysis on collected data; begin building and testing point neutralization breadboard systems based on evaluation and assessment of prior field experiments. In FY06, will build cross-country acoustic-based mine confirmation and localization sensor data collection system(s); investigate landmine confirmation and localization signal processing and associated target recognition algorithms; with application to realistic data collected from field experiments; conduct joint field data collections with precision mine neutralization breadboard systems and confirmation and localization sensor data collection systems. In FY07, will combine multiple standoff mine confirmation, localization, and neutralization technologies onto a single, or integrated, platform; conduct field experiments against mines and IEDs in realistic on- and off-route environments; perform assessment of combined technologies.	683	3292	4637	5874
Future Combat Systems (FCS) Mine Detection and Neutralization. In FY04, conducted first blind tests of forward looking ground penetrating radar and infrared sensors; conducted field data collections for forward looking ground penetrating radar, acoustic, and infrared sensors. Conducted end-to-end testing with statistical results to compare against program exit criteria.	4837	0	0	0
Off Route Mine Detection and Neutralization. In FY04, examined a variety of forward looking detection technologies including ground penetrating radar and infrared, against improvised explosive devices (IEDs). In FY05, continue to examine and conduct evaluations of off route detection capabilities designed to provide FCS increased operational tempo and enhanced vehicle and soldier survivability.	3783	3858	0	0
Countermine Phenomenology Studies. In FY04, conducted analyses and investigations to characterize and predict the effects of the environmental, surface, and shallow subsurface conditions on sensor response and signal interpretation. In FY05, conduct an investigation of clutter encountered with various sensor modalities that will be used to predict and reduce false alarms. In FY06, will conduct site characterization and countermine sensing field experiments to determine predictive capabilities of improved geo-environmental models and assemble database of mines in background signatures. In FY07, will conduct blind countermine experiments at well characterized sites to evaluate model performance and clutter rejection improvements.	2847	3554	4447	4540
Sensors for Explosive Detection. In FY05, conduct initial studies on signatures of explosives and their behavior in various environments. In FY06, will investigate a field portable explosive detection sensor technology for data collection. In FY07, will conduct lab and field experiments of new portable sensors and evaluate performance.	0	960	1420	1887

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
Totals	17561	17230	16674	20348

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2005

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602712A - Countermine Systems**	**H35**

COST (In Thousands)		FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H35	CAMOUFLAGE & COUNTER-RECON TECH	2493	2530	2619	2689	2801	2833	2858	2879

A. Mission Description and Budget Item Justification: This project designs, develops, and investigates advanced signature management and deception technologies for masking friendly force capabilities and intentions. These technologies support Future Combat Systems (FCS), the Future Force, and where feasible, exploit opportunities to enhance Current Force capabilities. The Low Cost Counter Reconnaissance Technology effort 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 FCS/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 the Future Force. The Advanced Electronic Deception Techniques effort will investigate spectral characteristics of targets and backgrounds to determine optimum filter bands; spatial resolution requirements; spatial and spectral registration requirements; and sensor noise effects.

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/Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2004	FY 2005	FY 2006	FY 2007
Low Cost Counter Reconnaissance Technology. In FY04, constructed first version of a background database and pattern generation software to determine new low cost measures to defeat hyperspectral sensors, fabricated new reduced signature uncooled infrared (IR) focal plane arrays (FPA), and determined the laser vulnerabilities of advanced uncooled IR sensors. In FY05, integrate new FPAs and optics into a prototype uncooled IR sensor and fabricate advanced paints and patterns incorporating spectral signature reduction. In FY06, will perform field experiments to validate optical augmentation and spectral signature reductions.	2493	2530	2619	0
Advanced Electronic Deception Techniques. In FY07, will investigate spectral characteristics of targets and backgrounds to determine optimum filter bands, spatial resolution requirements, spatial and spectral registration requirements and sensor noise effects.	0	0	0	2689
Totals	2493	2530	2619	2689