ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		18408	26016	20547	20064	26768	27844	28016
H24	COUNTERMINE TECH	16033	18038	17918	17341	23997	25029	25145
H35	CAMOUFLAGE & COUNTER-RECON TECH	2375	2557	2629	2723	2771	2815	2871
HB2	COUNTERMINE COMPONENT TECHNOLOGY (CA)	0	5421	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 the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. This program focuses on concepts and technologies that improve mine detection and neutralization using standoff man-portable, ground and air platforms. The goal of this program is to increase mine and improvised explosive device detection probability, reduce false alarm rate, and research precision neutralization capabilities in support of sustaining a high operational tempo in Future Force operations. Working in conjunction with the US Army Engineering, Research and Development Center (ERDC), examine countermine phenomenology of booby-traps, improvised explosive devices, and surface and buried mines. In addition, mature 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. This PE also examines signature management techniques for tactical operation centers and counter sensor techniques to reduce the reconnaissance capabilities of our adversaries. This effort is fully coordinated with the Marine Corps. It 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. It also is fully coordinated with PE 0602709A (Night Vision and Electro-Optics Technology), PE 0603606A (Countermine and Barrier Development), PE 0603710A (Night Vision Advanced Technology)and ERDC. 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 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.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	16857	21291	21422
Current Budget (FY 2005 PB)	18408	26016	20547
Total Adjustments	1551	4725	-875
Congressional program reductions		-247	
Congressional rescissions			
Congressional increases		5600	
Reprogrammings	1551	-628	
SBIR/STTR Transfer			
Adjustments to Budget Years			-875

Significant Change Explanation:
FY04 - Four FY04 Congressional adds totaling $5600 were added to this PE.

FY04 Congressional Adds with no R-2A:
($1596) Advanced Airborne Hyperspectral Imaging System (AAHIS) Overland Countermine, Project HB2: The purpose of this one year Congressional add is to research passive and active airborne hyperspectral minefield detection sensors in the visible through long-wave infrared wavebands. No additional funding is required to complete this project.

($1034) Acoustic Technology for Landmine Detection, Project HB2: The purpose of this one year Congressional add is to investigate linear and non-linear acoustic technology for use in landmine detection. No additional funding is required to complete this project.

($1315) Polymer Based Landmine Detection, Project HB2: The purpose of this one year Congressional add is to research the development of amplified fluorescence quenching polymer (AFP) based explosive sensing technology and its application as a mine detecting device. No additional funding is required to complete this project.

($1315) Small Synthetic Aperture Radar (SAR) Buried Mine Detection, Project HB2: The purpose of this one year Congressional add is to investigate a synthetic aperture radar system with a unique switching component and interface and to test and modify the system for forward and side standoff

mine detection. No additional funding is required to complete this project.

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COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H24	COUNTERMINE TECH	16033	18038	17918	17341	23997	25029	25145

A. Mission Description and Budget Item Justification: This project supports the Future Force by examining new countermine technologies using man-portable, ground-vehicular, and airborne platforms for detection discrimination and neutralization of individual mines and minefields, and, where feasible exploits opportunities to enhance Current Force capabilities. The types of mines include both conventional and electronically activated categories. Uses data collections to assess the ability of various sensor combinations and signal processing/fusion algorithms to consistently detect mines while sustaining continued reductions in false alarms and increased operational tempo. To increase the potential for sustained rapid movement of tactical forces, emphasizes forward-looking mine detection and stand-off neutralization technologies. It will also characterize a variety of airborne sensor technologies to support wide area minefield detection. This project will investigate the phenomenology of booby-traps, improvised explosive devices, surface and buried mines, and research models for exploiting novel sensing devices. Additionally, it will examine sensors for the detection of off-route mines. The 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 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 Communications-Electronics Research, Development and Engineering Center, 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 2003	FY 2004	FY 2005
Center of Excellence for Unexploded Ordnance: In FY03, this DoD center provided continuous and global surveillance of possible detection and neutralization efforts. In FY04, identify possible Countermine Technologies for examination by the Services for technology maturation/ insertion into mission programs through coordination with and leveraging of technological capabilities of the government, industry, academic and international communities. In FY05, will continue surveillance, studies, and examination of promising technologies to improve countermine detection and neutralization efforts.	482	460	480
Wide Area Airborne Countermine Technologies: In FY03, conducted field tests and data collection at Yuma Proving Grounds and performed analysis of the data collected. In FY04, continue the testing and characterization of a variety of airborne sensor technologies and collect image data for signal processing/clutter rejection to support wide area minefield detection. Pacing technologies include 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, will obtain and analyze measurements in a wider variety of environmental conditions (soil conditions, temperature, humidity, ambient lighting, etc.) and collect extensive clutter data for algorithm development, testing and refinement.	800	4780	4750
Forward Looking Precision Mine Neutralization. In FY04, evaluate and select neutralization technology options. In FY05, will design and build precision neutralization breadboard components and subsystems, perform initial field experiments, and conduct analysis on collected data. Will begin building and testing point neutralization breadboard systems based on evaluation and assessment of prior field experiments.	0	680	2850

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
FCS Mine Detection. In FY03, built mobile forward looking Ground Penetrating Radar (GPR) data collection and acoustic sensor data collection systems. Performed data collection for GPR systems from distances of 2-15 kph(s) at relevant field sites of tactically realistic mine deployments on roads. Created an electronically accessible data repository for Automatic Target Recognition (ATR) developers. Conducted initial analysis of metal-cased AT mines at all tactically revelant deployment depths on roads. In FY04, show performance and speed improvements in forward looking GPR and acoustic sensors. Combine forward looking sensors onto a single vehicle platform and conduct data collections and phenomenological studies with the combined systems. Continue maturation of forward looking ATR algorithms with emphasis on the detection of buried plastic mines. Conduct analysis and assess improvements of individual forward looking detection sensors. Conduct end-to-end demonstration with statistical results to compare against program exit criteria.	7144	4686	0
Off Route Mine Detection and Neutralization: In FY03, this program examined and evaluated technologies to provide the warfighter new detection capabilities against the threats of off-route/side attack mines, booby traps, anti-helicopter mines, and improvised explosive devices through the exploitation of their distinctive short wave infrared and acoustic resonance signatures. In FY04, examine a variety of forward looking detection technologies including ground penetrating radar and infrared, against improvised explosive devices (IEDs). In FY05, will continue to examine and conduct evaluations of off route detection capabilities designed to provide FCS increased OPTEMPO and enhanced vehicle and soldier survivability.	2200	3740	3918
Countermine Phenomenology: In FY04, conduct analyses, tests and evaluations to characterize and predict the effects of the environmental, surface, and shallow subsurface conditions on sensor response and signal interpretation. In FY05, will conduct an investigation of clutter encountered with various sensor modalities that will be used to predict and reduce false alarms.	0	2730	3650
Precision Forward looking Confirmation and Localization. In FY04, develop a data collection system, collect acoustic confirmation sensor data and information, and evaluate the data. Examine aided target recognition concepts, investigate algorithms, and conduct breadboard design and environmental component tests. In FY05, will perform data collection and evaluation, continue algorithm development and maturation, and fabricate breadboard for field evaluation/testing and environmental studies.	0	480	2270

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Countermine (CM) Task Force (TF). Established in FY03 to conduct a review of existing CM S&T programs and to determine which mine detection and neutralization technologies offered the greatest potential to satisfy detection and neutralization needs for the Future Force. In FY03, resourced an Independent Review Team (IRT) to evaluate the current posture of CM S&T and future investments in science and technology which showed greatest promise to satisfy mine detection and neutralization requirements for FCS.	916	0	0
Polymer-based Landmine Detection: This one-year Congressional add examined chemical based explosive detection techniques and conducted modeling and data collections that facilitated a better understanding of the phenomenology associated with these two applications. No additional funding was required to complete this project.	1338	0	0
Acoustic Mine Detection: This one-year Congressional add examined and evaluated phenomenology of linear/non-linear acoustics combined with ground penetrating radar for mine detection in downward and forward looking modes of anti-tank (AT) mines in roads. No additional funding was required to complete this project.	3153	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	482	0
Totals	16033	18038	17918

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2 - Applied Research	**0602712A - Countermine Systems**	**H35**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H35	CAMOUFLAGE & COUNTER-RECON TECH	2375	2557	2629	2723	2771	2815	2871

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, thereby increasing Future Force unit survivability, and, where feasible, exploits opportunities to enhance Current Force capabilities. Specific research areas include: (1) advanced materials and processes for countering visual, infrared (IR), and spectral sensors; (2) optical and electronic techniques for reducing the signatures of uncooled IR sensors used in Future Combat Systems/Future Force; (3) modeling and simulation of the vulnerability of sensors to laser blinding; and (4) new technologies to exploit or deny the enemy's use of reconnaissance sensors against the Future Force. 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 Communications-Electronics Research, Development and Engineering Center, Night Vision & Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Low Cost Counter Reconnaissance Technology. In FY03, conducted field data collection to quantify near infrared/short wave infrared (SWIR) performance of existing camouflage nets and materials. Completed analysis of SWIR performance and constructed a new system performance model. In FY04, fabricate new reduced signature uncooled infrared (IR) focal plane arrays (FPA), determine the laser vulnerabilities of advanced uncooled IR sensors, and develop a background database and pattern generation software to determine new low cost measures to defeat hyperspectral sensors. In FY05, will integrate new FPAs and optics into a prototype uncooled IR sensor and fabricate advanced paints and patterns incorporating spectral signature reduction.	2375	2492	2629
Small Business Innovative Research/Small Business Technology Transfer Programs	0	65	0
Totals	2375	2557	2629