ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)

June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE
2 - APPLIED RESEARCH	**0602712A - COUNTERMINE AND BARRIER TECHNOLOGY**

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	15054	17721	16689	0	0	0	0	0	0	0
H24 COUNTERMINE TECH	13011	15333	14214	0	0	0	0	0	0	0
H35 CAMOUFLAGE TECHNOLOGY	2043	2388	2475	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification:

PLEASE NOTE: This administration has not addressed FY2003-2007 requirements. All FY 2003-2007 budget estimates included in this book are notional only and subject to change.

This Program Element (PE) researches and investigates advanced technologies to improve countermine, signature management and deception capabilities for the Army's Transformation to the Objective Force. Countermine research focuses on system concepts and technologies that improve mine detection and neutralization from standoff man-portable, ground and air platforms. The goal is to increase mine detection probability, while also reducing false alarm rate, to maintain high Operational Tempo (OPTEMPO) in the Objective Force. Emerging mine threats in both the conventional and electronically activated categories are being addressed by this PE. A Center of Excellence (COE) for Landmines has been established to coordinate and standardize land mine signature models; maintain a catalogue of mine signatures; and support the evaluation of mine detection sensors and algorithms. This PE also researches deception and robust signature management techniques that will potentially alter an adversary's perception of friendly force capabilities and intentions. This effort is completely coordinated with the Marine Corps. The work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. It also adheres to Tri-Service/Project Reliance Agreements on conventional air/surface weapons and ground vehicles. This PE contains no duplication with any other effort within the Army, 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) and PE 0603710A (Night Vision Advanced Technology). This PE is managed by the Night Vision Electronic Sensors Directorate (NVESD), Communications-Electronics Research, Development and Engineering Center (CERDEC). Contractors include: EOIR, Spotsylvania, VA; IMT, San Jose, CA; SAIC, San Diego, CA; and TRW, Fairfax, VA.

B. Program Change Summary	FY 2000	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2001 PB)	14380	12386	12639	0
Appropriated Value	14521	17886	0	
Adjustments to Appropriated Value	0	0	0	
a. Congressional General Reductions	0	0	0	
b. SBIR / STTR	-326	0	0	
c. Omnibus or Other Above Threshold Reductions	-50	0	0	
d. Below Threshold Reprogramming	1000	0	0	
e. Rescissions	-91	-165	0	
Adjustments to Budget Years Since FY2001 PB	0	0	4050	
Current Budget Submit (FY 2002/2003 PB)	15054	17721	16689	0

Change Summary Explanation: Funding - FY 2001: Congressional adds were received for Nonlinear Acoustic Mine Detection (+1000), Acoustic Mine Detection (+2500) and Landmine Warfare and Barrier Advanced Development (+2000).
- (+1000) For design, investigation, modeling and application on nonlinear acoustic techniques for phenomenology assessment of imaging surface and buried anti-tank/anti-personnel (AT/AP) landmines.
- (+2500) For investigation, modeling and application of acoustic/seismic energy for detection and discrimination of AT/AP land mines from downward and forward-looking sensor modalities.
- (+2000) For assessment of forward-looking radar and IR technologies for detection and discrimination of AT land mines at distances greater than

10 meters.

FY 2002: Additional funds (+4000) were added for investigation and assessment of sensor technologies for wide area mine detection and surveillance.

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June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - APPLIED RESEARCH	**0602712A - COUNTERMINE AND BARRIER TECHNOLOGY**	**H24**

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
H24 COUNTERMINE TECH	13011	15333	14214	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This project matures countermine technologies for standoff detection and discrimination of individual mines and minefields from manportable, ground vehicular and airborne platforms. Specific activities include close-in detection and neutralization of individual mines and minefields from handheld, ground and aerial sensor systems. Envisioned mines include both conventional and electronically activated mines. Data collections will be used to assess the ability of various sensor combinations, as well as signal processing/fusion algorithms, to consistently detect mines at reduced false alarms for increased force OPTEMPO. This project sponsors the COE established to coordinate and standardize land mine signature models; maintain a catalogue of mine signatures; and support the evaluation of mine detection sensors and algorithms. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2000 Accomplishments

- 1455
  - Designed laser illumination source with charge coupled device (CCD) camera for mine phenomenology data collections to support surface mine detection from an airborne platform.
  - Evaluated laser/CCD camera testbed and collected data which defined conditions and observable phenomena to optimize the multi-sensor approach.
- 3116
  - Evaluated and assessed advanced mine detection sensors and downselected to the most promising technologies and techniques. Collected and analyzed data to evaluate improvements in probability of detection and reduction of false alarm rates.
  - Completed design and tradeoff analyses of an acoustic laser Doppler vibrometer breadboard prototype to determine system parameters for detecting AT mines at greater standoff distances with possible application in the forward looking and close-in application areas.
  - Evaluated industry/academia concepts and technologies that may enhance force mobility and survivability by increasing the probability of detection, reducing false alarms or increasing standoff distances.
  - Established standards and techniques for evaluation of these mine detection technologies at various test sites to include Fort AP Hill, VA and Yuma Proving Ground, AZ.
  - Designed and matured processing capabilities for acoustic/laser, synthetic aperture radar (SAR)/ground penetrating radar (GPR), quadrupole resonance (QR), and novel metal detector technologies for the Advanced Mine Detection Sensors program to reduce false alarms and increase OPTEMPO.

FY 2000 Accomplishments (Continued)

- 485 - Enhanced mine signature simulations, updated database of mine signatures, and established methodology for evaluation of detection algorithms in support of landmine detection Joint Unexploded Ordinance Coordination Office (JUXOCO).
- 2910 - Evaluated forward-looking detection sensor designs (GPR and IR) through testing in Yuma Proving Ground, AZ and Fort AP Hill, VA against surface and buried AT mines with the goal of improving probability of detection and reducing false alarm rates for on route missions.

  - Evaluated forward looking detection sensor technologies with the goal of improved probability of detection and reduced false alarm rates while increasing operational speed.

  - Transitioned technologies into data collection devices for continual evaluation and assessment of sensors and algorithms.
- 1746 - Evaluated and assessed acoustic laser Doppler vibrometer (LDV) against AT and AP mines on varied environmental backgrounds. Designed, built and assessed new laser source technologies for LDV to increase area coverage and reduce scanning time. Reduced and isolated acoustic noise at LDV receiver for increased detection of mines.
- 1359 - Evaluated standoff GPR and infrared (IR) technologies in temperate environment against AT mines at standoff distances of 10-30 meters.
- 970 - Investigated non-linear acoustic technology for AT mine detection and evaluated the technology against surface AT mines in realistic environments along with modeling of acoustic phenomena.
- 970 - Evaluated advanced QR sensor for vehicular use in confirmation and/or scanning modalities. Hastened the technology transition to the ground stand-off mine detection system (GSTAMIDS) Block I spiral development program.

Total 13011

FY 2001 Planned Program

- 3605 - Investigate and evaluate algorithms and sensor fusion processing for mine data collection systems in field experiments and evaluation.

  - Conduct and evaluate field experiments using chemical sensors against realistic explosive concentrations to establish the prototype's operational envelopes as a function of target type, environment, and operational speed.

  - Test and evaluate acoustic/laser, ground penetrating - synthetic aperture radar, and advanced electromagnetic detection sensors for increased mine detection and discrimination capabilities.
- 487 - Continue to enhance mine signature simulations, update database of mine signatures, and establish methodology for evaluation of detection algorithms in support of landmine detection JUXOCO.

FY 2001 Planned Program (Continued)

- 5528 - Evaluate brassboard forward-looking sensors for the detection of surface and buried AT mines that will improve probability of detection and reduce false alarms to provide faster rates of advance and survivability for the Objective Force.

  - Evaluate initial Aided Target Recognition (ATR) and sensor fusion algorithms for forward looking detection sensors, which will improve the probability of detection and reduce false alarm rates, while increasing operational speeds.

  - Evaluate potential of acoustic time domain electromagnetic induction sensors and advanced mine detection sensors for inclusion in ongoing downward and forward looking mine detection programs as primary detection sensor.

  - Perform analysis, modeling and laboratory experiments on candidate standoff mine neutralization technologies to identify promising approaches for maturing spot (rather than area) neutralization providing enhanced survivability while reducing size, weight and logistics burdens.

- 965 - Investigate, model and apply nonlinear acoustic techniques for phenomenology assessment of imaging surface and buried anti-tank/anti-personnel land mines in this Congressional interest program.

- 2401 - Investigate, model and apply acoustic/seismic energy for detection and discrimination of anti-tank/anti-personnel landmines from downward and forward-looking sensor modalities in this Congressional interest program.

- 1920 - Assess forward looking radar and IR technologies for detection and discrimination of anti-tank landmines at distances of greater than 10 meters on routes. This land mine warfare and advanced barrier maturation is a Congressional interest effort.

- 427 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 15333

FY 2002 Planned Program

- 7400 - Investigate and evaluate electronically scanned ground penetrating - synthetic aperture radar (GP-SAR) and forward looking acoustic sensors for phenomenology assessment of mine detection data collection systems in field experiments to support the Army Transformation to the Objective Force.

  - Investigate and evaluate algorithms and sensor/data fuse the GP-SAR, infrared, and acoustic sensors for fusion processing to reduce false-alarms while increasing the probability of detection and operational tempo.

  - Conduct field experiments using forward looking mine detection data collection systems to evaluate target type, environment, and operational speed to enhance rate of advance and survivability of the Objective Force.

  - Modify, evaluate and validate modeling of forward looking mine detection sensors.

FY 2002 Planned Program (Continued)

- Investigate candidate standoff neutralization technologies for precision neutralization of surface and buried mines.

- 508 - Continue to enhance mine signature simulations, update database of mine signatures, and establish methodology for evaluation of detection algorithms in support of landmine detection JUXOCO.
- 2306 - Apply and investigate sensor technologies for trip wire detectability. Investigate nonlinear and imaging acoustics for AT and AP mine detection for ground vehicle and robotic platforms.
- 4000 - Investigate and assess sensor technologies and collect sensor data for signal processing/clutter rejection to support wide area minefield detection and surveillance.

  - Candidate sensor technologies include multispectral long wave infrared fused with short wave infrared laser polarization, hyperspectral infrared, ultra wideband ground penetrating synthetic aperature radar.

Total 14214

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2 - APPLIED RESEARCH	**0602712A - COUNTERMINE AND BARRIER TECHNOLOGY**	**H35**

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
H35 CAMOUFLAGE TECHNOLOGY	2043	2388	2475	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This project researches and investigates advanced signature management and deception technologies for masking friendly force capabilities and intentions, thereby increasing Objective Force unit survivability. This work is applicable to the Future Combat Systems (FCS) and other assets in the Objective Force. Specific research areas include: (1) advanced materials and processes for countering visual and infrared sensors; (2) simulation of key radar and communications signatures using electronic deception modules; (3) advanced modeling and simulation of proposed signature management and deception technologies; and (4) advanced materials, coatings, patterns and appliqués for suppressing electro-optical (EO) signatures of combat units. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2000 Accomplishments

• 2043 - Investigated 3-D image projection techniques, materials, and processes for visual and IR deception devices.

- Established modeling and simulation capabilities for design, maturation and evaluation of signature management and deception technologies.

- Investigated optical communication technologies to suppress combat unit radio frequency (RF) signatures.

- Investigated and formulated patterns, coatings, and materials for suppression of visual and EO signatures of combat units.

Total 2043

FY 2001 Planned Program

• 2321 - Mature 3-D image projection techniques in the laboratory that improve deception capabilities for combat units.

- Evaluate effectiveness of signature management and deception system design alternatives through modeling and simulation in laboratory experiments and force-on-force simulations.

- Evaluate effectiveness of improved signature management coatings, materials and patterns in visual and thermal bands through lab and field testing.

FY 2001 Planned Program (Continued)

- Investigate signature management materials having improved spectral performance against advanced threat multispectral sensors.
- Evaluate requirements and technologies for communications deception systems to defeat threat electronic intelligence collection assets.

• 67 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 2388

FY 2002 Planned Program

• 2475 - Incorporate improved visual, thermal and spectral coatings and materials into signature management components for field experiments.
- Assess performance of breadboard communications deception system in laboratory testing.
- Evaluate performance of signature management and deception suites for the TOC using predictive modeling and force-on-force simulations.

- Demonstrate techniques that combine physical and electronic decoys with signature management technologies to improve survivability of combat and combat support units.

Total 2475