

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602716A - HUMAN FACTORS ENGINEERING TECHNOLOGY

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	20247	23913	16899	18181	18707	18568	18856
H70 HUMAN FACT ENG SYS DEV	16913	18588	16899	18181	18707	18568	18856
J20 OMNI DIRECTIONAL TREADMILL UPGRADE	3334	5325	0	0	0	0	0

A. Mission Description and Budget Item Justification: The primary objectives of this program are to maximize the effectiveness of Soldiers in concert with their materiel so that they may survive and prevail on the battlefield in the context of the Army Transformation to the Future Force and, where feasible, exploit opportunities to enhance Current Force capabilities. Specialized laboratory studies and field evaluations are conducted to collect performance data on the capabilities and limitations of Soldiers, with particular attention on Soldier and equipment interaction. Work in this PE is related to and fully coordinated with efforts in PE 0602601 (Combat Vehicle and Automotive Advanced Technology), PE 0602786 (Warfighter Technology), PE 0603001 (Warfighter Advanced Technology), and PE 0603005 (Combat Vehicle and Automotive Technology). The program element contains no duplication with any effort within the Military Departments. 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 project is performed by the Army Research Laboratory (ARL).

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<u>B. Program Change Summary</u>	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	20516	16749	16357
Current Budget (FY 2005 PB)	20247	23913	16899
Total Adjustments	-269	7164	542
Congressional program reductions		-210	
Congressional rescissions			
Congressional increases		7950	
Reprogrammings	-269	-576	
SBIR/STTR Transfer			
Adjustments to Budget Years			542

Significant Change Explanation:

FY04 - Two FY04 Congressional adds totaling \$7950 were added to this PE.

FY04 Congressional Add with no R-2As:

(\$5167) Omni-Directional Treadmill Upgrade, Project J20: The purpose of this one year Congressional add is to research technology to upgrade the omni directional treadmill which allows Soldiers to move (crawl, walk, run) while training in a virtual environment. No additional funds are required to complete this project.

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PROJECT
H70

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H70 HUMAN FACT ENG SYS DEV	16913	18588	16899	18181	18707	18568	18856

A. Mission Description and Budget Item Justification: The goal of this program is to maximize the effectiveness of soldiers in concert with their equipment, in order to survive and prevail on the battlefield in the context of the Army Transformation to the Future Force. The barriers to achieving the goal include incomplete soldier performance data and models of the new missions, organizations, and new and complex technologies transforming the Army. Specialized laboratory studies and field evaluations are conducted to collect performance data on the capabilities and limitations of soldiers, with particular attention on soldier and equipment interaction. The resulting data are the basis for weapon systems and equipment design standards, guidelines, handbooks and soldier training and manpower requirements to improve equipment operation and maintenance. Application of advancements yields reduced workload, fewer errors, enhanced soldier protection, user acceptance, and allows the soldier to extract the maximum performance from the equipment. 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 is performed by the Army Research Laboratory (ARL).

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PROJECT
H70

Accomplishments/Planned Program

- Identify sources of stress, potential stress moderators, intervention methods, adaptive learning, and supporting information technology to reduce uncertainty and improve decision quality for leaders and teams engaged in Command and Control (C2) planning and execution. In FY03, generated Command, Control, & Communications: Technically Reliable Assessment of Concept Execution (C3TRACE) models of FCS Mounted Combat System company level personnel and information flow incorporating information from Lead System Integrator (LSI) demos and soldier-in-the-loop Fort Knox Battle Lab experiments. In FY04, mature a suite of C2 tools for Future Force commanders, leaders, and soldiers to employ during close combat in complex and urban terrain. In FY05, provide baseline C2 tools to Training and Doctrine Command (TRADOC) schools. These tools will allow for collaborative and distributed decision making with the objective of improving performance under time, combat, fatigue, and workload stressor conditions.

FY 2003	FY 2004	FY 2005
2900	1700	1638

- Enhance human performance modeling tools to optimize soldier machine interactions for Objective Force Warrior (OFW) and FCS. In FY03, created a digital library of selected individual soldier equipment to support human figure performance of FCS and OFW. This digital library will transition early FY04 to Natick Soldier Center (NSC), Tank and Automotive Research Development and Engineering Center (TARDEC), OFW Integrated Product Teams, and to FCS contractors. To evaluate soldier perceptual performance when operating in an urban environment compared dark adaptation times between green and white phosphor night vision goggles and investigated binocular depth perception cues for use in night vision goggle design. In FY04, link vehicle dynamics, biodynamics, and anthropometric modeling capabilities to extend soldier centered design tools and techniques. Apply the previously developed hearing hazard model to firing weapons in hazardous environments such as Military Operations in Urban Terrain (MOUT) enclosures and tunnels to specific hearing protection requirements. In FY05, provide user-accessible soldier-centered tools, models and expertise to combat and materiel developers so that the full range of soldier cognitive and task performance can be considered in a cost-effective manner in all phases of acquisition.

3160	2440	2651
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Accomplishments/Planned Program (continued)

	FY 2003	FY 2004	FY 2005
- Increase soldier performance while conducting operations on-the-move. Validate and recommend methods to mitigate soldier performance degradation due to motion sickness induced by noise, vibration, vehicle movement and confinement during operations-on-the-move. Identify, mature, and quantify human performance measures and methods to address future warrior performance issues. Model baseline task, workload, and human figure performances to assess soldier and system performance benefits of integrating advanced concepts into crewstations. In FY03, measured human performance in a simulated remote vehicle control task in an enclosed vehicle, in both moving and stationary conditions and examined aftereffects (i.e. motion sickness, eye fatigue, coordination) on performance. Investigated the availability and utility of generic Head-Related Transfer functions and surveyed commercially available three dimensional (3-D) systems and head trackers for potential use in Crew Integration and Automation Testbed environment. In FY04, evaluate new head-mounted displays (HMD), cognitive decision aids and driving aids concepts. Identify helmet and HMD clearance problems in vehicle's turret. Investigate the interaction of physical and cognitive loading and its impact on soldier shooting performance. In FY05, perform studies on discrete mitigation strategies to improve soldier performance in dynamic environments.	3284	3109	3941
- Investigate and determine interface design solutions for Unit of Action (UoA) Maneuver Team information systems that enhance situational understanding and decision cycle performance. In FY03, identified critical information required by UoA dismounted soldiers in three scenarios and for Mounted Combat System (MCS) and Reconnaissance Surveillance Target Acquisition (RSTA) vehicles in two scenarios. Initiated development of decision cycle performance models. In FY04, complete platform models of additional vehicle variants, conduct iterative live fight-ability experiments of interface solutions at minimum fight-ability levels, and identify initial information interface solution concepts. In FY05, refine metric development of decision cycle time and effectiveness, conduct experiments for model validation for integration into force-on-force models, provide interface design solutions to OFW, and conduct decision cycle time model validation studies.	3200	3050	2400

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Accomplishments/Planned Program (continued)

	FY 2003	FY 2004	FY 2005
- Provide on-site human factors engineering (HFE) and MANPRINT to the Army community to optimize soldier performance and soldier-machine interactions. In FY03, in support of Army Materiel Command (AMC) Logistical Support Element in Southwest Asia, investigated theater distribution of water and materiel, researched and supported improved maintenance initiatives fro Army Depots, Army Reserve and National Guard, and collected empirical maintenance and personnel information to support the development of the Improved Performance Research Integration Tool (IMPRINT) maintenance model. Provided unique materiel design solutions to provide a laser-based "direct lay" night operations fire control system for 60mm Mortar Sections. In FY04 and FY05, continue to provide Human Factors Engineering (HFE) and MANPRINT support to AMC, Army Research Development and Engineering Centers (RDECs), Army Test and Evaluation Command (ATEC), Joint Forces Command, and other service laboratories. Support Commanders with Science and Technology expertise, identify problems or opportunities to apply new technologies, and assist with field evaluations and demonstrations.	2320	2301	2360
- Improve human-robotic interaction in a full mission context. In FY04, determine common operational definitions of soldier-robot interaction in concert with tri-service, university and industry programs to advance a common understanding of issues and metrics. Conduct task and workflow analysis. Identify initial requirements for Operator Control Unit (OCU) for mounted and dismounted applications and transition results to TARDEC. In FY05, model cognitive workload and performance in multi-task conditions, and examine span of control, levels of autonomy, shared situation awareness, trust, and collaborative modalities. Determine requirements for mixed asset control and workload management for mounted and dismounted missions and transition results to TARDEC.	0	3766	3909
- MANPRINT Modeling: This congressional add focused on developing human performance modeling tools and associated databases for the Objective Force Warrior and FCS. No additional funding is required to complete this project.	2049	0	0
- Human System Interaction Modeling: The purpose of this one year congressional add is to augment human performance modeling tools to represent system level human performance tradeoffs at the system of systems level for Command, Control, and Communications (C3), level of automation, interface modality, and workload. No additional funding is required to complete this project.	0	2112	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	110	0
Totals	16913	18588	16899