

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)						February 2006	
BUDGET ACTIVITY 2 - Applied Research			PE NUMBER AND TITLE 0602716A - HUMAN FACTORS ENGINEERING TECHNOLOGY				
COST (In Thousands)	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	20746	28420	18858	18312	18450	18614	18956
H70 HUMAN FACT ENG SYS DEV	16721	17232	18858	18312	18450	18614	18956
J21 HUMAN FACTORS APPLIED RESEARCH CA	4025	11188	0	0	0	0	0
<p>A. Mission Description and Budget Item Justification: This program investigates and evaluates aspects of human factors engineering that may limit or improve capabilities of individuals and teams of Soldiers operating in complex, dynamic environments to enable maximizing the effectiveness of Soldiers and their equipment for mission success. Key research areas include sensing, perceptual and cognitive processes, ergonomics, and biomechanics, and the tools and methodologies required to manage interaction within these areas and within the Soldiers' combat environment. Research is focused on decision-making; human robotic interaction; crew station design; improving soldier performance under stressful conditions such as time pressure, information overload, information uncertainty, fatigue, on-the-move, and geographic dispersion; and enhancing human performance modeling tools. Specialized laboratory studies and field evaluations are conducted to collect performance data on the capabilities and limitations of Soldiers, with particular emphasis on Soldier and equipment interaction. Application of advancements and tools yields reduced workload, fewer errors, enhanced soldier protection, user acceptance, and allows the soldier to extract the maximum performance from the equipment. Work in this Program Element (PE) is related to, and fully coordinated with, efforts in PE 0602601A (Combat Vehicle and Automotive Advanced Technology), PE 0602786A (Warfighter Technology), PE 0602120A (Sensors and Electronic Survivability), PE 0602784A (Military Engineering Technology), PE 0602783A (Computer and Software Technology), PE 0602308A (Advanced Concepts and Simulation), PE 0603005A (Combat Vehicle and Automotive Technology), PE 0603710A (Night Vision Advanced Technology), PE 0603015A (Next Generation Training and Simulation) and PE 0603007A (Manpower, Personnel and Training Advanced Technology).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).</p>							

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BUDGET ACTIVITY
2 - Applied Research

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<u>B. Program Change Summary</u>	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	20656	17482	18160
Current BES/President's Budget (FY 2007)	20746	28420	18858
Total Adjustments	90	10938	698
Congressional Program Reductions		-125	
Congressional Rescissions		-287	
Congressional Increases		11350	
Reprogrammings	90		
SBIR/STTR Transfer			
Adjustments to Budget Years			698

Three FY06 Congressional adds totaling \$11350 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):	
(\$3500) 3rd Generation Omni-Directional Treadmill LITE	

(\$3850) MANPRINT
(\$4000) Team Performance and Optimization in Agent and Human Agent Teams

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BUDGET ACTIVITY 2 - Applied Research			PE NUMBER AND TITLE 0602716A - HUMAN FACTORS ENGINEERING TECHNOLOGY			PROJECT H70	
COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H70 HUMAN FACT ENG SYS DEV	16721	17232	18858	18312	18450	18614	18956
<p>A. Mission Description and Budget Item Justification: The goal of this project is to maximize the effectiveness of Soldiers in concert with their equipment, in order to survive and prevail on the Future Force battlefield. Major efforts in this project include research to 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; enhancement of human performance modeling tools to optimize Soldier machine interactions for Future Force Warrior (FFW) and Future Combat Systems (FCS) and the collection of empirical data on human perception (vision and hearing) to support the development and validation of human and system performance models; investigations on the effects on Soldier performance from integration of advanced concepts in crew stations designs; the identification, assessment, and mitigation of the effects of vehicle motion on Soldier performance; investigations to determine interface design solutions for Unit of Action (UA) Maneuver Team information systems that enhance situational understanding and decision cycle performance; identification and quantification of human performance measures and methods to address future warrior performance issues; and improvement of human robotic interaction (HRI) in a full mission context. 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. Work in this project is conducted in cooperation with Tank and Automotive Research, Development and Engineering Center (TARDEC); Natick Soldier Center (NSC); Communications -Electronics Research, Development and Engineering Center (CERDEC); Simulation and Training Technology Center (STTC); Engineer Research and Development Center (ERDC); Army Research Institute (ARI); and Army Materiel Systems Analysis Activity (AMSAA). 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).</p>							
<u>Accomplishments/Planned Program</u>				<u>FY 2005</u>	<u>FY 2006</u>	<u>FY 2007</u>	
- 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 FY05, determined and transitioned critical performance requirements for prototype information displays; and determined metrics to assess the training effectiveness of interactive simulation technology. In FY06, will refine decision aids to optimize visualization and information sharing requirements in the UA; and will investigate the usability and effectiveness of interactive technology for immersive training scenarios. In FY07, will validate a suite of tools to improve C2 capabilities in uncertain and urban environments; and will conduct cognitive task analysis of multi player training modules.				3442	3700	4391	
- Enhance human performance modeling tools to optimize Soldier machine interactions for FFW and FCS. Collect empirical data on human perception (vision and hearing) to support the development and validation of human and system performance models. In FY05, linked vehicle dynamics, biodynamics, and anthropometric modeling capabilities to extend soldier centered design tools; developed architectures for modeling human performance of system of systems (SoS) through linked IMPRINT models and the Modeling				2708	2735	3062	

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Architecture for Technology and Research Experimentation (MATREX); investigated the relationship between the extent of binocular parallax and the accuracy of terrain -contour evaluation to establish the basis for guidelines for mounted and dismounted off-road mobility. In FY06, will incorporate ability to model human performance in joint operations with IMPRINT 8 (Pro); will establish parameters that improve the detection and recognition of terrain hazards for mounted and dismounted off-road mobility by using multi-regression techniques. In FY07, will identify and apply analysis metrics aimed at distinguishing performance of teams embedded within SoS and joint operations; will create and distribute a protected web-based repository of human performance models used in Manpower and Personnel Integration (MANPRINT) analyses; will model sniper targeting performance using dual band sensors and transition to Army Aeromedical Research Laboratory and special operations communities.				
- Investigate effects on Soldier performance from integration of advanced concepts in crew stations designs. Identify, assess, and mitigate the effects of vehicle motion on Soldier performance. In FY05, extended motion-based simulation validation with multimodal modeling approaches to provide an integrated approach to analysis of multiple crew station issues. In FY06, will further extend mitigation solutions to a broad cross section of ride problems and integrate with multimodal display and control approaches for a complete solution. In FY07, will consolidate crew station guidelines for designers of future vehicles to provide a basis for next generation enhancements.	2155	2248	2399	
Investigate and determine interface design solutions for UA Maneuver Team information systems that enhance situational understanding and decision cycle performance. Identify, mature, and quantify human performance measures and methods to address future warrior performance issues. In FY05, refined models using newly gathered field data; conducted further experiments for model validation for integration into force-on-force models; provided interface design solutions to FFW; conducted decision cycle time model validation studies. In FY06, will run final experiments using displays that provide information across the Soldiers' sensory modalities, and publish display design guidelines for FCS based upon the experiment and model results. In FY07, will mature physics-based models of human locomotion to research Soldier load and range of motion of future systems; and will evaluate Soldier physical and cognitive performance using prototype FFW Soldier systems.	4526	4649	5096	
- Improve human robotic interaction (HRI) in a full mission context. In FY05, modeled cognitive workload and performance in multi-task conditions at the system of system level; examined workload, levels of autonomy, shared situation awareness, and Soldier performance for scalable Operator Control Unit (OCU) concepts; determined requirements for mixed asset control and workload management for mounted and dismounted missions; and investigated Soldier-robot team performance and workload using realistic simulation environments. In FY06, will examine effects of situational uncertainty, user expectancies, task interruption, knowledge representation, and adaptive automaton on HRI using realistic simulations of FCS and FFW missions; will Investigate OCU concepts during field experimentations and transition results to the TARDEC; and will investigate HRI implications of mixed asset teaming concepts in realistic simulation or field experiments. In FY07, will address Soldier-robotics team performance using models and metrics with the goal of identifying optimal systems for particular operational contexts and understanding the implications of each; and will utilize metrics and diagnostics to determine optimal span of control and adaptive automation for mounted and dismounted Future Force missions using aerial and ground unmanned systems.	3890	3900	3910	
Total	16721	17232	18858	