

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY

PE NUMBER AND TITLE

2 - Applied Research

0602786A - LOGISTICS 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	54385	47667	25436	22078	19827	19991	20132
283	AIRDROP ADV TECH	2483	2168	2352	2348	2370	2391	2408
C60	AC60	3503	1631	3699	0	0	0	0
E01	Warfighter Technology Initiatives (CA)	34343	26270	0	0	0	0	0
H98	CLOTHING & EQUIPM TECH	9037	12785	14334	14462	12131	12230	12313
H99	JOINT SERVICE COMBAT FEEDING TECHNOLOGY	5019	4813	5051	5268	5326	5370	5411

A. Mission Description and Budget Item Justification: This applied research Program Element (PE) investigates technologies to improve soldier survivability and performance for use in the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. The PE addresses technologies for: the air delivery of personnel and cargo, combat clothing and personal equipment, and combat rations and combat feeding equipment. The Airdrop Advanced Technology Program (project 283) supports all Services' requirements for air dropping larger combat and logistics loads while improving delivery accuracy, minimizing vulnerability of aircraft, and reducing life cycle costs. Investigation of technologies for safer, more combat efficient personnel parachutes addresses a critical capability for rapid deployment force projection, particularly into hostile environments. The Clothing and Equipment Technology Program (project H98) funds cutting edge research and technologies that will enhance warfighter survivability from both combat threats (e.g., ballistics, flame, directed energy) and the field environment (e.g., cold, heat, wet); enhance signature management; provide wearable, conducting materials to augment data and power transmission; provide cooling to the Soldier to reduce risk of heat stress; and lighten the soldier's load. Human science is incorporated into modeling and analysis tools that will enable technologists and military users to trade-off potential warrior system capabilities and mature a human-centered warrior system design. The Joint Services Combat Feeding Technology Program (project H99) supports all Military Services, the Special Operations Command, and the Defense Logistics Agency with research conducted on high payoff technologies for performance enhancing combat rations, ration packaging, and combat feeding equipment/systems. Research will enhance nutrient composition and consumption to maximize cognitive and physical performance on the battlefield; minimize physical, chemical and nutritional degradation of combat rations during storage; meet the needs of individual soldiers in highly mobile battlefield situations; and provide equipment and energy technologies to reduce the logistics footprint of field feeding while improving the quality of food service. The efforts in this PE adhere to Tri-Service Reliance agreements on clothing, textiles, and operational rations and field food service equipment, the last with oversight and coordination by the Department of Defense (DoD) Combat Feeding Research & Engineering Board. Project E01 funds Congressional special interest items. Efforts are related to and fully coordinated with those in PE 0603001A (Warfighter Advanced Technology). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, and the Defense Technology Area Plan. Work in this PE is performed by the U.S. Army Natick Soldier Center, Natick, MA.

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	FY 2005	FY 2006	FY 2007
<u>B. Program Change Summary</u>			
Previous President's Budget (FY 2006)	54051	21707	24778
Current BES/President's Budget (FY 2007)	54385	47667	25436
Total Adjustments	334	25960	658
Congressional Program Reductions		-209	
Congressional Rescissions		-481	
Congressional Increases		26650	
Reprogrammings	334		
SBIR/STTR Transfer			
Adjustments to Budget Years			658

Fifteen FY06 Congressional adds totaling \$26650 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount shown):

(\$1750) Advanced Warfighter Sustainment Systems for the 21st Century (AWSS-21)

(\$1000) Army Combat Uniform Advanced Fabric Treatment Technology Demonstration

(\$2600) Biosecurity Research for Soldier Food Safety

(\$1700) Center for Geosciences Phase IV

(\$1800) Development of Long-shelf Life Fruits and Vegetables for Military Rations

(\$1000) Electro-Textile

(\$3400) GPS-Guided Parasail System

(\$500) Improved Self Sintered Silicon Carbide to Meet Body Armor Protection

(\$2800) Integrated, Unbreakable, Flexible Visible Infrared Lighting Surfaces for Shelters

(\$1000) Mosaic Flexible Armor

(\$4300) NBC Integrated Protection Membrane Shelters

(\$1000) Research on Structures and Composites in Construction for Force Protection

(\$1000) Smart Apparel for Warriors (SAW), Next Generation ACU

(\$1000) Soldier System Center 6.3

(\$1800) Ultra Lightweight Flexible Photovoltaics for the Individual Warrior

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BUDGET ACTIVITY 2 - Applied Research			PE NUMBER AND TITLE 0602786A - LOGISTICS TECHNOLOGY			PROJECT 283	
COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
283 AIRDROP ADV TECH	2483	2168	2352	2348	2370	2391	2408
A. Mission Description and Budget Item Justification: This project researches technologies to enhance cargo and personnel airdrop capabilities. These enabling technologies support the goals of the Army Transformation for global precision delivery, rapid deployment, and insertion capabilities for force projection, particularly into hostile regions. Areas of emphasis include parachute technologies, parachutist injury reduction, precision offset aerial delivery, soft landing technologies, and airdrop simulation. Efforts will result in increased personnel safety; more survivable and more accurate cargo delivery; and reduced aircraft, crew, and cargo vulnerability. The goal for personnel parachute technology is to reduce injuries and to improve performance and combat effectiveness of the Advanced Tactical Parachute System (ATPS). The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan, and the Army Modernization Plan. Work in this project is performed and managed by the US Army Natick Soldier Center, Natick, MA.							
<u>Accomplishments/Planned Program</u>					<u>FY 2005</u>	<u>FY 2006</u>	<u>FY 2007</u>
Advanced Air Cargo Delivery - In FY05, evaluated sub-scale concept models for Precision Airdrop - Medium (30,000 lb payload); identified fundamental physical and numerical instabilities inherent in modeling large canopies necessary for advanced cargo airdrop applications with up to 30,000 lb payload and incorporated new modeling techniques, to address physical and numerical instabilities, into a suite of high fidelity modeling tools available for simulating cargo airdrop applications.					2483	0	0
Advanced Sensor Technology Development - In FY06, explore technology (when no commercial solution exists) for advanced pressure, stress/strain, and shape measurement prototype devices suitable as instruments in providing the dynamic response of flexible aerodynamic decelerator systems. In FY07, apply sensor technology to realistic flowfields related to airdrop applications.					0	700	852
Modeling and Simulation for Tactical Parachute System Performance Enhancement - In FY06, develop experimental methodologies providing high level of detail of parachute physics for use with both personnel and cargo parachutes; and use High Performance Computing (HPC) modeling and simulation to investigate fully open parachutist control and rate of descent aspects of ATPS. In FY07, will utilize experimental methodologies to develop detailed knowledge of baseline parachute physics; will complete investigation of fully open parachutist control and rate of descent issues; and will investigate parachute opening phenomena.					0	1468	1500
Total					2483	2168	2352

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BUDGET ACTIVITY 2 - Applied Research			PE NUMBER AND TITLE 0602786A - LOGISTICS TECHNOLOGY			PROJECT H98	
COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H98 CLOTHING & EQUIPM TECH	9037	12785	14334	14462	12131	12230	12313
<p>A. Mission Description and Budget Item Justification: This project researches and investigates technologies to improve Soldier survivability and performance. Research focuses on lightweight materials for personal protection and survivability from both combat threats (e.g., improved ballistic, flame, and directed energy) and the field environment (e.g., cold, heat, wet); enhanced signature management; modeling and analysis tools for optimizing Soldier system clothing and equipment; and advances in emerging technology (e.g. nanotechnology, electrotexiles) to improve the performance, multi-functionality, and fightability of Soldier clothing and equipment. The goal of the ballistic protection work is to research and apply advances in materials technology to improve the protection and performance of warrior armor systems against conventional and emerging ballistic threats. The supporting biomechanical tools effort will provide a capability to identify promising candidate configurations of extremity armor to provide individual Soldiers with extremity ballistic protection affording flexibility, agility and mobility, while minimizing the energy expended during dismounted operations. The objective of the novel blast protection effort is to characterize blast profiles, determine the hazard, and demonstrate improved protection concepts. The goal of Infantry Warrior Simulation is to build essential analytic tools needed to assess the combat worth of next generation warrior systems, with a focus on network centric warfare technologies. Nanotechnology is being applied to several soldier clothing and equipment areas, and potentially could revolutionize the performance of various Soldier-worn components. The major nanotechnology effort focuses research on conducting, flexible, wearable materials for lightweight power generating and storage devices to augment power sources for Soldier-worn computers and equipment. The purpose of the microclimate cooling effort is to provide a capability that mitigates the effects of heat stress encountered by dismounted infantry exposed to hot environments and encumbered in protective clothing. The goal of the directed energy protection effort is to apply recent developments in nano-materials research to provide the dismounted soldier with eye protection against tunable-laser threats occurring on the battlefield and to provide improved ballistic fragmentation protection for the eyes, face and neck, and scratch resistance for the lenses. This project leverages work performed by the Institute for Soldier Nanotechnologies supported by Program Element (PE) 0601104A (University and Industry Research Centers) and PE0 602105A (Materials Technology). The cited work is consistent with the Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, and the Defense Technology Area Plan. Work in this project is performed by the U.S. Army Natick Soldier Center, Natick, MA.</p>							
<u>Accomplishments/Planned Program</u>					<u>FY 2005</u>	<u>FY 2006</u>	<u>FY 2007</u>
Ballistic Protection for the Individual Warrior - In FY05, enhanced fiber mechanical properties through processing/post-processing techniques and evaluated their ability to meet performance requirements; began research on material system(s) architecture incorporating advanced fibers into flexible materials and composite technology. In FY06, mature material(s) system(s) architecture for both flexible and composite technology to include resins system, adhesion modifiers, and fiber architecture. In FY07, will demonstrate technology with a 30% reduction in weight (over the level achieved in FY03) with equivalent fragmentation protection in flexible and composite configurations; and will transition composite technologies to ballistic protective garments to reduce weight and/or increase multiple-hit capability.					2930	2464	2021
Novel Blast Protection - In FY05, defined and developed initial protective material system concepts for fielded Interceptor Vest ("add-on" blast protection) and conducted preliminary evaluations on material system concept(s). In FY06, define and develop initial protective material system concepts for Future Force Warrior (FFW), continue development of test device for blast protective concepts, and refine concept for Interceptor Vest and transfer technology to PM-Clothing & Individual Equipment. In FY07, will develop an integrated					2930	2464	1723

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT		
2 - Applied Research	0602786A - LOGISTICS TECHNOLOGY	H98		
concept for blast protection for the future warrior, validate performance and transition to Program Executive Office (PEO) Soldier development program.				
Infantry Warrior Simulation (IWARS) - In FY05, explored alternative representations of intra-small unit information transfer, identified and developed optimal software approaches for integration of the Army Materiel Systems Analysis Activity's target detection, target engagement, and weapons effects algorithms for inclusion in IWARS. Released IWARS version 1.0. In FY06, complete information centric capability for intra-platoon operations and release IWARS version 2.0. In FY07, will develop initial small unit battle command module to support small unit information transfer impacts, and release the High Level Architecture compliant version 3.0 IWARS.	2059	1853	2240	
Electrotextiles: Self Powered, Conductive and Smart - In FY05, conducted research to create photovoltaic (PV) fibers and identified promising near-term conductive textile-based technologies; continued investigating technology for prototype portable PV mats and PV integrated shelters to recharge batteries used to power soldier-borne items. In FY06, develop prototype PV battery rechargers, PV shelters and new stealthy camouflage pattern photovoltaics; and develop near-term technologies for conductive fiber-based compositions, while identifying advanced materials with high payoff potential. In FY07, will transition PV prototypes to PEO Soldier, Special Operations Command, and FFW; explore power generation and electrical conductivity in unique fiber-based compositions; and investigate new power generating and electrically conductive textile-based compositions compatible with warrior systems.	1118	1479	2027	
Soldier Borne Microclimate Cooling - In FY06, investigate alternate material and design approaches for reducing the weight and power consumption of cooling technologies by focusing on the maturation of desiccant-assisted evaporative cooling technology and on new technologies for vapor compression cooling (e.g., carbon foam and micro-channel heat exchangers, optimized fan designs, soft packing, and biofeedback for power management). In FY07, will downselect material and design approaches, and begin the integration of technological elements and components into a breadboard system.	0	887	1470	
Soldier Integrated Tunable (Frequency Agile) Laser/Ballistic Eye Protection - This effort addresses the emerging threat of frequency agile lasers on the battlefield and provides increased ballistic fragmentation protection. In FY06, evaluate laser protection schemes, research optical limiting concepts that do not require an intermediate focal plane, and improve the performance of ballistic protective materials within the weight limit of the currently fielded system. Establish experimental protocols to evaluate lens abrasion due to blown sand and define baselines for subsequent experimental abrasion measurements. In FY07, will mature lighter weight ballistic materials while maintaining the improved level of performance; will identify and evaluate abrasion resistant coatings and coating application procedures; and will research optical limiting concepts that meet system design response time requirements.	0	2702	3243	
Biomechanical Tools for Individual Soldier Extremity Protection - In FY06, define Soldier performance output measures for extremity worn body armor and equipment, initiate human experiments to collect energy expenditure data and construct an initial principles-based biomechanical model for the effect of extremity loading on the defined output measures. In FY07, will complete a principles-based biomechanical model that predicts Soldier performance when encumbered with body armor, define performance thresholds for the biomechanical variables and develop empirically based fatigue model for integration with the principles-based biomechanical model.	0	936	1610	
Total	9037	12785	14334	

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COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
H99 JOINT SERVICE COMBAT FEEDING TECHNOLOGY	5019	4813	5051	5268	5326	5370	5411
<p><u>A. Mission Description and Budget Item Justification:</u> The Joint Services Combat Feeding Technology project researches and applies combat ration and field food service equipment technologies to revolutionize the manner in which we sustain and support the Armed Forces, ensuring optimal nutritional intake. This project supports the Army Transformation in the areas of sustainability and reduced logistics footprint, with goals to demonstrate technology to reduce field feeding logistics by over 75% (i.e., weight, cube, fuel and water) and labor requirements by 50%, while improving the quality of food service. Thrust areas include: combat rations, ration packaging, and combat feeding equipment/systems. Near-term goals are to: enhance nutrient composition and consumption to maximize cognitive and physical performance on the battlefield; reduce ration weight/volume and food packaging waste to minimize the logistics footprint; tailor rations to the combat situation and provide an "eat on the move" capability, thereby improving mobility; reduce replenishment demand by extending shelf-life, permitting more extensive prepositioning of stocks, while maintaining initial quality; and provide equipment and energy technologies to reduce the logistics footprint and to enhance operational efficiency of field feeding while improving the quality of food service. The work in this project supports all military Services, the Army's Future Force, Special Operations Command, and the Defense Logistics Agency. The Army has Executive Agency responsibility for this Department of Defense (DoD) program, with oversight and coordination provided by the DoD Combat Feeding Research & Engineering Board. The cited work is consistent with the Strategic Planning Guidance, the Army Science and Technology Master Plan, the Army Modernization Plan, and the Defense Technology Area Plan. Work in this project is performed by the US Army Natick Soldier Center, Natick, MA, and this project has collaborative efforts with the U.S. Army Research Institute for Environmental Medicine.</p>							
<u>Accomplishments/Planned Program</u>				<u>FY 2005</u>	<u>FY 2006</u>	<u>FY 2007</u>	
Equipment and Energy Technologies - In FY05, completed materials research and developed concept for individual beverage chiller; transitioned a prototype Capillary Force Vaporizer stove that weighs 50% less and consumes 50% less fuel than commercial stoves; developed process for applying quasicrystalline coatings on aluminum cookwear that provides nonstick properties similar to fluorocarbons and hardness similar to steel; explored self-powered and solar-powered refrigerated container technology; developed technology to flamelessly combust methanol as a preliminary step to JP8; developed a proof-of-concept thermoelectric self-powered tray ration heater; and explored an alkaline fuel cell concept to control hydrogen emissions for group ration chemical heaters. In FY06, integrate and test water chiller subsystems for Soldier hydration; complete and transition self-powered tray ration heater; complete prototype design for a solar powered refrigerated container; and down select four competing designs for Waste to Energy Converters. In FY07, will complete prototype development of JP8 fueled flameless catalytic sheet materials and integrate into a safe heating system with potential to consume less fuel than chemical or open-flame heaters; and fabricate a prototype Solar Powered Refrigerated Container.				2277	2177	2281	
Ration Stabilization, Packaging, Food Safety & Novel Nutrient Delivery Technologies - In FY05, researched pathogen probe technology and transitioned to diagnostics platforms to advance biosensor effectiveness for food pathogen detection; researched self-hydrating membrane pouch forward osmosis technology for safe/effective re-hydration of dried beverages/rations by non-potable water sources; investigated Radio Frequency Identification (RFID) technologies applicable to ration logistics, integrated into tamper evident concept; validated barrier results which met oxygen transmittal rates for MRE packaging; investigated technology to predict combat ration quality via RFID; investigated performance enhancing ration component technology and encapsulated micronutrients to enhance mobility and reduce weight/volume; investigated oral mucosal (buccal) absorption; and researched novel delivery systems. In FY06, tailor food				2742	2636	2770	

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sampling extraction procedures using immunoassays; investigate electrospon arrays for capture from complex matrices and validate array technologies to identify multiple pathogens; and evaluate self-hydrating pouch forward osmosis technology. Analyze RFID-based storage temperature data and document recommendations for shelf-life management to provide to Defense Supply Center Philadelphia and the Services. Develop methods for buccal delivery of anti-inflammatory micronutrients to extend onset of muscle fatigue. Optimize barrier coating technology and producibility. In FY07, will continue modification and evaluation of food sampling procedures used for biosensor systems to improve their accuracy and sensitivity to pathogenic organisms; will validate buccal delivery systems and optimize nutrient delivery/absorption; and will verify/evaluate percent loss of performance enhancers in ration over time and focus on enhancers requiring protection.			
Total	5019	4813	5051