ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2005

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGY

COST (In Thousands)		FY 2004 Actual	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	49071	54051	21707	24778	21777	19551	19713	19848
283	AIRDROP ADV TECH	4714	2484	2200	2265	2314	2336	2357	2373
C60	AC60	3958	4105	1654	3651	0	0	0	0
E01	WARFIGHTER TECHNOLOGY INITIATIVES (CA)	18602	33400	0	0	0	0	0	0
H98	CLOTHING & EQUIPM TECH	17022	9041	12970	13804	14268	11964	12061	12141
H99	JOINT SERVICE COMBAT FEEDING TECHNOLOGY	4775	5021	4883	5058	5195	5251	5295	5334

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 encapsulated cooling to the Soldier in extremely hot environments; and significantly 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.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2005)	21131	22371	25215
Current Budget (FY 2006/2007 PB)	54051	21707	24778
Total Adjustments	32920	-664	-437
Net of Program/Database Changes			
Congressional Program Reductions	-685		
Congressional Rescissions			
Congressional Increases	34840		
Reprogrammings			
SBIR/STTR Transfer	-1235		
Adjustments to Budget Years		-664	-437

Change Summary Explanation:

Fifteen FY05 Congressional adds totaling $34840 were added to this PE.

FY05 Congressional Adds in Project E01 with no R2-A:
($1439) Advanced Antimicrobial Technology: The purpose of this one year Congressional add is to complete evaluation of advanced antimicrobial technologies for clothing and individual equipment for the soldier. No additional funding is required to complete this project.

($1630) Aviation Inflatable Maintenance Shelter (AIMS) Test and Evaluation: The purpose of this one-year Congressional add is to fabricate and evaluate large airbeam maintenance shelters. No additional funding is required to complete this project.

($959) Field Evaluation and Manufacturing Improvements on Flexible Monolithically Integrated Solar Panels: The purpose of this one-year Congressional add is to improve manufacturing processes for flexible solar panel tech for field shelters. No additional funding is required to complete this project.

($2148) Flexible Monolithically Integrated Solar Panels on a Polymer Substrate: The purpose of this one-year Congressional add is to research advanced flexible solar panel technology for field shelters. No additional funding is required to complete this project.

($3117) Improved Shelf-Life in Fresh Fruits and Vegetables: The purpose of this one-year Congressional add is to research non-genetically modified varieties of produce using advanced molecular biology techniques for shelf life extension. No additional funding is required to complete this project.

($2397) Integrated, Unbreakable, Flexible Visible and Infrared Lighting Surfaces: The purpose of this one-year Congressional add is to investigate and evaluate textile-based luminescent panels for battlefield shelters. No additional funding is required to complete this project.

($3739) NBC Integrated Protection Membrane-Shelters: The purpose of this one year Congressional add is to research breathable, non-powered chemical/biological shelter technology. No additional funding is required to complete this project.

($1199) Next Generation Chemical/Biological Agent Protection: The purpose of this one-year Congressional add is to investigate materials for improved chemical and biological agent protection. No additional funding is required to complete this project.

($2397) Self-Decontaminating Selectively Permeable Membranes: The purpose of this one-year Congressional add is to complete research chemical/biological decontaminating membrane materials. No additional funding is required to complete this project.

($959) Smart Apparel for Warriors: The purpose of this one-year Congressional add is to research textile materials incorporating sensing and/or response mechanisms. No additional funding is required to complete this project.

($959) Soldier Systems Center: The purpose of this one year Congressional add is to complete evaluation of large-scale production processing of combat ration components using advanced thermal and non-thermal sterilization technologies. No additional funding is required to complete this project.

($959) Special Operations Precision Airdrop Technology: The purpose of this one-year Congressional add is to research into new methods of parachute control. No additional funding is required to complete this project.

($5084) Supplemental Body Armor Research: The purpose of this one-year Congressional add is to investigate improved production processes for high performance fiber. No additional funding is required to complete this project.

($4315) US Army Center of Excellence: Advanced Structures and Composites in Construction: The purpose of this one-year Congressional add is to

develop advanced modeling and empirical evaluation capability for flexible composites. No additional funding is required to complete this project.

($2110) Warfighter Technology: The purpose of this one-year Congressional add is research technologies with potential to improve the survivability of the soldier. No additional funding is required to complete this project.

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February 2005

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602786A - LOGISTICS TECHNOLOGY**	**283**

COST (In Thousands)	FY 2004 Actual	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	4714	2484	2200	2265	2314	2336	2357	2373

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 (ATAPS). 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 project is performed and managed by the US Army Natick Soldier Center, Natick, MA.

Accomplishments/Planned Program	FY 2004	FY 2005	FY 2006	FY 2007
Advanced Air Cargo Delivery - In FY04, completed the airdrop system modeling tool and refinement; investigated material alternatives for Precision Airdrop - Medium (30,000 lbs); identified preferred concepts and conducted component modeling. In FY05, complete airdrop system model validation and transition high-fidelity computer modeling tool to Program Manager Force Sustainment Systems and industry; and evaluate sub-scale concept models for Precision Airdrop - Medium.	1855	2484	0	0
Parachutist Proximity Detection Technology - In FY04, completed evaluation of Radio Frequency (RF) technology as a proximity detection system in order to determine the most reliable frequencies and or coding techniques to minimize the effects of interference due to a tumbling and unstable jumper.	500	0	0	0
Personnel Parachute Technology - In FY06, will investigate soft landing and parachute opening technologies aligned with ATAPS Preplanned Product Improvement needs. In FY07, will complete investigation of soft landing and parachute opening technologies aligned with ATAPS program and transition results to PM Clothing & Individual Equipment (PM-CIE).	0	0	1200	1065

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
Parachutist Airdrop Systems Modeling and other concept studies – In FY06, will use High Performance Computing modeling to investigate fully open parachutist control behavior, rate of descent issues, and parachute opening performance; and will model the biomechanics of jumper exit and landing. In FY07, will complete investigation of fully open parachutist control behavior, rate of descent issues, and parachute opening performance; will complete modeling of the biomechanics of jumper exit and landing; and will transition results to PM-CIE ATAPS program. Will conduct concept study for very large, gliding decelerators for their potential use with payloads up to 20 tons.	0	0	1000	1200
Standoff Precision Aerial Delivery System (PADS)- In FY04, this one-year Congressional add improved PADS capabilities through multi-channel wind sensors, advanced wireless download capabilities and raising performance up to 35K ft Mean Sea Level (MSL). No additional funding is required to complete this effort.	2359	0	0	0
Totals	4714	2484	2200	2265

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2005

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602786A - LOGISTICS TECHNOLOGY**	**H98**

COST (In Thousands)		FY 2004 Actual	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	17022	9041	12970	13804	14268	11964	12061	12141

A. Mission Description and Budget Item Justification: This project researches and investigates technologies to improve Soldier survivability and performance. Research focuses on: ways to significantly lighten the Soldier's load; lightweight materials for personal survivability (e.g., improved ballistic, flame, and directed energy protection, enhanced signature management); and modeling and analysis tools for optimizing Soldier system 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 objective of the novel blast protection effort is to characterize blast profiles, determine the hazard, and demonstrate improved protectin concepts. The Lightweight Soldier effort employed virtual prototyping tools to integrate warrior "system-of-systems" concepts on the human to increase the fightability of dismounted warrior systems. The goal of warrior systems modeling and simulation is to build essential analytic tools needed to assess the combat worth of next generation warrior systems ranging from the current Soldier to the Future Force Unit of Action Soldier. 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 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. This project leverages work performed by the Institute for Soldier Nanotechnologies supported by PE0601104A (University and Industry Research Centers) and PE0602105A (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.

Accomplishments/Planned Program	FY 2004	FY 2005	FY 2006	FY 2007
Ballistic Protection for the Individual Warrior – In FY04, established technology with 25% reduced areal density over FY00 baseline against tungsten-carbide core projectiles (0.30 caliber or less); established transparent armor technology for face protection with a 30% reduced areal density for fragmentation protection that will also provide handgun protection; evaluated initial set of composite material systems for novel integrated armor and load carriage components of the Future Force Warrior (FFW) system architecture that enhance Soldier mobility, thermal balance, protection, and performance; and established enhanced assessment model to evaluate advanced fibers for potential ballistic protective materials and selected those that have potential to achieve weight reductions. In FY05, enhance fiber mechanical properties through processing/post-processing techniques and evaluate ability to meet performance requirements; begin research on material system(s) architecture incorporating advanced fibers into flexible materials and composite technology. In FY06, will 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.	4645	2930	2500	1500
Novel Blast Protection – In FY04, established fundamental theories for material behavior for personnel blast protection and constructed a force-based test device for testing protective material system concepts. In FY05, define and develop initial protective material system concepts for fielded Interceptor Vest (“add-on” blast protection) and Future Force Warrior. Conduct evaluations on material system concept(s). In FY06, will validate test device for blast protective materials, refine concept for Interceptor Vest and transfer technology to PM-Clothing & Individual Equipment. In FY07, will develop an integrated concept for blast protection of future warrior, validate performance and transition to Land Warrior development program.	1000	2930	2500	1700

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
Lightweight Soldier Materials & Virtual Prototyping Tools – In FY04, completed documentation of performance of nanotechnology-based system components and enhancements of virtual prototyping tools; accelerated and applied virtual prototyping enhancements to FFW technology components in two of four planned FFW component design cycles; completed fatigue detection algorithms to better predict fatigue for dismounted soldiers; completed methodologies for data extraction/transfer from Data Access and Retrieval Tool (DART), a data repository being developed for modelers and analysts throughout DoD; and accelerated technology development in advanced materials areas including ventilation/cooling, electro-textiles, and novel uniform materials for transition to the FFW program in FY05.	7450	0	0	0
Warrior Systems Modeling Technology – In FY04, completed development of a small unit, force-on-force, High Level Architecture compliant model to assess the combat effectiveness of warrior components and systems. In FY05, establish next generation intelligent agent capabilities to assess information inputs and decision-making at the small unit level. In FY06, will develop small unit intelligent agent decision-making capability for urban building interior operations. In FY07, will model the effects of sensor information used by the networked warrior. Will provide initial small unit battle command module to evaluate impact of information transfer on small unit performance.	2077	2059	1830	2210
Nanocomposites/fibers and Electrotextiles for Warrior Systems - In FY04, matured technology towards lightweight and conformal prototype photovoltaic (PV) battery rechargers that could be either directly integrated into a soldier “mule” or carried by the individual soldier for renewable battery recharging for FFW systems. In FY05, conduct research to create PV fibers and identify most promising near-term conductive textile-based technologies; continue investigating technology for prototype portable PV mats and PV integrated shelters to recharge batteries used to power soldier-borne items. In FY06, will complete technology evaluation of PV battery recharger and transition to PEO Soldier for current forces and to FFW; and will explore power generation and electrical conductivity in unique fiber-based compositions. In FY07, will investigate and optimize new power generating and electrically conductive textile-based compositions compatible with warrior systems.	1850	1122	1500	2000

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
Technologies to Enhance Warrior System Performance - In FY06, will research and evaluate emerging materials/technologies for the individual soldier that have the potential to improve warrior performance, such as, microclimate conditioning (MCC) and "smart" load carriage systems; and will apply new analytical tools to design and simulate load carriage gear for a "smart" load carriage suspension system designed to automatically adjust the backpack's position, orientation, and suspension characteristics. In FY07, will research and evaluate the potential of textile-embedded, miniaturized bio-sensors to provide highly sensitive detection of bio-warfare agents, munitions and environmental hazards; and will further research and mature MCC and "smart" load carriage technologies.	0	0	1640	2394
Tunable (Frequency Agile) Laser Eye Protection - In FY06, will combine nonlinear dyes with nanostructured arrays and examine the optical limiting characteristics of the technology for tunable-laser eye protection. In FY07, will investigate materials with potential to maximize light transmission through soldier protective eyewear to provide adequate sight for the soldier, while minimizing activation response time of the materials used to block the tunable laser light.	0	0	3000	4000
Totals	17022	9041	12970	13804

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602786A - LOGISTICS TECHNOLOGY**	**H99**

COST (In Thousands)		FY 2004 Actual	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	4775	5021	4883	5058	5195	5251	5295	5334

A. Mission Description and Budget Item Justification: 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.

Accomplishments/Planned Program	FY 2004	FY 2005	FY 2006	FY 2007
Equipment and Energy Technologies – In FY04, researched Field Feeding and Advanced Sustainment Technologies including central heat, cogeneration and greywater recycling to achieve logistical reductions; designed, fabricated and tested a prototype, lightweight, cost-effective thermoelectric water heater chiller for Future Combat Systems crew sustainment that provides the benefit of chilled water to vehicle crews; improved the process to coat commercial cookware with quasicrystals to increase the wear resistance and non-stick qualities; investigated flameless catalytic combustion of JP8 fuel; and developed an alkaline fuel cell concept that converts hydrogen (extracted from the Meal Ready to Eat flameless ration heaters in a controlled reaction) to electricity. In FY05, research technology for individual beverage chiller and water heaters for the future Soldier; will test and evaluate quasicrystalline coating technology on commercial cookware; explore self-powered and solar-powered refrigerated container technology for the Battlefield Kitchen; and evaluate and transition an alkaline fuel cell concept to control hydrogen emissions for group ration chemical heaters. In FY06, will integrate and test water chiller subsystems for soldier hydration; will complete integration of thermoelectric modules and evaluation of self-powered tray ration heater. In FY07, will complete evaluation of JP8 fueled flameless catalytic sheet materials and integrate into heater system for use with group rations; and will design and fabricate subsystems for waste to energy conversion.	2069	2277	2207	2328

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
Ration Preservation & Stabilization, Revolutionary Packaging & Food Safety Technologies - In FY04, researched surface scanning technologies; increased sensitivity of food probes to enhance antibody based pathogen sensor by 30-fold; incorporated research on pathogen resistant technologies, i.e. probiotics, into ration components and evaluated viability; selected cost-effective nanotechnology-based films/packaging with optimum barrier properties; and investigated tamper evident (TE) packaging technologies at ISO-container, pallet and case level to insure security of combat rations. In FY05, research pathogen probe technology and transition to diagnostics platforms; research self-hydrating membrane pouch forward osmosis technology for safe/effective re-hydration of dried beverages/rations by non-potable water sources for the future warrior; investigate Radio Frequency Identification (RFID) technologies applicable to ration logistics, integrate into TE concept, and evaluate performance; and investigate technology to predict combat ration quality via RFID. In FY06, will tailor food sampling extraction procedures using immunoassays; will investigate electrospun arrays for capture from complex matrices and validate array technologies; and will evaluate self-hydrating pouch forward osmosis technology using various osmotic acccelerators and packaging materiel and make downselection. In FY07, will continue modification and evaluation of food sampling procedures used for biosensor systems to improve their accuracy and sensitivity to pathogenic organisms.	1663	1861	1823	1855
Technologies for Nutrients and Novel Delivery Systems – In FY04, investigated and integrated extrusion, protein encapsulation, dehydration, and combinations of technologies to provide novel nutrient delivery for ration components and enhanced performance. In FY05, investigate performance enhancing ration component technology such as gels, calorie-dense savory meat and vegetable bars, rehydratable bars, beverages and encapsulated micronutrients to enhance mobility and reduce weight and volume, and investigate oral mucosal (buccal) absorption; and research novel delivery systems. In FY06, will develop methods for buccal delivery of nutrients. In FY07, will validate buccal delivery systems and optimize nutrient delivery/absorption; will verify/evaluate percent loss of performance enhancers in ration over time and select enhancers requiring protection; and will initiate design of a system to provide continuous hydration/sustainment in an encapsulated/hazardous environment.	1043	883	853	875
Totals	4775	5021	4883	5058