ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602786A - LOGISTICS 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	35826	49349	21131	22371	25215	21696	19616
283	AIRDROP ADV TECH	5621	4748	2543	2288	2332	2325	2368
C60	AC60	0	3935	4285	1675	3624	0	0
E01	WARFIGHTER TECHNOLOGY INITIATIVES (CA)	2334	18492	0	0	0	0	0
E02	CHEMICAL BIOLOGICAL COMMAND	952	0	0	0	0	0	0
H98	CLOTHING & EQUIPM TECH	17076	17358	9153	13330	14049	14149	11928
H99	JOINT SERVICE COMBAT FEEDING TECHNOLOGY	6986	4816	5150	5078	5210	5222	5320
WA1	CENTER FOR RELIABLE WIRELESS COMM TECH	2857	0	0	0	0	0	0

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: combat clothing and personal equipment; combat rations and combat feeding equipment; and the air delivery of personnel and cargo. 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 and integration; 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 impact/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. Similarly, 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. It adheres 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) Food & Nutrition Research & Engineering Board. The program element contains no duplication with any effort within the Military Departments. 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 Natick Soldier Center, Natick, MA.

B. Program Change Summary	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	34239	29421	21375
Current Budget (FY 2005 PB)	35826	49349	21131
Total Adjustments	1587	19928	-244
Congressional program reductions		-433	
Congressional rescissions			
Congressional increases		21550	
Reprogrammings	1587	-1189	
SBIR/STTR Transfer			
Adjustments to Budget Years			-244

Significant Change Explanation.
FY04 - Nine FY04 Congressional Adds totaling $21550 were added to this PE.

FY04 Congressional Adds with no R-2A:
($939) Advanced Antimicrobial Technology, Project E01: The purpose of this one year Congressional add is to research antimicrobial technology for possible application to fibers, textiles, and soldier equipment. No additional funding is required to complete this project.
($1879) Chem-Bio Protection Technology, Project E01: The purpose of this one year Congressional add is to research chemical/biological protective technology for possible application to fibers and textiles. No additional funding is required to complete this project.
($3288) Chem/Bio Reactive Nanoparticle Materials, Project E01: FY04 is the second year for this Congressional add. The purpose is to support research on a nano-based process to improve the chemical/biological protection of textiles. No additional funding is required to complete this project.
($939) Chemical Biological Command, Natick Soldier Center, Project E01: FY04 is the second year for this Congressional add

. The purpose is to improve materials for airbeam shelters. No additional funding is required to complete this project.
($4791) MERWS (Modular Extendable Rigid Walled Shelter) Composite Field Medical Facility Prototype, Project E01: FY04 is the second year for this Congressional add that was previously funded under line 183 (Manufacturing Technology). The purpose is to research medical shelter technology. No additional funding is required to complete this project.
($3194) NBC Integrated Protection Membrane – Shelters, Project E01: The purpose of this one year Congressional add is to research chemical/biological protective technology for possible application to fibers and textiles. No additional funding is required to complete this project.
($939) Shelter Extension for Future Combat Vehicle, Project E01: The purpose of this one year Congressional add is to research chemical/biological protective technology for possible application to fibers and textiles. No additional funding is required to complete this project.
($1973) Soldier Systems Center, Project E01: FY04 is the third year for this Congressional add previously under project H99. The purpose is to develop food processing methods, optimize processing parameters, and improve ration formulations for combat food and feeding processes. No additional funding is required to complete this project.

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February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
283 AIRDROP ADV TECH	5621	4748	2543	2288	2332	2325	2368

A. Mission Description and Budget Item Justification: This project researches technologies to enhance cargo airdrop and personnel capabilities. These are key to Army Transformation rapid deployment and insertion capabilities for force projection, particularly into hostile areas. Areas of emphasis include parachute technology for improved performance, precision offset aerial delivery, soft landing technologies, airdrop simulation, and low altitude/high speed airdrop systems technologies. Efforts will result in increased personnel safety, more survivable and more accurate cargo delivery and reduced personnel, aircraft, and cargo vulnerability. The goal for personnel parachute technology is to increase personnel safety by providing an auto sensing capability to trigger parachute opening in the event the parachutist is incapacitated or disoriented and therefore unable to respond to a malfunction. This project will enhance the military's capability for global precision delivery and rapid force projection and supports the rapid deployment goal of the Army Transformation. 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 2003	FY 2004	FY 2005
Advanced Air Cargo Delivery - In FY03, optimized the design of advanced low cost autonomous controllable airdrop systems utilizing high performance computing (HPC) modeling tools; designed and conducted scaled tests on smaller and less expensive autonomous guidance navigation & control systems for low and primarily high altitude airdrop applications; completed the graphical user interface front end for Airdrop System Modeling tools. In FY04, complete the airdrop system modeling tool and refinement. Investigate material alternatives for Precision Airdrop - Medium (30,000 lbs). Identify preferred concepts and conduct component modeling. In FY05, will complete airdrop system model validation and transition high-fidelity computer modeling tool to PMForce Sustainment Systems and industry. Will evaluate sub-scale concept models for Precision Airdrop - Medium.	1790	1796	2543
Personnel Parachute Technology - In FY03, fabricated system component prototypes for automatic opening capability and conducted component-level field experiments. In FY04, conduct systems integration/human factor analysis for the parachute reserve automatic opening capability and transition to a 6.3 follow-on program.	950	469	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Standoff Precision Aerial Delivery System (PADS)- In FY03, this Congressional add advanced the near real time wind forecast/sensing capabilities on Standoff PADS, matured computer-based airdrop mission planner and tested the linkage of the PADS system via a wireless communication method to “smart” precision airdrop systems. In FY04, the purpose of this Congressional add is to improve 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.	2881	2391	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	92	0
Totals	5621	4748	2543

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February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H98	CLOTHING & EQUIPM TECH	17076	17358	9153	13330	14049	14149	11928

A. Mission Description and Budget Item Justification: This project supports the Army Transformation in the area of improved dismounted Soldier capabilities by researching and investigating technologies to improve Soldier survivability and performance. Research emphasizes: 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 human science, modeling and analysis tools for optimizing Soldier system clothing and equipment. The goal of the ballistic protection work is to research and mature advances in materials technology to improve the protection and performance of warrior armor systems against conventional and emerging ballistic threats. The lightweight Soldier effort will reduce the weight of dismounted warrior systems by exploiting nanotechnology and by employing virtual prototyping tools to integrate warrior "system-of-systems" concepts on the human. The goal of the project's modeling effort is to construct essential analytic tools that can be used to assess the military worth of next generation warrior systems (including Objective Force Warrior (OFW)) and evaluate alternatives. This effort will produce modeling tools having the potential to reduce program risk in the areas of prototype development and system down-selection. The load carriage optimization effort developed biomechanical methods, design guidance, and predictive analytical/statistical models addressing the human locomotion and load-bearing functions of the Soldier system. These tools will enhance the efficiency of ground maneuver and the fightability of dismounted troops. Nanotechnolgy 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 on researching conducting, flexible, wearable materials for lightweight power generating and storage devices to augment power sources for Soldier-worn computers and equipment. The objective of the novel blast protection activity is to characterize blast profiles and determine the hazard in order to provide improved protection concepts. This project leverages work performed by the Institute for Soldier Nanotechnologies supported by PE0601104A (University and Industry Research Centers) and PE0602105A (Materials Technology). A portion of this project accelerates technology development for transition to the Objective Force Warrior (OFW) program. 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.

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Ballistic Protection for the Individual Warrior – In FY03, demonstrated an improved (over FY99 baseline) material system breadboard for 2nd generation multiple ballistic threat protection prototype with 25% decrease in weight (or an increase in protection or a combination, depending on user requirements). Constructed an opaque armor system with 30% reduced areal density (over FY00 baseline) against emerging fragment threat without incurring significant cost, bulk, or flexibility penalties. In FY04, establish technology with 30% reduced areal density over FY00 baseline against tungsten-carbide core projectiles (0.30 caliber or less). Establish transparent armor technology for face protection with a 30% reduced areal density for fragmentation protection that will also provide handgun protection. Research and evaluate composite material systems for novel integrated armor and load carriage components of the Objective Force Warrior system architecture that enhance Soldier mobility, thermal balance, protection, and performance. Establish enhanced assessment model to evaluate advanced fibers for potential ballistic protective materials and select those that have potential to achieve weight reductions. In FY05, will enhance fiber mechanical properties through processing/post-processing techniques and evaluate ability to meet required properties. Will begin research on material system(s) architecture incorporating advanced fibers into flexible materials and composite technology.	2900	4672	3400
Lightweight Soldier Materials & Virtual Prototyping Tools – In FY03, collected and used human system data to enhance and verify virtual prototyping tools for soldier systems with human biomechanical and performance data. Evaluated the performance of breadboard prototype panels or system components made with nanomaterials to determine technology readiness for transition to the Objective Force Warrior (OFW) program (PE63001, Project J50), and to determine the path for further nanotechnology refinement and manipulation. In FY04, complete documentation of performance of nanotechnology-based system components and enhancements of virtual prototyping tools. Accelerate and apply virtual prototyping enhancements to OFW technology components in two of four planned OFW component design cycles. Complete fatigue detection algorithms to better predict fatigue for dismounted soldiers. Complete methodologies for data extraction/transfer from Data Access and Retrieval Tool (DART) – a data repository being developed for modelers and analysts throughout DoD. Accelerate technology development in advanced materials areas including ventilation/cooling, e-textiles, and novel uniform materials for transition to the OFW program in FY05.	6600	7650	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Warrior Systems Modeling Technology – In FY03, established a capability to improve the representation of human behavior using reactive intelligent agents in modeling the close combat/Military Operations in Urban Terrain environment. Demonstrate first generation Intelligent Agent model. In FY04, deliver a small unit, force-on-force, High Level Architecture compliant model to assess the combat effectiveness of warrior components and systems. In FY05, will establish next generation intelligent agent capabilities to expand the capability to assess information inputs and decision-making at the small unit level.	2283	2000	2353
Load Carriage Optimization for Enhanced Warfighter Performance – In FY03, validated and finalized load carriage data and analysis for transition to the Warrior Systems Modeling Technology effort; developed design guidance for load carriage that improves mobility by 15%.	1400	0	0
Nanocomposites & Nanofibers for Warrior Systems – In FY03, fabricated conformal solar cell devices with a minimum 30% reduction in weight (compared to current devices with similar power levels) for use in Soldier systems. In FY04, mature technology towards lightweight and conformal prototype photovoltaic battery rechargers that could be either directly integrated into a soldier “mule” or carried by the individual soldier for renewable battery recharging for Objective Force Warrior systems. In FY05, will continue to mature a photovoltaic fiber that can be employed by warrior systems to power soldier-borne items.	1893	1700	400
Novel Blast Protection – In FY03, modeled the behavior of protective clothing materials exposed to blast using impedance theory and compared results to experimental shock tube data. Working with U.S. Army Medical Research and Materiel Command, incorporated results into a casualty model to predict interaction of blast with the thorax. Initiated analysis to define experimental needs and test device requirements. In FY04, establish fundamental understanding of blast protection and construct test device for testing protective material system concepts. In FY05, will define and develop initial protective material system concepts for Interceptor Vest (“add-on” blast protection) and Objective Force Warrior. Will conduct evaluations on material system concept(s).	2000	1000	3000
Small Business Innovative Research/Small Business Technology Transfer Programs	0	336	0
Totals	17076	17358	9153

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February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H99	JOINT SERVICE COMBAT FEEDING TECHNOLOGY	6986	4816	5150	5078	5210	5222	5320

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 mature technology that reduce field feeding logistics by over 75% (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 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 Food & Nutrition 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 (USARIEM).

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Equipment and Energy Technologies – In FY03, integrated and tested experimental cogenerators, refrigerators, sanitation, greywater recycling and experimental field kitchen appliances for Field-Feeding and Advanced Sustainment Technology (FAST). Completed proof of principle for thermoelectric technology to provide hot water to re-hydrate meals and cold beverages for crew sustainment in Future Combat Systems (FCS). Matured nonstick durable quasicrystalline coating technology for cookware to reduce the life cycle costs of cookware and the water consumption during sanitation. Evaluated new compact insulation technology for food containers to reduce footprint by 65%. Prepared methodology models to estimate kitchen workload reduction for future kitchens. In FY04, mature FAST technologies to include a single multi-stage burner, 2nd generation expander and heat driven refrigeration system. Design, fabricate and evaluate prototype, lightweight, cost-effective thermoelectric water heater chiller for FCS crew sustainment; transition to 6.3. Coat commercial cookware with quasicrystals. Investigate flameless catalytic combustion of JP8 fuel. Expand kitchen workload database and finalize workload/staffing computer model. In FY05, will research technology for individual beverage chiller and water heaters for the Objective Force Warrior. Will test and evaluate quasicrystalline coating technology. Will explore self-powered and solar-powered refrigerated container technology for the Battlefield Kitchen. Will develop Class I decision support tools and Field Feeding Kitchen Workload Models to optimize cost, readiness and workload.	1948	2099	2357

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Ration Preservation & Stabilization, Revolutionary Packaging & Food Safety Technologies - In FY03, evaluated various surface scanning technologies for real time ration contamination assessment. Identified pathogen technologies for maturing ration components resistant to the virulent effects of food pathogens. Prepared decision support tools to quantify/analyze annual cost impacts of current/alternative ration concepts, shelf life, rotation policies, and ration consumption mixes. In FY04, mature surface scanning technologies. Increase sensitivity of food probes to enhance antibody based pathogen sensor by 30-fold. Incorporate research on pathogen resistant technologies into ration components and evaluate viability. Select cost-effective nanotechnology-based films/packaging with optimum barrier properties. Investigate tamper evident (TE) packaging technologies at ISO-container, pallet and case level to insure security of combat rations. In FY05, will mature probes and transition to diagnostics platforms. Will mature 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. Will establish rapid, reliable, easy-to-use objective techniques for detecting ration degradation to reduce waste. Will investigate Radio Frequency Identification (RFID) technologies applicable to ration logistics, integrate into TE concept and evaluate. Will mature technology to predict combat ration quality via RFID.	2037	1691	1910
Technologies for Nutrients and Novel Delivery Systems – In FY03, investigated/identified novel component technologies such as compressed meals and gels to enhance operational effectiveness (i.e., mobility), reduce weight/volume and optimize warfighter acceptance, consumption and performance. Downselected anti-fatigue nutraceuticals for novel nutrient delivery (i.e. buccal, transdermal, gel). In FY04, investigate and integrate extrusion, protein encapsulation, dehydration, and combinations of technologies to provide novel nutrient delivery for ration components and enhanced performance. In FY05, will mature performance enhancing ration component technology such as gels, calorie-dense savory meat and vegetable bars, rehydratable bars, performance enhancing beverages and encapsulated micronutrients, and investigate oral mucosal absorption.	970	986	883
Combat Feeding Research, Soldier Systems Center - In FY03, this Congressional add established processing parameters, optimized equipment/ration formulations and conducted microbial efficacy studies for novel processing technologies (radio frequency sterilization, microwave sterilization and high pressure processing) to improve ration quality and variety. It also identified/conducted efficacy testing of nutraceuticals for transdermal and other novel delivery systems to relieve effects of stress on the warfighter. No additional funding is required to complete this project.	2031	0	0

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Small Business Innovative Research/Small Business Technology Transfer Programs	0	40	0
Totals	6986	4816	5150