ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)

February 2003

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602786A - LOGISTICS TECHNOLOGY

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	31650	34239	29421	21375	22652	25638	22167	20070
283	AIRDROP ADV TECH	6192	5672	2454	2522	2248	2290	2317	2375
C60	AC60	1357	0	4065	4522	1764	3821	0	0
E01	REACTIVE NANOPARTICLE MATERIALS	0	2335	0	0	0	0	0	0
E02	CHEMICAL BIOLOGICAL COMMAND	0	953	0	0	0	0	0	0
H98	CLOTHING & EQUIPM TECH	15796	15343	17928	9191	13582	14337	14584	12298
H99	JOINT SERVICE COMBAT FEEDING TECHNOLOGY	7347	7077	4974	5140	5058	5190	5266	5397
WA1	CENTER FOR RELIABLE WIRELESS COMM TECH	958	2859	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) improves soldier survivability and performance by researching and investigating 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; enhance signature management and integration; provide wearable, conducting materials to augment data and power transmission; 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 develop 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 and development of high impact/high payoff technologies for performance enhancing combat rations, 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. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. 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). Work is performed by the Natick Soldier Center, Natick, MA. This program supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds have been provided to this program.

B. Program Change Summary	FY 2002	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2003)	33474	25502	23655	23141
Current Budget (FY 2004/2005 PB)	31650	34239	29421	21375
Total Adjustments	-1824	8737	5766	-1766
Congressional program reductions				
Congressional rescissions		-1976		
Congressional increases		11550		
Reprogrammings	-1251	-196		
SBIR/STTR Transfer	-573	-641		
Adjustments to Budget Years			5766	-1766

Change Summary Explanation: Funding - FY03 Congressional Adds: Soldier Systems Center, Project H99 ($2100); Center for Reliable Wireless Communications Technology for Digital Battlefield, Project WA1 ($3000); Standoff Precision Aerial Delivery System aerial drops, Project 283 ($3000); Chemical/Biological Command, Natick Soldier Center, Project E02 ($1000); Chemical/Biological Reactive Nanoparticle Materials, Project E01 ($2450)

Projects with No R-2A:
- ($2859), Project WA1, Center for Reliable Wireless Co mmunications Technology for Digital Battlefield: The objective of this one year Congressional add is to support research in a wireless test bed facility for potential application to digital communications. No additional funding is required to complete this project.
- ($2335), Project E01, Chemical/Biological Reactive Nanoparticle Materials: The objective of this one year Congressional add is to support research on nano-based process to improve chem/bio protection in textiles. No additional funding is required to complete this project.
- ($953), Project E02, Chemical, Biological Command: The objective of this one year Congressional add is to support research to improve airbeam shelter materials. No additional funding is required to complete this project.

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February 2003

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

COST (In Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
283 AIRDROP ADV TECH	6192	5672	2454	2522	2248	2290	2317	2375

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. This program supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds have been provided to this project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Advanced Air Cargo Delivery - In FY02, researched components and technologies in support of the Deployment Combat Aerial Delivery program and transitioned to 6.3 programs; utilized Airdrop System Modeling to simulate brassboards and prototypes in tech base and development programs (such as the Affordable Guided Airdrop System and the Advanced Tactical Parachute System) while validating the results with flight test data; and researched concepts for, and feasibility of, developing a 20-ton, high altitude (25,000 ft), high offset (up to 20 miles) precision airdrop system to provide greater deployability and sustainability for the Objective Force. In FY03, optimize the design of advanced low cost autonomous controllable airdrop systems utilizing high performance computing (HPC) modeling tools; design and conduct scaled tests on smaller and less expensive autonomous guidance navigation & control systems for low and primarily high altitude airdrop applications; complete the graphical user interface front end for Airdrop System Modeling tools. In FY04, complete the airdrop system modeling tool development and refinement. Conduct component modeling for Objective Force Precision Airdrop (30,000 lbs). In FY05, complete airdrop system model validation and transition high fidelity computer modeling tool to PM-Force Sustainment and industry. Conduct component-level evaluations for Objective Force Precision Airdrop.	3832	2083	1954	2522
Personnel Parachute Technology - In FY02, designed automatic opening capability system prototypes. In FY03, fabricate system component prototypes for automatic opening capability and conduct component-level field experiments. In FY04, conduct systems integration/human factor analysis for the parachute reserve automatic opening capability; and transition to 6.3 follow-on program.	596	789	500	0
Standoff Precision Aerial Delivery System (PADS) (Congressional add): In FY02, researched a computer based airdrop mission planner to improve the accuracy of ballistic and autonomous airdrop systems. In FY03, advance the near real time wind capabilities on Standoff PADS, mature computer-based airdrop mission planner and test the linkage of the PADS system via a wireless communication method to "smart" precision airdrop systems. No additional funding is required to complete this effort.	1764	2800	0	0
Totals	6192	5672	2454	2522

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February 2003

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

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H98	CLOTHING & EQUIPM TECH	15796	15343	17928	9191	13582	14337	14584	12298

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 develop essential analytic tools to quantify the military worth of next generation warrior systems (e.g., Objective Force Warrior) and evaluate the alternatives. This effort will produce modeling tools having the potential to reduce program risk by 50% in the areas of prototype development and system down-selection. The load carriage optimization effort is developing 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 disparate 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 goal of the other nanotechnology effort is to produce conducting textiles that will eliminate multiple antennas currently required to accomplish the function of "whip" antennas (a signature problem). Conducting textiles also will enable conducting pathways to be included in textiles for data and power transmission, without compromising the flexibility and comfort of the clothing in which they are contained. The objective of the thermobaric 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). This project accelerates technology development for transition to the Objective Force Warrior (OFW) Advanced Technology Demonstration (ATD). This program supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds have been provided to this project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Ballistic Protection for the Individual Warrior - In FY02, completed an improved personnel armor casualty assessment model that will permit evaluation of personnel armor systems against conventional and emerging ballistic threats. FY03, investigate 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). Develop an opaque armor system with 30% reduced areal density (over FY00 baseline) against fragment threat without incurring significant cost, bulk, or flexibility penalties. FY04, demonstrate technology with 30% reduced areal density over FY00 baseline against tungsten-carbide core projectiles (0.30 caliber or less). Demonstrate transparent armor technology for face protection with a 30% reduced areal density for fragmentation protection that will also provide handgun protection. Accelerate technology development for transition to the OFW ATD to meet FY05 design lock. FY05, conduct optimization of new fiber technology (e.g., M5) and material systems integration for advanced high performance materials (e.g., nanotechnology).	3452	2774	4882	2723
Lightweight Soldier Materials & Virtual Prototyping Tools - FY02, focused on the head and torso areas to advance the state-of-the-art in designing body-worn soldier clothing and equipment. Enhanced the capabilities of virtual prototyping tools. Completed beta simulations to test model effectiveness in biomechanical analysis. Produced breadboard prototype panels and system components made with nanomaterials for performance testing to determine the potential for significant system weight reduction and/or enhanced performance. FY03, collect/use human system data to enhance and verify virtual prototyping tools for soldier systems with human biomechanical and performance data. Evaluate the performance of breadboard prototype panels or system components made with nanomaterials to determine technology readiness for transition to the Objective Force Warrior program (PE63001, Proj J50), and to determine the path for further nanotechnology refinement and manipulation. FY04, complete verification of performance of nanotechnology-based system components and enhancements of virtual prototyping tools. Accelerate technology development for transition to the OFW ATD to meet FY05 design lock.	6831	6450	8803	0
Warrior Systems Modeling Technology - In FY02, developed close combat/small arms algorithms to assess warrior survivability and lethality at distances less than 25 meters. FY03, develop a capability to represent human behavior using reactive intelligent agents in the close combat/Military Operations in Urban Terrain environment. FY04, deliver a small unit, force-on-force, High Level Architecture compliant model to assess the combat effectiveness of warrior components and systems. FY05, develop next generation intelligent agent capabilities to expand the capability to assess information inputs and decision-making at the small unit level.	2236	2150	1830	2111

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Load Carriage Optimization for Enhanced Warfighter Performance - In FY02, developed design guidance for load carrying equipment that enhances mobility performance across squad positions by 15%. FY03, validate and finalize load carriage data and analysis for transition to the Warrior Systems Modeling Technology effort; evaluate physical training programs designed to improve locomotor performance.	1211	1300	0	0
Nanocomposites & Nanofibers for Warrior Systems - In FY02, improved the energy density and conversion efficiencies of photovoltaic nanostructures to functional levels for soldier system use through unique materials, modeling, processing/fabrication strategies. FY03, fabricate conformal solar cell devices with a minimum 30% reduction in weight (compared to current devices with similar power levels) for use in soldier systems. Test carbon nanotube arrays with broad band response for textile integrated antennas. FY04, mature technology for prototype conformal solar cells that can be directly integrated into warrior systems. Conduct research on a multifunctional nanomaterial-based textile undergarment system that includes flame resistance, anti-fungal, anti-microbial, chemical and biological warfare barrier and self-decontaminating capabilities. FY05, optimize integration of conformal solar cells into warrior systems; begin coupling of polymeric battery and solar cell devices for "all in one" power generation and storage (anytime power). Mature technology for organic elastomeric conducting textile fibers for conformal clothing applications.	1117	2168	1913	3357
Thermobaric Blast Protection - FY03, Model the propagation of thermobaric blast through protective clothing and model its interaction with the thorax. FY04, initiate experimental verification of predicted blast propagation through protective clothing and its interaction with the thorax and assessment of current thoracic simulators. FY05, conduct laboratory evaluation on proposed blast protective clothing concepts.	0	501	500	1000
This FY 2002 Congressional plus-up for Airbeam Manufacturing Process achieved advances in manufacturing technology to improve affordability and reliability of new inflatable, lightweight, textile based structures for rapidly deployable shelters to provide logistical support on a fast moving battlefield. No additional funding is required to complete this project.	949	0	0	0
Totals	15796	15343	17928	9191

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February 2003

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

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H99	JOINT SERVICE COMBAT FEEDING TECHNOLOGY	7347	7077	4974	5140	5058	5190	5266	5397

A. Mission Description and Budget Item Justification: The Joint Services Combat Feeding Technology project researches and applies combat feeding and food system 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 develop 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, packaging, and combat feeding equipment/systems. Near-term goals include: enhancing nutrient composition and consumption to maximize cognitive and physical performance on the battlefield; reducing ration weight/volume and food packaging waste to minimize the logistics footprint; tailoring rations to the combat situation and radically improving mobility; reducing replenishment demand by extending shelf-life, permitting more extensive prepositioning of stocks, while maintaining initial quality; and providing equipment and energy technologies to reduce the logistics footprint of field feeding while improving the quality of food service. The work in this project supports all military Services, the Army's Objective Force, Special Operations Command, and the Defense Logistics Agency. The Army has Executive Agency responsibility for this DoD program, with oversight and coordination provided by the DoD Food & Nutrition Research & Engineering Board. This project has collaborative efforts with the U.S. Army Research Institute for Environmental Medicine (USARIEM). This program supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds have been provided to this project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Equipment and Energy Technologies - FY02, designed/fabricated kitchen test bed for evaluating experimental cogenerators, refrigerators, sanitation, greywater recycling and field kitchen appliances. Tested cogenerators; researched thermoacoustic refrigeration and methods for safely tempering and storing perishable foods; tested experimental filtration and distillation prototypes; tested lightweight food sanitation center and transitioned to 6.3. Completed testing of Remote-Unit Self Heating Meals. FY03, integrate and test experimental cogenerators, refrigerators, sanitation, greywater recycling and experimental field kitchen appliances for Field-Feeding and Advanced Sustainment Technology (FAST); explore thermoelectric technology to provide hot water to re-hydrate meals and cold beverages for crew sustainment in Future Combat Systems. Develop methodology and models that estimate kitchen workload reduction for future kitchens. FY04, complete development of FAST and a crew sustainment system for Future Combat Systems; transition both to 6.3. Demonstrate Class I decision support tools and Field Feeding Kitchen Workload Models. FY05, design beverage chiller/water heater for the Objective Force Warrior; explore refrigerator container technology for the Battlefield Kitchen.	1817	1992	2239	2369

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Technologies for Ration Preservation & Stabilization, Revolutionary Packaging & Food Safety - FY02, investigated high-pressure ration processing for nutrient retention and sensory quality. Designed a family of shelf-stable breakfast concepts expanding menu choice, enhancing mobility, reducing weight by 53% and cube by 55%. Researched use of novel ration packaging technologies to extend quality/shelf-life of rations, reduce weight/signature, and minimize environmental impact. FY03, down select surface scanning technology for ration contamination assessment; transition to 6.3. Investigate pathogen technologies for developing ration components resistant to the virulent effects of food pathogens. Develop decision support tools to quantify/analyze annual cost impacts of current/alternative ration concepts, shelf life, rotation policies, and ration consumption mixes. FY04, increase sensitivity of probes to enhance antibody based pathogen sensor by 30-fold. Optimize novel processing/stabilization techniques. With USARIEM, prioritize next generation combat ration supplements that enhance warfighter cognitive/ physical performance. Incorporate research on pathogen resistant technologies into ration components and evaluate viability. Fabricate optimized ration packaging; transition to 6.3. FY05, complete development of probes, transition to biosensors and array diagnostics platforms. Verify shelf life of novel processing/stabilization techniques; transition to 6.3. Conduct validation studies for performance enhancing supplements. Develop self-hydrating membrane pouch using osmotic enhancing compounds for the safe/effective re-hydration of dried beverages/rations by non-potable water sources. Develop rapid, reliable, easy-to-use objective techniques for detecting ration degradation to reduce waste.	1968	2084	1710	1894

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Technologies for Nutrients and Novel Delivery Systems - FY02, initiated cellular assays to determine effectiveness of candidate nutraceutical compounds for transdermal nutrient delivery to delay fatigue or otherwise enhance human performance; designed and assessed methodologies for indexing the satiety value of military rations to improve acceptance and reduce battlefield waste; completed data analysis from Combat Optimized Rations Concept initial user evaluation, implemented changes and transitioned to First Strike Ration to reduce weight and cube; investigated technology for "smart" food ration components to sustain cognitive and physical performance. FY03, develop ration systems and novel components to enhance operational effectiveness (i.e.mobility), reduce weight/volume and optimize acceptance, consumption and performance; and down select anti-fatigue nutraceuticals. FY04, investigate and integrate glucose modulation, extrusion, encapsulation, oral mucosal absorption, drying, and hurdle technologies to provide novel nutrient delivery for ration components and enhance performance. FY05, complete development of ration systems and transition items such as gels, calorie- dense savory meat and vegetable bars, rehydratable bars, performance enhancing beverages and micronutrients to 6.3.	996	967	1025	877
Combat Feeding Research (FY02); Soldier Systems Center (FY03)- In FY02, this Congressional add completed three-year High Pressure Processing (HPP) Dual Use S&T Flow International press installation at FDA National Center for Food Safety Technology and initiated food product testing and microbial testing to gain FDA regulatory approval for HPP. In FY03, this Congressional add will develop processing parameters, optimize equipment/ration formulations and seek regulatory approval for novel processing techniques (radio frequency sterilization, microwave sterilization and high pressure processing) and identify/conduct efficacy testing of nutraceuticals for transdermal delivery systems. No additional funding is required to complete this project.	1588	2034	0	0
This Congressional add for the Army Nutrition Program supported USARIEM Military Nutrient Division through cooperative agreement with Pennington Biomedical Center in Louisiana. No additional funds are required to complete this work.	978	0	0	0
Totals	7347	7077	4974	5140