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

February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE
1 - Basic research	**0601101A - In-House Laboratory Independent Research**

	COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
	Total Program Element (PE) Cost	13983	14688	22998	26886	27271	28450	29057
91A	ILIR-AMC	9710	10206	17853	21427	21741	22699	23209
91C	ILIR-MED R&D CMD	3562	3743	3849	3910	3980	4104	4185
91D	ILIR-CORPS OF ENGR	711	739	1296	1549	1550	1647	1663

A. Mission Description and Budget Item Justification: Established by DoD Directive number 3201.4, dated October 8, 1993, the Army's In-House Laboratory Independent Research (ILIR) program has supported and will continue to promote the 1987 Defense Science Board Study on Technology Base Management's recommendation to attract and retain top flight science and engineering PhDs in the Army's research organizations. The ILIR program provides a source of competitive funds to technical directors to stimulate high quality, innovative research with significant opportunity for payoff in Army warfighting capability. The ILIR program serves as a catalyst for major technology breakthroughs by giving laboratory directors flexibility in implementing novel research ideas and nurturing promising young scientists and engineers. Successful ILIR projects are typically transitioned to start-up projects under 6.1 or 6.2 mission funding within an organization. Many past and current ILIR projects have supported or are currently supporting developmental efforts in support of the Objective Force. ILIR funding allocations are based on past program performance as judged by a panel of leading scientists and engineers from the National Academy of Sciences, the Army Science Board, and Army Secretariat. The work in this program is performed by the Army Materiel Command, Army Medical Research and Materiel Command and Army Corps of Engineers Engineer Research and Development Center. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance, and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). This program element contains no duplication with any effort within the Military Departments.

B. Program Change Summary	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	14326	14815	15035
Appropriated Value	14459	14815	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-127	0
b. SBIR / STTR	-343	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	0	0	0
e. Rescissions	-133	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	7963
Current Budget Submit (FY 2003 PB)	13983	14688	22998

Change Summary Explanation:

FY03 (+$7963) - Project 91A (+$7415), Project 91D (+$544), and Project 91C (+$4) increased to enhance investment in innovative research at Research Development and Engineering Centers to address commodity-focused fundamental phenomenology and support recruitment and retention of high quality junior scientists to refresh the science and engineering workforce.

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

February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601101A - In-House Laboratory Independent Research**	**91A**

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
91A ILIR-AMC	9710	10206	17853	21427	21741	22699	23209

A. Mission Description and Budget Item Justification: This project provides funding for ILIR research in the Army Materiel Command's seven Research, Development and Engineering Centers (RDECs). This basic research lays the foundation for future developmental efforts by identifying the fundamental principles governing various phenomena and appropriate pathways to exploit this knowledge. Past and current ILIR efforts have had and are having significant impacts on technology development efforts supporting the Army Transformation to the Objective Force. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance, and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). The work in this program is performed by the Army Materiel Command. This program element contains no duplication with any effort within the Military Departments. This project supports the Objective Force transition path of the Transformation Campaign Plan.

FY 2001 Accomplishments:

- 9710 - Missile RDEC - Validated gel propellant additive technology to extend missile propellant shelf life to 20 years; investigated the use of extended capillary electrophoresis to analyze missile propellant formulations and their synthetic by-products to reduce the amount of waste produced during explosives production by 90%; investigated the ignition criteria and chemical/particulate formulation for neutralization of chemical/biological missile warheads and determine concept feasibility; analyzed and modeled the driving potential physics for the fluctuating control force on interceptor sensor performance and compare results with experimental data, to enable possible electro-optical guidance techniques for hypervelocity missiles; investigated ablation models for hypervelocity missiles components (nose cone, IR dome, nozzles); investigated the control of high frequency chaos in diode lasers testbed for possible application to high efficiency/lower cost diode lasers; analyzed photonic band gap materials to provide sensor protection of missile guidance systems against optical countermeasures.

  - Armaments RDEC - Characterized metastable intermolecular composites for more powerful explosives development. Examined the areas of high pressure loading of composite materials for increasing gun components life. Developed smart materials to provide in flight course corrections of ballistic projectiles.

  - Tank-Automotive RDEC - Evaluated and validated the accuracy and sensitivity of warfighting requirements simulation models for advanced propulsion, non-linear multibody dynamics, signature management and nontraditional material stress analysis to support development of vehicles for the Objective Force that are lighter, more mobile, and highly survivable.

FY 2001 Accomplishments: (Continued)

- Natick Soldier Center - Researched biotechnology-based sensor to improve ration safety and to provide more serviceable chemical protective fabrics.

- Edgewood Chemical Biological Center - Demonstrated that organisms may transfer pathogenesis from one to another depending on the specific chemical compounds they secrete. This may offer methods of identifying those organisms. Investigated computationally, the stabilizing effect of substitutents on the conformation of a series of large basket shaped molecules being designed as pot4ential agent traps/detectors.

- Aviation RDEC - Validated concepts for smart materials and/or microelectromechanical systems (MEMS) to alleviate dynamic stall and improve rotor blade aerodynamics.

- Communications-Electronics RDEC - Upgraded battlefield visualization tools, transitioned newly developed antenna technologies, improved power sources technology, and advanced sensor technology base to provide greater communications and sensors capabilities for the warfighter.

Total 9710

FY 2002 Planned Program

- 10206 - Missile RDEC - Transition long shelf lifetime gel propellant technology to the Compact Kinetic Energy Missile (CKEM) development effort for Objective Force applications; validate and transition methods to reduce the propellant synthesis waste by 90%; transition analytical and Computational Fluid Dynamics models and new designs into current and future missile systems for both chemical/biological warhead neutralization and guidance sensor improvement; validate improved heatshield designs for hypervelocity missiles nose cones, IR domes, and reduction of nozzle throat erosion to advance capabilities of Army missiles; validate chaos control techniques for diode lasers to enable advanced laser systems development; transition photonic bandgap sensor protection technology to current and evolving missile programs.

  - Armaments RDEC - Develop new metastable intermolecular composites for explosives applications; develop new composite materials that will extend the operational life of gun components; develop new smart materials to enable in-flight course corrections of ballistic projectiles.

  - Tank-Automotive RDEC - Refine warfighting requirements simulation models for advanced propulsion, non-linear multibody dynamics, signature management and nontraditional material stress analysis to support development of vehicles for the Objective Force that are lighter, more mobile, and highly survivable.

  - Natick Soldier Center - Evaluate nanomaterials for potential broad range uses in soldier survivability/sustainability equipment. Model effects of air gaps in clothing on heat transfer. Visualize/quantify air mass trapped by a parafoil and apply to airdrop modeling and simulation.

FY 2002 Planned Program (Continued)

- Edgewood Chemical Biological Center - Complete the development of a method to study the transfer of pathogenesis between organisms and propose transition of the investigative tools to the core Joint Service CB Defense program. Begin detailed computational study of the conformation of the most promising basket shaped model compounds predicted by last year's work and begin to develop synthetic routes to those compounds.

- Aviation RDEC - Conduct buildup of Background Oriented Stereoscopic Schlieren, Doppler Global Velocimetry, and Particle Imaging Velocimetry technique for full-scale vortex and wake applications to increase rotor blade performance.

- Communications-Electronics RDEC - Evaluate concepts for new electronics materials for more powerful, reliable and lighter weight battlefield visualization tools, communications systems, power sources technology, and sensors.

Total 10206

FY 2003 Planned Program

- 17853 - Missile RDEC - Examine concepts for improved sensors, propulsion, guidance and control, and structural components for missiles and transition these components and concepts to weapons systems.

- Armaments RDEC - Evaluate metastable intermolecular composites developed for explosives applications. Evaluate composite materials developed for extending gun components operational life. Evaluate smart material designed to provide in flight course corrections of ballistic projectiles.

- Tank-Automotive RDEC - Evaluate/validate the accuracy and sensitivity of revised warfighting requirements simulation models for advanced propulsion, non-linear multibody dynamics, signature management and nontraditional material stress analysis to support development of vehicles for the Objective Force that are lighter, more mobile, and highly survivable.

- Natick Soldier Center - Screen promising nanomaterials for performance improvements. Validate experimental technique and airdrop equipment design data collection and extend understanding of parachute dynamics with emphasis on opening forces generated during parachute inflation.

- Edgewood Chemical Biological Center - Begin synthesis of model basket shaped compounds and initiate evaluation of their ability to trap and bind simulants for a classical chemical and a classical biological agent. Begin work on the development of a novel CB decontaminant and on investigations leading to the generation of new protective mask/helmet concepts.

- Aviation RDEC - Apply Stereoscopic Schlieren technique to full-scale helicopter vortex to improve rotor blade performance; conduct low Reynolds Number airfoil tests for Unmanned Aerial Vehicle (UAV) applications.

- Communications-Electronics RDEC - Investigate novel new electronics materials for more powerful, reliable and lighter weight battlefield visualization tools, communications systems, power sources technology, and sensors.

Total 17853

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

February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601101A - In-House Laboratory Independent Research**	**91C**

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
91C	ILIR-MED R&D CMD	3562	3743	3849	3910	3980	4104	4185

A. Mission Description and Budget Item Justification: This project covers ILIR research to address medical and force protection needs at the six Medical Research and Materiel Command laboratories; the Aeromedical Research Laboratory, the Institute of Surgical Research, the Research Institute of Environmental Medicine, the Medical Research Institute of Chemical Defense, the Medical Research Institute of Infectious Diseases, and Walter Reed Army Institute of Research. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance, and supports the Objective Force transition path of the Transformation Campaign Plan (TCP). This program element contains no duplication with any effort within the Military Departments.

FY 2001 Accomplishments:

- 3562 -Conducted basic research on countermeasures against militarily relevant infectious diseases to include development of drugs and vaccines against malaria, diarrheal diseases, and viral hemorrhagic fever.

  -Conducted basic research on defenses against environmental extremes and operational hazards to health and performance as well as development of models to predict physiological responses to these hazards; mechanisms of combat trauma; and development of innovative treatment and surgical procedures.

Total 3562

FY 2002 Planned Program

- 3743 -Explore opportunities for identification of new countermeasures against militarily relevant infectious diseases using state-of-the-art techniques such as DNA microarray technology to facilitate identification of candidate genes for drug and vaccine development.

  -Investigate new methods of testing for infection.

  -Study new vaccine delivery mechanisms including needle-less delivery.

  -Pursue modeling to predict physiological, operational stressors on the battlefield.

  -Study the use of gene therapy to reverse early tissue damage in organs.

Total 3743

FY 2003 Planned Program

•	3849	-Exploit candidate countermeasures against militarily relevant infectious diseases identified through application of microarray technology.
		-Refine candidate methods of testing for infection.
		-Refine models to predict physiological, operational stressors on the battlefield.
		-Exploit use of promising gene therapies to reverse early tissue damage in organs.
Total	3849	

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February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic research	**0601101A - In-House Laboratory Independent Research**	**91D**

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
91D	ILIR-CORPS OF ENGR	711	739	1296	1549	1550	1647	1663

A. Mission Description and Budget Item Justification: This basic research lays the foundation for future developmental efforts by identifying the fundamental principles governing various phenomena and appropriate pathways to exploit this knowledge. This project encompasses ILIR research funds allocated to the seven Corps of Engineers laboratories. Past and current ILIR efforts have had and are having significant impacts on technology development efforts supporting the Army Transformation to the Objective Force. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The work under this program element is performed by the U.S. Army Engineer Research and Development Center. This program element contains no duplication with any effort within the Military Departments. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 711
  - Transitioned techniques developed for image noise reduction.
  - Completed development of a response- and durability-based model for coal tar seal coats for asphalt pavements.
  - Developed a hydrologic model combining surface water with saturated and unsaturated groundwater.
  - Demonstrated the potential to detect/discriminate unexploded ordnance using trace chemical detection.
  - Developed techniques for directed sub-surface migration/concentration of contaminants through soils using electro-osmotic pulse technology.

Total 711

FY 2002 Planned Program

•	739	- Investigate the effects of soils on the strengths of ground and air surface waves as input to the design of a short-range ground communications system for networked battlefield sensors. - Assess the effectiveness of using wavelet-based variograms in classifying hyperspectral data for use in terrain analysis. - Develop a method of mathematically creating a virtual reference image required for the Phase Profilometry optical technique being employed to measure surface topography and objects for use in robotics. - Analyze NASA aircraft data and other field data to define realistic in-cloud icing conditions for investigating the rate of ice accumulation on the main wing of the Hunter unmanned aerial vehicle. - Determine the mortality of potential pathogens added to soils, prerequisite to developing a future combat system chemical-biological (CB) defense strategy for endospore pathogens and application to diverse environmental conditions.
Total	739	

FY 2003 Planned Program

•	1296	- Explore the chemical phenomena needed to ultimately develop highly selective and sensitive DNA biosensors for detection of explosives, including vapor signatures of landmines and unexploded ordinance. - Model selected geosynthetic materials for pavement applications. - Investigate fluorescence signatures as a means of detecting and monitoring biological hazards in water and soil. - Develop a technique that enables researchers to map the processes of cracking in construction materials while under dynamic loading conditions, as in blast and projectile penetration, which is essential in preparing hardened materials for use on the battlefield. - Exploit phase profilometry, an optical technique, to accurately measure surface topography and objects, a capability that is critical to the development of robots and robotic vehicles.
Total	1296	