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

June 2001

BUDGET ACTIVITY
1 - BASIC RESEARCH

PE NUMBER AND TITLE
0601101A - In House Laboratory Independent Research

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	13855	14326	14815	0	0	0	0	0	0	0
91A ILIR-AMC	9596	9930	10294	0	0	0	0	0	0	0
91C ILIR-MED R&D CMD	3541	3669	3775	0	0	0	0	0	0	0
91D ILIR-CORPS OF ENGR	718	727	746	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification:

PLEASE NOTE: This administration has not addressed FY2003-2007 requirements. All FY 2003-2007 budget estimates included in this book are notional only and subject to change.

In-house Laboratory Independent Research (ILIR) 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. Since its establishment by DoD Directive number 3201.4, dated October 8, 1993, the Army's 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 cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the DOD Basic Research Plan. The program element contains no duplication with any effort within the Military Departments.

B. Program Change Summary	FY 2000	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2001 PB)	14119	14459	14763	0
Appropriated Value	14193	14459	0	
Adjustments to Appropriated Value	0	0	0	
a. Congressional General Reductions	0	0	0	
b. SBIR / STTR	-264	0	0	
c. Omnibus or Other Above Threshold Reductions	-40	0	0	
d. Below Threshold Reprogramming	0	0	0	
e. Rescissions	-34	-133	0	
Adjustments to Budget Years Since FY2001 PB	0	0	52	
Current Budget Submit (FY 2002/2003 PB)	13855	14326	14815	0

Projects with no R-2A

Project 91D:
- (FY02 Funding = $746) ILIR-Corps of Engr (91D): This project covers ILIR research conducted at the Engineer Research and Development Center (ERDC) addressing military operational environments, mine detection and neutralization, subsurface contaminant and unexploded ordnance detection and mitigation, and civil works efforts. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

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

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
91A ILIR-AMC	9596	9930	10294	0	0	0	0	0	0	0

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 and the Objective Force. This project supports the Objective Force transition path of the Transformation Campaign Plan.

FY 2000 Accomplishments

- 9596 - Missile RDEC - Developed Coefficient Polynomial Arithmetic (CPA) and Parallel Arithmetic Structures methodology to greatly reduce processing time for Automatic Target Recognition; developed and improved analytical models and Computational Fluid Dynamics (CFD) models to evaluate neutralization of chemical/biological missile warheads, jet-interaction to control plume degradation of interceptor seeker performance, and high speed separated flows; derived and analyzed the fundamental loss rate (spontaneous emission rate) of solid-state lasers to increase laser efficiency; completed data collection and modeling methodology for ablation phenomena affecting heatshield materials for hypersonic missiles; determined the controlling mechanism for the decomposition of gel propellants to extend their shelf life.

  - Armaments RDEC - Conducted research to develop metastable intermolecular composites (nanoparticle explosives) as a new class of more powerful explosives; examined low cost fuzing technology (MEMS, multi-function processing) to develop more effective fuzes; advanced barrel coating modeling and effects studies of high flame temperatures and high pressures to increase gun barrel life; evaluated smart materials to enable projectile in-flight course correction.

  - Tank-Automotive RDEC - Improved concepts for a unique advanced propulsion technology, sophisticated multibody ground vehicle dynamic systems, and advanced signature management techniques to support development of sensor systems and vehicles that are lighter, more mobile, and highly survivable for Objective Force applications.

  - Natick Soldier Center - Validated mathematical models to gain insights into protective properties, strength of fabrics, and aerodynamics of parachutes. Examined creation of new high performance polymers for fabrics and protection applications. Characterized and enhanced food biopreservative function.

FY 2000 Accomplishments (Continued)

- Edgewood Chemical Biological Center - Validated concept for a specific virus detector. Started development of data reduction/analysis algorithms needed for satellite/high altitude chemical imaging sensors.

- Aviation RDEC - Optimized blowing-slot location, frequency of oscillation, and amplitude of blowing in the dynamic stall environment for rotor blades; constructed a full-scale Particle Image Velocimeter for imaging airflow over concept rotor blades; developed design approaches and concepts to integrate the actuation system with the blade structure to enable continuous elastic deformation of the airfoil contour near the trailing edge of a rotor blade.

- Communications-Electronics RDEC - Transitioned antenna technologies, improved power sources technology, and advanced the sensor technology base.

Total 9596

FY 2001 Planned Program

- 9710 - Missile RDEC - Validate gel propellant additive technology to extend missile propellant shelf life to 20 years; investigate 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%; determine the ignition criteria and chemical/particulate formulation for neutralization of chemical/biological missile warheads and determine concept feasibility; analyze and model the driving potential physics for the fluctuating control force on interceptor sensor performance and compare results with experimental data, making possible electro-optical guidance techniques for hypervelocity missiles; investigate and develop ablation models for hypervelocity missiles components (nose cone, IR dome, nozzles); investigate the control of high frequency chaos in diode lasers testbed leading to high efficiency/lower cost diode lasers; fabricate photonic band gap materials to provide sensor protection of missile guidance systems against optical countermeasures.

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

  - Tank-Automotive RDEC - Evaluate/validate 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.

  - Natick Soldier Center - Transition results from biotechnology efforts to improve ration safety and to provide more serviceable chemical protective fabrics.

FY 2001 Planned Program (Continued)

- Edgewood Chemical Biological Center - Develop a specific virus detector based on previously validated concepts. Construct data reduction/analysis algorithms needed for the development of a satellite/high altitude chemical imaging sensor.

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

- Communications-Electronics RDEC - Upgrade battlefield visualization tools, transition newly developed antenna technologies, improve power sources technology, and advance sensor technology base to provide greater communications and sensors capabilities for the warfighter.

• 220 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 9930

FY 2002 Planned Program

• 10294 - 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 - Create models for transition to technology efforts that address improved human performance and new materials for individual protection. Specifically, these models will assess: cognitive function as affected by performance enhancing nutrients; and air gaps in clothing systems as they affect heat transfer.

- Edgewood Chemical Biological Center - Develop and model specific virus detectors based on previously validated concepts. Evaluate effectiveness of data reduction/analysis algorithms needed for the development of a satellite/high altitude chemical imaging sensor.

FY 2002 Planned Program (Continued)

- Aviation RDEC - Conduct buildup of Background Oriented Stereoscopic Schlieren technique for full-scale vortex 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 10294

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

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
91C ILIR-MED R&D CMD	3541	3669	3775	0	0	0	0	0	0	0

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. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2000 Accomplishments

- 2260 Evaluated transdermal delivery of malaria vaccine and explored the immune cell responses generated by this delivery mechanism. Preliminary data indicate this new painless immunization technique may enhance immune response and offer better protection for soldiers.

  Elucidated the structure of the protein complex that enables the malaria parasite to invade red blood cells. Synthesized chemically, and by gene expression, the protein that will be used in an in vitro malaria assay.

- 1092 Explored use of the new cDNA microarray technology to evaluate the molecular actions that result in disease, after infection by Filovirus. These studies will enable a better understanding of the mechanism of action, resulting in novel drugs and vaccines.

  Investigated the use of novel approaches to predict the stability and potency of new vaccines. This modeling approach will enable more rapid screening of vaccine stockpiles and may thus significantly reduce screening time and cost.

- 189 Conducted a study of leg muscle fatigue in humans to enable the development of a laboratory device to more accurately measure the increasing muscle fatigue that occurs in sustained work situations. This capability may yield a better understanding of the phenomenon and lead to appropriate medical countermeasures to enhance warfighter endurance.

  Investigated the new Stress-Gen ELISA Kit for evaluating Heat Shock Protein (HSP72) in humans under stress. A Standard Operating Procedure for determining HSP72 from human blood was drafted based on these findings. The new technique for determining HSP72 is far more suitable for large-scale studies of soldiers under a variety of stressors, and is faster and less costly than other methods.

  Completed a computer simulation model that predicts physiological responses of various body regions to different cyclic microclimate cooling. Findings may lead to strategies that enable soldiers wearing protective clothing to work harder and longer without increased risk of overheating injuries.

Total 3541

FY 2001 Planned Program

•	3562	Conduct basic research on countermeasures against militarily relevant infectious diseases to include development of drugs and vaccines against malaria, diarrheal diseases, and viral hemorrhagic fever; 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.
•	107	Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	3669	

FY 2002 Planned Program

•	3775	Explore opportunities for identification of new countermeasures against militarily relevant infectious diseases. Study new vaccine delivery mechanisms including needle-less delivery. Pursue modeling to predict physiological, operational stressors on the battlefield.
Total	3775	