

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

**February 2007**

BUDGET ACTIVITY		PE NUMBER AND TITLE						
<b>2 - Applied Research</b>		<b>0602787A - MEDICAL TECHNOLOGY</b>						
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
Total Program Element (PE) Cost	263507	229893	76544	72584	70754	71665	73197	74884
845 BONE DISEASE RESEARCH PROGRAM	959	989						
863 BTLFLD SURGICAL REPLAC	959							
865 CENTER FOR MILITARY BIOMATERIALS RESEARCH	1916							
866 CLINICAL TRIAL PLEZOELECTRIC DRY POWDER INHALATION	1							
867 DIAGNOSTICS IN TRAUMATIC BRAIN INJURY BLOOD BASED	959							
869 T-MED/ADVANCED TECHNOLOGY	2512	2978	3051	3154	3029	3057	3124	3193
870 DOD MED DEF AG INF DIS	14774	14768	14981	15360	15742	16103	16412	16851
873 HIV EXPLORATORY RSCH	9474	11306	11319	11456	10780	10849	11088	11332
874 CBT CASUALTY CARE TECH	14471	13531	14692	8983	9077	9144	9345	9551
878 HLTH HAZ MIL MATERIEL	9294	13718	14017	14502	13715	13863	14169	14479
879 MED FACT ENH SOLD EFF	9002	9966	10021	10327	9894	9968	10187	10411
953 DISASTER RELIEF & EMERGENCY MEDICAL SVC (DREAMS)	5462							
968 SYNCH BASED HI ENERGY RADIATION BEAM CANCER DETECT	8146	7912						
96C DIGITAL IMAGING AND CATHERIZATION EQUIPMENT	959							
96I REMOTE ACOUSTIC HEMOSTASIS	1342							
977 EMERGING INFECTIOUS DISEASES	6757	3560						
FH2 FORCE HEALTH PROTECTION - APPLIED RESEARCH	6787	8309	8463	8802	8517	8681	8872	9067
MA2 DIABETES PROJECT	3258	2077						
MA3 MEDICAL AREA NETWORK FOR VIRTUAL TECHNOLOGY	4888	4253						
OA3 CENTER FOR ADV SURGICAL &	6517	2374						

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<b>2 - Applied Research</b>		<b>0602787A - MEDICAL TECHNOLOGY</b>						
	INTERVENTIONAL TECH (CA)							
OA5	COMPUTATION PROTEOMICS (CA)	959						
OA7	ELGEN GENE DELIVERY TECHNOLOGY (CA)		1088					
OA8	ENHANCED RES IN TRAUMA PREVENTION/TREATMENT/REHAB	959						
OA9	GENETIC ACUTE ENHANCED BOWWARFARE THERAPY PROG (CA)	959						
PA4	WOUND HEALING PROJECT (CA)	959	989					
PA5	NANOFABRICATED BIOARTIFICIAL KIDNEY (CA)	1533	1483					
PA9	PROSTHETIC DEVICE CLIN EVAL AT WRAIR AMPUTEE CTR	5271	5933					
RA2	TARGETED NANOTHERAPEUTICS FOR CANCER (CA)	959						
RA4	TRANSPORTABLE PATHOGEN REDUCT AND BLOOD SAFETY SYS	1199	1088					
RA6	VERSA HSDI (CA)	5750						
TA1	AUTO MEDICAL EMERGENCY INTRAVASCULAR ACCESS (CA)	1438						
TA7	COMBAT CASUALTY CARE FOR BATTLEFIELD WOUNDS (CA)	2684	3857					
UA2	HIGH-SPEED MEMS ELECTROMAGNETIC CELL SORTER (CA)	2875						
UA5	NEUTRON THERAPY (CA)	1725						
UA6	PREDICTIVE TOOLS FOR PTSD (CA)	1438						
UA7	PREVENTIVE MEDICINE RESEARCH INSTITUTE (CA)	1342	1780					
UA8	PROTEIN HYDROGEL (CA)	959	989					

0602787A  
MEDICAL TECHNOLOGY

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Exhibit R-2  
Budget Item Justification

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# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

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BUDGET ACTIVITY			PE NUMBER AND TITLE						
<b>2 - Applied Research</b>			<b>0602787A - MEDICAL TECHNOLOGY</b>						
VB3	MEDICAL TECHNOLOGY INITIATIVES (CA)	121569	114176						
X06	HIBERNATION GENOMICS	2492	2769						

**A. Mission Description and Budget Item Justification:** This program element (PE) supports applied research required to sustain a force of healthy, medically protected warfighters. The primary goal of military medical applied research is to develop medical knowledge and technology (drugs, vaccines, and devices) to effectively protect and improve the survivability of US Forces. This PE funds applied research in the following areas: Militarily Relevant Infectious Diseases including HIV (Human Immunodeficiency Virus); Combat Casualty Care; and Military Operational Medicine (efforts aimed at protecting the Soldier against physiological and environmental degradation). Applied research program development and execution is externally peer reviewed and, to prevent unnecessary duplication, fully coordinated with other Services and Agencies through the Joint Technology Coordinating Groups of the Armed Services Biomedical Research Evaluation and Management Committee.

All medical applied research is conducted in compliance with US Food and Drug Administration (FDA) regulations. The FDA requires thorough testing in animals (referred to as preclinical testing) to assure safety and, where possible, effectiveness (i.e., efficacy) prior to approving controlled clinical trials where these experimental (previously unproven in humans) drugs, vaccines, and medical devices are tested in humans. Subsequent clinical trials are conducted in three phases (Phase 1, 2, and 3) to prove safety and effectiveness of the drug/vaccine/device for the targeted disease/condition, including an increasing number of people in each subsequent phase. Research conducted in this PE primarily focuses on completing preclinical technology maturation activities, although some activities may require use of human subjects to determine preliminary effectiveness when there are no validated animal models.

The Military Relevant Infectious Diseases effort focuses on designing and developing medical protection and treatment against naturally occurring diseases of military importance as identified by worldwide medical surveillance and military threat analysis. Methods identified and matured for prevention and treatment of infectious diseases include candidate vaccines, prophylactic (i.e. preventive measures) intervention, therapeutic drugs, and control of disease-carrying vectors (e.g., mosquitoes, ticks, and mites). HIV Exploratory Research focuses on developing diagnostics, surveillance, epidemiology, and identification of candidate vaccines for prevention and treatment of HIV subtypes found outside the US, which are problematic in military deployments and joint operations with coalition forces.

The Combat Casualty Care effort conducts research to develop knowledge and technologies that can improve medical treatment outcomes for battlefield injuries. Work involves identification and evaluation of drugs, biologics (products derived from living organisms), and diagnostics for resuscitation and life support, as well as trauma care systems for use by forward medics and surgeons. This effort also includes Combat Dentistry research with a focus on prevention of cavities, dental disease, and combat maxillofacial (face/neck) injuries on the battlefield.

The Military Operational Medicine (MOM) effort focuses on biomedical solutions that protect Soldiers and enhance their performance in the face of multiple stressors in operational and training environments. Research matures knowledge and technologies, such as biomedically-valid design criteria for body armor and physiological monitors, to protect Soldiers from injuries from exposure to hazardous environments and materials. This research also examines physiological indicators and associated algorithms/sensors that potentially indicate performance degradation produced by operational stressors such as high altitude, extreme temperatures, hydration, fatigue, isolation, and sleep deprivation.

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The cited work is consistent with Strategic Planning Guidance, the Army Science

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# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

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BUDGET ACTIVITY

PE NUMBER AND TITLE

**2 - Applied Research**

**0602787A - MEDICAL TECHNOLOGY**

and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this PE is performed by the Walter Reed Army Institute of Research, Silver Spring, MD; U.S. Army Medical Research Institute of Chemical Defense, Aberdeen Proving Ground, MD; U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, MD; U.S. Army Research Institute of Environmental Medicine, Natick, MA; U.S. Army Institute of Surgical Research, Fort Sam Houston, TX; U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL; and the Naval Medical Research Center, Silver Spring, MD.

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

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BUDGET ACTIVITY	PE NUMBER AND TITLE
<b>2 - Applied Research</b>	<b>0602787A - MEDICAL TECHNOLOGY</b>

<u>B. Program Change Summary</u>	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)	279780	75407	73951	72517
Current BES/President's Budget (FY 2008/2009)	263507	229893	76544	72584
Total Adjustments	-16273	154486	2593	67
Congressional Program Reductions		-878		
Congressional Rescissions				
Congressional Increases		157050		
Reprogrammings	-16273	-1686		
SBIR/STTR Transfer				
Adjustments to Budget Years			2593	67

Seventy-eight FY07 congressional adds totaling \$150524 (after adjustment for Congressional Undistributed Reductions) were added to this PE.

- (\$958) Bone Health & Military Medical Readiness
- (\$7668) Synchrotron-based Scanning for Prec Proton Therapy
- (\$2492) Northern CA Institute for Research and Education
- (\$958) Rare Blood Program
- (\$2013) Type 1 Diabetes Regeneration Project
- (\$4121) Medical Area Network for Virtual Technology
- (\$2300) Center for Adv Surgical & Interventional Tech
- (\$1055) Elgen Gene Delivery Technology
- (\$958) Rapid Wound Healing Technology Dev Project
- (\$1438) Nanofabricated Bioartificial Kidney
- (\$5750) Applied & Clinical Prosthetic Research Pgm at WRAC
- (\$1055) Transportable Pathogen Reduction & Blood Safety
- (\$3737) Cbt Casualty Care for Battlefield Wounds
- (\$1725) Preventive Medicine Research Institute
- (\$958) Protein Hydrogel
- (\$959) Advanced Proteomics for Clinical Applications
- (\$1822) Biological & Immunological Inf Agent & Cancer Vac
- (\$1726) Biomarkers: Evaluating & Test Acute & Chronic TBI
- (\$1055) Cancer Prevention through Remote Biological Detect
- (\$1247) Center for Diagnosis of Pathogens
- (\$1439) Combat Stress Intervention Program

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

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BUDGET ACTIVITY	PE NUMBER AND TITLE
<b>2 - Applied Research</b>	<b>0602787A - MEDICAL TECHNOLOGY</b>
<p>(\$1918) CRF Spinal Chord Injury Clinical Trials Res Init</p> <p>(\$959) Early &amp; Rapid Analyzer for Heart Attack Diagnosis</p> <p>(\$959) Eval of p75 Protein for NS Trea of CNS Trauma</p> <p>(\$1535) IC4 Program</p> <p>(\$958) Life Science Research Initiative</p> <p>(\$959) Medical Image Db Holographic Archiving Library Sys</p> <p>(\$1535) Medical Resource Conservation Tech Sys</p> <p>(\$4313) Military Complimentary &amp; Alternative Med Research</p> <p>(\$16678) Military Molecular Medicine Initiative M3I</p> <p>(\$958) MCIS Portable Clinical Information Initiative</p> <p>(\$3835) National Eye Evaluation and Research Network</p> <p>(\$1390) Neural Controlled Prosthetic Device for Amputees</p> <p>(\$1725) Non-Electric Disposable IV Infusion Pump</p> <p>(\$958) Online Health Services Optimization</p> <p>(\$6519) Orthopaedic Extremity Trauma Research</p> <p>(\$958) Orthopaedic Implant Design &amp; Manufactures for TI</p> <p>(\$9968) Pain and Neuroscience Center Research</p> <p>(\$958) Prevention of Compartment Syndrome</p> <p>(\$1581) Respiratory Biodefense Research</p> <p>(\$958) Center for Respiratory Biodefense</p> <p>(\$958) Silver Foam Technologies Healing Research</p> <p>(\$958) Advanced Antimicrobial-Nano Technology</p> <p>(\$958) Adv Bioengineering for Enhancement of Solider Surv</p> <p>(\$958) Biomedical Materials Initiative</p> <p>(\$958) Blast Protection Research</p> <p>(\$958) Bone and Tissue Repair and Regeneration Center</p> <p>(\$958) Carbon Nanotube Production</p> <p>(\$1246) Ctr for Res on Integrative Med in the Military</p> <p>(\$958) Center for the Advanced Studies of Brain Injury</p> <p>(\$2157) CIC Res for Prev, Diagnosis, &amp; Treatment of Cancer</p> <p>(\$1438) Comprehensive Mngt Init for Chronic Diseas (CMICD)</p> <p>(\$958) Computer-based Training Methods for Surgical Trng</p> <p>(\$958) Dev of Minimally Invasive Cardiac-assist Devices</p> <p>(\$479) Diabetes Research - Madigan Army Medical Center</p> <p>(\$479) Epigenetic Origin of Disease Res for Casualty Det</p> <p>(\$958) High Technology Mass Spectromatry Laboratory</p>	

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

BUDGET ACTIVITY	PE NUMBER AND TITLE
<b>2 - Applied Research</b>	<b>0602787A - MEDICAL TECHNOLOGY</b>
(\$479) Hydrogen Sulfide Human Health and Disease Research (\$958) IDEAnet (\$958) Immunostimulating HIV Therapy (\$958) Improving Musulaskkeletal Health and Function (\$958) Infectious Disease Research (\$1534) Integrated Multimedia Medical Record (\$1917) Lehman Injury Research Center/Ryder Trauma Center (\$3834) Military Interoperable Dgital Hospital Testbed (\$958) Neuroprosthetics and BioMEMS Development Project (\$3163) Neutron/Hadron Particle Therapy (\$958) Parallelavax Rapid Vaccine Testing Technology (\$958) Rapid Prototyping Prosthetic Limbs (\$958) Reservist Medical Simulation Training (\$958) Robotic Surgical System (\$1054) Sci, Humanitary Inter, Educ, Learning f/Disasters (\$958) Storage Area Network Impl - Eisenhower Med Center (\$958) Synthetic Malaria Vaccine Research (\$958) Targeted Nanotherapy f/Adv Breast & Prostate Cance (\$958) Viral Immunology Center Rapid Pathogen ID (\$2013) Weapons Agents Bio-Defense Analysis Program (\$2683) Hibernation Genomics	

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>	<b>PE NUMBER AND TITLE</b> <b>0602787A - MEDICAL TECHNOLOGY</b>					<b>PROJECT</b> <b>869</b>			
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
869 T-MED/ADVANCED TECHNOLOGY	2512	2978	3051	3154	3029	3057	3124	3193	

**A. Mission Description and Budget Item Justification:** This project funds applied research in the design and development of physiological status monitoring technology that enables remote monitoring of the Soldier to provide commanders and medics information on health and performance, including performance status (tracking changes in warfighter physical characteristics and physiological capacities), casualty avoidance (preventing environmentally-related non-battle injuries) and wound detection (a signal identifying the occurrence of a wound). The focus is on developing the reliable interpretation of signals from a wearable, integrated system that can monitor Soldier physiological status and provide actionable information. It enables personnel to quickly and accurately determine that a Soldier is fully functional, impaired but still capable of functioning, or in need of medical attention. This information would also be useful in planning the evacuation and treatment of casualties. Work includes identification and initial development of parallel and supporting technologies including medical informatics (science of organizing and interpreting medical information), medical artificial intelligence, and data mining tools that develop predictors of detrimental physiologic changes. Work is performed in coordination with Natick Soldier Center (NSC) and the Future Force Warrior (FFW) program. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; U.S. Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX; and the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD.

<u>Accomplishments/Planned Program:</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Physiological/Life Sign Monitoring: In FY06, completed integration of the sensor suite and algorithms (heart rate, respiration, body posture and activity, ballistic wound detector, fluid intake, sleep status) using wireless body area network technologies. Evaluated performance with the FFW soldier ensemble; completed integration of the initial capability Warfighter Physiological Status Monitoring (WPSM) with FFW Advanced Technology Demonstration; evaluated relationships among variables that signal cardiovascular collapse. WPSM initiatives are coordinated with related efforts in the US Army Medical Research and Materiel's Combat Casualty Care research program. In FY07, evaluate the Spartan network (SPARNET) prototype at the Ranger Training Brigade (RTB); assess its ability to track student hydration, and geo-location; evaluate system scalability and contribution to RTB situational- and medical-awareness, for example, linking data to the Fort Benning Local Area Network to provide a tool to prevent heat casualties in training environments. Evaluate technologies that provide medics with noninvasive measures of human tissue changes that predict shock by blood loss and aid diagnosis of collapsed lungs. In FY08, will test validity of near real-time SPARNET-enabled model predictions of hydration requirements and heat strain using physiological and weather data. Predictive modeling and simulation will be used to support improvements in training doctrine and individual equipment. In FY09, will complete final testing prior to transition of SPARNET-enabled WPSM technologies to the 5th RTB (mountain phase) and 6th RTB (swamp phase), and evaluate training improvements. Conduct experiments with human test volunteers to non-invasively simulate blood loss and to support the development of algorithms to aid in shock prediction.	2512	2920	3051	3154
Small Business Innovative Research/Small Business Technology Transfer Programs		58		
<b>Total</b>	<b>2512</b>	<b>2978</b>	<b>3051</b>	<b>3154</b>

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>	<b>PE NUMBER AND TITLE</b> <b>0602787A - MEDICAL TECHNOLOGY</b>						<b>PROJECT</b> <b>870</b>		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
870 DOD MED DEF AG INF DIS	14774	14768	14981	15360	15742	16103	16412	16851	

**A. Mission Description and Budget Item Justification:** This project supports applied research on medical countermeasures to naturally occurring infectious diseases that pose a significant threat to the operational effectiveness of forces deployed outside the United States. Preventive countermeasures would protect the force from infection and sustain operations by preventing hospitalizations and evacuations from the theater of operations. Of major importance to the military are malaria, bacterial diseases responsible for diarrhea (i.e., caused by Shigella, enterotoxigenic Escherichia coli (ETEC), and Campylobacter), and viral diseases (e.g., dengue fever and hantavirus). This project explores improved materiel to control disease transmission by insects, ticks, and other organisms (vectors) that transmit diseases to humans, thus reducing incidence of these diseases. It also addresses a variety of other infectious disease threats to mobilizing forces, including leishmania, meningitis, viral encephalitis, scrub typhus, and hemorrhagic fevers. Improved diagnostic capabilities will enable rapid battlefield identification important for a commander's medical situational awareness and physician's intervention. Major goals include the discovery and application of new technologies including integration of genomic (DNA-based) and proteomic (protein-based) technologies into vaccine and drug discovery; developing broad spectrum vaccines that can protect against multiple disease strains; and developing improved drugs to prevent or treat malaria. For development of drugs and biological products, preclinical studies in the laboratory and in animal models assess safety, toxicity and effectiveness and are necessary to provide evidence to the Food and Drug Administration to justify approval for that product to enter into future human clinical trials. Additional non-clinical studies are often needed even after candidate products enter into human testing, usually at the direction of the Food and Drug Administration to assess potential safety issues. Drug and vaccine development bear high technical risk; of those candidates identified as promising in initial screens, the vast majority are eliminated after additional safety, toxicity, and/or effectiveness testing. Work is managed by the US Army Medical Research and Materiel Command. As the lead Service for infectious diseases research within the DOD, the Army is responsible for programming and funding all research on joint and Service-specific requirements, thereby precluding duplication of effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and its overseas laboratories; the US Army Medical Research Institute of Infectious Diseases (USAMRIID), Fort Detrick, MD; and the Naval Medical Research Center (NMRC), Silver Spring, MD, and its overseas laboratories.

<b><u>Accomplishments/Planned Program:</u></b>	<b><u>FY 2006</u></b>	<b><u>FY 2007</u></b>	<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>
Drugs to Prevent/Treat Parasitic Diseases: Conduct studies to investigate new candidate drugs. Continue to assess and improve current candidate drugs for prevention and treatment of malaria and/or leishmania, selecting the most effective and safe candidates for continued development. The malaria parasite becomes resistant to the currently licensed drugs making it necessary to continually search for new drugs to maintain the developmental pipeline. In FY06, tested prophylactic (preventive) antimalarial drugs and identified promising candidates for further assessment and validation; identified drugs with known antileishmanial activity for possible further development; continued preclinical testing of a new, safer drug (artesunate) to treat severe malaria. In FY07, assess, design, or disqualify candidate drugs against malaria and leishmania, introducing novel approaches identified in basic research, and continue to refine promising candidates in the developmental pipeline. In FY08, will continue studies to assess, design, or disqualify candidate drugs identified in the drug discovery program. In FY09, will continue effort to test new drugs against malaria and/or leishmania, identified in discovery programs, for applicability as new countermeasures against these disease threats, maintaining a pipeline of new technologies to counter the threat from malaria.	5387	6400	8490	9068

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**February 2007**

BUDGET ACTIVITY	PE NUMBER AND TITLE			PROJECT
<b>2 - Applied Research</b>	<b>0602787A - MEDICAL TECHNOLOGY</b>			<b>870</b>
<p>Bacterial Threats Vaccine Programs: Conduct studies to design and assess antibacterial vaccine candidates to prevent diarrhea and dysentery (a threat to deployed troops), meningitis (a threat to trainee and deployed troops), and scrub typhus (a debilitating disease that is developing resistance to the only treatments available). In FY06, continued to study and validate potential of vaccines against the three major bacterial causes of diarrhea and dysentery. Continued to genetically modify one of the bacteria causing meningitis against which the current vaccine is not effective, for use in manufacturing a more broadly protective vaccine. Successfully demonstrated protection against scrub typhus in a mouse model using a candidate protein-based vaccine and constructed scrub typhus DNA-based vaccine to demonstrate DNA vaccine technology in animal models. In FY07, continue to design and validate potential vaccine candidates against diarrhea, meningitis and scrub typhus, including assessment of new vaccine strategies and of candidate vaccines against diarrhea; complete improved version of meningitis vaccine for assessment in animals; and assess new and revised scrub typhus DNA and protein vaccines in mouse model based on lessons learned in FY06. In FY08, will refine anti-diarrhea vaccine candidates and assess a potential vaccine made of bacterial proteins associated with the bacteria adhering to the gut; establish a model of dysentery (bloody diarrhea caused by Shigella) in nonhuman primates; complete preclinical evaluation of new diarrheal and meningitis vaccines. In FY09, will continue systematic examination of potential adhesion bacterial proteins as new vaccines and other countermeasures against diarrhea; continue genetic modification of meningitis bacteria based upon ongoing efforts to improve range of protection induced in animal models, and test new scrub typhus proteins as potential candidates in a broadly protective vaccine.</p>	4620	3942	2348	2146
<p>Insect Vector Control and Infectious Disease Diagnostics Programs: Develop interventions that protect warfighters from insect bites that transmit diseases and design new medical diagnostic and surveillance tools for the field. Sand flies can transmit Leishmania and different species of mosquitoes can transmit dengue fever and malaria. In FY06, assessed a sand fly field identification system and sand fly control materials including insecticides and disease detection systems for use by Preventive Medicine Units. Tested new insect repellents as possible replacements for the current military repellent. Evaluated and/or refined clinical laboratory tests compatible with standard military lab diagnostic systems and rapid tests for use by physicians in clinics for diagnosis of several militarily important diseases (dengue fever, diarrheal agents, malaria, and leishmania). In FY07, conduct studies to find better ways to protect from insect-borne diseases and to improve medical diagnostic capabilities in the field. Refine field pathogen detection kits; continue to assess sand fly preventive medicine materials and an improved standard bed net that is an effective barrier to the tiny sand flies. Continue to develop improved laboratory diagnostics for malaria and diarrheal diseases. In FY08, will refocus effort to reduce disease threat from insects other than sand flies including testing of insect-based pathogen detection assays; downselect a new insect repellent for final formulation, and continue to improve medical diagnostic capability in the field. Assess individual and combined components of diagnostic tests for selected infectious disease agents and begin design of next-generation diagnostic assays. In FY09, will investigate new interventions methods that reduce/prevent biting by insect vectors and will design and evaluate new medical diagnostic and surveillance tools for the field to improve the medical response to threats for which solutions have not been found.</p>	1462	2040	2071	2137
<p>Viral Threats Vaccine Programs: Design and test new vaccine candidates against dengue and hantaviral hemorrhagic fever viruses (infections resulting in internal bleeding) and assess newer technologies to protect against other lethal viral diseases. In FY06, conducted preclinical studies of second-generation dengue vaccine; established method to rapidly screen samples from vaccinated persons to determine if they had a response to the vaccine; demonstrated that a DNA vaccine for a second hantavirus strain could protect against that strain in an animal model; and continued preclinical studies of DNA vaccines for hantavirus. In FY07, continue developing and testing new vaccine candidates against dengue and hantaviruses, and assess new technologies to protect against other lethal viral diseases. In FY08, will evaluate new antiviral vaccines against newly identified emerging viral threats, and conduct preclinical studies of a combined DNA vaccine against several highly lethal viruses including Rift Valley fever, Crimean Congo hemorrhagic fever, and tick-borne encephalitis. In FY09, will continue to assess and evaluate new antiviral vaccines and examine use of human antibodies (protective</p>	3305	2373	2072	2009

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<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>	<b>PE NUMBER AND TITLE</b> <b>0602787A - MEDICAL TECHNOLOGY</b>			<b>PROJECT</b> <b>870</b>
immune proteins found in the blood) as an alternative approach to vaccines for protecting or treating viral disease threats.				
Small Business Innovative Research/Small Business Technology Transfer Programs		13		
<b>Total</b>	14774	14768	14981	15360

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<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>	<b>PE NUMBER AND TITLE</b> <b>0602787A - MEDICAL TECHNOLOGY</b>					<b>PROJECT</b> <b>873</b>		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
873 HIV EXPLORATORY RSCH	9474	11306	11319	11456	10780	10849	11088	11332

**A. Mission Description and Budget Item Justification:** This project supports the medical technology area of the Future Force by conducting applied research and development of improved diagnostics, surveillance, and epidemiology (the study of the causes, distribution, and control of disease in populations), and candidate vaccines for prevention and treatment of Human Immunodeficiency Virus (HIV) infection. HIV is the virus that causes the disease of Acquired Immunodeficiency Syndrome (AIDS). This program is jointly managed through an Interagency Agreement between the US Army Medical Research and Materiel Command (USAMRMC) and the National Institutes of Allergy and Infectious Diseases. Main efforts include development and preclinical studies (studies required before testing in humans) of candidate vaccines, such as small animal and nonhuman primate studies, as well as laboratory methods to assess vaccine protection, improved diagnosis of HIV infection, and improved prognostic assessment and disease management of HIV-infected individuals. This project contains no duplication with any effort within the Military Departments or other government organizations. Work is related to and fully coordinated with work funded in PE 0603105, project H29. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and its overseas laboratories; and the Naval Medical Research Center (NMRC), Silver Spring, MD, and its overseas laboratories. Most work is conducted under a cooperative agreement with the Henry M. Jackson Foundation (HMJF), Rockville, MD.

<b><u>Accomplishments/Planned Program:</u></b>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
HIV Research Program: Conduct projects assessing new HIV vaccine candidates, vaccine test site development worldwide, assessment of HIV disease outbreaks, and genetic assessment of HIV threat. In FY06, continued preclinical testing of candidate vaccines; conducted global surveillance and genetic analyses of new emerging HIV subtypes (genetically divergent strains) collected by DOD; developed new international field trial sites; continued US Military Clinical Intervention Network (MCIN) operations to study the frequency and impact of HIV/AIDS in/on military populations; and continued technical watch for new drugs that protect against HIV/AIDS. In FY07, continue with assessment of new HIV vaccine candidates, additional vaccine test site development in Africa and Asia, and epidemiological and genetic assessment of the HIV threat. Continue vaccine testing using a "prime-boost" vaccine strategy (using a combination of two different vaccines to try to induce strong and long-term protective immune response); evaluation of animal and human physiological responses that correlate with disease protection for assessing effectiveness of vaccines in humans; and assessing novel vaccine strategies. In FY08, will continue ongoing long-term candidate vaccine refinement based on the studies of the globally-prevalent HIV viral subtypes; continue to improve methodologies for medical monitoring of DOD personnel's viral exposure and infection; and continue to improve and integrate new methods to assess effectiveness of candidate vaccines in support of clinical research (tests in humans). In FY09, will continue the long-term efforts to find solutions to the HIV threat to DOD personnel with ongoing studies directed at assessing new HIV vaccine candidates, vaccine test site assessment and development in Africa and Asia, and assessment of continuing changes in global risk and genetic makeup of HIV threat to US forces to help direct future research and intervention programs.	9474	11007	11319	11456
Small Business Innovative Research/Small Business Technology Transfer Programs		299		
<b>Total</b>	<b>9474</b>	<b>11306</b>	<b>11319</b>	<b>11456</b>

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>	<b>PE NUMBER AND TITLE</b> <b>0602787A - MEDICAL TECHNOLOGY</b>						<b>PROJECT</b> <b>874</b>		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
874      CBT CASUALTY CARE TECH	14471	13531	14692	8983	9077	9144	9345	9551	

**A. Mission Description and Budget Item Justification:** This project supports applied research to develop and assess the feasibility of concepts, techniques, and materiel that improve survivability and assure better medical treatment outcomes for warfighters wounded in combat and military operations other than war. The focus is on improving the effectiveness of medical treatment in the pre-hospital setting and during evacuation. Major areas of emphasis include hemorrhage control (novel bandages and techniques), resuscitation (fluid replacement and oxygen delivery), prognostics and diagnostics (predictive indicators, decision aids, and devices for triage), life support (computerized monitors and autonomous patient care devices), and repair (novel treatments to minimize tissue damage and accelerate restoration of function). This project also funds research to enable better medical training for Soldiers, medics, and other battlefield medical personnel, to reduce evacuations due to dental disease, and reduce the medical logistics footprint (weight, cube, number of personnel) on the battlefield. For development of drugs/biological products/medical devices, preclinical studies in the laboratory and in animal models assess safety, toxicity, and effectiveness and are necessary to provide evidence to the Food and Drug Administration to justify approval for that product to enter into future human clinical trials. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the US Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX; the US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; and the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD.

<b><u>Accomplishments/Planned Program:</u></b>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Hemorrhage Control, Blood, and Resuscitative Fluids-including materials and systems for minimizing the effects of traumatic blood loss, preserving blood and blood products, and trauma resuscitation: In FY06, identified new products for intravenous control of bleeding; evaluated freeze-dried plasma (alternative to frozen plasma); identified a product derived from blood components that causes coagulation to restore clotting function in wounded Soldiers for further study; investigated damage to blood products as a result of storage over time; demonstrated survival benefit of resuscitation with whole blood; and developed preclinical model of blast trauma. In FY07, complete stability studies of freeze-dried plasma prior to beginning human trials; select best method to inactivate disease-causing agents in blood to prevent disease transmission from transfusions; develop preclinical models of abnormal blood clotting in combined injury, bleeding and massive resuscitation model; define resuscitation strategies to correct abnormal clotting; begin to engineer a nonperishable fluid to mimic fresh whole blood; complete comparative experiments to determine the best new fluid for resuscitation; and select the most promising additive to reduce tissue and organ injury, inflammation and the shock in severely injured patients. In FY08, will identify new strategies to treat the abnormal blood clotting response in severely injured patients; establish effects of resuscitation to treat blast-trauma-hemorrhage on brain and lung; determine if red cells lose efficacy near the end of their shelf life. Also, will test products and methods of using a foam blood clotting agent to stop internal bleeding. In FY09, will identify specific diagnostic and therapeutic interventions for abnormal blood clotting from the candidates identified in FY08 and optimize resuscitation strategies for blast-trauma-hemorrhage on brain and lung in small animal models. Investigate methods to freeze-dry red cells.	7188	6050	7747	5138
Combat Trauma Therapies-including identification and development of candidate drugs and medical procedures to minimize the effects of combat injuries: In FY06, evaluated several devices which use infrared light to assess wound cleaning and tissue health in animal models; selected best material for repair of bone defects; used the Penetrating Head Injury (PHI) animal model in further studies to evaluate the	1992	3800	4000	1552

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

**BUDGET ACTIVITY**  
**2 - Applied Research**

**PE NUMBER AND TITLE**  
**0602787A - MEDICAL TECHNOLOGY**

**PROJECT**  
**874**

body's responses to a PHI. The head injury effort is coordinated with related efforts under the Military Operational Medicine Research Program in PE 0602787A, project 878. In FY07, begin a long-term collaborative effort to restore function of limbs by reducing infections and regenerating skin, muscle, and bone in battle-injured extremities; evaluate a method of cooling the brain as a neuroprotection therapy, and study a drug to enhance brain function as post-injury rehabilitation for brain trauma. In FY08, will assess emerging therapeutics (stem cell therapy, growth factors) in animal models and assess new methods to repair areas with major injuries caused by projectiles; develop selective brain cooling and neuroregeneration for early intervention and treatment; establish neuroprotection initiatives on neuroregeneration methods to reduce death and sickness resulting from brain trauma including stem cell therapies, tissue grafts, and a drug to improve new learning and memory; complete studies of FDA-licensed drugs that are anti-seizure candidates for Silent Brain Seizure (SBS) therapy; and design a prototype device for brain injury diagnostics. In FY09, will focus tissue regeneration activities on the most promising clinical treatments in blood vessel grafts, muscle regeneration, regeneration of bones in the head and face; and preclinical assessment of long-bone regeneration; will continue to refine selective brain cooling and neuroregeneration for early intervention and treatment; and conduct drug combination studies for the treatment of acute brain trauma.

Far-Forward Medical Systems-including diagnostic and therapeutic medical devices and associated algorithms, software and data processing systems for resuscitation, stabilization, life-support, surgical support, and dental care treatments that can be applied in a pre-hospital, operational field setting: In FY06, completed preclinical evaluation of a software algorithm for automated fluid resuscitation based on blood pressure, which works for all currently-available resuscitation fluid types; assessed performance of the Warfighter Physiological Status Monitoring (WPSM) with the Future Force Warrior ensemble; continued experiments to provide additional data for identification of markers of impending shock through refinement of algorithms; identified simple medical measurements such as variability of heart rate as a signal of impending cardiovascular collapse requiring life saving intervention; completed several toxicity and formulation studies of a compound (antimicrobial/antiplatelet) to prevent tooth decay. The WPSM activities are coordinated with related efforts under the Military Operational Medicine Research Program in PE 0602787A, project 869 and PE 0603002, project 800. In FY07, complete preclinical evaluation of a software algorithm for automated ventilation and oxygen administration based on lung mechanics and blood gas measurements; and complete remaining toxicity and formulation studies on the antimicrobial, antiplatelet compound. In FY08, will complete preclinical evaluation of simultaneous operation of closed loop control of ventilation, oxygen administration and fluid administration and identify, from a number of candidates, a hardware platform. In FY09, will complete preclinical evaluation of oxygen, ventilation and fluid resuscitation algorithms in an integrated hardware platform (either the Army's integrated litter or the Navy's Lightweight Trauma Module) for casualty transport.

Combat Casualty Bioinformatics and Simulation-focuses on a data management system to capture and analyze time series data such as heart and respiration rates over time, and development of casualty simulations and durable, realistic simulators for initial and reinforcement training of care providers: In FY06, improved database user interfaces and incorporated features to allow storage of data from additional studies; and finalized technical testing of prototype Advanced Medic Training Technologies system, designed to teach medics basic skills. In FY07, refine components of a deployable medical simulation training system for reinforcement training of far-forward care providers and design new technologies to add to simulators that depict realistic battlefield injuries to train combat medics in treatment of severe trauma. This effort builds upon previous medical simulator technology effort through the introduction of simulated skin, flesh and blood. This will increase realism of models to reduce the need for live tissue (animal) training for trauma treatment. In FY08, will complete prototype patient trauma simulations with advances in material sciences that depict realistic skin, flesh, blood, bone, fluids, and organs, as well as sensor (detects and provides feedback on medic interventions) and simulated fluid loss technologies. In FY09, will support testing and perform evaluation of the trauma simulation components developed in a joint RDECOM/MRMC effort to assess training effectiveness at Army Medical Department Center and School and other military training venues.

	4834	2200	1186	1228
	457	1290	1759	1065

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>	<b>PE NUMBER AND TITLE</b> <b>0602787A - MEDICAL TECHNOLOGY</b>		<b>PROJECT</b> <b>874</b>	
Small Business Innovative Research/Small Business Technology Transfer Programs		191		
<b>Total</b>	14471	13531	14692	8983

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>	<b>PE NUMBER AND TITLE</b> <b>0602787A - MEDICAL TECHNOLOGY</b>						<b>PROJECT</b> <b>878</b>		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
878 HLTH HAZ MIL MATERIEL	9294	13718	14017	14502	13715	13863	14169	14479	

**A. Mission Description and Budget Item Justification:** This project supports the Medical and Survivability technology areas of the Future Force with a focus on providing Soldier protection from health hazards associated with materiel and operational environments. Emphasis is on identifying health hazards inherent to the engineering design and operational use of equipment, systems, and materiel used in Army combat operations and training. Major areas of emphasis include battlefield lasers, ballistic, and mechanical injury (e.g., models of protection by soft body armor), health hazards of operations in environmental extremes, and toxic environments. Specific hazards addressed include blast overpressure generated by weapons systems, toxic chemical hazards associated with deployment into environments contaminated with industrial and agricultural chemicals (which compliment ongoing Defense Threat Reduction Agency initiatives for chemical/biological threat agent detection), directed energy sources (laser), and environmental stressors (heat, cold, and high altitude). Specific research tasks include characterizing the extent of exposure to potential hazards; delineating exposure thresholds for illness, injury, and performance degradation; establishing biomedical databases to support protection criteria; and developing and validating models for hazard assessment, injury prediction, and health and performance protection. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; the US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; the United States Army Center for Environmental Health Research (USACEHR), Fort Detrick, MD; and the US Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL.

<b><u>Accomplishments/Planned Program:</u></b>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
Laser Protection Research: In FY06, completed assessment of advanced therapy (anti-inflammatory treatment with FDA-licensed drugs) for the treatment of laser exposure from military systems; Updated Army Regulation AR 11-9, (Army Radiation and Safety Program, which established safe exposure limits for laser radiation in the near infrared wavelength range) by augmenting it with laser eye injury threshold limits for exposure pertinent to military systems, after coordination with the American National Standards Institute. In FY07, examine candidate drug therapy interventions for laser-induced eye injuries and monitor recovery rates of nerve fibers, which are responsible for eye-to-brain data transmissions. In FY08, will complete functional assessment of visual acuity recovery in a behavioral model based on emerging laser injury research to determine the best eye injury treatment approach; and will refine a strategy for combined drug therapies in treatment of laser and trauma-induced eye injuries (blast, fragments). In FY09, will utilize animal testing to assess laser eye injury hazards from advanced military systems. Will evaluate a combination of drugs for treatment of laser induced eye injury.	2204	1694	1960	2706
Injury Protection (face/eye): In FY06, produced dose-response models, i.e., models that compare injury type and severity with projectile characteristics, that predict varying levels of eye injury severity as a result of projectile impacts such as those caused by secondary blast effects. These predictive models of injury risk are available for use by the US Army Soldier Systems Center, Natick MA, to enhance their development of protective equipment. In FY07, use laboratory tests and injury trend data to assess computational and physical models of the face and eye, and propose injury-based protection criteria. In FY08, will validate and transition physical model and face/eye injury dose-response models to Army materiel developers. In FY09, will design an impact test methodology for assessing face shield performance.	2016	3661	3613	3221
Pulmonary Hazards and Risk Assessment Models: In FY06, validated a body armor blunt trauma test device with animal injury data and	2183	4482	4530	5070

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

**BUDGET ACTIVITY**  
**2 - Applied Research**

**PE NUMBER AND TITLE**  
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**PROJECT**  
**878**

released a body armor blunt trauma testing method with human injury prediction software to the Research, Development, and Engineering Command/Natick Soldier Center. This new testing method enables body armor developers to test novel ballistic materials for lighter body armor. Conducted small-animal tests to establish dose-response effects of inhaled hydrogen chloride (a typical component of fire gases generated behind defeated vehicle armor) to help refine the Toxic Gas Assessment Software-Performance Evaluator (TGAS-PE) model that predicts human injury and performance decrements resulting from exposure to inhaled fire gases. In FY07, develop assessment software that predicts lung damage progression caused by blunt impacts and severe injuries. Conduct large-animal tests to determine the effects of inhaled toxic fire gases on physical performance. In FY08, will develop an integrated model that will predict lung injury and performance outcomes from exposures to combined insults of blast over-pressure and blunt trauma. Will collect experimental data required to expand the scope of the TGAS-PE model to predict the impact of inhaled fire gas exposures on physical performance. In FY09, will use new and existing animal injury and performance data to validate the integrated blast overpressure/blunt trauma lung injury and performance model. Will use large animal performance data to validate the TGAS-PE model for performance impacts from exposure to inhaled toxic fire gases and release TGAS-PE1 (performance) to survivability assessors for live-fire vehicle testing.

Biomonitor System/Dehydration Research: In FY06, tested a set of toxicity sensors and selected best candidates for incorporation into an environmental sentinel biomonitor system to allow rapid identification of toxicity levels in drinking water samples. Determined that dehydration degrades performance during high-altitude missions but does not degrade performance in cold environments, and modified existing medical doctrine based on findings. In FY07, design and verify models to predict water needs for a broad spectrum of modern missions in environmental extremes; complete laboratory testing of an environmental sentinel biomonitor platform that integrates toxicity sensor information to provide rapid analysis of drinking water quality; and refine and validate models to predict water needs for a broad spectrum of modern missions in environmental extremes. In FY08, will conduct field testing of the environmental sentinel biomonitor system to demonstrate capability to rapidly assess drinking water quality and provide relevant health risk information to decision makers on toxic hazards in water. Will conduct laboratory studies using human subjects data to assess the effects of nutritional countermeasures (such as caffeine) on fluid balance and performance when working in hot environments. In FY09, will assess technologies for rapidly identifying chemical contamination by Toxic Industrial Chemicals (TICs) and that are appropriate for use with field water production equipment. Will conduct field test to evaluate novel hardware solutions, such as on-the-move enhanced fluid and nutrient delivery systems to enhance fluid and electrolyte delivery to Soldiers.

Small Business Innovative Research/Small Business Technology Transfer Programs

Total

2891	3617	3914	3505	
	264			
9294	13718	14017	14502	

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>	<b>PE NUMBER AND TITLE</b> <b>0602787A - MEDICAL TECHNOLOGY</b>						<b>PROJECT</b> <b>879</b>		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
879 MED FACT ENH SOLD EFF	9002	9966	10021	10327	9894	9968	10187	10411	

**A. Mission Description and Budget Item Justification:** This project supports applied research with a focus on sustaining and enhancing Soldier health and performance during military operations in the full spectrum of military environments. Emphasis is on identification of baseline physiological performance and assessment of degradations produced by operational stressors. The resulting databases and collection of rules and algorithms for performance degradation in multi-stressor environments form the basis for the development of behavioral, training, pharmacological, and nutritional interventions, including psychological debriefing, to prevent degradation in Soldier health and sustain Soldier performance. Key stressors include psychological stress from isolation, new operational roles, frequent deployments; inadequate restorative sleep; prolonged physical effort, and inadequate hydration in extreme environments. Will also assess the adverse effect of shifting biological rhythms during deployments across multiple time zones (extreme jet lag), night operations, and thermal and altitude stress. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; the US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; and the US Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL.

<b><u>Accomplishments/Planned Program:</u></b>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
High Altitude Research: In FY06, evaluated potential changes to pre-deployment doctrine that addresses requirements for the acceleration of altitude acclimatization. Designed and evaluated a high-carbohydrate diet for reducing the incidence of acute mountain sickness and determined that this nutritional approach was more effective than traditional creatine or antioxidant supplements. Discovered that partial acclimatization of individuals to altitude (e.g., living at Fort Carson) provides nearly complete protection against altitude effects at altitudes as high as 12,600 feet (the Army's Pike's Peak Laboratory). Completed altitude chamber studies with intermittent hypoxia exposure (exposure to air with lowered oxygen content) that indicated utility of this method to substantially reduce acclimatization time. In FY07, refine predictive models of altitude acclimatization and complete studies to determine how to optimally accelerate high altitude acclimatization through intermittent exposure to reduced levels of oxygen. In FY08, will integrate doctrinal and technological components into the prototype Altitude Readiness Management System (ARMS), a personalized digital assistant device designed to use altitude and physiological modeling data to monitor individual susceptibility to adverse health and performance at high altitudes. ARMS will provide an enhanced planning and prediction capability. In FY09, will reexamine approaches to reduce performance degradation caused by altitude illness by evaluating the benefits of various drug interventions.	2425	2686	2888	2657
Fatigue/Sleep Research: In FY06, developed an initial laboratory version of the Fatigue Intervention and Recovery Model (FIRM) that predicts the amount of sleep recovery needed for military units following a period of extended sleep restriction allowing optimization of Soldier recycle rate. FIRM also provides an estimate of the variability of the performance prediction based on the quality and amount of data input, and makes some initial predictions on the effects of a fatigue countermeasure on psychomotor performance, for example, caffeine's effects on performance measures such as reaction time and ability to sustain vigilance. In FY07, conduct field studies to improve Soldier effectiveness predictions and assess the efficacy of drug countermeasures for individual Soldiers. In FY08, will conduct laboratory studies to assess predictions of performance effectiveness and the efficacy of drug interventions for individual Soldiers. In	1194	1590	1712	1682

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

BUDGET ACTIVITY	PE NUMBER AND TITLE			PROJECT
<b>2 - Applied Research</b>	<b>0602787A - MEDICAL TECHNOLOGY</b>			<b>879</b>
FY09, will further integrate components of the next-generation FIRM, which will include enhanced capability for prediction of the effects of stimulants, into the Sleep History and Readiness Predictor (SHARP).				
Mental Health Research: In FY06, conducted two field tests that assessed the effectiveness of strategies such as psychological debriefing following traumatic events in reducing psychiatric illness in soldiers. The results of these studies may help to improve the mental health of Soldiers returning from deployments in Iraq. In FY07, determine the impact of deployment length and frequency of deployments in identifying unit/individual characteristics that enhance resilience. In FY08, will assess individual intervention strategies such as DoD post-deployment health assessment and post-deployment reassessments, leader development tools such as pre-deployment-battlemind-training, and Soldier and leader training modules including post-deployment-battlemind-training and spouse battlemind training. In FY09, will develop unit-level intervention tools for military-wide implementation to improve warfighter resiliency, health, and performance.	2848	3153	2835	3600
Vision and Auditory Research: In FY06, evaluated performance of hearing enhancement and protective devices for mounted and dismounted warfighters; conducted a Vice-Chief of Staff Army-directed feasibility study to replace the combat vehicle crewman helmet with the Army Combat Helmet and a headset. As a result of this study the decision was made not to replace the combat vehicle crewman helmet with the Army combat helmet and headset. These findings will reduce the incidence of trauma-based hearing loss among deployed to Iraq. In FY07, use data generated in human and animal studies to initiate evaluation of a hearing damage model, Auditory Hazard Assessment Algorithm for the Human Ear, to assess its utility in performing auditory health risk assessments and guiding development of hearing protection devices. In FY08, will conduct preclinical studies to compare the effectiveness of various pharmacological agents (such as antioxidants) in preventing and treating acoustic trauma. In FY09, will complete studies required to verify utility of the Auditory Hazard Assessment Algorithm for the Human Ear in predicting hearing loss and guiding development of hearing protection devices.	2535	2450	2586	2388
Small Business Innovative Research/Small Business Technology Transfer Programs		87		
<b>Total</b>	<b>9002</b>	<b>9966</b>	<b>10021</b>	<b>10327</b>

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>		<b>PE NUMBER AND TITLE</b> <b>0602787A - MEDICAL TECHNOLOGY</b>					<b>PROJECT</b> <b>FH2</b>		
COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	
FH2 FORCE HEALTH PROTECTION - APPLIED RESEARCH	6787	8309	8463	8802	8517	8681	8872	9067	

**A. Mission Description and Budget Item Justification:** This project supports applied research directed toward the sustainment of a healthy force of warfighters from accession through retirement. This research focuses on enhanced protection of Soldiers against health threats in military operations and training. Stressors that adversely affect individual Soldier health readiness are identified and studied in order to develop interventions that will protect Soldiers and improve their health and performance in stressful environments. This is follow on research that extends and applies findings from a decade of research on Gulf War Illnesses (GWI) and other chronic multisymptom illnesses that have suspected nerve and behavioral alterations due to environmental contaminants and deployment stressors. Force Health Protection (FHP) applied research is conducted in close coordination with the Department of Veterans Affairs. The program has the following three major thrust areas: (1) global health monitoring; (2) health behavior interventions and health risk communication (e.g., weight management and benefits of exercise); and (3) health risk assessment methods and medical materiel safety (e.g., interactions of operational stressors (e.g., interactions of operational stressors such as heat strain, psychological trauma, and pesticides) with neurotoxic chemical exposures including petroleum products and insecticides). The goals of the Health Behavior/Weight Control effort are to evaluate the effectiveness of specific health behavior interventions, modification to establish their benefit to readiness, especially non-drug, neuroprotection that comes from an informed and positive lifestyle. This project contains no duplication with any effort within the Military Departments and includes direct participation by other Services working on Army projects. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA.

<b><u>Accomplishments/Planned Program:</u></b>	<b><u>FY 2006</u></b>	<b><u>FY 2007</u></b>	<b><u>FY 2008</u></b>	<b><u>FY 2009</u></b>
Nerve-based Disease Research: In FY06, conducted detailed neuropsychological testing to characterize behavioral and cognitive changes associated with deployment in Operation Enduring Freedom, measuring deployment, and redeployment effects in various units across the Army. This established normal deployment-related changes due to operational factors, and provides a baseline for comparison of future test results. In FY07, further characterize cognitive and behavioral changes associated with deployment, and assess the time it takes for recovery. Refine the Automated Neuropsychological Assessment Metric (ANAM) test battery to a minimum number of robust, reproducible, and well-validated set of tests, which provide measures of change in psychological and neural functioning due to military operational impacts. In FY08, will complete a study of relationships between military occupation and nerve degeneration diseases. Will complete comprehensive data collection on the health effects of exposure to jet fuel in a military setting. Plan to complete examination of individual permethrin (insect repellent) exposure and dose levels in different environmental settings designed to simulate operationally relevant scenarios. In FY09, complete analyses of the association between jet fuel exposure over a workweek and nervous system health outcomes. Will complete studies of head trauma (i.e. head impact due to poor parachute landings and boxing as models) and neuropsychological adverse effects (mood and cognitive function).	3687	6065	6313	4692
Health Behavior/Weight Control: In FY06, completed an evaluation of the Army Weight Control Program that led to a change in current regulations and standards, allowing for increased body fat standard accommodation with higher levels of fitness. The validation involved extensive laboratory-based measurements and field implementation experiments to ensure that the changes in the regulation provide	3100	2010	2150	4110

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2007**

**BUDGET ACTIVITY**  
**2 - Applied Research**

**PE NUMBER AND TITLE**  
**0602787A - MEDICAL TECHNOLOGY**

**PROJECT**  
**FH2**

substantive improvements in management of health and fitness of the Army. This modification permits increased recruitment and retention of fully qualified performers that are not at increased risk for deployment health issues. Completed evaluation of a Personal Digital Assistant based weight management program. In FY07, develop a diet and exercise program for redeployed Soldiers to reduce body fat without loss of lean body tissue (including bone and muscle). In FY08, will assess novel military weight management programs that include food intake monitoring, meal replacement, and portion size retraining. Will complete analysis of two community based interventions programs for military weight management in active duty and reserve forces. In FY09, will characterize the benefits of scientifically based fitness programs in protecting Soldiers against near and long-term disease risks, with special emphasis on the relationship between weight management, fitness habits, and pre-diabetes health and performance consequences. Will develop and test programs to enhance physical readiness of reserve forces. Will complete collaborative study with University of California and the Army Institute for Creative Technologies, which is focused on developing new technology for training interventions to prevent health damaging behaviors, optimize personal fitness, and increase operational readiness.

Small Business Innovative Research/Small Business Technology Transfer Programs

234

Total

6787

8309

8463

8802