Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army											Date: February 2018	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602787A / *Medical Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**	**Cost To Complete**	**Total Cost**
Total Program Element	-	78.341	83.434	90.075	-	90.075	94.708	93.828	96.041	97.431	0.000	633.858
869: *Warfighter Health Prot & Perf Stnds*	-	36.586	40.201	35.777	-	35.777	39.136	41.246	42.110	42.803	0.000	277.859
870: *Dod Med Def Ag Inf Dis*	-	20.841	22.234	21.651	-	21.651	22.081	19.405	19.813	20.209	0.000	146.234
874: *Cbt Casualty Care Tech*	-	9.849	11.127	12.781	-	12.781	14.944	15.063	15.431	15.615	0.000	94.810
ET4: *Appl Resch in Clinical and Rehabilitative Medicine*	-	6.993	7.871	12.138	-	12.138	7.133	6.392	6.402	6.241	0.000	53.170
VB3: *MEDICAL TECHNOLOGY INITIATIVES (CA)*	-	2.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.000
VB4: *System Biology And Network Science Technology*	-	2.072	2.001	2.008	-	2.008	2.050	2.099	2.143	2.187	0.000	14.560
XV5: *Medical Capabilities to Support Dispersed Operations*	-	0.000	0.000	5.720	-	5.720	9.364	9.623	10.142	10.376	0.000	45.225

Note

Funding for Medical Simulation and Information Sciences in project XV5 begins in FY19

A. Mission Description and Budget Item Justification

This Program Element (PE) supports application of knowledge gained through basic research to refine drugs, vaccines, medical devices, diagnostics, medical practices/ procedures, and other preventive measures essential to the protection and sustainment of Warfighter health. Research is conducted in five principal areas: Combat Casualty Care, Military Operational Medicine, Military Relevant Infectious Diseases, Clinical and Rehabilitative Medicine, Medical Simulation and Information Sciences, and Systems Biology/Network Sciences.

Research is funded in six projects.

Project 869 refines knowledge and technologies on screening tools and preventive measures for post-traumatic stress disorder (PTSD) and mild traumatic brain injuries, physiological monitors, and interventions to protect Warfighters from injuries resulting from operational stress, and exposure to hazardous environments and materials. Also conducts research on medically valid testing devices (i.e., the test mannequins that are true to the human form and physiologically and anatomically accurate) and predictive models used for the refinement of Warfighter protective equipment. This project is being coordinated with the Defense Health Agency.

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Project 870 designs and refines drugs, vaccines, medical diagnostic assays/tests devices, other preventive measures for protection and treatment against naturally occurring infectious diseases as identified by worldwide medical surveillance and military threat analysis. This project is being coordinated with the Defense Health Agency.

Project 874 identifies and evaluates drugs, biologics (medical products derived from living organisms), medical devices, and diagnostics for field trauma care systems, resuscitation, and life support, and post-evacuation restorative and rehabilitative care. Focus is identifying more effective critical care technologies and clinical practice guidelines to treat severe bleeding, traumatic brain injury, burns and other combat related traumatic injuries, and treatments for ocular (eye) injury and visual system dysfunction. Additional focus areas are laboratory and animal studies of regenerating skin, muscle, nerves, vascular and bone tissue for the care and treatment of wounded Service Members. This project is being coordinated with the Defense Health Agency.

Project ET4 identifies and evaluates drugs, biologics, medical devices, treatments and diagnostics for post-evacuation restorative, regenerative and rehabilitative care, as well as systems for use by field medics and surgeons for ocular trauma. Research focus is on identifying more effective technologies and protocols to treat ocular injury and visual system dysfunction, as well as laboratory and animal studies for regenerating skin, muscle, nerves, vascular and bone tissues for the care and treatment of wounded Service Members. This project is coordinated with the Defense Health Agency.

Project VB4 includes applied research in systems biology to provide a highly effective mechanism to integrate biological tests and computer simulations in clinical trials and in animal studies. The PTSD and coagulopathy exemplars have demonstrated the power of an iterative systems biology approach and are moving projects related to objective diagnostics and improved and personalized therapeutic strategies. Development of the SysBioCube (a data analysis, management and integration system) has provided the ability for complex collaborative efforts to share, process, and evaluate data using innovative technologies. These concerted refinement efforts using systems biology are showing reduction of time and funding for solutions to intractable problems of critical military importance.

Project XV5 conducts applied research on health information technologies that support combat casualty care under conditions of dispersed small-unit operations or requiring prolonged field care before evacuation. Technologies include autonomous casualty care systems and virtual health communications for Roles of Care one (combat medic and battalion aid station) through three (field hospital).

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology, focus areas and the Army Modernization Strategy.

All medical applied research is conducted in compliance with Food and Drug Administration (FDA) or Environmental Protection Agency (EPA) regulations. The FDA requires thorough testing in animals (preclinical testing) to ensure safety and, where possible, effectiveness prior to evaluation in controlled human clinical trials (upon transition to 6.3 Advanced Technology Development). This PE focuses on research and refinement of technologies such as product formulation and purification and laboratory test refinement with the aim of identifying candidate solutions. This work often involves testing in animal models. The EPA also requires thorough testing of products, such as sterilants, disinfectants, repellents, and insecticides to ensure the environment is adequately protected before these products are licensed for use.

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Program refinement and execution is externally peer-reviewed and fully coordinated with all Services as well as other agencies through the Joint Technology Coordinating Groups of the Armed Services Biomedical Research Evaluation and Management (ASBREM) Community of Interest (COI). The ASBREM COI, formed under the authority of the Assistant Secretary of Defense for Research and Engineering, serves to facilitate coordination and prevent unnecessary duplication of effort within the Department of Defenses (DoD) biomedical research and refinement community, as well as their associated enabling research areas.

Work funded in this PE is fully coordinated with efforts undertaken in PE 0603002A (Medical Advanced Technology) and the Defense Health Program.

B. Program Change Summary ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	77.111	83.434	88.575	-	88.575
Current President's Budget	78.341	83.434	90.075	-	90.075
Total Adjustments	1.230	0.000	1.500	-	1.500
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	2.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.582	-			
• Adjustments to Budget Years	0.832	-	1.500	-	1.500
• FFRDC	-0.020	-	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2017	FY 2018
Project: VB3: *MEDICAL TECHNOLOGY INITIATIVES (CA)*		
Congressional Add: *Military operational medical research program*	2.000	-
Congressional Add Subtotals for Project: VB3	2.000	-
Congressional Add Totals for all Projects	2.000	-

Change Summary Explanation

FY17 Congressional increase in VB3 Medical Technology Initiatives

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / *Medical Technology*	Project (Number/Name) 869 / *Warfighter Health Prot & Perf Stnds*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
869: *Warfighter Health Prot & Perf Stnds*	-	36.586	40.201	35.777	-	35.777	39.136	41.246	42.110	42.803	0.000	277.859

Note

Starting in Fiscal Year (FY) 2019 a number of efforts were consolidated into the four main thrust areas.

A. Mission Description and Budget Item Justification

This project conducts research to prevent and protect Warfighters from training and operational injuries, refine mechanisms for detection of physiological (human physical and biochemical function) and psychological (mental) health problems, evaluate hazards to head, neck, spine, eyes, and ears, set the standards for rapid return to duty, and determine new methods to sustain and enhance performance across the operational spectrum. This research provides medical information important to the design and operational use of military systems, and this work forms the basis for behavioral, training, pharmacological (drug actions), and nutritional interventions.
The four main areas of study are:

(1) Environmental Health and Protection
(2) Physiological Health and Performance
(3) Injury Prevention and Reduction
(4) Psychological Health and Resilience

Additionally the Warfighter Systems Engineering Architecture task advances medical science and technology (S&T) in the areas of injury prevention and performance sustainment in the context of human interaction with new Soldier systems, and provides greater insight into informing new research in developing Warfighter systems and the interactions between Warfighters and the systems they employ.
Promising efforts identified in this project are further matured under PE 0603002A, project MM3.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology, focus areas and the Army Modernization Strategy.

Work in this project is performed by the US Army Aeromedical Research Laboratory (USAARL), Fort Rucker, AL; US Army Center for Environmental Health (USACEHR), Ft. Detrick, MD; US Army Institute of Surgical Research (USAISR), Joint Base San Antonio, TX; US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD; Naval Health Research Center (NHRC), San Diego, CA; and the Biotechnology High Performance Computing Software Institute (BHSAI), Frederick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Physiological Health - Nutritional Sustainment and Fatigue Interventions	2.569	4.679	-

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602787A / *Medical Technology*	**Project (Number/Name)** 869 / *Warfighter Health Prot & Perf Stnds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Description: This effort evaluates methods for managing and controlling the effects of fatigue on Warfighter operational performance and the impact of nutritional strategies to optimize operational performance. Starting in Fiscal Year (FY)19 this effort moves to Physiological Health. ***FY 2018 Plans:*** Conduct one or more field studies to determine the efficacy of energy and/or protein supplementation for preventing declines in lean body mass and cognition during and after caloric deficit (shortage of calories consumed). From the results of field studies, will continue to develop a descriptive model outlining factors linking the central nervous system and other organs/systems that impact resilience. Assess the effect of nutritionally optimized snack products for maintaining body composition and nutritional status during and after military training and operations in a field study. Develop interventions promoting resistance to physical, cognitive and environmental stressors. Evaluate the role of nutritional factors in the maintenance of physiological and neurobehavioral health under operationally relevant conditions. Analyze the effects of nutritional interventions on indicators of nutritional status. Demonstrate the effectiveness of nutrient and dietary strategies (e.g., omega-3 polyunsaturated fatty acids, zinc, and hydration) for reducing the vulnerability to and/or accelerating the recovery from mild TBI. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** In FY19, funding for Physiological Health - Nutritional Sustainment and Fatigue Interventions is reduced due to movement of funding for Nutrition & Weight Balance, Cognitive Health and Resilience, Nutrition to Accelerate Physiological Recovery Physical and Cognitive Readiness STO and Optimizing Mental Acuity STO to Physiological Health and Performance in order to reduce the number of R-Form Research Areas addressing Physiological Health.			
Title: Physiological Health and Performance ***Description:*** This effort evaluates methods for managing and controlling the effects of fatigue on Soldier operational performance and the impact of nutritional strategies to optimize operational performance. Efforts will also contribute to human health and performance optimization and enhancement. ***FY 2019 Plans:*** Will develop nutritional interventions for resistance to stress (environmental/physical/cognitive) in the field. Will evaluate individual differences of environmental influences on Soldier eating behavior. Will improve the health of muscle and bone through characterization of protein source effects on metabolic kinetics. Will develop a military-specific eating questionnaire for evaluation of nutritional approaches to resist military stress. Will conduct studies to determine the effectiveness of energy and/or protein supplementation for preventing declines in lean body mass and cognition during and after caloric deficit. Will continue to develop a descriptive model outlining factors linking the central nervous system and other organs/systems that impact resilience. Will investigate physiological aspects of human health and performance optimization and enhancement. ***FY 2018 to FY 2019 Increase/Decrease Statement:***	-	-	7.649

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
FY19 funding for Physiological Health and Performance is available due to 1) movement of funding for Nutrition & Weight Balance, Cognitive Health and Resilience, Optimizing Mental Acuity STO, Nutrition to Accelerate Physiological Recovery Physical and Cognitive Readiness STO and Brain Health and Performance Risk is moved from Physiological Health - Nutritional Sustainment and Fatigue Interventions to Physiological Health and Performance to this task in order to reduce the number of R-Form Research Areas addressing Physiological Health and Performance; 2) increased funding for Nutrition & Weight Balance due to normal progression of the effort. reduced funding for Cognitive Health and Performance due to realignment of a sub-task to another CMI task and 3) reduced funding for Optimizing Mental Acuity due to normal progression and winding down of the effort as a result of realignment of funds in FY20 and beyond in support of new high priority programs and 4) reduced funding for Nutrition to Accelerate Physiological Recovery Physical and Cognitive Readiness STO due to planned progression of the effort and 5) increased funding for Brain Health & Performance Risk due to realignment of a sub-task from another CMI task and 6) increased funding for Biomedical Performance Enhancement due to normal progression of the effort and the fact that it became a new high priority program in FY18.			
Title: Concussion/Mild Traumatic Brain Injury (mTBI) Interventions	1.340	2.302	-
Description: This effort refines and evaluates methods to detect and treat concussion as well as identify and evaluate the effects of cognitive deficits (decreases in the ability of individuals to acquire knowledge and understanding through thought experience and the senses) and risk factors for spinal injury in Military vehicle occupants during operations. Starting in FY19 this effort moves to Injury Prevention and Reduction. ***FY 2018 Plans:*** Develop models of military vehicle occupant exposures that will be used for predicting cervical spine injury risk. Will collect exposure outcome data from the operational environments to improve provisional spinal injury criteria and assessment methods for occupant protection. Assess the effects of sleep duration, timing, and continuity of Mild Traumatic Brain Injury (mTBI) patients versus controls using actimetry sensors (non-invasive method of monitoring human activity/rest cycles) with the goal of determining differences in baseline sleep between mTBI patients, non-mTBI controls, and recovered mTBI controls in their home environments. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** In FY19, reduced funding for Concussion/Mild Traumatic Brain Injury (mTBI) Interventions is due to movement of funding for Blunt, Blast, & Accelerative Injury & Protection to Injury Prevention and Reduction in order to reduce the number of R-Form Research Areas addressing Injury Prevention and Reduction.			
Title: Environmental Health and Protection - Physiological (human physical and biochemical functions) Awareness Tools and Warrior Sustainment in Extreme Environments	1.351	1.380	-
Description: This effort evaluates the combined impact of extreme temperatures, humidity, and altitude on human health and performance and determines novel mitigation strategies to enhance tolerance, sustain performance, and protect the Warfighter			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602787A / *Medical Technology*	**Project (Number/Name)** 869 / *Warfighter Health Prot & Perf Stnds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
against environmental injury. This effort provides evidence-based practice recommendations, biomarkers of adaptation, and models for protecting health and performance against combinations of environmental threats. Starting in FY19 this effort is combined into Environmental Health and Protection. ***FY 2018 Plans:*** Evaluate the reliability, reproducibility, and validity of a novel militarily-relevant dexterity assessment instrument during cold- air exposures. Develop a low-power microclimate forearm heating prototype to maintain finger blood flow and hand dexterity during cold-air exposures. Determine the areas on the human that, when warmed, cause a physiological reflex response that increases finger blood flow and maintains manual dexterity in a cold environment. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** In FY19, funding for Environmental Health and Protection - Physiological (human physical and biochemical functions) Awareness Tools and Warrior Sustainment in Extreme Environments is reduced due to movement of funding for Heat, Cold & Terrestrial Altitude to Environmental Health & Protection in order to reduce the number of R-Form Research Areas addressing Environmental Health & Protection.			
Title: Environmental Health and Protection ***Description:*** This effort involves applied research addressing the physiological (human physical and biochemical functions) mechanisms of exposure to extreme heat, cold, altitude, and other environmental stressors. This effort establishes scientific evidence for specific and sensitive diagnostics of exertional heat illness to optimize Soldier performance in austere environments. This effort also supports and maturates non-invasive technologies, decision-aid tools, and models to enhance Soldier protection and sustainment across the operational spectrum. This effort provides the scientific basis for developing focused heating and cooling solutions to maintain fine motor dexterity, core temperature, and optimize physical and cognitive performance during cold-weather and hot-humid operations. This effort will develop knowledge and materiel solutions that enable Soldier individualized metabolic assessments and optimization during training and operations. ***FY 2019 Plans:*** Will determine the combined impact of heat, humidity, and high altitude on human health and performance. Will quantify Heat Tolerance Test specificity to include the effects of heat acclimation on the prediction of heat illness susceptibility and return to duty guidelines. Will quantify how physiological adaptations and acquired thermal tolerance to heat stress protect against acute mountain sickness susceptibility as well as physical and cognitive performance at high altitude. Will develop new technologies that enable quantitative measurements at a point-in-time during training and operational activities. Will increase dexterity performance in cold environments by combining facial and forearm microclimate heating interventions. Will develop computational models of individualized Soldier health, readiness, and physiological performance. ***FY 2018 to FY 2019 Increase/Decrease Statement:***	-	-	5.757

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
In FY19, funding for Environmental Health and Protection increased due to movement of funding from Physiological Awareness Tools and Warrior Sustainment in Extreme Environments: Heat, Cold & Terrestrial Altitude to Environmental Health & Protection in order to reduce the number of R-Form Research Areas addressing Environmental Health and Protection.			
Title: Biomarkers of Exposure and Environmental Biomonitoring (measurement of the body?s response to toxic chemical compounds, elements, or their metabolites, in biological substances) ***Description:*** This effort supports refinement and evaluation of methods to detect exposure to environmental contaminants and toxic chemicals during military operations. This effort develops an integrated experimental and computational platform to characterize host responses to environmental hazards in terms of pathogenic (disease causing) and adaptive processes, yielding mechanistically based drug targets and molecular diagnostics. Starting in FY19 this effort is combined into Environmental Health and Protection. ***FY 2018 Plans:*** Utilize an integrated experimental and computational platform to evaluate host responses to exposure (through the mouth, nose and skin) to environmental hazards (including toxic industrial chemicals [TICs] and metals such as chromium) in terms of pathogenic and adaptive processes. Develop several physiological-based dosimetery models of toxicity for TICs and heavy metals with adverse outcome pathways of liver, kidney, cardiac, and/or neural injury based on published and experimentally- derived data. Model output will guide small unit decision making through the generation of actionable health risk information that can predict the risk of adverse health effects in Warfighters with high sensitivity and specificity. Develop a methodology of evaluating central nervous system toxicity in order to determine sensitive and specific indicators of central nervous system injury. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** In FY19, reduced funding for Biomarkers of Exposure and Environmental Biomonitoring is due to: 1) movement of funding for Environmental Toxicant Exposure to Environmental Health and Protection; and 2) elimination of funding for the Environmental Toxicant Exposure STO in order to accelerate new high priority programs within MRMC.	5.249	4.889	-
Title: Injury Prevention and Reduction - Neurosensory Injury Prevention ***Description:*** This area includes research efforts to develop prevention based strategies and medically based injury criteria for hearing, vestibular (sensory system supporting movement and sense of balance, located in the inner ear), and ocular/facial protection devices, develop and evaluate neurosensory operational risk factors, develop medically based guidelines to assess neurosensory performance and model the effects of acoustic and impact trauma, as stressors on vision and hearing. Starting in FY19 this effort is combined into Injury Prevention and Reduction. ***FY 2018 Plans:*** Assess the complex interaction between auditory and vestibular protective systems. Validate blast exposure conditions that lead to cellular level ocular injury and continue to refine scaling laws to be able to relate experiments conducted in small animal	3.569	4.752	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
models to exposure conditions in humans, which will enable the development of computational models that can help predict the effects of the primary blast wave on the eyes and visual system in humans. Analyze potential neuroprotective (preserve nerve function) chemicals against primary blast injuries to the visual system. Evaluate provisional mandible blunt impact injury risk using two models (Facial and Ocular Countermeasures for Safety Headform (FOCUS) and Post Mortem Human Subjects (PMHS) to improve standards requirements for Warfighter protective gear. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** In FY19, reduced funding for Injury Prevention and Reduction - Neurosensory Injury Prevention is due to: 1) elimination of funding for Sensory Performance, Injury & Protection in order to accelerate new priority programs within MRMC; 2) movement of funding for Aircrew Health and Performance to the Injury Prevention and Reduction in order to reduce the number of R-Form Research Areas addressing Injury Prevention and Reduction.			
Title: Injury Prevention and Reduction - Musculoskeletal Injury Prevention ***Description:*** This effort evaluates and assesses the effects of repetitive motion during military operations and training on the human body; provides mathematical models to predict the likelihood of physical injuries following continuous operations and muscle fatigue; evaluates current standards for return-to-duty; and establishes improved medical test methods with the goal of rapid return to duty of Warfighters following injury. Starting in FY19 this effort is combined into Injury Prevention and Reduction. ***FY 2018 Plans:*** Consolidate results from animal- and human-based studies to refine the roles of endocrine (i.e., hormonal) and intracellular (i.e., within the cell) signaling molecules that are involved in skeletal muscle and bone development, utilizing animal and human models for transition to clinical trials. Refine a mathematical model of ideal bone density and structure that offsets risk of stress fracture. Utilize the Total Army injury and Health Outcomes Database (TAIHOD) to evaluate situations that create unnecessary musculoskeletal risk-hazards, and provide recommendations for mitigation. Analyze incidence and risk factors during the last 10 years for spinal injury in military personnel. Study the military vehicle occupant environment for the development of vibration health hazard assessment models. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Reduced funding for Injury Prevention and Reduction - Musculoskeletal Injury Prevention is due to movement of funding for Musculoskeletal Injury to Injury Prevention & Reduction in order to reduce the number of R-Form Research Areas addressing Injury Prevention & Reduction.	4.594	3.248	-
Title: Injury Prevention and Reduction ***Description:*** This effort addresses the Army?s number one priority of readiness by improving musculoskeletal injury prevention efforts as well as contributing to preparing Soldiers for potential threats (e.g., directed energy) in and developing capabilities for the multi domain battle environment; evaluates and assesses the effects of repetitive motion during military operations and	-	-	11.258

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
training on the human body; provides mathematical models to predict the likelihood of physical injuries following continuous operations and muscle fatigue; evaluates current standards for return-to-duty; and establishes improved medical test methods with the goal of rapid return to duty of Soldiers following injury. This effort also develops prevention based strategies and medically based injury criteria for hearing, vestibular (sensory system supporting movement and sense of balance, located in the inner ear), and ocular/facial protection devices, develops and evaluates neurosensory operational risk factors, develops medically based guidelines to assess neurosensory performance and models the effects of acoustic and impact trauma, as stressors on vision and hearing. Efforts will investigate the medical aspects of manned/unmanned teaming (MUM-T) and medical aspects of and protection against directed energy. ***FY 2019 Plans:*** Will develop injury criteria for the prevention of acute and chronic cervical neck injury and pain that will guide the development of helmets and technologies added to the helmet. Will develop mTBI injury thresholds for repetitive blast exposure that can guide the development of head protection. Will refine physical performance thresholds for potential improvements to the Occupational Physical Assessment Test (OPAT) which will improve how well recruits are screened to do DoD relevant physically demanding tasks. Will develop countermeasures to reduce the risk of overuse injury within the training and operational environment. Will identify cognitive and sensory performance metrics associated with optimal manned/unmanned teaming (MUM-T) and identify physiological and behavioral fitness for duty metrics to operate in MUM-T paradigms. Will develop medical standards and health hazard assessment algorithms for exposure to directed energy threats. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** In FY19, funding for Injury Prevention and Reduction is available due to: 1) movement of funding from Musculoskeletal Injury, Aircrew Health and Performance and Blunt, Blast, & Accelerative Injury to this task; 2) increased funding for Musculoskeletal Injury due to normal progression of the effort and high priority of the task; 3) eliminated funding for Sensory Performance, Injury & Protection to accelerate new priority programs within MRMC; 4) movement of funding from Aircrew Health & Protection to MM3 funding to support normal progression of task; 5) reduced funding for Blunt, Blast, & Accelerative Injury due to realignment of subtask to another CMI task; 6) increased funding for Medical Aspects of Man-Machine Teaming (MUM-T) due to normal progression of the effort and the fact that it became a new high priority program in FY18; and 7) increased funding for Directed Energy Health Hazard Assessment due to normal progression of the effort and the fact that it became a new high priority program in FY18.			
Title: Psychological Health - Psychological Resilience	6.403	8.467	-
Description: This effort refines and evaluates early interventions to prevent and reduce combat-related behavioral health problems, including symptoms of post-traumatic stress disorder (PTSD), depression, anger problems, anxiety, substance abuse, post-concussive symptoms, and other health risk behaviors. Also assesses and refines tools and interventions to enhance and			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
sustain psychological resilience throughout the Warfighter's career. Starting in FY19 this effort moves to Psychological Health and Resilience. ***FY 2018 Plans:*** Determine if a diet formulated with a balanced omega-3/6 fatty acids ratio, glutamine, and antioxidants provides enhanced resiliency against psychological stressors in humans. Evaluate the effects of novel compounds active in the glucocorticoid system (steroid hormones that are essential for the utilization of carbohydrate, fat and protein by the body and for the normal response to stress) and the endocannabinoid system (brain receptors that are involved in various physiological processes including appetite, pain sensation, mood and memory) for their ability to mitigate the adverse behavioral effects of traumatic stress and traumatic conditioning processes. Evaluate at least one drug candidate modulating the activity of orexin/hypocretin (a peptide found in the nervous system that regulates arousal, wakefulness and appetite) for its ability to mitigate the adverse behavioral effects of traumatic stress and traumatic conditioning processes. Continue studies focused upon identification of PTSD subtypes, stage of disease progression, and development of associated biomarkers for use in the identification and development of matched risk-based prevention interventions and development of a precision medicine algorithm approach to PTSD treatment. Determine the influence of sleep history on the efficacy and durability of Attention Bias Modification Training (ABMT), which is a computerized treatment that involves retraining an individual?s interpretation of other?s facial expressions away from predisposed perceptions of hostility, shifting interpretations in the direction of neutrality, to reduce his or her level of anxiety. Conduct a study with Soldiers in an operational unit to determine the predictive validity of trial-by-trial attention bias analytics versus traditional measures. Develop and pilot an evidence-based, self-discipline education program that positively influences Soldier outcomes related to resilience and readiness through the development of adaptive self-control and emotion regulation. Develop and pilot emotion regulation leadership training modules for unit leaders. Develop and pilot an evidence-based, team-level intervention that positively influences Soldier outcomes related to behavioral health, resilience, and unit readiness through the regulation of small-team dynamics (e.g., group-affect). Develop and pilot an individual-to-tool matching paradigm that allows leaders to optimally tailor intervention strategies to precisely meet their personnel and operational health needs. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** In FY19, reduced funding for Concussion/Mild Traumatic Brain Injury (mTBI) Interventions is due to movement of funding for Blunt, Blast, & Accelerative Injury & Protection to Injury Prevention and Reduction in order to reduce the number of R-Form Research Areas addressing Injury Prevention and Reduction.			
Title: Psychological Health & Resilience - Suicide Prevention ***Description:*** This effort supports methods to identify and modify causative and preventive factors in military suicides. Starting in FY19 this effort moves to Psychological Health and Resilience. ***FY 2018 Plans:***	5.389	4.873	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Assess key high risk emotional and behavioral transition points to decrease suicide behaviors. Develop and refine guidelines and tools for leaders, which will include evidence-based recommendations for identifying and addressing difficulties with post-combat adjustment and military community transformation and a revised Unit Behavioral Health Needs Assessment tool with metrics from combat operations, non-combat operations, and garrison. Develop a non-contact screening tool that identifies Service members at-risk for suicidal behaviors. Evaluate a theory-based suicide screen and clinical decision-making tool that identifies at-risk Service members. Conduct studies to develop tools to decrease suicide behaviors during key transition points of Service Members careers. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** In FY19, reduced funding for Psychological Health & Resilience - Suicide Prevention is due to movement of funding for Behavioral Health, Wellness & Resilience to Psychological Health and Resilience in order to reduce the number of R-Form Task areas related to Psychological Health & Resilience.			
Title: Psychological Health and Resilience	-	-	11.113
Description: This effort refines and evaluates early interventions to prevent and reduce combat-related behavioral health problems, including symptoms of post-traumatic stress disorder (PTSD), depression, anger problems, anxiety, substance abuse, suicide, and other health risk behaviors. This effort assesses and refines tools and interventions to enhance and sustain psychological resilience throughout Soldiers? careers. Efforts also address the health and well-being of families. ***FY 2019 Plans:*** This effort will assess risk and resilience markers (e.g., moral injury) for male and female Soldiers? psychological and behavioral health; determine the optimal dosing of Attention Bias Modification Training, a computerized treatment that reduces anxiety. Will evaluate evidence-based individual (e.g., self-distancing education, emotion regulation leadership training) and team-level (e.g., regulation of small-team dynamics) interventions that positively influence behavioral health, resilience, and unit readiness. Will assess key high-risk emotional and behavioral transition points, develop a non-contact screening tool and other interventions to decrease suicide behaviors. Will adapt and evaluate a diet formulated with a balanced omega-3/6 fatty acid ratio, glutamine, and antioxidants in an animal model for pilot study in humans in order to provide neuroprotection against military stressors. Will develop molecular pharmacological approaches and novel compounds to mitigate the adverse behavioral effects of traumatic stress. Will continue studies focused upon identification of PTSD subtypes, stage of disease progression, and development of associated biomarkers in order to develop a precision medicine approach to PTSD treatment. Will initiate studies for enhancing behavioral health treatment engagement, improving provider clinical support tools for return-to-duty decisions and identifying dissemination models for optimal behavioral health provider education. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** In FY19, funding for Psychological Health and Resilience is available due to: 1) movement of funding for Behavioral Health, Wellness & Resilience and Psychiatry & Clinical Psychology Disorders to this task in order to reduce the number of R-Form			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602787A / *Medical Technology*	**Project (Number/Name)** 869 / *Warfighter Health Prot & Perf Stnds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Research Areas addressing Psychological Health and Resilience; 2) reduced funding for Behavioral Health, Wellness & Resilience due to realignment of a subtask to another CMI task; 2) reduced funding for Psychiatry & Clinical Psychology Disorders is reduced due to realignment of funds to new high priority programs within MRMC.			
Title: Millennium Cohort Research ***Description:*** This effort supports a long-term study of Warfighters that includes psychological and physical impacts of military service throughout their lifetime. The Millennium Cohort and Deployment Health Task area employs prospective epidemiological (study of health-event patterns in a society) surveillance research designed to address mental health and comorbid (multiple concurrent) disorders, including neurological and other chronic degenerative disorders, fitness and readiness performance outcomes, and longer-term physical and mental health illnesses and disease over the life cycle of military Service Members. ***FY 2018 Plans:*** Continue to evaluate the impact of military service on Warfighter and Family physical and psychological health. Specifically, will determine factors associated with persistent and long-term mental health and evaluate factors moderating or mediating associations between service-related experiences and mental disorders. Evaluate associations between behavioral health characteristics (e.g. physical activity, alcohol and tobacco use, and sleep hygiene) and short- and long-term outcomes among Service members and Veterans. Establish a program to investigate chronic disease risk among Service members and Veterans. Develop a program area focusing on environmental exposures experienced during deployments. Evaluate the representativeness and generalizability of the Millennium Cohort Family Study and initiate a study examining the impact of family relations on the Service member spouse. Develop a program area focusing on physical injury (traumatic and chronic) experienced during military service and mental health resilience, and establish agreements for access to objective data sources. Initiate processing of completed 2017-2018 paper surveys.. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Funding for Millennium Cohort Research was eliminated in FY19 to fund higher priority research in Medical Aspects of Man-Machine Teaming, Directed Energy Health Hazard Assessments, and Biomedical Performance Enhancement.	5.134	4.618	-
Title: Soldier Systems Engineering Architecture ***Description:*** This effort will advance medical science in the areas of injury prevention to optimize and sustain performance. This effort develops bio- mathematical models and networked physiological sensor systems that accurately predict metabolic cost, thermal strain and other negative health impacts to the Warfighter during physical challenges, i.e., during load carriage or operating in extreme environments. ***FY 2018 Plans:*** Evaluate newly developed bio-mathematical models, algorithms, and networked physiological sensor systems that accurately predict human metabolism rates, thermal strain and negative health impacts of Warfighters during physical challenges (i.e.,	0.988	0.993	-

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
complex operational scenarios in extreme environments). Computationally-intelligent network-capable sensors will have the ability to monitor and predict individual Warfighter physiological status (thermal, hydration, sleep status) in response to environmental conditions. Inform new research across the research and development community in the development of optimized systems and the interactions between Warfighters and the systems they employ. Leverage research in the Military Operational Medicine portfolio areas of Physiological Health and Protection, Injury Prevention and Reduction (both musculoskeletal and neurosensory), Psychological Health and Resilience and Environmental Health and Protection to inform the Warfighter Systems Engineering Architecture initiative. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** In FY19, reduced funding for Soldier Systems Engineering Architecture is due to: 1) movement of funding for Warfighter Physical Performance to Environmental Health & Protection in order to reduce the number of R-Form Research Areas addressing Environmental Health & Protection.			
Accomplishments/Planned Programs Subtotals	36.586	40.201	35.777

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / *Medical Technology*	Project (Number/Name) 870 / *Dod Med Def Ag Inf Dis*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
870: *Dod Med Def Ag Inf Dis*	-	20.841	22.234	21.651	-	21.651	22.081	19.405	19.813	20.209	0.000	146.234

Note

Diagnostics Systems funding ends in FY18 and the remaining FY19 funds are for Vector Identification and Control.

A. Mission Description and Budget Item Justification

This Project conducts applied research for medical countermeasures to naturally occurring infectious diseases that pose a significant threat to the operational effectiveness of forces deployed outside the United States. Effective preventive countermeasures (protective/therapeutic drugs and vaccines and insect repellents and traps) protect the Force from disease and sustain operations by avoiding the need for evacuations from the theater of operations. Diseases of military importance are malaria, bacterial diarrhea, and viral diseases (e.g., dengue fever and hantavirus). In addition to countermeasures, this project funds refinement of improved diagnostic tools to facilitate early identification of infectious disease threats in an operational environment, informing Commanders of the need to institute preventive actions and improve medical care. Major goals are to integrate genomics (deoxyribonucleic acid (DNA)-based) and proteomics (protein-based) as well as other new biotechnologies into the refinement of new concepts for new vaccine, drug, and diagnostics candidates.

Research conducted in this project focuses on the following four areas:

(1) Prevention/Treatment of Parasitic (organisms living in or on another organisms) Diseases
(2) Bacterial Disease Threats (diseases caused by bacteria)
(3) Viral Disease Threats (diseases caused by viruses)
(4) Diagnostic Systems and Vector Identification and Control

For the refinement of drugs and biological products, studies in the laboratory and in animal models provide a proof-of-concept for these candidate products, including safety, toxicity (degree to which a substance can damage an organism), and effectiveness, and are necessary to provide evidence to the Food and Drug Administration (FDA) to justify approval for a product to enter into future human subject testing. Additional non-clinical studies are often needed in applied research even after candidate products enter into human testing during advanced technology development, usually at the direction of the FDA, to assess potential safety issues. Drug and vaccine refinement bears 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. Similarly, vaccine candidates have a high failure rate, because animal testing may not be a good predictor of human response, and therefore candidate technologies/products are often eliminated after going into human trials. Because of this high failure rate, a continuing effort to identify other potential candidates to sustain a working pipeline of countermeasures is critical for replacing those products that fail in testing.

Work is managed by the United States Army Medical Research and Materiel Command (USAMRMC) in coordination with the Naval Medical Research Center (NMRC). The Army is responsible for programming and funding all Department of Defense (DoD) naturally occurring infectious disease research requirements, thereby precluding duplication of effort within the Military Departments.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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Promising medical countermeasures identified in this project are further matured under PE 0603002A, Project 810.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology, focus areas and the Army Modernization Strategy.

Work in this Project is performed by the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD, and its overseas laboratories; the United States (U.S.) Army Medical Research Institute of Infectious Disease (USAMRIID), Fort Detrick, MD; and the NMRC, Silver Spring, MD, and its overseas laboratories.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Applied Research on drugs and vaccines against parasitic diseases	10.122	11.902	10.086

Description: This effort assesses and improves on candidate drugs coming from the Department of Defense (DoD) discovery program and from other collaborations for prevention and treatment of malaria; to counter the continuing spread of drug resistance to current drugs; assesses currently available drugs for use against cutaneous leishmaniasis (a skin-based disease transmitted by sand flies) in animal models; and select the most effective and safe candidates for continued refinement and possible clinical testing. This effort also conducts studies to investigate new candidate vaccines for preventing malaria and selects the best candidate(s) for continued refinement. A highly effective vaccine would reduce or eliminate the use of anti-malarial drugs and would minimize the progression and impact of drug resistance to current/future drugs.

FY 2018 Plans:
Continue studies in validated animal models to test reformulated chemical compounds for safety and efficacy against malarias. Continue assessment of pyramidinlyguanidine compounds (a newly discovered family of similar chemical compounds that are active against malaria parasites in experimental animals) for the treatment of malaria. Continue assessment of primaquine-like compounds (Primaquine is an FDA-licensed drug capable of preventing relapsing malaria) for use in treatment of relapsing malarias in the monkey model. Complete safety testing in validated animal models in order to test reformulated and down-selected vaccines against falciparum malaria (the most lethal of four types of malaria species). Continue to evaluate new vaccine candidates against vivax malaria (the most common of four types of malaria species) in small animals.

FY 2019 Plans:
Will complete studies in validated animal models to test reformulated triazine lead compound for safety and the dissemination in blood and tissues. These studies are required by FDA to enable oral dosing studies in humans. Will complete testing of pyrimidinylguanidine (a newly discovered family of similar chemical compounds that are active against malaria parasites in experimental animals) and primaquine-like compounds in primate malarias to enable initial human testing. Will complete laboratory based analyses of human immune cells from Plasmodium falciparum malaria vaccine trials to enable down selection of a lead vaccine for transition to advanced development. Will conduct initial effectiveness trials of potential lead vaccine formulations in primate models of a relapsing malaria, Plasmodium vivax.

FY 2018 to FY 2019 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Decrease due to economic adjustment.			
Title: Diagnostic Systems and Vector Identification and Control	1.358	1.438	0.524
Description: This effort designs and prototypes new medical diagnostic and surveillance tools for the field, focusing on bedside and field-deployable diagnostic systems and refines interventions that protect Warfighters from biting insects such as sand flies (transmitters of leishmaniasis) and mosquitoes (transmitters of dengue, Japanese encephalitis, malaria, etc.). Note: Diagnostics Systems funding will end in Fiscal Year (FY) 2018. ***FY 2018 Plans:*** Develop new vector repellant and control methods. Confirm spatial repellent efficacy testing protocols and systems that enable testing and development of best candidates for military use. Advance the capability for fabrics treated with repellants to protect or resist against biting insects and other arthropod vectors. Develop the multiplexed pathogen detection systems (capable of detecting multiple pathogens at the same time) that are cost effective, sustainable and usable to screen for priority emerging or re-emerging pathogens. ***FY 2019 Plans:*** Will further develop and evaluate the capability for fabrics treated with repellants to protect or resist against biting insects and other arthropod vectors. Will continue to evaluate multiplexed pathogen detection systems (capable of detecting multiple pathogens at the same time) to screen for priority emerging or re-emerging pathogens. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** A change in the priority of the effort. The civilian market is driving much of the innovation in this area of diagnostic research. As such, it is cost effective to let the market develop diagnostic platforms and the DoD develop the military relevant test menu of assays. This approach was successful with the BioFire FilmArray (Next Generation Diagnostic System). While a dedicated diagnostic capability will be eliminated within the Military Infectious Diseases Research Program, many of the existing task areas have the knowledge and proficiency to develop diagnostic assays.			
Title: Viral Threats Research	3.685	3.319	4.852
Description: This effort designs and laboratory tests new vaccine candidates against hemorrhagic fever viruses, i.e. Dengue Virus, Hantaviruses Lassa fever Virus and Crimean-Congo hemorrhagic fever virus, and assesses other non-vaccine technologies to protect against hemorrhagic fever viruses. Efforts also include establishing and maintaining of clinical trial sites worldwide. ***FY 2018 Plans:*** Expand vaccine test site infrastructure in selected communities at risk for dengue virus exposure and support research partner efforts in testing dengue vaccine immunogenicity (ability to provoke an immune response) and effectiveness. Continue to assess new vaccine formulations for safety and immunogenicity. Further develop additional DNA vaccines and combination vaccines against viruses of interest, e.g. Crimean Congo Hemorrhagic Fever. Explore multi-agent (combination of two or more molecules			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602787A / *Medical Technology*	**Project (Number/Name)** 870 / *Dod Med Def Ag Inf Dis*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
capable of inducing an immune response) vaccine concepts e.g., pan-hantavirus vaccine, Rift Valley Fever, Crimean Congo Hemorrhagic Fever vaccine. Develop an animal model of disease to test drugs and vaccines for protection against Hantavirus. ***FY 2019 Plans:*** Will sustain field sites as part of ongoing research partner efforts in testing dengue vaccine immunogenicity (ability to provoke an immune response) and effectiveness. Will conduct immune cell and antibody assessments in human subjects exposed to dengue by dengue human infection model. Will conduct immune cell and antibody assessments in human subjects immunized with purified inactivated virus and live attenuated virus vaccines. Will explore multi-agent (combination of two or more molecules capable of inducing an immune response) vaccine concepts e.g., pan-hantavirus vaccine, Rift Valley Fever, Crimean Congo Hemorrhagic Fever vaccine. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Increase due to economic adjustment.			
Title: Bacterial Threats ***Description:*** This effort conducts studies to refine bacterial countermeasures, including vaccine candidates, to prevent diarrhea (most commonly caused by enterotoxigenic E. coli, Campylobacter and Shigella), wound infection and scrub typhus (a debilitating mite-borne disease). ***FY 2018 Plans:*** Continue with the development of additional vaccine candidates against Shigella, Campylobacter and enterotoxigenic E.coli. Down-select vaccine candidates for further testing in animal models of diarrhea caused by Shigella, Campylobacter and enterotoxigenic E.coli. Continue to test the feasibility of clinical field sites for evaluation of vaccine candidates. Conduct studies on mechanisms of immune response to scrub typhus infection. Maintain an animal model for scrub typhus and will characterize host-pathogen interactions in animal models. ***FY 2019 Plans:*** Will continue to develop and advance additional vaccine candidates against Shigella, Campylobacter and enterotoxigenic E. coli (ETEC). Will continue to down select vaccine candidates for testing in animal models of diarrhea caused by Shigella, Campylobacter and ETEC. Will perform an assessment of multivalent (different types) vaccine candidates for Shigella and ETEC in animal models of diarrhea. Will produce vaccine candidates for testing in humans using Good Manufacturing Processes. Will continue to evaluate the feasibility of clinical field sites for the assessment of vaccine candidates in humans. Will continue to maintain the animal model for scrub typhus infection and will continue studies on characterization of host-pathogen interactions in these animal models. ***FY 2018 to FY 2019 Increase/Decrease Statement:***	5.676	5.575	6.189

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Increase due to economic adjustment.			
Accomplishments/Planned Programs Subtotals	20.841	22.234	21.651

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / *Medical Technology*	Project (Number/Name) 874 / *Cbt Casualty Care Tech*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
874: *Cbt Casualty Care Tech*	-	9.849	11.127	12.781	-	12.781	14.944	15.063	15.431	15.615	0.000	94.810

A. Mission Description and Budget Item Justification

This project refines and assesses concepts, techniques, and materiel that improve survivability and ensure improved treatment outcomes for Warfighters wounded during combat operations, as well as treatment under austere field conditions. Combat casualty care research addresses control of severe bleeding, resuscitation and stabilization, predictive indicators and decision support technologies for life support systems, treatment of burns, and traumatic injuries to hard and soft tissues of the face, mouth, and extremities and traumatic brain injury (TBI).
This project is coordinated with the Military Departments and other government organizations to avoid duplication.
Research conducted in this project focuses on Combat Casualty Care Research in the following four areas:

(1) Damage Control Resuscitation
(2) Combat Trauma Therapies
(3) Combat Critical Care Engineering
(4) Traumatic Brain Injury

All drugs, biological products, and medical devices are refined in accordance with US Food and Drug Administration (FDA) regulations, which govern testing in animals to assess safety, toxicity, and effectiveness and subsequent human subject clinical trials.
Promising efforts identified in this project are further matured under Program Element (PE) 0603002A, Project 840.
The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology, focus areas and the Army Modernization Strategy.

Work on this project is performed by US Army Institute of Surgical Research (USAISR), Joint Base San Antonio, TX, and the Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Damage Control Resuscitation	4.026	4.234	4.822
Description: This effort develops and refines knowledge products (such as clinical practice guidelines, manuals, protocols, studies, and media), materials, and systems for control of internal bleeding; minimizing the effects of traumatic blood loss; preserving, storing, and transporting blood and blood products; and resuscitation following trauma.			
FY 2018 Plans: Conduct studies to optimize performance metrics and assays of stem cells for treatment of trauma- or infection- induced impairment of blood clotting ability. Develop sensor technology for early assessment of blood clot strength. Evaluate novel products and approaches, including aortic balloon occlusion, automatically operated tourniquets, and new wound packing			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
materials, to treat bleeding from chest, abdomen, arm pit and groin wounds and large, soft tissue wounds. Work to investigate drugs and key molecular components of blood required to optimize low volume resuscitation adjuncts to control bleeding and stabilize tissues in the pre-hospital phase of care. ***FY 2019 Plans:*** Will begin study of new techniques to control bleeding using catheters or other devices that are introduced into damaged blood vessels. Will conduct studies of new hemostatic (stops bleeding) dressings to determine if they may be safely left in place on wounds to control bleeding for extended periods of time. Will start a new research focus area on endovascular (refers to device that is directly introduced into a major blood vessel) hemorrhage control and resuscitation. Will continue studies to optimize performance metrics and assays of stem cells for treatment of trauma- or infection-induced impairment of blood clotting ability. Will continue development of new technologies for early assessment of blood clot strength. Will continue work to investigate drugs and blood products to optimize treatment of impaired blood clotting and destabilized tissues due to traumatic bleeding. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** This research area was expanded to include new research on endovascular hemorrhage control technologies. This new applied research work was originally planned to begin in Fiscal Year (FY) 2019; however, funds became available in FY18 to accelerate the effort. Project 874 funding for the Battlefield Platelets STO ended in FY18.			
Title: Combat Trauma Therapies ***Description:*** This effort conducts research to enhance the ability to diagnose, stabilize, and accelerate wound healing and repair of damaged tissue for casualties with severe wounds to the face, mouth and extremities. ***FY 2018 Plans:*** Develop preclinical wound model to examine effect of various resuscitation strategies (e.g., fluids, timing, volume) on healing of injured muscle and bone. Continue work from FY17 to develop and test combined agents (containing agents to kill bacteria, prevent bacteria from becoming infective, and to control inflammation) to treat contaminated facial, mouth and extremity wounds. ***FY 2019 Plans:*** Will conduct animal studies to assess adverse effects of inflammation factors released in response to blast injury. Will examine potential treatments to mitigate adverse effects of hemorrhage resuscitation on severe extremity wounds. Will evaluate stem cell therapy and drugs to promote healing in severe extremity injuries. Will continue development and testing of combined agents (containing agents to kill bacteria, prevent bacteria from becoming infective, and to control inflammation) to treat contaminated facial, mouth and extremity wounds. ***FY 2018 to FY 2019 Increase/Decrease Statement:***	2.539	3.374	2.567

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Planned decrease in Project 874 funding for Combat Trauma Therapies research area as elements of the work mature towards Project 840 funding for advanced technology development and clinical evaluation.			
Title: Combat Critical Care Engineering ***Description:*** This effort refines diagnostic and therapeutic medical devices as well as associated algorithms, software, and data-processing systems for resuscitation, stabilization, life support, surgical support and preservation of vital organ function that can be applied across the pre-hospital, operational field setting, and initial definitive care facilities. ***FY 2018 Plans:*** Study means to mitigate risk of blood clot formation within the tubing of external life support devices (devices that oxygenate and purify the blood outside of the body) while at the same time allows normal blood clotting to occur in the patient. Continue work from FY17 to validate treatment algorithms in animal burn injury model. Continue work from FY17 to validate technologies to reduce preventable deaths due to difficult airway management. ***FY 2019 Plans:*** Will conduct animal studies to determine whether currently used pain-relieving drugs produce detrimental cardiovascular effects during hemorrhage resuscitation. Will study use of different stem cell products in animal models of lung injury. Will develop a small animal model of acute kidney injury caused by cessation of kidney blood flow due to severe, prolonged blood loss in which to assess new agents that protect the blood-deprived kidney. Will determine the whole-body effects of tourniquet release after prolonged use. Will design an automated, closed-loop burn and trauma resuscitation system that continuously monitors the patient's condition and automatically executes, without human intervention, an immediate and appropriate therapeutic response whenever the patient's condition deviates from normal. Will examine the ability of different critical care treatment algorithms to accurately detect and diagnose changes in patient condition and elicit an appropriate therapeutic response. Will develop and evaluate new technologies that will enable combat medics to provide basic critical care in out-of-hospital settings when medical evacuation is either delayed or prolonged. Will continue work to mitigate risk of blood clot formation within the tubing of external life support devices (devices that oxygenate and purify the blood outside of the body) while at the same time allow normal blood clotting to occur in the patient. Will continue work to assess physiological responses to airway compromise and to test new airway management techniques. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Planned increase in Project 874 funding for Combat Critical Care Engineering research area as elements of the work mature towards Project 840 funding for advanced technology development and clinical evaluation.	1.371	1.476	2.628
Title: Traumatic Brain Injury	1.913	2.043	1.361

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602787A / *Medical Technology*	**Project (Number/Name)** 874 / *Cbt Casualty Care Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Description: This effort supports refinement of drug (includes mature drug technologies; Food and Drug Administration [FDA] approved for other indications) and therapeutic (i.e. novel use of stem cells or selective brain cooling) strategies to manage traumatic brain injury (TBI) resulting from battlefield trauma. ***FY 2018 Plans:*** Use data from neuroplasticity (ability of the nervous system to adapt to injury) marker studies to refine current animal models of military relevant brain injury to support studies of TBI treatments that work by affecting the injured brain?s ability to use energy and repair itself. Refine animal models of acute, severe TBI in combination with severe bleeding and lung and other vital organ injuries for evaluation of neurotherapeutic (therapies to protect brain tissue from further damage following a TBI event) resuscitation strategies for treatment of TBI and hemorrhagic (bleeding) shock. ***FY 2019 Plans:*** Will evaluate mild TBI treatment strategies using animal models. Will evaluate potential stem cell therapies in a severe TBI animal model. Will complete development of large animal models of TBI and TBI-polytrauma (TBI in combination with severe bleeding and lung and other vital organ injuries). Will perform studies to determine which biomarkers effectively indicate whether a particular therapy works and recovery is occurring. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is a planned decrease in Project 874 funding for Traumatic Brain Injury research as elements of the work mature towards Project 840 funding for clinical evaluation.			
Title: Prolonged Field Care ***Description:*** This effort performs applied research to study the physiological implications of delayed medical evacuation and limited access to definitive surgical care in severely injured casualties ***FY 2019 Plans:*** This is a new effort originally planned to begin in FY19; however, funds became available in FY18 to accelerate the work. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** This is a new start for FY19. There is a planned reduction in Project 874 funding for this area in FY19 as supportive Project S14 funded efforts begin (Project S14 funding for this new area does not begin until FY19). The Project S14 funded research will be necessary to support further advancement in the Project 874 funded research in this new research area.	-	-	1.403
Accomplishments/Planned Programs Subtotals	9.849	11.127	12.781

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
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C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / *Medical Technology*	Project (Number/Name) ET4 / *Appl Resch in Clinical and Rehabilitative Medicine*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
ET4: *Appl Resch in Clinical and Rehabilitative Medicine*	-	6.993	7.871	12.138	-	12.138	7.133	6.392	6.402	6.241	0.000	53.170

Note

The Battlefield Pain Management effort begins in FY19.

A. Mission Description and Budget Item Justification

This Project identifies and evaluates drugs, biologics (products derived from living organisms), medical devices, treatments and diagnostics for post-evacuation restorative, regenerative and rehabilitative care, as well as systems for use by field medics and surgeons for ocular trauma. Research focus is on identifying more effective technologies and protocols to treat ocular injury and visual system dysfunction, as well as laboratory and animal studies for regenerating skin, muscle, nerves, vascular and bone tissues for the care and treatment of traumatic injury. This Project is being coordinated with the Defense Health Program. Research involves extensive collaboration with multiple academic institutions to refine treatments for combat wounds through Armed Forces Institute of Regenerative Medicine (AFIRM). This Project is coordinated with the Military Departments and other government organizations to avoid duplication. Research conducted in this Project focuses on Clinical and Rehabilitative Medicine.

All drugs, biological products, and medical devices are refined in accordance with Food and Drug Administration (FDA) regulations, which govern testing in animals to assess safety, toxicity, and effectiveness and subsequent human subject clinical trials.

Promising efforts identified in this project are further matured under Program Element (PE) 0603002A, Project ET5.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology, focus areas and the Army Modernization Strategy.

Work on this Project is performed by United States Army Institute of Surgical Research (USAISR), Joint Base San Antonio, TX; and the AFIRM, at Multiple Institutions across the United States.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Clinical and Rehabilitative Medicine	6.993	7.871	9.439
Description: This effort conducts laboratory and animal studies for the purpose of regenerating and restoring traumatically-injured tissues, including skin, muscle, nerve, bone tissue, and the ocular system. This research moved from Project 874 to Project ET4 starting in FY17.			
FY 2018 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602787A / *Medical Technology*	**Project (Number/Name)** ET4 / *Appl Resch in Clinical and Rehabilitative Medicine*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Optimize preclinical design of a novel ocular medical device designed to deliver therapeutics, protect, and preserve vision post-injury. Establish the effects of treatment of up to three promising pharmaceuticals designed to restore vision in the scarred eye after injury for down selection. Conduct pre-clinical safety and efficacy testing of an eye bandage with therapeutics to optimize vision restoration post-injury. Evaluate methods for enhancing skin substitute performance for improvement of skin function following burns and loss from trauma. Examine pharmacologic (drug) treatments to prevent scarring from deep partial-thickness burns. Establish effectiveness of treatment methodologies for large volume muscle loss to restore muscle form and function. Develop devices and biologics for regeneration or restoration of genitourinary (genital and urinary) tissues lost or damaged due to traumatic injury. ***FY 2019 Plans:*** Will continue to optimize the preclinical design of a novel ocular medical device designed to deliver therapeutics, protect, and preserve vision post-injury. Will advance evaluations of stem-cell based therapies to regenerate damaged eye tissues into pre-clinical animal testing. Will utilize intra-eye large animal drug delivery system to deliver and evaluate effectiveness of nerve therapeutics to preserve and regenerate injured optic nerves. Will continue to conduct pre-clinical safety and effectiveness testing of an eye bandage with therapeutics to optimize vision restoration post-injury. Will continue to develop and evaluate methods for enhancing skin substitute performance for improvement of skin function following burns and loss from trauma. Will continue the examination of pharmacologic (drug) treatments to prevent scarring from deep partial-thickness burns. Will examine the effectiveness of treatment methodologies for large volume muscle loss to restore muscle form and function. Will continue to develop devices and biologics for regeneration or restoration of genitourinary (genital and urinary) tissues lost or damaged due to traumatic injury. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Adjustment due to inflation for Regen and Sensory. New Task Area created for Battlefield Pain Management to accelerate research of several potential novel drugs for elimination of acute and battlefield pain.			
Title: Battlefield Pain Management	-	-	2.699
Description: This effort performs applied research in laboratory and animal studies to develop novel, non-opioid drugs to treat pain in the austere battlefield environment with minimal side effects. ***FY 2019 Plans:*** Will conduct animal studies to investigate the role of ion channel receptors and pain signaling; will develop peripheral nerve or antagonist analgesics to preserve the fighting force and maximize pain relief from combat wounds in austere and prolonged care environments while minimizing adverse side effects such as tolerance, dependence and chronification (occasional/intermittent pain that progresses to a chronic state) of acute pain. ***FY 2018 to FY 2019 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602787A / *Medical Technology*	**Project (Number/Name)** ET4 / *Appl Resch in Clinical and Rehabilitative Medicine*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Accelerate research of several potential novel drugs for elimination of acute and battlefield pain.			
Accomplishments/Planned Programs Subtotals	6.993	7.871	12.138

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / *Medical Technology*	Project (Number/Name) VB3 / *MEDICAL TECHNOLOGY INITIATIVES (CA)*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
VB3: *MEDICAL TECHNOLOGY INITIATIVES (CA)*	-	2.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.000

Note

Congressional Increase

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Medical Technology applied research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018
Congressional Add: Military operational medical research program	2.000	-
FY 2017 Accomplishments: N/A		
Congressional Adds Subtotals	2.000	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / *Medical Technology*	Project (Number/Name) VB4 / *System Biology And Network Science Technology*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
VB4: *System Biology And Network Science Technology*	-	2.072	2.001	2.008	-	2.008	2.050	2.099	2.143	2.187	0.000	14.560

A. Mission Description and Budget Item Justification

This Project supports biological and clinical applied research using the data analysis and integration grid (SysBioCube) as an overarching means of complex data usage to solve critical health problems. The primary capability of systems biology (field of study that focuses on complex interactions within biological systems, using a holistic approach) is the integration and analysis of complex human and animal study data and development of computational disease models, using global multi-omic methods to identify and discriminate unique combinations of biological molecules corresponding to clinical conditions (physiologic, immunologic, endocrine, etc.), supporting transition of research to clinical applications. This capability applies a systematic integrated approach to trace progression of illnesses and diseases and has already shown that the approach significantly reduces time, funds and effort invested in medical product development and refinement as seen in biomarker development for Post-Traumatic Stress Disorder (PTSD) and enhanced analyses of coagulopathy. Another application of systems biology is to characterize physiological pathways altered by toxic substances enabling identification of the causative toxic substances as well as to understand the injury mechanisms. The detection/identification of physiological markers of exposure to toxic substances can then be used to support medical countermeasure decisions or development of targeted therapeutic drugs.

These examples of more complex, yet integrated approaches to Projects studying biological systems (PTSD) Project have been shown to reduce both the time and expense of medical product development for the Army.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology, focus areas and the Army Modernization Strategy.

Work in this Project is performed by the United States Army Medical Research and Materiel Command (USAMRMC), Fort Detrick, MD / United States Army Center for Environmental Health Research (USACEHR).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Systems Biology	2.072	2.001	2.008
Description: The core capability for multidisciplinary applied research in systems biology enables integration and analysis of complex data from human and animal studies and development of computational network models, allowing researchers to differentiate among molecular signatures (unique combinations of biological molecules corresponding to clinical conditions) of disease, and supports transition of research to clinical applications to diseases of military relevance. Applied research is being conducted to identify biological networks that are causative of illness in Post-Traumatic Stress Disorder (PTSD) and co-morbidities (presence of one or more diseases or disorders), coagulopathy (impaired ability to clot blood) of trauma, Traumatic Brain Injury,			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602787A / *Medical Technology*	**Project (Number/Name)** VB4 / *System Biology And Network Science Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019

pain, suicide, infectious disease, and immune responses. In particular, the studies of PTSD are directed to refine biomarkers for screening, early diagnosis and therapeutic target discovery.

FY 2018 Plans:

Expand Systems Biology capabilities, to facilitate collaborative intramural and extramural partnerships, and to accommodate an expected increase in the number of end-users of the SysBioCube (USAMRMC?s information management suite, hosted by the National Cancer Institute (NCI) / National Institutes of Health (NIH) via the Frederick National Laboratory for Cancer Research). Oversee data sharing and data integration of large, complex datasets. Increase capabilities to develop novel methods that integrate different systems biology data (e.g., genetics and metabolism data) that, in turn, lead to new knowledge products. Provide support to the Integrative Systems Biology Program at United States Army Center for Environmental Health Research (USACEHR) for oversight of research efforts. Time-dependent clinical data collections and integrated omics analyses of treatment efficacies to be used in a wide range of studies including biomarker development and the understanding the altered molecular mechanisms that underlie PTSD, coagulopathy (blood?s ability to form clot is impaired), chronic pain perception, infectious diseases, and micro-gravitational stress on bone. Build a data-repository capability within the SysBioCube that will initially be for publications and associated datasets from 6.1 (Basic Research)-funded intramural research.

FY 2019 Plans:

Will expand Systems Biology capabilities through collaborative intramural and extramural partnerships, and accommodate an expected increase in the number of end-users of the SysBioCube (USAMRMC?s information management suite, hosted by the National Cancer Institute (NCI)/National Institutes of Health (NIH) via the Frederick National Laboratory for Cancer Research (FNLCR)). Will expand the data repository capability within the SysBioCube. Will continue to oversee data sharing and data integration of large, complex datasets. Will continue to increase capabilities to develop novel methods that integrate different systems biology data (e.g., genetics, microbiome, and metabolism data) that, in turn, will lead to new knowledge products. Will continue to provide support to the Integrative Systems Biology Program at USACEHR for oversight of research efforts. Will continue development of SysBioCube capabilities and functions such as integration and harmonization of additional data types (variant level Next Generation Sequencing data), browse and filtering functions to search for and sort specific assay types and associated data, tracking of assays conducted, and additional tools for longitudinal analysis and visualization of integrated data. Will use time-dependent clinical data collections and integrated omics (omics refers to the collective technologies used to explore the roles, relationships, and actions of the various types of molecules that make up the cells of an organism) analyses of treatment efficacies to support a wide range of research efforts that will include additional biomarker development and understanding of the underlying altered molecular mechanisms of a) PTSD (including changes in the microbiome (gut microbes) and in metabolism) that will begin to correlate co-morbid (concurrent) conditions, and b) infectious diseases.

FY 2018 to FY 2019 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602787A / *Medical Technology*	**Project (Number/Name)** VB4 / *System Biology And Network Science Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Starting in FY19, the effort for refinement and evaluation of methods to detect exposure to environmental contaminants and toxic chemicals during military operations is combined into Environmental Health and Protection of MOMRP. The remaining VB4 effort will have adjustment to inflation.			
Accomplishments/Planned Programs Subtotals	2.072	2.001	2.008

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / *Medical Technology*	Project (Number/Name) XV5 / *Medical Capabilities to Support Dispersed Operations*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
XV5: *Medical Capabilities to Support Dispersed Operations*	-	0.000	0.000	5.720	-	5.720	9.364	9.623	10.142	10.376	0.000	45.225

Note

This is a new start in FY19.

A. Mission Description and Budget Item Justification

This Project line will support the following three new medical task areas: 1) Autonomous and Unmanned medical capability - will focus on developing the ability to deliver emergency resupply of CLVIII by ground or air, such as blood products, and, utilization of platforms to perform evacuations, 2) Virtual Health - will enable prolonged care and deciding faster by exploiting emerging communications and information technology for remote telemonitoring and telementoring, 3) Medical Aspects of man-machine teaming - will enable teaming to deliver medical care, and establish medical performance criteria to ensure Soldiers have the physiological, cognitive, and psychological capacity to perform man-machine teaming.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Autonomous and Unmanned Medical Capability	-	-	1.721
Description: Research, design, and prototype autonomous and unmanned capabilities to deliver high quality combat casualty care in dispersed operations with limited or absent medical care personnel in support of the Army Multi-Domain Battle concept and the Army Force 2025 and Beyond vision. ***FY 2019 Plans:*** Will utilize invasive and non-invasive sensor systems to define new models for human physiologic responses to injury. Data from these models will be used to define new algorithms that drive resuscitation and critical care procedures in animal models. Algorithms will be defined for implementation across a full spectrum of automation capabilities. Will define the physiological process associated with injury in trauma simulations that would be amenable to automated therapeutics with autonomous medical systems. Will explore feasibility of integrating medical capabilities and information systems with Army unmanned systems (UMS) Programs of Record in order to leverage multipurpose robotic platforms for medical capabilities. Will research standardization of medical device interfaces for use in an autonomous platform. Will research feasibility of Unmanned Aerial Systems (UAS) to support remote patient monitoring research prototypes, closed-loop patient support systems, and prototype automated diagnostic and therapeutic en route care capabilities. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The MCSDO program (XV5) is a new start in FY19.			
Title: Virtual Health	-	-	1.998

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602787A / *Medical Technology*	**Project (Number/Name)** XV5 / *Medical Capabilities to Support Dispersed Operations*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Description: To develop future Virtual Health enterprise process architectures and integrated physical solutions capable to supporting prolonged field care in conditions with limited or lacking traditional field communications. ***FY 2019 Plans:*** Will generate an overall Virtual Health technology research plan with detailed research tasks to support the Multi-Domain Battlefield Concept to include potential cross-domain with other research task areas. Will research and model novel Virtual Health enterprise process architectures to provide new intersections of health information and knowledge far forward to support the Multi-Domain Battlefield Concept. Will conduct a gap analysis of mechanisms for Virtual Health secure data transmission and communications in the tactical environment leveraging novel means to reduce virtual health encounter data packet sizes through novel compression algorithms to facilitate use in very limited communication scenarios to support the Multi-Domain Battlefield Concept. Will determine key physiological constructs that are predictive of health status and readiness for development of a micro-footprint biosensor-based assessment tools. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The MCSDO program (XV5) is a new start in FY19.			
Title: Medical Aspects of Man-Machine Teamining/Medical Robotics ***Description:*** Research, design, and prototype future medical robotic systems capable of providing autonomous combat casualty care while optimizing the medical logistic footprint in far-forward and dispersed geographic environments in support of the Army Multi-Domain Battle concept and the Army Force 2025 and Beyond vision. ***FY 2019 Plans:*** Will research the design of robotic systems, including physical interfaces and hardware configurations, to effectively implement and control resuscitation and critical care procedures driven by algorithms defined by complementary research described in the Autonomous and Unmanned Medical Capability Task Area. Will research and design a proof of concept field robotic fold-up litter to show the feasibility of deploying soft robotics sensors and also show the capability to apply pressure using a soft robotics manipulator. Will model and characterize the problems caused by signal latency and constrained bandwidth on complex tele-robotic surgical tasks. Will research and prioritize procedures amenable to full automation of tele-robotic operations. Will research and explore the feasibility of using robotic perception systems to detect casualties from a standoff distance and at closer ranges using both conventional computer vision approaches and recent advancements in deep learning techniques. Will research and prioritize procedures. ***FY 2018 to FY 2019 Increase/Decrease Statement:***	-	-	2.001

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602787A / *Medical Technology*	**Project (Number/Name)** XV5 / *Medical Capabilities to Support Dispersed Operations*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
The MCSDO program (XV5) is a new start in FY19.			
Accomplishments/Planned Programs Subtotals	-	-	5.720

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A