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Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army **Date:** May 2021

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	-	110.928	101.341	91.720	-	91.720	-	-	-	-	-	-
874: <i>Cbt Casualty Care Tech</i>	-	0.834	-	-	-	-	-	-	-	-	-	-
BS7: <i>Medical Technology (CA)</i>	-	13.800	7.000	-	-	-	-	-	-	-	-	-
MK4: <i>Warfighter Health Applied Rsch Technology</i>	-	37.652	29.726	28.664	-	28.664	-	-	-	-	-	-
MM4: <i>Cbt Casualty Care Applied Rsch Technology</i>	-	17.708	19.301	23.437	-	23.437	-	-	-	-	-	-
MM6: <i>Medical Technologies to Support Dispersed Ops Tech</i>	-	11.780	14.052	10.724	-	10.724	-	-	-	-	-	-
MM8: <i>Infectious Diseases and Applied Rsch Technology</i>	-	21.277	24.542	28.895	-	28.895	-	-	-	-	-	-
MN1: <i>Applied Sensory Systems Trauma Technology</i>	-	7.302	6.720	-	-	-	-	-	-	-	-	-
VB4: <i>System Biology And Network Science Technology</i>	-	0.575	-	-	-	-	-	-	-	-	-	-

Note

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 six principal areas: Combat Casualty Care, Military Operational Medicine, Military Relevant Infectious Diseases, Clinical and Rehabilitative Medicine, Medical Capabilities to Support Dispersed Operations, and Systems Biology/Network Sciences. Projects are coordinated with the Defense Health Agency.

Project 874: Cbt Casualty Care Tech

Description: Identifies and evaluates drugs, biologics (medical products derived from living organisms), medical devices, and associated clinical practices for field trauma care systems, resuscitation, and life support, with emphasis on provision of prolonged field care when medical evacuation and access to definitive surgical care are delayed. Focus is identification of more effective critical care technologies and clinical practices to treat severe bleeding, traumatic brain injury, burns and other combat related injuries. This Project is coordinated with the Defense Health Agency.

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<p>Project MK4: Warfighter Health Applied Rsch Technology Description: Refines knowledge and technologies on screening tools and preventive measures for PTSD, behavioral health problems, 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 and predictive models used for the refinement of Warfighter protective equipment.</p> <p>Project MM4 Cbt Casualty Care Applied Rsch Technology Description: Identifies and evaluates drugs, biologics (medical products derived from living organisms), medical devices and associated clinical practices for field trauma care, resuscitation, and life support with emphasis on provision of prolonged field care when medical evacuation and access to definitive surgical care is delayed. Focus is identification of more effective critical care technologies and clinical practices to treat severe bleeding, traumatic brain injury, burns and other combat related injuries.</p> <p>Project MM6: Medical Technologies to Support Dispersed Ops Technology Description: Medical Robotic and Autonomous Systems (Med-RAS) - Research to develop the ability to deliver emergency resupply of Medical material including repair parts peculiar to medical equipment by ground or air, such as blood products, and, utilization of autonomous platforms to perform medical treatment and medical evacuations in dispersed and multi-domain battle environments.</p> <p>Project MM8: Infectious Diseases Applied Rsch Technology Description: Applied research to design and refine drugs, vaccines, and other medical countermeasures against naturally occurring infectious diseases as identified by worldwide medical surveillance and capability needs assessments.</p> <p>Project MN1: Applied Sensory Systems Trauma Technology Description: Research to understand the influence of stress on the effectiveness of pain relief drugs (analgesics). This Project conducts laboratory and animal studies for the purpose of developing novel, non-opioid drugs to treat pain in the austere battlefield environment with minimal side effects.</p> <p>Project VB4: System Biology and Network Science Technology Description: Includes strategic oversight, direction and management of applied research in integrative systems biology of military relevant conditions, and the Systems Biology Collaboration Center (SBCC). The Sys Bio Cube (a biomedical research data integration and analysis system), managed by the SBCC, provides the ability for multi-site collaborative efforts to integrate, visualize and evaluate complex data using innovative technologies. Post-Traumatic Stress Disorder and coagulopathy (a disorder that impairs the blood's ability to form clots) projects have utilized the systems biology analytical tools and visualization within the Sys Bio Cube to inform the development of prognostic indicators, objective diagnostics, and improved and personalized therapeutic strategies more quickly than non-systems approaches. The SBCC also serves as a US Army Medical Research and Development Command (USAMRDC) resource for data sharing and data management for maximizing the value of all research efforts across the Command.</p> <p>The cited work is consistent with the Under Secretary of Defense for Research and Engineering science and technology focus areas and the Army Modernization Strategy.</p>		

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Work in this PE is performed by the United States Army Medical Research and Development Command (USAMRDC), Fort Detrick, MD.

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 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. 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 Defense (DoD) biomedical research community, as well as their associated enabling research areas.

B. Program Change Summary (\$ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	112.955	95.496	95.558	-	95.558
Current President's Budget	110.928	101.341	91.720	-	91.720
Total Adjustments	-2.027	5.845	-3.838	-	-3.838
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	7.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.027	-1.155			
• Adjustments to Budget Years	-	-	-3.838	-	-3.838

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: BS7: *Medical Technology (CA)*

Congressional Add: *Military Force Vector Borne Health Protection*

Congressional Add: *Heat Stress on Female Soldiers*

Congressional Add: *Burn Patient Transfer System*

Congressional Add: *Musculoskeletal Injury and Bone and Muscle Adaption for Military Physical Training*

Congressional Add: *Program increase - safety and performance of female warfighters in extreme heat*

Congressional Add: *Program increase - military force vector borne health protection*

	FY 2020	FY 2021
	5.000	-
	2.000	-
	2.000	-
	4.800	-
	-	2.000
	-	5.000

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Congressional Add Details (\$ in Millions, and Includes General Reductions)

	FY 2020	FY 2021
Congressional Add Subtotals for Project: BS7	13.800	7.000
Congressional Add Totals for all Projects	13.800	7.000

Change Summary Explanation

\$7.000 million of FY22 will be realigned to APE 622787MM4 (Cbt Casualty Care Applied Rsch Technology) and \$18.200 million of FY22-26 will be realigned to APE 622787MM8 (Infectious Diseases Applied Rsch Technology) from PE 0603002A (Medical Advanced Technology), APE 633002MM9((Tech Base/Enabling Research for Infect Dis Adv Tech)

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Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>				Project (Number/Name) 874 / <i>Cbt Casualty Care Tech</i>			
COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
<i>874: Cbt Casualty Care Tech</i>	-	0.834	-	-	-	-	-	-	-	-	-	-

Note

In Fiscal Year 2021 (FY21) this Project is being realigned to:
 Program Element (PE) 0602787A Medical Technology
 * Project MM4 Cbt Casualty Care Applied Rsch Technology

A. Mission Description and Budget Item Justification

Applied technology development of burn recovery optimization technologies: applied technologies for acute burn treatment that remove dead tissue, prevent infection, and protect the wound from further damage until definitive burn care is available; diagnostic technologies to predict skin graft success or failure, identify patients at heightened risk for scarring, and monitor effectiveness of treatment.

Research conducted in this Project focuses on the following five areas:

- (1) Damage Control Resuscitation
- (2) Combat Trauma Therapies
- (3) Combat Critical Care Engineering
- (4) Traumatic Brain Injury (TBI)
- (5) Prolonged Field Care

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 PE 0603002A (Medical Advanced Technology) / Project 840 (Combat Injury Mgmt).

The cited work is consistent with the Under 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 Medical Research and Development Command (USAMRDC), Fort Detrick, MD.

B. Accomplishments/Planned Programs (\$ in Millions)

Title: Combat Trauma Therapies	FY 2020	FY 2021	FY 2022
	0.834	-	-

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>	Project (Number/Name) 874 / <i>Cbt Casualty Care Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021	FY 2022
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.			
Accomplishments/Planned Programs Subtotals	0.834	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>				Project (Number/Name) BS7 / <i>Medical Technology (CA)</i>			
COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
BS7: <i>Medical Technology (CA)</i>	-	13.800	7.000	-	-	-	-	-	-	-	-	-

Note

Congressional Interest Item funding provided for Medical Technology.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Medical Technology.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2020	FY 2021
Congressional Add: Military Force Vector Borne Health Protection FY 2020 Accomplishments: Program Increase supported applied research on Military Force Vector Borne Health Protection. Work executed under the direction of the Army Futures Command.	5.000	-
Congressional Add: Heat Stress on Female Soldiers FY 2020 Accomplishments: Program Increase supported applied research on Heat Stress on Female Soldiers. Work executed under the direction of the Army Futures Command.	2.000	-
Congressional Add: Burn Patient Transfer System FY 2020 Accomplishments: Program Increase supported applied research on Burn Patient Transfer System. Work executed under the direction of the Army Futures Command.	2.000	-
Congressional Add: Musculoskeletal Injury and Bone and Muscle Adaption for Military Physical Training FY 2020 Accomplishments: Program Increase supported applied research on Musculoskeletal Injury and Bone and Muscle Adaption for Military Physical Training. Work executed under the direction of the Army Futures Command.	4.800	-
Congressional Add: Program increase - safety and performance of female warfighters in extreme heat	-	2.000

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>	Project (Number/Name) BS7 / <i>Medical Technology (CA)</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021
<p><i>FY 2021 Plans:</i> Program Increase supported applied research on Safety and Performance of Female Warfighters in Extreme Heat.</p> <p>Work executed under the direction of the Army Futures Command.</p>		
<p><i>Congressional Add:</i> Program increase - military force vector borne health protection</p> <p><i>FY 2021 Plans:</i> Program Increase supported applied research on Military Force Vector Borne Health Protection.</p> <p>Work executed under the direction of the Army Futures Command.</p>	-	5.000
Congressional Adds Subtotals	13.800	7.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>				Project (Number/Name) MK4 / <i>Warfighter Health Applied Rsch Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
MK4: <i>Warfighter Health Applied Rsch Technology</i>	-	37.652	29.726	28.664	-	28.664	-	-	-	-	-	-

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; reduce the effects of trauma and promote rapid recovery from acute stress in far forward operational environments; 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 and readiness 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, and nutritional interventions.

- The four main areas of study are:
- (1) Physiological Health and Performance
 - (2) Environmental Health and Protection
 - (3) Injury Prevention and Reduction
 - (4) Psychological Health and Resilience

This effort is coordinated with and complimentary to work done in PE 0602143A Soldier Lethality Technology and PE 0603118A Soldier Lethality Advanced Technology.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the United States Army Medical Research and Development Command (USAMRDC), Fort Detrick, MD.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2020	FY 2021	FY 2022
Title: Physiological Health and Performance	21.488	14.272	-
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 new high-priority medical investments in human biomedical performance enhancement and medical aspects of manned-unmanned machine teaming (MUM-T).			
FY 2021 Plans: Expeditionary Force Nutrition to Improve Performance ? Evaluate the effects of nutritional energy balance on inflammatory response.			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>? Refine understanding of the environmental influences on eating behavior, to include extreme environmental influences such as heat, cold and altitude.</p> <p>? Evaluate the effects of protein source in protein kinetics and muscle growth and strength.</p> <p>Medical Interventions to Reduce Impact of Fatigue on Performance</p> <p>? Develop a demonstration of the effectiveness of electrical stimulation of the brain for enhancing learning through the consolidation of emotional memories.</p> <p>? Evaluate the effectiveness of SWS augmentation via AS for enhancing tactical performance and reducing sleepiness during a subsequent period of sustained wakefulness.</p> <p>Biomedical Performance Enhancement</p> <p>? Evaluate drug-delivered testosterone for maintenance of physiological and psychological performance under conditions of medically relevant hypogonadism (a failure of the gonads, testes in men and ovaries in women, to function properly) induced by high operational tempo military activity.</p> <p>? Provide medical and Soldier integration criteria for single-joint exoskeleton to enhance Soldier physical performance in military operations.</p> <p>? Evaluate pharmacological strategies for improving Soldier endurance.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned to other efforts within Project MK4 (Biomedical Performance Enhancement, Expeditionary Force Nutrition to Improve Performance, and Medical Interventions to Reduce Impact of Fatigue on Performance).</p>				
<p>Title: Environmental Health and Protection</p> <p>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 matures 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.</p> <p>FY 2021 Plans: Operational Risk Planning Tools for Battlefield Environmental Threats</p>		5.688	7.431	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>? Predict, protect, and enhance performance of the Soldier operating in dense urban and subterranean environments, with a focus on respiratory threats, mental and physical performance, and survivability.</p> <p>? Develop studies exposing zebrafish to low oxygen conditions, altered temperatures, and psychological stressors (e.g., predator exposure) to evaluate the potential effectiveness of pharmaceutical interventions to optimize performance.</p> <p>? Develop an immersive screening task that, in combination with select measures, will be utilized as screening tool for predicting individuals likely to experience impairment.</p> <p>? Develop tools to assess medical effects for using personal protective equipment in dense urban and subterranean environments to prevent degraded physical and cognitive performance.</p> <p>Prevention of Soldier Performance Degradation in Extreme Environments</p> <p>? Evaluate human performance in heat, cold and altitude studies which provide physiological monitoring data for algorithms for an integrated Soldier sensor system to sustain lethality, optimize performance, and improve health and readiness.</p> <p>? Evaluate strategies to improve Soldier health, readiness and mission performance through interventions designed to prevent injuries that result from multi-environmental stressors.</p> <p>? Evaluate interventions to reduce environmental injuries in the heat and cold weather operations.</p> <p>? Refine and develop tools that sustain lethality, improve health, and optimize performance to reduce injuries following exposures to heat, cold, terrestrial altitude for squad leaders and mission planners.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned to other efforts within Project MK4 (Operational Risk Planning Tools for Battlefield Environmental Threats and Prevention of Soldier Performance Degradation in Extreme Environments).</p>				
<p>Title: Injury Prevention and Reduction</p> <p>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 operations environment. It 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 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.</p>		6.556	4.379	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p><i>FY 2021 Plans:</i> Physical Fitness Standards to Prevent Musculoskeletal Injuries ? Administer field expedient physical performance tests (PPTs) known to be predictive of performance of common Soldier tasks to Soldiers following lower extremity musculoskeletal injuries. ? Compare PPT data to known reference values to assess readiness for return to duty (RTD). ? Use data to assess the prognostic accuracy of PPTs in determining Soldier progression from initial injury to readiness for RTD.</p> <p>Leader Tools to Reduce Musculoskeletal Injury in all Settings ? Establish and publish modifiable and non-modifiable factors that impart resilience or contribute to risk for stress fracture and other musculoskeletal injury development during Basic Combat Training (BCT).</p> <p>Leader Decision Aids to Manage Blast Head Injury in All Settings ? Determine an objective blood-based biomarker of cognitive status from field studies of blast overpressure and head impact exposures in various heavy weapons military training environments.</p> <p><i>FY 2021 to FY 2022 Increase/Decrease Statement:</i> Funds realigned to other efforts within Project MK4 (Physical Fitness Standards to Prevent Musculoskeletal Injuries, Leader Tools to Reduce Musculoskeletal Injury in all Settings and Leader Decision Aids to Manage Blast Head Injury in All Settings).</p>				
<p><i>Title:</i> Psychological Health and Resilience</p> <p><i>Description:</i> This effort refines and evaluates tools and early interventions to prevent and reduce the impact of military stressors and combat-related exposures on 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.</p> <p><i>FY 2021 Plans:</i> Optimal Delivery of Far Forward Psychological Health Care ? Develop content and products to deliver behavioral health services oriented to far forward operational settings for the promotion of rapid recovery from acute stress and other behavioral health issues. ? Develop readiness tools and recommendations to assist in behavioral health readiness decisions made by unit leaders and medics. ? Develop clinical practice guidelines medics will follow to address the core behavioral health problems encountered in far-forward settings.</p>		3.920	3.644	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>? Develop neurocognitive optimization and enhancement tools to mitigate health and performance decrements during and following stress exposure (i.e., point of psychological injury).</p> <p>Unit-Level Psychological Interventions to Enhance Performance</p> <p>? Develop and evaluate next-generation bystander intervention training to increase unit member response to high-risk behaviors.</p> <p>? Determine how transition points place Soldiers at risk.</p> <p>? Conduct assessment of Security Forces Assistance Brigades.</p> <p>? Develop a method for assessing military-relevant moral injury concerns.</p> <p>? Establish components for enhancing behavioral health leadership skills and develop new training.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned to other priorities within Project MK4 (Tasks Optimal Delivery of Far Forward Psychological Health Care and Unit-Level Psychological Interventions to Enhance Performance).</p>				
<p>Title: Operational Risk Planning Tools for Battlefield Environmental Threats</p> <p>Description: This effort investigates and incorporates mechanisms for health risks of heat, cold, and altitude injuries to develop guidelines and advise countermeasure development for operations in extreme environments. Investigates health risks from industrial chemicals and pollutants found in dense urban and subterranean (SubT) environments in which Soldiers operate.</p> <p>FY 2022 Plans: Will develop risk profiles for exposures in extreme environments including cold water; develop and validate models for high-throughput screening for novel or repurposed drugs to counter performance decrements encountered in SubT operational environments; validate heat injury biomarkers to inform return to duty guidance.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MK4 (Environmental Health & Protection).</p>		-	-	2.282
<p>Title: Prevention of Soldier Performance Degradation in Extreme Environments</p> <p>Description: This effort develops and matures non-invasive technologies, decision-aid tools, and other countermeasure to prevent and enhance Soldier performance in extreme environments of heat, cold, altitude, dense urban and subterranean (SubT) environments. This effort includes validation of approved pharmaceuticals as well as provides improved sensors and predictive algorithms models.</p> <p>FY 2022 Plans: Will validate performance of pharmaceuticals to reduce acute mountain sickness, heat injuries and other environmental exposures; assess the feasibility of dietary supplements as a mitigation for increased carbon dioxide blood levels and potential</p>		-	-	4.198

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
respiratory failure recurrent in SubT environments; evaluate cold habituation as an intervention to augment peripheral blood flow in cold exposure; investigate models for the effect of wet clothing on heat loss; determine advanced decision aids for pacing and load carriage optimization; design physiological modes to predict human state during complex military scenarios; develop and/or assess various countermeasures for improved performance in extreme environments. FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MK4 (Environmental Health & Protection).				
Title: Leader Decision Aid to Manage Blast Head Injury in All Settings Description: Develop injury risk assessment/guidance/criteria that will inform the development of technologies (i.e., personal protection equipment, vehicles) and strategies (i.e., health hazard assessments) to protect the Soldier against current and emerging operational threats (i.e., blast, blunt, ballistic, and accelerative). Improve the prevention of and reduce the severity of spinal injuries experienced by military vehicle occupants and dismounted Warfighters during non-underbody blast operational exposures (aircrew crash, vibration, head-supported mass) through the development of improved, biomedically valid spinal injury criteria and health hazard assessments. FY 2022 Plans: Will conduct experiments to build upon performance based weight limit criteria for loads added to the head (head protection systems, night vision goggles) to include acute injury based criteria for mounted and dismounted environments. FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MK4 (Injury Prevention & Reduction).		-	-	0.255
Title: Physical Fitness Standards to Prevent Musculoskeletal Injuries Description: Develops validated standards and strategies to optimize Soldier readiness and performance related to musculoskeletal injury (MSKI) in order to provide military leadership with strategies and standards to mitigate musculoskeletal injuries, facilitate quick return to combat effectiveness after MSKI, and decrease risk of re-injury once been cleared to return after injury to increase the probability of mission success. FY 2022 Plans: Will quantify relative contributions of modifiable and non-modifiable risk factors for MSKI; examine relationship between Holistic Health and Fitness (H2F) metrics and Soldier fitness and operational readiness to inform updates to H2F program; determine incidence of degraded performance metrics in combat units with and without embedded specialty providers and develop strategies to enhance performance and reduce injury and re-injury rates. FY 2021 to FY 2022 Increase/Decrease Statement:		-	-	1.625

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
Funds realigned from other efforts within Project MK4 (Injury Prevention & Reduction).				
<p>Title: Leader Tools to Reduce Musculoskeletal Injury In All Settings</p> <p>Description: Enhances the Army's understanding of the physiological mechanisms underlying musculoskeletal injuries and identifies countermeasures to mitigate injury risk in order to reduce musculoskeletal injuries in new recruits, thereby directly impacting force readiness and improving lethality.</p> <p>FY 2022 Plans: Will define factors that contribute to risk for stress fracture and other MSKI development during Basic Combat Training (BCT); develop evidence-based, actionable recommendations to Army leadership (TRADOC-Center for Initial Military Training) to reduce MSKI in recruits without reducing training standards; determine trends/rates of negative health outcomes incurred by Soldiers to include risk and protective factors.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MK4 (Injury Prevention & Reduction).</p>		-	-	3.626
<p>Title: Forward Neuro-Muscular Skeletal Injury Assessment</p> <p>Description: Focus on developing portable imaging technologies to identify soft tissue musculoskeletal injury severity in the field and generate capabilities to guide musculoskeletal injury management to inform appropriate evacuation vs. return to duty (RTD) decisions.</p> <p>FY 2022 Plans: Design and conduct experiments for an ultrasound-based bone injury screening device and investigate its translation to a soft tissue imaging based capability for diagnosing and screening of musculoskeletal injury.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts in Project MN1 (Forward Neuro-Muscular Skeletal Injury Assessment).</p>		-	-	0.391
<p>Title: Biomedical Performance Enhancement</p> <p>Description: This effort evaluates strategies and technologies that enhance Soldier physical and mental performance in Multi-Domain operations. Additional efforts concentrate on characterization of physiological and genetic factors that contribute to physiological resilience to military stressors.</p> <p>FY 2022 Plans: Will complete evaluation of drug-delivered testosterone for maintenance of physiological and psychological performance under conditions of medically relevant hypogonadism (a failure of the gonads, testes in men and ovaries in women, to function properly)</p>		-	-	6.511

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
induced by high operational tempo military activity; investigate pharmacological strategies for improving Soldier vigilance & endurance; refine electrical stimulation technologies to augment military performance and mitigate high OPTEMPO performance degradation. FY 2021 to FY 2022 Increase/Decrease Statement: Fund realigned from other efforts within Project MK4 (Physiological Health and Performance).				
Title: Expeditionary Force Nutrition to Improve Performance Description: Characterizes and refines field fueling and garrison practices to sustain Medical readiness, military performance and recovery from military operations. Evaluates combat ration components to sustain Medical Readiness and performance in deployed, disaggregated and dispersed operations. FY 2022 Plans: Will conduct experiments to improve understanding of environmental influences (heat, cold, altitude) on eating behavior; investigate the effects of protein source on muscle mass growth, strength and maintenance; evaluate nutritional requirements for maintenance of cognitive, physical and immune function during arduous military training. FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MK4 (Physiological Health and Performance).		-	-	1.793
Title: Medical Interventions to Reduce Impact of Fatigue on Performance Description: Investigates and determines strategies and technologies that prevent or mitigate fatigue-related performance decrements and injuries during training and operations. Refines interventions that prevent or mitigate clinical sleep disorders in Soldiers. Evaluates technologies to non-intrusively & non-invasively monitor vigilance and performance in real-time. FY 2022 Plans: Will determine the effectiveness of electrical stimulation of the brain for enhancing learning through the consolidation of emotional memories; investigate the effectiveness of slow-wave sleep augmentation via auditory and electrical stimulation for enhancing tactical performance and reducing sleepiness during a subsequent period of sustained wakefulness. FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MK4 (Physiological Health and Performance).		-	-	2.349
Title: Optimal Delivery of Far Forward Behavioral Health Care Description: This effort will develop a Far Forward Behavioral Health (BH) delivery system of care for rapid recovery in austere environments, and guidelines for use of pharmacologic and non-pharmacologic solutions for BH issues in MDO without dedicated		-	-	2.752

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>BH assets, tailored to needs and training of medics, that will reduce the development of deployment-related psychological health issues.</p> <p>FY 2022 Plans: Will investigate pharmacotherapies in preclinical models for their efficacy in speeding recovery and restoring behavioral and physiological function after traumatic stress, to inform clinical trials in humans; design guidelines for medics to use existing Role 1 pharmacologic solutions to prevent and reduce the development of behavioral health issues in Soldiers; investigate the safety and efficacy of pharmacologic candidate compounds to speed recovery after traumatic stress exposure, to be tested in humans; investigate delivery of far-forward, non-pharmacological behavioral health services intervention package, and report on feasibility and effectiveness; determine a neurocognitive optimization, sustainment and recovery platform that mitigates responses to and expedites recovery from stress/trauma at or near point of psychological injury (Role 1); determine a blood-based biomarker screening panel to characterize objective signatures of Acute Stress Disorder that indicate risk of unresolved symptoms.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MK4 (Psychological Health & Resilience).</p>				
<p>Title: Unit-Level Psychological Interventions to Enhance Performance</p> <p>Description: This effort will deliver evidence-based strategies and inform policies to optimize, enhance and sustain Service member and Unit psychological health, well-being, resilience and readiness.</p> <p>FY 2022 Plans: Determine recommendations for leaders to address behavioral health threats and profiles identified by the rapid feedback mechanism; design and investigate measures of morally-challenging combat events, moral reactions, and moral leadership; design and conduct experiments on a framework that assists in identifying profiles of cognition and behavior to assist in matching individuals to appropriate resilience interventions; design and investigate candidate tools to improve small-team culture, performance and resilience; determine neurocognitive mechanisms of performance, particularly under high stress conditions.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MK4 (Psychological Health & Resilience).</p>		-	-	2.882
Accomplishments/Planned Programs Subtotals		37.652	29.726	28.664
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				

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D. Acquisition Strategy
N/A

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COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
MM4: <i>Cbt Casualty Care Applied Rsch Technology</i>	-	17.708	19.301	23.437	-	23.437	-	-	-	-	-	-

Note

In FY 2022 funding for this Project was realigned from:

PE 0602148A (Future Vertical Lift Technology)

*Project BZ7 (Future Vertical Lift Medical Technologies)

PE 0602787A (Medical Technology)

*Project MM6 (Medical Technologies to Support Dispersed Ops Tech)

*Project MK4 (Warfigher Health Applied Rsch Technology)

PE 0603002A (Medical Advanced Technology)

*Project MN3 (Immediate Cardiopulmonary Stabilization Adv Tech)

*Project MO2 (Traumatic Brain Injury (TBI) Treatment Adv Tech)

*Project MO4 (Burn Recovery Optimization Advanced Technology)

A. Mission Description and Budget Item Justification

This Project refines and assesses concepts, techniques, and materiel that improve survivability and treatment outcomes for Warfighters wounded during combat operations and treated under austere field conditions, including prolonged field care, and during medical evacuation, and maintains laboratory capability to perform these functions. Combat casualty care research addresses control of severe bleeding; resuscitation and stabilization; advanced automated life support systems suitable for use in forward areas, treatment of severe orthopedic injuries, treatment of severe burns, and combat-related brain injury.

Promising efforts identified in this Project are further matured under PE 0603002A (Medical Advanced Technology).

The cited work is consistent with the Under 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 Development Command (USAMRDC), Fort Detrick, MD.

B. Accomplishments/Planned Programs (\$ in Millions)

Title: Damage Control Resuscitation	FY 2020	FY 2021	FY 2022
	4.216	-	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
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.				
Title: Combat Trauma Therapies		4.125	-	-
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 burn, facial or extremity wounds.				
Title: Pre-Hospital Tactical Combat Casualty Care		0.864	-	-
Description: This effort refines diagnostic and therapeutic medical devices, drugs, and new clinical practices for resuscitation, stabilization, and preservation of vital organ function that can be applied by combat medical personnel in the pre-hospital combat setting.				
Title: Traumatic Brain Injury (TBI)		1.622	-	-
Description: This effort supports refinement of drug (includes mature drug technologies and those that are 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 TBI resulting from battlefield trauma.				
Title: Prolonged Care		6.881	7.299	-
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 2021 Plans:				
Battlefield sustainment of critical organ function cap set 1 ? Perform large animal studies of stem cell products to treat acute respiratory distress syndrome.				
Future en Route Casualty Care Sustainment System Cap Set ? Assess biological effects and safety of new extracorporeal life support technologies (medical devices situated external to the body that provide prolonged organ support in casualties whose vital organs are, due to illness or injury, unable to sustain life).				
Modular and Automated Battlefield Sustainment of Critical Organ Function Cap Set 2 ? Develop sepsis prediction and prolonged field care decision support system.				

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>Limb Function Repair and Return to Combat Duty ? Evaluate technologies to preserve injured limb tissues and function under prolonged field care conditions.</p> <p>Field Stabilization of Preparation of Evac ? Evaluate drug and biological compounds to improve extremity wound healing. ? Begin evaluation of litter carriage performance and post-carry fatigue effects in prolonged field care environments.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned to other priorities within Project MM4 (Candidate Capabilities for Battlefield Sustainment of Critical Organ Function, Modular and Automated Battlefield Sustainment of Critical Organ Function Cap Set 2, Future En Route Casualty Care Sustainment System Cap Set).</p>				
<p>Title: Blood and Blood Products</p> <p>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 and mitigation of shock; minimizing the effects of traumatic blood loss; preserving, storing, and transporting blood and blood products.</p> <p>FY 2021 Plans: Synthetic Blood Replacement (\$0.987M) ? Study use of whole blood as treatment for acute traumatic coagulopathy (blood clotting disorder).</p> <p>Next Generation Human-Derived Blood Replacement (\$3.949M) ? Identify new efficacious preservative solutions for platelets and whole blood. ? Begin study of cellular therapies for treatment of acute radiation sickness combined with traumatic injury.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned to other efforts within Project MM4 (Next Generation Human-Derived Blood Replacement, Bioengineered Blood Surrogate).</p>		-	4.906	-
<p>Title: Severe Burns</p> <p>Description: This effort conducts research to enhance the ability to treat acute severe burns at or near the point of injury; protect burn wounds from further injury, infection and inflammation, especially when definitive surgical burn wound care is delayed or unavailable; and accelerate wound healing and return to combat duty.</p> <p>FY 2021 Plans: Rapid Burn Injury Treatment and Return to Duty Cap Set 1 (\$2.272M)</p>		-	2.822	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>? Assess novel technologies to prevent burn progression in casualties treated in far forward environments. ? Develop new severe burn animal models in which to assess new burn treatments along with technologies that quantify burn wound healing rate and measure effectiveness of treatment.</p> <p>Next Generation Rapid Burn Injury Treatment and Return to Duty Cap Set 2 (\$0.568M) ? Develop new treatment approaches to protect burn wounds, prevent infection and inflammation, accelerate healing and restore function.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned to other efforts within Project MM4 (Candidate Capabilities for Rapid Burn Treatment, Next Generation Rapid Burn Injury Treatment and Return to Duty Cap Set 2).</p>				
<p>Title: Tactical Combat Casualty Care</p> <p>Description: This effort refines diagnostic and therapeutic medical devices, drugs, and new clinical practices for hemorrhage control, resuscitation, stabilization, and preservation of vital organ function that can be immediately applied by combat medical personnel in the pre-hospital combat setting.</p> <p>FY 2021 Plans: Advanced Tactical Combat Casualty Stabilization System Cap Set 2 (\$0.423M) ? Examine therapeutic approaches to preserving kidney function following crush injuries.</p> <p>Tactical Combat Casualty Stabilization System Cap Set 1 (\$1.690M) ? Evaluate catheter-based techniques to control non-compressible hemorrhage. ? Characterize new animal pain models.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned to other efforts within Project MM4 (Tactical Combat Casualty Care Candidate Pharmaceuticals and Devices, Autonomous Cardiopulmonary Resuscitation).</p>		-	2.099	-
<p>Title: Brain Trauma</p> <p>Description: This effort supports refinement of drug (includes mature drug technologies and those that are FDA approved for other indications) and therapeutic strategies to manage brain injury resulting from battlefield trauma.</p> <p>FY 2021 Plans: Drugs to Prevent and Treat Brain Injury (\$1.751M) ? Perform applied research on nanoparticles to evaluate their use as a drug delivery vehicle.</p>		-	2.175	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>? Study therapies that enhance inherent brain healing abilities. ? Evaluate nicotine as a potential neuroprotective drug.</p> <p>Advanced Medic Brain Injury Diagnostic and Treatment System (\$0.438M) ? Study correlative relationships between brain injury-induced non-convulsive seizures, brain injury-specific biomarkers, and clinical outcomes.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned to other efforts within Project MM4 (Prevention and Treatment of Brain Injury, Automated Management of TBI & Concussion in Prolonged MDO (Multi-Domain Operations)).</p>				
<p>Title: Modular and Automated Battlefield Sustainment of Critical Organ Function Cap Set 2</p> <p>Description: This effort performs applied research to support development of novel, disruptive technologies to improve survival of the most severely injured casualties when medical evacuation is delayed and access to definitive surgical care is limited.</p> <p>FY 2022 Plans: Will conduct experiments on technologies designed to mitigate detrimental effects that would otherwise occur in critically wounded casualties receiving prolonged care in forward operating areas when medical evacuation is either delayed or not possible, or definitive surgical care is unavailable; design tools that will enable medics to continuously monitor vital organ function in severely injured casualties, who for tactical reasons must be provided prolonged critical care in forward operating areas pending availability of medical evacuation and/or definitive surgical care; investigate the effects of reducing inflammation on vital organ function following severe injury; initiate investigation of drugs and other medical products that will protect blood deprived tissues from further damage after blood flow is restored.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM4 (Prolonged Care, Modular and Automated Battlefield Sustainment of Critical Organ Function Cap Set 2).</p>		-	-	1.257
<p>Title: Battlefield Pain Control without Physiological Impairment</p> <p>Description: This effort performs applied research in laboratory and animal studies to determine novel, non-opioid drugs to treat pain in the austere battlefield environment with minimal side effects.</p> <p>FY 2022 Plans:</p>		-	-	2.351

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>Will conduct preclinical evaluation of promising non-opioid, side effect-free pain relieving drugs that act on non-opioid targets in the nervous system to inhibit pain signaling without affecting cognitive ability in treating post-traumatic, moderate-to severe pain in order for the wounded casualty to be able to remain in the fight.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts in Project MN1 (Battlefield Pain Control without Physiological Impairment).</p>				
<p>Title: Candidate Capabilities for Rapid Burn Treatment</p> <p>Description: This effort conducts research to enhance the ability to treat acute severe burns at or near the point of injury, protect burn wounds from further injury, infection and inflammation, especially when definitive surgical burn wound care is delayed or unavailable, and accelerate wound healing and return to combat duty.</p> <p>FY 2022 Plans: Will conduct experiments to evaluate new technologies and clinical practices for improving treatment of acute burns at the point of injury with aim to accelerate wound healing, reduce complications, and increase rate of return to duty; determine a dual treatment targeting both ischemia (poor blood & oxygen supply) and inflammation to prevent burn progression on the battlefield using a large animal model; investigate the effect of enzymatic debridement (removal of damaged tissue) on wound healing of full thickness burns in a preclinical pig large animal model; evaluate extracellular vesicle (particles that are naturally released from a cell)-releasing plasma-alginate wound dressing to reduce inflammation and improve healing of acute wounds; investigate optimal off-the-shelf therapies to accelerate wound healing in a large, 20% total body surface area, and deep partial thickness burn wound model.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM4 (Severe Burns).</p>		-	-	1.695
<p>Title: Autonomous Cardiopulmonary Resuscitation</p> <p>Description: Currently, definitive surgical repair is required to stop non-compressible bleeding (bleeding that cannot be stopped with application of direct pressure or tourniquet) in the chest or abdomen. This effort investigates new technologies addressing major causes of battlefield mortality, including non-compressible hemorrhage, safe mitigation of hemorrhagic shock, and airway obstruction and ventilation.</p> <p>FY 2022 Plans:</p>		-	-	0.528

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>Will investigate new technologies that may be deployed by medics in the far-forward, prehospital environment to temporarily stop lethal non-compressible bleeding until definitive surgical repair is available; will design and determine efficacy and safety of emerging foams that stop bleeding in animal models of non-compressible truncal hemorrhage.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM4 (Tactical Combat Casualty Care).</p>				
<p>Title: Unconventionally-acquired Brain Injury (UBI)</p> <p>Description: This effort performs applied research aimed at determining the physiological effects of unconventionally-acquired threat technologies to support development of future diagnostic and treatment tools.</p> <p>FY 2022 Plans: Will determine and investigate treatment for unconventionally-acquired brain injury threat technologies; conduct Unconventionally-acquired Brain Injury human-like animal experiments; validate Unconventional-acquired Brain Injury threat source symptomology and determine injury mechanisms; validate understanding of injury mechanisms to enable direct medical diagnosis, treatment and clinical management.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds reprogrammed from Project MN1 (Battlefield Pain Control without Physiological Impairment).</p>		-	-	8.897
<p>Title: Automated Management of TBI & Concussion in Prolonged MDO</p> <p>Description: This effort performs applied research to support development of therapies to treat and clinically manage brain injury under prolonged care conditions.</p> <p>FY 2022 Plans: Will investigate efficacy of an immunomodulation agent (stimulates or suppresses the immune system) to mitigate both intracerebral bleeding (bleeding within the brain tissue), as well as neurological, motor impairment and cognitive deficits following TBI.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM4 (Brain Trauma).</p>		-	-	1.266
<p>Title: Prevention and Treatment of Brain Injury</p> <p>Description: This effort supports refinement of drug (includes mature drug technologies and those that are FDA approved for other indications) and therapeutic strategies to manage brain injury resulting from battlefield trauma.</p> <p>FY 2022 Plans:</p>		-	-	1.497

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>Will determine the efficacy of a novel anti-oxidant and anti-inflammatory peptide, currently undergoing FDA evaluation, against blast-induced TBI, and will perform dosing studies to determine the optimum effective dose.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM4 (Brain Trauma).</p>				
<p>Title: Next Generation Rapid Burn Injury Treatment and Return to Duty Cap Set 2</p> <p>Description: This effort conducts research to support development of novel, disruptive technologies that will significantly enhance the ability to treat acute severe burns at or near the point of injury, protect burn wounds from further injury, infection and inflammation, especially when definitive surgical burn wound care is delayed or unavailable, and accelerate wound healing and return to combat duty.</p> <p>FY 2022 Plans: Will determine effectiveness of a thin film containing antimicrobial and anti-inflammatory drugs applied to deep partial thickness- and full thickness-burn wounds early after injury to reduce bacterial burden, inflammation, and injury progression.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM4 (Severe Burns).</p>		-	-	0.726
<p>Title: Bioengineered Blood Surrogate</p> <p>Description: This effort performs applied research focused on development of modified whole blood or blood products, and synthetic blood products that will stop life threatening bleeding, stabilize tissue metabolism, mitigate shock and restore normal blood clotting, and will improve prompt hemorrhage control and minimize sustainment requirements.</p> <p>FY 2022 Plans: Will comparatively investigate ability of promising cold-stored whole blood additives to extend shelf life and maintain normal blood function.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM4 (Blood and Blood Products).</p>		-	-	0.361
<p>Title: Next Generation Human-Derived Blood Replacement</p> <p>Description: This effort performs applied research focused on development of improved blood products and biopharmaceutical technologies that stop life threatening bleeding, stabilize tissue metabolism, mitigate shock and restore normal blood clotting, and will improve prompt hemorrhage control and minimize sustainment requirements.</p> <p>FY 2022 Plans:</p>		-	-	0.772

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
Will investigate single drugs and multiple drugs in combination to determine their efficacy in prolonging survival and improving outcomes in animal models of hemorrhagic shock. FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM4 (Blood and Blood Products).				
Title: Future En Route Casualty Care Sustainment System Cap Set Description: This effort performs applied research to support development of technologies that will increase capability and capacity to provide combat casualty care from point of injury to final point of care. FY 2022 Plans: Will determine and validate a post mortem human subject model for use in patient in transport research- all use of post-mortem human subjects will be done in an ethical and respectful manner in accordance with the 05-November-2019 Army Policy for Use of Human Cadavers for RDTE, Education and Training. Will conduct engineering evaluation of the Interim Medevac Mission Support System to support future studies aimed at improving patient and medical attendant survivability in potentially survivable mishaps. FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM4 (Prolonged Care).		-	-	1.843
Title: Candidate Capabilities for Field Stabilization of Bone in Preparation for Evacuation Description: This effort focuses on multiple disruptive technologies for early treatment of extremity fractures to accelerate healing and mitigate complications, while maintaining soldier mobility. FY 2022 Plans: Will investigate pharmaceuticals and biologics that reduce cellular metabolism in injured limbs and protects injured tissues from the effects of prolonged lack of blood and oxygen followed by period of blood and oxygen re-supply. FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM4 (Prolonged Care).		-	-	0.542
Title: Candidate Capabilities for Limb Function Repair and Return to Combat Duty Description: This effort focuses on multiple disruptive technologies directed toward early treatment of extremity fractures to accelerate healing and mitigate complications and includes compartment syndrome (Increased pressure within a closed body space, especially of the leg or forearm. May require surgery and loss tissue or extremity). FY 2022 Plans:		-	-	0.596

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>	Project (Number/Name) MM4 / <i>Cbt Casualty Care Applied Rsch Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
Will determine efficacy of two drugs in preserving skeletal muscle function following extended tourniquet application.				
FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM4 (Prolonged Care).				
Title: Candidate Capabilities for Battlefield Sustainment of Critical Organ Function		-	-	1.106
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 2022 Plans: Will investigate field-deployable pharmacological treatments using a previously developed combat-relevant small animal model that reliably produces acute kidney injury; investigate drugs that increase renal oxygen delivery and improve energy utilization; determine the efficacy of targeting key immunomodulatory (affecting the immune system) players on progression of smoke inhalation injury in a small animal lung injury model.				
FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM4 (Prolonged Care).				
Accomplishments/Planned Programs Subtotals		17.708	19.301	23.437
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army										Date: May 2021		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>				Project (Number/Name) MM6 / <i>Medical Technologies to Support Dispersed Ops Tech</i>			
COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
MM6: <i>Medical Technologies to Support Dispersed Ops Tech</i>	-	11.780	14.052	10.724	-	10.724	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project supports applied research in two task areas: 1) Medical Robotic and Autonomous Systems (Med-RAS) - will a) leverage emerging technologies in biomedical engineering, robotics, autonomy, unmanned systems, and assured position navigation and timing, to improve capabilities and expand capacity to deliver prolonged care, perform evacuation, delivery emergency resupply of CLVIII, such as blood products, by ground or air, in dispersed and Multi-Domain Operations and b) establish medical performance criteria to ensure Soldiers are able to effectively perform manned-unmanned teaming tasks; and, 2) Virtual Health - will leverage emerging technologies in information science, artificial intelligence, telecommunications network engineering, and cyber security to enable prolonged care, remote telemonitoring, automated decision support, and telementoring between providers in Role of Care 3 and 4 to patients in Role of Care 1 and 2. Promising work in this Project will be further matured in PE 0603002A (Medical Advanced Technology) / Project MM7 (Enabling Med Cap to Support Dispersed OPS Adv Tech).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. Work in this Project is performed by the United States Army Medical Research and Development Command (USAMRDC), Fort Detrick, MD.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2020	FY 2021	FY 2022
Title: Medical Robotic and Autonomous Systems (Med-RAS)	7.886	9.726	7.377
Description: Research, design, and validate autonomous and unmanned capabilities to deliver high quality combat casualty care in dispersed operations with limited or absent medical care personnel, and 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 Operations concept and the Army Force 2025 and Beyond vision documents.			
FY 2021 Plans:			
Medical Robotic and Autonomous Systems (Med-RAS)			
? Design medical robotic systems, including physical interfaces and hardware configurations, for procedures driven by AI and Machine Learning (ML) by: 1) refining polytrauma protocols for animals, 2) conducting human stress testing in a Lower Body Negative Pressure (LBNP) chamber, and 3) performing lab testing of ?soft? robotic noninvasive sensing, force feedback control, needle insertion, patient immobilization, and airway access and insertion.			
? Expand methods for integrating medical systems with unmanned aerial system (UAS) platforms that address patient transport safety concerns, reliability of medical systems in flight, and low-bandwidth and cyber-secure transmission of medical data by 1) testing the patient simulator system on board a unmanned aerial vehicle (UAV) research platform and 2) prototyping and flight testing various communication architectures for closed-loop and tele-operated patient support systems.			

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021		
Appropriation/Budget Activity 2040 / 2		R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>		Project (Number/Name) MM6 / <i>Medical Technologies to Support Dispersed Ops Tech</i>
B. Accomplishments/Planned Programs (\$ in Millions)				FY 2020
<p>? Refine and further develop Prolonged Field Care guidelines for a prototype AI assisted Decision Support System (DSS). Based on previous year?s research, develop strategies to implement 1) predictive patient state algorithms, 2) ML capabilities to continually improve recommendations, and 3) automated patient encounter and medic interventions through speech to text technologies.</p> <p>? Expand research and design of autonomy-based countermeasures to signal latency and constrained bandwidth capabilities for conducting tele-robotic tasks by: 1) integrating force/torque sensing capabilities with the robotic vision system, and 2) designing semi-autonomous surgical protocols.</p> <p>? Design layout of a ?CASEVAC kit? subsystem of the Combat Medical Mission Module (CEMM) based on new en route care technologies to include: 1) remotely operated, or semi-autonomous/closed-loop intervention and patient management systems, and 2) enabling medical communications systems and telehealth/Virtual Health and 3) creating computer-aided design (CAD) models and constructing mock-up models.</p> <p>FY 2022 Plans: Will conduct in-flight experimentation of emerging semi-autonomous and autonomous en route care technologies and capabilities that are candidates for providing patient management during UAS Casualty Evacuation (CASEVAC) missions; investigate comparisons of performance of medical devices and support systems on board UAS to performance in a controlled environment; funds research of in-flight testing of at least two technologies for low-band width, cyber- secure, communications networking with potential for overcoming limitations in bandwidth, range, beyond line-of-sight transmissions, cyber security, and security domain restrictions which limit medical use of current tactical networks; initiate investigation of methods to modify communications protocols for transmitting telemetry data from the UAS in order to mitigate UAS flight induced communications effects determine and investigate a method for interfacing with the unmanned vehicle?s flight controller to adapt the vehicles route planning and flight performance parameters based on patient conditions and injury type to ensure a safe ride profile is attainable; determine method for visual and audio data capture for hands free documentation, requiring a data collection system that is worn by the end user; investigate low size, weight, and power (SWaP) body worn data collection system to ensure solutions function within Army established performance parameters; investigate baseline, rule based, Medic Computer Decision Support System (CDSS) prototype for an end user study of CDSS effectiveness.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Decrease reflects the technical maturation of Med-RAS and Automated Unmanned Medical Capabilities (AUMC) knowledge, devices and methods toward inclusion in, and development of, subsystems and components. Funding realigned to PE 0602787A Project MM4 (Cbt Casualty Care Applied Rsch Technology) and PE 0603002A Project MO2 (Traumatic Brain Injury (TBI) Treatment Adv Tech).</p>				
Title: Virtual Health				3.894
				4.326
				-

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>	Project (Number/Name) MM6 / <i>Medical Technologies to Support Dispersed Ops Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>Description: Develop future Virtual Health enterprise process architectures and integrated physical solutions capable of supporting prolonged field care in conditions with limited or lacking traditional field communications.</p> <p>FY 2021 Plans: Virtual Health Applications For Multi Domain Operational Environments ? Research and validate enterprise architectures for the Virtual Health support and integration with autonomous (real time) and/or semi-autonomous patient care capabilities. ? Expand research and validate means to leverage contemporary VH data components to drive future semi-autonomous and autonomous VH system support tools. ? Explore strategies for VH solutions that align with best practices to counteract threats from electronic warfare (EW). ? Expand mechanisms to streamline the engagement with VH solutions by clinical end users in the operational environment. ? Expand research mechanisms to provide VH solutions when an established synchronous VH consultation is disrupted due to communication failure/outages to include, but not limited to, closed loop systems and machine learning techniques.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned to other efforts within Project MM6 (Virtual Health Applications for Multi Domain Operational Environments).</p>				
<p>Title: Virtual Health Applications for Multi Domain Operational Environments</p> <p>Description: Investigate future Virtual Health enterprise process architectures and integrated physical solutions capable of supporting prolonged field care in conditions with limited or lacking traditional field communications. Deliver sustainable high-quality medical care using advanced technology approaches to export medical expertise to ill/injured soldiers where and when it is needed regardless of geographic location of medical providers, enabling the MDO tenet of maximizing human potential."</p> <p>FY 2022 Plans: Will conduct research and validation of models for the Virtual Health (VH) support and integration with autonomous (real time) and/or semiautonomous patient care capabilities; investigate methods and determine means to leverage contemporary VH data components to drive future semi-autonomous and autonomous VH system support tools; conduct research and design strategies and mechanisms to provide VH solutions when an established synchronous VH consultation is disrupted due to communication failure/outages to include, but not limited to closed loop systems and machine learning techniques; funds research on vocal patterning data analysis to link vocal capture to stress-related changes in risk mechanisms; investigate the link between vocal behavioral markers sleep loss and stress-related changes in health risk mechanisms for more accurate interpretation of commands and recognize changes in environment to determine risk, for improved recommended/best medical courses of action; conduct a systematic retrospective review and case analysis of virtual/telehealth encounters across the Military Health System to quantify and categorize the types of casualty information data required to deliver care and methods of data communication</p>		-	-	3.347

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>	Project (Number/Name) MM6 / <i>Medical Technologies to Support Dispersed Ops Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
using a mixed method (qualitative and quantitative) approach; determine virtual/telehealth health information data elements and prioritization guide and roadmap for future casualty care information data optimization for virtual/telehealth application in the Role 1&2 environment.				
FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM6 (Virtual Health).				
Accomplishments/Planned Programs Subtotals		11.780	14.052	10.724
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army										Date: May 2021		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>				Project (Number/Name) MM8 / <i>Infectious Diseases and Applied Rsch Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
MM8: <i>Infectious Diseases and Applied Rsch Technology</i>	-	21.277	24.542	28.895	-	28.895	-	-	-	-	-	-

Note

In FY22 funding for this Project was realigned from:

PE 0603002A Medical Advanced Technology

* Project CJ3 (Prophylactic for Endemic Diarrheal Diseases)

* Project MP3 (Physiological Chemical Toxicity Assessment System)

* Project MN3 (Immediate Cardiopulmonary Stabilization Adv Tech)

PE 0602787A (Medical Technology)

*Project MK4 (Warfighter Health Applied Rsch Technology)

A. Mission Description and Budget Item Justification

This Project conducts applied (pre-clinical) research for medical countermeasures to prevent naturally occurring infectious diseases that impact operational readiness and maintains laboratory capability to perform these functions. The Project builds on basic research to optimize lead countermeasures and determines their safety and efficacy in animal models of infection. Effective preventive countermeasures protect the Warfighter from disease and sustain readiness and operations. Infectious disease threats from parasitic diseases, bacterial diseases, and viral diseases are high priorities for military operations.

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

- (1) Parasitic Diseases
- (2) Bacterial Diseases
- (3) Viral Diseases

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy.

Work is managed by the United States Army Medical Research and Development Command (USAMRDC) 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.

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>	Project (Number/Name) MM8 / <i>Infectious Diseases and Applied Rsch Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>Title: Applied research on drugs and vaccines against parasitic diseases</p> <p>Description: Develop and validate malaria preclinical animal models. Demonstrate and optimize prophylactic safety and efficacy in validated malaria preclinical animal models. Down-select lead malaria prophylactic candidates for use in human clinical trials.</p> <p>FY 2021 Plans: Prevention and Treatment of Parasitic Diseases ? Perform test tube and/or cell-based studies to optimize and select the next lead prophylactic and/or treatment candidate for prevention and treatment of malaria. ? Develop, assess and validate performance parameters of a mouse and/or non-human primate malaria efficacy models. ? Evaluate the safety and efficacy of lead candidates in validated malaria animal models. ? Assess technologies for extended release that provides long-term prophylaxis.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned to other efforts within Project MM8 (Prevention & Treatment of Combat Wound Infections during Prolonged Care, Prevention and Treatment of Endemic Diseases).</p>		10.252	13.451	-
<p>Title: Applied Research to Prevent Viral Diseases</p> <p>Description: Develop and validate viral disease preclinical animal models. Demonstrate and optimize prophylactic safety and effectiveness in validated viral disease preclinical animal models. Down-select lead viral disease prophylactic candidates for use in human clinical trials.</p> <p>FY 2021 Plans: Prevention and Treatment of Viral Diseases ? Perform test tube and/or cell-based studies to optimize and select the next lead prophylactic and/or treatment candidate for prevention and treatment of viral diseases. ? Develop, assess and validate performance parameters of animal efficacy models of viral diseases. ? Evaluate the safety and efficacy of lead candidates in validated viral diseases animal models. ? Assess technologies for extended release that provides long-term prophylaxis.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned to other efforts within Project MM8 (Prevention and Treatment of Endemic Diseases) and Project CJ3 (Prophylactic for Endemic Diarrheal Diseases).</p>		5.401	6.039	-
<p>Title: Applied Research to Prevent Bacterial Diseases</p>		5.624	5.052	-

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021	
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>	Project (Number/Name) MM8 / <i>Infectious Diseases and Applied Rsch Technology</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021
<p>Description: Optimize antigens and platforms for use in animal studies. Evaluate bacterial diarrheal vaccine candidates for safety, effectiveness, and immunogenicity in animal models to advance to human clinical trials (ETEC, Shigella and Campylobacter). Examine host/pathogen/vector interactions for scrub typhus and other Rickettsial diseases.</p> <p>FY 2021 Plans: Prevention and Treatment of Bacterial Diseases ? Perform test tube and/or cell-based studies to optimize and select the next lead prophylactic and/or treatment candidate for prevention and treatment of bacterial diarrheal disease. ? Develop, assess and validate performance parameters of animal efficacy models of bacterial diarrheal and rickettsial diseases. ? Evaluate the safety and efficacy of lead candidates in validated diarrheal disease animal models. ? Assess technologies for extended release that provides long-term prophylaxis.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned to other efforts within Project MM8 (Prevention & Treatment of Combat Wound Infections during Prolonged Care).</p>			
<p>Title: Prevention & Treatment of Combat Wound Infections during Prolonged Care</p> <p>Description: Determine and validate combat wound infection preclinical animal models. Investigate and validate prophylactic and treatment safety and effectiveness in validated combat wound infection preclinical animal models. Fund research to down-select lead combat wound infection prophylactic and treatment candidates for use in human clinical trials.</p> <p>FY 2022 Plans: Will perform test tube and/or cell-based studies to determine the next lead prophylactic and/or treatment candidate for prevention and treatment of combat wound infections; design, assess and validate performance parameters of animal efficacy models of combat wound infections; evaluate the safety and efficacy of lead candidates in validated combat wound infection animal models; investigate technologies for extended release that provides long-term prophylaxis in order to reduce disease and non-battle injury (DNBI) through prevention of wound infections and reduce unit loss rate for effective wound infection prevention to sustain unit readiness, operational effectiveness, Warfighter performance, and quicker return to duty.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM8 (Prevention and Treatment of Bacterial Diseases (Prevention and Treatment of Parasitic Diseases).</p>		-	-
Title: Prevention and Treatment of Endemic Diseases		-	11.704
		-	17.191

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>	Project (Number/Name) MM8 / <i>Infectious Diseases and Applied Rsch Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021	FY 2022
<p>Description: Determine and validate endemic bacterial and viral disease preclinical animal models. Investigate and validate prophylactic and treatment safety and effectiveness in validated bacterial and viral disease preclinical animal models. Down-select lead bacterial and viral infection prophylactic and treatment candidates for use in human clinical trials.</p> <p>FY 2022 Plans: Will perform test tube and/or cell-based studies to investigate and determine the next lead prophylactic and/or treatment candidate for prevention and treatment of endemic bacterial and viral infections; determine, assess and validate performance parameters of animal efficacy models of endemic bacterial and viral infections; investigate the safety and efficacy of lead candidates in validated bacterial and viral infection animal models; assess technologies for extended release that provide long-term prophylaxis.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funds realigned from other efforts within Project MM8 (Prevention and Treatment of Parasitic Diseases, Prevention and Treatment of Viral Diseases).</p>			
Accomplishments/Planned Programs Subtotals	21.277	24.542	28.895

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army **Date:** May 2021

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>	Project (Number/Name) MN1 / <i>Applied Sensory Systems Trauma Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
MN1: <i>Applied Sensory Systems Trauma Technology</i>	-	7.302	6.720	-	-	-	-	-	-	-	-	-

Note

In FY22, this Project is being realigned to:

PE 0602787A Medical Technology

* Project MK4 Warfighter Health Applied Rsch Technology

* Project MM4 Cbt Casualty Care Applied Rsch Technology

PE 0603002A - Medical Advanced Technology

* Project MN7 Musculoskeletal Injury Screening Tool Adv Tech

A. Mission Description and Budget Item Justification

This Project conducts laboratory and animal studies for the purpose of developing novel, non-opioid drugs to treat pain in the austere battlefield environment with minimal side effects. Research to understand the influence of stress on the effectiveness of pain relief drugs (analgesics). 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 PE 0603002A (Medical Advanced Technology) / Project MN7 (Musculoskeletal Injury Screening Tool Advanced Technology).

The cited work is consistent with the Under 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 Development Command (USAMRDC), Fort Detrick, MD.

B. Accomplishments/Planned Programs (\$ in Millions)

Title: Applied Sensory Systems Trauma Technology	FY 2020	FY 2021	FY 2022
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.	7.302	6.720	-
FY 2021 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>	Project (Number/Name) MN1 / <i>Applied Sensory Systems Trauma Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>Applied Sensory Systems Trauma Technology ? Conduct preclinical evaluation of promising non-opioid, side effect-free analgesics in treating post-traumatic, moderate-to-severe pain. These drugs act on non-opioid targets in the nervous system that inhibit pain signaling without affecting cognitive capability.</p> <p>Applied Sensory Systems Trauma Technology ? Identify and assess treatment for unconventionally-acquired brain injury (UBI) threat technologies. ? Conduct UBI human-like animal assessments. ? Validate UBI threat source symptomology and assess injury mechanisms. ? Transition understanding of injury mechanisms to enable direct medical diagnosis, treatment and clinical management.</p> <p><i>FY 2021 to FY 2022 Increase/Decrease Statement:</i> Funds realigned to other efforts within Project MM4 (Battlefield Pain Control without Physiological Impairment and Unconventionally-acquired Brain Injury) and Project MK4 (Forward Neuro-Muscular Skeletal Injury Assessment) and 0603002A (Medical Advanced Technology) Project MN7 (Forward Neuro-Muscular Skeletal Injury Assessment to Reduce Unnecessary Evacuations).</p>				
Accomplishments/Planned Programs Subtotals		7.302	6.720	-
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army **Date:** May 2021

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>	Project (Number/Name) VB4 / <i>System Biology And Network Science Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
VB4: <i>System Biology And Network Science Technology</i>	-	0.575	-	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This Project supports biological and clinical applied research using the data analysis and integration grid (Sys Bio Cube) 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.

The cited work is consistent with the Under 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 Development Command (USAMRDC), Fort Detrick, MD.

B. Accomplishments/Planned Programs (\$ in Millions)

Title: Systems Biology	FY 2020	FY 2021	FY 2022
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 for 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, 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.	0.575	-	-
Accomplishments/Planned Programs Subtotals	0.575	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / <i>Medical Technology</i>	Project (Number/Name) VB4 / <i>System Biology And Network Science Technology</i>

D. Acquisition Strategy

N/A