Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Chemical and Biological Defense Program	Date: March 2023
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	205.018	244.364	240.610	0.000	240.610	231.758	217.085	228.565	233.469	Continuing	Continuing
UN2: *Understand (Applied Research)*	-	0.000	112.952	119.182	0.000	119.182	111.773	107.842	107.193	107.193	Continuing	Continuing
PT2: *Protect (Applied Research)*	-	0.000	58.091	55.057	0.000	55.057	56.153	57.817	61.452	61.452	Continuing	Continuing
MT2: *Mitigate (Applied Research)*	-	0.000	73.321	66.371	0.000	66.371	63.832	51.426	59.920	64.824	Continuing	Continuing
CB2: *Chemical Biological Defense (Applied Research)*	-	97.410	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	97.410
TM2: *Techbase Medical Defense (Applied Research)*	-	107.608	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	107.608

A. Mission Description and Budget Item Justification

This program element (PE) resources Applied Research across the Understand, Protect, and Mitigate portfolios. Chemical and Biological Defense Program (CBDP) investments provide an integrated, layered capability to enable combating weapons of mass destruction (CWMD) missions ranging from combat operations to Department of Defense (DoD) support to domestic incident prevention and response. The Projects in this PE support applied research in the areas of physical technologies, non-traditional agent (NTA) medical and physical defense technologies, and medical technologies. These investments are a key component to sustaining the core physical and intellectual chemical and biological (CB) defense infrastructure of the Department and support the delivery of capabilities, assessments of emerging threats, and the ability to surge unique capabilities in response to a CB event. FY24 funding accelerates characterization and situational awareness of emerging biothreats and accelerates delivery of improved protection from and mitigation of biothreats, including rapid repurposing of available therapeutics and development of new vaccines.

Individual Projects include:

- Understand (UN2): Development of next-generation chemical and biological hazard detectors, point-of-need diagnostic devices, next-generation diagnostics systems, decision support tools, algorithms, and software.

- Protect (PT2): Development of antidotes, disease surveillance medical technologies, vaccines, nerve agent pretreatments, and respiratory and ocular protection. Improvement of protection technologies and biological weapon/agent surveillance.

- Mitigate (MT2): Improvement of CB defense material, including contamination avoidance and decontamination. Development of drug treatments, therapeutics, patient decontamination technologies, and individual protection advancements.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Chemical and Biological Defense Program	Date: March 2023
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602384BP *I Chemical and Biological Defense Program*

- Chemical Biological Defense (CB2) and Techbase Medical Defense (TM2) are no longer active Projects due to budget restructuring.

CBDP Science and Technology (S&T) Applied Research Performers: U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC), United States Army Medical Research Institute of Infectious Diseases (USAMRIID), United States Army Medical Research Institute of Chemical Defense (USAMRICD), United States Army Natick Soldier Systems Center, Naval Research Lab (NRL), Air Force Research Lab (AFRL), and Department of Energy Laboratories such as Pacific Northwest National Laboratory (PNNL), among others. The intent is to maintain strategic partnerships with the DoD Service communities & the interagency for mission success across the enterprise through collaborative planning and programming maintaining budget assurance.

Efforts under this PE will transition to or will provide risk reduction for Advanced Technology Development (PE 0603384BP), Advanced Component Development and Prototypes (PE 0603884BP), and System Development and Demonstration (PE 0604384BP) activities.

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	209.956	256.197	248.726	-	248.726
Current President's Budget	205.018	244.364	240.610	-	240.610
Total Adjustments	-4.938	-11.833	-8.116	-	-8.116
• Congressional General Reductions	-	-0.273			
• Congressional Directed Reductions	-	-11.560			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-1.500	-			
• SBIR/STTR Transfer	-3.438	-			
• Other Adjustments	-	-	-8.116	-	-8.116

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Project: TM2: *Techbase Medical Defense (Applied Research)*		
Congressional Add: *Biological Warfare Defense Therapeutics*	3.000	-
Congressional Add Subtotals for Project: TM2	3.000	-
Congressional Add Totals for all Projects	3.000	-

Change Summary Explanation

Funding: FY 2022 (+$3.000 Million): Congressional Add for tularemia medical countermeasure is reflected in the Previous President's Budget total.
FY 2022 (-$1.500 Million): Reprogrammed prior year execution balances to RDT&E Management Support, Budget Activity 6 in support of the Departments higher priorities.

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Chemical and Biological Defense Program	Date: March 2023
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602384BP *I Chemical and Biological Defense Program*

FY 2022 (-$3.438 Million): Transfer of funding to support Small Business Innovative Research/Small Business Technology Transfer efforts.

FY 2023 (-$0.273 Million): Congressional General Reductions to support Federally Funded Research and Development Centers (FFRDCs).
FY 2023 (-$11.560 Million): Congressional Directed Reductions.

FY 2024 (-$8.116 Million): Departmental inflation rate adjustments (+$1.167 Million) and a reduction in Applied Research due to technology progressing to Advanced Technology Development (-$9.283 Million).

Schedule: N/A

Technical: N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program											Date: March 2023	
Appropriation/Budget Activity 0400 / 2					R-1 Program Element (Number/Name) PE 0602384BP / *Chemical and Biological Defense Program*				Project (Number/Name) UN2 / *Understand (Applied Research)*			
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
UN2: *Understand (Applied Research)*	-	0.000	112.952	119.182	0.000	119.182	111.773	107.842	107.193	107.193	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Understand Applied Research Project provides the Joint Force with the abilities to detect, identify, and characterize chemical and biological (CB) threat agents. This includes classification and/or identification of the threat and potentially the amount of chemical, biological, radiological, and nuclear (CBRN) hazards in all physical states. Efforts provide the ability to characterize the CBRN hazard to a commander and develop a clear understanding of the current and predicted CBRN situation; collect, query, and assimilate information from sensors, intelligence and medical communities, etc., in near real time to inform decisions; and provide actual and potential impacts of CBRN hazards. In FY 2023, the Chemical Biological Defense Program (CBDP) RDT&E Projects have been restructured to align with the CBDP portfolio construct. UN2 efforts in FY 2022 remain in Projects CB2 and TM2. This restructuring provides standardization and alignment across CBDP research, development and acquisition efforts.

Thrust Areas included in this Project are:

(1) Chemical, Biological, Radiological, and Nuclear (CBRN) Battlespace Sensing, Alerting & Response
(2) CBRN Decision Aids
(3) CBRN Situational Awareness
(4) Chemical Diagnostics
(5) Diagnostic Building Blocks
(6) Emerging Threats
(7) Distributed CB Reconnaissance
(8) Emerging and Enhanced Biothreat Sensing
(9) Employment Characterization
(10) Environmental Response
(11) First Look (Chemical and Biological)
(12) Host Response
(13) Technical Surprise
(14) Expeditionary Analytical Toolkit (ExAnT)
(15) Unattended Perimeter Monitoring
(16) Unconventional Detection Modalities

CBRN Battlespace Sensing, Alerting & Response: Development of algorithms that generate and disseminate warning to personnel in time to prevent exposure to or limit the impact of CBRN threats. This thrust area conducts data collection trials to support algorithm development; leverage Artificial Intelligence (AI) to identify key

indicators, combinations of indicators, and sensing modalities to reduce false alarms and predict the likelihood of exposure; explore remote and contactless monitoring and analysis for application in Warfighter chemical and biological threat exposure alerting.

CBRN Decision Aids: Providing tools that assess risk from CBRN hazards and identify courses of action to limit impact. This thrust area permits connectivity, enabling the dynamic discovery, querying, and control of sensors through standard protocols; allow for dynamic discovery and integration between networked devices at the tactical edge to enable sharing of information and capabilities across connected components.

CBRN Situational Awareness: Providing operationally relevant context to CB-specific phenomena data to ensure the Joint Force is able to characterize new CB hazards and mitigate their effects on mission success. This thrust area provides the analytic framework to determine optimal defense postures by extrapolating scientific data generated during the course of technology development and hazard assessment data into an assessment to help inform operational utility.

Chemical Diagnostics: Discovers innovative and integrated capabilities that are able to diagnose threats across the chemical spectrum and enhance force protection by investing in diagnostics for exposure to traditional and nontraditional Chemical Warfare Agents (CWA), including pharmaceutical based agents. Efforts include coordinating with Threat Agent Science and the Intelligence Community and to understand the chemical threat space.

Diagnostic Building Blocks: Develops foundational capabilities for the entire diagnostics portfolio; invests in innovative, cutting-edge technologies to improve the development pipeline for diagnostics; and exploits areas in artificial intelligence synthetic biology and machine learning to develop novel and rapid diagnostic tests for utilization. Efforts accelerate assay development timelines and optimize test parameters by leveraging novel concepts and tools that readily allow a pivot to assay development for emerging threats. Efforts include additional investments in enhanced biodefense and pandemic preparedness.

Emerging Threats: Efforts to push beyond the boundaries of the traditional threat list in the field of diagnostics to better prepare for surprise. Investments in developing diagnostic systems that leverage novel approaches to characterize the pathogen or the host response enables the delivery of actionable information, such as administering the appropriate antibiotic, antiviral, or vaccine to a medic or primary care provider. Efforts include additional investments in enhanced biodefense and pandemic preparedness.

Distributed CB Reconnaissance: Enhances early warning and situational awareness of CB threats while reducing potential Warfighter exposure using distributed CB reconnaissance tools to include low-cost point sensors and sensing/collection systems for unmanned platforms. Efforts include developing threat sensing and sampling payloads for manned and unmanned aerial and ground platforms to enhance early warning and situational awareness of CB threats.

Enhanced and Emerging Biothreat Sensing: Establishes a capability to rapidly develop advanced, agile, pathogen-agnostic laboratory and field forward detection capabilities to detect emerging and enhanced biological threats across all force echelons (presumptive, field confirmatory, theater validation, and definitive identification). Further, multiple biological measurements will be used to modernize laboratory capabilities and leverage synthetic biology methods and tools to deliver enhanced biothreat sensing/detection capabilities to the Joint Force.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

Employment Characterization: Conduct studies to help refine threat assessments and potential impacts of indoor or outdoor releases of threat agents on operations, strategy, and capabilities. Studies will include both laboratory, chamber-based dissemination characterization and full-scale outdoor trials. Results from studies will help determine risks posed by an agent employed in a similar fashion by an adversary.

Environmental Response: Evaluate CB threats that have been released into the environment (e.g., persistence, degradation, and decomposition) along with the effects environmental conditions (e.g., ozone, ultraviolet, humidity, etc.) have on those agents. Identify and characterize behavior of chemical and biological agents in the environment (to include soil, water, and plants) on clothing, on and in structures, and on equipment to support model development and decision-making tools.

First Look (Chemical and Biological): Provide the initial characterization of potential CB threats and provide a fundamental assessment of the potential risk(s) they pose. Evaluate agents and develop both methods and capabilities to quickly and accurately characterize chemical, biological, and toxin agent properties to inform capability development and modeling for CB defense community stakeholders.

Host Response: Characterize effects (acute vs. chronic) from exposure to toxic chemicals or infectious biological agents using operationally relevant exposure scenarios, exposure routes, and appropriate assessment methods and models. Improve understanding of the mechanisms of action, infectivity, morbidity, and mortality of agents and provide adverse health effects information and other relevant data. Data from host response studies will also be used to help develop predictive capabilities for identifying the human response to chemical and biological threat agents.

Technical Surprise: Mitigate technical surprise by providing technology over-watch and horizon scanning tools to assess advances in technologies and scientific knowledge, with a focus on breakthroughs that can/will overcome bottlenecks and enable the development of capabilities of concern. Improve threat awareness scanning capabilities allowing for continuous, real-time monitoring to identify emerging threats, maintain situational awareness of the threat environment, and assess technological convergence. Efforts include additional investments in enhanced biodefense and pandemic preparedness.

Expeditionary Analytical Toolkit (ExAnT): Provides general and specialized forces with the ability to modernize detection technologies for traditional threats while enhancing detection capabilities for non-traditional, emerging, and mixed chemical hazards.

Unattended Perimeter Monitoring: Invests in efforts supporting Integrated Early Warning and Integrated Layered Defense by establishing a layered defense capability through developing and implementing automated and integrated technologies enabling unattended monitoring for chemical and biological threats.

Unconventional Detection Modalities: Develops disruptive technologies pushing the boundaries of currently fielded sensors and detection technologies to develop novel sensors that operate in complex threat environments with high fidelity.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: 1) CBRN Battlespace Sensing, Alerting, and Response	-	8.000	7.250
Description: Improve the Department of Defense's capability to detect, identify, alert, and respond to deliberate releases and naturally occurring outbreaks of chemical and biological threat agents. Focus on large, real-time human data collects			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
of chemical and biological (CB) agent / agent proxy exposures. Studies will focus on examining the feasibility of specifically isolating indicators of respiratory infection, determining severity of infection, predicting return to mission readiness after exposure, and examining physiological effects on human tissue in multi-organ-chips after exposure to CB threat agents. Enable early implementation of countermeasures such as isolation, quarantine, and removal from an area, thus potentially reducing transmission, morbidity, and mortality rates. Mature algorithms and incorporate Machine Learning (ML) approaches for refining sensitivity and specificity. ***FY 2023 Plans:*** - Continue wearable device-based non-invasive biomarker analysis and algorithm enhancement for pre-symptomatic indication of chemical or biological exposure. - Continue to develop predictive algorithms and analytic tools utilizing artificial intelligence (AI) and ML techniques to allow for rapid response to emerging threats and detection of genetically engineered pathogens. - Continue development of AI-based drug discovery algorithms for Emerging Threats. - Continue the advancement of standoff physiological monitoring capabilities. - Utilize a multi-organ chip system to characterize the effects of biological threat agents on several different cultured human tissues and conduct multi-omics analysis (e.g. proteomics, metabolomics) to identify potential biomarkers associated with physiological responses from exposure to high, mid, and low multiplicity of infection. ***FY 2024 Plans:*** - Continue wearable device-based non-invasive algorithm enhancements for pre-symptomatic indication of chemical or biological exposure. - Continue to develop predictive algorithms and analytic tools utilizing artificial intelligence (AI) and ML techniques to allow for rapid response to emerging threats and detection of genetically engineered pathogens. - Continue development of AI-based drug discovery algorithms for Emerging Threats. - Continue the advancement of standoff physiological monitoring capabilities to include efforts that increase the standoff distance at which physiological data can be captured. - Continue work with multi-organ chip system to characterize the effects of biological threat agents on several different cultured human tissues and conduct multi-omics analysis (e.g. proteomics, metabolomics) to identify potential biomarkers associated with physiological responses from exposure to high, mid, and low multiplicity of infection. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.			
Title: 2) CBRN Decision Aids	-	4.667	3.250

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: In order to unencumber the Warfighter at the tactical edge, efforts continue to develop and transition science & technology for CBRN Decision Aids on End User Devices (EUDs) in both connected and disconnected operations. Focus on utilizing automation, reducing the burden experienced by the warfighter, while providing accurate, actionable information. Develop a Contamination Avoidance Decision Aid to inform the warfighter on how to avoid, respond to and plan routes around CB hazards. Develop an Autonomous Asset Guidance capability to optimize their use and reduce the burden incurred by the warfighter in order to operate them. Fuse and utilize data from Autonomous Assets to improve and refine other CBRN Decision Aids. ***FY 2023 Plans:*** - Continue development of warning and decision aids for tactical users leveraging the compute resources resident on EUDs. - Continue development of AR-based technologies to incorporate CB threat situational awareness in EUDs. ***FY 2024 Plans:*** - Continue development of warning and reporting decision aids for tactical users leveraging the compute resources resident on EUDs. - Continue development of Augmented Reality (AR) based technologies to incorporate CB threat situational awareness in EUDs. -Initiate the development of tools that support the interoperability, integration, and automation of decision aids to further reduce the need for manual user inputs. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease due to change in program/project technical parameters. Decrease due to efforts within this area maturing and transitioning to Budget Activity 3.			
Title: 3) CBRN Situational Awareness	-	11.812	15.880
Description: Expand on the types of threats that can be modeled with hazard assessment capabilities to include fixed-wing and rotary-wing drones of interests and allow for airborne CB releases from single drones and swarms to be modeled. Leverage Virtual Reality (VR) and Augmented Reality (AR) technologies to develop CB focused training and mission rehearsal capabilities that will be integrated into systems widely used by the Joint Force. Develop virtual training environments to implement, visualize and account for hazard source terms and plumes generated by transport and dispersion (T&D) models. Explore AR applications for tactical use to maximize warfighter CB situational awareness on the battlefield. Modernize hazard modeling capabilities by adopting a modular framework and integrating across Service command and control systems to operationalize reachback support. Enhance hazard modeling by creating a seamless indoor-to-outdoor T&D modeling capability and improve urban T&D modeling to support operations in urban and mixed environments. Leverage new state-of-the-art computational fluid dynamics modeling techniques and their use of computing resources to increase both modeling speed and accuracy. Develop CB health effect modeling software and analytic tools to support force readiness and facilitate medical planning against chemical and biological agents. Develop epidemiological models to quantify and visualize mission operational impacts from exposure to, and spread of,			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
infectious biological threat agents. Leverage threat agent science (TAS) data to enhance capabilities for modeling health effects and host pathogen interactions from exposures to traditional and non-traditional CB agents, providing the warfighter with more accurate casualty estimates accounting for human health effects. ***FY 2023 Plans:*** - Complete development of models to provide operationally relevant outputs to support medical decision making. - Continue to develop Machine Learning (ML) algorithms for disease prediction and forecasting for mobile platforms. - Continue to enhance CB situational awareness capabilities for integration into Heads up Display (HUD) technologies. - Initiate efforts to expand focus on emerging threat hazard modeling, leveraging TAS data to ensure the Joint Force is able to characterize new CB hazards and mitigate their effects on mission success. - Explore new areas for targeted investment in synthetic environments to provide a CBRN-specific cognitive, collective, multi-echelon training and mission readiness capability. - Explore in-host modeling capabilities leveraging ML/Artificial Intelligence (AI) techniques to characterize predictive biomarkers of chemical and biological exposure prior to onset of symptoms. ***FY 2024 Plans:*** - Continue to develop Machine Learning (ML) algorithms for disease prediction and forecasting for mobile platforms. - Continue to enhance CB situational awareness capabilities for integration into Heads up Display (HUD) technologies. - Continue efforts to expand emerging threat hazard modeling, leveraging TAS data to ensure the Joint Force is able to characterize new CB hazards and mitigate their effects on mission success. - Continue the development of VR-based synthetic environments in order to provide a CBRN-specific cognitive, collective, multi-echelon training and mission readiness capability. - Continue the development of in-host modeling capabilities leveraging ML and Artificial Intelligence (AI) techniques to characterize predictive biomarkers of chemical and biological exposure prior to onset of symptoms. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Increase due to change in program/project technical parameters.			
Title: 4) Chemical Diagnostics ***Description:*** Provide innovative and integrated capabilities to the Warfighter that are able to diagnose threats across the chemical spectrum. Enhance force protection by investing in diagnostics for exposure to traditional and nontraditional Chemical Warfare Agents (CWAs), including pharmaceutical based agents (PBAs). Leverage the development of a chemical diagnostic that monitors blood, indicating whether a Warfighter has been exposed to nerve agents within minutes. ***FY 2023 Plans:***	-	0.693	0.698

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Continue the development of integrated capabilities that address portable ultra-low detection of opioids to the Next Generation Diagnostic System Increment 2 Chemical Diagnostic (NGDS 2 CHEMDX) device that will allow for differentiating between classes of CWAs, resulting in more informed treatment decisions. ***FY 2024 Plans:*** - Continue the development of integrated capabilities that address portable ultra-low detection of opioids to the Next Generation Diagnostic System Increment 2 Chemical Diagnostic (NGDS 2 CHEMDX) device that will allow for differentiating between classes of CWAs, resulting in more informed treatment decisions. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.			
Title: 5) Diagnostic Building Blocks	-	1.693	3.839
Description: Develop novel, state of the art capabilities that lay the foundation for modernizing other areas within the diagnostics portfolio. This includes exploiting areas such as synthetic biology and chemistry to develop novel and rapid diagnostic tests for utilization in the event of an outbreak of an unknown threat. Invest in efforts that lead to accelerated assay development timelines and optimized test parameters through leveraging artificial intelligence (AI) and machine learning (ML) to allow us to quickly pivot and develop assays for emerging threats and speed up development to days instead of weeks. ***FY 2023 Plans:*** - Continue efforts to collect the baseline data required for future development of a whole breath diagnostic platform the use of breath as a non-invasive sampling mechanism offers Warfighters little-to-no interruption to mission activities and provides the opportunity for earlier diagnosis/indication of infection or chemical exposure. ***FY 2024 Plans:*** - Continue field validation studies for diagnostics prototypes using synthetic binders and evaluate performance against current gold standard diagnostic methods and integrate enzymes to create inexpensive, on-demand, diagnostics with reduced logistical burdens. - Continue efforts to collect the baseline data required for future development of a whole breath diagnostic platform the use of breath as a non-invasive sampling mechanism offers Warfighters little-to-no interruption to mission activities and provides the opportunity for earlier diagnosis/indication of infection or chemical exposure. - Initiate efforts to identify and establish testing methods utilizing low to minimally invasive clinical matrices. Matrices like breath, sweat or interstitial fluid could significantly expand field-forward testing abilities and minimize requirements for trained personnel to collect and administer testing. ***FY 2023 to FY 2024 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Increase due to change in program/project technical parameters.			
Title: 6) Emerging Threats	-	2.773	2.443
Description: Push beyond the boundaries of the traditional threat list in the field of diagnostics to better prepare for surprise. Development of diagnostic systems that leverage novel approaches to characterize pathogen or host response and can identify the classification of threat (e.g., bacterial vs viral) from an unknown sample. Invest in diagnostic tests that enable the delivery of actionable information, such as administering the appropriate medical countermeasure (e.g. antibiotic, antiviral, vaccine), by a medic or primary care provider greatly improves turnaround time for soldier wellness and return to duty. ***FY 2023 Plans:*** - Complete efforts on several complementary approaches to address challenges in small molecule toxin diagnosis at the point of contamination (POC) and initiate validation of these prototypes for potential use as a threat agnostic capability to enable field-forward responses to emerging threats. - Complete the development of a universal blood sample preparation platform to be compatible with several diagnostic systems, improving the speed of sample preparation tools at low pathogen concentrations (i.e. pre-symptomatic levels) is one of the biggest challenges holding back diagnostics in point-of-care, outbreak, and remote testing scenarios. ***FY 2024 Plans:*** - Initiate efforts to identify novel platforms that are capable of identifying broad classes of toxins in complex matrices. These platforms will ideally enable the diagnosis of exposure to toxins as well as other biological threats, resulting in a broad-spectrum capability in the hands of the warfighter. - Begin preliminary research efforts to diagnose biological threats that are truly unknown but could cause genomic or proteomic changes in infected individuals. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.			
Title: 7) Diagnostic Building Blocks - Enhanced Biodefense (ENBD)	-	6.500	4.100
Description: This effort will focus on Assay Development and Delivery Pipeline, Expand Biological Artificial Intelligence for Diagnostics (BioAID) Efforts as well as developing novel, state of the art capabilities that lay the foundation for modernizing other areas within the diagnostics portfolio. This includes exploiting areas such as synthetic biology and chemistry to develop novel and rapid diagnostic tests for utilization in the event of an outbreak of an unknown threat. Invest in efforts that lead to accelerated assay development timelines and optimized test parameters through leveraging artificial intelligence (AI) and machine learning (ML) to allow us to quickly pivot and develop assays for emerging threats and speed up development to days instead of weeks. ***FY 2023 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Expand work with collection & analysis of individual's breath, skin emissions or other minimally invasive testing methods which offers Warfighters little-to-no interruption to mission activities and provides the opportunity for earlier diagnosis/indication of infection or chemical exposure. ***FY 2024 Plans:*** - Continue collection & analysis of individual's breath, skin emissions or other minimally invasive testing methods and adapt to possible prototypes which offers Warfighters little-to-no interruption to mission activities and provides the opportunity for earlier diagnosis/indication of infection or chemical exposure. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease due to change in program/project technical parameters.			
Title: 8) Emerging Threats - Enhanced Biodefense (ENBD) ***Description:*** This effort will focus on Novel Non-Invasive Screening and Characterization. It will push beyond the boundaries of the traditional threat list in the field of diagnostics to better prepare for surprise. Development of diagnostic systems that leverage novel approaches to characterize pathogen or host response and can identify the classification of threat (e.g., bacterial vs viral) from an unknown sample. Invest in diagnostic tests that enable the delivery of actionable information, such as administering the appropriate medical countermeasure (e.g. antibiotic, antiviral, vaccine), by a medic or primary care provider greatly improves turnaround time for soldier wellness and return to duty. ***FY 2023 Plans:*** - Complete training and development efforts by the Army Medical Research Institute for Infectious Disease (USAMRIID) to become an authorized developer of assays for the Cepheid Flex Cart technology supporting the Man Portable Diagnostic System (MPDS). - Initiate efforts to explore innovative methods to investigate genetically modified threats including pre-symptomatic, host-based biomarkers or synthetic biology approaches. Novel methods will allow for rapid assay fielding potentially cutting development time from months to weeks. - Accelerate next generation diagnostic platform development to meet the evolving needs of the CBDP enterprise, providing diagnostics that would address detection and identification technology needs with a combined affinity based and molecular platform for emerging pathogens. - Initiate effort to predict disease severity to provide agnostic disease screening tool that enhances triage, transport and resource decision making support for the Warfighter in field forward environments. - Expand agnostic biomimetic sensing to explore additional panels of small and large molecular weight toxins with various modes of activity, and tested in both clinical and aerosol sample matrices to include environmental background. ***FY 2024 Plans:***	-	8.000	5.200

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Continue efforts to explore innovative methods to investigate genetically modified threats including pre-symptomatic, host-based biomarkers or synthetic biology approaches. Novel methods will allow for rapid assay fielding potentially cutting development time from months to weeks. - Continue next generation diagnostic platform development to meet the evolving needs of the CBDP enterprise, providing diagnostics that would address detection and identification technology needs with a combined affinity based and molecular platform for emerging pathogens. - Continue effort to predict disease severity to provide agnostic disease screening tool that enhances triage, transport and resource decision making support for the Warfighter in field forward environments. - Continue agnostic biomimetic sensing to explore additional panels of small and large molecular weight toxins with various modes of activity, and tested in both clinical and aerosol sample matrices to include environmental background. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease due to change in program/project technical parameters.			
Title: 9) Unconventional Detection Modalities - Enhanced Biodefense (ENBD) ***Description:*** Develop disruptive technologies to identify unknown or emerging threats and develop sensors that can operate in complex threat environments with high fidelity. This thrust area supports others as appropriate to the Joint Force mission needs (e.g., expeditionary, perimeter defense, or unmanned reconnaissance. ***FY 2023 Plans:*** - Expand Assays on Demand (AoD) for emerging biological threat detection. AoD will allow for real time assay manufacturing reducing supply chain constraints typically seen in currently fielded systems. ***FY 2024 Plans:*** - Continue Assays on Demand (AoD) for emerging biological threat detection. AoD will allow for real time assay manufacturing reducing supply chain constraints typically seen in currently fielded systems. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease due to change in program/project technical parameters.	-	2.000	1.000
Title: 10) Distributed CB Reconnaissance - Biological Detection ***Description:*** Developing capability to warn and inform the Joint Force of operationally-relevant threat utilizing sampling and sensing payloads on manned and unmanned systems (e.g. UAS, UGS). Point sensors on manned and unmanned assets will remotely sense threats relevant to mission environment at presumptive echelon of Integrated Layered Defense and Integrated Early Warning.	-	3.614	1.313

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
FY 2023 Plans: - Continue to invest in low size, weight, power, and cost technologies for near-real time detection capabilities for deployable or distributed biological and chemical sensing for hazard awareness and assessment of operational environments. - Invest in innovative technologies to increase situational awareness using manned and unmanned platforms and provide operational advantages to the Warfighter. - Explore application of advanced computational tools, Artificial Intelligence (AI) and Machine Learning (ML), to connect multiple sensor technologies to provide improved early warning and integrated threat awareness ***FY 2024 Plans:*** - Continue to explore fundamental science and novel technologies to increase sensing performance through enhanced speed and specificity; low size, weight, and power; and reduced consumables and life-cycle costs of fielded biological sensors. - Continue developing biological threat sensing and sampling systems, to include unmanned and manned platforms. - Continue to evaluate the use of computational tools, like machine learning into detector/identifier technologies to further reduce false reporting due to environmental factors. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease due to change in program/project technical parameters.			
Title: 11) Emerging and Enhanced Biothreat Sensing	-	10.753	12.922
Description: Establish a capability to rapidly develop advanced, agile, pathogen-agnostic laboratory and field forward detection capabilities to detect emerging and enhanced biological threats across all force echelons (presumptive, field confirmatory, theater validation, and definitive identification). Further, multi-omics and data sciences (MODS) - multiple biological measurements - will be used to modernize laboratory capabilities and leverage synthetic biology methods and tools to deliver enhanced biothreat sensing/detection capabilities to the Joint Force. ***FY 2023 Plans:*** - Continue development of detection algorithms and laboratory workflows to identify threats in unknown samples. - Continue automated computational tools to design and expedite assay development for biological detection. - Continue applied research component of far-forward pathogen agnostic sensing toolkit development. - Pursue advanced biological measurements and data processing techniques into sensor development to enable an agile response to emerging threats with emerging pathogen targeted detection capabilities. ***FY 2024 Plans:*** - Continue development of detection algorithms, laboratory workflows, and implementation of bioinformatics analysis tools to identify threats in unknown samples			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Continue incorporating advanced biological measurements and data processing techniques to detect biological threats. - Continue to leverage Assays on Demand (AoD) to develop computational tools to design and expedite assay development for biological detection. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Increase due to change in program/project technical parameters.			
Title: 12) Unattended Perimeter Monitoring - Biological Detection ***Description:*** Aims to enhance situational awareness against potential biological hazards by developing monitoring solutions to provide continuous, synchronous information of the operational environment and dynamic threat landscape. Capabilities developed here will focus on autonomy and improved accuracy and reliance that decreases operational burden to the Warfighter. ***FY 2023 Plans:*** - Continue to evaluate the use of computational tools, like machine learning, into detector/identifier technologies to further reduce false reporting due to environmental factors. - Continue to make technological improvements to enhance early warning of aerosolized biological threats. ***FY 2024 Plans:*** - Continue to make technological improvements to enhance early warning of aerosolized biological threats. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease due to change in program/project technical parameters.	-	4.871	1.771
Title: 13) Unconventional Detection Modalities - Biological Detection ***Description:*** Focuses on developing and evaluating novel, disruptive sensor approaches to address Joint Force needs and modernize existing biological detection technologies that go beyond current technologies. ***FY 2023 Plans:*** - Continue refinement of novel optical detector for bioaerosols modernizing current technologies. - Explore innovative detection methods such as synthetic or organ on a chip biosensors to provide agent agnostic techniques that identify an unknown as hazardous to a human. - Continue to integrate advanced computational tools, Artificial Intelligence (AI)/Machine Learning (ML) into sensor development to improve speed of detection, reduce false alarms and enable integration of data from multiple detection sources. - Initiate Assays on-Demand efforts aimed to rapidly deliver novel assay solutions to be used in the field. ***FY 2024 Plans:***	-	5.581	5.276

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Continue Assays on Demand (AoD) to augment targeted detection modalities that focus on rapid delivery of novel assay development solutions. - Continue investigating alternative optical detection development not reliant on fluorescence for real-time detection of anomalous biological activity. - Continue evaluating the feasibility of organ-on-a-chip technologies for agent-agnostic techniques. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.			
Title: 14) Employment Characterization ***Description:*** Employment Characterization studies refine threat assessments and identifies potential impacts of indoor and/or outdoor releases of threat agents on CBDP operations, strategy, and capabilities. These studies directly define the Warfighter threat space by determining how CB agents behave when released. This effort reduces risk to the CBDP Enterprise by closing knowledge gaps and informing on the type, extent and magnitude of a potential hazard a warfighter may face in an operational environment. Employment Characterization will: review state of knowledge on agent employment (laboratory and outdoors) to identify gaps and TAS assessment opportunities; continue coordination with international partners to leverage skills and resources; develop closer linkages to hazard prediction modelers to identify knowledge gaps and TAS opportunities; prepare evaluation of potential munitions for applicability to potential future threats based on performance characteristics; and continue chamber tests and operational trials as appropriate for compounds of interest. ***FY 2023 Plans:*** - Continue to review state of knowledge on agent employment (laboratory and outdoors) to identify gaps and threat agent science assessment opportunities. - Continue studying scale employment methods and feasibility for emerging threat agents. - Begin Toxin Dissemination Efficiency and Anti-Material Efficacy Characterization studies. ***FY 2024 Plans:*** - Continue to assess state of knowledge on agent employment (laboratory and outdoors) to identify gaps and threat agent science opportunities. - Continue studying different scale employment methods and their feasibility for use with emerging threat agents. - Continue Toxin Dissemination Studies and Anti-Material Efficacy Characterization studies. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.	-	4.657	5.358
Title: 15) Environmental Response	-	6.042	6.037

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: Environmental Response evaluates CB threats to understand how they will behave in the environment (e.g., persistence, degradation, decomposition), along with the effects of environmental conditions (e.g., ozone, ultraviolet, humidity, etc.) on those agents; evaluates CB threat agents on soil, water, and plants, and operational surfaces such as clothing, structures, and equipment; reduces risk to the CBDP Enterprise by closing knowledge gaps and informing on the type, extent and magnitude of a potential hazard a warfighter may face in an operational environment. Small-scale laboratory measurements are used to predict the larger-scale behavior and fate of the agents in outdoor and operational settings, while examining agents deposited on operationally relevant substrates refines our understanding of their environmental persistence and hazards. Knowledge obtained from Environmental Response is used to inform operators, predictive model development, and capability development. ***FY 2023 Plans:*** - Continue evaluating stability of toxin and viral threats, including exploring the fundamental characteristics that influence viral stability in the environment. - Continue closing knowledge gaps associated with aerosol biology and its implications with the outdoor release of biological threats. - Continue environmental characterization of chemical threats, increasing evaluation of degradation products and reaction byproducts for detection, diagnostics and other applications. ***FY 2024 Plans:*** - Continue evaluating stability of toxin and viral threats, including exploring the fundamental characteristics that influence viral stability in the environment. - Continue closing knowledge gaps associated with aerosol biology and its implications with the outdoor release of biological threats. - Continue environmental characterization of chemical threats, and increasing evaluation of degradation products and reaction byproducts for detection, diagnostics and other applications. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.			
Title: 16) First Look (Chemical and Biological) ***Description:*** First Look provides the initial evaluation of known and emerging threat agents to determine their potential hazard to the Warfighter. For both chemical and biological agents, this initial fundamental risk assessment includes evaluation of synthesis and toxicity screening for chemicals and toxins and growth and/or virulence for biological agents as well as production and feasibility of weaponization for all agents; evaluates threat agents and develop methods and capabilities to quickly and accurately characterize chemical, biological, and toxin threat agent properties. First Look products/data inform warfighter mission	-	9.850	9.910

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
planning, requirements generation, capability development, model development, the larger CBDP Enterprise, Intelligence and other government stakeholders about known or emerging agent threats. ***FY 2023 Plans:*** - Continue developing innovative laboratory tools and approaches to enable expedient characterization of emerging or novel biological threats (to include highly infectious and novel organisms), including understanding enabling technologies' impact to gene modification/expression and the ability to assess toxin activity. - Continue developing advanced methods for threat agent characterization, including more complex chemical agent mixtures or combinations. - Continue evaluating findings of technological advancement implications to discounted threats study. ***FY 2024 Plans:*** - Continue developing innovative laboratory tools and approaches to enable expedient characterization of emerging or novel biological threats (to include highly infectious and novel organisms), including understanding enabling technologies' impact to gene modification/expression and the ability to assess toxin activity. - Continue developing advanced methods for threat agent characterization, including complex chemical agent mixtures or combinations. - Continue evaluating findings of technological advancement implications to discounted threats study. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.			
Title: 17) Host Response ***Description:*** Host Response assesses the human response of exposure to CB threat agents using operationally relevant exposure scenarios (acute versus chronic) and exposure routes (e.g., inhalation, dermal, ingestion, etc.) and appropriate assessment methods and models. Data from host response studies is used to develop quantitative exposure limits and qualitative information (e.g., mechanism of action) to inform Warfighter mission planning, requirements generation, capability development, model development, the larger CBDP Enterprise, Intelligence and other government stakeholders. Host Response includes predictive capabilities for rapidly assessing the human response to chemical and biological threat agents; works to close known knowledge gaps associated with traditional threats, including exploring synergistic effects associated with combinatorial agent exposures; assesses bioavailability of threats that are encapsulated to understand host response differences between exposures to encapsulated versus un-encapsulated threats. ***FY 2023 Plans:*** - Continue to build on and develop predictive methods and technologies for CB agent characterizations.	-	12.643	13.500

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Continue studies to address host response areas identified by gap analysis studies for traditional biological agents. - Deliver IOC (initial operating capacity) for CRISTAL (Computational Rapid Identification and Scientific Threat Analysis) incorporating results into future host response. Continue to enhance and modernize CRISTAL methods and tools. - Continue to assess the human (host) response to novel and emerging threats (including combinatorial and mixtures). ***FY 2024 Plans:*** - Continue to build on and further develop predictive methods and technologies for CB agent characterizations. - Continue studies to address host response areas identified by gap analysis studies for traditional biological agents. - Begin improvements/upgrades for CRISTAL (Computational Rapid Identification and Scientific Threat Analysis). Continue to enhance and modernize CRISTAL methods and tools. - Continue to assess the human (host) response to novel and emerging threats (including combinatorial threats and mixtures). ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.			
Title: 18) Technical Surprise	-	4.007	4.500
Description: Technical Surprise assesses technological advancements for potential implications to the threat space, including agent use and release. Include horizon scanning to identify potential areas of concern and conduct technical assessments of emerging technological advancements (e.g., biotechnology, artificial intelligence, machine learning, quantum computing); develops capabilities to evaluate and assess technical enhancements that may alter the nature or magnitude of a threat agent; evaluates emerging technologies and convergence of technologies that improve the ease of threat use and make threats more likely to survive being released; identifies the limitations and barriers associated with synthetic biology and assess the implications, and identify and assess former technology hurdles that have been lowered or overcome and assess implications of increasing potential threat. ***FY 2023 Plans:*** - Continue identifying and assessing technological advancements that will impact the chemical and biological threat space, including potential threats that are not specifically chemical or biological in nature, but have implications to chemical and biological defense capabilities. - Continue a horizon scanning capability to provide situational awareness in assessing technological growth and convergence that can affect the chemical and biological threat space, while keeping abreast of changes in the nature of future threats. - Continue the assessment of synthetic biological tools and other biotechnology developments that can enhance or alter the threat space. - Enhance evaluation of converging technologies and their implications to the threat space. ***FY 2024 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Continue identifying and assessing technological advancements that will impact the chemical and biological threat space, including potential threats that are not specifically chemical or biological in nature but have implications with respect to chemical and biological defense capabilities. - Continue a horizon scanning capability to provide situational awareness in assessing technological growth and convergence that may affect the chemical and biological threat space, while keeping abreast of changes in the nature of future threats. - Continue the assessment of synthetic biological tools and other biotechnology developments that can enhance or alter the threat space. - Enhance evaluation of converging technologies and their implications to the threat space. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.			
Title: 19) Technical Surprise - Enhanced Biodefense (ENBD) ***Description:*** This effort will focus on Advanced Pathogen and Emerging Threat Characterization with attention on characterizing host responses and pathogen signatures using multi-omic analyses and enabling technologies to develop the ability to characterize known and emerging threats. This effort will include understanding the host response to various pathogen insults to identify patterns of response that allow for the prediction of novel threat agents based on the host responses they generate. Evaluations of pathogenesis and viral transmission to understand differences in disease severity will also be conducted. Within this program, efforts to characterize synthetic and natural viral pathogens to compare varying gene expressions between the two will be executed. This program accelerates the ability to characterize emerging threats and will generate more robust data sets for training threat agnostic tools to provide better characterization capabilities. ***FY 2023 Plans:*** - Begin the development of a robust characterization pipeline capable of characterizing emerging pathogens. - Begin the development of robust threat agnostic tools to characterize emerging pathogens. ***FY 2024 Plans:*** - Continue the development of a robust characterization pipeline capable of characterizing emerging pathogens. - Continue the development of robust threat agnostic tools to characterize emerging pathogens. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Increase due to fact of life change in the program/project.	-	1.500	3.500
Title: 20) Distributed CB Reconnaissance - Chemical Detection ***FY 2024 Plans:***	-	-	2.322

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Continue to explore fundamental science and novel technologies to increase sensing performance through enhanced speed and specificity; reduced size, weight, and power; and reduced consumables and life-cycle costs of fielded chemical sensors. - Continue developing chemical threat sensing and sampling systems, to include unmanned and manned platforms. - Continue to evaluate the use of computational tools, like machine learning, into detector/identifier technologies to further reduce false reporting due to environmental factors. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Program/project funding transferred from another funding line.			
Title: 21) Expeditionary Analytical Toolkit (ExAnT) - Chemical Detection ***Description:*** Provide general and specialized forces with the ability to modernize detection technologies for traditional threats while enhancing detection capabilities for non-traditional, emerging, and mixed chemical hazards. ***FY 2023 Plans:*** - Continue to support expeditionary forces in leveraging reach-back capabilities for identification purposes. Invest in novel detection capabilities to address opioids and emerging chemical threats. - Continue to invest in improvements of current detection technologies for chemical hazards in complex and obscurant-heavy environments. ***FY 2024 Plans:*** - Continue to invest in novel detection capabilities to address opioids and emerging chemical threat, focusing on developing more analogue agnostic capabilities. - Continue to invest in improvements of current detection technologies for chemical hazards in obscurant-heavy environments by improving currently-fielded detectors to provide early warning of chemical threats and offer robust performance in the future battlespace. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.	-	3.296	3.616
Title: 22) Unattended Perimeter Monitoring - Chemical Detection ***Description:*** Establish a layered defense capability by developing and implementing automated and integrated technologies enabling unattended monitoring for chemical threats. These technologies will provide early warning of vapor, aerosol, solid, and liquid hazards and unencumber the Warfighter by reducing logistics and operator burden. Providing a reliable detect-to-warn capability at fixed or expeditionary sites will enhance the overall protective posture of ground and maneuver forces as robust technologies can be miniaturized for portability and operational sustainment.	-	-	3.054

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** UN2 / *Understand (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 Plans: - Continue to make technological improvements to enhance early warning of vapor, aerosol, solid, and liquid hazards. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Program/project funding transferred from another funding line.			
Title: 23) Unconventional Detection Modalities - Chemical Detection ***Description:*** Develop disruptive technologies to identify unknown or emerging chemical threats and develop chemical sensors that can operate in complex threat environments with high fidelity. This thrust area supports others as appropriate to the Joint Force mission needs (e.g., expeditionary, perimeter defense, or unmanned reconnaissance). This thrust area will also explore utilizing machine learning and other advanced computational tools to increase detection and identification accuracy, reduce false alarms, and enable mapping of hazardous locations to support Integrated Early Warning (IEW) capabilities. ***FY 2024 Plans:*** - Continue pursuing advances in photonic integrated circuits by reducing size, weight and power of traditional photonic sensors but keeping the selectivity and sensitivity of a traditional sensor. - Incorporate early warning and threat mapping using machine learning (ML)/artificial intelligence (AI) tools to aggregate and analyze sensor data in real-time. - Continue library-less detection to surmount current sustainment limitations of library-based or analyte-specific chemical sensor to be updated to detect emerging threats. - Continue development in ML and AI to make sensor detection faster with reduced false alarm rates. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Program/project funding transferred from another funding line.	-	-	2.443
Accomplishments/Planned Programs Subtotals	-	112.952	119.182

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• UN3: *Understand (ATD)*	-	68.415	83.825	-	83.825	81.392	87.384	73.515	71.015	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program											Date: March 2023	
Appropriation/Budget Activity 0400 / 2					R-1 Program Element (Number/Name) PE 0602384BP / *Chemical and Biological Defense Program*				Project (Number/Name) PT2 / *Protect (Applied Research)*			
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
PT2: *Protect (Applied Research)*	-	0.000	58.091	55.057	0.000	55.057	56.153	57.817	61.452	61.452	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Protect Applied Research Project provides the Joint Force the ability to prevent the effects from exposure to chemical and biological hazards. PT2 emphasizes increasing protection capability and reducing physiological effects, preventing or reducing individual and collective exposures, applying prophylaxis to prevent or mitigate negative physiological effects, and protecting critical equipment in Chemical, Biological, Radiological, and Nuclear (CBRN) environments. In FY 2023, the Chemical Biological Defense Program (CBDP) RDT&E Projects have been restructured to align with the CBDP portfolio construct. PT2 efforts in FY 2022 remain in Projects CB2 and TM2. This restructuring provides standardization and alignment across CBDP research, development and acquisition efforts.

Thrust Areas included in this Project are:

(1) Biological Warfare Defense Prophylaxis
(2) Air Purification Enhancements
(3) All-Hazards & Respiratory Protection
(4) Dynamic Multifunctional Materials for Second Skin
(5) Enhanced Survivability Coatings
(6) Lightweight Protective Garments
(7) Multifunctional Materials for Protection
(8) Nerve Agent Prophylaxis/Pretreatments
(9) Reactivators of AChE as Therapeutics (ReACT)

Biological Warfare Defense Prophylaxis: Provides the Warfighter protection against biothreat agents through the pre-exposure administration of prophylactics against known bacterial, viral and toxin agents of interest and emerging infectious threats. Medical countermeasure (MCM) strategies against broader classes of biological agents will be pursued with emphasis on broad-spectrum protection based on mechanism of action. Platform technologies will be utilized and adapted to maximize flexibility, increase stability, shelf life, and expand storage conditions. Efforts will also be adapted to maximize delivery flexibility through modifying delivery routes, which will allow for dose and reagent sparing. Efforts include additional investments in enhanced biodefense and pandemic preparedness.

Air Purification Enhancements: Optimizes and extends filter life and reduces lifecycle costs while maintaining or enhancing protection against all chemical weapons agents and toxic industrial chemicals/materials. Improves integration of collective protection into developmental Service major combat platforms. Investigates existing filtration performance against emerging and non-traditional threats and identify and develop countermeasures.

All Hazards and Respiratory Protection: Develops next generation general purpose mask that unencumbers the Warfighter, integrates with existing system technology, and closes capability gaps in current technologies. Supports special purpose units (e.g., special operations, Civil Support Teams, Explosive Ordnance Disposal) and

modernization efforts to insert new, scalable protection technologies into current respirator programs of record that protect against the full spectrum of threats for the full range of military operations.

Dynamic Multifunction Materials for Second Skin: Efforts support percutaneous protection and will utilize responsive technologies to provide chemical and biological protective suits that adapt to the environment by synthesizing scaled samples via roll-to-roll manufacture which exhibit materials properties that reduce thermal burden and integrate with current combat garments. These technologies include interpenetrating polymer networks that will change moisture permeability and molecular selectivity on demand, and membranes with higher moisture vapor transfer rates than existing fabrics.

Lightweight Protective Garments: Advances garment material and ensemble technologies with revolutionary capability improvements using integrated, low encumbrance garment designs and fabrication for thermal burden reduction. Incorporates state-of-the-art threat protection technologies and supporting test methodologies and methods that provide operationally relevant, comparable test data on garments. Improves testing methods for rapid, operationally-relevant, consistent garment performance evaluation.

Enhanced Survivability Coatings: Addresses materiel surface ease of decontamination and resistance to chemical agent penetration. Develops durable temporary coatings that resist chemical agent absorption and are quickly decontaminated in the field and allow the rapid regeneration of combat power.

Multifunctional Materials for Protection: Supports Protection and Hazard Mitigation Core Capability Areas. Combines basic and applied research to discover, develop, engineer, and integrate novel, reactive/catalytic materials into next generation CB defense systems. Engineers and scales material manufacturing to maximize sorption, reactivity, and service life while unencumbering the warfighter. Characterizes materials using state-of-the-art ambient pressure spectroscopies for integration into next generation filters and protective garments that reactively decontaminate chemical warfare agents.

Nerve Agent Prophylaxis/Pretreatments: Obtain the first prophylactic MCMs designed to prevent severe morbidity and mortality upon exposure to nerve agents without the need for additional individual physical protective equipment.

Reactivators of AChE as Therapeutics (ReACT): Provide rapid acting MCMs to counter adverse effects from exposure to nerve agents and maintain force lethality.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: 1) Biological Warfare Defense Prophylaxis	-	26.032	22.116
Description: The ultimate protection of the warfighter is achieved by pretreating the warfighter to withstand any biological threat with no adverse side effects from the pretreatment. Such pretreatment would enable the warfighter to work in a less restrictive environment, absent of any personal protective equipment, facilitating the warfighter to operate at peak performance. Efforts support innovative concepts in prophylaxis that support needs specific to the warfighter such as broad spectrum protection, rapid onset to protection, fewer doses required, no cold chain required, and needle-free administration.			
FY 2023 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** PT2 / *Protect (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Bacterial: - Continue development of nanobodies. - Continue plague and melioidosis human surveillance. - Continue non-human primate (NHP) model development for co-infection models. - Continue NHP melioidosis neurological model. - Initiate development of plaque Messenger Ribonucleic Acid (mRNA) vaccine. - Continue to evaluate protective efficacy of Anthrax vaccines against novel Bacillus anthracis strains. Viral: - Conduct nonclinical studies for vaccines and pretreatments for Crimean Congo Hemorrhagic Fever viruses. - Complete Marburg virus infection studies of bats. - Continue immune correlate identification for Ebola. Toxins: - Increase half-life of monoclonal antibodies (mAb) and scale up manufacturing of mAb against marine toxins. - Continue evaluation of naturally occurring anti-toxins to protect against marine toxins. - Continue to develop novel antitoxin technologies including exploring the use of cell membrane coated nanosponges. - Continue evaluation of toxins and antitoxin prophylaxis in animal models. - Continue to develop functional assays to determine biological activity for various toxins. Broad Spectrum: - Continue novel pan virus nanosponge platform development and animal testing to address emerging threats, explore additional applications of nanosponge technology to include emerging toxin and bacterial threats. - Continue development of a prototype broad spectrum neuronal nanosponge platform technology. - Continue exploration of additional strategies and platforms for broad spectrum protection to address protection against emerging threats.			
FY 2024 Plans: Viral: - Continue nonclinical studies for vaccines and pretreatments for Crimean Congo Hemorrhagic Fever viruses. - Discovery and development of broadly protective strategies and nontraditional approaches (e.g., host-directed, nucleic acid, antibody, and immunomodulators) against new and emerging viral threats. - Explore the use of production pipelines for mosaic and/or engineered antigens for rapid deployment into established vaccine platforms.			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** PT2 / *Protect (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Continue immune correlate identification for Ebola. - Continue animal model development for viral families to support Emerging Infectious Diseases (EID). - Test protective vaccine/therapeutic layered defense approaches to prevent Ebola Virus respiratory disease. Toxins: - Continue half-life extension of monoclonal antibodies (mAb) and scale up manufacturing of mAb against palytoxin. - Continue evaluation of naturally occurring anti-toxins to protect against marine toxins. - Continue development of animal models for evaluation of toxins and antitoxin prophylaxis. - Continue development of functional assays to determine biological activity for various toxins. - Continue evaluation of aptmers as MCM against conotoxins. - Continue characterization of toxin-host cell interactions for the continued development of pretreatment strategies. - Evaluate genetic and genomics approaches to address previously unforeseen threat of deliberate manipulation of threat agents so that they no longer are amenable for detection and neutralization Broad Spectrum: - Initial Prototype Development of Broad-spectrum Neuronal Nanosponges to protect against multiple types of neurotoxins. - Evaluate broad spectrum protection strategies based on mechanisms of action. - Expand nanosponge platform to target multiple toxin families. - Continue layered defense testing with candidate vaccine/antibiotic/antibody combinations to broaden protection and avoid interference between medical countermeasure. - Continue to evaluate multiple novel broad spectrum platform strategies for potential use to respond to EID, appropriate prototype pathogens will be used for test & evaluation, emphasis on broad-spectrum protection based on mechanism of action. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease due to change in program/project technical parameters. Decrease due to the Bacterial program does not have funding past FY23 and all work associated with plague mRNA vaccine has been cancelled.			
Title: 2) Biological Warfare Defense Prophylaxis - Enhanced Biodefense (ENBD) ***Description:*** This effort will focus on Innate Immune Training and Adjuvant Discovery & Tissue Targeting of Vaccines to enhance immune response. Investments include efforts to strengthen and tune the host immune system through enhancement or stimulation to increase the ability to resist disease progression and spread. Characterization of vaccine platform technologies relative to the way a pathogen or toxin causes disease and how the host immune system responds will be executed to optimize matching of a disease indication with the most appropriate vaccine platform. ***FY 2023 Plans:***	-	16.000	20.000

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** PT2 / *Protect (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Develop a predictive capability to rapidly identify the optimal vaccine platform with which to counter any particular current, novel or emerging biological threat. - Initiation of projects that identify and evaluate adjuvants/encapsulation formulations/mucosal delivery technologies that can be combined with vaccines to stimulate a customized immunogenicity profile without compromising vaccine safety. ***FY 2024 Plans:*** - Continue to develop a predictive capability to rapidly identify the optimal vaccine platform with which to counter any particular current, novel or emerging biological threat. - Continue to identify and evaluate adjuvants/immune modulation technologies that can be combined with vaccines to stimulate a customized immunogenicity profile without compromising vaccine safety. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Additional investment in enhanced biodefense and pandemic preparedness.			
Title: 3) Air Purification Enhancements ***Description:*** Existing Collective Protection (ColPro) systems have high life cycle costs driven by maintenance and limited service life. Efforts will focus on optimizing and extending filter life to reduce lifecycle costs while maintaining or improving protection. ***FY 2023 Plans:*** - Continue materials testing for effectiveness against novel threats for Next Generation Filtration systems. - Complete and publish report on computational modeling for filter protection against advanced agents. - Complete and publish report on design of high air flow collective protection systems that increase the performance against advanced agents delivered in all states of matter (vapor, aerosol, and liquid) in operationally relevant environments. - Continue to engineer novel filter bed materials for chemical agent destruction, integrate them into next generation filters, and develop methods to assess filter performance in an operationally-relevant environment. - Develop low-cost, continuous operation collective protection engineering standards and guidelines for temp, rapid enhancement of unprotected facilities during pandemic/bio warfare attack. ***FY 2024 Plans:*** - Integrate new filtration technologies with more stable, reactive materials into a next generation M98 filter to reduce costs and extending filter operational life. - Continue to assess and mitigate impact of advanced threats on current and developing filtration technologies. - Transition Residual Life Indicator System to Modernization Collective Protection program of record in FY24 ***FY 2023 to FY 2024 Increase/Decrease Statement:***	-	4.705	1.169

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** PT2 / *Protect (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Program/project transitioned to Advanced Development. Decrease due to transition of Residual Life Indicator System to Modernization Collective Protection program of record in early FY24.			
Title: 4) All-Hazards & Respiratory Protection ***Description:*** Efforts will improve chemical and biological agent protection while maintaining warfighter capability through integrated research on respirator, seams, closures, and new manufacturing techniques and materials; perform early surveys for end-user jury input with frequent user operational evaluation; focus on low burden next generation protective mask. ***FY 2023 Plans:*** - Complete evaluate and assess systems that provide chemical biological respiratory protection technologies in support of tactical all hazard, full spectrum respiratory protection system. - Transition operationally-relevant respirator fit testing system to the Joint Service Mask Leakage Tester (JSMLT). - Transition specification for anti-fog lenses in respirators as a Ground Mask modification work order. - Continue to design and test prototypes for a low-encumbrance, next generation protective mask. ***FY 2024 Plans:*** - Develop designs for innovative, low burden respirator prototypes. - Develop use of innovative manufacturing techniques for respirators, such as 3D facial scanning and additive manufacturing. - Establish operationally-relevant protocols for next generation respiratory protection prototype testing. - Transition microcooling garment to Tactical Advance Threat Protective Ensemble (TATPE) under the UIPE FoS GP program of record. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Program/project transitioned to Advanced Development.	-	1.482	1.026
Title: 5) Dynamic Multifunction Materials for Second Skin ***Description:*** Efforts will utilize responsive technologies to provide chemical biological protective suits that adapt to the environment by synthesizing scaled samples via roll-to-roll manufacture which exhibit materials properties that reduce thermal burden and integrate with current combat garments. These technologies include interpenetrating polymer networks that will change moisture permeability and molecular selectivity on demand, and membranes with higher moisture vapor transfer rates than existing fabrics. ***FY 2023 Plans:*** - Continue development and testing of protective garment materials that respond to the presence of chemical agents to increase Warfighter protection.	-	1.793	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** PT2 / *Protect (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Begin integration of responsive systems into protective suit paradigms for whole system testing. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Program/project funding transferred to another funding line. Project funding transfers to the Lightweight Protective Garments and Multifunctional Materials for Protection thrust areas starting in FY24.			
Title: 6) Enhanced Survivability Coatings ***Description:*** Efforts seek to produce enhanced coatings that increase chemical warfare agent survivability and decontaminatability of military materiel to levels comparable to that of stainless steel. Improved coatings will resist chemical agent absorption and be quickly decontaminated in field, to rapidly return materiel to unprotected mission operations level. ***FY 2023 Plans:*** - Continue to characterize bio-inspired surface treatments for materiel coatings to repel agents of interest from materiel surfaces. - Evaluate and incorporate new or commercially-available appliques (to include chemical transport studies in current military coatings, novel coatings characterization, thin film overcoats, strippable coat, reactive coat, and lock-down coats) in support of CBRN Coatings, Coverings, and Protective Overlays Program of Record. - Advance thin repellent film coating systems from fundamental research to applied research test and evaluation. ***FY 2024 Plans:*** - Increase chemical agent resistance of current military coatings through development and testing of novel temporary coatings to reduce the spread of contamination and ease decontamination of military assets. - Continue to improve equipment coatings through bio-inspired surface treatments to repel agents of interest from current military equipment coatings. - Develop and verify test methods for chemical decontamination efficiency of equipment elastomers, including tire rubber. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.	-	1.178	1.881
Title: 7) Lightweight Protective Garments ***Description:*** Efforts will advance garment material and ensemble technologies with new capabilities using integrated garment designs and fabrication for thermal burden reduction, state-of-the-art threat protection technologies, and supporting test methodologies and methods that provide operationally relevant, comparable data on test garments. ***FY 2024 Plans:*** - Manufacture scaled responsive/reactive textile swatch samples that adapt or react to the threat and environment while reducing thermal burden and integrate with current combat garments.	-	-	0.234

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** PT2 / *Protect (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Test scaled responsive/reactive textile swatch samples using whole system test methods. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Program/project funding transferred from another funding line. Project funding transferred from the Dynamic Multifunctional Materials for Second Skin thrust area which ends in FY23.			
Title: 8) Multifunctional Materials for Protection ***Description:*** Efforts will discover, develop and integrate novel, reactive/catalytic materials and scale material manufacturing with maximum sorption and reactivity. They will characterize materials using state-of-the-art in operando and ambient pressure spectroscopies for eventual integration into next generation decontaminants, coatings, filters, and protective garments that reactively decontaminate chemical warfare agents. ***FY 2023 Plans:*** - Continue to engineer reactive/catalytic nano-structure materials from basic research efforts for chemical agent destruction, to feed air purification enhancement. - Continue to integrate engineered reactive/catalytic nano-structure materials into filters, decontaminants, and textiles to assess materials in an operationally-relevant environment for personnel decontamination. - Advance next generation materials to design reactive, regenerative protective garments with longer service life and lower thermal burden. ***FY 2024 Plans:*** - Generate prototype next generation reactive and regenerative protective garment swatches with longer service life and lower thermal burden for whole system testing. - Incorporate novel materials into individual and collective protection filtration systems and test for increased performance against conventional and advanced threats delivered in all states of matter (vapor, aerosol, and liquid) in laboratory. - Begin demonstration of enhanced filter bed performance towards emerging/advanced threats and toxic industrial chemicals/ materials in operationally-relevant environments. - Develop scaled manufacturing techniques for novel materials for incorporation into prototype protection technologies. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Program/project funding transferred from another funding line. Project funding transferred from the Dynamic Multifunctional Materials for Second Skin thrust area which ends in FY23.	-	2.743	5.087
Title: 9) Nerve Agent Prophylaxis/Pretreatments ***Description:*** Develop pretreatments and prophylactics that counter chemical warfare agents, including organophosphorus nerve agents (OPNA), using targeted and innovative science and technology efforts that will offer broad-spectrum protection, flexible	-	4.158	2.576

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** PT2 / *Protect (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
route of administration, lower dose requirements, and reduced operational and logistical burden. The use of these medical countermeasures (MCM) will protect the lives and effectiveness of our Warfighters, thus maintaining force strength and force capability. ***FY 2023 Plans:*** - Continue efforts to develop catalytic enzymes for use against selected, priority non-traditional agents (NTA). - Complete expanded pre-clinical studies of lead catalytic scavengers to support future investigative new drug (IND) filing. - Continue efforts to develop capability for rapid development of medical countermeasures. - Continue efforts to explore and further develop novel non-enzyme nerve agent prophylaxis. - Continue new approaches to identify pretreatment and prophylaxis against multiple classes of NTAs and emerging chemical threats. ***FY 2024 Plans:*** - Continue exploration of the therapeutic efficacy of atipamezole and other FDA-approved and developmental MCMs for non-opioid-based pharmaceutical based agents (PBAs). - Continue cross-toxidromic and pathway analysis to determine possible targets for multi-toxidromic therapeutic MCM discovery and development. - Finish a paper study to identify previous accomplishments, current state of the science and outline a path forward for discovering, developing, and fielding therapeutic MCMs for a broad scope of emerging chemical threats beyond PBAs. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease due to change in program/project technical parameters.			
Title: 10) Reactivators of AChE as Therapeutics (ReACT) ***Description:*** Provide rapid acting MCMs to counter adverse effects from exposure to nerve agents and maintain force lethality. ***FY 2024 Plans:*** - Initiate efforts that utilize modelling and structural activity relationships in order to develop prophylactics with both centrally acting and broad spectrum capabilities. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Increase due to change in program/project technical parameters.	-	-	0.968
Accomplishments/Planned Programs Subtotals	-	58.091	55.057

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program			Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** PT2 / *Protect (Applied Research)*	

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• PT3: *Protect (ATD)*	-	32.113	29.261	-	29.261	48.969	42.794	46.159	52.581	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program			Date: March 2023
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602384BP / *Chemical and Biological Defense Program*	Project (Number/Name) MT2 / *Mitigate (Applied Research)*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
MT2: *Mitigate (Applied Research)*	-	0.000	73.321	66.371	0.000	66.371	63.832	51.426	59.920	64.824	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Mitigate Applied Research Project emphasizes the ability to conduct decontamination and medical actions that enable the quick restoration of combat power, maintain/recover essential functions that are free from the effects of Chemical, Biological, Radiological, and Nuclear (CBRN) hazards, and facilitate the return to pre-incident operational capability as soon as possible. In FY 2023, the Chemical Biological Defense Program (CBDP) RDT&E Projects have been restructured to align with the CBDP portfolio construct. MT2 efforts in FY 2022 remain in Projects CB2 and TM2. This restructuring provides standardization and alignment across CBDP research, development and acquisition efforts.

Thrust Areas included in this Project are:

(1) Biological Warfare Defense Therapeutics
(2) Discovery of Medical Countermeasures Against New and Emerging (DOMANE)
(3) Chemically Reactive Ocular Wound and Dermal Therapeutics (CROWD)
(4) Emerging and Pharmaceutical-based Agent Threats (EMPATH)
(5) Enabling Science
(6) Reactivators of AChE as Therapeutics (ReACT)
(7) Enhanced Survivability Coatings
(8) Equipment Decontamination
(9) Multifunctional Materials for Protection
(10) Personnel Decontamination

Biological Warfare Defense Therapeutics: Discovers broad-spectrum bacterial, toxin and viral therapeutics, and label expansion (repurposing) of medical countermeasures that are U.S. Food & Drug Administration (FDA) approved or in advanced stages of clinical development. These efforts are coordinated with Interagency and Department, to leverage public and force/defense health related investments made to minimize risk and speed approval of novel antibiotic countermeasures.

DOMANE: Provides innovative and rapid medical countermeasures (MCMs) development capabilities that reduce developmental risks, cost and schedule associated with MCM fielding, and afford protection against and allow the Joint Force to rapidly respond to traditional, new and emerging biological warfare threat exposures to allow freedom of action.

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** MT2 / *Mitigate (Applied Research)*

Chemically Reactive Ocular Wound and Dermal Therapeutics (CROWD): Develop a fielded medical countermeasure for the Warfighter that can treat a chemical agent that has breached the skin. Collect the data that the Food and Drug Administration (FDA) will require for approval.

Emerging and Pharmaceutical-based Agent Threats (EMPATH): Assess candidate MCMs and transitions them to partner United States Government entities for development into fieldable drug products. Activities focus on assessing current therapeutic drugs for protection against opioid agents and developing MCMs to treat non-opioid sedatives.

Enabling Science: Leverage technological advances and innovative approaches that will improve the time to develop and field chemical medical countermeasures (MCM) to the Warfighter. Modernize the chemical MCM development process to allow for an earlier assessment of both the safety and efficacy of candidate therapeutics before regulatory submission and to cultivate technologies that enable development efforts across other medical portfolios to improve the ability to conduct MCM testing more cost-effectively with fewer animals.

Reactivators of AChE as Therapeutics (ReACT): Develops broad-spectrum, centrally-acting acetylcholinesterase (AChE) reactivators, that increase survival, reduce morbidity, and decrease neurological damage.

Enhanced Survivability Coatings: Develops temporary coatings that resist chemical agent absorption and are quickly decontaminated in the field and allow the rapid regeneration of combat power.

Equipment Decontamination: Addresses the limited capability to decontaminate personal equipment, weapons, vehicles, ships, and facilities; sensitive equipment, and hazardous waste. Efforts within this thrust seek to develop decontaminant formulations and procedures that reduce or eliminate residual contamination hazards, enable unit-level decontamination with rapid unmasking, reduce logistic needs, enable rapid sorting of clean from dirty to rapidly return high-value equipment to normal use, and to develop improved test methods.

Multifunctional Materials for Protection: Discovers, develops, and integrates novel, reactive/catalytic materials and scale material manufacturing with maximum sorption and reactivity, and characterize materials using state-of-the-art in operando and ambient pressure spectroscopies, for eventual integration into next generation decontaminants that reactively decontaminate chemical warfare agents.

Personnel Decontamination: Develops personnel decontaminants with lower lifecycle costs and storage constraints and determines time, efficacy, and logistics burdens to Warfighters for mass casualty decontamination.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: 1) Biological Warfare Defense Therapeutics	-	31.034	31.363
Description: This effort funds biomedical research focused on the early discovery and evaluation of therapeutic countermeasures against known and emerging biological warfare (BW) threats for which FDA-approved therapeutics are limited or lacking. BW defense therapeutics mitigate and reverse the effects of known and emerging biological warfare threats in symptomatic			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** MT2 / *Mitigate (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
warfighters diagnosed with BW disease. They are the last line of defense against BW threats and are critical to returning symptomatic Warfighters to service. Biomedical research is focused on discovery and development of broad-spectrum therapeutic candidates and therapeutic platforms that target viruses, bacteria or toxins directly, enhance the host response (e.g., by modulating the immune system) and/or relieve BW disease symptoms. Broad-spectrum therapeutic candidates that are shown to be both safe and efficacious against BW threats in small animal models will advance for additional pre-clinical evaluation, and can be accelerated for use against emerging infectious diseases during an outbreak. Therapeutic target identification discovery and evaluation of novel small molecules (chemically synthesized), novel biologic molecules (isolated from natural sources), drug and drug/vaccine combinations (aka layered defense), and repurposing of drugs approved by the FDA for other indications, are included in this research. Development of appropriate animal models and assays in which to evaluate therapeutic candidates is also included. Projects leverage interagency and commercial sector investments to accelerate development and reduce costs. ***FY 2023 Plans:*** Viral Therapeutics: - Evaluate conserved targets, including host targets and processes of pathogenesis, for broad-spectrum treatment. - Continue drug discovery and development efforts to prepare for emerging threats by focusing on broad spectrum mechanism of action conserved targets and platform technologies. Upon establishment of proof of concept in small animal models, transition therapeutic candidates to advanced technology development. Bacterial Therapeutics: - Evaluate conserved therapeutic targets, with a focus on circumventing or overcoming antimicrobial resistance, for broad-spectrum treatment. - Continue to discover therapeutic candidates that employ novel strategies and mechanisms, such as new pathogen targets, drug delivery methods, or modulating the immune response, to overcome current and emerging mechanisms of antibiotic resistance in bacterial infections. Upon establishment of proof of concept in small animal models, transition to advanced technology development. - Establish proof of concept efficacy of biologics to treat intracellular bacterial biothreat infections to lay the groundwork for future expansion of investments in biologic therapeutic class. Toxin Therapeutics: - Continue evaluation of repurposed small molecule drug for efficacy in the treatment of multiple serotypes of botulinum neurotoxin (BoNT) in small animal models; evaluate repurposed drug in combination with botulinum antitoxin in small animal models. ***FY 2024 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** MT2 / *Mitigate (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Viral Therapeutics: - Continue to evaluate conserved targets, including host targets and processes of pathogenesis, for broad-spectrum treatment. - Continue drug discovery and development efforts to prepare for emerging threats by focusing on broad spectrum mechanism of action conserved targets and platform technologies. Upon establishment of proof of concept in small animal models, transition therapeutic candidates to advanced technology development. Bacterial Therapeutics: - Continue to evaluate conserved therapeutic targets, with a focus on circumventing or overcoming antimicrobial resistance, for broad-spectrum treatment. - Continue to discover therapeutic candidates that employ novel strategies and mechanisms, such as new pathogen targets, drug delivery methods, or modulating the immune response, to overcome current and emerging mechanisms of antibiotic resistance in bacterial infections. Upon establishment of proof of concept in small animal models, transition to advanced technology development. - Continue to establish proof of concept efficacy of biologics to treat intracellular bacterial biothreat infections to lay the groundwork for future expansion of investments in biologic therapeutic class. Toxin Therapeutics: - Continue evaluation of repurposed small molecule drug for efficacy in the treatment of multiple serotypes of botulinum neurotoxin (BoNT) in small animal models in combination with botulinum antitoxin. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.			
Title: 2) Discovery of Medical Countermeasures Against New and Emerging (DOMANE) ***Description:*** Develop and successfully transition emerging technology platforms to identify MCMs, targets, as well as innovative platforms that will support transition to applied programs for clinical trials. These developmental and translational studies will provide a knowledge foundation and broad candidate pipeline that will underpin the availability (via FDA-regulated Expanded Access, Compassionate Use and Emergency Use authorities) of BW MCM to the Joint Force at the speed of relevance to allow freedom of action. ***FY 2023 Plans:***	-	4.334	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** MT2 / *Mitigate (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Pursuing high-throughput 3D structural biology, combined with organs-on-a-chip and artificial intelligence/machine learning technologies to transition to applied programs to address mechanisms of action, drug development platforms and medical countermeasure identification. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Program/project terminated in FY 2024.			
Title: 3) Chemical Reactive Ocular Wound and Dermal Therapeutics (CROWD) ***Description:*** Focuses on therapeutic strategies to effectively treat Chemical Warfare Agents (CWA) contamination on wounds, eyes, and large areas of intact skin. This effort involves the development of products capable of removing or neutralizing CWA from those routes of exposure, to decrease the toxic load of agent and allow optimal effectiveness of other systemic therapeutics. ***FY 2023 Plans:*** - Continue advanced preclinical studies to validate safety and efficacy in support of clinical trials. - Continue assessment of candidate products for advanced development. - Refine pathway to regulatory approval and licensure. ***FY 2024 Plans:*** - Initiate proof of concept test of candidate decontamination products for capability to decontaminate CWAs from wounds. - Determination of dosing strategies for use of candidate products in traumatic wounds. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease due to change in program/project technical parameters.	-	6.351	5.639
Title: 4) Emerging and Pharmaceutical-based Agent Threats (EMPATH) ***Description:*** The Warfighter requires effective MCMs that prevent or reverse the adverse effects of Pharmaceutical Based Agents (PBAs) and Emerging Chemical Threats (ECTs), while still allowing for the use of FDA approved drugs (e.g. morphine, fentanyl) by Joint Force Medical Staff for their originally intended purposes of pain management and sedation. This portfolio seeks to develop MCMs that are efficacious against a range of toxidromes, are fast-acting, and have a prolonged protective and/or therapeutic benefit to minimize the potential for re-intoxication and maintain Force Lethality. ***FY 2023 Plans:*** - Continue to assess drug products for use against other priority PBA emerging threats (e.g., non-opioids). ***FY 2024 Plans:*** - Continue exploration of the therapeutic efficacy of atipamezole and other FDA-approved and developmental MCMs for non-opioid-based PBAs.	-	5.586	3.753

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** MT2 / *Mitigate (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Continue cross-toxidromic and pathway analysis to determine possible targets for multi-toxidromic therapeutic MCM discovery and development. - Finish a paper study to identify previous accomplishments, current state of the science and outline a path forward for discovering, developing, and fielding therapeutic MCMs for a broad scope of emerging chemical threats beyond PBAs. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease due to change in program/project technical parameters.			
Title: 5) Enabling Science	-	12.877	13.878
Description: Focus on protection of the Warfighter against CWA to maintain force lethality, leverage innovative approaches and emerging technologies to support modernization of chemical medical countermeasure (cMCM) pipeline, and develop and deploy cMCMs more rapidly to the Warfighter. Efforts include: 1) development of Artificial Intelligence/Machine Learning (AI/ML) tools to more efficiently identify cMCMs and assess their safety and efficacy for regulatory submission; 2) AI/ultra-high throughput screening-based sampling of large chemical spaces with the aim of providing broad spectrum cMCMs with improved efficacy and selectivity, minimal toxicity, and decreased expense and fielding times to the warfighter; 3) development of technologies to deliver MCMs across the blood brain barrier (BBB) into the brain; 4) maturation of cMCMs with innovative mechanisms of actions; and 5) development of well characterized or FDA qualified animal models, as needed, to support cMCM discovery and development under the FDA animal rule. ***FY 2023 Plans:*** - Continue to employ AI/ML-based tools for drug design and predictive drug safety. - Continue to maintain screening and safety databases for drug candidates - Continue to perform select animal and safety studies for lead therapeutic candidates, including anticholinergics, for treatment of CWAs. - Continue to investigate technologies for delivering therapeutics (e.g. 2-pyridine aldoxime methyl chloride/2-PAM) to the brain. - Continue to support the therapeutic candidate pipeline. - Develop well characterized or FDA qualified animal models to support the development of MCMs requiring licensure under the FDA animal rule that provide protection for the Warfighter against CWAs. - Continue to test the safety and efficacy of candidate resurrectors of aged/inhibited enzyme in animal models. - Develop naturally derived MCM with innovative mechanism of action against broad spectrum of organophosphorus nerve agent (OPNA) threats. ***FY 2024 Plans:*** - Continue to employ AI/ML-based tools for drug design and predictive drug safety. - Continue to maintain screening and safety databases for drug candidates.			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** MT2 / *Mitigate (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Continue to perform select animal and safety studies for lead therapeutic candidates. - Continue to investigate technologies for delivering therapeutics (e.g. 2-PAM) to the brain. - Continue to support the therapeutic candidate pipeline. - Continue to develop well characterized or FDA qualified animal models to support the development of MCMs requiring licensure under the FDA animal rule that provide protection for the Warfighter against CWAs. - Continue to develop naturally derived MCMs with innovative mechanisms of action against a broad specturm of OPNA threats. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.			
Title: 6) Reactivators of AChE as Therapeutics (ReACT)	-	3.779	4.879
Description: The Warfighter requires rapid acting medical countermeasures (MCMs) to counter adverse effects from exposure to Nerve Agents (NAs) and maintain force lethality. Utilize modelling and structural activity relationships in order to develop prophylactics or therapeutics for acetylcholinesterase enzyme reactivation with both centrally acting and broad spectrum capabilities. Develop potential candidates that will ultimately be submitted for Food and Drug Administration (FDA) licensure or to identify previously licensed products for new uses in the treatment of chemical warfare casualties. ***FY 2023 Plans:*** - Continue to down select generated chemical libraries to the most promising broad spectrum therapeutic candidates for follow on safety and efficacy assessments. - Continue drug formulation efforts for MCMs with a longer shelf-life and with feasibility of an auto-injector containing material and chemical composition. - Continue development screening for novel broad spectrum enzyme reactivators that are effective in the brain. - Transition critical in vivo data to advanced developer for lead reactivators. ***FY 2024 Plans:*** - Continue efforts that utilize modelling and structural activity relationships in order to develop therapeutics with both centrally acting and broad spectrum capabilities. - Continue to down select generated chemical libraries to the most promising broad spectrum therapeutic candidates for follow on safety and efficacy assessments. - Continue development screening for novel broad spectrum enzyme reactivators that are effective in the brain. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Minor change due to routine program adjustments.			
Title: 7) Enhanced Survivability Coatings	-	1.071	0.542

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** MT2 / *Mitigate (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: Efforts seek to produce enhanced coatings that increase chemical warfare agent survivability and decontaminatability of military materiel to levels comparable to that of stainless steel. Improved coatings will resist chemical agent absorption and be quickly decontaminated in field, to rapidly return materiel to unprotected mission operations level. ***FY 2023 Plans:*** - Continue to characterize bio-inspired surface treatments for equipment coatings to repel agents of interest from current military equipment coatings. - Evaluate and incorporate new or commercially-available appliques (to include chemical transport studies in current military coatings, novel coatings characterization, thin film overcoats, strippable coat, reactive coat, and lock-down coats) in support of CBRN Coatings, Coverings, and Protective Overlays Program of Record. - Advance thin repellent film coating systems from fundamental research to applied research test and evaluation. ***FY 2024 Plans:*** - Continue evaluating polymer coatings as potential temporary or permanent military equipment coatings to decrease logistical burden of decontamination. - Increase chemical agent resistance of current military coatings through development and testing of novel temporary coatings to reduce the spread of contamination and enable more facile decontamination of military assets. - Continue to improve equipment coatings through bio-inspired surface treatments to repel agents of interest from current military equipment coatings. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease due to change in program/project technical parameters.			
Title: 8) Equipment Decontamination	-	5.774	2.925
Description: The Warfighter has a limited capability to decontaminate personal equipment, weapons, vehicles, ships, and facilities; Sensitive equipment (weapon system optics, electronic equipment, interior spaces, and aircraft); and hazardous waste. Efforts seek to develop decontaminant formulations and procedures that reduce or eliminate residual contamination hazards; enable unit-level decontamination with rapid unmasking; reduce logistic needs (need for water); enable rapid sorting of clean from dirty to rapidly return high-value equipment to normal use; and develop improved realistic test methods. ***FY 2023 Plans:*** - Transition methodology for testing for effective decontamination of complex surfaces and real-world systems to the Service Equipment Decontamination System or Tactical Contamination Mitigation System programs of record. - Finish development and demonstration of an autonomous decontamination platform to reduce troop-to-task burden of operational decontamination.			

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** MT2 / *Mitigate (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Develop bioagent disclosure spray and bio contamination mapping technologies into prototypes to demonstrate. ***FY 2024 Plans:*** - Refine autonomous equipment decontamination platform to reduce troop-to-task and logistics requirements for operational decontamination. - Transition hot air decontamination technologies to Joint Biological Aircraft Decontamination System and Service Equipment Decontamination Systems programs of record in early FY24. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Decrease due to change in program/project technical parameters.			
Title: 9) Multifunctional Materials for Protection ***Description:*** Efforts will discover, develop and integrate novel, reactive/catalytic materials and scale material manufacturing with maximum sorption and reactivity, and characterize materials using state-of-the-art in operando and ambient pressure spectroscopies, for eventual integration into next generation decontaminants and coatings. ***FY 2023 Plans:*** - Develop and characterize novel reactive/catalytic materials that decontaminate biological and chemical threats and integrate materials into next generation decontaminants and coatings. ***FY 2024 Plans:*** - Integrate reactive materials into decontamination systems for enhanced threat spectrum mitigation. - Continue ambient pressure characterization of reactive chemical decontamination mechanisms. - Scale materials manufacturing processes for cost-efficiency and characterize materials using operationally-relevant conditions. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Increase due to change in program/project technical parameters.	-	1.823	2.222
Title: 10) Personnel Decontamination ***Description:*** Efforts will develop decontaminants for decontamination of unbroken skin with lower lifecycle costs and storage constraints and determination of time, efficacy and logistics burdens to warfighters for mass casualty decontamination. Decrease Warfighter burden in the event of a CWA exposure by identifying science and technology gaps in the mass personnel decontamination process as well as possible substitutions for current approved personnel decontamination formulations. ***FY 2023 Plans:*** - Develop and use laboratory and animal models to assess physical removal technologies for potential replacement of reactive skin decontamination lotion (RSDL).	-	0.692	1.170

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** MT2 / *Mitigate (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
- Continue to integrate new dry decontamination into a mitt form factor and determine science and technology challenges within process and procedure improvements. This includes investigation of FDA requirements for approval of technology as a medical device. ***FY 2024 Plans:*** - Generate efficacy and safety data against representative traditional and nontraditional agents required to submit a medical device package for FDA consideration for skin decontaminants. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Increase due to accelerated development effort.			
Accomplishments/Planned Programs Subtotals	-	73.321	66.371

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• MT3: *Mitigate (ATD)*	-	86.157	100.791	-	100.791	89.511	91.704	85.795	85.480	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program			Date: March 2023
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602384BP / *Chemical and Biological Defense Program*	Project (Number/Name) CB2 / *Chemical Biological Defense (Applied Research)*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
CB2: *Chemical Biological Defense (Applied Research)*	-	97.410	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	97.410

A. Mission Description and Budget Item Justification

Project CB2 provides physical science applied research to develop future, multi-disciplinary, and multi-functional capabilities in life sciences, physical sciences, environmental sciences, mathematics, cognitive sciences, and engineering. Efforts in this project support the seamless integration of state-of-the-art-technologies into a collection of systems across the spectrum of capabilities required to support chemical and biological defense missions. After FY 2022, the Chemical Biological Defense Program (CBDP) RDT&E Projects were restructured to align with the CBDP portfolio construct. CB2 efforts in FY 2022 progress to Projects MT2, PT2, and UN2. This restructuring provides standardization and alignment across CBDP research, development and acquisition efforts.

Individual efforts in this Project include:

- Protection and hazard mitigation focuses on providing technologies that protect from and reduce the impact of chemical/biological threat or hazard to the Warfighter, weapons platforms, and structures.
- Detection focuses on developing technologies for remote and point detection and identification of chemical and biological agents.
- Decision analysis and management focuses on advanced hazard prediction, medical and epidemiological modeling of biological agents, operational effects and risk assessment, and systems performance modeling.
- Warning and reporting focuses on methods of alerting to chemical or biological threat agent releases and exposures.
- Threat agent science is devoted to characterizing threat agents and the hazards they present in terms of agent fate in the environment, toxicology, and pathogenicity, and focuses on the horizontal integration of threat agent information across CB defensive technologies in support of the Joint Services.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: 1) Unattended Perimeter Monitoring ***Description:*** Develop automated technologies to improve detection of aerosolized hazards while minimizing or removing user intervention to enable a reliable detect-to-warn capability, providing a capability for unattended monitoring of perimeters for temporary defense positioning, including base camps, to enable early indication of threats. This thrust area will evaluate current and novel technologies to provide improved chemical threat detection and automated biological detection capabilities.	4.114	-	-
Title: 2) Unconventional Detection Modalities ***Description:*** Develop disruptive technologies to identify unknown or emerging threats and develop sensors that can operate in complex threat environments with high fidelity. This thrust area supports others as appropriate to the Joint Force mission needs (e.g., expeditionary, perimeter defense, or unmanned reconnaissance.	3.997	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** CB2 / *Chemical Biological Defense (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: 3) Distributed CB Reconnaissance ***Description:*** Develop threat sensing and sampling payloads for manned and unmanned aerial system (UAS) and ground (UGS) platforms to enhance early warning and situational awareness of biological and chemical threats. Sensor development will support dismounted reconnaissance and surveillance missions by providing low size, weight, power and cost sensors or sensing/ collection systems that are rugged, rapid and accurate.	3.328	-	-
Title: 4) Enhanced/Emerging Biothreat Sensing ***Description:*** Establish a capability responsive to detecting emerging and enhanced biological threats across all force echelons (presumptive, field confirmatory, theater validation, and definitive identification) through a pathogen-agnostic laboratory workflow coupled with advanced computational tools that produce a field ready test. field forward detection capabilities to detect emerging and enhanced biological threats across all force echelons. Further, advanced biological measurement approaches and data processing sciences to understand if a biological sample presents threat characteristics that could harm the warfighter. Leveraged modern laboratory capabilities and synthetic biology methods to deliver enhance biothreat sensing capabilities to the Joint Force.	7.825	-	-
Title: 5) Expeditionary Analytical Toolkit (ExAnT) ***Description:*** Provide general and specialized forces with the ability to modernize detection technologies for traditional threats while enhancing detection capabilities for non-traditional, emerging, and mixed chemical hazards.	2.903	-	-
Title: 6) Air Purification Enhancements ***Description:*** This effort supports the Expeditionary Collective Protection (CP). Existing CP systems have high life cycle costs driven by maintenance and limited service life. Efforts will focus on optimizing and extending filter life to reduce lifecycle costs while maintaining or improving protection.	0.393	-	-
Title: 7) All-Hazards & Respiratory Protection ***Description:*** This effort supports the Respiratory and Ocular Protection. Efforts will improve chemical and biological agent protection while maintaining warfighter capability through integrated research on respirator, seams, closures, and new materials; perform early surveys for end-user jury input; frequent user operational evaluation; focus on closed circuit full spectrum respiratory protection.	1.380	-	-
Title: 8) Dynamic Multifunction Materials for Second Skin	1.839	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** CB2 / *Chemical Biological Defense (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: This effort supports the Percutaneous Protection. Efforts will utilize responsive technologies to provide chemical biological protective suits that adapt to the environment by synthesizing scaled samples via roll-to-roll manufacture which exhibit materials properties that reduce thermal burden and integrate with current combat garments. These technologies include interpenetrating polymer networks that will change moisture permeability and molecular selectivity on demand, and membranes with higher moisture vapor transfer rates than existing fabrics.			
Title: 9) Enhanced Survivability Coatings ***Description:*** This effort supports the Materiel Contamination Mitigation. Military equipment coatings are challenging and logistically intensive to decontaminate. Efforts within this thrust seek to produce enhanced coatings that increase chemical warfare agent survivability and decontaminability of military equipment to levels comparable to that of stainless steel. Improved coatings will resist chemical agent absorption and be quickly decontaminated in field, to rapidly return equipment to mission operations level.	2.436	-	-
Title: 10) Equipment Decontamination ***Description:*** This effort supports the Materiel Contamination Mitigation. The Warfighter has a limited capability to decontaminate personal equipment, weapons, vehicles, ships, and facilities; Sensitive equipment (weapon system optics, electronic equipment, interior spaces, and aircraft); and hazardous waste. Efforts within this thrust seek to develop decontaminant formulations and procedures that reduce or eliminate residual contamination hazards; enable unit-level decontamination with rapid unmasking; reduce logistic needs (need for water); enable rapid sorting of clean from dirty to rapidly return high-value equipment to normal use; and develop improved realistic test methods.	2.523	-	-
Title: 11) Multifunctional Materials for Protection ***Description:*** This effort supports the Respiratory and Ocular Protection, Percutaneous Protection, Expeditionary Collective Protection, Materiel Contamination Mitigation, and Personnel Contamination Mitigation. Efforts will discover, develop and integrate novel, reactive/catalytic materials and scale material manufacturing with maximum sorption and reactivity, and characterize materials using state-of-the-art in operando and ambient pressure spectroscopies, for eventual integration into next generation decontaminants, coatings, filters, and protective garments that reactively decontaminate chemical warfare agents.	4.677	-	-
Title: 12) Personnel Decontamination ***Description:*** This effort supports the Personnel Contamination Mitigation. Efforts will develop decontaminants for decontamination of unbroken skin with lower lifecycle costs and storage constraints and determination of time, efficacy and logistics burdens to warfighters for mass casualty decontamination. Decrease Warfighter burden in the event of a Chemical	1.180	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** CB2 / *Chemical Biological Defense (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Warfare Agent (CWA) exposure by identifying science and technology gaps in the mass personnel decontamination process as well as possible substitutions for current approved personnel decontamination formulations.			
Title: 13) Employment Characterization ***Description:*** Employment Characterization studies refine threat assessments and identify potential impacts of indoor and/or outdoor releases of threat agents on CBDP operations, strategy, and capabilities. These studies directly define the Warfighter threat space by determining how chemical and biological agents behave when released. This thrust area reduces risk to the CBDP Enterprise by closing knowledge gaps and informing on the type, extent and magnitude of a potential hazard a warfighter may face in an operational environment. Employment Characterization will: review state of knowledge on agent employment (laboratory and outdoors) to identify gaps and threat agent science (TAS) assessment opportunities; continue coordination with international partners to leverage skills and resources; develop closer linkages to hazard prediction modelers to identify knowledge gaps and TAS opportunities; prepare evaluation of potential munitions for applicability to potential future threats based on performance characteristics; and continue chamber tests and operational trials as appropriate for compounds of interest.	4.159	-	-
Title: 14) Environmental Response ***Description:*** Environmental Response evaluates CB threats to understand how they will behave in the environment (e.g. persistence, degradation, decomposition), along with the effects of environmental conditions (e.g. ozone, UV, humidity, etc.) on those agents. Studies include evaluations of chemical and biological threat agents on soil, water, and plants, and operational surfaces such as clothing, structures, and equipment. This thrust area reduces risk to the CBDP Enterprise by closing knowledge gaps and informing on the type, extent and magnitude of a potential hazard a warfighter may face in an operational environment. Small-scale laboratory measurements are used to predict the larger-scale behavior and fate of the agents in outdoor and operational settings, while examining agents deposited on operationally relevant substrates refines our understanding of their environmental persistence and hazards. Knowledge obtained from Environmental Response is used to inform operators, predictive model development, and capability development.	6.467	-	-
Title: 15) First Look (Chemical and Biological) ***Description:*** First Look provides the initial evaluation of known and emerging threat agents to determine their potential hazard to the Warfighter. For both chemical and biological agents, this initial fundamental risk assessment includes evaluation of synthesis and toxicity screening for chemicals and toxins and growth and/or virulence for biological agents as well as production and feasibility of weaponization for all agents. Investments in this area are used to evaluate threat agents as well as develop methods and capabilities to quickly and accurately characterize chemical, biological, and toxin threat agent properties. First Look products/data inform warfighter mission planning,	9.850	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** CB2 / *Chemical Biological Defense (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
requirements generation, capability development, model development, the larger CBDP Enterprise, Intelligence and other government stakeholders about known or emerging agent threats.			
Title: 16) Host Response ***Description:*** Host Response assesses the human response of exposure to biological and chemical threat agents using operationally relevant exposure scenarios (acute versus chronic) and exposure routes (e.g., .inhalation, dermal, ingestion, etc.) and appropriate assessment methods and models. Data from host response studies are used to develop quantitative exposure limits (e.g. LD50 or ID50) and qualitative information (e.g. mechanism of action) to inform warfighter mission planning, requirements generation, capability development, model development, the larger CBDP Enterprise, Intelligence and other government stakeholders. The program, known as CRISTAL (Computational Rapid Identification and Scientific Threat Analysis) is modernizing to include predictive capabilities for rapidly assessing the human response to chemical and biological threat agents. In addition, host response will be working to close known knowledge gaps associated with traditional threats, including exploring synergistic effects associated with combinatorial agent exposures. Bioavailability of threats that are encapsulated to understand host response differences between exposures to encapsulated versus un-encapsulated threats will be also be assessed.	15.199	-	-
Title: 17) Technical Surprise ***Description:*** Technical Surprise assesses technological advancements for potential implications to the threat space, including agent use and release. Technical Surprise includes horizon scanning to identify potential areas of concern as well as conducts technical assessments of emerging technological advancements (e.g. biotechnology, artificial intelligence, machine learning, quantum computing). This program develops capabilities to evaluate and assess technical enhancements that may alter the nature or magnitude of a threat agent. The technical surprise program will be evaluating emerging technologies and convergence of technologies that improve the ease of threat use and make threats more likely to survive being released. Identify the limitations and barriers associated with synthetic biology and assess the implications. These efforts will identify and assess former technology hurdles that have been lowered or overcome and assess implications of increasing potential threat.	4.500	-	-
Title: 18) CBRN Battlespace Surveillance, Alerting & Response ***Description:*** Improve the Department of Defense's capability to detect, identify, alert, and responds to deliberate releases and naturally occurring outbreaks of chemical and biological threat agents. Current predictive algorithms in development by JSTO are based on large in-hospital datasets from patients with comorbidities. Improving on the applicability and efficacy of these algorithms will focus on large, real-time human data collects of chemical and biological agent / agent proxy exposures. Additionally, studies will focus on examining the feasibility of specifically isolating indicators of respiratory infection, determining	9.459	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** CB2 / *Chemical Biological Defense (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
severity of infection, and predicting return to mission readiness after exposure. This capability will enable early implementation of countermeasures such as isolation, quarantine, and removal from an area, thus potentially reducing transmission, morbidity, and mortality rates. The maturation of algorithms will incorporate Machine Learning (ML) approaches for refining sensitivity and specificity.			
Title: 19) CBRN Decision Aids ***Description:*** In order to unencumber the warfighter at the tactical edge, continue to develop and field CBRN Decision Aids on End User Devices (EUDs) in both connected and disconnected operations. Capabilities will focus on utilizing automation, reducing the burden experienced by the warfighter, while providing accurate, actionable information. During this time period, a focus will be put on developing a Contamination Avoidance Decision Aid to inform the warfighter on how to avoid, respond to and plan routes around CB hazards. Another area of focus will be the development of Autonomous Asset Guidance. This capability will be used in conjunction with other capabilities developed under the CBRN Decision Aids portfolio to optimize the use of Autonomous Assets and reduce the burden incurred by the warfighter in order to operate them. This capability will also aim to incorporate, fuse and utilize data from Autonomous Assets to improve and refine other CBRN Decision Aids.	3.100	-	-
Title: 20) CBRN Situational Awareness ***Description:*** To enhance CB Situational Awareness, efforts will expand the types of threats that can be modeled with hazard assessment capabilities to include fixed-wing and rotary-wing drones of interests. These capabilities will allow for single drones and swarms to be modeled. Virtual Reality (VR) and Augmented Reality (AR) technologies will be leveraged to develop CB focused training and mission rehearsal capabilities that will be integrated into systems widely used by the Joint Force. Virtual training environments will be developed to implement, visualize and account for hazard source terms and plumes generated by transport and dispersion (T&D) models Augmented Reality applications will also be explored for tactical use to maximize warfighter CB situational awareness on the battlefield. Modernize hazard modeling capabilities by adopting a modular framework and integrating across Service command and control systems to operationalize Reachback support. Further enhance hazard modeling by creating a seamless indoor-to-outdoor T&D modeling capability and improve urban T&D modeling to support operations in urban and mixed environments. New state-of-the-art computational fluid dynamics modeling techniques and their exploitation of the latest computing resources will be leveraged to increase both speed and accuracy.	8.081	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** CB2 / *Chemical Biological Defense (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Develop CB health effect modeling software and analytic tools to support force readiness and facilitate medical planning against chemical and biological agents. Epidemiological models will be developed that quantify and visualize mission operational impacts from exposure to, and spread of, infectious biological threat agents to DoD relevant populations. Additionally, efforts will leverage Threat Agent Science (TAS) data to enhance capabilities for modeling health effects and host pathogen interactions from exposures to traditional and non-traditional CB agents. This will provide the warfighter with more accurate casualty estimates accounting for human health effects.			
Accomplishments/Planned Programs Subtotals	97.410	-	-

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• CB3: *Chemical Biological Defense (ATD)*	28.484	-	-	-	-	-	-	-	-	0.000	28.484
• MT3: *Mitigate (ATD)*	-	86.157	100.791	-	100.791	89.511	91.704	85.795	85.480	Continuing	Continuing
• PT3: *Protect (ATD)*	-	32.113	29.261	-	29.261	48.969	42.794	46.159	52.581	Continuing	Continuing
• UN3: *Understand (ATD)*	-	68.415	83.825	-	83.825	81.392	87.384	73.515	71.015	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program			Date: March 2023
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602384BP / *Chemical and Biological Defense Program*	Project (Number/Name) TM2 / *Techbase Medical Defense (Applied Research)*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
TM2: *Techbase Medical Defense (Applied Research)*	-	107.608	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	107.608

A. Mission Description and Budget Item Justification

Project TM2 provides for applied research for innovative technology approaches to advance medical systems designed to rapidly identify, diagnose, prevent, and treat disease due to exposure to chemical and biological threat agents. After FY 2022, the Chemical Biological Defense Program (CBDP) RDT&E Projects were restructured to align with the CBDP portfolio construct. TM2 efforts in FY 2022 progress to Projects MT2, PT2, and UN2. This restructuring provides standardization and alignment across CBDP research, development and acquisition efforts.

Individual efforts in this Project include:

- Core science efforts in Medical Chemical, Medical Biological, Diagnostics, and Medical Countermeasures.
- Supports applied research for the investigation of new medical countermeasures to include prophylaxes, pretreatments, antidotes, skin decontaminants, and therapeutic drugs against identified and emerging biological and chemical warfare agents.
- Medical Science and Technology (S&T) efforts in this Budget Activity refine promising medical initiatives identified in Budget Activity 1, resulting in the development of countermeasures to protect against and treat the effects of exposure to chemical and biological (CB) agents.
- Diagnostic research focuses on providing high quality data closer to the point-of-need comprising device innovation, panels of biomarkers driven by bioinformatics, and epidemiological modeling tools.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: 1) Chemical Diagnostics ***Description:*** Provide innovative and integrated capabilities to the Warfighter that are able to diagnose threats across the chemical spectrum. Enhance force protection by investing in diagnostics for exposure to traditional and nontraditional Chemical Warfare Agents (CWAs), including pharmaceutical based agents (PBAs). Leverage the development of a chemical diagnostic that monitors blood, indicating whether a Warfighter has been exposed to nerve agents within minutes.	0.699	-	-
Title: 2) Diagnostic Building Blocks ***Description:*** Develop novel, state of the art capabilities that lay the foundation for modernizing other areas within the diagnostics portfolio. This includes exploiting areas such as synthetic biology and chemistry to develop novel and rapid diagnostic tests for utilization in the event of an outbreak of an unknown threat. Invest in efforts that lead to accelerated assay development timelines and optimized test parameters through leveraging artificial intelligence (AI) and machine learning (ML) to allow us to quickly pivot and develop assays for emerging threats and speed up development to days instead of weeks.	4.446	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** TM2 / *Techbase Medical Defense (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: 3) Emerging Threats ***Description:*** Push beyond the boundaries of the traditional threat list in the field of diagnostics to better prepare for surprise. Development of diagnostic systems that leverage novel approaches to characterize pathogen or host response and can identify the classification of threat (e.g., bacterial vs viral) from an unknown sample. Invest in diagnostic tests that enable the delivery of actionable information, such as administering the appropriate medical countermeasure (e.g. antibiotic, antiviral, vaccine), by a medic or primary care provider greatly improves turnaround time for soldier wellness and return to duty.	4.110	-	-
Title: 4) Bacterial Therapeutics ***Description:*** Discover and develop therapeutic countermeasures to mitigate the effects of known and emerging bacterial threats to the warfighter.	14.456	-	-
Title: 5) Toxin Therapeutics ***Description:*** Discover and develop therapeutic countermeasures to protect the warfighter against biotoxin threats.	0.250	-	-
Title: 6) Viral Therapeutics ***Description:*** Discover and develop therapeutic countermeasures to mitigate the effects of known and emerging viral threats to the warfighter.	14.457	-	-
Title: 7) Bacterial/Viral/Toxins/Broad Spectrum Prophylaxis ***Description:*** The ultimate protection of the Warfighter is achieved by pretreating the Warfighter to withstand any biological threat with no adverse side effects from the pretreatment. Such pretreatment would enable the Warfighter to work in a less restrictive environment, absent of any personal protective equipment, facilitating the Warfighter to operate at peak performance. Investments in this Program Element support innovative concepts in prophylaxis that support needs specific to the warfighter such as broad spectrum protection, rapid onset to protection, fewer doses required, no cold chain required, and needle-free administration.	35.512	-	-
Title: 8) Chemical Reactive Ocular Wound and Dermal Therapeutics (CROWD) ***Description:*** Focuses on therapeutic strategies to effectively treat CWA contamination on wounds, eyes, and large areas of intact skin. This effort involves the development of products capable of removing or neutralizing CWAs from those routes of exposure, to decrease the toxic load of agent and allow optimal effectiveness of other systemic therapeutics.	6.679	-	-
Title: 9) Enabling Science	10.214	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** TM2 / *Techbase Medical Defense (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: Protection of the Warfighter against Chemical Warfare Agents (CWAs) to maintain force lethality is the ultimate goal of the Enabling Sciences portfolio. The portfolio leverages innovative approaches and emerging technologies to support modernization of chemical medical countermeasure (cMCM) pipeline. The portfolio is designed to develop and deploy cMCMs more rapidly to the warfighter. Portfolio elements include: 1) development of Artificial Intelligence/Machine Learning (AI/ML) tools to more efficiently identify cMCMs and assess their safety and efficacy for regulatory submission; 2) AI/ultra-high throughput screening-based sampling of large chemical spaces with the aim of providing broad spectrum cMCMs with improved efficacy and selectivity, minimal toxicity, and decreased expense and fielding times to the warfighter; 3) development of technologies to deliver MCMs across the blood brain barrier (BBB) into the brain; 4) maturation of cMCMs with innovative mechanisms of actions; and 5) development of well characterized or FDA qualified animal models, as needed, to support cMCM discovery and development under the FDA animal rule.			
Title: 10) Nerve Agent Prophylaxis/Pretreatments ***Description:*** Develop pretreatments and prophylactics that counter chemical warfare agents, including organophosphorus nerve agents (OPNA), using targeted and innovative science & technology efforts that will offer broad-spectrum protection, flexible route of administration, lower dose requirements, and reduced operational and logistical burden. The use of these MCMs will protect the lives and effectiveness of our warfighters, thus maintaining force strength and force capability.	3.282	-	-
Title: 11) Pharmaceutical Based Agents (PBAs) ***Description:*** Focuses on therapeutic strategies to effectively minimize injuries resulting from exposure to Pharmaceutical Based Agents (PBAs). This effort involves the evaluation FDA approved therapeutics for operational use, as well as generation of novel drug products to enhance level of protection and/or operational utility for the Warfighter. Efforts in this area are designed to develop drug candidates that will ultimately be submitted for Food and Drug Administration (FDA) licensure or to identify previously licensed products for new uses in the treatment of chemical warfare casualties.	6.673	-	-
Title: 12) Reactivators of AChE as Therapeutics (ReACT) ***Description:*** The warfighter requires rapid acting medical countermeasures (MCMs) to counter adverse effects from exposure to Nerve Agents (NAs) and maintain force lethality. This effort involves the development of improved therapies for acetylcholinesterase enzyme reactivation. Efforts in this area are designed to develop potential candidates that will ultimately be submitted for U.S. Food and Drug Administration (FDA) licensure or to identify previously licensed products for new uses in the treatment of chemical warfare casualties.	3.830	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2024 Chemical and Biological Defense Program		Date: March 2023
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** TM2 / *Techbase Medical Defense (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Accomplishments/Planned Programs Subtotals	104.608	-	-

	FY 2022	FY 2023
Congressional Add: Biological Warfare Defense Therapeutics	3.000	-
FY 2022 Accomplishments: For PUL 042 (Burkholderia, Tularemia), a clinical stage inhaled therapeutic proof of concept small animal efficacy studies will be completed with options for non human primate pharmacokinetics studies, and Good Manufacturing Practice (GMP) manufacturing. The candidate will then be ready to transition to advanced development. This is a host directed therapeutic and fits with our broad spectrum strategy for MCMs. - Continue non-clinical animal immunogenicity and efficacy studies for a Tularemia subunit.		
Congressional Adds Subtotals	3.000	-

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• EN3: *Enabling Investments (ATD)*	-	39.540	43.196	-	43.196	43.198	44.449	44.449	44.449	Continuing	Continuing
• MT2: *Mitigate (Applied Research)*	-	73.321	66.371	-	66.371	63.832	51.426	59.920	64.824	Continuing	Continuing
• MT3: *Mitigate (ATD)*	-	86.157	100.791	-	100.791	89.511	91.704	85.795	85.480	Continuing	Continuing
• PT2: *Protect (Applied Research)*	-	58.091	55.057	-	55.057	56.153	57.817	61.452	61.452	Continuing	Continuing
• PT3: *Protect (ATD)*	-	32.113	29.261	-	29.261	48.969	42.794	46.159	52.581	Continuing	Continuing
• TM3: *Techbase Medical Defense (ATD)*	144.779	-	-	-	-	-	-	-	-	0.000	144.779
• UN2: *Understand (Applied Research)*	-	112.952	119.182	-	119.182	111.773	107.842	107.193	107.193	Continuing	Continuing
• UN3: *Understand (ATD)*	-	68.415	83.825	-	83.825	81.392	87.384	73.515	71.015	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A