Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Chemical and Biological Defense Program	Date: March 2024
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 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	0.000	240.016	240.610	224.777	0.000	224.777	240.585	255.974	256.969	256.969	Continuing	Continuing
UN2: *Understand (Applied Research)*	-	106.499	119.182	97.205	0.000	97.205	107.842	107.193	107.193	107.193	Continuing	Continuing
PT2: *Protect (Applied Research)*	-	66.409	55.057	49.328	0.000	49.328	54.817	59.861	58.452	58.452	Continuing	Continuing
MT2: *Mitigate (Applied Research)*	-	67.108	66.371	55.744	0.000	55.744	55.426	66.420	68.824	68.824	Continuing	Continuing
EN2: *Enabling Investments (Applied Research)*	-	0.000	0.000	22.500	0.000	22.500	22.500	22.500	22.500	22.500	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) resources Applied Research across the Understand, Protect, Mitigate, and Enabling Investments 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. FY25 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.

- Enabling Investments (EN2): Characterization of alternate animal and microphysiological models that mimic the human response to biological and chemical agents. Development and addition of physical and intellectual infrastructure capabilities to conduct defensive classified DoD work in laboratories. Execution of a robust emerging biothreat portfolio to enable readiness for future incidents.

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 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	244.364	240.610	231.758	-	231.758
Current President's Budget	240.016	240.610	224.777	-	224.777
Total Adjustments	-4.348	0.000	-6.981	-	-6.981
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.721	-			
• Other Adjustments	-0.627	-	-6.981	-	-6.981

Change Summary Explanation

Funding: FY 2023 (-$3.721 Million): Transfer of funding to support Small Business Innovative Research/Small Business Technology Transfer efforts.
FY 2023 (-$0.627 Million): CBDP funding transferred to Under Secretary of Defense (Acquisition & Sustainment) high priority efforts.

FY 2025 (-$6.981 Million): Applied Research adjustment to support DoD high priority efforts.

Schedule: N/A

Technical: N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program											Date: March 2024	
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 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
UN2: *Understand (Applied Research)*	-	106.499	119.182	97.205	0.000	97.205	107.842	107.193	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.

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) Operational Diagnostics
(8) Employment Characterization
(9) Environmental Response
(10) First Look
(11) Host Response
(12) Distributed CB Reconnaissance
(13) Emerging and Enhanced Biothreat Sensing
(14) Operational Biological Sensing
(15) Expeditionary Analytical Toolkit (ExAnT)
(16) Modernized and Enhanced Chemical Sensing
(17) Operational Chemical Sensing
(18) Unattended Perimeter Monitoring
(19) Unconventional Detection Modalities
(20) Technical Surprise

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
Title: 1) CBRN Battlespace Sensing, Alerting, and Response	7.270	7.250	4.600

Description: The CBDP is trying to improve detection capabilities while reducing the burden on the warfighter. Wearable technologies will be a significant part of this effort, acting as the initial “check engine” light for the warfighter without adding any equipment requirements (since the Joint Force will already be equipped with wearables). This thrust area invests in breakthrough technology to improve wearable device-based early warning capabilities by conducting data collection trials to support algorithm development; leveraging artificial intelligence (AI) to identify key indicators, combinations of indicators, and sensing modalities; and exploring alternative methods for non-invasive early warning of chemical and biological (CB) exposure. This will reduce false alarms and strengthen predictions of potential CB exposure—including emerging threats.

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 2025 Plans:
- Continue wearable device-based non-invasive algorithm enhancements for pre-symptomatic indication of chemical or biological (CB) exposure.
- Continue to develop predictive algorithms and analytic tools utilizing artificial intelligence (AI) and machine learning (ML) techniques to allow for rapid response to emerging threats and early warning of exposure to genetically engineered pathogens.
- Continue to advance standoff physiological monitoring capabilities (e.g., detecting fever from a distance and/or within a given population) to include efforts that increase the standoff distance at which physiological data can be captured and analyzed.
- Continue work with multi-organ chip system to characterize the effects of CB threat agents on different parts of the human body (e.g., lung, brain, and skin), which will improve the accuracy and effectiveness of wearable-based early warning algorithms by helping us better understand how CB threats impact with the human body (biomarkers).

FY 2024 to FY 2025 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Decrease due to delay in development of the Agile Medical Countermeasure Decision Support Tool prototype.			
Title: 2) CBRN Decision Aids	4.296	3.250	3.100
Description: In order to unencumber the warfighter at the tactical edge, efforts continue to develop and transition science & technology for Chemical, Biological, Radiological and Nuclear (CBRN) Decision Aids on End User Devices (EUDs) in both connected and disconnected operations by leveraging automation, reducing the burden experienced by the warfighter, and providing accurate, actionable information. ***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 2025 Plans:*** - Continue development of warning and reporting decision aids for tactical users leveraging the compute resources resident on End User Devices (EUDs). - Continue development of Augmented Reality (AR) based technologies to incorporate Chemical and Biological (CB) threat situational awareness in EUDs. - Enhance tools that support the interoperability, integration, and automation of decision aids to further reduce the need for manual user inputs. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to developmental efforts maturing and transitioning to the Project UN3 CBRN Decision Aids thrust area.			
Title: 3) CBRN Situational Awareness	10.712	15.880	17.180
Description: Understanding how various chemical and biological (CB) threats—both traditional and emerging—interact with the environment and impact the human body is essential for the Joint Force to operate effectively in a CB-contested environment. Leveraging data from other Science and Technology (S&T) programs, Chemical, Biological, Radiological, and Nuclear (CBRN) Situational Awareness creates forecasting models and hazard assessments to provide warfighters with optimal situational awareness in these environments. This thrust area is also exploiting advances in eXtended Reality (XR), Virtual Reality (VR) and Augmented Reality (AR) to provide warfighters with an immersive environment for realistic training and mission rehearsal opportunities. ***FY 2024 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- 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 2025 Plans:*** - Enhance machine learning (ML) algorithms for disease prediction and forecasting on various platforms (e.g., mobile/handheld, web-based, standalone). - Continue to enhance and expand chemical and biological (CB) situational awareness capabilities for integration into Heads up Display (HUD) technologies. - Expand emerging threat hazard models and assessment capabilities, leveraging experimental data to ensure the Joint Force is able to characterize new CB hazards and mitigate their effects on mission success. - Enhance and improve virtual reality (VR)-based synthetic environments through improved terrain transport and dispersion and infectious disease modeling to provide a Chemical, Biological, Radiological, and Nuclear (CBRN)-specific training and mission readiness capability. - Continue to leverage ML and artificial intelligence (AI) to develop modeling capabilities focused on the human response (e.g., biomarkers) to CB agent exposure, with a focus on characterizing predictive biomarkers that are expressed in the body prior to onset of symptoms and warfighter susceptibility. - Begin to explore next generation hazard modeling technologies (e.g., quicker run times, improved accuracy, dynamic visualization, course of action analysis) to increase CBRN situational awareness and further mitigate the effects of CB hazards on mission success. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred from another thrust area. Increase due to transfer of the Project UN3 CBRN Situational Awareness thrust area efforts focused on development of modeling capabilities utilizing Artificial Intelligence and Machine Learning and begin next generation hazard modeling capability development.			
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	0.693	0.698	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
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 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 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred to another thrust area. Funding moved to the Operational Diagnostics thrust area for better project alignment.			
Title: 5) Operational Diagnostics ***Description:*** Rapid diagnostics enables the use of MCMs to save warfighters' lives and minimize the impact chemical and biological threats have on Joint Force operations. Operational Diagnostics is investing in far-forward, point of care medical diagnostics to support the Joint Force's concepts of operations in priority theaters. It is also focused on producing platforms that can test for a wide variety of chemical and biological threats, including new and emerging ones. ***FY 2025 Plans:*** - Continue the development of integrated capabilities that address portable ultra-low detection of opioids to the advanced development Program of Record (POR) for Next Generation Diagnostic System Increment 2 Chemical Diagnostic (NGDS 2 CHEMDX) device and begin development of tests for Toxic Industrial Chemicals (TICs), resulting in more informed treatment decisions. - Continue development of diagnostics using novel, minimally invasive testing methods, including breath and the ocular (eye) system to identify biomarkers associated with CB threats and pre-symptomatic and contagious indicators that can be detected using portable diagnostics platforms. - Continue development of Wearable technologies to investigate customizable hardware and algorithms that detect warfighters autonomic- response to biological warfare agents, both natural and unnatural. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred from another thrust area. Minor decrease due to the Chemical Diagnostics thrust area transfer for economic cost adjustments.	-	-	0.689
Title: 6) 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 diagnostics for	2.479	3.839	1.963

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
unknown threat. By leveraging artificial intelligence and machine learning, this thrust area aims to develop tests for new and emerging threats in days instead of weeks. This will allow the Joint Force to fight through initial exposure to novel threats. ***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 2025 Plans:*** - Continue development of diagnostics prototypes using synthetic materials to potentially speed up the development of diagnostics methods. - Integrate enzymes to create modernized on-demand molecular assays (for tests) that are less reliant on supply chain disruptions and enable rapid, field-forward utilization. - Complete investments in breath-based diagnostics by expanding collection of data to establish a baseline of normal, healthy exhaled breath profiles. - Continue development of a portable, low to minimally invasive, rapid whole breath diagnostic platform that offers the warfighter little to no interruption to mission activities and provides the opportunity for earlier diagnosis/indication of infection or chemical exposure. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to the breath-based diagnostics development schedule changes requiring an expanded collection of data to establish a baseline of normal.			
Title: 7) Emerging Threats ***Description:*** To address the proliferation of potential CB threats, Emerging Threats invests in technologies that can provide actionable information on various characteristics of novel threats (e.g., bacterial vs viral) even before the threat is known. This works in conjunction with threat-agnostic medical countermeasures to allow the Joint Force to fight through initial exposure to novel threats before they are characterized as part of the new Chemical and Biological Defense Program (CBDP) Medical Countermeasures (MCM) approach.	2.773	2.443	1.275

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
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. ***FY 2025 Plans:*** - Continue to identify novel, field-forward deployable platforms capable of identifying broad classes of biological agents (toxins, viruses) in complex samples (i.e., blood, breathe), resulting in a broad-spectrum capability in the hands of the warfighter. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to development schedule changes for a rapid production pipeline of new high affinity reagents against toxins.			
Title: 8) Diagnostic Building Blocks - Enhanced Biological Defense (ENBD) ***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 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 2025 Plans:*** - Continue collection & analysis of minimally invasive methodologies for rapid threat diagnostics to enable future identification of markers from threat-specific signatures. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to change in thrust area requirement. FY24 funding was used for a baseline study to identify biomarkers from minimally invasive samples (breath, skin). As the baseline study winds down, further development of diagnostics prototypes using breath or skin biomarkers will be done under the Operational Diagnostics thrust area.	6.500	4.100	2.400
Title: 9) Emerging Threats - Enhanced Biological Defense (ENBD)	8.000	5.200	3.100

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
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 2024 Plans:*** - 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 2025 Plans:*** - Continue development of a comprehensive diagnostics platform that can be administered before or during medical transport that integrates human biomarkers, physiological data, and machine learning to predict disease severity before life-threatening symptoms develop. - Continue the development of agnostic biomimetic sensing techniques to combat emerging and unknown threats from diverse origins (e.g. toxins), and test in both clinical and aerosol sample matrices to include environmental background. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to change in thrust area requirement. FY25 funding will develop next generation diagnostic platform technology under the Operational Diagnostic thrust area.			
Title: 10) Unconventional Detection Modalities - Enhanced Biological Defense (ENBD)	2.000	1.000	-
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).			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
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 2024 to FY 2025 Increase/Decrease Statement:*** The Assays on Demand (AoD) program has matured from Project UN2 to Project UN3 Emerging and Enhanced Biothreat Sensing.			
Title: 11) Employment Characterization ***Description:*** How Chemical-Biological (CB) threats are delivered/disseminated has major impacts on the utility of CB defensive countermeasures. For example, our personal protective equipment (PPE) might be effective against an agent that is delivered in one way, but that same agent delivered a different way may make the same PPE ineffective or less effective. The same is true for detection, modeling and medical countermeasures. Employment characterization explores what is technically possible in terms of adversarial delivery/dissemination methods for known and emerging CB threats. This helps the Chemical and Biological Defense Program (CBDP) and ultimately the Joint Force understand gaps or potential gaps in CB defense capabilities. The data from these efforts then feeds into efforts to close/mitigate those gaps. ***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 2025 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. - Evaluate the effect of encapsulation on adversarial employment of threat agents. - Continue to advance our understanding of adversaries' capabilities in agent employment to identify CBDP gaps and inform further research needs. These studies involve highly controlled laboratory (indoor) tests and outdoor releases of simulants to collect as much relevant and realistic data as possible. - Continue adapting these employment studies to understand their utility for adversarial emerging threat agents, dissemination technologies and the application of technologies (e.g. coating) that might alter the survivability, persistence, or detectability of	4.235	5.358	5.325

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
the agents. New areas of study include naturally occurring toxic compounds and biologicals designed to degrade structural materials. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Minor decrease due to reduced investment in characterization deliverables.			
Title: 12) Environmental Response ***Description:*** The specific surface or soil type, along with conditions such as temperature, humidity, sunlight etc. on which an adversary's Chemical-Biological (CB) agent lands can have an enormous impact on how long that surface remains a danger to the warfighter. The same environmental conditions impact how far a gas/aerosol cloud might travel. In a contaminated operational environment, understanding the range of exposure levels that would allow continued operation without long-term adverse effects will impact decontamination vs. avoidance operational considerations. The information obtained is used to inform operators, predictive model development, and capability development. In addition, this information feeds into analysis of existing protection, decontamination and medical intervention capabilities to identify capability gaps that must be closed. Environmental response has the tools and processes to analyze solids, liquids, aerosols, toxins and pathogens on a variety of surfaces (soil, concrete, plant leaves, painted surfaces) under a variety of temperature and humidity conditions that might alter persistence and viability of CB agents. Preparing and adapting these same processes for responding to emerging chemical and biological threats is a fundamental responsibility of Threat Agent Science. ***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 2025 Plans:*** - Evaluate the stability of chemical/toxin and viral threats in the environment remains an ongoing core function of Threat Agent Science. - Close existing knowledge gaps associated with aerosol biology and its implications with the outdoor release of CB threats (to include re-aerosolization of previously released threats) as well as ensuring processes and procedures are in place to respond to new, emerging threats as they are developed by our adversaries. This includes processes for understanding degradation products and reaction byproducts for detection, diagnostics and other applications. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	5.243	6.037	5.192

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Decrease due to delays in the nanoaerosols and encapsulation threat areas.			
Title: 13) First Look	8.433	9.910	9.117
Description: Often, concerns about new Chemical-Biological (CB) threat agents involve assumptions and suspicions at the 'worst case' end of the spectrum – this is inherent in an absence of good, solid data. However, there can be a host of reasons that an extremely deadly substance would make an impractical weapon and should thus be viewed as a less realistic threat. Is it prohibitively expensive to produce a militarily insignificant amount? Is it so fragile that it cannot survive dissemination? Is it so intractable that it cannot be made into a deliverable form? Understanding what threats rise to the credible/actionable level is what First Look is all about. First Look provides the science-based evaluation of known and emerging threat agents to determine their potential hazard to the warfighter. For both chemical and biological agents, this initial fundamental assessment includes evaluation of production/ availability, toxicity screening for chemicals and toxins, growth and/or virulence for biological agents, and feasibility of weaponization. It also develops methods and capabilities to quickly and accurately characterize the properties of chemical, biological, and toxin threat agents. First Look products and data inform warfighter mission planning, requirements generation, capability development, model development, the larger Chemical and Biological Defense Program (CBDP) Enterprise, Intelligence and other government stakeholders about known or emerging agent threats. ***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 2025 Plans:*** - Develop innovative laboratory tools and approaches to enable rapid 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. - Develop advanced methods for threat agent characterization of chemical agent mixtures and threat agents 'coated' to alter our ability to detect or identify them. - Develop methodologies to provide rapid computer-based vetting and assessment of emerging threats. - Evaluate technological advancements that are anticipated to have potential implications for previously discounted threats (i.e. "Second Look"). ***FY 2024 to FY 2025 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
Decrease due to revised priorities in characterization deliverables for new threat evaluations.			
Title: 14) Host Response	11.168	13.500	12.153
Description: How do we know if an individual has been exposed? What symptoms will develop? How soon? How can the effects of various attack agents be differentiated? How much time do we have to initiate medical intervention? Host Response provides the tools and data to understand what the body's response will be after exposure to Chemical-Biological (CB) threat agents under a variety of realistic concentrations and routes of entering the body (e.g., lungs, skin, mouth, etc.) and looking at sudden versus long-term/low exposure. Data from host response studies are also used to develop exposure limits acceptable for continued utilization of decontaminated equipment in a combat environment to inform mission planning, requirements generation, capability development and model development for the larger Chemical and Biological Defense Program (CBDP) Enterprise, Intelligence and other government stakeholders. Host Response also includes developing the ability to rapidly predict the human response to chemical and biological threat agents, especially new/emerging threats. While these capabilities also work to close knowledge gaps associated with "traditional" threats, they are key to having an ability to explore effects associated with exposure to mixed threat agents, assesses bioavailability of threat agents that have been 'coated' to increase viability and/or decrease the detectability of a threat agent. Understand how the body's response to such 'coated' agents is different versus un-coated threats is a vital part of our Threat Agent Science mission. ***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 2025 Plans:*** - Build on and further develop predictive methods and technologies for CB agent characterizations, both computer-based as well as in living tissues – increasingly making use of organ-on-a-chip technologies to replace older methodologies. - Continue studies to address host response areas for traditional CB agents that earlier gap analyses have identified. These methodologies are also directly applicable to any emerging CB threat. - Continue to implement improvements and upgrades for computer-based prediction of physical and toxicological properties as one of our key new tools and continue to assess the body's response to mixed agents and any novel/emerging threats. ***FY 2024 to FY 2025 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
Decrease due to revised priorities in characterization deliverables for implementing faster and less expensive threat toxicology determination technological advances.			
Title: 15) 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. ***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 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred to another thrust area. Funding moved to the Operational Biological Sensing thrust area for better project alignment.	1.278	1.313	-
Title: 16) 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 2024 Plans:*** - Continue to make technological improvements to enhance early warning of aerosolized biological threats. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred to another thrust area. Funding moved to the Operational Biological Sensing thrust area for better project alignment.	1.721	1.771	-
Title: 17) Operational Biological Sensing ***Description:*** The Operational Biological Sensing Thrust Area aims to inform and alert the warfighter of biological hazards they may encounter in an operational setting, including technologies to support field-confirmatory and theater-level validation to support	-	-	2.938

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
Joint Force operational concepts. This thrust area continues to develop fieldable technologies capable of collecting and detecting biological hazards in the battlespace. ***FY 2025 Plans:*** - Initiate development of autonomous collection and detection systems for novel and innovative sensing solutions for automated, rapid biological detection, assessments and analyses. - Continue to develop preservation techniques that stabilize sample for storage and transport of samples to laboratory for analysis. - Continue to quantify risks due to infectious aerosol threats, including naturally-occurring infectious disease outbreaks and threats beyond the list. - Continue to invest in innovative biological sensing technologies that can be integrated onto manned and unmanned platforms to provide warfighters with situational awareness without imposing an additional logistical burden. - Continue efforts to reduce false alarm rates and increase sensitivity and specificity. - Continue to develop low Size, Weight, Power and Cost (SWaP-C) sensors to support tactical and dismounted site assessment missions and reduce the logistical burden on the Joint Force. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred from another thrust area. Decrease due to efficiencies gained by consolidating the Distributed CB Reconnaissance - Biological Detection and Unattended Perimeter Monitoring - Biological Detection thrust areas for biological threat sensing efforts.			
Title: 18) Emerging and Enhanced Biothreat Sensing ***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 different Joint Force Operational Concepts and Force Postures. Further investments will be used to modernize laboratory capabilities and tools to deliver enhanced biothreat sensing/ detection capabilities to the Joint Force. ***FY 2024 Plans:*** - Continue development of detection algorithms, laboratory workflows, and implementation of bioinformatics analysis tools to identify threats in unknown samples - 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 2025 Plans:***	9.921	12.922	7.329

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
- Develop novel detection algorithms through streamlined laboratory workflows (e.g. data generation, collection, analysis) that generate complex biological datasets and exploit advances in Artificial Intelligence/Machine Learning (AI/ML). - Develop novel detection solutions that differentiate between naturally occurring or genetic engineered, enhanced and emerging biological threats. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to Assays on Demand (AoD) technology maturation and transition to the Project UN3 Emerging and Enhanced Biothreat Sensing and Unconventional Detection Modalities - Biological Detection thrust areas.			
Title: 19) Unconventional Detection Modalities - Biological Detection ***Description:*** Develops disruptive technologies to identify unknown or emerging biological threats as well as sensors that can operate in complex threat environments with high accuracy. Efforts in this area pursue a “fail fast” approach, with promising technologies transferred to other thrust areas/budget lines for further development. ***FY 2024 Plans:*** - 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 2025 Plans:*** - Initiate efforts to develop novel and innovative technologies to detect and identify toxins. Efforts will explore technologies beyond those based on traditional methods. - Continue to develop sensors that integrate advances in data science to address challenges in sample collection and detection of biological agents. The hope is to improve the speed, accuracy, and portability of tests under development. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The Assays on Demand (AoD) program has matured from Project UN2 to Project UN3 Emerging and Enhanced Biothreat Sensing.	5.032	5.276	3.055
Title: 20) Distributed CB Reconnaissance - Chemical Detection ***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.	1.970	2.322	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
FY 2024 Plans: - 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 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred to another thrust area. Funding moved to the Operational Chemical Sensing thrust area for better project alignment.			
Title: 21) 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. ***FY 2024 Plans:*** - Continue to make technological improvements to enhance early warning of vapor, aerosol, solid, and liquid hazards. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred to another thrust area. Funding moved to the Operational Chemical Sensing thrust area for better project alignment.	2.279	3.054	-
Title: 22) Operational Chemical Sensing ***Description:*** This thrust area will mature and miniaturize chemical threat sensing and sampling technologies for distributed and networked detection systems beyond the warfighter's line of sight to support early warning of chemical threats for fixed site, reconnaissance, and maneuver operations. Furthermore, the thrust area will provide capabilities for the full spectrum of missions and threats with rugged, low-cost point sensors and automated technologies. ***FY 2025 Plans:*** - Initiate investment in novel standoff detection technology concepts to provide non-contact chemical sensors that further distance the warfighter from the threat.	-	-	5.191

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
- Continue to make technological improvements to low size, weight, power, and cost sensors to enhance early warning of vapor, aerosol, solid, and liquid chemical hazards. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred from another thrust area. Decrease due to efficiencies gained by consolidating the Distributed CB Reconnaissance - Chemical Detection and Unattended Perimeter Monitoring - Chemical Detection thrust areas for chemical threat sensing efforts.			
Title: 23) 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 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 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred to another thrust area. Funding moved to the Modernized and Enhanced Chemical Sensing thrust area for better project alignment.	3.296	3.616	-
Title: 24) Modernized and Enhanced Chemical Sensing ***Description:*** This thrust area will develop novel detection tools for a wide variety of chemical threats and miniaturize high confidence identification instruments for field use within the Joint Force's Operational Concepts. ***FY 2025 Plans:*** Surface and Ground Contamination Detection and Avoidance: - Develop technologies to advance detection of surface and ground chemical contamination while on-the-move for maneuver support operations. - Identify and develop optical detection technology candidates for improved equipment and vehicle decontamination verification. Threat Agnostic Detection:	-	-	3.445

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
- Continue to invest in early developments of low size, weight, and power colorimetric detection technologies for the iterative modernization of the currently fielded chemical detection kits. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred from another thrust area. Decrease due to the Expeditionary Analytical Toolkit (ExAnT) thrust area transfer for developing modernized detection technologies for traditional chemical threats in complex environments.			
Title: 25) Unconventional Detection Modalities - Chemical Detection ***Description:*** Develops disruptive technologies to identify unknown or emerging chemical threats as well as sensors that can operate in complex threat environments with high accuracy. Efforts in this area pursue a “fail fast” approach, with promising technologies transferred to other thrust areas/budget lines for further development. 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 2025 Plans:*** - Continue to develop database-independent (library-less) detection capabilities for identifying novel and emerging chemical threats by fusing data from multiple detection modalities. - Continue to develop novel approaches and materials (e.g. coatings) and new sensor approaches for the detection, quantification and/or identification of liquid, solid, gas, vapor, and aerosol chemical threats. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to economic cost adjustments.	2.030	2.443	2.328
Title: 26) Technical Surprise ***Description:*** Technological advancements may always have potential implications to aspects of agent use, production, release, persistence and even toxicity/pathogenicity. On the other hand, technological advancements can provide us with better tools for protecting our warfighters against Chemical-Biological (CB) threats. Technical Surprise conducts a continuous review of newly	3.670	4.500	3.825

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
published technologies (e.g., synthetic biology, artificial intelligence, machine learning, quantum computing, etc.) to identify areas of potential concern as well as those that can be utilized to improve our CB defenses. Technical Surprise efforts also develop capabilities to evaluate and assess technical enhancements that potentially alter the nature or magnitude of risk posed by a threat agent; reduce obstacles to threat use; or make threats more likely to survive being released, etc. Additionally, Technical Surprise identifies and assesses where technological advancements may have overcome operational, logistical or technological hurdles, thus increasing the impact of a formerly discounted potential threat. ***FY 2024 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 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 2025 Plans:*** - Assess 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 is an iterative and ongoing process. - Continue to review new technologies such as AI/ML, production/ synthesis, dissemination, etc. - Maintain and continuously modernize the horizon scanning capability to provide situational awareness to assess technological growth and convergence that may affect the chemical and biological threat space, while keeping abreast of changes in the nature of future threats is fundamental to negate any advantage our adversaries may perceive themselves to have. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to revised priorities in characterization deliverables for understanding/countering adversarial production capabilities.			
Title: 27) Technical Surprise - Enhanced Biological Defense (ENBD)	1.500	3.500	3.000
Description: The technological plausibility of an adversary developing advanced biological pathogens is a particularly challenging (and relatively new) area of concern within the Chemical and Biological Defense Program (CBDP). Thus, in order to develop the unique capabilities with attention on synthetic biology tools adoption, methods development and characterization of host responses via multiomics, new funding line Enhanced Biodefense (ENBD)) was initiated. Technical Surprise (ENBD) aims to develop the capabilities needed to identify and assess for pathogenesis/transmissibility/equivalence studies, emerging biothreat			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
characterization, signature assessments to accelerate threat understanding, detection/diagnostics, and medical countermeasures (MCM) development. This program enables our ability to quickly characterize emerging threats and will generate more robust data sets for training threat agnostic tools. ***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 2025 Plans:*** - Continue the development of robust threat agnostic tools to characterize emerging pathogens - Continue the development of a robust characterization process capable of safely addressing emerging pathogens. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to revised priorities in characterization deliverables for new and emerging biothreats.			
Accomplishments/Planned Programs Subtotals	106.499	119.182	97.205

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
• UN3: *Understand (ATD)*	69.652	83.825	76.114	-	76.114	87.384	73.515	71.015	71.015	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program			Date: March 2024
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 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
PT2: *Protect (Applied Research)*	-	66.409	55.057	49.328	0.000	49.328	54.817	59.861	58.452	58.452	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.

Thrust Areas included in this Project are:

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: 1) Biological Warfare Defense Prophylaxis	32.256	22.116	16.544
Description: The ultimate protection of the warfighter is achieved by pretreating the warfighter to withstand any biological threat, which will decrease reliance on early warning and personal protective equipment, and facilitate the warfighter to operate at peak performance. Medical countermeasure (MCM) strategies against broader classes of biological agents will be pursued with emphasis on broad-spectrum protection, platform technologies to enable rapid response, rapid onset to protection, fewer doses required, no cold chain required, and needle-free administration.			
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.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
- Explore the use of production pipelines for mosaic and/or engineered antigens for rapid deployment into established vaccine platforms. - 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 2025 Plans:*** - Discovery and development of broadly protective strategies and nontraditional approaches (e.g., host-directed, nucleic acid, antibody, and immunomodulators) against new and emerging threats. - Evaluation and development of vaccine platform technologies for potential use for rapid response to new and emerging threats, appropriate prototype pathogens will be used for test & evaluation, emphasis on broad-spectrum protection to enable rapid response. - Development of novel administration strategies (e.g. needle free) to reduce logistical burden and optimize immune response - Development of key enabling technologies to accelerate FDA approval for vaccine and pretreatment development			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
- Test and evaluate integrated layered defense strategies with candidate vaccine/therapeutic combinations to broaden protection and avoid interference between medical countermeasures. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to revised priorities to focus on emerging threats.			
Title: 2) Biological Warfare Defense Prophylaxis - Enhanced Biological Defense (ENBD) ***Description:*** Investments include efforts to develop technologies that strengthen and tune the host immune system through enhancement or stimulation to increase the ability to resist disease progression and spread (e.g. adjuvants and formulation). Identifying the most effective vaccine platform technologies for different threat agents based on host response and level of efficacy. ***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 2025 Plans:*** - Continue development of a computational tool to rapidly identify the optimal vaccine platform with which to counter any particular current, novel, or emerging biological threat. - Continue to test threat agnostic prophylactic products as stand-alone MCMs and in combination with vaccines and therapeutics in a layered defense strategy. - Continue to evaluate novel adjuvants in various vaccine constructs to improve immune response. - Continue to evaluate multi-threat encapsulated oral platform for protection against biological threats.	15.898	20.000	20.000
Title: 3) Air Purification Enhancements ***Description:*** Air purification filters go on individual protective gear (masks) and collective protection (i.e., military systems such as tanks, ships, and buildings). Current filters are expensive and do not alert operators when they are no longer effective at blocking CB threats. Air Purification Enhancements develops filters that last longer and reduce lifecycle costs, as well as satellite filters to monitor their effectiveness throughout their lifecycle. The thrust's filters will develop and mature enhanced protection technologies against both traditional and advanced threats. ***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.	1.558	1.169	1.170

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
- 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 2025 Plans:*** - Assess and publish report on novel filter materials performance against conventional and advanced agents delivered in all states of matter (vapor, aerosol, and liquid) in operationally relevant environments. - Continue to assess impact of novel threats on current filter performance. - Reduce life-cycle maintenance costs by validating manufacturing processes and performing and validating new operationally relevant test methods. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Increase due to economic cost adjustments.			
Title: 4) All-Hazards & Respiratory Protection ***Description:*** Current individual protective gear can be uncomfortable to wear for extended periods of time and the gear can make it less natural to perform essential warfighting functions. All-Hazards and Respiratory Protection designs and develops reduced burden, low encumbrance respiratory and ocular (eye) protection. This will make it easier for the Warfighter to perform mission essential tasks while operating in individual protective gear. Because current CB protective masks don't integrate with the Services' existing, non-CB defense helmets and displays, All-Hazards Respiratory Protection works to develop CB defense masks that integrate with existing combat systems. ***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 2025 Plans:*** - Down select designs for prototype low-burden, unencumbering respirator that integrates with existing systems (e.g., helmets and displays) and may include off-the-face and low-profile filter designs. - Validate manufacturing methods for next generation respiratory protection, including potentially using additive manufacturing to produce customized mask for each warfighter. - Develop new individual protection filter for next generation protective mask. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	4.037	1.026	0.716

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
Decrease due to delayed transition of next generation respirator until FY29.			
Title: 5) Enhanced Survivability Coatings ***Description:*** Enhanced Survivability Coatings improves ability to restore asset to use in normal, unprotected operations and speeds ability to reduce MOPP. ***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 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred to another thrust area. Funding moved to the Protective Garments thrust area to support required development of scaling and manufacturing processes for prototype protective garments that detoxify chemical and biological agents and regenerate protective capacity.	1.657	1.881	-
Title: 6) Protective Garments ***Description:*** Protective Garments provides reduced burden, low encumbrance protective garments integrated into full systems with operationally relevant, whole system test methods, and reduces cost, logistical resupply demand, and increases sustainability of solutions. ***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. - Test scaled responsive/reactive textile swatch samples using whole system test methods. ***FY 2025 Plans:*** - Develop, verify, validate, and transition improved protective garment prototype test methodologies that provide greater validation of CB protection, are repeatable, and support testing under relevant conditions to UIPE FoS. - Continue development of scaling and manufacturing processes for prototype protective garments that detoxify chemical and biological agents and regenerate protective capacity. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	-	0.234	2.819

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
Program/project funding transferred from another thrust area. Decrease due to efficiencies gained by consolidating the Enhanced Survivability Coatings thrust area and efforts within the MMfP thrust area for developing scaling and manufacturing processes for prototype protective garments that detoxify chemical and biological agents and regenerate protective capacity.			
Title: 7) Multifunctional Materials for Protection ***Description:*** Multifunctional Materials for Protection (MMfP) develops new materials for protective garment, filter, and coatings technologies that will absorb, neutralize, and repel chemical and biological warfare agents. This will reduce costs by extending service life. New materials can also reduce the heat burden of individual protection (i.e., boots, suits, masks, and gloves) and make it more natural to operate in. This will allow Warfighters to operate in individual protection gear for extended periods of time, reducing the necessity of early warning. MMfP replaces PFAS-based textile finishes and surface coatings. MMfP matures material technologies that transition to all physical protection thrust areas. ***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 2025 Plans:*** - Develop scaled materials manufacturing processes for cost and process efficiency and characterize materials using operationally relevant test methods. - Assess new materials (i.e., biologically inspired and two-dimensional) for protection and hazard mitigation proof-of-concept as they mature from fundamental research to applied research. - Use machine learning techniques to develop materials that destroy chemical and biological agents more quickly and effectively. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to $1.000M Protective Garments thrust area transfer of efforts developing scaling and manufacturing processes for prototype protective garments that detoxify chemical and biological agents and regenerate protective capacity.	3.177	5.087	4.087
Title: 8) Nerve Agent Prophylaxis/Pretreatments ***Description:*** Exposure to nerve agents is at worst catastrophic and at best disabling for an extended period – and in most cases the onset of symptoms is very fast. Nerve agents work by blocking the signal flow across nerve junctions, ultimately resulting in	7.826	2.576	3.211

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
a loss of ability to control both voluntary and involuntary muscles and death by asphyxiation. Maintaining full mission readiness in a CB contested environment would require advance administration of a medical antidote well before exposure and would not require additional treatment after exposure (prophylaxis). Until now, no such antidote has existed. The nerve agent (NA) prophylaxis portfolio is developing protective medicines that are effective against a broader range of nerve agents – including fourth generation agents – than had ever before been thought possible. Successful development of these medicines will greatly enhance the ability of the Warfighter to stay in the fight and move forward. ***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 2025 Plans:*** - Develop drug products currently focused on improving the duration of protection, determining the full spectrum of protection (in terms of agents and exposure concentration) and exploring the length of time protection lasts. - Conduct small animal testing and a large animal study to better predict drug behavior in humans. - Initiate efforts of one or more alternative nerve agent prophylactic technologies as a risk mitigation step. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Lead candidate drugs are advancing toward a Phase I Clinical Trial in 1.5 – 2 years. In preparation for that, studies grow more complex and expensive from this point on, thus there is an increase in required funding.			
Title: 9) Reactivators of AChE as Therapeutics (ReACT) ***Description:*** Exposure to nerve agents is at worst catastrophic and at best disabling for an extended period – and in most cases the onset of symptoms is very fast. Nerve agents work by blocking the signal flow across nerve junctions, ultimately resulting in a loss of ability to control both voluntary and involuntary muscles and death by asphyxiation. Currently, there is only one FDA- approved post-exposure drug treatment that restores the activity of the human molecule deactivated by nerve agent, and it is essentially unchanged since the 1950s. The ReACT portfolio is developing a number of different candidate medicines that are effective against a broader range of nerve agents – including fourth generation agents - than had ever before been thought possible. Successful development of these medicines will greatly enhance the ability of the Warfighter to survive and potentially stay in the fight and move forward.	-	0.968	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
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 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred to another funding line. Work in FY25 focuses on therapeutics within Project MT2.			
Title: 10) Enabling Science ***Description:*** There are many technologies that can be applied across multiple thrust areas in the medical and physical portions of the S&T house, and thus pay dividends well beyond the actual investment. Examples include development of well-characterized animal models for use in FDA filings; incorporation of "organ-on-a-chip" technologies that will reduce the reliance on animal testing; development of AI capability to predict toxicology of new/unknown chemical compounds or evaluate the predicted safety profile of drug candidates. The Enabling Science thrust area funds research efforts that modernize the chemical medical countermeasure (cMCM) pipeline to develop and deploy cMCMs more rapidly to the Warfighter. ***FY 2025 Plans:*** - Continue to develop well characterized animal models with the goal of applying for status as FDA qualified animal models. This is key to support the development of MCMs that provide protection for the Warfighter against CWAs. Having multiple well-characterized animal models (per the FDA standard) is vital where licensure can only be accomplished under the FDA animal rule, as is the case with all scheduled chemical and biological agents. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred from another funding line. The continuing projects underlying this funding were initiated with Project MT2 funding in FY24 and focused on animal model development for therapeutics (mitigate), but in FY25 will include development for pre-exposure prophylaxis.	-	-	0.781
Accomplishments/Planned Programs Subtotals	66.409	55.057	49.328

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
• PT3: *Protect (ATD)*	29.631	29.261	46.050	-	46.050	46.703	46.159	54.536	54.535	Continuing	Continuing

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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)*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program			Date: March 2024
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 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
MT2: *Mitigate (Applied Research)*	-	67.108	66.371	55.744	0.000	55.744	55.426	66.420	68.824	68.824	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.

Thrust Areas included in this Project are:

(1) Biological Warfare Defense Therapeutics
(2) Discovery of Medical Countermeasures Against New and Emerging Threats (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 (MMfP)
(10) Personnel Decontamination

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: 1) Biological Warfare Defense Therapeutics	32.224	31.363	24.913
Description: Therapeutics represent an important component of integrated layered defense. Therapeutics will mitigate the impact of biological threats to the warfighter by enabling rapid recovery and expediting return to the fight. 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 Food & Drug Administration (FDA)-approved therapeutics are limited or lacking.			
FY 2024 Plans: Viral Therapeutics: - Continue to evaluate conserved targets, including host targets and processes of pathogenesis, for broad-spectrum treatment.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
- 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 2025 Plans:*** - Continue to evaluate targets, including host targets and processes of pathogenesis, for broad-spectrum treatment of biological threats. - Continue to test therapeutic products as stand-alone MCMs and in combination with vaccines in a layered medical defense strategy. - Continue drug discovery and development efforts, including repurposing, to prepare for emerging threats by focusing on broad spectrum platform technologies. - Establish efficacy in small animal models and transition therapeutic candidates to advanced technology development. - Continue to evaluate therapeutic targets, with a focus on circumventing resistance, for broad- spectrum treatment. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to revised priorities to focus on emerging threats.			
Title: 2) Discovery of Medical countermeasures Against New and Emerging threats (DOMANE)	3.603	-	-
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			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
Access, Compassionate Use and Emergency Use authorities) of BW MCM to the Joint Force at the speed of relevance to allow freedom of action.			
Title: 3) Discovery of Medical countermeasures Against New and Emerging threats (DOMANE) - Enhanced Biological Defense (ENBD) ***Description:*** Provides innovative and rapid medical countermeasures (MCMs) development capabilities (Artificial Intelligence, machine learning, data science, and platform technologies) that reduce developmental risks, cost, and schedule associated with MCM fielding. These rapid MCM developmental approaches afford protection against new and emerging threats and allow the Joint Force freedom of action. Effort is focused on developing tools that enable prediction of disease type and identify broad-spectrum targets for both host and pathogen. ***FY 2025 Plans:*** - Establish a universal data format - Validate protocols for AI/ML (e.g. meet FDA standards) - Manage small/limited datasets - Understand the algorithm decision making process ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Increase due to no Project MT2 funding in FY24.	-	-	4.000
Title: 4) Chemically Reactive Ocular, Wound and Dermal Therapeutics (CROWD) ***Description:*** While there exist multiple processes and reagents for cleaning physical surfaces that have been contaminated with chemical agents, there are limited options for human skin, and nothing that could be used for open wounds. This represents a source of continuing exposure for the warfighter and a hazard to medical personnel treating them. CROWD focuses on developing a ready-to-use product to remove Chemical Warfare Agent (CWA) contamination on skin, eyes and ultimately wounds. Removing or neutralizing CWA decreases the total exposure to the warfighter and allows optimal effectiveness of other medicines. ***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 2025 Plans:*** - Continue to develop animal models for dermal and wound application, determine dosing strategies, format for use in the battlefield, and establish the regulatory strategy for candidate products in traumatic wounds. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	3.915	5.639	2.937

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
Decrease due to revised priorities.			
Title: 5) Emerging and Pharmaceutical-based Agent Threats (EMPATH)	2.425	3.753	0.855
Description: As technology increases, so does the number of available chemicals. Some of these new chemicals pose threats to the warfighter and are therefore termed Emerging Chemical Threats (ECTs). In addition to ECTs, a subset of chemical threats includes legitimate medicines that are repurposed as chemical threat agents, referred to collectively as Pharmaceutical Based Agents (PBAs). These compounds have genuine medical utility but can be abused (by level of exposure and/or delivery method) as a general incapacitants and large doses can easily become lethal. The warfighter requires effective MCMs that prevent or reverse the adverse effects of ECTs and PBAs, while still allowing for the use of U.S. Food & Drug Administration (FDA) approved drugs (e.g., morphine, fentanyl) by Joint Force Medical Staff for their labeled indications of pain management and sedation. EmPATh is evaluating approved medicines as well as developing new ones for use in the field to counteract these effects. The portfolio is working to develop MCMs that are effective against a wide range of ECT/PBA-induced symptoms which may be common across several different types of threat agents. Groups of symptoms caused by a family of threat agents that act similarly are called toxidromes; and medical countermeasures that address the symptoms of several different types of threat agents are called cross-toxidromic medicines. ***FY 2024 Plans:*** - Continue exploration of the therapeutic efficacy of atipamezole and other FDA-approved and developmental MCMs for non-opioid-based 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 2025 Plans:*** - Continue to find medicine candidates that treat key symptoms regardless of the specific agent that is causing them. This moves us away from “one risk, one remedy” solutions. This approach is called a “cross-toxidromic” approach and will be critical in addressing the rapidly expanding universe of chemical threat agents. Additional work here includes efforts based on a recently completed paper study to identify and assess 1) novel chemical threat agnostic MCMs and 2) previously FDA approved drugs (human and/or veterinary) with potential to prevent or treat the adverse effects of multiple classes of chemical threats. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to moving away from “one risk, one remedy” and to an approach that treats sets of symptoms regardless of the agent that causes them (called a cross-toxidromic approach).			
Title: 6) Enabling Science	13.136	13.878	10.451

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
Description: There are many technologies that can be applied across multiple thrust areas in the medical and physical portions of the S&T house, and thus pay dividends well beyond the actual investment. Examples include development of well-characterized animal models for use in FDA filings; incorporation of "organ-on-a-chip" technologies that will reduce the reliance on animal testing; development of Artificial Intelligence/Machine Learning (AI/ML) capability to identify new drug targets, to predict toxicology of new/unknown chemical compounds or evaluate the predicted safety profile of drug candidates. The Enabling Science thrust area funds research efforts that modernize the chemical medical countermeasure (cMCM) pipeline to develop and deploy cMCMs more rapidly to the Warfighter, with lower costs to the government. ***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. - 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 spectrum of OPNA threats. ***FY 2025 Plans:*** - Continue efforts on projects that include using AI/ML to better design drugs and predict drug safety; maintain screening and safety databases for drug candidates; investigate new production technologies (e.g. "on demand" or "continuous flow" manufacturing); alternate indications for existing medications; and further characterize animal models with the goal of applying for status as fully qualified with the FDA. - Support modernized development of MCMs to provide protection for the Warfighter against known and emerging CWAs. Having multiple well-characterized animal models (per the FDA standard) is vital where licensure can only be accomplished under the FDA animal rule, as is the case with all scheduled chemical and biological agents. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to revised priorities and $0.500M transfer of technologies into the Project MT2 line ReACT thrust area.			
Title: 7) Reactivators of AChE as Therapeutics (ReACT)	3.486	4.879	6.423
Description: Exposure to nerve agents is at worst catastrophic and at best disabling for an extended period – and in most cases the onset of symptoms is very fast. Nerve agents work by blocking the signal flow across nerve junctions, ultimately resulting in a loss of ability to control both voluntary and involuntary muscles and death by asphyxiation. Currently, there is only one FDA- approved post-exposure drug treatment that restores the activity of the human molecule deactivated by nerve agent, and			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
it is essentially unchanged since the 1950s. The ReACT portfolio is developing a number of different candidate medicines that are effective against a broader range of nerve agents – including fourth generation agents - than had ever before been thought possible. Successful development of these medicines will greatly enhance the ability of the Warfighter to survive and potentially stay in the fight and move forward. ***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 2025 Plans:*** - Continue efforts that use modeling tools to develop therapeutics that are effective both in the brain and against a broader range of nerve agents. - Initiate preclinical and formulation studies for improved reactivators. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Increase due to 1) $0.500M associated with transfer of technologies from the Project MT2 Enabling Science thrust area and 2) initiating preclinical and formulation studies in FY25 cost more than the continuation of modeling, down select and screening efforts.			
Title: 8) Enhanced Survivability Coatings ***Description:*** Enhanced Survivability Coatings assesses existing technologies and develops new coatings to increase chemical agent resistance for equipment and individual protection gear. This will make it quicker and easier to decontaminate and restore assets for use in normal, unprotected operations. It will also allow the Joint Force to reduce individual protective gear more quickly. ***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.	1.283	0.542	0.537

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
- Continue to improve equipment coatings through bio-inspired surface treatments to repel agents of interest from current military equipment coatings. ***FY 2025 Plans:*** - Continue evaluating new types of coatings as potential temporary or permanent military equipment coatings to decrease logistical burden of decontamination in support of the Tactical Temporary Coatings (TTC) Program of Record. - Increase chemical agent resistance of current military coatings through development and testing of novel temporary coatings to reduce the spread of contamination and enable easier decontamination of all military asset surfaces. - Develop and optimize test methods for temporary overcoat evaluation for elastomers. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to economic cost adjustments.			
Title: 9) Equipment Decontamination ***Description:*** Equipment Decontamination provides reduced troop-to-task, logistics decontaminants, and decontamination methods with operationally-relevant test methods. ***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 2025 Plans:*** - Test autonomous equipment decontamination subsystems to reduce troop-to-task and logistics requirements for operational decontamination. - Develop technologies and methods for chemical and biological tactical and thorough decontamination of aircraft (e.g., helicopter) interiors and exteriors. - Investigate directed energy-driven and on-demand vaporous technologies to improve sensitive equipment and facility decontamination processes, logistics, and materials compatibility. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Decrease due to transfer of funds to the Enhanced Survivability Coatings thrust area to support development of coating evaluation test method for hazard mitigation applications.	4.232	2.925	2.236
Title: 10) Multifunctional Materials for Protection	1.854	2.222	2.222

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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 2023	FY 2024	FY 2025
Description: Multifunctional Materials for Protection (MMfP) develops new materials for decontaminants and coatings technologies that will absorb, neutralize, and repel chemical and biological warfare agents. This will make decontamination easier, reducing costs and the logistical burden on the Joint Force, supporting the Joint Force's operational concepts in priority theaters. MMfP also develops new materials to replace PFAS-based finishes and surface coatings. MMfP matures technologies that transition to all hazard mitigation thrust areas. ***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 2025 Plans:*** - Continue to improve scaled materials manufacturing processes for cost and process efficiency and characterize materials using operationally relevant test methods. - Assess two-dimensional materials for integration into hazard mitigation technologies. - Develop analyses that show environmentally relevant, real-time decontamination on surfaces. - Design more effective materials using machine learning techniques to discover materials that rapidly destroy threats.			
Title: 11) Personnel Decontamination ***Description:*** Decontamination is critical to being able to fight through and recover quickly after CB threat usage. Personnel Decontamination provides new personnel decontamination kits with reduced costs and logistics (storage and shelf-life limitations) compared to the currently fielded product and provides new processes and methods for decontamination of unbroken skin. ***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 2025 Plans:*** - Assess existing and novel decontaminants and processes for individual and skin decontamination in support of the Medical Decontamination Personnel Skin (MDPS) program of record. - Develop and assess physical removal technologies for potential replacement of reactive skin decontamination lotion.	0.950	1.170	1.170
Accomplishments/Planned Programs Subtotals	67.108	66.371	55.744

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
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)*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
• MT3: *Mitigate (ATD)*	83.766	100.791	81.920	-	81.920	90.704	84.795	86.434	86.435	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program											Date: March 2024	
Appropriation/Budget Activity 0400 / 2					R-1 Program Element (Number/Name) PE 0602384BP / *Chemical and Biological Defense Program*				Project (Number/Name) EN2 / *Enabling Investments (Applied Research)*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
EN2: *Enabling Investments (Applied Research)*	-	0.000	0.000	22.500	0.000	22.500	22.500	22.500	22.500	22.500	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Enabling Investments Applied Research Project focuses on characterization of alternate animal and microphysiological models that mimic the human response to biological and chemical agents. This area also develops and provides infrastructure capabilities to conduct defensive classified Department of Defense (DoD) work in laboratories, the appropriate DoD workforce to execute Science & Technology (S&T) in high containment at various levels of classification, and executes a robust emerging biothreat portfolio to enable readiness for future incidents. In FY 2025, Project EN2 aligns revised CB incident preparedness and response priorities for required applied research activities. The FY 2025 efforts continue resourcing for this portfolio in alignment with efforts conducted in Project EN3.

Thrust Areas included in this Project are:

(1) Biological Warfare Defense Prophylaxis
(2) Enabling Science

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: 1) Biological Warfare Defense Prophylaxis - Comparing Animal Models to Organ (CAMO) ***Description:*** This effort will focus on the characterization of alternative to animal models that mimic the human response to biological and chemical agents to enable rapid response. ***FY 2025 Plans:*** -Initiate evaluation of alternative animal models for exemplar chemical and biological agents and compare to the accepted large animal models. -Initiate evaluation of microphysiological platforms ability to mimic human response to biological threats ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Program/project funding transferred from another funding line. Funds were moved from Project EN3 Medical Countermeasures Initiative to better align requirements within Budget Activity 2 to support investments in alternatives to animal models supporting rapid response for new and emerging threats.	-	-	2.500
Title: 2) Enabling Science ***Description:*** This effort is aimed at identifying what alterations (policy, processes and facilities) will be required in order to attain the ability to conduct classified defensive DoD work in biosafety laboratories. This will necessarily include training and	-	-	20.000

Exhibit R-2A, RDT&E Project Justification: PB 2025 Chemical and Biological Defense Program		Date: March 2024
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602384BP / *Chemical and Biological Defense Program*	**Project (Number/Name)** EN2 / *Enabling Investments (Applied Research)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
maintaining sufficient scientists and technicians able to execute S&T in high containment at various levels of classification. This effort executes a robust emerging biothreat portfolio to enable readiness for future incidents. ***FY 2025 Plans:*** - Provide oversight and accreditation assistance to upgrade selected existing high containment suites to adhere to SCIF standards as promulgated and/or mitigated by DIA. Implement and develop protocols and execute S&T biothreat characterization work that can be performed at various classification levels. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Increase due to additional requirements for infrastructure capabilities to conduct laboratory work.			
Accomplishments/Planned Programs Subtotals	-	-	22.500

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
• EN3: *Enabling Investments (ATD)*	38.164	43.196	16.967	-	16.967	19.040	19.040	19.040	19.040	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A