Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Defense Advanced Research Projects Agency	Date: March 2024
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*

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	-	316.176	344.986	337.772	-	337.772	385.764	434.132	458.998	475.338	-	-
MBT-01: *MATERIALS PROCESSING TECHNOLOGY*	-	127.121	150.549	177.523	-	177.523	202.746	228.167	241.236	249.824	-	-
MBT-02: *BIOLOGICALLY BASED MATERIALS AND DEVICES*	-	189.055	194.437	160.249	-	160.249	183.018	205.965	217.762	225.514	-	-

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) address the Applied Research associated with the Materials and Biological Technology Program that is focused on developing materials and biological technologies that make possible a wide range of new military capabilities. This PE also supports innovation and robust transition planning in the technology cycle by working with entrepreneurs to increase the likelihood that DARPA funded technologies take root in the U.S. and provide new capabilities for national defense.

The major goal of the Materials Processing Technology project is to develop novel materials, fabrication and processing techniques, models, devices and components that will lower the cost, increase the performance, and/or enable new missions for military platforms and systems. Included in this project are efforts across a wide range of technology areas including manufacturing, electronics, sensors, optics, and complex and autonomous systems.

The Biologically Based Materials and Devices project will leverage the growing application space of the biological sciences for the development of new DoD capabilities to improve the sustainability of warfighters, and operational platforms in varied environments. This project will develop solutions for critical resource processing, materials development, threat detection and characterization, environmental remediation, and warfighter resilience to infectious disease and environmental stressors. The materials developed through this project will protect and sustain warfighters and operations in austere environments.

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Defense Advanced Research Projects Agency	Date: March 2024
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*

B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	337.726	344.986	349.088	-	349.088
Current President's Budget	316.176	344.986	337.772	-	337.772
Total Adjustments	-21.550	0.000	-11.316	-	-11.316
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	-9.900	0.000			
• SBIR/STTR Transfer	-11.650	0.000			
• TotalOtherAdjustments	-	-	-11.316	-	-11.316

Change Summary Explanation

FY 2023: Decrease reflects SBIR/STTR transfer and reprogrammings.

FY 2024: N/A

FY 2025: Decrease reflects minor program repricing.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency			Date: March 2024
Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*	Project (Number/Name) MBT-01 / *MATERIALS PROCESSING TECHNOLOGY*	

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
MBT-01: *MATERIALS PROCESSING TECHNOLOGY*	-	127.121	150.549	177.523	-	177.523	202.746	228.167	241.236	249.824	-	-

A. Mission Description and Budget Item Justification

The major goal of the Materials Processing Technology project is to develop novel materials, fabrication, and processing techniques, models, devices, and components that will lower the cost, increase the performance, and/or enable new missions for military platforms and systems. Included in this project are efforts across a wide range of technology areas, including manufacturing, electronics, sensors, optics, and complex and autonomous systems.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Materials for Extreme Environments	51.600	72.640	70.100

Description: The Materials for Extreme Environments thrust is exploring new materials, innovative architectures, and development processes that will significantly enhance the performance and persistence of DoD platforms operating in extremely harsh environments. Materials with superior strength, functionality, and resiliency are critical for enabling DoD platforms, weapons and other components to operate and persist under conditions including, but not limited to, extremely high or low temperatures, turbulence, ionizing radiation, and/or corrosive environments. Recent developments in materials such as high entropy alloys, superconducting materials, and infiltrated carbon fiber composites hold promise for achieving material solutions for improved survivability in a wide range of harsh environmental conditions. Similarly, advancements in material design, processing and manufacturing are enabling novel material architectures that can further enhance performance and resilience in structures such as leading edges, windows and apertures, propulsion systems, and space structures. Exemplar areas of research within the Materials for Extreme Environments thrust include the following: 1) high temperature materials for hypersonic platforms, 2) high temperature window and aperture materials, 3) radiation and/or electromagnetic pulse (EMP) hardened electronics for space platforms, 4) coatings for platform survivability in corrosive environments, 5) active and passive cooling methods for apertures and forward-facing vehicle features, and 6) superconducting and magnetic materials for novel propulsion systems.

FY 2024 Plans:

- Create two additional analytic techniques that leverage physics-based design principles to increase convergence speed while minimizing computational resources.
- Complete validation of system-level models that couple vehicle geometry, materials response, and vehicle trajectory to performance.
- Transition new performance models to defense analysts to use in further research, development, and operational systems design efforts.
- Demonstrate increased precision of the materials and manufacturing system to enable the exemplar application of a >100-meter diameter radio frequency (RF) reflector antenna.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*	**Project (Number/Name)** MBT-01 / *MATERIALS PROCESSING TECHNOLOGY*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Refine manufacturing and cost models based on fabrication trials of higher precision subcomponents. - Demonstrate ability to meet area built per mass launched metric (10 meters squared per kilogram) in a laboratory setting by testing higher precision subcomponents. - De-risk manufacturing and assembly approaches for future in-orbit demonstrations. - Develop system-level models that project improved seeking capability. - Conduct testing of novel infrared and radio frequency apertures suitable for hypersonic platforms under high-temperature conditions to validate performance models. - Prepare bench top demonstration(s) of novel technology for sustained very low Earth orbit (VLEO) operations. - Determine the feasibility of the novel technologies to enable sustained VLEO operations. - Develop electrode material solutions for magnetohydrodynamic pumps. - Generate material models based on conceptual point designs for undersea magnetohydrodynamic pump prototypes. ***FY 2025 Plans:*** - Demonstrate increased precision of the materials and manufacturing systems to enable the exemplar application of segmented longwave infrared optics. - Demonstrate ability to meet area built per mass launched metric (1 meter squared per kilogram) in a laboratory setting by testing higher precision subcomponents. - Demonstrate suitable designs that support one (1) meter segmented longwave infrared optics. - Initiate flight test readiness review(s) for in-orbit demonstrations of developed technology. - Conclude bench top demonstration(s) and finalize feasibility studies of the novel technologies to enable sustained VLEO operations. - Conduct initial design trades and scalability study of undersea magnetohydrodynamic pump to show traceability to larger application. - Conduct materials testing of electrode design to ensure proposed solution will achieve program metrics. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects minor program repricing.			
Title: Functional Materials and Devices	35.021	45.800	60.023
Description: The Functional Materials and Devices thrust is developing advanced materials, components and systems to improve device performance for DoD structural, sensing, imaging and communication applications. One focus of this thrust involves development of advanced transductional materials that convert one form of energy to another for DoD-relevant applications. While promising transduction materials are known for a variety of applications, integration into devices has not been realized. Another focus area is the development of physics-based models that predict material behavior when illuminated by high peak power electromagnetic interference. A third focus area involves development of new multi-functional materials and device designs			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
that will radically decrease the size, weight and power requirements of high-energy photon sources. Such devices should enable fieldable detection units for sensing, non-destructive evaluation of parts, and detection of DoD-relevant targets. A fourth focus area is developing new liquid-based, large-aperture imaging systems such as telescopes. Such telescopes would break the unfavorable, exponential scaling between aperture size and cost for normal telescopes and enable low-cost imaging platforms for ground- and space-based applications. Another focus area under this thrust involves novel nano-architected materials to enhance device-relevant properties for applications to quantum-enhanced sensors. Finally, novel design optimization approaches will be explored where material composition and microstructure are included as explicit, continuous variables alongside shape optimization. This co-optimization of shape and material together will enable new combinations of structural performance and sustainability for a variety of DoD applications. ***FY 2024 Plans:*** - Finalized system design for a compact and ruggedized electron accelerator system based on demonstrated components. - Complete and test a compact and ruggedized electron accelerator prototype system. - Validate performance of integrated system prototypes at Government lab sites. Begin transition of prototypes to Government entities. - Extend optimized night vision designs to include visual access to an additional infrared spectral band beyond the near-infrared, i.e., the short-, mid-, or long-wave infrared). - Scale-up synthesis of novel obscurant particles suitable for cubic meter-scale pilot demonstrations of passive obscurants and lab-scale demonstrations of active obscurants and demonstrate asymmetric visibility in both cases. - Finalize experimental material test platform designs and continuum material design optimization approach. - Explore design frameworks integrating both shape and material as concurrent degrees of freedom to unlock new optimal design balancing performance, cost, and sustainability metrics. - Conduct proof-of-concept manufacturing demonstrations to produce and test multi-material structural components. - Complete preliminary design review and critical design review of large liquid-mirror telescope. - Begin building lab demo of large liquid-mirror telescope, with plans to double aperture sizes. - Develop preliminary designs, models and synthesis protocols for functionally engineered electronic metamaterials with enhanced quantum properties. - Conduct lab experiments to explore self-neutralized air breathing plasma as a medium to enable novel electronic propulsion techniques capable of using air from the atmosphere as the ionization medium. - Explore hybrid additive manufacturing approaches to enable embedded structural health monitoring for load-bearing metallic components. ***FY 2025 Plans:*** - Demonstrate prototype of previously developed extended optimized night vision designs developed.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*	**Project (Number/Name)** MBT-01 / *MATERIALS PROCESSING TECHNOLOGY*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Demonstrate novel material testing techniques to generate design-relevant properties 10x faster than current approaches. - Evaluate novel multimaterial designs to quantify performance, cost, and sustainability benefits. - Conduct out-of-plane liquid mirror hardware demonstration and begin advancing designs from laboratory setting to on-sky demonstrations. - Explore the design space for metamaterial-based nanoelectronic device architectures for applications to quantum sensing, computing, and communications. - Explore and develop device-level fabrication techniques to incorporate functionally engineered quantum materials within nanoelectronic device architectures. - Perform preliminary materials and device characterization of metamaterial-based nanoelectronic devices to validate material-scale and device-scale models of enhanced quantum effects. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects a shift from exploration to development and testing.			
Title: Reconfigurable Systems	17.000	17.000	11.000
Description: In the Reconfigurable Systems thrust, new approaches are being developed to enable more rapid and robust adaptation of defense systems and systems-of-systems to changing mission requirements and unpredictable environments. This includes development of capabilities across sensing, perception, planning and control for autonomous, high-speed operation in cluttered environments without Global Positioning System (GPS) information. This also includes development of capabilities to manipulate and control adversary sensory perception and/or situational awareness. Additional work in this thrust focuses on how sensing systems and military systems-of-systems are designed for real-time resilient response to dynamic, unexpected signals and contingencies. Research is developing a more unified view of system behavior that allows better understanding and exploitation of complex interactions among components, including development of formal mathematical approaches to complex adaptive system composition and design. These capabilities will impact autonomous systems and systems-of-systems, including those that involve humans, in a variety of DoD-relevant contexts. ***FY 2024 Plans:*** - Initiate integration of critical components into a high-performance, environmentally-robust portable optical clock device with picosecond timing precision. - Initiate integration of critical components into a high-performance, environmentally-robust transportable optical clock with month-long nanosecond holdover. ***FY 2025 Plans:*** - Conduct integration, environmental testing, and performance characterization of high-performance, environmentally-robust portable optical clock device with picosecond timing precision.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Conduct integration, environmental testing, and performance characterization of high-performance, environmentally-robust transportable optical clock with month-long nanosecond holdover. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects a transition from development to integration and testing.			
Title: Chemical Processing for Force Protection ***Description:*** Research in the Chemical Processing for Force Protection thrust is focused on the development of new chemical approaches and technologies across a broad spectrum of DoD needs. One area involves development of innovative approaches for scalable small molecule synthesis coupled with predictive tools for route design, possibly offering a new strategy to discover how to make new molecules such as pharmaceuticals and explosives. A second area includes qualification of new molecules made using agile manufacturing platforms. Another focus leverages advances in automation to develop safe, reproducible experimental approaches for systematic development of energetic materials. In addition, investments in this thrust will advance chemical characterization, information management and analysis, and automation. ***FY 2024 Plans:*** - Integrate semi-automated experimental platforms into cleared, U.S. Government facilities and begin demonstrating system operability through a series of Government-directed demonstrations. - Generate systematized data sets for energetic formulation development. - Initiate efforts to determine if detecting and/or characterizing adverse genetic effects by developing initial indicators consistent with an attack in food systems is a viable approach to early detection and warning. - Prepare and assemble sites and synthesis platforms to support the agile manufacturing and qualification of new molecules. ***FY 2025 Plans:*** - Demonstrate final system operability through a series of Government-directed demonstrations. - Demonstrate synthesis of multiple targets on modular agile manufacturing platforms. - Develop informatics models capable of near real-time qualification of molecules manufactured on agile synthesis platforms. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects a shift from system development to final demonstrations and transition.	23.500	15.109	10.400
Title: Making and Maintaining in Materials Processing Technology ***Description:*** The Making and Maintaining thrust is developing technologies that enable the production of molecules, materials, and parts in an expeditionary setting that will untether military forces from supply chains and enable a continuous global presence. Focus areas include making products at the point of need from local feedstock, developing the ability to use non-optimized	-	-	10.000

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
materials in manufacturing; accelerating part qualification; and new approaches to developing room temperature superconductors and efficient thermoelectric materials. ***FY 2025 Plans:*** - Investigate methods for embedded material damage sensing for structural parts. - Develop initial screening of 2D catalytic materials for low temperature solid oxide fuel cell running on complex hydrocarbons. - Investigate new methods for low energy carbon/hydrogen capture from air. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects program initiation.			
Title: Awareness in Materials Processing Technology ***Description:*** Efforts in the Awareness thrust examine and develop opportunities to increase our understanding of adversarial systems and through improved processing techniques, models, and signals of opportunity that will generate low-cost, actionable solutions for enhanced detection and characterization of events and systems of interest. Focus areas include improved sensing and assessment. ***FY 2025 Plans:*** - Assess feasibility multi-spectral sensing modalities for improved sensing. - Assess operational potential of multi-spectral sensor designs. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase is due to program initiation.	-	-	6.000
Title: Access in Materials Processing Technology ***Description:*** The Access thrust is exploring novel approaches to modeling and controlling physical environments in various conditions for improved vehicle design. Nonlinear flow conditions impact underwater, hypersonic, and space vehicles and represent some of the oldest unsolved challenges in physics. The ability to model high-Reynolds number classical turbulence, for instance, or turbulent cascades in compressible fluids, is extremely limited. Focus areas include new modeling and simulation tools to understand complex physical conditions, and to aid engineers in design, regardless of scale. ***FY 2025 Plans:*** - Develop new sensing to characterize turbulent conditions. - Explore methods to reduce effects of turbulence and pressure fluctuations. - Develop a modeling and simulation tool to improve performance in turbulent conditions. - Test surface solutions improve performance in turbulent conditions.	-	-	10.000

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Initiate the development of modeling and simulation tools to predict electromagnetic field modulation at large distances. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase is due to program initiation.			
Accomplishments/Planned Programs Subtotals	127.121	150.549	177.523

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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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
MBT-02: *BIOLOGICALLY BASED MATERIALS AND DEVICES*	-	189.055	194.437	160.249	-	160.249	183.018	205.965	217.762	225.514	-	-

A. Mission Description and Budget Item Justification

The Biologically Based Materials and Devices project will leverage the growing application space of the biological sciences for the development of new DoD capabilities to improve the sustainability of warfighters and operational platforms in varied environments. This project will develop solutions for critical resource processing, materials development, threat detection and characterization, environmental remediation, and warfighter resilience to infectious disease and environmental stressors. The materials developed through this project will protect and sustain warfighters and operations in austere environments.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Persistent Terrestrial Living Sensors	15.140	14.384	4.118
Description: The Persistent Terrestrial Living Sensors program is developing engineered biological sensor platforms capable of detecting land-based threats (e.g., chemicals, radiation, and biologics) and relaying unique signals to existing DoD assets. Unlike conventional methods that monitor threats and are limited by sensor energy needs, these biological sensors are effectively energy independent, increasing the potential for wide distribution and environmental robustness. Resulting platforms will enable a variety of remote, persistent monitoring and reporting capabilities to address threat scenarios relevant for national security, including passively detecting chemicals, pathogens, and radiation in various environments. These sensors will provide a flexible suite to complement conventional sensor systems within the DoD. ***FY 2024 Plans:*** - Quantify plant phenotype changes in relevant environments to determine and optimize functional molecular characteristics. - Integrate technical approaches for plant molecular responses to environmental stimuli and functional protein production. - Investigate the potential for additional plant phenotypes as an outcome of protein production. ***FY 2025 Plans:*** - Scale technical approaches for increased usability and reliability of plant phenotypes as an outcome of protein production. - Ensure integration of technical approaches does have intended and desirable effects at scale for relevant use cases. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects completion of foundational research on component technologies for final integration and testing.			
Title: Gene Editor Enabled Diagnostics & Biosurveillance	18.931	12.158	4.000

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: The Gene Editor Enabled Diagnostics & Biosurveillance program aims to develop fieldable, low-cost, programmable and reconfigurable diagnostic capabilities for rapid, specific, sensitive, and multiplexed detection and characterization of biological threats in military and public health scenarios. This program is investigating the design rules for high confidence diagnostic biosurveillance as well as develop agnostic pathogen detection and characterization platform technology for overall threat assessment. These design rules will inform advanced computational and machine learning approaches to scan genome data, algorithmically design probes and guides for optimal assay results, and characterize previously unknown organisms or threats. Additional work will develop portable, cold chain-free platforms that can preserve microbe samples to enable field-forward diagnostics and threat assessments either at the point-of-need or in other areas of interest. ***FY 2024 Plans:*** - Complete assay and component integration into ruggedized field-forward devices. - Evaluate program performance through independent verification and validation (IV&V) studies with government partners. - Assess progress towards manufacturing and distribution goals of devices and disposable components. - Evaluate durability of prototype devices in simulated field conditions. - Initiate technology development to support in-field, agnostic detection, preservation, characterization, and threat assessment of potential pathogens. ***FY 2025 Plans:*** - Demonstrate reconfigurability for the device containing multiplexed diagnostic assays. - Finalize respiratory and sepsis panels for Point of Need (PON) devices. - Initiate regulatory approval procedures for PON device. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects completion of research activities and shift to finalizing device integration and transition.			
Title: Unburdening the Warfighter from Chemical/Biological (CB) Defense	17.558	15.748	6.916
Description: The Unburdening the Warfighter from Chemical/Biological (CB) Defense program aims to increase warfighter survivability by developing improved personal protective equipment (PPE) and medical countermeasure (MCM) technologies to protect against CB threats. Current methods of CB protection require significant logistical burdens, including suits that are bulky and hot, which limit operational effectiveness. These burdens increase if additional levels of protection are required. The Unburdening the Warfighter from CB Defense program will investigate and design novel biological and material approaches that provide rapid protection against multiple CB agents for the warfighter. This research will innovate PPE through the discovery of compounds and lightweight, durable systems designed to capture, neutralize, or repel CB agents. This novel approach will provide almost immediate and lasting protection even in austere operational settings.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
FY 2024 Plans: - Develop clinically relevant animal models to test safety and efficacy of platform technologies. - Scale up protection requirements while maintaining adherence to safety and burden requirements. - Initiate safety and toxicity testing of system components in tissue-specific experimental models. ***FY 2025 Plans:*** - Investigate the protection breadth (e.g., threat agnostic) and adaptability of platform technologies against multiple chemical and biological agents in animal models. - Test the ability to rapidly reconfigure the protective platform against agents (toxins). - Characterize baseline safety and toxicity of platform technology components in animal models. - Investigate chemical agent neutralization characteristics in barrier protection strategies. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects reduction of research activities to conduct system demonstration.			
Title: Bio-Inspired Coastal Defense	12.002	15.322	17.941
Description: The Bio-Inspired Coastal Defense program is developing self-sustaining, hybrid man-made and biological reef structures to fortify and defend DoD bases in low-lying coastal regions. Military assets in these coastal regions are vulnerable to storm surges, wave action, and sea-level rise that cause erosion, degrade infrastructure, and impede operations. Innovative coastal defense will require major technological advances in (1) design, construction, and placement of manufactured reef primers, (2) accelerated recruitment and/or growth of reef species, and (3) sustained, zero-cost natural maintenance and improvement (e.g., increased durability after challenge) of the defensive reef. The primary benefit of such structures is to attenuate wave height during storm events for both established and under construction coastal facilities. ***FY 2024 Plans:*** - Initiate field tests for ecosystem engineers to achieve improved coral and oyster growth. - Deploy test structure in the field and measure wave attenuation. - Continue to optimize temperature tolerance for corals with field trials. - Optimize oyster growth to achieve disease tolerance in the lab and in the field. ***FY 2025 Plans:*** - Evaluate wave attenuation performance in the field. - Optimize temperature tolerance, growth, and disease resistance in the field. - Test larval attractance and algal inhibitors in the field.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Assess biomarker development for coral and oysters. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects a shift from initial laboratory studies to field development and testing for ecosystem engineering technologies.			
Title: Environmental Microbes as a Bioengineering Resource (EMBER) ***Description:*** The Environmental Microbes as a Bioengineering Resource (EMBER) program aims to develop novel, bio-based technologies to overcome key challenges facing domestic supply of Rare Earth Elements (REEs) critical to the U.S. and Department of Defense (DoD). This program will leverage the diversity, specificity, and customizability of environmental microbiology to enable new domestic biomining methods for the separation, purification, and conversion of REEs into manufacturing-ready forms. Advances in this area will deliver capabilities to assure access to DoD-critical materials domestically and in operational settings. ***FY 2024 Plans:*** - Design, build, and test survival and functionality of multiple, engineered environmental microbe strains under biomining-relevant conditions. - Demonstrate the ability to utilize a bio-based approach to bind several individual REEs with high specificity and to recover a single target REE from complex mixtures. - Utilize a biological approach to convert at least two REEs from one chemical form into another at high yield. - Refine bio-based REE purification pipeline to reflect compatibility with domestic source material as well as any containment strategies for living genetically engineered organisms used in the pipeline. ***FY 2025 Plans:*** - Continue to advance engineerable chassis strains that function and grow under the extreme conditions relevant to REE biomining/bioprocessing. - Complete development of assays for REE binding to expand the number of REEs detected and the assay throughput, in support of the REE biomining workflow. - Develop and demonstrate biomining modules for the separation and recovery of multiple individual REEs from mining partner source material. - Continue development of techno-economic analysis and lifecycle analysis that reflects the biomining approach. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects the completion of bench scale studies to prepare for pilot scale demonstrations.	9.200	11.879	9.815
Title: Materiel Protection through Biologics	15.188	17.093	17.835

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*	**Project (Number/Name)** MBT-02 / *BIOLOGICALLY BASED MATERIALS AND DEVICES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: Military infrastructure and systems are expected to function years beyond their original intended lifetime but are subject to degradation by environmental factors. For instance, the formation of biofilms is ubiquitous, corroding and biofouling many military systems, such as aircraft, fuel tanks, ships, medical devices, and filtration systems for water and air. In another example, critical defense assets such as missile silos and naval piers rely on aging concrete infrastructure, ultimately costing the DoD billions of dollars annually to repair and maintain. Building upon technologies investigated under the Bio-Inspired Coastal Defense program, the Materiel Protection through Biologics thrust will develop approaches to sustain military infrastructure and systems by developing biological or bio-inspired technologies to imbue beneficial functions into existing systems, resulting in benefits such as, but not limited to, reducing drag, mitigating corrosion, or repairing concrete. These bio-inspired interventions will protect and sustain equipment and infrastructure, reducing operation costs and increasing service lifetime. ***FY 2024 Plans:*** - Adapt accelerated-aging methods and testbeds to assess the long-term performance of self-repairing concrete. - Develop tools to apply and maintain function of self-repairing treatments to concrete prisms and cylinders. - Integrate diagnostic data from non-destructive evaluation and accelerated aging testbeds into material-scale models of crack healing in concrete. - Generate models that predict assembling biofilms in static conditions using high-throughput testbeds. - Engineer communities that are resilient to disturbances while simultaneously generating target function, such as reduction of corrosion. ***FY 2025 Plans:*** - Engineer and validate that microbial communities and/or community members can produce a target function and resist or recover from disturbances such as low-temperature to high-temperature environmental cycling. - Demonstrate the system can run multiple testbeds in parallel and track biofilm function(s) non-destructively. - Identify strategies to evaluate concrete repair technologies at the component scale (e.g., columns, beams, slabs, or mock craters). - Integrate concrete repair technologies with quality control diagnostics for non-destructive evaluation. - Generate models for predicting efficacy of concrete repair technologies. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects minor program repricing.			
Title: Bioremediation of Battlefields	6.150	12.829	13.457
Description: The Bioremediation of Battlefields effort is addressing the DoD need to stabilize and remediate sites impacted by prior military activities, including contaminated combat zones, defense installations, and test ranges. This will ensure the safety of service members and local communities, and minimize the environmental impact of warfare by developing biological tools			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*	**Project (Number/Name)** MBT-02 / *BIOLOGICALLY BASED MATERIALS AND DEVICES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
that remediate soil contamination. This program will eliminate contaminants, and thus restore habitability, by identifying and optimizing organisms, such as microbes, fungi, and plants, that can detect toxic compounds, mitigate their impact, and report on the state of remediation. Bioremediation of Battlefields will reduce the long-term impacts of military activities and improve the overall environmental health and land use potential for contaminated sites. ***FY 2024 Plans:*** - Characterize biochemically-based approaches to specifically biodegrade soil contaminants. - Establish high-throughput testbeds for studying bioremediation activity in complex soil environments. - Develop and test potential mechanisms for enabling overt signaling of soil contamination state. - Develop potential strategies for ecological containment of the plant and microbial species. ***FY 2025 Plans:*** - Demonstrate integration of the synthetic plant-microbe communities. - Demonstrate bioremediation of the focal soil contaminant(s). - Demonstrate overt signaling to demonstrate remediation of the focal soil contaminant(s). - Demonstrate scalability of the high-throughput plant-microbe testbed platform(s). ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects minor program repricing.			
Title: Biotechnology for Challenging Environments	11.813	14.659	13.270
Description: The Biotechnology for Challenging Environments program is developing novel biological solutions to enable warfighter operations in remote and extreme environmental conditions. As the DoD expands operations into previously inaccessible domains, new and unique logistical constraints imposed by extreme conditions and resource scarcity threaten warfighter and warfighting platform readiness. This program will develop technologies using biological approaches to protect and maintain performance of warfighters and warfighting platforms, such as electronics and infrastructure, from challenging environments. Technology advances developed in this effort will extend mission duration and enhance operational capabilities in emerging domains. ***FY 2024 Plans:*** - Initiate design and engineering of microbes and other biological or bio-inspired components to produce novel materials for capabilities in extreme environments. - Down-select candidate molecules from libraries of biologically sourced or inspired molecules with potential ice modulation activity for DoD applications. - Assess performance of molecules with demonstrated ice modulation properties using a quantitative testbed.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*	**Project (Number/Name)** MBT-02 / *BIOLOGICALLY BASED MATERIALS AND DEVICES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Begin optimizing high performing molecules to enhance material properties and increase performance. ***FY 2025 Plans:*** - Continue molecule engineering activities on best performing molecules to improve activity. - Explore chemical functionalization of molecules for incorporation into different materials and form factors. - Scale-up molecules and materials for prototyping, testing and evaluation. - Initiate safety and toxicity studies of molecules and materials. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects focus on execution of iterative design, build, and test cycles to improve and optimize activity of top performing molecules identified.			
Title: Turning Upcycled Waste into Novel, Sustainable Materials ***Description:*** Currently the DoD relies on critical materials and commodity molecules, such as petroleum-, rubber- and wood-derived products, which are needed to protect and provide mobility to our warfighters in an austere, expeditionary setting. Unfortunately, providing these materials to our warfighters suffers from vulnerabilities such as fragile supply chains, foreign sourcing, or costly shipping to points of need. These critical materials also contribute to DoD waste streams with no further value, while also creating environmental and logistical challenges. To address this, the Turning Upcycled Waste into Novel, Sustainable Materials program will investigate the feasibility of converting abundant DoD waste stream products (e.g., tires, scrap wood, and paper) into durable, and sustainable materials. Approaches will be investigated to develop materials suitable for use in applications ranging from contingency construction materials to commodity molecules. ***FY 2024 Plans:*** - Identify strategies to support programmable culture-based approaches to produce commodity molecules. - Identify experimental approaches to generate datasets for multi-scale, switchable, metabolic models of culture-based biomanufacturing. - Identify approaches to validate and verify biosynthesis optimization. - Initiate research into the pre-processing of wood/paper waste stream feedstocks and synthesis of DoD-relevant materials from those feedstocks. ***FY 2025 Plans:*** - Initiate research on alternative multi-input, multi-output culture-based approaches. - Design testbeds to characterize culture-based production of molecular commodities. - Determine culture types and metabolic pathways required for culture-based commodity production. - Investigate methods to optimize culture-based commodity production, incorporating commercialization and techno-economic analysis.	-	8.332	16.914

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*	**Project (Number/Name)** MBT-02 / *BIOLOGICALLY BASED MATERIALS AND DEVICES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Demonstrate highly efficient production and scalability of DoD-relevant materials from wood waste feedstocks. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects the shift from design to development of multi-input, multi-output commodity chemical production platforms.			
Title: Signal Processing and Communication with Biotechnology ***Description:*** The DoD requires the ability to monitor complex operating environments with sufficient resolution and confidence to inform missions and protect personnel and platforms against various physical and chemical threats. The Signal Processing and Communication with Biotechnology program will develop a new customizable sensing methodology using a novel microbe-based, platform technology capable of detecting a variety of input signals, processing information, and generating multiple output signal types in diverse operational environments. Technology developed in this program will offer insight into signal processing and transmission methodologies with logistical advantages and reliable operability in contested environments. ***FY 2024 Plans:*** - Initiate development of living, microbial sensing devices that respond to multiple input signal types (e.g., chemicals, magnetic fields, light) and produce signals that are detectable by receiver devices. - Assess living microbial sensors for user-defined multi-channel input signal processing, response time, sensitivity, and durability under conditions that mimic operational environments. - Establish speed and accuracy baseline for microbial device design methodology. ***FY 2025 Plans:*** - Initiate pressure-testing of design, build, and test cycle using prescribed parameters and time limitations for additional microbial devices. - Demonstrate increased speed and accuracy of the microbial device design methodology. - Begin to establish theoretical stand-off/remote sensing distances for microbial devices. - Begin testing of methodology and microbial device performance. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects a shift in focus from initial microbial system designs to implementation of pressure tests.	-	9.028	13.348
Title: Strengthening Resilient Emotions and Nimble Cognition Through Engineering Neuroplasticity (STRENGTHEN) ***Description:*** The Strengthening Resilient Emotions and Nimble Cognition Through Engineering Neuroplasticity (STRENGTHEN) program, building upon efforts started under the Human Social Systems program in PE 0601101E, Project CCS-02, aims to overcome the limitations of focusing on descriptions of individual disease effects and suicide risk factors by adopting a transdiagnostic approach that addresses the mechanisms (i.e., predictors or causes) of mental health and wellbeing.	-	10.902	9.500

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*	**Project (Number/Name)** MBT-02 / *BIOLOGICALLY BASED MATERIALS AND DEVICES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
STRENGTHEN will optimize the brain networks essential for Cognitive Flexibility and Emotional Regulation, establishing dose response, time-to-onset, and duration-of-effect curves to quantify the impact of change in Cognitive Flexibility and Emotional Regulation on validated measures of suicidality, behavioral health, and wellbeing within DoD. ***FY 2024 Plans:*** - Develop individualized neurobehavioral response models of Cognitive Flexibility and Emotional Regulation. - Design individualized multimodal multidimensional neuroplastic interventions to optimize Cognitive Flexibility and Emotional Regulation. - Develop suite of interventions to optimize Cognitive Flexibility and Emotional Regulation in populations at low risk, at risk, and at high risk of suicide to maximize well-being and minimize suffering from mental illness, substance abuse, and suicidality. - Commence development of a mechanistic understanding of mental health for transdiagnostic treatment. - Assess and select hybrid interventions designed to increase mental health resiliency. ***FY 2025 Plans:*** - Evaluate impact of hybrid interventions on Cognitive Flexibility and Emotional Regulation. - Refine individualized neurobehavioral response models of Cognitive Flexibility and Emotional Regulation. - Enhance hybrid interventions demonstrated to increase mental health resiliency with additional techniques. - Evaluate impact of enhanced hybrid interventions on Cognitive Flexibility and Emotional Regulation. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects a shift from initial design and development to testing and evaluation.			
Title: Field Forward Biothreat Storage Solutions for Force Protection	-	-	11.179
Description: Warfighters are currently deployed to emerging disease hotspots with increasing pathogen spillovers. Biosurveillance groups tasked with force health protection rely on cold chains and transport media to maintain sample viability for characterization in a laboratory setting, but these methods are unreliable, sometimes inaccessible, or limited in their utility. Building upon technologies investigated under the Gene Editor Enabled Diagnostics & Biosurveillance program, the Field Forward Biothreat Storage Solutions for Force Protection program will offer expanded capabilities to microbial threat characterization by developing systems capable of long-term, cold chain-free storage of microbial samples. Systems that are able to reliably store and retrieve viable microbes over long timescales will ensure that collected samples reach the lab for study in a usable state, allowing the DoD to better leverage its field-forward laboratories to perform pathogenicity assessments for countermeasure development. ***FY 2025 Plans:*** - Acquire microbes necessary to begin testing storage and retrieval methods. - Develop generalizable methods for storing and retrieving multiple types of microbes from different sample types.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*	**Project (Number/Name)** MBT-02 / *BIOLOGICALLY BASED MATERIALS AND DEVICES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Demonstrate ability to store and retrieve multiple microbes without cold chain for at least one week. - Collect relevant samples necessary to inform design specifications for prototype system. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects program initiation.			
Title: Biological Undersea Energy ***Description:*** The Biological Undersea Energy program will aim to develop emerging technologies that ensure the DoD has the capability to maintain a presence in austere oceanic environments to provide advanced knowledge of resources and conditions and achieve desired mission effects. Approaches will be developed that utilize biological processes and products to provide energy for improved endurance and performance capabilities while reducing the reliance on servicing or resupply. ***FY 2025 Plans:*** - Identify and model key biological processes that will enable autonomous remote energy production in oceanic environments. - Develop modeled biological processes into optimized biological systems with improved performance capabilities in a lab setting. - Complete a capability design that describes all components and processes in a brassboard including engineering diagrams, expected performance metrics, and other design considerations. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects program initiation.	-	-	14.456
Title: Environmental Dynamics with Biologically Based Materials and Devices ***Description:*** The Environmental Dynamics with Biologically Based Materials and Devices thrust aims to develop technologies to advance understanding of changing environmental dynamics that result from anthropogenic activities. Understanding the dynamics of physical, complex biological environments in the face of human activity, natural disasters, and severe weather events is a key component of DoD missions. Novel approaches will be developed that utilize biological processes to better understand environmental dynamics in order to exploit changing environments for a DoD strategic advantage, provide solutions to mitigate/ negate environmental damage, and restore operational function to damaged DoD installations at tactical and strategic timescales. ***FY 2025 Plans:*** - Initiate comparison of environments to identify key species for improved environmental resilience and recovery. - Characterize key community species in the environment to understand ecosystem succession and recovery processes in response to environmental dynamics. - Begin investigation of natural vegetation response to relevant DoD activities. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	-	-	7.500

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*	**Project (Number/Name)** MBT-02 / *BIOLOGICALLY BASED MATERIALS AND DEVICES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
The FY 2025 increase reflects program initiation.			
Title: Expanding Human Resiliency ***Description:*** The Expanding Human Resiliency program aims to maximize warfighter resiliency by leveraging the human microbiome to improve physiology. This program will develop new technologies to control and manipulate the microbiome, expanding on current state-of-the-art approaches to have more precise and on-demand control of microbiomes. Technologies in this effort will be developed to elucidate the complex interactions between the microorganisms and their host as well as the interactions between consortia of adapted and evolved microorganisms. Advances in this area will both develop novel technologies to interrogate complex microbial communities in human systems and discover ways to beneficially harness microbiomes to expand warfighter resiliency. ***FY 2024 Plans:*** - Complete independent verification and validation (IV&V) testing to assess efficacy of engineered skin microbial formulations to reduce landings by mosquitoes using a small animal model. - Conduct studies in large animal models to assess microbiome safety, efficacy, and transience needed for regulatory approvals. - Initiate regulatory approval procedures to test microbiome formulations. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects program completion.	13.621	8.074	-
Title: Persistent Aquatic Living Sensors ***Description:*** The Persistent Aquatic Living Sensors program is developing novel capabilities to achieve strategic objectives in operational environments by leveraging chemical solutions and living organisms present in the environment. This effort focuses on characterizing marine biological behavior in response to targets of interest. This program will enable persistent dominance in contested waters and provide the DoD with a toolbox of materials and methods for achieving strategic objectives. Results from this research will enhance future DoD naval operations. ***FY 2024 Plans:*** - Complete development of current system prototypes. - Develop, refine, and scale-up the new materials and system prototypes. - Complete field testing of the materials and system prototypes under real-world conditions with DoD end-users. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects program completion.	18.004	6.466	-
Title: Restoring Cognitive Capability	10.860	10.318	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*	**Project (Number/Name)** MBT-02 / *BIOLOGICALLY BASED MATERIALS AND DEVICES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: The Restoring Cognitive Capability program is developing novel drugs to provide rapid therapy for neuropsychiatric disorders experienced by warfighters and veterans. Active-duty military personnel face increased risk of acute and chronic neuropsychiatric dysfunction, limiting day-to-day function and return to duty. Current therapeutic approaches for many neuropsychiatric disorders (e.g., Post Traumatic Stress Disorder [PTSD], mood disorders, and substance abuse) rely on individual management with integrated psychiatric therapy and medication. However, most interventions approved for use in these conditions lack long-term efficacy, involve a logistical burden of treatment and/or carry a risk of serious adverse side effects. Novel drugs developed under this program will be designed to functionally interact with neuronal receptor subtypes known to play a role in these neuropsychiatric conditions, with the aim of enabling fast-acting and effective alleviation of neuropsychiatric dysfunction with single or minimal doses. ***FY 2024 Plans:*** - Optimize novel compounds for pharmacological properties (adsorption, distribution, metabolism, and excretion (ADME)) and validate with in vivo models. - Perform full dose-response and time-course studies with candidate compounds in vivo. - Confirm mechanism of action in vivo by verifying gene expression and protein biomarkers. - Demonstrate preclinical therapeutic efficacy and lack of adverse effects in vivo. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects program completion.			
Title: Food and Feedstocks on Demand	17.395	9.480	-
Description: The Food and Feedstocks on Demand program is developing biological technologies to support the DoD need to strengthen local resource security for the warfighter. Currently, operators in the field are burdened with transport and disposal of single-use materials. This program is using these impure mixed waste materials as inputs to re-form the molecules for nutrition or other strategic applications. Research in this program will provide a versatile system that delivers food and petroleum/oils/lubricants (POLs) so that warfighters can independently produce material support from waste materials to extend mission duration and/or expand operational flexibility in resource-limited environments. ***FY 2024 Plans:*** - Design and engineer deconstruction methods and waste breakdown systems to align with relevant military scenarios and waste types. - Evaluate modular systems for additional military use cases. - Pressure test robustness and system integration between waste deconstruction platforms and bioreactor systems.			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*	**Project (Number/Name)** MBT-02 / *BIOLOGICALLY BASED MATERIALS AND DEVICES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Provide preliminary analyses that products are within desired specifications. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects program completion.			
Title: Atmospheric Water Extraction (AWE) ***Description:*** The Atmospheric Water Extraction (AWE) program aims to enable water harvesting directly from the atmosphere by leveraging new materials and advanced engineering and manufacturing techniques to alleviate logistical and tactical burdens. Currently, the DoD relies on purification of existing water sources and/or distribution of bottled or treated water to provide the warfighter with sufficient daily hydration. State-of-the-art water-from-air generation systems are not suitable for military applications because the systems do not operate in a range of atmospheric conditions needed by our soldiers, from arid conditions (<40% relative humidity) to extremely humid, and are too energy-intensive (<7 gallons of water output per gallon of fuel). This program will deliver systems with extraordinarily low size, weight, and power (SWaP) characteristics to provide potable water to individual warfighters and expeditionary units and will provide insights into how new materials can help the warfighter overcome existing material challenges. Technologies developed under this program will provide strategic and tactical advantages aligned with the DoD's vision of future combat operations carried out by distributed and self-sustaining forces. ***FY 2024 Plans:*** - Select final scaled sorbent material candidates for integration into device prototype. - Integrate sorbent materials with final components of water extraction device. - Test and evaluate final fabricated components of water extraction device. - Demonstrate final prototype water extraction device under program test conditions. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects program completion.	13.952	13.257	-
Title: Preemptive Expression of Protective Alleles and Response Elements (PREPARE) ***Description:*** The Preemptive Expression of Protective Alleles and Response Elements (PREPARE) program is creating a transient, near immediate prophylaxis and treatment to protect military personnel and civilians against public health and national security threats. Currently, protection against Chemical, Biological, Radiological, and Nuclear (CBRN) threats relies on physical barrier technology. This program includes research to develop novel transient and reversible gene modulator therapies to bolster intrinsic host defenses. Work within this program will provide novel solutions that extend beyond the DoD's capabilities to respond to re-emerging, newly emerging, or engineered threats. ***FY 2024 Plans:*** - Demonstrate the utility of using programmable gene modulators to combat chemical threats in an animal model.	9.241	4.508	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency		Date: March 2024
Appropriation/Budget Activity 0400 / 2	**R-1 Program Element (Number/Name)** PE 0602715E / *MATERIALS AND BIOLOGICAL TECHNOLOGY*	**Project (Number/Name)** MBT-02 / *BIOLOGICALLY BASED MATERIALS AND DEVICES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Demonstrate the use of programmable gene modulators to combat multiple viral threats in small and large animal models of infection. - Finalize formulations to deliver programmable gene modulators to appropriate cells and tissues with high specificity for infectious disease threat exposures in an animal model. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects program completion.			
Accomplishments/Planned Programs Subtotals	189.055	194.437	160.249

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A