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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Defense Advanced Research Projects Agency **Date:** March 2024

Appropriation/Budget Activity 0400: <i>Research, Development, Test & Evaluation, Defense-Wide / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603767E / <i>SENSOR TECHNOLOGY</i>
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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
Total Program Element	-	292.757	358.580	267.961	-	267.961	129.658	159.392	159.875	156.808	-	-
SEN-01: <i>SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY</i>	-	45.681	62.563	66.218	-	66.218	24.812	85.109	89.984	93.187	-	-
SEN-02: <i>SENSORS AND PROCESSING SYSTEMS</i>	-	58.258	62.067	45.208	-	45.208	53.516	74.283	69.891	63.621	-	-
SEN-06: <i>SENSOR TECHNOLOGY</i>	-	188.818	233.950	156.535	-	156.535	51.330	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) address the Advanced Technology Development associated with the Sensor Technology Program focused on sensor efforts that will improve the accuracy and timeliness of our surveillance and targeting systems for improved battlefield awareness, strike capability and battle damage assessment.

The Surveillance and Countermeasures Technology project funds sensor efforts that will improve the accuracy and timeliness of our surveillance and targeting systems for improved battlefield awareness, strike capability, and battle damage assessment. Timely surveillance of enemy territory under all weather conditions is critical to providing our forces with the tactical information needed to succeed in future wars. This operational surveillance capability must continue to perform during enemy efforts to deny and deceive the sensor systems, and operate, at times, in a clandestine manner. This project will exploit recent advances in multispectral target phenomenology, signal processing, low-power high-performance computing, and low-cost microelectronics to develop advanced surveillance and targeting systems. In addition, this project encompasses several advanced technologies related to the development of techniques to counter advanced battlefield threats.

The Sensors and Processing Systems project develops and demonstrates the advanced sensor and processing technologies and systems necessary for Intelligence, Surveillance, and Reconnaissance (ISR) missions. Future battlefields will continue to be populated with targets that use mobility and concealment as key survival tactics, and high-value targets will range from specific individual insurgents and vehicles to groups of individuals and large platforms such as mobile missile launchers and artillery. The Sensors and Processing Systems project is primarily driven by four needs: (a) providing day-night ISR capabilities against the entire range of potential targets; (b) countering camouflage, concealment, and deception of mobile ground targets; (c) detecting and identifying objects of interest/targets across wide geographic areas in near-real-time; and (d) enabling reliable identification, precision fire control tracking, timely engagement, and accurate battle damage assessment of ground targets. The Sensors and Processing Systems project develops and demonstrates technologies and system concepts that combine novel approaches to sensing with emerging sensor technologies and advanced sensor and image processing algorithms, software, and hardware to enable comprehensive knowledge of the battlespace and detection, identification, tracking, engagement, and battle damage assessment for high-value targets in all weather conditions and combat environments.

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Appropriation/Budget Activity 0400: <i>Research, Development, Test & Evaluation, Defense-Wide / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603767E / <i>SENSOR TECHNOLOGY</i>
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B. Program Change Summary (\$ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	308.442	358.580	334.971	-	334.971
Current President's Budget	292.757	358.580	267.961	-	267.961
Total Adjustments	-15.685	0.000	-67.010	-	-67.010
• 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	-7.467	0.000			
• SBIR/STTR Transfer	-8.218	0.000			
• TotalOtherAdjustments	-	-	-67.010	-	-67.010

Change Summary Explanation

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

FY 2024: N/A

FY 2025: Decrease reflects completion of the Fiddler, Moving Target Recognition (MTR) and Thermal Imaging Technology Experiment-Recon (TITE-R) programs, as well as the ramping down of efforts in the Painter and classified programs.

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Defense Advanced Research Projects Agency										Date: March 2024		
Appropriation/Budget Activity 0400 / 3					R-1 Program Element (Number/Name) PE 0603767E / <i>SENSOR TECHNOLOGY</i>				Project (Number/Name) SEN-01 / <i>SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY</i>			
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
SEN-01: <i>SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY</i>	-	45.681	62.563	66.218	-	66.218	24.812	85.109	89.984	93.187	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Surveillance and Countermeasures Technology project funds sensor efforts that will improve the accuracy and timeliness of our surveillance and targeting systems for improved battlefield awareness, strike capability, and battle damage assessment. Timely surveillance of enemy territory under all weather conditions is critical to providing our forces with the tactical information needed to succeed in future wars. This operational surveillance capability must continue to perform during enemy efforts to deny and deceive the sensor systems, and operate, at times, in a clandestine manner. This project will exploit recent advances in multispectral target phenomenology, signal processing, low-power high-performance computing, and low-cost microelectronics to develop advanced surveillance and targeting systems. In addition, this project encompasses several advanced technologies related to the development of techniques to counter advanced battlefield threats.

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

	FY 2023	FY 2024	FY 2025
Title: Ouija	16.550	23.981	26.924
<p>Description: The goal of the Ouija program is to quantify the High Frequency (HF) noise environment in space and improve the characterization of the ionosphere in support of warfighter capabilities. Ouija intends to make ionospheric measurements of unprecedented granularity using ground equipment and satellites in very low earth orbit (VLEO) to improve ionospheric models and better predict long-range HF propagation. Ouija technology will result in improved performance and characterization of radars and communication systems that operate in the HF band. Technology developed under this program will transition to the Services.</p> <p>FY 2024 Plans:</p> <ul style="list-style-type: none"> - Build and launch Ouija satellite. - Conduct test and measurement campaign using satellite and ground assets. - Develop assimilative HF propagation models. - Validate HF modeling using Ouija data. <p>FY 2025 Plans:</p> <ul style="list-style-type: none"> - Conduct on-orbit operations and test demonstration. - Incorporate satellite launch and operations lessons learned to build additional satellites. - Launch additional satellites for further measurement campaigns. - Conduct scaled test between multiple satellites and ground assets. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2023	FY 2024	FY 2025
<ul style="list-style-type: none"> - Validate assimilative HF propagation models using scaled satellite demonstration. <p>FY 2024 to FY 2025 Increase/Decrease Statement: The FY 2025 increase reflects a shift from initial satellite launch to additional launches and data analysis.</p> <p>Title: Dynamic Optimization for Defense of Ground bases with Electromagnetic warfare (DODGEball)</p> <p>Description: The Dynamic Optimization for Defense of Ground bases with Electromagnetic warfare (DODGEball) program will develop algorithms for optimization of non-kinetic countermeasures for efficient and effective resource management in extended campaign warfare. Based on technologies developed in the Strategic Chaos for Planning, Tactics, Experimentation, and Resiliency (SCEPTER) program (budgeted in PE 0603760E, Project CCC-02), DODGEball will optimize heterogeneous applications of electromagnetic warfare for the defense of surface forces and infrastructure for long duration campaigns. Technology developed under this program will transition to the Services.</p> <p>FY 2024 Plans:</p> <ul style="list-style-type: none"> - Analyze Government-furnished information on threat characteristics and operational scenarios. - Develop initial multi-objective optimization algorithms for long duration engagements. <p>FY 2025 Plans:</p> <ul style="list-style-type: none"> - Develop simulation environment to evaluate optimization, countermeasures, and feedback. - Refine initial optimization algorithms for efficient resource management including countermeasure and feedback parameters. - Evaluate non-kinetic countermeasure effectiveness within Government hardware-in-the-loop laboratory. - Iterate subsystem designs based on laboratory and modeling evaluations. - Develop initial feedback techniques, hardware, and models. - Begin combined evaluation of optimization algorithms integrated with countermeasure and feedback models in a realistic simulation environment. <p>FY 2024 to FY 2025 Increase/Decrease Statement: The FY 2025 increase reflects a shift from model development to laboratory testing and demonstration.</p>		-	6.000	28.000
<p>Title: Awareness in Surveillance and Countermeasures Technology</p> <p>Description: The Awareness in Surveillance and Countermeasures Technology thrust will design and demonstrate advanced sensing systems and countermeasure technologies that provide novel capabilities to inform unique future capabilities and expand capabilities into new areas of operation. Efforts will emphasize improvements to size, weight and performance to extend endurance, advance autonomous operations, and reduce costs to maximize system coverage and provide operational capability. Challenges that will be overcome include extended operations without the need for supporting infrastructure, continued operations in harsh physical environments, and extended persistent operations in contested environments.</p>		-	-	11.294

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2023	FY 2024	FY 2025
<p><i>FY 2025 Plans:</i></p> <ul style="list-style-type: none"> - Conduct a feasibility analysis for affordable, distributed cislunar spacecraft orbital mobility concepts. - Conduct a conceptual design review for an affordable cislunar spacecraft. - Conduct prototype testing of critical sub-systems for an affordable cislunar spacecraft. <p><i>FY 2024 to FY 2025 Increase/Decrease Statement:</i> The FY 2025 increase reflects program initiation.</p>				
<p><i>Title:</i> Fiddler</p> <p><i>Description:</i> The Fiddler program seeks to train an artificial intelligence (AI) algorithm to synthesize artificial Synthetic Aperture Radar (SAR) images at any arbitrary look angle, frequency, and polarization based on a few examples of real images. These artificial images will be used to train and improve the performance of Automatic Target Recognition (ATR) algorithms. This capability will allow the government to collect a small amount of SAR imagery on a desired target and then rapidly develop new SAR-based ATR algorithms which are effective at detecting that target. Technology developed under this program will transition to the Services.</p> <p><i>FY 2024 Plans:</i></p> <ul style="list-style-type: none"> - Demonstrate that the baseline software-generated images can effectively train an ATR algorithm over a wide range of viewing angles. - Demonstrate that the baseline software can meet the specified time requirements for generating new images. - Conduct laboratory testing of the baseline software. - Evaluate the baseline software to demonstrate that it can successfully create synthetic SAR imagery for a wide range of viewing angles. - Implement algorithm improvements to reduce the number of training samples required. <p><i>FY 2024 to FY 2025 Increase/Decrease Statement:</i> The FY 2025 decrease reflects program completion.</p>		8.700	17.935	-
<p><i>Title:</i> Moving Target Recognition (MTR)</p> <p><i>Description:</i> The Moving Target Recognition (MTR) program seeks to enable the use of synthetic aperture radar (SAR) sensors to detect, track, image, and automatically recognize moving ground targets within an area of interest. SAR sensors provide the capability to detect and identify high-value targets in all weather conditions but only when the targets are stationary due to limitations in traditional SAR processing. Ground moving target indicator (GMTI) radars are capable of detecting and tracking moving targets, but they cannot form recognizable images of targets. MTR will overcome the limitations of traditional SAR and improves the operational utility of widely deployed SAR sensors on many different types of platforms. The recognition capability</p>		13.372	14.647	-

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2023	FY 2024	FY 2025
<p>enables new concepts of operation for maintaining persistent custody of high-value targets on the move. Unlike GMTI, which loses custody if the track is broken due to terrain or other factors, MTR-enabled SAR sensors are able to tolerate coverage gaps by reacquiring and reestablishing identification of the moving targets. Technology developed under MTR will transition to the Services.</p> <p>FY 2024 Plans:</p> <ul style="list-style-type: none"> - Continue to develop and mature moving target Automatic Target Recognition (ATR) algorithms and characterize their performance using ground-truth data. - Tailor the moving target imaging algorithms to create optimal inputs to the ATR algorithms. - Perform independent verification and validation of ATR algorithm performance. - Transition the MTR software and algorithms to the transition partners. <p>FY 2024 to FY 2025 Increase/Decrease Statement: The FY 2025 decrease reflects program completion.</p>			
<p>Title: All Source Combat Operations and Targeting (ASCOT)</p> <p>Description: The All Source Combat Operations and Targeting (ASCOT) program allowed maritime platforms to maintain robust battlespace awareness and survivability by combining data and coordinating operations using all available sensors. The program created methods for optimal balancing of battlespace awareness and survivability by leveraging existing networked sensors and local platform sensors. Key attributes of this program were survivability, information latency, reliability, and endurance. Demonstrations on relevant platforms in relevant environments were used to validate the technology. Technologies from this program transitioned to the Navy.</p>	7.059	-	-
Accomplishments/Planned Programs Subtotals	45.681	62.563	66.218

<p>C. Other Program Funding Summary (\$ in Millions) N/A</p> <p>Remarks</p> <p>D. Acquisition Strategy N/A</p>

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Appropriation/Budget Activity 0400 / 3					R-1 Program Element (Number/Name) PE 0603767E / <i>SENSOR TECHNOLOGY</i>				Project (Number/Name) SEN-02 / <i>SENSORS AND PROCESSING SYSTEMS</i>			
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
SEN-02: <i>SENSORS AND PROCESSING SYSTEMS</i>	-	58.258	62.067	45.208	-	45.208	53.516	74.283	69.891	63.621	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Sensors and Processing Systems project develops and demonstrates the advanced sensor and processing technologies and systems necessary for Intelligence, Surveillance, and Reconnaissance (ISR) missions. Future battlefields will continue to be populated with targets that use mobility and concealment as key survival tactics, and high-value targets will range from specific individual insurgents and vehicles to groups of individuals and large platforms such as mobile missile launchers and artillery. The Sensors and Processing Systems project is primarily driven by four needs: (a) providing day-night ISR capabilities against the entire range of potential targets; (b) countering camouflage, concealment, and deception of mobile ground targets; (c) detecting and identifying objects of interest/targets across wide geographic areas in near-real-time; and (d) enabling reliable identification, precision fire control tracking, timely engagement, and accurate battle damage assessment of ground targets. The Sensors and Processing Systems project develops and demonstrates technologies and system concepts that combine novel approaches to sensing with emerging sensor technologies and advanced sensor and image processing algorithms, software, and hardware to enable comprehensive knowledge of the battlespace and detection, identification, tracking, engagement, and battle damage assessment for high-value targets in all weather conditions and combat environments.

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

	FY 2023	FY 2024	FY 2025
Title: Painter	21.097	25.562	15.524
<p>Description: The Painter program seeks to create revolutionary advancements in laser technologies for future active optical systems. Painter will translate efficiency benefits from critical laser components into compact optical sources. The objective of Painter is to simultaneously increase the power and decrease the size of laser sources compared to state of the art. Aggressive packaging objectives will be met by overcoming the thermal management challenges of state-of-the-art lasers. Painter development is guided and constrained by spectral properties required to support multiple mission applications. Technologies from Painter will transition to the Services.</p> <p>FY 2024 Plans:</p> <ul style="list-style-type: none"> - Conduct critical design review for Painter laser technology. - Complete construction of laboratory-based Painter laser. - Create Painter laser technology breadboard demonstration system. - Evaluate breadboard and rack-mounted Painter hardware in lab and operationally relevant environments. <p>FY 2025 Plans:</p> <ul style="list-style-type: none"> - Conduct critical design review of brassboard Painter demonstration system. - Demonstrate breadboard Painter system performance against operational scenarios in an operationally relevant environment. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2023	FY 2024	FY 2025
<ul style="list-style-type: none"> - Build Painter demonstration lasers and conduct field testing. <p><i>FY 2024 to FY 2025 Increase/Decrease Statement:</i> The FY 2025 decrease reflects a shift from component design and construction to system demonstration.</p>				
<p><i>Title:</i> Distributed Radar Image Formation Technology (DRIFT)</p> <p><i>Description:</i> Based on recent developments in small synthetic aperture radar (SAR) satellites in commercial industry, there are new opportunities to experiment with novel SAR-related concepts. The goal of the Distributed Radar Image Formation Technology (DRIFT) program is to demonstrate advanced capabilities enabled by a cluster of SAR satellites flown in formation. DRIFT seeks to acquire data from SAR satellites flown in formation and to demonstrate novel processing algorithms on this data. This will expand the utility of small SAR satellites, including commercial satellites, for military applications. Technology developed under this program will transition to the Services.</p> <p><i>FY 2024 Plans:</i></p> <ul style="list-style-type: none"> - Perform on-orbit data collection to demonstrate formation flying and joint radar operation. - Test and validate performance of DRIFT algorithms using real data from on-orbit collections. - Begin to optimize algorithms and software to run on tactically relevant timescales. <p><i>FY 2025 Plans:</i></p> <ul style="list-style-type: none"> - Further optimize algorithms and software using SAR data collected on-orbit. - Finalize tactical-relevant software framework. - Demonstrate tactical use-case scenarios for DoD applications. <p><i>FY 2024 to FY 2025 Increase/Decrease Statement:</i> The FY 2025 decrease reflects a shift from data collection and initial validation toward tactical demonstrations.</p>		7.054	12.977	7.049
<p><i>Title:</i> Cancun</p> <p><i>Description:</i> The Cancun program will create distributable nodes to measure the radio high frequency (HF) environment for improved war fighter situational awareness. Cancun will enable cost-effective wide-area deployment of low size, weight, power, and cost (SWaP-C) nodes. Cancun will also develop the command and control (C2) network and planning tools required to address the challenge of coordinating large numbers of Cancun nodes deployed over distances of well over 1000 kilometers. The Cancun nodes will measure the state of the ionosphere using a sounding function, as well as record and relay portions of the HF radio band for analysis. The mission planning tool will be developed with war fighter input to optimize functionality. Technologies developed under the Cancun program will transition to the Services.</p> <p><i>FY 2024 Plans:</i></p>		6.500	15.447	22.635

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2023	FY 2024	FY 2025
<ul style="list-style-type: none"> - Build and deliver Cancun hardware nodes and functional software. - Integrate the hardware and software for fully functional Cancun nodes. - Design, build, and deliver Cancun C2 software. - Field test integrated Cancun nodes. <p>FY 2025 Plans:</p> <ul style="list-style-type: none"> - Integrate field test results to develop initial mission planning tools. - Refine Cancun hardware nodes and software based on field test results. - Refine Cancun command and control software based on field test results. - Develop new algorithms and functionality for mission planning tools. - Purchase hardware and scale node production for follow-on field tests. <p>FY 2024 to FY 2025 Increase/Decrease Statement: The FY 2025 increase reflects the shift from designing and building to scaling hardware for larger field tests.</p>				
<p>Title: Thermal Imaging Technology Experiment-Recon (TITE-R)</p> <p>Description: The Thermal Imaging Technology Experiment-Recon (TITE-R) program developing and demonstrating complimentary sensing modalities, advanced processing, and low size, weight, and power which will more closely represent an objective capability. TITE-R is developing sensors and software automation capable of supporting future operations implemented on small (< 250 kg) satellites. TITE-R is also developing mission software to support automated on-board processing and simplified operator tasking. TITE-R aims to rapidly develop and test early-to-space prototype system payloads to be made available to transition partners to integrate with space vehicles and conduct experimentation. Technology developed by this program will transition to the Services and other government agencies.</p> <p>FY 2024 Plans:</p> <ul style="list-style-type: none"> - Build, deliver and test payloads. - Complete transition of integrated software and hardware capability to transition partners. <p>FY 2024 to FY 2025 Increase/Decrease Statement: The FY 2025 decrease reflects program completion.</p>		14.190	8.081	-
<p>Title: Coho</p> <p>Description: The Coho program developed advanced signal processing technologies and techniques for future Radio Frequency (RF) systems. These systems created an asymmetric advantage for tactical operations in anti-access/area-denial environments by extending the real-time operating bandwidth of tactical signal processing, underpinning the ability of U.S. and Allied Forces to accurately orient and beneficially maneuver in the electromagnetic spectrum. Coho provided ultra-wideband RF signal detection</p>		9.417	-	-

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2023	FY 2024	FY 2025
and recognition capabilities in a form factor suitable for tactical platforms. Coho sought to provide capabilities for multiple mission areas. These capabilities included (1) surveillance: combining wide operating bandwidth with noise isolation for background electromagnetic search in the low signal to noise ratio environment, (2) filtering: isolating signals based on modulation features to process signals in the presence of co-channel interference, and (3) localization: supporting low-latency execution of multi-aperture processing for discrimination of signals based on angle of bearing. Technology from Coho transitioned to the Services.			
Accomplishments/Planned Programs Subtotals	58.258	62.067	45.208

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
SEN-06: <i>SENSOR TECHNOLOGY</i>	-	188.818	233.950	156.535	-	156.535	51.330	0.000	0.000	0.000	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project funds classified DARPA programs that are reported in accordance with Title 10, United States Code, Section 119(a)(1) or its successor.

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

	FY 2023	FY 2024	FY 2025
<i>Title:</i> Classified DARPA Program	188.818	233.950	156.535
<i>Description:</i> This project funds Classified DARPA Programs. Details of this submission are classified.			
<i>FY 2024 Plans:</i> Details will be provided under separate cover.			
<i>FY 2025 Plans:</i> Details will be provided under separate cover.			
<i>FY 2024 to FY 2025 Increase/Decrease Statement:</i> Details will be provided under separate cover.			
Accomplishments/Planned Programs Subtotals	188.818	233.950	156.535

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

N/A

Remarks

D. Acquisition Strategy

N/A