Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Defense Advanced Research Projects Agency	Date: May 2021
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	-	158.040	190.220	294.792	-	294.792	-	-	-	-	-	-
SEN-01: *SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY*	-	24.413	28.281	36.785	-	36.785	-	-	-	-	-	-
SEN-02: *SENSORS AND PROCESSING SYSTEMS*	-	47.350	64.414	84.248	-	84.248	-	-	-	-	-	-
SEN-06: *SENSOR TECHNOLOGY*	-	86.277	97.525	173.759	-	173.759	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The Sensor Technology program element is budgeted in the Advanced Technology Development Budget Activity because it 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.

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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Defense Advanced Research Projects Agency	Date: May 2021
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603767E *I SENSOR TECHNOLOGY*

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	158.903	200.220	189.258	-	189.258
Current President's Budget	158.040	190.220	294.792	-	294.792
Total Adjustments	-0.863	-10.000	105.534	-	105.534
• Congressional General Reductions	0.000	-10.000			
• 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	6.752	0.000			
• SBIR/STTR Transfer	-7.615	0.000			
• TotalOtherAdjustments	-	-	105.534	-	105.534

Change Summary Explanation

FY 2020: Decrease reflects the SBIR/STTR transfer offset by reprogrammings.

FY 2021: Decrease reflects congressional adjustments.

FY 2022: Increase reflects initiation of the Painter program, as well as, increased scope of classified programs.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency			Date: May 2021
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603767E / *SENSOR TECHNOLOGY*	Project (Number/Name) SEN-01 / *SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
SEN-01: *SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY*	-	24.413	28.281	36.785	-	36.785	-	-	-	-	-	-
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 2020	FY 2021	FY 2022
Title: All Source Combat Operations and Targeting (ASCOT)	9.943	12.856	13.300

Description: The All Source Combat Operations and Targeting (ASCOT) program will allow maritime platforms to maintain robust battlespace awareness and survivability by combining data and coordinating operations using all available sensors. The program will create methods for optimal balancing of battlespace awareness and survivability by leveraging existing networked sensors and local platform sensors. The program builds upon technology developed as a part of the Resilient Synchronized Planning and Assessment Contested Environment (RSPACE) program, budgeted in PE 0603766E/Project NET-01. Key attributes of this program are survivability, information latency, reliability, and endurance. Demonstrations on relevant platforms in relevant environments will be used to validate the technology. Technologies from this program will transition to the Services.

FY 2021 Plans:
- Conduct field testing with prototype payload.
- Conduct performance review of payload design and sensor fusion/data analysis tools.
- Initiate development of full payload and advanced targeting architecture.
- Conduct initial sensor fusion and data analysis tests in support of an at-sea demonstration.

FY 2022 Plans:
- Complete development of final payload and advanced targeting architecture.
- Conduct performance evaluation and flight testing with final payload.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-01 / *SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Perform sensor fusion, data analysis, and system integration tests in support of an at-sea demonstration. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 increase reflects the movement from development and integration activities to system testing.			
Title: Aerial Dragnet ***Description:*** Aerial Dragnet seeks to detect multiple small Unmanned Aerial Systems (UAS) in complex and/or urban terrain before they are within Line-Of-Sight (LOS) of friendly assets. Unlike traditional air targets, small UASs pose a special threat in urban terrain for several reasons: they can fly at low altitudes between buildings, they are small making them difficult to sense, and they move at slow speeds making them difficult to differentiate from other moving objects. Moreover, the development of small UASs is driven by commercial technologies, which make them rapidly adaptable and very easy to use. Building upon research conducted in the System of Systems Integration Technology and Experimentation (SoSITE) program (budgeted in PE 0603766E, Project NET-01), Aerial Dragnet will perform surveillance using an architecture consisting of networked sensor payloads deployed on buildings, masts and aerial platforms. The ability to see over and into urban terrain allows Aerial Dragnet to detect, track, and classify UAS incursions rapidly, thus enabling multiple defeat options. Aerial Dragnet sensor payloads are low-cost and comprised of signal processing software, sensor hardware, and networking for distributed, autonomous operation. The system will be scalable to provide cost-effective surveillance coverage from neighborhood to city-sized areas. Aerial Dragnet technologies are expected to transition to the Army, Marine Corps, and Department of State. ***FY 2021 Plans:*** - Develop and test new and enhanced sensor payloads that complement the current sensor suite, building from experience gained during FY 2020 large urban experiment. ***FY 2022 Plans:*** - Evaluate system performance, mission planning and modeling tools of the sensors in a persistent deployment (more than 30 days) within a dense urban environment. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects a shift from development and testing of new sensors to evaluation of overall system performance.	7.125	3.847	3.568
Title: Shosty ***Description:*** Shosty seeks to develop and demonstrate enhanced capabilities for high frequency (HF) over-the-horizon-radar (OTHR) systems. This program will develop techniques to characterize distributed skywave HF radar propagation channels and measure radar backscatter from the surface. System signal processing, modeling, analysis, and over-the-air experimentation will be conducted to assess performance. Technologies developed under the Shosty program will transition to the Services.	7.345	7.078	6.055

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-01 / *SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 2021 Plans: - Design and procure multi-site receive system capable of handling advanced waveform design. - Develop signal processing algorithms for coordinated, multi-site receive system. - Perform end-to-end multi-site, multi-static over-the-horizon radar demonstration. ***FY 2022 Plans:*** - Update algorithms based on testing and needs of identified transition partners, and verify with modeling and simulation. - Perform end-to-end multi-site, multi-static over-the-horizon radar demonstration incorporating advanced waveforms. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects a shift from algorithm development to testing of over-the-horizon radar.			
Title: Moving Target Recognition (MTR) ***Description:*** Based on technologies developed under the Automatic Target Recognition (ATR) Technology program (previously budgeted in 0603767E, SEN-02), 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 improve the operational utility of widely deployed SAR sensors on many different types of platforms. The recognition capability will enable 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 will be able to tolerate coverage gaps by reacquiring and reestablishing identification of the moving targets. Technology developed under MTR will transition to the Services. ***FY 2021 Plans:*** - Modify airborne research radar hardware in preparation for data collect experiments. - Develop software to enable novel MTR collection techniques in preparation for data collect experiments. ***FY 2022 Plans:*** - Develop novel MTR algorithms for ground moving target detection, tracking, and imaging with SAR sensors. - Plan and conduct airborne data collect experiments involving ground-truthed moving military vehicles to test the MTR algorithms and collection techniques. - Analyze MTR algorithm performance using the airborne experiment data.	-	4.500	13.862

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Determine system requirements for objective SAR sensors to support the MTR algorithms. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 increase reflects a shift from data collection planning to algorithm creation and airborne data collection.			
Accomplishments/Planned Programs Subtotals	24.413	28.281	36.785

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency			Date: May 2021
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603767E / *SENSOR TECHNOLOGY*	Project (Number/Name) SEN-02 / *SENSORS AND PROCESSING SYSTEMS*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
SEN-02: *SENSORS AND PROCESSING SYSTEMS*	-	47.350	64.414	84.248	-	84.248	-	-	-	-	-	-
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 2020	FY 2021	FY 2022
Title: Military Tactical Means (MTM)	13.806	28.335	23.718
Description: The Military Tactical Means (MTM) program is developing sensors and exploitation techniques capable of performing wide-area search to detect high-value targets in order to task engagement systems to close effects-chains. Finding and prosecuting targets with distributed effects-chains requires the ability to detect, track, and maintain custody of targets across sensors with different modalities residing in various domains. This program will examine both the sensors and the exploitation needed to perform this wide-area search for missions in denied territories and maintain positive chain of custody hand-offs to one or more targeting sensors. The sensors developed under this program will concentrate on sensor modalities that are mostly geometry-invariant and have the potential to be used in highly proliferated systems, such as small satellite constellations and small terrestrial platforms (e.g., class-I or II unmanned aerial system). The exploitation portion of this program will develop algorithms to ensure consistency when passing chain of custody between sensors in different domains where there is the possibility of different sensing modalities and will also be designed to increase confidence and accuracy as targets are passed between sensors. Technology developed by this program will transition to the Services and other government agencies.			
FY 2021 Plans: - Complete development of initial multi-mode exploitation algorithms. - Complete multi-mode sensor module design based on size, weight, power, and modality requirements.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-02 / *SENSORS AND PROCESSING SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Conduct preliminary and critical design reviews of the sensor modules to determine viability of the designs. - Begin building sensor modules and integration efforts for brassboard demonstration. - Continue development of exploitation algorithms to further refine the effectiveness of the modalities. ***FY 2022 Plans:*** - Integrate algorithms and sensors compatible with field experimentation. - Execute experiments to measure sensor and algorithm performance and effectiveness. - Evaluate both sensor and processor compatibility for objective platform size, weight, and power (SWAP). - Continue modeling and simulation of MTM capabilities against real world use cases developed jointly with operational stakeholders. - Perform objective system modeling to validate performance and effectiveness in military utilization. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects a shift from module design and development to system integration.			
Title: Dynamically Composed RF Systems	7.960	13.158	6.900
Description: Dominance of the Radio Frequency (RF) spectrum is critical to successful U.S. military operations. Radar systems, electronic warfare (EW) systems, and communication systems require custom software and hardware that is costly and time-consuming to build and integrate onto platforms. The Dynamically Composed RF Systems program addresses these challenges by developing adaptive, converged RF array systems. This enables enhanced operational capability by dynamically adapting the system for tasks to support radar, communications, and EW in a converged manner. This program will design and develop: (1) a modular architecture for collaborative, agile RF systems; (2) advanced techniques for RF apertures and airframe integration and the associated wide-band agile electronics to support converged missions over those apertures; (3) a heterogeneous signal processing complex implementing hardware-agnostic RF operating modes (the RF Virtual Machine); (4) software tools for the control, coordination, and scheduling of RF functions and payloads at the element level to maximize overall task performance (a System and Sensor Resource Manager (SSRM)). This capability can be adapted to address diverse missions. Technology developed under this program will transition to the Services. ***FY 2021 Plans:*** - Conduct laboratory testing of the SSRM installed on the two payloads to demonstrate the SSRM's ability to control the two payloads in concert. - Install SSRM and a second payload on the testbed aircraft. ***FY 2022 Plans:*** - Conduct ground testing of SSRM on testbed aircraft and demonstrate ability to control both payloads on the ground.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-02 / *SENSORS AND PROCESSING SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
- Conduct flight tests of the SSRM controlling two third-party payloads and demonstrate ability to control those payloads in flight. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 decrease reflects the transition from development and testing of the SSRM software and integration of the payloads to a focus on flight demonstration.			
Title: Coho ***Description:*** The Coho program will develop advanced signal processing technologies and techniques for future Radio Frequency (RF) systems. These systems will create 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. Based on technologies developed under the All-Signal Tactical Real-time Analyzer (ASTRAL) program, budgeted in this PE and Project, the objective of Coho is to provide ultra wide-band RF signal detection and recognition capabilities in a form factor suitable for tactical platforms. Coho seeks to provide capabilities for multiple mission areas. These capabilities include (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 will transition to the Services. ***FY 2021 Plans:*** - Define concept of employment for Coho signal detection and recognition. - Begin development of algorithms for signal recognition. - Simulate performance of Coho in the contested electromagnetic environment. ***FY 2022 Plans:*** - Conduct Conceptual Design Review for the Coho system. - Continue development of algorithms for signal recognition. - Develop brassboard Coho system. - Conduct initial testing of the brassboard system to determine efficacy of the technology. - Conduct Critical Design Review for final prototype system. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 increase reflects program brassboard hardware instantiation and testing.	-	11.985	16.534
Title: Thermal Imaging Technology Experiment-Recon (TITE-R)* ***Description:*** *Formerly Military Tactical Means (MTM) Demo	-	10.936	21.742

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-02 / *SENSORS AND PROCESSING SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
The Thermal Imaging Technology Experiment-Recon (TITE-R) leverages and expands upon the successful technology demonstrations associated with Small Satellite Sensors program, budgeted in this PE/Project. TITE-R will develop and demonstrate complimentary sensing modalities, advanced processing, and low swap cross and downlinks which will more closely represent an objective tactical capability. TITE-R will develop sensors and software automation capable of supporting future tactical Intelligence, Surveillance, and Reconnaissance (ISR) operations implemented on small (< 250 kg) satellites. This scalable multi-modal ISR approach will allow tactical users to rapidly characterize, quantify and report battlespace environments and conditions. TITE-R will also expand upon the utility of small satellites to enable access to the world-wide data necessary to optimize machine learning (ML) automation. In addition, this world-wide access will enable discovery of new sources of false positives which is a key factor in using proliferated Low Orbit Earth (pLOE) to support tactical operations. Such broad accesses are not possible through traditional R&D airborne testing. TITE-R aims to rapidly develop and demonstrate an early-to-space prototype system, the data from which will be used to optimize signature discovery and target discrimination algorithms. Technology developed by this program will transition to the Services and other government agencies. ***FY 2021 Plans:*** - Develop concepts of operation with military partners. - Develop demonstration plans for tactical scenarios. ***FY 2022 Plans:*** - Complete payload design and build. - Conduct system-level preliminary design review (PDR) and critical design review (CDR). - Complete payload space qualification and testing of all hardware components. - Implement a baseline set of mission software demonstrating mission feasibility. - Establish a software integration laboratory consisting of an integrated framework of hardware emulators to enable testing and evaluation. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 increase reflects a shift from design and planning activities to prototype development, validation, and experimentation efforts.			
Title: Painter	-	-	15.354
Description: The Painter program seeks to create revolutionary advancements in laser technologies for future active optical systems. Building on technologies developed in the Efficient Ultra-Compact Laser Integrated Devices (EUCLID) program, previously budgeted in PE 0603739E, Project MT-15, 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			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
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. ***FY 2022 Plans:*** - Conduct application studies for Painter-enabled active optical systems. - Perform architectural studies for critical Painter components and sub-systems. - Model Painter effectiveness over multiple concepts of employment. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The FY 2022 increase reflects program initiation.			
Title: Small Satellite Sensors ***Description:*** The Small Satellite Sensors program developed and space-qualified an Electro-Optical Infrared (EO/IR) sensor and an inter-satellite communications approach establishing feasibility for new DoD tactical capabilities to be implemented on small (< 100 kg) satellites. Experimental payloads were flown on small satellites, and data was collected to validate new operational concepts. Small satellites provide a low-cost and quick-turnaround capability for testing new technologies and experimental payloads. Operationally, small and low-cost satellites enable the deployment of larger constellations, which can provide greater coverage, persistence, and survivability compared to a small number of more expensive satellites, as well as the possibility for launch-on-demand. This program successfully leveraged the rapid progress being made by the commercial sector on small satellite bus technology, as well as investments being made by DoD and industry on low-cost launch and launch-on-demand capabilities for small satellites. The program focused on developing, demonstrating, and validating key payload technologies needed by DoD that are not currently being developed for commercial space applications. Technologies developed under this program transitioned to the Services.	12.848	-	-
Title: All-Signal Tactical Real-Time Analyzer (ASTRAL) ***Description:*** The All-Signal Tactical Real-time Analyzer (ASTRAL) program developed and demonstrated a system for radio frequency and optical electromagnetic signal surveillance and environment understanding. Built on technologies explored under the Dynamically Composed RF Systems program, also budgeted in this PE/Project, the objective of ASTRAL was to provide a factor of at least 1,000 times improvement over current signal awareness processing speed over broad spectral coverage. The program used technology that supports a development path leading to a mobile, tactical capability. The development objectives of the ASTRAL program were to (1) develop a hybrid processor that provides real-time processing of the most challenging Low-Probability-of-Intercept (LPI) threat signals across a wide bandwidth, and (2) identify exploitation algorithms for military applications that are well-suited to this type of hybrid processor. Several strategic and tactical spectrum awareness applications	3.832	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-02 / *SENSORS AND PROCESSING SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
that were addressed include, but are not limited to: (a) real-time exploitation of optical communications, (b) city-wide wireless device geo-location, (c) broadband LPI radar warning, and (d) theater-wide spread-spectrum LPI radio geo-location. ASTRAL transitioned to the Navy.			
Title: Collection and Monitoring via Planning for Active Situational Scenarios (COMPASS) ***Description:*** The goal of the Collection and Monitoring via Planning for Active Situational Scenarios (COMPASS) program was to build decision aids for gray zone scenarios, where adversaries attempt to manipulate a U.S.-allied nation through the use of both kinetic and non-kinetic means. Based on research performed under the Resilient Synchronized Planning and Assessment Contested Environment (RSPACE) program, budgeted in PE 0603766E, Project NET-01, the purpose of the COMPASS program was to reduce ambiguity and reveal intent of gray zone actors who use techniques such as misinformation and intimidation to destabilize host nations and possibly produce advantageous conditions for military engagements. COMPASS produced tools to automate gray zone information operations and help U.S. forces adapt to changing conditions and adversary responses. Instead of relying on passive collection of sensory data, COMPASS employed active sensing and recommended actions that U.S. Forces and allied partners can take to stimulate the environment and elicit a response from the adversary that reveals its strategies. To achieve this goal, COMPASS sought to build and demonstrate tools to: 1) discover the structure of the operating environment that includes the goals and objectives of the adversary as it engages in illicit and subversive activities, 2) develop models that capture the dynamics of the situations including the actors, relationships, timings, and dependencies of the adversary campaigns, and 3) integrate the various algorithms into a comprehensive gaming architecture that allows operators to assess the decision space, recommend sensing actions, and monitor progress towards reducing the ambiguity of the operating environment and suggest adjustments. Models and a planning technology prototype were provided to INDOPACOM.	5.278	-	-
Title: Seeker Cost Transformation (SECTR) ***Description:*** The Seeker Cost Transformation (SECTR) program developed novel weapon terminal sensing and guidance technologies and systems for air-launched and air-delivered weapons that can: (1) find and acquire fixed and moving targets with only minimal external support, (2) achieve high navigation accuracy in a GPS-denied environment, and (3) be very small in size and weight and potentially low cost. SECTR-developed systems and technologies are small size, weight and power (SWaP), low recurring cost, and applicable to a wide range of weapons and missions, such as small unit lethality, suppression of enemy air defenses, precision strike, and strike of time-sensitive targets. Hardware technology leveraged passive Electro-Optical and Infrared (EO/IR) sensors, which have evolved into very small and inexpensive devices in the commercial market, and a reconfigurable processing architecture. SECTR also developed a Government-owned open system architecture for the seeker with standardized interfaces between components (both hardware and software). The technical approach to target recognition started from "deep learning" and machine vision algorithms pioneered for facial recognition and the identification of critical image features. Technologies developed under this program transitioned to the Services.	3.626	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency		Date: May 2021
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-02 / *SENSORS AND PROCESSING SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Accomplishments/Planned Programs Subtotals	47.350	64.414	84.248

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Defense Advanced Research Projects Agency											Date: May 2021	
Appropriation/Budget Activity 0400 / 3					R-1 Program Element (Number/Name) PE 0603767E / *SENSOR TECHNOLOGY*				Project (Number/Name) SEN-06 / *SENSOR TECHNOLOGY*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
SEN-06: *SENSOR TECHNOLOGY*	-	86.277	97.525	173.759	-	173.759	-	-	-	-	-	-
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) in the Special Access Program Annual Report to Congress.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Classified DARPA Program	86.277	97.525	173.759
Description: This project funds Classified DARPA Programs. Details of this submission are classified. ***FY 2021 Plans:*** Details will be provided under separate cover. ***FY 2022 Plans:*** Details will be provided under separate cover. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Details will be provided under separate cover.			
Accomplishments/Planned Programs Subtotals	86.277	97.525	173.759

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A