Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Defense Advanced Research Projects Agency											Date: February 2016	
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 2015**	**FY 2016**	**FY 2017 Base**	**FY 2017 OCO**	**FY 2017 Total**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**Cost To Complete**	**Total Cost**
Total Program Element	-	283.905	240.127	241.288	-	241.288	207.325	197.278	236.505	270.554	-	-
SEN-01: *SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY*	-	32.266	18.121	19.027	-	19.027	11.331	11.527	16.401	16.401	-	-
SEN-02: *SENSORS AND PROCESSING SYSTEMS*	-	115.315	116.396	145.732	-	145.732	149.194	167.876	215.104	254.153	-	-
SEN-03: *EXPLOITATION SYSTEMS*	-	48.924	13.411	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-
SEN-06: *SENSOR TECHNOLOGY*	-	87.400	92.199	76.529	-	76.529	46.800	17.875	5.000	0.000	-	-

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 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 processing technologies and systems necessary for intelligence surveillance and reconnaissance (ISR) missions. The project is primarily driven by four needs: 1) providing day-night ISR capabilities against the entire range of potential targets; 2) countering camouflage, concealment, and deception of mobile ground targets; 3) detecting and identifying objects of interest/targets across wide geographic areas in near-real-time; and 4) enabling reliable identification, precision fire control tracking, timely engagement, and accurate battle damage assessment of ground targets.

The Exploitation Systems project develops algorithms, software, and information processing systems to extract information from massive intelligence, surveillance, and reconnaissance (ISR) datasets. In particular, it develops new technologies for detection and discrimination of targets from clutter, classification and fingerprinting of high value targets, localization and tracking over wide areas, and threat network identification and analysis.

Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Defense Advanced Research Projects Agency	Date: February 2016
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*

B. Program Change Summary ($ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	302.821	257.127	275.921	-	275.921
Current President's Budget	283.905	240.127	241.288	-	241.288
Total Adjustments	-18.916	-17.000	-34.633	-	-34.633
• Congressional General Reductions	0.000	-6.000			
• Congressional Directed Reductions	0.000	-11.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	-9.693	0.000			
• SBIR/STTR Transfer	-9.223	0.000			
• TotalOtherAdjustments	-	-	-34.633	-	-34.633

Change Summary Explanation

FY 2015: Decrease reflects reprogrammings and the SBIR/STTR transfer.

FY 2016: Decrease reflects congressional reduction.

FY 2017: Decrease reflects completion of Insight and drawdown of classified programs.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Defense Advanced Research Projects Agency			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
SEN-01: *SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY*	-	32.266	18.121	19.027	-	19.027	11.331	11.527	16.401	16.401	-	-

A. Mission Description and Budget Item Justification

This 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 2015	FY 2016	FY 2017
Title: Multi-Optical Sensing (MOS)*	18.060	18.121	19.027

Description: *Formerly Multi-Function Optical Sensing (MOS)

The proliferation of radio frequency (RF)-based countermeasures, such as digital radio frequency memory (DRFM), has presented challenges to the effectiveness of data sensors. The Multi-Optical Sensing (MOS) program will enable an alternative approach to detecting, tracking, and performing non-cooperative target identification, as well as providing fire control for fighter class and long-range strike aircraft. This program leverages emerging high-sensitivity focal plane array (FPA) and compact, multiband laser systems technology in the near/mid/long-wave infrared bands to enable the development of a multi-optical sensing system. Technical challenges include the demonstration of inexpensive, multiband, large-format, photon-counting, high-bandwidth receivers and their integration into a multi-optical sensor suite compatible with airborne assets. The MOS program seeks to advance the state of the art of components and technology to support an all-optical airborne system that can detect, geolocate, and identify targets at standoff ranges. Technologies from this program will transition to the Services.

FY 2015 Accomplishments:
- Completed initial capability demonstrations, which collected target imagery used to baseline simulations.
- Initiated the development of the first-generation prototype system.
- Incorporated advanced data processing and target tracking algorithms into the sensor processing chain.
- Demonstrated capability of active focal plane arrays and variable waveform lasers to meet the desired detection performance.
- Initiated packaging activity for the incorporation of the developed active focal plane arrays and variable waveform lasers into the second-generation architecture.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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 2015	FY 2016	FY 2017
- Developed a hardware traceability strategy for the second-generation prototype sensor, which will be part of a roadmap for the development of a fully operational system. ***FY 2016 Plans:*** - Complete the development of the first-generation prototype system. - Perform air-to-air demonstrations with the first-generation prototype system. - Initiate the development of a second-generation prototype system, which will demonstrate the full capability out to operational ranges. ***FY 2017 Plans:*** - Complete the development of the second-generation prototype system and integrate onto an airborne platform. - Perform air-to-air demonstrations with the second-generation prototype system. - Demonstrate the full capability of the second-generation prototype system out to operational ranges.			
Title: Adaptable Navigation Systems (ANS) ***Description:*** The Adaptable Navigation Systems (ANS) program provided the U.S. warfighter with the ability to effectively navigate challenging environments including when Global Positioning System (GPS) is unavailable due to hostile action (jamming) or blockage by structures, foliage, or other environmental obstacles. The ANS approach relied on three major technology innovations. The first was the development of a new type of inertial measurement unit (IMU) that required fewer GPS position fixes. Using cold atom technology, this IMU exceeds the performance of strategic-grade IMUs, with comparable size, weight, and power (SWaP). The second innovation used Signals of Opportunity (SoOp) from a variety of ground-, air-, and space-based sources, as well as natural SoOps to reduce dependency on GPS position fixes. The third technology innovation allowed SoOp-based position information to be combined with inertial and other sensors to enable flexible navigation systems that can be reconfigured in the field to support any platform or environment. This capability enhanced new advanced component technology for positioning, navigation, and timing (PNT) emerging from other programs in the form of Micro Electro-Mechanical System devices, clocks, and new aiding sensors. Recent advances in mathematics, data abstraction, and network architectures built upon these capabilities by enabling "plug-and-play" integration of both existing and future navigation components and processing to allow real-time reconfiguration of navigation systems. Major improvements in navigation accuracy and system cost were also realized. Potential transition partners include all Services, with emphasis on platforms and users that must operate in multiple environments, such as Naval forces. ***FY 2015 Accomplishments:*** - Designed, built, and evaluated components of a cold atom interferometer for inertial sensing. - Demonstrated the navigation performance, independent of GPS, of the integrated ANS system, comprised of various sensors, including IMUs and SoOp receivers, and a sensor fusion processor, on multiple sea-, air-, and land-based platforms.	11.482	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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 2015	FY 2016	FY 2017
- Integrated additional ship-based non-navigation sensors into an ANS system and demonstrated GPS-independent navigation at sea to effect transition to the Navy.			
Title: Adaptable, Low Cost Sensors (ADAPT) ***Description:*** The objective of the Adaptable, Low Cost Sensors (ADAPT) program was to leverage commercial technology and manufacturing techniques to improve the development time and significantly reduce the cost of sensors and sensor systems. Currently, military sensors are designed and developed with unique, mission-specific hardware and software capability requirements in a single, fully integrated device. This approach significantly increases both the cost and difficulty of meeting continuously changing requirements and upgrades. Commercial processes, such as those used in the smart phone industry, create reference designs for common system functions and features to accelerate system development time. This makes changing requirements and completing upgrades far simpler. Adopting these commercial processes enables a mission-independent, designed-to-cost "commercial smart core" that can be combined with an appliqué of mission-specific hardware to provide low-cost, independently upgradable, and previously infeasible sensor system distribution capabilities. The ADAPT Smart Munitions effort has applied ADAPT's sensing, processing, communications, and location capabilities to provide positive identification and man-in-the-loop control of distributed, unattended ground sensor systems. It also developed a reference design to demonstrate capability and develop tactics for unattended sensors. This program will transition to the Army and Navy. ***FY 2015 Accomplishments:*** - Field tested and demonstrated mobile coordinated device operation using ADAPT reference designs (Smart Munitions and UAVs). - Investigated alternative low-cost sensor designs for other small form factor unmanned military platforms. - Completed development and testing of the ADAPT reference designs. - Transitioned reference designs to the Army and Navy.	2.724	-	-
Accomplishments/Planned Programs Subtotals	32.266	18.121	19.027

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

Specific programmatic performance metrics are listed above in the program accomplishments and plans section.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-01 / *SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
ADAPT	C/Various	Various : Various	-	1.755		0.000		0.000		-		0.000	0	1.755	0
Adaptable Navigation Systems	C/Various	Various : Various	-	7.692		0.000		0.000		-		0.000	0	7.692	0
Multi Optical Sensing	C/CPFF	Various : Various	-	2.547		5.475		5.655		-		5.655	Continuing	Continuing	Continuing
Multi Optical Sensing	C/CPFF	BAE SYSTEMS INTEGRATION I : NH	-	7.014	Mar 2015	0.000		0.000		-		0.000	0	7.014	0
Multi Optical Sensing	C/CPFF	RAYTHEON COMPANY : CA	-	7.729	Sep 2015	10.624		11.660		-		11.660	Continuing	Continuing	Continuing
		Subtotal	-	26.737		16.099		17.315		-		17.315	-	-	-

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Support	C/Various	Various : Various	-	1.291		0.725		0.761		-		0.761	Continuing	Continuing	Continuing
		Subtotal	-	1.291		0.725		0.761		-		0.761	-	-	-

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
ADAPT	MIPR	Various : Various	-	0.186		0.000		0.000		-		0.000	0	0.186	0
Adaptable Navigation Systems	MIPR	Various : Various	-	1.945		0.000		0.000		-		0.000	0	1.945	0
Multi Optical Sensing	SS/CPFF	MIT LINCOLN LABORATORY : MA	-	0.494	Apr 2015	0.391		0.000		-		0.000	0	0.885	0
		Subtotal	-	2.625		0.391		0.000		-		0.000	0.000	3.016	0.000

Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-01 / *SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management Support	C/Various	Various : Various	-	1.613		0.906		0.951		-		0.951	Continuing	Continuing	Continuing
		Subtotal	-	1.613		0.906		0.951		-		0.951	-	-	-

	Prior Years	FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	32.266		18.121		19.027		-		19.027	-	-	-

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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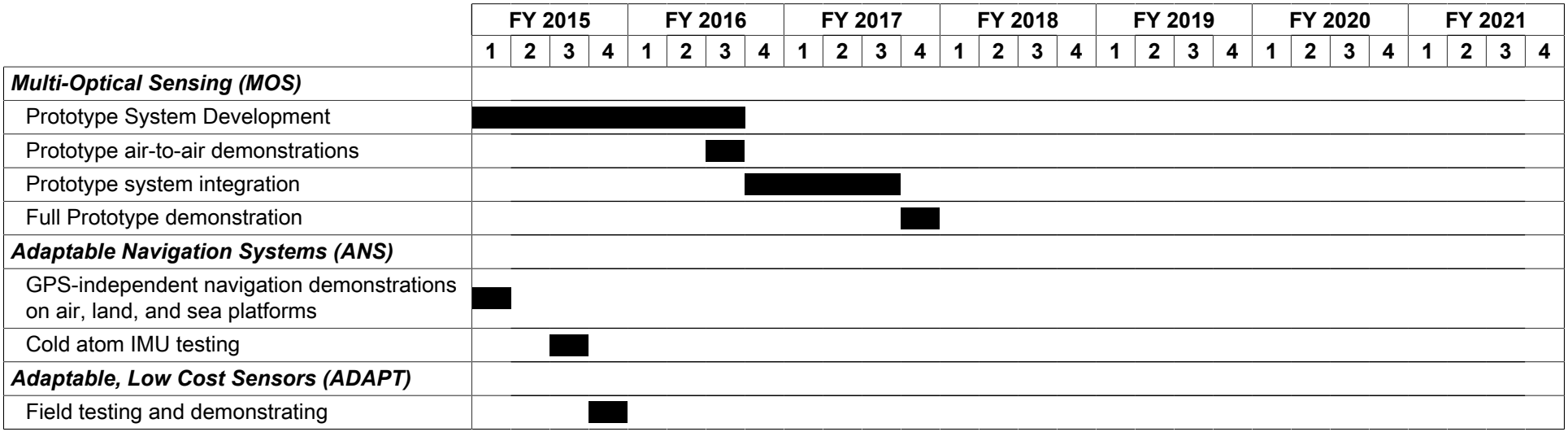

Exhibit R-4A, RDT&E Schedule Details: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-01 / *SURVEILLANCE AND COUNTERMEASURES TECHNOLOGY*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Multi-Optical Sensing (MOS)				
Prototype System Development	1	2015	3	2016
Prototype air-to-air demonstrations	3	2016	3	2016
Prototype system integration	4	2016	3	2017
Full Prototype demonstration	4	2017	4	2017
Adaptable Navigation Systems (ANS)				
GPS-independent navigation demonstrations on air, land, and sea platforms	1	2015	1	2015
Cold atom IMU testing	3	2015	3	2015
Adaptable, Low Cost Sensors (ADAPT)				
Field testing and demonstrating	4	2015	4	2015

Exhibit R-2A, RDT&E Project Justification: PB 2017 Defense Advanced Research Projects Agency			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
SEN-02: *SENSORS AND PROCESSING SYSTEMS*	-	115.315	116.396	145.732	-	145.732	149.194	167.876	215.104	254.153	-	-

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 2015	FY 2016	FY 2017
Title: Adaptive Radar Countermeasures (ARC)	26.475	20.512	19.487

Description: The goal of the Adaptive Radar Countermeasures (ARC) program is to provide effective electronic countermeasure (ECM) techniques against new or unknown threat radars. Current airborne electronic warfare (EW) systems rely on the ability to uniquely identify a threat radar system to apply an appropriate preprogrammed countermeasure technique which can take many months to develop. Countering radar systems is increasingly challenging as digitally programmed radars exhibit novel behaviors and agile waveform characteristics. ARC will develop new processing techniques and algorithms that adapt in real-time to generate suitable countermeasures. Using techniques such as state modeling, machine learning, and system probing, ARC will learn the behavior of the threat system, then choose and implement an appropriate countermeasure strategy. The program is planned for transition to Air Force, Navy, and Marine Corps airborne EW systems.

FY 2015 Accomplishments:
- Refined and integrated component algorithms for end-to-end system testing in simulation.
- Developed adaptive radar threat models for use in testing which emulate future adversary radar capabilities that are expected to challenge current baseline EW systems.
- Began porting software algorithms onto transition partner provided baseline EW systems to demonstrate enhanced performance against unknown or ambiguous threat radars.

FY 2016 Plans:

Exhibit R-2A, RDT&E Project Justification: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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 2015	FY 2016	FY 2017
- Complete real-time software and firmware implementation of all major algorithm modules on transition partner provided baseline EW systems. - Refine adaptive radar threat models for use in testing which emulate future adversary radar capabilities that are expected to challenge current baseline EW systems. - Demonstrate real-time prototype systems by effectively operating against unanticipated or ambiguous radar signals in a hardware-in-the-loop laboratory environment. ***FY 2017 Plans:*** - Develop detailed flight test plans in concert with relevant programs of record and Service partners. - Identify test ranges and relevant assets which can emulate modern unanticipated and ambiguous radar signals in an open-air testing environment. - Update software algorithms testing robustness to realistic RF test conditions using emulation in real-time laboratory testing and stationary open-air tests.			
Title: Spatial, Temporal and Orientation Information for Contested Environments (STOIC)	18.425	23.500	21.365
Description: Building on technologies developed in the Adaptable Navigation Systems (ANS) program, budgeted in PE 0603767E, Project SEN-01, the Spatial, Temporal and Orientation Information for Contested Environments (STOIC) program will enable precision cooperative effects by developing global time transfer and synchronization systems independent of GPS. As a corollary to time synchronization, this program will also enable GPS-independent positioning to maintain precise time synchronization between collaborating mobile users. Key attributes of this program are global availability; minimal and low cost infrastructure; anti-jamming capability; and performance equal to or better than GPS through recent advances in optical clocks and time transfer. Demonstrations on relevant platforms in relevant environments will be used to validate the technology. This program will transition to the Services, emphasizing platforms that operate in GPS-denied environments. ***FY 2015 Accomplishments:*** - Began developing a compact optical clock that maintains GPS-level time for over a year. - Began developing a wireless precision time transfer system that provides better than GPS-level performance using tactical data links. - Began developing jam-proof PNT systems that provide GPS-level performance in contested environments. ***FY 2016 Plans:*** - Complete prototype components of optical clocks. - Complete detailed design and begin development of compact optical clocks. - Develop prototype components and systems for enabling precision time transfer independent of GPS. - Complete detailed design and begin development of GPS-independent precision time transfer systems.			

Exhibit R-2A, RDT&E Project Justification: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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 2015	FY 2016	FY 2017
- Develop prototype jam-proof PNT system components (signal transmit and receive) for achieving GPS-level positioning performance in contested environments. - Complete detailed design and begin development of jam-proof PNT system based on very low frequency (VLF) transmitters and waveforms. ***FY 2017 Plans:*** - Commence integration and testing of compact optical clocks. - Complete development of prototype GPS-independent precision time transfer system and begin system evaluations. - Complete development of jam-proof PNT system and conduct tests to validate system performance.			
Title: Automatic Target Recognition (ATR) Technology ***Description:*** Automatic Target Recognition (ATR) systems provide the capability to detect, identify, and track high value targets from collected sensor data. Current ATRs are typically designed for specific sensors and static due to pre-programmed target lists and operating mode, limiting mission execution capabilities. Extending ATR Technology to accommodate sensor upgrades or include new emerging targets can be costly and time consuming. The objective of the ATR Technology program is to develop technologies that reduce operation limitations while also providing significant performance improvements, dramatically reduced development times, and reduced life cycle maintenance costs. Recent breakthroughs in deep learning, sparse representations, manifold learning, and embedded systems offer promise for dramatic improvements in ATR Technology. The program will focus on three core areas: (1) development of on-line adaptive algorithms that enable performance-driven sensing and ATR technology; (2) recognition technology that enables rapid incorporation of new targets; and (3) technologies that dramatically reduce required data rates, processing times, and the overall hardware and software footprint of ATR systems. ATR technology developed under the program is planned for transition to the Services. ***FY 2015 Accomplishments:*** - Developed a modeling and simulation framework for testing and evaluating performance-driven ATR systems. - Established baseline performance for existing radar ATR algorithms against challenge problem data sets. - Designed and executed a data collection experiment to provide additional data for algorithm development and testing. - Initiated development of advanced algorithms that support signature generalization and reduced signature database complexity. ***FY 2016 Plans:*** - Initiate design of an embedded real-time, low-cost radar ATR processor that incorporates advanced ATR algorithms and uses commercial mobile embedded computing platforms. - Design and execute additional data collection experiments for continued algorithm development and testing. - Continue to improve ATR algorithm performance, including decoy rejection and false target rejection. ***FY 2017 Plans:***	11.500	18.000	24.759

Exhibit R-2A, RDT&E Project Justification: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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 2015	FY 2016	FY 2017
- Develop adaptable ATR algorithms to rapidly learn new targets with minimal measured data and evaluate algorithm learning rate. - Continue to improve ATR algorithm performance, focusing on false-alarm performance. - Complete design and begin development of a flightworthy, low-power ATR processing hardware that executes the ATR algorithm in real-time.			
Title: Advanced Scanning Technology for Imaging Radars (ASTIR) ***Description:*** The Advanced Scanning Technology for Imaging Radars (ASTIR) program will provide immediate benefit to applications that are constrained by power, weight, and the complexity limits of production. The goal of this program, building on technologies developed under the Multifunction RF (MFRF) program which is budgeted in this PE/Project, is to demonstrate a new imaging radar architecture using an electronically scanned sub-reflector to produce a more readily available, cost-effective sensor solution that does not require platform or target motion. Key system attributes will: (1) provide high-resolution 3D imaging for enhanced identification and targeting, independent of platform or target motion; (2) produce video frame rates to provide well-focused images even when there is platform or target motion; (3) beam steer with a single transmit/receive chain to reduce system complexity resulting in lower cost, power, and weight; and (4) integrate millimeter-wave (mmW)/terahertz (THz) electronic component advancements from other DARPA programs for transmit and receive functions. The completion of this program will result in a more readily available, cost-effective imaging radar technology that will work in concert with a wide area surveillance system to provide target identification at video frame rates in all conditions where existing sensors will not work. Candidate military applications include efficient terminal seekers, imaging systems for defense of shipping in ports and littoral environments, base perimeter monitoring, and screening of personnel passing through access control points. This technology is intended to transition to Special Operations Command and the Navy. ***FY 2016 Plans:*** - Develop sensor design concepts and define processing requirements. - Build prototype electronic sub-reflector beam-steering systems and conduct tests to characterize performance and validate approach. - Conduct mission studies and determine the system performance metrics required to support specific candidate military applications. ***FY 2017 Plans:*** - Complete assessments of candidate military applications and show benefit from technologies developed under this effort. - Complete electronically scanned sub-reflector sensor requirements. - Design imaging radar system utilizing technologies developed under this effort to address additional military applications.	-	9.988	13.985
Title: Small Satellite Sensors	-	8.000	24.478

Exhibit R-2A, RDT&E Project Justification: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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 2015	FY 2016	FY 2017
Description: Building upon low-cost and small form factor sensor research conducted under DARPA's Adaptable, Low Cost Sensors (ADAPT) and Multi-Optical Sensing (MOS) programs (budgeted in PE 0603767E, Project SEN-01), the Small Satellite Sensors program will develop and space-qualify electro-optical and infrared (EO/IR) sensor and inter-satellite communications technologies, and establish feasibility that new DoD tactical capabilities can be implemented on small (< 100 lb) satellites. Experimental payloads will be flown on small satellites, and data will be 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 seeks to leverage 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 will focus 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 will transition to the Air Force. ***FY 2016 Plans:*** - Develop conceptual designs for EO/IR sensor and inter-satellite communications link subsystems. - Develop software performance models for candidate sensor systems, and perform laboratory or airborne testing to improve model fidelity and assist in design of flight hardware. - Begin design of experimental sensor payloads compatible with a small satellite bus, and perform preliminary design review. - Begin development of lightweight and low-power inter-satellite communications links suitable for providing high-bandwidth crosslinks for 100 lb class satellites. - Investigate alternative low-cost payloads suitable for integration on a small satellite. ***FY 2017 Plans:*** - Complete detailed design of small satellite EO/IR sensor, and complete a preliminary design review. - Complete construction of the small EO/IR payload and satellite bus. - Build inter-satellite communications link hardware for integration into satellites. - Develop and test mission data processing software. - Develop detailed plan for on-orbit operations.			
Title: Seeker Cost Transformation (SECTR)* ***Description:*** *Formerly Low Cost Seeker	-	8.000	20.658

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
The Seeker Cost Transformation (SECTR) program will develop 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) have very small size and weight, and potentially low cost. The development objectives are technologies and systems with small size, weight and power (SWaP), low recurring cost, applicability to a wide range of weapons and missions such as small unit operations, suppression of enemy air defenses, precision strike, and time-sensitive targets. The technical approach for the sensing/processing hardware is to use both passive electro-optical infrared (EO/IR) sensors, which have evolved into very small and inexpensive devices in the commercial market, and a reconfigurable processing architecture, such as the architecture developed in DARPA's ADAPT program (budgeted in PE 0603767E, Project SEN-01). The program will also develop a Government-owned open architecture for the seeker with standardized interfaces between components (both hardware and software). The technical approach to target recognition will start from "deep learning" and 2D/3D machine vision algorithms pioneered for facial recognition and the identification of critical image features. Technologies developed under this program will transition to the Services. ***FY 2016 Plans:*** - Initiate development of core seeker system engineering design. - Initiate development of open seeker standard interfaces. - Develop small size, weight, and power (SWaP) and cost sensor and processing unit. - Design novel target recognition algorithms. - Design GPS-free image navigation and processing sensor and algorithm. - Perform initial hardware-in-the-loop (HWIL) test for GPS-free navigation unit. - Perform initial HWIL test for target recognition algorithms. ***FY 2017 Plans:*** - Conduct laboratory demonstrations of sensor/processing unit. - Conduct captive flight test of small SWaP sensor/processing unit. - Conduct laboratory demonstrations of GPS-free navigation algorithms. - Conduct laboratory demonstration of target recognition algorithms. - Integrate GPS-free navigation algorithm and target recognition algorithms into the small SWaP sensors/processing unit. - Complete and distribute seeker open standard interfaces.			
Title: Unbanded SPectrum operatIoNs (U-SPIN)	-	-	7.000
Description: The goal of the Unbanded SPectrum operatIoNs (U-SPIN) program is to develop technologies which enable interoperability of multiple spectrum objectives simultaneously. Currently, U.S. forces divide the RF spectrum into "bands" to deconflict specific functions which are considered incompatible with one another (for example, communications, electronic warfare, signals intelligence, and RADAR). This approach relies on a static RF environment and accurate intelligence about			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
the opposing force's spectrum capabilities and allocations. It also enables the enemy to accurately predict where and what our spectrum functions will be. U-SPIN will demonstrate the ability to dynamically co-design the previously incompatible functions on-the-fly using learned knowledge about the RF environment. ***FY 2017 Plans:*** - Initiate algorithmic study of techniques that can achieve multiple spectrum objectives simultaneously. - Select best of breed application of technology (achieving at least two functions simultaneously) and demonstrate proof of concept in a laboratory setting.			
Title: Dynamically Composed RF Systems ***Description:*** Dominance of the 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. Expanding on ideas developed under the Multifunction RF program, also in this PE, 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 their associated airframe integration; (3) wide-band agile electronics to support converged missions over those apertures; and (4) software tools for the control, coordination, and scheduling of RF functions and payloads at the element level to maximize overall task performance. This capability can be adapted to address diverse missions. Technology developed under this program will transition to the Services. ***FY 2017 Plans:*** - Assemble requirements to provide an abstraction of underlying software and hardware architectures. - Commence design of modular architecture for agile, collaborative converged RF systems. - Commence design of RF apertures and associated airframe integration, and agile low-power wide-band RF electronics suitable for an RF payload on low-cost platforms/UAVs. - Commence development of software for controlling and scheduling RF hardware (including processor) to carry out the desired RF functions.	-	-	14.000
Title: Multifunction RF (MFRF) ***Description:*** The Multifunction RF (MFRF) program goal is to enable U.S. rotary wing aircraft forces to fight effectively in all forms of severely Degraded Visual Environments (DVE) when our adversaries cannot. The program goes beyond landing aids in DVE to address all elements of combat to include landing, takeoff, hover/taxi, enroute navigation, lethality, and survivability. Building on previous RF sensors advancements, the program will seek to eliminate many redundant RF elements of current	12.075	6.385	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
independently developed situational and combat support systems to provide multifunction capability with flexibility of adding new mission functions. This will reduce the overall size, weight, power, and cost (SWaP-C) of subsystems and protrusive exterior antennas on military aircraft, enabling greater mission capability with reduced vehicle system integration burden. The program approach includes: (1) development of synthetic vision for pilots that fuses sensor data with high-resolution terrain databases; (2) development of Advanced Rotary Multifunction Sensor (ARMS), utilizing silicon-based tile arrays, for agile electronically scanning technology at low SWAP-C; and (3) implementation of software development kit to re-define modes as required by mission or platform needs, and ease of adding new modes via software without hardware modifications. The program is planned for transition to the Army and Marines. ***FY 2015 Accomplishments:*** - Demonstrated utility of software development kit through third-party programming. - Selected test platform and began modifications on Army helicopter for flight testing ARMS sensor. - Investigated alternative imaging radar architectures to further reduce size, weight, power, and cost. - Successfully built two unique tile prototype designs and selected final design for demonstration array. ***FY 2016 Plans:*** - Conduct laboratory and field demonstrations with integrated ARMS, synthetic vision backbone, other potential collision avoidance sensors and multifunction software development kit. - Demonstrate DVE landing, takeoff, Ground Moving Target Indicator (GMTI), and Synthetic Aperture Radar (SAR) modes of operation. - Conduct flight tests of ARMS integrated with synthetic vision system on an Army helicopter in cooperation with CERDEC and AMRDEC. - Transition DVE system to the Army. - Further explore RF technologies to determine feasibility of capability convergence.			
Title: Video-rate Synthetic Aperture Radar (ViSAR) ***Description:*** Recent conflicts have demonstrated the need for close air support by precision attack platforms such as the AC-130J aircraft in support of ground forces. Under clear conditions, targets are easily identified and engaged quite effectively, but in degraded environments, the atmosphere can inhibit traditional optical sensors. The AC-130J must fly above cloud decks in order to avoid anti-aircraft fire, negating optical targeting sensors. Similarly, rotary/wing blades in urban operations generate copious amounts of dust that prevent circling assets from supplying cover fire for ground forces. The Video-rate Synthetic Aperture Radar (ViSAR) program seeks to develop a real-time spotlight synthetic aperture radar (SAR) imaging sensor that will provide imagery of a region to allow high-resolution fire direction in conditions where optical sensors do not function. Technology from this program is planned to transition to Air Force Special Operations Command (AFSOC).	18.847	12.250	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
FY 2015 Accomplishments: - Completed development and testing of prototype high power amplifier. - Demonstrated the integration of low power transmitter and receiver components into sensor and conducted over-the-air testing to validate system performance. - Integrated phenomenology data into scene simulator and generated data for demonstration of algorithm performance. ***FY 2016 Plans:*** - Complete development and unit-level testing of flightworthy high power amplifier. - Integrate hardware into a sensor control system (gimbal) and demonstrate performance in a laboratory scenario, and in over-the-air testing against calibration targets. - Integrate hardware and gimbal on a surrogate aircraft. - Begin flight tests to demonstrate ViSAR performance in comparison to Electro-Optic sensors. - Conduct flight demonstrations in cooperation with AFRL and AFSOC.			
Title: Military Imaging and Surveillance Technology (MIST)	22.493	9.761	-
Description: The Military Imaging and Surveillance Technology (MIST) program is developing a fundamentally new optical Intelligence, Surveillance, and Reconnaissance (ISR) capability that can provide high-resolution 3-D images to locate and identify a target at much longer ranges than is possible with existing optical systems. Short, moderate, and long-range prototype optical surveillance and observation systems are being developed that: (1) demonstrate probabilities of recognition and identification at distances sufficient to allow stand-off engagement; (2) overcome atmospheric turbulence, which now limits the ability of high-resolution optics; and (3) increase target identification confidence to reduce fratricide and/or collateral damage. The program will develop and integrate the necessary component technologies including high-energy pulsed lasers, receiver telescopes that have a field of view and depth of field that obviates the need for steering or focusing the optical system, computational imaging algorithms to improve system resolution, and data exploitation and analysis tools. Advances in laser systems, digital imagers, and novel image processing algorithms will be leveraged to reduce the overall size, weight, and power (SWaP) of imaging systems to allow for soldier portable and Unmanned Aerial Vehicle (UAV) platform integration. The MIST program will transition the optical ISR technology to the Services and SOCOM. ***FY 2015 Accomplishments:*** - Continued the development of a short-range 3-D imaging system. - Completed ground demonstrations of the moderate and long-range 3-D imaging systems, including testing and demonstration of critical subsystem components. - Completed a packaging study and testing of the MIST high-energy pulsed laser.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
- Initiated the development of a mountain-to-ground demonstration capability for the moderate-range 3-D imaging system. ***FY 2016 Plans:*** - Complete the development of the short-range 3-D imaging system. - Demonstrate the capabilities of the completed short-range 3-D imaging system - Complete the development of the mountain-to-ground demonstration capability for the moderate-range 3-D imaging system. - Conduct mountain-to-ground demonstrations of the moderate-range 3-D imaging system. - Transition the short-range and moderate-range 3-D imaging system to the Services and SOCOM.			
Title: Behavioral Learning for Adaptive Electronic Warfare (BLADE) ***Description:*** The Behavioral Learning for Adaptive Electronic Warfare (BLADE) program developed the capability to jam adaptive and rapidly evolving wireless communication threats in tactical environments and at tactically-relevant timescales. This has changed the paradigm for responding to evolving threats from lab-based manual development to an adaptive in-the-field systems approach. When an unknown or adaptive communication threat appears in theater, BLADE dynamically characterized the communication network, synthesized an effective countering technique, and evaluated jamming effectiveness by iteratively probing, learning, and adapting to the threat. An optimization process tailored real-time responses to specific threats, producing a countermeasure waveform that maximizes jam effectiveness while minimizing the required jamming resources. BLADE enabled the rapid defeat of new communication threats and provided the warfighter with real-time feedback on jam effectiveness. The program transitioned to the U.S. Army Communications-Electronic RDT&E Center, Intelligence and Information Warfighter Directorate for further maturation and hardening. ***FY 2015 Accomplishments:*** - Tested and evaluated ground-based and airborne prototype systems in an operationally relevant over-the-air environment featuring agile and commercial communications threat networks. - Quantified the minimum hardware requirements, including processing and memory, necessary to execute the BLADE algorithms on transition platforms. - Transitioned BLADE components to U.S. Army Communications-Electronic RDT&E Center Intelligence and Information Warfare Directorate. - Executed an Airborne demonstration against tactically relevant threat networks at Electronics Proving Ground, Ft. Huachuca, AZ, to transition partners.	5.500	-	-
Accomplishments/Planned Programs Subtotals	115.315	116.396	145.732

C. Other Program Funding Summary ($ in Millions)

N/A

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C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

Specific programmatic performance metrics are listed above in the program accomplishments and plans section.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Adaptive Radar Countermeasures (ARC)	C/CPFF	Leidos : VA	-	8.450	Dec 2015	8.456		9.265		-		9.265	Continuing	Continuing	Continuing
Adaptive Radar Countermeasures (ARC)	C/CPFF	BAE : NH	-	9.350	Nov 2015	0.224		0.520		-		0.520	Continuing	Continuing	Continuing
Adaptive Radar Countermeasures (ARC)	C/CPFF	Various : Various	-	7.403		9.692		7.742		-		7.742	Continuing	Continuing	Continuing
Spatial, Temporal and Orientation Information for Contested Environments	C/Various	Various : Various	-	12.128		20.226		16.829		-		16.829	Continuing	Continuing	Continuing
Spatial, Temporal and Orientation Information for Contested Environments	C/CPFF	ROCKWELL COLLINS,INC. : IA	-	5.391	Apr 2015	0.000		0.000		-		0.000	0	5.391	0
Automatic Target Recognition (ATR) Technology	C/Various	Various : Various	-	8.934		15.853		22.730		-		22.730	Continuing	Continuing	Continuing
Advanced Scanning Technology for Imaging Radars (ASTIR)	C/Various	Various : Various	-	0.000		9.694		11.903		-		11.903	Continuing	Continuing	Continuing
Small Satellite Sensors	C/Various	Various : Various	-	0.000		7.823		22.763		-		22.763	Continuing	Continuing	Continuing
Seeker Cost Transformation (SECTR)*	C/CPFF	Various : Various	-	0.000		6.888		17.935		-		17.935	Continuing	Continuing	Continuing
Unbanded SPectrum operatIoNs (U-SPIN)	C/TBD	Various : Various	-	0.000		0.000		6.568		-		6.568	Continuing	Continuing	Continuing
Dynamically Composed RF Systems	C/TBD	Various : Various	-	0.000		0.000		13.212		-		13.212	Continuing	Continuing	Continuing
Multifunction RF (MFRF)	C/Various	Various : Various	-	9.702		4.801		0.000		-		0.000	0	14.503	0
Video-rate Synthetic Aperture Radar (ViSAR)	C/Various	Various : Various	-	16.586		10.965		0.000		-		0.000	0	27.551	0
Military Imaging and Surveillance Technology (MIST)	C/CPFF	TREX ENTERPRISES CORPORATION : CA	-	19.315	Mar 2015	7.835		0.000		-		0.000	0	27.150	0

Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Behavioral Learning for Adaptive Electronic Warfare (BLADE)	C/CPFF	LOCKHEED MARTIN CORPORATION : CA	-	5.148		0.000		0.000		-		0.000	0	5.148	0
		Subtotal	-	102.407		102.457		129.467		-		129.467	-	-	-

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Support	MIPR	Various : Various	-	4.613		4.656		5.829		-		5.829	Continuing	Continuing	Continuing
		Subtotal	-	4.613		4.656		5.829		-		5.829	-	-	-

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Spatial, Temporal and Orientation Information for Contested Environments	C/Various	Various : Various	-	0.457		0.440		1.321		-		1.321	Continuing	Continuing	Continuing
Automatic Target Recognition (ATR) Technology	C/Various	Various : Various	-	1.635		0.000		0.000		-		0.000	0	1.635	0
Advanced Scanning Technology for Imaging Radars (ASTIR)	C/Various	Various : Various	-	0.000		0.000		0.350		-		0.350	Continuing	Continuing	Continuing
Small Satellite Sensors	C/Various	Various : Various	-	0.000		0.250		0.737		-		0.737	Continuing	Continuing	Continuing
Seeker Cost Transformation (SECTR)*	C/Various	Various : Various	-	0.000		0.969		0.741		-		0.741	Continuing	Continuing	Continuing
Multifunction RF (MFRF)	C/Various	Various : Various	-	0.437		0.533		0.000		-		0.000	0	0.970	0
Video-rate Synthetic Aperture Radar (ViSAR)	C/Various	Various : Various	-	0.000		0.831		0.000		-		0.000	0	0.831	0

Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Military Imaging and Surveillance Technology (MIST)	SS/CPFF	LEIDOS,INC. : OH	-	0.000		0.440		0.000		-		0.000	0	0.440	0
		Subtotal	-	2.529		3.463		3.149		-		3.149	-	-	-

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management Support	C/Various	Various : Various	-	5.766		5.820		7.287		-		7.287	Continuing	Continuing	Continuing
		Subtotal	-	5.766		5.820		7.287		-		7.287	-	-	-

	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	115.315		116.396		145.732		-		145.732	-	-	-

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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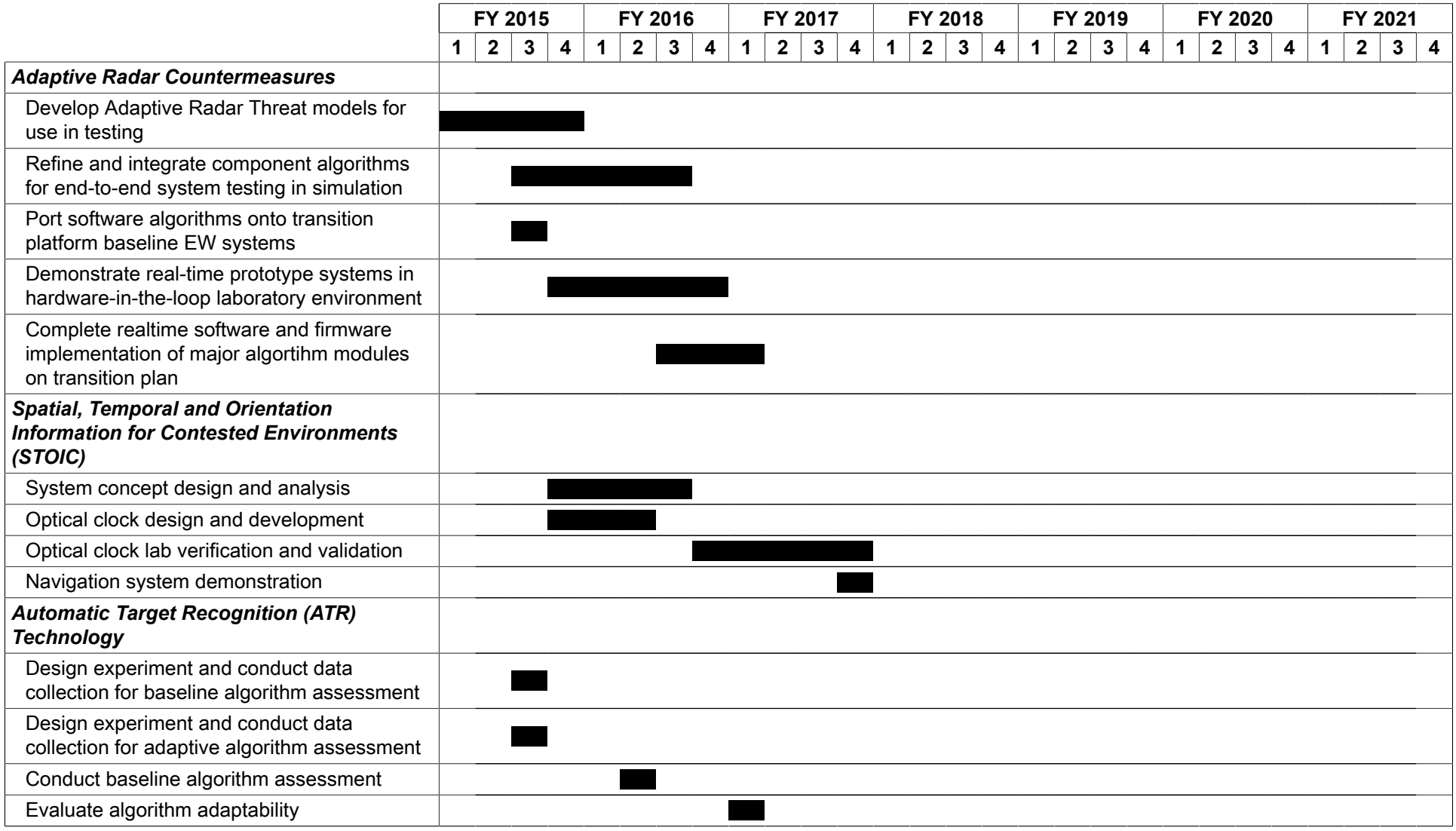

Exhibit R-4, RDT&E Schedule Profile: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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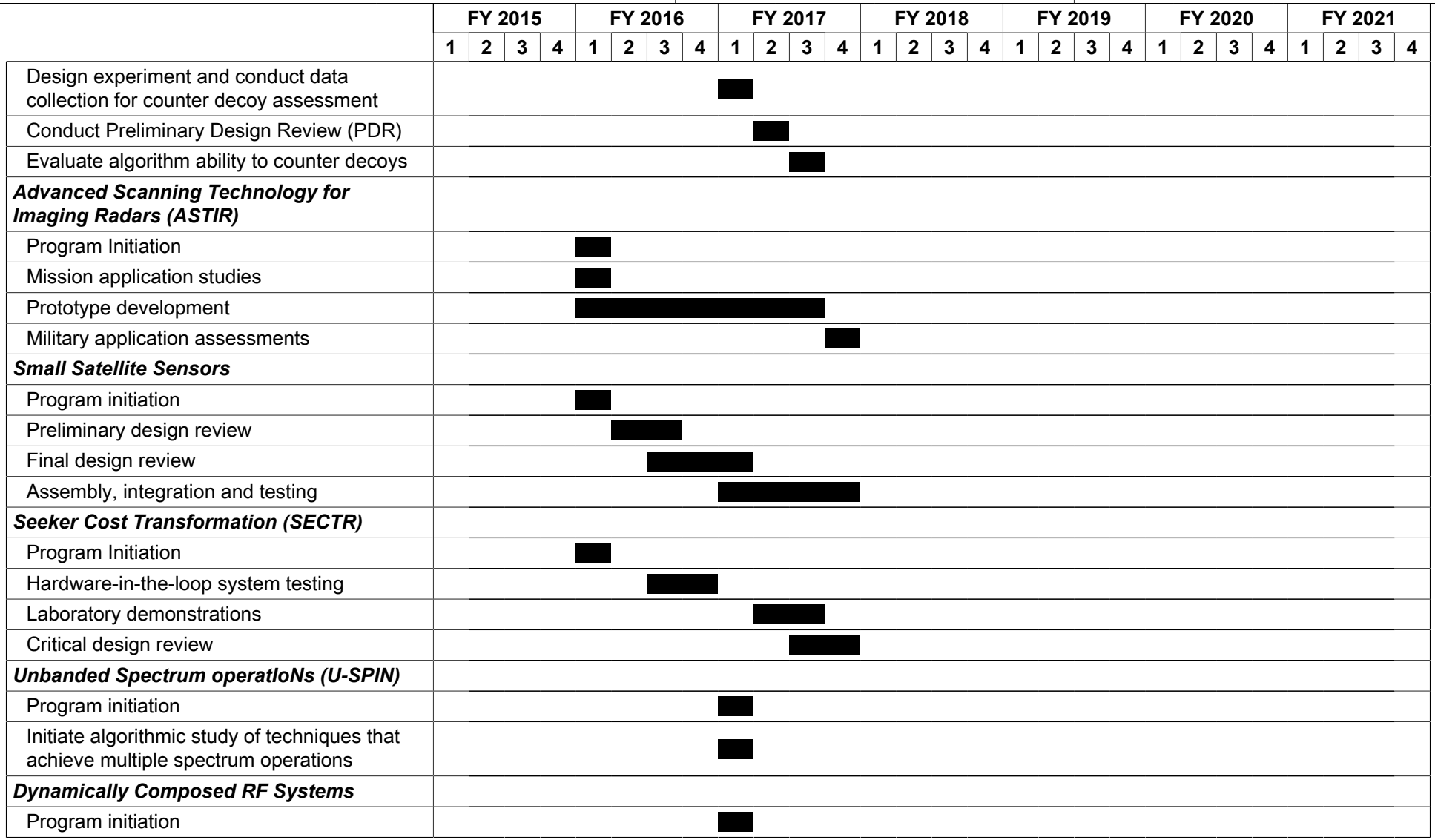

Exhibit R-4, RDT&E Schedule Profile: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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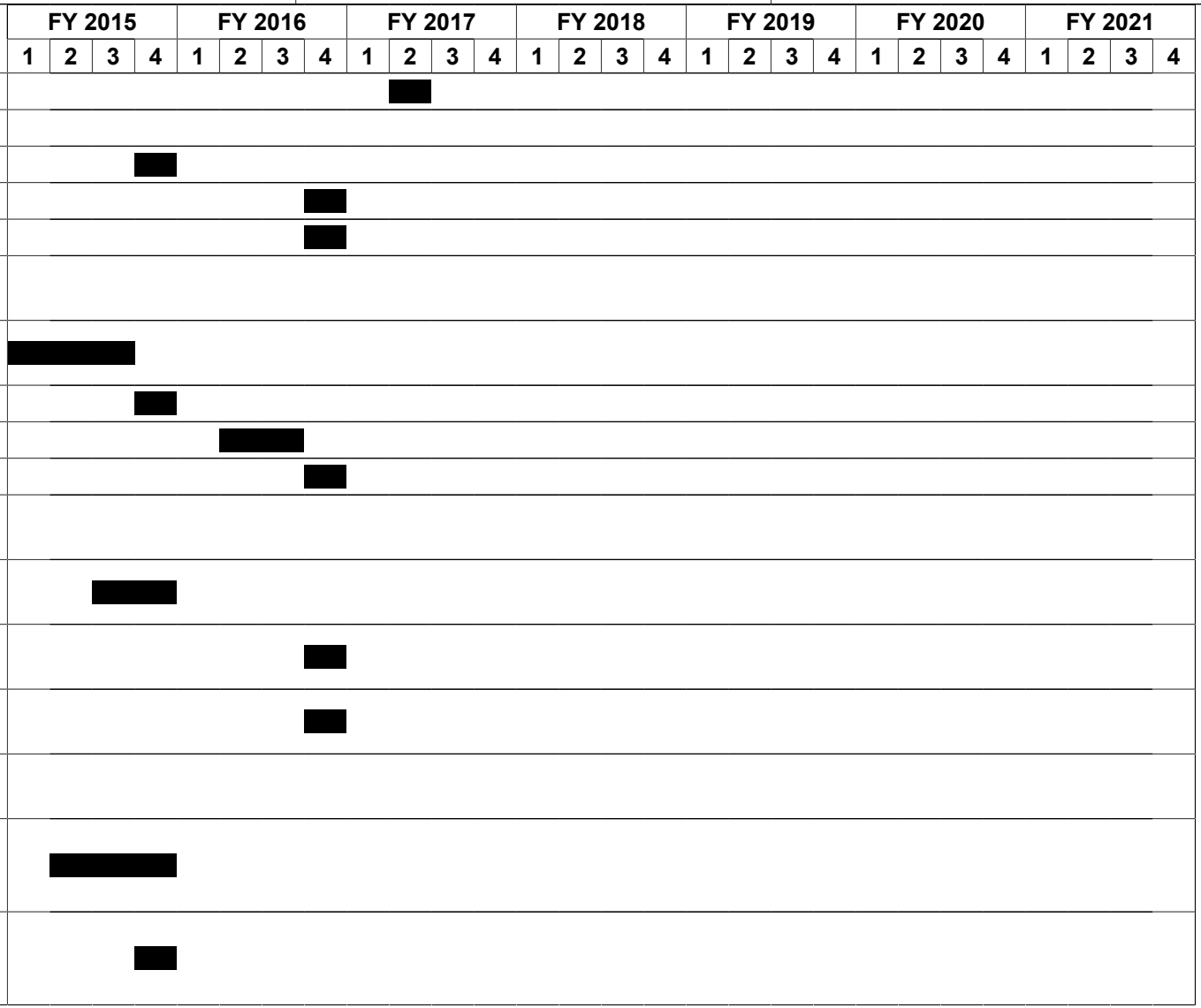

Exhibit R-4, RDT&E Schedule Profile: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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	FY 2015				FY 2016				FY 2017				FY 2018				FY 2019				FY 2020				FY 2021			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Conduct airborne demonstration against tactically relevant threats				■																								
Transition BLADE to US Army CERDEC I2WD				■																								

Exhibit R-4A, RDT&E Schedule Details: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Adaptive Radar Countermeasures				
Develop Adaptive Radar Threat models for use in testing	1	2015	4	2015
Refine and integrate component algorithms for end-to-end system testing in simulation	3	2015	3	2016
Port software algorithms onto transition platform baseline EW systems	3	2015	3	2015
Demonstrate real-time prototype systems in hardware-in-the-loop laboratory environment	4	2015	4	2016
Complete realtime software and firmware implementation of major algortihm modules on transition plan	3	2016	1	2017
Spatial, Temporal and Orientation Information for Contested Environments (STOIC)				
System concept design and analysis	4	2015	3	2016
Optical clock design and development	4	2015	2	2016
Optical clock lab verification and validation	4	2016	4	2017
Navigation system demonstration	4	2017	4	2017
Automatic Target Recognition (ATR) Technology				
Design experiment and conduct data collection for baseline algorithm assessment	3	2015	3	2015
Design experiment and conduct data collection for adaptive algorithm assessment	3	2015	3	2015
Conduct baseline algorithm assessment	2	2016	2	2016
Evaluate algorithm adaptability	1	2017	1	2017
Design experiment and conduct data collection for counter decoy assessment	1	2017	1	2017
Conduct Preliminary Design Review (PDR)	2	2017	2	2017
Evaluate algorithm ability to counter decoys	3	2017	3	2017
Advanced Scanning Technology for Imaging Radars (ASTIR)				

Exhibit R-4A, RDT&E Schedule Details: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
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	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Program Initiation	1	2016	1	2016
Mission application studies	1	2016	1	2016
Prototype development	1	2016	3	2017
Military application assessments	4	2017	4	2017
Small Satellite Sensors				
Program initiation	1	2016	1	2016
Preliminary design review	2	2016	3	2016
Final design review	3	2016	1	2017
Assembly, integration and testing	1	2017	4	2017
Seeker Cost Transformation (SECTR)				
Program Initiation	1	2016	1	2016
Hardware-in-the-loop system testing	3	2016	4	2016
Laboratory demonstrations	2	2017	3	2017
Critical design review	3	2017	4	2017
Unbanded Spectrum operatIoNs (U-SPIN)				
Program initiation	1	2017	1	2017
Initiate algorithmic study of techniques that achieve multiple spectrum operations	1	2017	1	2017
Dynamically Composed RF Systems				
Program initiation	1	2017	1	2017
Software development	2	2017	2	2017
Multifunction RF (MFRF)				
Test platform modifications	4	2015	4	2015
Tower demonstration of prototype sensor	4	2016	4	2016
Prototype flight demonstrations	4	2016	4	2016
Video-rate Synthetic Aperture Radar (ViSAR)				

Exhibit R-4A, RDT&E Schedule Details: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-02 / *SENSORS AND PROCESSING SYSTEMS*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Prototype high power amplifier development and testing	1	2015	3	2015
Integrate phenomenology data	4	2015	4	2015
Integrate components in gimbal in laboratory	2	2016	3	2016
Conduct flight tests	4	2016	4	2016
Military Imaging and Surveillance Technology (MIST)				
Ground demonstrations of moderate range imaging system capability	3	2015	4	2015
Demonstrations of short-range imaging system	4	2016	4	2016
Mountain-to-ground demonstrations of moderate range imaging system	4	2016	4	2016
Behavioral Learning for Adaptive Electronic Warfare (BLADE)				
Test & evaluate ground-based & airborne prototype system in an operationally relevant environment	2	2015	4	2015
Quantify minimum hardware requirements to execute the BLADE algorithms on transition platforms	4	2015	4	2015
Conduct airborne demonstration against tactically relevant threats	4	2015	4	2015
Transition BLADE to US Army CERDEC I2WD	4	2015	4	2015

Exhibit R-2A, RDT&E Project Justification: PB 2017 Defense Advanced Research Projects Agency			Date: February 2016
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COST ($ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
SEN-03: *EXPLOITATION SYSTEMS*	-	48.924	13.411	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

The Exploitation Systems project develops algorithms, software, and information processing systems to extract information from massive intelligence, surveillance, and reconnaissance (ISR) datasets. In particular, it develops new technologies for detection and discrimination of targets from clutter, classification and fingerprinting of high value targets, localization and tracking over wide areas, and threat network identification and analysis. Interest extends to open source information and issues such as trustworthiness and provenance. The resulting technology will enable operators to more effectively and efficiently incorporate all sources of information, including sensor, human, and open source data, in intelligence products.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
Title: Insight	48.924	13.411	-

Description: Insight is developing the next generation multi-intelligence exploitation and analysis system. Insight provides new exploitation capabilities through an integrated, standards-based system that is designed for mission flexibility and cross-theater applicability. Insight will enable threat detection through combination and analysis of information from imaging and non-imaging sensors and other sources. The technical approach emphasizes graph-based correlation, adversary behavior modeling, threat network analysis tools, a unified data management and processing environment, novel exploitation algorithms and analysis methodologies, and tools to integrate human and machine processing, including visualization, hypothesis manipulation, and on-line learning. Insight development activities leverage both virtual and physical test bed environments. The virtual test bed enables evaluation of alternative sensor mixes and algorithms under extended operating conditions. The physical test bed enables live testing under realistic operational conditions using current and next generation sensing and processing systems. Insight technology development is coordinated with the following transition sponsors: Army Program Executive Office - Intelligence, Electronic Warfare & Sensors, United States Army Intelligence Center of Excellence, Project Manager Distributed Common Ground System - Army, Air Staff, National Air and Space Intelligence Center, and Air Force Research Laboratory. Insight provides a unified architecture for plug-and-play ISR with extensibility to all Services and Combatant Commands.

FY 2015 Accomplishments:

- Completed initial software deliveries and transferred fusion and analytic technology to the Army and Air Force.
- Adapted capabilities to emerging operational environments, including integration of additional non-traditional sensors and information sources.
- Tested and matured advanced fusion and analytic technologies in live and virtual environments.
- Executed a live field test in coordination with a military training rotation to demonstrate improvements and maturity of system capabilities in a dynamic operational environment.
- Developed a new and advanced data model compatible with existing system data models.

Exhibit R-2A, RDT&E Project Justification: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-03 / *EXPLOITATION SYSTEMS*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2015	FY 2016	FY 2017
- Delivered refined, advanced and integrated capabilities to transition partner programs of record that address key performance parameters and are aligned with their software release cycles. ***FY 2016 Plans:*** - Test advanced fusion and analytic technologies, and demonstrate improvements and maturity of multi-intelligence exploitation capabilities. - Tailor final component and system level capabilities to specific transition partner objectives. - Deliver final integrated capabilities that address key performance parameters required by transition partner programs of record for insertion into software baselines. - Prepare and finalize software packages and documentation for transition to Services.			
Accomplishments/Planned Programs Subtotals	48.924	13.411	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

Specific programmatic performance metrics are listed above in the program accomplishments and plans section.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Defense Advanced Research Projects Agency			Date: February 2016
Appropriation/Budget Activity 0400 / 3	R-1 Program Element (Number/Name) PE 0603767E / *SENSOR TECHNOLOGY*	Project (Number/Name) SEN-03 / *EXPLOITATION SYSTEMS*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Insight	C/CPFF	BAE : MA	-	27.008	Oct 2014	0.000		0.000		-		0.000	0	27.008	0
Insight	C/Various	Various : Various	-	15.014		11.283		0.000		-		0.000	0	26.297	0
		Subtotal	-	42.022		11.283		0.000		-		0.000	0.000	53.305	0.000

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Insight	MIPR	Various : Various	-	1.956		0.536		0.000		-		0.000	0	2.492	0
		Subtotal	-	1.956		0.536		0.000		-		0.000	0.000	2.492	0.000

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Insight	C/Various	Various : Various	-	2.500		0.921		0.000		-		0.000	0	3.421	0
		Subtotal	-	2.500		0.921		0.000		-		0.000	0.000	3.421	0.000

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Insight	C/CPFF	Various : Various	-	2.446		0.671		0.000		-		0.000	0	3.117	0
		Subtotal	-	2.446		0.671		0.000		-		0.000	0.000	3.117	0.000

	Prior Years	FY 2015 Cost	FY 2015 Award Date	FY 2016 Cost	FY 2016 Award Date	FY 2017 Base Cost	FY 2017 Base Award Date	FY 2017 OCO Cost	FY 2017 OCO Award Date	FY 2017 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	48.924		13.411		0.000		-		0.000	0.000	62.335	0.000

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-03 / *EXPLOITATION SYSTEMS*

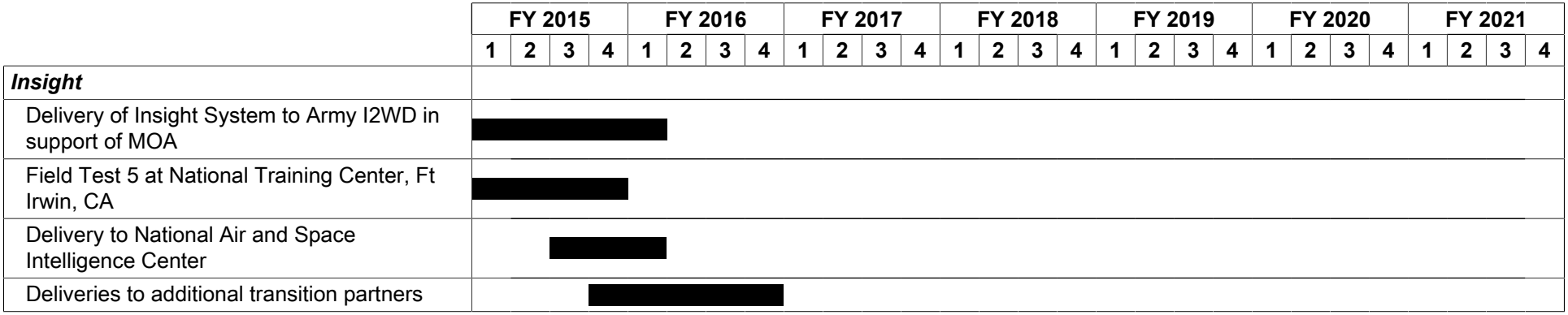

Exhibit R-4A, RDT&E Schedule Details: PB 2017 Defense Advanced Research Projects Agency		Date: February 2016
Appropriation/Budget Activity 0400 / 3	**R-1 Program Element (Number/Name)** PE 0603767E / *SENSOR TECHNOLOGY*	**Project (Number/Name)** SEN-03 / *EXPLOITATION SYSTEMS*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Insight				
Delivery of Insight System to Army I2WD in support of MOA	1	2015	1	2016
Field Test 5 at National Training Center, Ft Irwin, CA	1	2015	4	2015
Delivery to National Air and Space Intelligence Center	3	2015	1	2016
Deliveries to additional transition partners	4	2015	4	2016

Exhibit R-2A, RDT&E Project Justification: PB 2017 Defense Advanced Research Projects Agency			Date: February 2016
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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
SEN-06: *SENSOR TECHNOLOGY*	-	87.400	92.199	76.529	-	76.529	46.800	17.875	5.000	0.000	-	-

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 2015	FY 2016	FY 2017
Title: Classified DARPA Program	87.400	92.199	76.529
Description: This project funds Classified DARPA Programs. Details of this submission are classified. ***FY 2015 Accomplishments:*** Details will be provided under separate cover. ***FY 2016 Plans:*** Details will be provided under separate cover. ***FY 2017 Plans:*** Details will be provided under separate cover.			
Accomplishments/Planned Programs Subtotals	87.400	92.199	76.529

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

Details will be provided under separate cover.