Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 5: *System Development & Demonstration (SDD)*					R-1 Program Element (Number/Name) PE 0604820A / *Radar Development*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	31.651	39.289	105.243	-	105.243	103.427	105.394	65.574	69.407	0.000	519.985
E10: *Sentinel*	-	31.651	39.289	105.243	-	105.243	103.427	105.394	65.574	69.407	0.000	519.985

A. Mission Description and Budget Item Justification

This system is a component of the overall Air and Missile Defense (AMD) architecture and will provide for an incrementally fielded Integrated Air and Missile Defense Fire Control System/capability for the composite Army Air and Missile Defense Brigades. The Sentinel system is a key component of the Army Integrated Air and Missile Defense (AIAMD) architecture and provides critical air surveillance of the forward areas.

Sentinel (AN/MPQ-64A3) consists of a radar-based sensor with its prime mover/power, Identification Friend or Foe (IFF), and Forward Area Air Defense (FAAD) Command, Control and Intelligence (C2I) interfaces. The radar is deployed in both an air defense role and a force protection role for Counter-Rocket, Artillery, and Mortar (C-RAM) missions. The sensor is an advanced three-dimensional battlefield X-Band air defense phased-array radar with an instrumented range of 75 kilometers. Sentinel is capable of operating day or night, in adverse weather conditions, in the battlefield environments of dust, smoke, aerosols and enemy countermeasures. It provides 360-degree azimuth coverage for acquisition tracking. Sentinel contributes to the digital battlefield by automatically detecting, classifying, identifying and reporting targets (cruise missiles, unmanned aircraft systems, rotary wing and fixed wing aircraft). Sentinel acquires targets sufficiently forward of the battle area to allow weapons reaction time and engagement at optimum ranges. Sentinel's integrated IFF reduces the potential for fratricide of US and Coalition aircraft.

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	32.968	39.338	91.534	-	91.534
Current President's Budget	31.651	39.289	105.243	-	105.243
Total Adjustments	-1.317	-0.049	13.709	-	13.709
• Congressional General Reductions	-0.027	-0.049			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.290	-			
• Adjustments to Budget Years	-	-	13.709	-	13.709

Change Summary Explanation

The increase in overall program funding will support ongoing Sentinel A3 modifications and the Sentinel Active Electronically Scanned Array (AESA) (Sentinel A4) contract award for Engineering and Manufacturing Development (EMD). FY 2020 increase of $13.709 million addresses upgrades to the Sentinel Counter

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
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Rocket, Artillery and Mortar (C-RAM) capability as well as the Resiliency and Software Assurance Modification (RSAM) upgrade to incorporate software messaging to counter emerging threats.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0604820A / *Radar Development*	Project (Number/Name) E10 / *Sentinel*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
E10: *Sentinel*	-	31.651	39.289	105.243	-	105.243	103.427	105.394	65.574	69.407	0.000	519.985
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Mission & System Description:

This system is a component of the overall Air and Missile Defense (AMD) architecture and will provide for an incrementally fielded Integrated Air and Missile Defense Fire Control System/capability for the composite Army Air and Missile Defense Brigades. The Sentinel system is a key component of the Army Integrated Air and Missile Defense (AIAMD) architecture and provides critical air surveillance of the forward areas.

Sentinel (AN/MPQ-64A3) consists of a radar-based sensor with its prime mover/power, Identification Friend or Foe (IFF), and Forward Area Air Defense (FAAD) Command, Control and Intelligence (C2I) interfaces. The radar is deployed in both an air defense role and a force protection role for Counter-Rocket, Artillery, and Mortar (C-RAM) missions. The sensor is an advanced three-dimensional battlefield X-Band air defense phased-array radar with an instrumented range of 75 kilometers. Sentinel is capable of operating day or night, in adverse weather conditions, in the battlefield environments of dust, smoke, aerosols and enemy countermeasures. It provides 360-degree azimuth coverage for acquisition tracking. Sentinel contributes to the digital battlefield by automatically detecting, classifying, identifying and reporting targets (cruise missiles, unmanned aircraft systems, rotary wing and fixed wing aircraft). Sentinel acquires targets sufficiently forward of the battle area to allow weapons reaction time and engagement at optimum ranges. Sentinel's integrated IFF reduces the potential for fratricide of US and Coalition aircraft.

The Research and Development funding supports Sentinel modernization/upgrades, hardware/software issue resolution, resolution of obsolescence issues, engineering studies, and cost reduction initiatives. The funding for Fiscal Year (FY) 2018 through FY 2024 development activities addresses the following Sentinel system capability gaps and obsolescence issues identified by the User: 1) Target Detection gap; 2) Target Tracking gap; 3) Net Readiness gap; 4) Electronic Counter Measures (ECM) gap; 5) Unmanned Aircraft Systems (UAS) Defense gap; and 5) Rockets, Artillery & Mortars (RAM) gap.

FY 2020 Funds address the following:

Electronic Attack/Electronic Protect (EA/EP) addresses the electronic countermeasures (ECM) gap. This effort continues through the life of the radar, addressing both changing threats and electronic counter measure gaps.

The Active Electronically Scanned Array (AESA) (Sentinel A4) is the next generation of radar technology to replace the current phase and frequency scanned array used by Sentinel today. The AESA Antenna will provide increased capability including extended range for ground-based surveillance and situational awareness, faster and more accurate Non-Cooperative Target Recognition (NCTR) for clearing fires and preventing fratricide, improved Fire Control (FC) quality track accuracy, and management of larger track loads. The AESA will also provide improved operation in severe/urban clutter. The system will detect and track small targets, such as Unmanned Aircraft Systems (UAS) and Cruise Missiles, in clutter and will detect and track slow targets, such as UAS and Rotary Wing (RW) aircraft, at low altitudes

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
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in clutter. The system will detect, track, and classify Rocket, Artillery, and Mortar (RAM) threats and will support Integrated Air and Missile Defense Battle Command System (IBCS) requirements and can contribute sensor support for mitigating current and future Indirect Fire Protection Capability Increment 2 mission requirements.

Mode S upgrade to existing Sentinel Identification Friend or Foe (IFF) will address Sentinel's objective requirement to interrogate IFF mode S which is currently not being met. Mode S transmissions are a key component of the Automatic Dependent Surveillance-Broadcast (ADS-B) surveillance technology being used by the Federal Aviation Administration for tracking aircraft as part of the Next Generation Air Transportation System (NextGen). In the United States, all aircraft required to have transponders (most aircraft) must transition to Mode S capable units by 2020. Without the Mode S upgrade, Sentinel will have to rely on these aircraft transponders responding to the legacy mode 3/A interrogations. The data available in the Mode S response will be valuable in identifying the aircraft and correlating Sentinel tracks with civil aviation tracks/data and other track data sources. Addresses the M Code Global Positioning System (GPS) capability requirement with the new interrogator.

Resiliency and Software Assurance Modification (RSAM) upgrade to counter emerging threats and provide the Operational Commander Assured Position Navigation and Timing capabilities. Sentinel SW will be updated to accept new RSAM messages and provide RSAM status to the Radar operator.

Counter Rocket, Artillery & Mortars (C-RAM) capability increase to current Sentinel A3's effectiveness against the Low, Slow, Small (LSS) and RAM threat. This effort develops and implements advanced waveforms and processing to significantly enhance RAM capabilities. These efforts will provide fire control quality data to support RAM interceptors.

Additional Development:

Signal Data Processor (SDP)/North Finding Module (NFM) addresses the Target Detection, Target Tracking, and Electronic Countermeasures (ECM) capability gaps and funds the mitigation of the SDP and NFM obsolescence issues. SDP cards are estimated to go obsolete every four to six years. Provides for new SDP kit to address obsolescence issues and allow for additional Electronic Protect capability.

Medium Bandwidth Waveform upgrade will address latent tracking issues that currently exist with Sentinel in certain applications. This development effort modifies firmware as well as software in the Sentinel radar. This effort will provide better target resolution and more accurate tracking in the slant range coordinate. This improved target resolution and tracking accuracy will provide improved retention of target identification and more robust tracking that addresses the latent tracking issues.

Sentinel System of Systems: Software Development in support of a system of systems architecture (IAMD and IFPC Inc 2-I) for a required simulation capability. The simulation capability will add a high fidelity representation of Sentinel to IAMD to allow for optimum engagement management and mission planning. Supports Sentinel Digital Simulation Software (SDS/SENTSIM) development efforts for testing of future capabilities. Includes software development for Low Slow Small in a test fix test environment as well as integration and testing of the IAMD B kit on board the Sentinel FMTV platform.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
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Adjunct sensor technology effort will integrate and test a supplemental technology for the Sentinel A3 radar to detect and identify current and emerging threats. Adjunct sensor technology compliments current radar capabilities to improve system performance and reduces adversaries countermeasure abilities by improving system electronic protect capabilities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: Product Development	26.865	33.114	102.130	-	102.130
Description: Funding is provided for the following efforts: ***FY 2019 Plans:*** Integrate firmware, software and hardware. Design and build prototype subsystems/components for testing. Complete software code coding and modification of the system search and track logic, clutter mapping, and waveforms. Characterize performance, design & replace firmware, software and hardware. Perform technical assessments, concept studies, cost reduction, risk reduction, threat analysis, and required documentation. Continue analysis of technology, program milestone documentation, development of contract requirement packages and proposal evaluation activities in support of Active Electronically Scanned Array (AESA) technology. Support acquisition and contract activities for Sentinel AESA in preparation for Milestone B and contract award. ***FY 2020 Base Plans:*** Will integrate firmware, software and hardware. Design and build prototype subsystems/components for testing. Complete software code coding and modification of the system search and track logic, clutter mapping, and waveforms for Counter Rocket, Artillery, & Mortar (C-RAM) and Counter Unmanned Aircraft System (C-UAS) missions as well as the Resiliency and Software Assurance Modification (RSAM) upgrade effort. Characterize performance, design & replace firmware, software and hardware. Perform technical assessments, concept studies, cost reduction, risk reduction, threat analysis, and required documentation. Continue development of Active Electronically Scanned Array (AESA) technology, conduct design reviews for Sentinel AESA (Sentinel A4), begin procurement of material for Engineering and Manufacturing Development (EMD) assets. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Initiate Counter Rocket, Artillery, & Mortar (C-RAM) improvement capabilities to the Sentinel A3 and continued support for Sentinel AESA (Sentinel A4) Engineering and Manufacturing Development (EMD) efforts. FY 2020 contains the first full year of the EMD Contract for Sentinel AESA A4 as well as the procurement of material for five (5) EMD assets; FY 2019 only contained four (4) months of the EMD contract effort.					
Title: Test & Evaluation	4.786	4.735	3.113	-	3.113
Description: Funding is provided for the following efforts:					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
FY 2019 Plans: Conduct software qualification test and hardware verification testing, field testing against representative targets. Prepare logistics products and required documentation for materiel release of software and hardware upgrades. ***FY 2020 Base Plans:*** Will conduct software qualification test and hardware verification testing, field testing against representative targets. Prepare logistics products and required documentation for materiel release of software and hardware upgrades. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Funding decrease due to completion of major hardware upgrade testing for the Sentinel A3 program. Active Electronically Scanned Array (AESA) (Sentinel A4) testing will not commence until a later date.					
Title: FY2019 SBIR/STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	1.440	-	-	-
Accomplishments/Planned Programs Subtotals	31.651	39.289	105.243	-	105.243

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• EF9: *System Integration and Test*	69.558	77.188	107.746	-	107.746	111.080	121.308	37.186	40.999	0.000	565.065
• EX2: *Lower Tier Air Missile Defense (LTAMD) Capability*	57.437	89.248	427.772	-	427.772	376.738	332.322	241.461	87.500	0.000	1,612.478
• C50016: *System Integration and Test Procurement*	136.579	105.395	0.000	113.857	113.857	105.044	107.288	86.178	87.410	Continuing	Continuing
• FM3: *Future Interceptor*	-	-	8.000	-	8.000	8.000	8.000	88.918	120.000	0.000	232.918
• C53101: *MSE Missile*	1,103.040	1,131.276	0.000	736.541	736.541	767.495	749.530	999.731	898.131	793.430	7,179.174
• DU3: *IFPC2*	10.871	40.979	0.000	-	0.000	-	-	-	-	0.000	51.850
• EY7: *IFPC Increment 2 - Block 1*	156.361	132.283	243.228	-	243.228	101.000	58.000	45.000	5.000	0.000	740.872

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0604820A / *Radar Development*	Project (Number/Name) E10 / *Sentinel*	

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• C62001: *IFPC Inc 2-I Block 1 Missile 1*	50.056	145.636	0.000	-	0.000	-	-	-	-	0.000	195.692
• C62002: *IFPC INC 2-I BLOCK 1 SYSTEM*	-	31.286	0.000	9.337	9.337	241.387	446.464	424.568	446.541	0.000	1,599.583
• FI4: *Maneuver - Short Range Air Defense (M-SHORAD)*	19.201	79.016	33.100	6.000	39.100	105.700	341.100	382.600	308.700	0.000	1,275.417
• C14300: *M-SHORAD - Procurement*	-	-	0.000	262.100	262.100	537.400	292.200	80.500	78.600	Continuing	Continuing
• S40: *Army Integrated Air and Missile Defense*	339.051	322.263	208.938	-	208.938	130.859	63.738	33.193	94.845	0.000	1,192.887
• BZ5075: *IAMD Battle Command System*	-	-	29.629	-	29.629	254.834	353.929	417.426	413.775	Continuing	Continuing
• 0604741A: *Air Defense Command, Control and Intelligence - Eng Dev*	190.385	212.373	43.502	-	43.502	24.944	7.068	1.228	3.405	0.000	482.905
• AD5070: *AIR & MSL Defense Planning & Control Sys*	132.713	29.913	24.730	14.331	39.061	49.147	106.671	63.143	0.075	0.000	420.723

Remarks

These programs are an integral part of the Army Integrated Air and Missile Defense (IAMD) architecture.

D. Acquisition Strategy

Sentinel was procured from Raytheon as a non-developmental item. Raytheon owns the Technical Data Package (TDP) for the Sentinel A3 and its predecessors and therefore no other contractor has the technical ability to modify the Sentinel radar or Sentinel software. The modifications planned for the Sentinel that fall into this category are: Electronic Attack/Electronic Protect, Signal Data Processor/North Finding Module, Medium Bandwidth, and Mode S. For the Active Electronically Scanned Array, the product office will issue a new contract to develop a modified Sentinel with a new Active Electronically Scanned Array (AESA) antenna.

Electronic Attack/Electronic Protect (EA/EP) (Sentinel A3): The Sentinel Product Office will contract with Raytheon to verify the initial EA/EP Database and update the database, software and hardware with more extensive EA/EP signatures to address evolving threats. The updated database will be tested, documented and released for installation.

Signal Data Processor (SDP)/North Finding Module (NFM) Obsolescence (Sentinel A3): The Sentinel Product Office will contract with Raytheon to upgrade and mitigate the Signal Data Processor and North Finding Module issues. The updated SDP and NFM hardware will be tested, documented and released for installation in the field.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 5	**R-1 Program Element (Number/Name)** PE 0604820A / *Radar Development*	**Project (Number/Name)** E10 / *Sentinel*

Medium Bandwidth Waveform (Sentinel A3): The Sentinel Product Office will contract with Raytheon to address latent tracking issues that currently exist with Sentinel in certain applications. The effort modifies firmware as well as software in the Sentinel radar. The updated medium bandwidth waveform software and firmware will be tested, documented and released for installation in the field.

Mode S (Sentinel A3): The Sentinel Product Office will contract with Raytheon to address both Sentinel's objective requirement to interrogate Identification Friend or Foe (IFF) mode S on board commercial aircraft as well as the M Code Global Positioning System (GPS) capability. The updated software will be tested, documented and released for installation in the field.

RSAM (Sentinel A3): The Sentinel Product Office will contract with Raytheon to address Sentinel's Resiliency and Software Assurance Modification (RSAM) requirement by updating Sentinel software to accept and respond to the new RSAM messages. The updated software will be tested, documented and released for installation in the field.

Active Electronically Scanned Array (AESA) (Sentinel A4): The Sentinel Product Office will award a new competitive contract to develop an AESA antenna and other associated radar modifications for integration with the existing Sentinel A3 hardware and software. The CMDS Product Office will support requirement documentation and conduct design analysis to include analysis of technology, decision review preparation, and contract package development for acquisition of the AESA antenna and other radar modifications to upgrade the current Sentinel A3. The software and hardware will be tested, documented and released for installation in the field.

Sentinel System of Systems (Sentinel A3): The Sentinel Product Office will contract with Raytheon for risk reduction efforts in the development of the software package to support the identification and engagement of Low Slow Small target sets. The Sentinel Product Office will work with Other Government Agencies to finalize integration and test of the IAMD B Kit on board the Sentinel platform and to add simulation capability to allow a high fidelity representation of Sentinel to IAMD.

Counter Rocket, Artillery & Mortars (Sentinel A3): The Sentinel Product Office will contract with Raytheon for software development to add increased capabilities against the Low Slow Small and Rocket, Artillery & Mortars (RAM) threats. The software will be tested, documented and released for installation in the field.

Adjunct Sensor (Sentinel A3): The Sentinel Product Office will integrate and test a government off the shelf adjunct sensor. The sensor will be tested, documented and released for installation in the field.

E. Performance Metrics

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army			Date: March 2019
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Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Electronic Attack/ Electronic Protect	Various	Various : Multiple	0.425	-		-		-		-		-	0.000	0.425	-
Signal Data Processor North Finding Module	Various	Various : Multiple	0.125	-		-		-		-		-	0.000	0.125	-
Medium Bandwidth Waveform	Various	Various : Multiple	0.213	-		-		-		-		-	0.000	0.213	-
Active Electronically Scanned Array (A4)	Various	Various : Multiple	0.549	-		-		-		-		-	0.000	0.549	-
Management Support	Various	Various : Multiple	1.498	2.841	Nov 2017	2.843	Nov 2018	4.015	Nov 2019	-		4.015	Continuing	Continuing	Continuing
		Subtotal	2.810	2.841		2.843		4.015		-		4.015	Continuing	Continuing	N/A

Remarks

The Management Services increase in FY20 is due to the additional Product Office support required for the Sentinel A4 development contract. Additional systems engineering and logistics oversight required to support Sentinel A4 development contract.

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Signal Data Processor/ North Finding Module	Various	Raytheon & Various : Fullerton, CA / Various	4.669	-		-		-		-		-	0.000	4.669	-
Medium Bandwidth Waveform	Various	Raytheon & Various : Fullerton, CA / Various	1.645	0.222	Jan 2018	-		-		-		-	0.000	1.867	-
System of Systems	Various	Raytheon & Various : Fullerton, CA / Various	-	4.900	Jan 2018	-		-		-		-	0.000	4.900	-
Electronic Attack/ Electronic Protect	Various	Raytheon & Various : Fullerton, CA / Various	8.856	6.460	Jan 2018	6.188	Jan 2019	5.358	Jan 2020	-		5.358	Continuing	Continuing	-
Active Electronically Scanned Array (A4)	C/CPIF	TBD & Cruise Missile Defense Systems :	6.780	12.024	Jan 2018	20.213	May 2019	79.685	May 2020	-		79.685	Continuing	Continuing	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army			Date: March 2019
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		TBD and Huntsville, AL													
Mode S	Various	Raytheon & Various : Fullerton, CA / Various	-	1.838	Jan 2018	5.134	Jan 2019	0.887	Jan 2020	-		0.887	0.000	7.859	-
Resiliency and Software Assurance Modification (RSAM) upgrade	Various	Raytheon & Various : Fullerton, CA / Various	-	-		-		2.209	Jan 2020	-		2.209	0.000	2.209	-
Counter Rocket Artillery and Mortars	Various	Raytheon & Various : Fullerton, CA / Various	-	-		-		9.240	Jan 2020	-		9.240	Continuing	Continuing	-
FY 2019 SBIR/STTR Transfer	TBD	TBD : TBD	-	-		1.440		-		-		-	0.000	1.440	-
		Subtotal	21.950	25.444		32.975		97.379		-		97.379	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Signal Data Processor North Finding Module	Various	Raytheon & Various : Fullerton, CA / Various	1.105	-		-		-		-		-	0.000	1.105	-
Medium Bandwidth Waveform	Various	Raytheon & Various : Fullerton, CA / Various	0.623	0.151	Jan 2018	-		-		-		-	0.000	0.774	-
System of Systems	Various	Raytheon & Various : Fullerton, CA / Various	-	1.561	Jan 2018	-		-		-		-	0.000	1.561	-
Electronic Attack/ Electronic Protect	Various	Raytheon & Various : Fullerton, CA / Various	1.320	1.138	Jan 2018	1.501	Jan 2019	0.765	Jan 2020	-		0.765	Continuing	Continuing	-
Mode S	Various	Raytheon & Various : Fullerton, CA / Various	-	0.516	Jan 2018	1.970	Jan 2019	1.264	Jan 2020	-		1.264	Continuing	Continuing	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army			Date: March 2019
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Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Resiliency and Software Assurance Modification (RSAM) upgrade	Various	Raytheon & Various : Fullerton, CA / Various	-	-		-		0.500	Jan 2020	-		0.500	0.000	0.500	-
Counter Rocket Artillery and Mortars	Various	Raytheon & Various : Fullerton, CA / Various	-	-		-		1.320	Jan 2020	-		1.320	Continuing	Continuing	-
		Subtotal	3.048	3.366		3.471		3.849		-		3.849	Continuing	Continuing	N/A

	Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	27.808	31.651		39.289		105.243		-		105.243	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 5	**R-1 Program Element (Number/Name)** PE 0604820A / *Radar Development*	**Project (Number/Name)** E10 / *Sentinel*

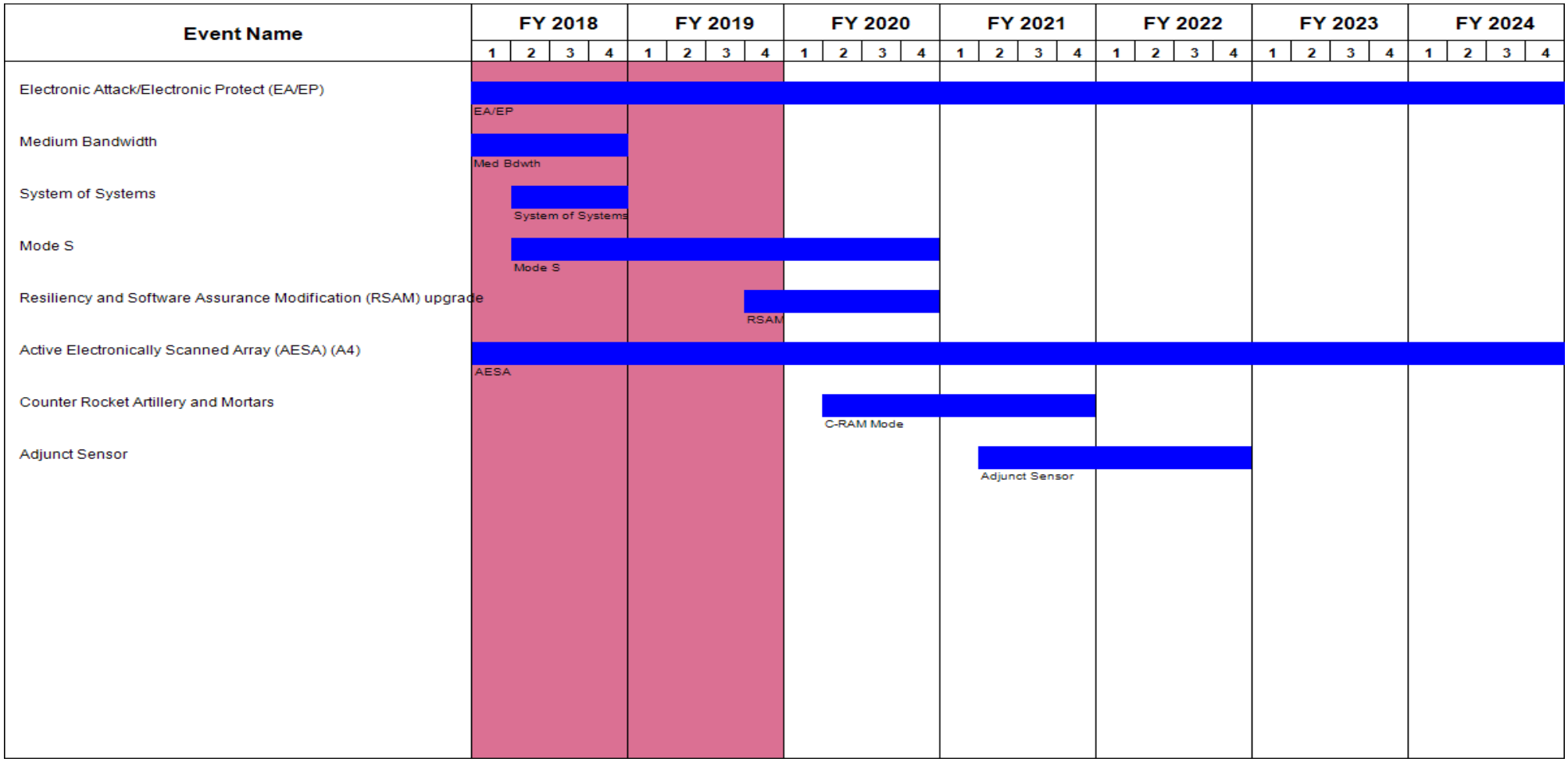

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 5	**R-1 Program Element (Number/Name)** PE 0604820A / *Radar Development*	**Project (Number/Name)** E10 / *Sentinel*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Battle Space Improvement	4	2012	4	2015
Stop, Stare and Track (SS&T)	4	2012	4	2015
Cross Domain Solution (CDS) Network Interface / Cyber Security	2	2015	4	2016
Electronic Attack/Electronic Protect (EA/EP)	2	2015	4	2033
Signal Data Processor (SDP) / North Finding Module (NFM)	2	2015	4	2017
Medium Bandwidth	2	2016	4	2018
System of Systems	2	2018	4	2018
Mode S	2	2018	4	2020
Resiliency and Software Assurance Modification (RSAM) upgrade	4	2019	4	2020
Active Electronically Scanned Array (AESA) (A4)	1	2017	4	2033
Counter Rocket Artillery and Mortars	2	2020	4	2021
Adjunct Sensor	2	2021	4	2022