

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 5: System Development & Demonstration (SDD)</i>	R-1 Program Element (Number/Name) PE 0604820A / <i>Radar Development</i>
--	--

COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	124.832	71.259	94.944	-	94.944	48.837	18.987	8.508	8.603	0.000	375.970
E10: <i>Sentinel</i>	-	124.832	71.259	94.944	-	94.944	48.837	18.987	8.508	8.603	0.000	375.970

A. Mission Description and Budget Item Justification

This funding line is a key enabler of the Army Modernization Priorities in support of the Sentinel Radar program 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, providing critical air surveillance of the forward areas. The AIAMD architecture is an integrated fires development effort that includes survivability, resiliency, and effectiveness improvements against advanced threats from near-peer adversaries. This effort includes integration with an evolving common fires mission command, common development tools and processes, and annual test and evaluation to provide data to support program assessments and progress toward closure of performance gaps.

Sentinel A3 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 U.S. and Coalition aircraft.

The Sentinel A4 Active Electronically Scanned Array (AESA) is the next generation of radar technology to replace the current phase and frequency scanned array used by Sentinel today. Sentinel A4 hardware and software upgrades will extend the range for ground-based surveillance and situational awareness; will have faster and more accurate Non-Cooperative Target Recognition (NCTR) for clearing fires and preventing fratricide; will improve track accuracy, and management of larger track loads; and improve operation in severe/urban clutter. The system will provide simultaneous multi-mission capability and provides hemispherical surveillance to 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 aircraft, at low altitudes in clutter. The system will detect, track, and classify Rocket, Artillery, and Mortar (RAM) threats and will support M-SHORAD, AIAMD, IFPC and Defense of Guam Operational requirements with Fire Control quality tracks. Sentinel A4 will incorporate the upgraded AN//TPX-61 IFF with M-Code capability added by replacing the GB-Gram card with M-Code GB-Gram cards. Sentinel A4 will also address system survivability enhancements via the Air and Missile Defense - Integration (AMD-I) efforts.

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Army	Date: March 2023
---	-------------------------

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 5: System Development & Demonstration (SDD)</i>	R-1 Program Element (Number/Name) PE 0604820A / <i>Radar Development</i>
--	--

B. Program Change Summary (\$ in Millions)	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024 Base</u>	<u>FY 2024 OCO</u>	<u>FY 2024 Total</u>
Previous President's Budget	122.607	71.259	74.055	-	74.055
Current President's Budget	124.832	71.259	94.944	-	94.944
Total Adjustments	2.225	0.000	20.889	-	20.889
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	2.225	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	20.889	-	20.889

Change Summary Explanation

FY 2024 Base dollars is in support of the Pacific Deterrence Initiative. This is an increase from the FY 2023 funding level, which had no request for PDI funding in Program Element 0604820A/ Radar Development. This funding will be utilized for Defense Guam (from R-3).

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army										Date: March 2023		
Appropriation/Budget Activity 2040 / 5					R-1 Program Element (Number/Name) PE 0604820A / <i>Radar Development</i>				Project (Number/Name) E10 / <i>Sentinel</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
E10: <i>Sentinel</i>	-	124.832	71.259	94.944	-	94.944	48.837	18.987	8.508	8.603	0.000	375.970
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Sentinel A4 detects, tracks, and classifies RAM threats and will support Integrated Air and Missile Defense Battle Command System (IBCS) requirements and contributes sensor support for mitigating current and future Indirect Fire Protection Capability Increment 2 mission requirements as well as Mobile Short Range Air Defense (M-SHORAD) battalions. FY 2024 funding supports the integration for five (5) Initial Operational Test and Evaluation (IOT&E) Systems, the development of additional survivability enhancements (AMD-I) for inclusion into Sentinel A4, as well as the non-recurring engineering efforts to enhance the Sentinel A4 configuration to support Defense of Guam mission set to enable fielding in country by requested timelines. Integration for the IOT&E systems will complete in FY2024. These IOT&E systems will field in support of IOT&E testing scheduled to begin in 1QFY2025.

Electronic Attack/Electronic Protect (EA/EP) addresses the electronic countermeasures (ECM) gap for Sentinel A3. This effort continues through the life of the radar, addressing both changing threats and electronic counter measure gaps.

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

	FY 2022	FY 2023	FY 2024
Title: Product Development	117.650	53.380	89.383
Description: Funding is provided for the following Product Development efforts:			
FY 2023 Plans: Will continue to build and integration of five (5) Sentinel A4 User Operational Evaluation Systems (UOES) to serve as soldier touch points for feedback prior to initiating Low Rate Initial Production (LRIP). Will provide UOES assets to support test events for emerging requirements. Will initiate build of five (5) Initial Operational Test and Evaluation (IOT&E) assets for delivery in support of system IOT&E. Will continue to perform technical assessments, concept studies, cost reduction, risk reduction, threat analysis, and required documentation for Sentinel A3.			
FY 2024 Plans: Will continue build and integration of five (5) Initial Operational Test and Evaluation (IOT&E) assets for delivery in support of system IOT&E. Will develop additional survivability enhancements (AMD-I) for inclusion into Sentinel A4. Will enhance Sentinel A4 to support Defense of Guam mission. Will continue to perform technical assessments, concept studies, cost reduction, risk reduction, threat analysis, and required documentation for Sentinel A3. See R-3 for details.			
FY 2023 to FY 2024 Increase/Decrease Statement:			

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army		Date: March 2023
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0604820A / Radar Development	Project (Number/Name) E10 / Sentinel

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 increase due to development of system survivability enhancements (AMD-I) for inclusion into Sentinel A4 and to enhance Sentinel A4 to support Defense of Guam mission.			
<p>Title: Test & Evaluation</p> <p>Description: Funding is provided for the following Test and Evaluation efforts:</p> <p>FY 2023 Plans: Supports completion of Developmental Test for Sentinel A4 EMD assets. Supports Sentinel A4 Limited User Test (LUT) and Operational Test Agency (OTA) Milestone Assessment Report (OMAR). Will conduct software qualification test and hardware verification testing, field testing against representative targets. Prepares logistics products and required documentation for materiel release of software and hardware upgrades for Sentinel A3.</p> <p>FY 2024 Plans: Supports soldier touchpoint for Sentinel A4 User Operational Evaluation Systems (UOES) to gain soldier feedback. Initiates target and range support for Sentinel A4 Initial Operational Test and Evaluation (IOT&E). Provides support for System of System integration test events. Will conduct software qualification test and hardware verification testing, field testing against representative targets. Prepares logistics products and required documentation for materiel release of software and hardware upgrades for Sentinel A3 and Sentinel A4.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Decrease from FY 2023 to FY 2024 due to completion of Developmental Testing and Limited User Testing (LUT) for Sentinel A4 in FY 2023.</p>	7.182	15.278	5.561
<p>Title: SBIR/STTR</p> <p>Description: Funding transferred in accordance with Title 15 USC §638.</p> <p>FY 2023 Plans: Funding transferred in accordance with Title 15 USC §638.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding transferred in accordance with Title 15 USC §638.</p>	-	2.601	-
Accomplishments/Planned Programs Subtotals	124.832	71.259	94.944

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2022	FY 2023	FY 2024	FY 2024	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	Cost To	Total Cost
			Base	OCO	Total					Complete	
• WK5057: Sentinel Mods	100.642	166.736	161.886	-	161.886	233.368	501.923	504.229	548.401	Continuing	Continuing

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army **Date:** March 2023

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 2022	FY 2023	FY 2024	FY 2024	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	Cost To	
			Base	OCO	Total					Complete	Total Cost
• EX2: Lower Tier Air Missile Defense (LTAMD) Capability	408.766	380.147	816.663	-	816.663	118.939	122.544	89.261	90.257	0.000	2,026.577
• FM3: Future Interceptor	6.643	8.179	8.040	-	8.040	8.042	8.052	8.138	8.229	0.000	55.323
• C53101: MSE Missile	1,333.148	1,037.093	1,212.832	-	1,212.832	961.192	973.464	985.250	985.854	Continuing	Continuing
• EY7: IFPC Increment 2 - Block 1	175.604	131.093	196.248	-	196.248	154.275	166.672	113.841	135.117	0.000	1,072.850
• C62002: IFPC INC 2- I BLOCK 1 SYSTEM	19.053	18.924	313.189	-	313.189	697.307	1,002.324	1,023.636	985.973	0.000	4,060.406
• FI4: Maneuver - Short Range Air Defense (M-SHORAD)	37.939	10.363	10.188	-	10.188	10.190	15.235	10.209	10.323	0.000	104.447
• C14300: M-SHORAD - Procurement	332.984	135.747	400.697	-	400.697	-	-	-	-	Continuing	Continuing
• S40: Army Integrated Air and Missile Defense	154.257	263.545	254.163	-	254.163	355.723	214.394	135.637	166.652	0.000	1,544.371
• BZ5075: IAMD Battle Command System	399.800	438.967	412.556	-	412.556	509.654	572.362	658.046	442.781	Continuing	Continuing
• 0604741A: Air Defense Command, Control and Intelligence - Eng Dev	58.633	55.541	74.738	-	74.738	70.022	64.141	70.657	71.628	Continuing	Continuing
• AD5070: AIR & MSL Defense Planning & Control Sys	67.193	72.619	68.892	-	68.892	67.495	-	-	-	0.000	276.199

Remarks

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

D. Acquisition Strategy

Sentinel A3 and its predecessors were procured from Raytheon as a non-developmental item. The U.S. Government does not have adequate data rights for the Sentinel A3 and its predecessors; therefore no other contractor has the technical ability to modify the Sentinel A3 radar or Sentinel A3 software. The modifications for Sentinel A3 fall into these categories: Electronic Attack/Electronic Protect; Signal Data Processor; North Finding Module; Medium Bandwidth; Resiliency and Software Assurance Modification (RSAM); Counter Rocket Artillery and Mortar (C-RAM), Low Slow Small, Unmanned Aircraft Systems, Cruise Missiles; and Mode S. Electronic Attack/Electronic Protect will be an ongoing effort to ensure Sentinel A3 remains relevant in the field until A4 is fielded.

For the Sentinel A4 modification, Lockheed Martin was competitively awarded a Fixed Price Incentive Firm (FPIF) contract to develop a modified Sentinel with a new Active Electronically Scanned Array (AESA) antenna. The contract award to Lockheed Martin includes EMD with priced options for LRIP. Fifteen RDTE funded assets are on contract with Lockheed Martin including five (5) EMD prototypes, five (5) UOES assets to support System of System Integration Testing and five (5) IOT&E assets.

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity	R-1 Program Element (Number/Name)	Project (Number/Name)
2040 / 5	PE 0604820A / <i>Radar Development</i>	E10 / <i>Sentinel</i>

Sentinel is a component of an integrated fires development effort that includes survivability, resiliency, and effectiveness improvements against advanced threats from near-peer adversaries. This effort includes integration with an evolving common fires mission command, common development tools and processes, and annual test and evaluation to provide data to support program assessments and progress toward closure of performance gaps.

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0604820A / Radar Development	Project (Number/Name) E10 / Sentinel
--	---	--

Management Services (\$ in Millions)				FY 2022		FY 2023		FY 2024 Base		FY 2024 OCO		FY 2024 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Management Support	Various	Various : Multiple	17.101	4.679	Nov 2021	4.768	Nov 2022	4.858	Nov 2023	-		4.858	Continuing	Continuing	Continuing
SBIR/STTR	TBD	N/A : N/A	-	-		2.601		-		-		-	0.000	2.601	-
Subtotal			17.101	4.679		7.369		4.858		-		4.858	Continuing	Continuing	N/A

Product Development (\$ in Millions)				FY 2022		FY 2023		FY 2024 Base		FY 2024 OCO		FY 2024 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Electronic Attack/ Electronic Protect	Various	Raytheon & Various : Fullerton, CA / Various	31.172	5.327	Jan 2022	4.000	Jan 2023	3.839	Jan 2024	-		3.839	Continuing	Continuing	-
Active Electronically Scanned Array (A4)	C/FPIF	Lockheed Martin & Search, Track, Acquire, Radiate, Eliminate (PM STARE) : Syracuse, NY and Huntsville, AL	204.839	100.944	Jan 2022	44.612	Jan 2023	54.108	Jan 2024	-		54.108	Continuing	Continuing	-
Anti-Tamper (A4)	SS/ Various	Lockheed Martin & Search, Track, Acquire, Radiate, Eliminate (PM STARE) : Syracuse, NY and Huntsville, AL	-	6.700	Jan 2022	-		-		-		-	0.000	6.700	-
System survivability Enhancements (AMD-I) (A4)	SS/ Various	Lockheed Martin & Search, Track, Acquire, Radiate, Eliminate (PM STARE) : Syracuse, NY and Huntsville, AL	-	-		-		12.064	Jan 2024	-		12.064	Continuing	Continuing	-
Defense of Guam Development (A4)	C/FPIF	Lockheed Martin & Search, Track, Acquire, Radiate,	-	-		-		14.514	Jan 2024	-		14.514	0.000	14.514	-

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0604820A / Radar Development	Project (Number/Name) E10 / Sentinel
--	---	--

Product Development (\$ in Millions)				FY 2022		FY 2023		FY 2024 Base		FY 2024 OCO		FY 2024 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
		Eliminate (PM STARE) : Syracuse, NY and Huntsville, AL													
Subtotal			236.011	112.971		48.612		84.525		-		84.525	Continuing	Continuing	N/A

Test and Evaluation (\$ in Millions)				FY 2022		FY 2023		FY 2024 Base		FY 2024 OCO		FY 2024 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Electronic Attack/ Electronic Protect	Various	Raytheon & Various : Fullerton, CA / Various	6.540	0.840	Jan 2022	0.225	Jan 2023	0.229	Jan 2024	-		0.229	Continuing	Continuing	-
Active Electronically Scanned Array (A4)	C/FPIF	Lockheed Martin & Search, Track, Acquire, Radiate, Eliminate (PM STARE : Syracuse, NY and Huntsville, AL	-	6.342	Jan 2022	15.053	Jan 2023	5.332	Jan 2024	-		5.332	Continuing	Continuing	-
Subtotal			6.540	7.182		15.278		5.561		-		5.561	Continuing	Continuing	N/A

Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	Cost To Complete	Total Cost	Target Value of Contract			
Project Cost Totals			259.652	124.832	71.259	94.944	-	94.944	Continuing	Continuing	N/A

Remarks

UNCLASSIFIED

Exhibit R-4, RDT&E Schedule Profile: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0604820A / Radar Development	Project (Number/Name) E10 / Sentinel
--	---	--

Event Name	FY 2022				FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028			
	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
Sentinel A3																												
Electronic Attack/Electronic Protect (EA/EP)																												
EA/EP																												
Active Electronically Scanned Array (AESA) (A4)																												
Engineering Manufacturing and Development Prototype Build																												
EMD Prototype Build and Integration																												
Contractor Verification Testing																												
CVT																												
Developmental Test																												
Developmental Test																												
Defense of Guam Development																												
Combatant Commands NRE																												
Limited User Testing																												
LUT																												
Operational Test Agency (OTA) Milestone Assessment Report																												
OMAR																												
Milestone C																												
MS C																												
User Operational Evaluation System (UOES) Build and Integration																												
UOES Build and Integration																												
Initial Operational Test and Evaluation System Build and Integration																												
IOT&E Asset Build and Integration																												
Soldier touchpoint and feedback and test																												
UOES system of systems integration																												

UNCLASSIFIED

Exhibit R-4, RDT&E Schedule Profile: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0604820A / <i>Radar Development</i>	Project (Number/Name) E10 / <i>Sentinel</i>
--	--	---

Event Name	FY 2022				FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028			
	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
System Survivability Enhancements (AMD-I)									AMD-I																			
Range and Target Support													Range and Test Support															
Initial Operational Test and Evaluation (IOT&E)													IOT&E															
Pre-Planned Product Enhancements													Product Enhancements															

UNCLASSIFIED

Exhibit R-4A, RDT&E Schedule Details: PB 2024 Army **Date:** March 2023

Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0604820A / <i>Radar Development</i>	Project (Number/Name) E10 / <i>Sentinel</i>
--	--	---

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Sentinel A3	2	2019	4	2030
Electronic Attack/Electronic Protect (EA/EP)	2	2015	4	2030
Active Electronically Scanned Array (AESA) (A4)	4	2019	4	2033
Milestone B	4	2019	4	2019
Engineering Manufacturing and Development Prototype Build and Integration	2	2020	2	2022
Preliminary Design Review	2	2020	2	2020
Critical Design Review	2	2021	2	2021
Contractor Verification Testing	4	2021	2	2022
Developmental Test	2	2022	2	2023
Defense of Guam Development	2	2023	2	2026
Limited User Testing	3	2023	3	2023
Operational Test Agency (OTA) Milestone Assessment Report	3	2023	3	2023
Milestone C	3	2023	3	2023
User Operational Evaluation System (UOES) Build and Integration	1	2022	2	2023
Initial Operational Test and Evaluation System Build and Integration	3	2023	4	2024
Soldier touchpoint and feedback and test	1	2024	3	2024
System Survivability Enhancements (AMD-I)	2	2024	3	2026
Range and Target Support	4	2024	4	2024
Initial Operational Test and Evaluation (IOT&E)	1	2025	2	2025
Pre-Planned Product Enhancements	2	2025	4	2030