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Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army **Date:** May 2021

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 5: System Development & Demonstration (SDD)</i>	R-1 Program Element (Number/Name) PE 0605051A / <i>Aircraft Survivability Development</i>
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COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	-	130.211	99.208	65.603	-	65.603	-	-	-	-	-	-
ER7: <i>Aircraft Survivability Equipment Development</i>	-	47.244	31.128	38.329	-	38.329	-	-	-	-	-	-
ER8: <i>Common Missile Warning System (CMWS)</i>	-	82.967	68.080	27.274	-	27.274	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The Aircraft Survivability Development budget line includes funding to support the development and integration of Aircraft Survivability Equipment (ASE) products onto Future Vertical Lift (FVL) Future Attack Reconnaissance Aircraft (FARA), Future Long Range Assault Aircraft (FLRAA) aircraft variants and future platforms.

The Aircraft Survivability Development program includes Projects titled Aircraft Survivability Equipment Development (ER7) and Common Missile Warning System (CMWS) (ER8). This program also includes funding for Joint Urgent Operational Needs Statement (JUONS) SO-0010 Phase 2a, Headquarters Department of the Army (HQDA) Directed Requirement for Advanced Threat Warner (ATW) portion of Phase 3 ATW/Common Infrared Countermeasures Quick Reaction Capability (ATW/ CIRCM QRC), and Limited Interim Missile Warning System Quick Reaction Capability (LIMWS QRC).

ER7: Aircraft Survivability Development.

The objective of the ASE Development project is to improve Radio Frequency (RF) ASE for Army Aviation. APR-39 Radar Warning Receiver (RWR) detects, categorizes, and prioritizes RF emitters and provides a visual / aural alert to aircrew members warning them of targeting by RF-guided weapons. The Milestone Decision Authority (MDA) approved Phases 1 and 2 of a 3-phased path forward.

Phase 1, APR-39C(V)1/4, serves as an obsolescence / sustainment upgrade to the Processor Line Replaceable Unit (LRU) for AN/APR-39A(V) RWR implemented to ensure that the currently fielded system remains viable until affordable improved RF ASE capability can be pursued in Phases 2 and 3.

Phase 2A is RWR Modernization begins by adopting the United States Navy APR-39D(V)2 system. APR-39D(V)2 will significantly improve the RF threat coverage, automatic detection and identification of threat types, bearing, and lethality. Phase 2B, the APR-39E(V)2, Modernized Radar Warning Receiver (MRWR), is an Army Engineering Change Proposal (ECP) to APR-39D(V)2, approved in the Acquisition Decision Memorandum (ADM) signed June 24, 2019. This ECP will implement enhanced hardware and software upgrades to keep APR-39 technically relevant against new and emerging agile threats. APR-39E(V)2 is part of the suite of ASE mission equipment for the FVL platforms.

Phase 3 adds active Radio Frequency Electronic Countermeasures (RF-ECM) capability for selected aircraft with Material Development Decision (MDD) planned in the future.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 5: System Development & Demonstration (SDD)</i>	R-1 Program Element (Number/Name) PE 0605051A / <i>Aircraft Survivability Development</i>	
<p>Justification: FY 2022 Base Research Development Technology & Evaluation (RDT&E) funding of \$38.329 million supports APR-39E(V)2 hardware and software system development, system government qualification, and performance testing.</p> <p>ER8: Common Missile Warning System (CMWS). The Fiscal Year (FY) 2022 Direct War/Enduring Operations dollars in the amount of \$19.129 million in Project ER8 will continue to support the CMWS program is a missile warning system that cues both flare and laser-based countermeasures to defeat incoming Infrared (IR)-seeking missiles and will alert aircrews to the presence of certain incoming unguided munitions. The B-Kit consists of the components which perform the missile detection and aircrew notification, unguided munitions detection and aircrew notification, false alarm rejection, and countermeasure employment/cueing functions of the system. The CMWS Electronic Control Unit (ECU) receives ultraviolet (UV) missile detection data from Electro-Optic Missile Sensors (EOMS), which detect UV signals, and sends a missile alert signal to warn aircrews via on-board avionics. Tier 1 threat missiles detected and tracked by CMWS are subsequently defeated by a combination of missile seeker countermeasures, including decoy flares and IR Laser Jamming (currently Common Infrared Countermeasures (CIRCM) -multiple platforms and Advanced Threat Infrared Countermeasures (ATIRCM)-equipped CH-47 platform only). In addition CMWS ECU receives from the EOMS unguided munitions detection data which it also passes to the aircrew through aural and visual alerts. The aircrew then applies the appropriate Tactics, Techniques and Procedures (TTPs) to break contact or engage the enemy with own-ship ordnance. CMWS Generation 3 (Gen 3) ECU in conjunction with ongoing software development efforts will address outstanding materiel release conditions and ensure protection against emerging IR-guided missile threats. Due to limited quantities of B-Kits, CMWS will remain in the Army inventory for a number of years and must remain relevant against emerging threats.</p> <p>The A-Kit for CMWS includes mounting hardware, wiring harnesses, cables, and other components necessary to install and interface the mission kit on host aircraft. The A-Kit ensures the mission kit is functionally and physically operational with a specific host aircraft type.</p> <p>As a part of Phase 2a of the JUONS (SO-0010) program, the Army integrated the Department of the Navy Large Aircraft Infrared Countermeasure (DoN LAIRCM) system onto the Army and Special Operations Aircraft platforms. Due to a number of challenges, circumstances, and variables, the Army updated the Advanced Threat Warning/CIRCM QRC and LIMWS Directed Requirements (dated November 16, 2018). The updated requirements extend the utilization of ATW DoN LAIRCM on conventional Army aircraft and cancel the need for the ATW/CIRCM QRC system for the conventional Army. (It should be noted that the updated requirement maintains the need for ATW/CIRCM on the Special Operations Aircraft. Sustainment of ATW on Special Operations Aircraft will transfer to Special Operations Aircraft budget line in FY22) As a result, the Army did not acquire the ATW sensors for use in Phase 3 of the JUONS effort. Instead, the Army accelerated the procurement of the CIRCM QRC systems for use with the currently fielded CMWS in preparation for transition to the LIMWS system.</p> <p>Phase 4 LIMWS QRC addresses the HQDA Directed Requirement to provide a greater capability than CMWS, the current Program of Record (POR), to bridge the gap between CMWS and the future POR. LIMWS is required to provide increased detection range, improved detection in clutter, more agile algorithms to rapidly respond to emerging threats, and eliminates the need for sensor alignments. To maintain overmatch of quickly emerging threat technology and tactics, LIMWS will explore and develop system modifications and performance improvements. LIMWS is part of the suite of ASE mission equipment for FVL platforms.</p>		

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Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 5: System Development & Demonstration (SDD)</i>	R-1 Program Element (Number/Name) PE 0605051A / <i>Aircraft Survivability Development</i>
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Justification:
 CMWS: FY 2022 Base RDTE dollars in the amount of \$8.149 million will fund Future Sensor and Algorithm Analysis including potential for incorporation of machine learning features, Threat and Vulnerability Analysis, and Systems Engineering Project Management (SEPM).

 Phase 4 LIMWS QRC: FY 2022 Direct War/Enduring Operation RDTE dollars in the amount of \$19.125 million are required to fund software development and testing of A-Kits for integration onto Army and Special Operations Aircraft; software, firmware, and hardware updates for Conventional Army Aircraft.

- References:**
- Joint Staff, J-8 Deputy Director for Requirements (DOR) memorandum, April 24, 2015
 - Phase 2a SOCOM JUONs S0-0010, Joint Rapid Acquisition Cell (JRAC) memorandum, May 29, 2015
 - Directed Requirement for the Phase 3 Advanced Threat Warner and Common Infrared Countermeasure Quick Reaction Capability (ATW/CIRCM QRC) to Support Joint Urgent Operational Need (JUON) S0-0010, CIRCM Critical Intelligence Parameters Breach, December 18, 2015
 - Directed Requirement for Limited Interim Missile Warning System to Detect Enemy Man Portable Air Defense Systems, March 26, 2017
 - Update to the Directed Requirement for the United States Special Operations Command Joint Urgent Operational Needs SO-0010 Threat Detection and Countermeasures to Enemy Man Portable Air Defense System Capability, November 16, 2018
 - Directed Requirement for Limited Interim Missile Warning System to Detect Enemy Man Portable Air Defense Systems, November 16, 2018
 - Aircraft Survivability Equipment (ASE) Modernization Fielding Guidance, Change 1, November 19, 2018
 - Acquisition Decision Memorandum (ADM) for Radio Frequency (RF) Project Manager Aircraft Survivability Equipment (PM ASE) Engineering Change Proposal (ECP) for Radar Warning Receiver AN/APR39-D(V)2 to AN/APR39-E(V)2, June 24, 2019 by PEO IEW&S.

B. Program Change Summary (\$ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	132.477	100.518	51.255	-	51.255
Current President's Budget	130.211	99.208	65.603	-	65.603
Total Adjustments	-2.266	-1.310	14.348	-	14.348
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.266	-1.310			
• Adjustments to Budget Years	-	-	14.348	-	14.348

Change Summary Explanation

The increase of \$14.348 million in FY22 base funding is due to a combination of the LIMWS movement of \$19.125 million from OCO to Direct War/Enduring Operation and the FY22 reduction in ER7 base of \$4.777 million.

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army										Date: May 2021		
Appropriation/Budget Activity 2040 / 5					R-1 Program Element (Number/Name) PE 0605051A / Aircraft Survivability Development				Project (Number/Name) ER7 / Aircraft Survivability Equipment Development			
COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
ER7: Aircraft Survivability Equipment Development	-	47.244	31.128	38.329	-	38.329	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Aircraft Survivability Equipment Development budget line includes funding to support the development and integration of ASE products onto FVL FARA, FLRAA aircraft variants and future platforms.

The objective of the ASE Development project is to improve RF ASE for Army aviation. APR-39 RWR detects, categorizes, and prioritizes RF emitters and provides a visual / aural alert to aircrew members warning them of targeting by RF-guided weapons. The MDA approved Phases 1 and 2 of a 3-phased path forward.

Phase 1, APR-39C(V)1/4, serves as an obsolescence / sustainment upgrade to the Processor LRU of APR-39A(V) RWR implemented to ensure that the currently fielded system remains viable until affordable improved RF ASE capability can be pursued in Phases 2 and 3.

Phase 2A is RWR Modernization begins by adopting the United States Navy APR-39D(V)2 system. APR-39D(V)2 will significantly improve the RF threat coverage, automatic detection and identification of threat types, bearing, and lethality. Phase 2B, the APR-39E(V)2, MRWR, is an Army ECP to APR-39D(V)2, approved in the ADM signed June 24, 2019. This ECP will implement enhanced hardware and software upgrades to keep APR-39 technically relevant against new and emerging agile threats. APR-39E(V)2 is part of the suite of ASE mission equipment for the FVL platforms.

Phase 3 adds active RF-ECM capability for selected aircraft with MDD planned in the future.

Justification: FY 2022 Base RDT&E funding of \$38.329 million supports APR-39E(V)2 hardware and software system development, system government qualification, and performance testing.

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

	FY 2020	FY 2021	FY 2022
Title: Phase 2 Radio Frequency Countermeasure (CM)	47.244	31.128	38.329
Description: Phase 2 RWR Modernization			
FY 2021 Plans: Will fund APR-39E(V)2 hardware and software system development, prototyping, platform integration, system engineering and program management, initial system government qualification and performance testing.			
FY 2022 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0605051A / Aircraft Survivability Development	Project (Number/Name) ER7 / Aircraft Survivability Equipment Development

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021	FY 2022
Will fund APR-39E(V)2 hardware and software system development, platform integration, systems engineering and program management, initial system government qualification and performance testing. Supports preliminary analysis for FVL A-Kit development and integration.			
<i>FY 2021 to FY 2022 Increase/Decrease Statement:</i> FY 2022 includes increased Base RDTE funding as APR-39E(V)2 is maturing in its system development.			
Accomplishments/Planned Programs Subtotals	47.244	31.128	38.329

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• AZ3511: Radio Frequency CM	46.353	36.890	56.441	-	56.441	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

Army RF ASE is managed by Project Manager ASE (PM ASE) for development, testing, procurement, integration and installation on Army rotary wing and fixed wing Special Electronic Mission Aircraft (SEMA) aviation platforms. PM ASE proposed a three-phased path forward commensurate with user priorities and affordability considerations. The MDA approved Phases 1 and 2 of a 3-phased path forward.

Phase 1, APR-39C(V)1/4, serves as an obsolescence / sustainment upgrade to the Processor LRU of APR-39A(V) RWR implemented to ensure that the currently fielded system remains viable until affordable improved RF ASE capability can be pursued in Phases 2 and 3. .

Phase 2A is RWR Modernization begins by adopting the United States Navy APR-39D(V)2 system. APR-39D(V)2 will significantly improve the RF threat coverage, automatic detection and identification of threat types, bearing, and lethality. Phase 2B, the APR-39E(V)2, MRWR, is an Army ECP to APR-39D(V)2, approved in the ADM signed June 24, 2019. This ECP will implement enhanced hardware and software upgrades to keep APR-39 technically relevant against new and emerging agile threats. APR-39E(V)2 is part of the suite of ASE mission equipment for the FVL platforms.

Phase 3 adds active RF-ECM capability for selected aircraft with MDD planned in the future.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army												Date: May 2021			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
2040 / 5				PE 0605051A / Aircraft Survivability Development				ER7 / Aircraft Survivability Equipment Development							
Management Services (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Threat Management/SEPM	Various	Various : -	9.624	1.788	Nov 2019	1.255	Nov 2020	1.910	Nov 2021	-		1.910	Continuing	Continuing	-
Project Management	Various	Various : -	1.926	-		-		-		-		-	Continuing	Continuing	-
NDA SEC 825 MDAP Cost Overrun	Various	Various : Various	0.028	-		-		-		-		-	0.000	0.028	-
Subtotal			11.578	1.788		1.255		1.910		-		1.910	Continuing	Continuing	N/A
Product Development (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Digital Radar Warning Receiver (RWR) (D(V)2)	Various	Lab Demo / Study : Various	10.634	-		-		-		-		-	Continuing	Continuing	-
APR-39E(V)2 SW & HW Development	Various	OGA : Aberdeen Proving Grounds, MD	47.837	42.321	Jan 2020	18.129	Oct 2020	19.799	Oct 2021	-		19.799	Continuing	Continuing	-
Threat and Vulnerability Analysis/Sil Updates	MIPR	I2WD : Aberdeen Proving Grounds, MD	2.547	-		-		-		-		-	Continuing	Continuing	-
Depot Standup	MIPR	Tobyhanna : Tobyhanna, PA	1.063	-		-		-		-		-	0.000	1.063	-
APR-39E(V)2 Platform Integration	Various	Multiple : -	4.552	1.391	Jan 2020	2.000	Jan 2021	-		-		-	Continuing	Continuing	-
Subtotal			66.633	43.712		20.129		19.799		-		19.799	Continuing	Continuing	N/A
Support (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Support	Various	Various : -	4.685	-		-		-		-		-	Continuing	Continuing	-
Matrix Support	Various	Various : -	6.800	-		-		-		-		-	Continuing	Continuing	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army												Date: May 2021			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
2040 / 5				PE 0605051A / Aircraft Survivability Development				ER7 / Aircraft Survivability Equipment Development							
Support (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Subtotal			11.485	-		-		-		-		-	Continuing	Continuing	N/A
Test and Evaluation (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
DT/OT	Various	Various : -	3.439	-		-		6.140	Mar 2022	-		6.140	Continuing	Continuing	-
Government System Test and Evaluation	Various	Various : -	20.967	1.744		9.744	Mar 2021	10.480	Oct 2021	-		10.480	Continuing	Continuing	-
Subtotal			24.406	1.744		9.744		16.620		-		16.620	Continuing	Continuing	N/A
Project Cost Totals			114.102	47.244		31.128		38.329		-		38.329	Continuing	Continuing	N/A
Remarks															

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Exhibit R-4, RDT&E Schedule Profile: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0605051A / Aircraft Survivability Development	Project (Number/Name) ER7 / Aircraft Survivability Equipment Development

Event Name	FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025				FY 2026				
	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	
Phase 2B APR-39E(V)2 Software and Hardware Development	[Redacted]																												
Phase 2B APR-39E(V)2 Government System Test and Evaluation					[Redacted]																								
Phase 2B APR-39E(V)2 DT/OT									[Redacted]																				
Phase 2B APR-39E(V)2 Platform Integration		[Redacted]																											

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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0605051A / Aircraft Survivability Development	Project (Number/Name) ER7 / Aircraft Survivability Equipment Development

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Threat Vulnerability Analysis//SIL Updates	3	2016	4	2017
Phase 2B APR-39E(V)2 Software and Hardware Development	2	2018	3	2023
Phase 2B APR-39E(V)2 Government System Test and Evaluation	3	2021	1	2024
Phase 2B APR-39E(V)2 DT/OT	2	2022	3	2023
Phase 2B APR-39E(V)2 Platform Integration	2	2020	4	2026

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army										Date: May 2021		
Appropriation/Budget Activity 2040 / 5					R-1 Program Element (Number/Name) PE 0605051A / Aircraft Survivability Development				Project (Number/Name) ER8 / Common Missile Warning System (CMWS)			
COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
ER8: Common Missile Warning System (CMWS)	-	82.967	68.080	27.274	-	27.274	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The CMWS budget line includes funding to support the development and integration of ASE products onto FVL FARA, FLRAA aircraft variants and future platforms.

The CMWS program is a missile warning system that cues both flare and laser-based countermeasures to defeat incoming IR seeking missiles and will alert aircrews to the presence of certain incoming unguided munitions. The B-Kit consists of the components which perform the missile detection and aircrew notification, unguided munitions detection and aircrew notification, false alarm rejection, and countermeasure employment/cueing functions of the system. The CMWS ECU receives UV missile detection data from EOMS, which detect UV signals, and sends a missile alert signal to warn aircrews via on-board avionics. Tier 1 threat missiles detected and tracked by the CMWS are subsequently defeated by a combination of missile seeker countermeasures, including decoy flares and IR Laser Jamming (currently CIRCM and ATIRCM equipped CH-47 platform only). In addition, the CMWS ECU receives from the EOMS unguided munitions detection data which it also passes to the aircrew through aural and visual alerts. The aircrew then applies the appropriate TTPs to break contact or engage the enemy with own-ship ordnance. The CMWS Generation 3 (Gen 3) ECU in conjunction with ongoing software development efforts will address outstanding materiel release conditions and ensure protection against emerging IR-guided missile threats. Due to limited quantities of B-Kits, CMWS will remain in the Army inventory for a number of years and must remain relevant against emerging threats.

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Phase 4 LIMWS QRC addresses the HQDA Directed Requirement to provide a greater capability than the current POR, CMWS, to bridge the gap between CMWS and the future POR. LIMWS is required to provide increased detection range, improved detection in clutter, more agile algorithms to rapidly respond to emerging threats, and eliminates the need for sensor alignments. To maintain overmatch of quickly emerging threat technology and tactics, LIMWS will explore and develop system modifications and performance improvements. LIMWS is part of the suite of ASE mission equipment for the FVL platforms.

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Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0605051A / Aircraft Survivability Development	Project (Number/Name) ER8 / Common Missile Warning System (CMWS)

CMWS: Fiscal Year FY 2022 Base RDTE dollars in the amount of \$8.149 million will fund Future Sensor and Algorithm Analysis including potential for incorporation of machine learning features, Threat and Vulnerability Analysis, and SEPM.

Phase 4 LIMWS: FY 2022 Direct War/Enduring Operation RDTE dollars in the amount of \$19.125 million are required to fund software development and testing of A-Kits for integration onto Army and Special Operations Aircraft; software, firmware, and hardware updates for Conventional Army Aircraft.

- References:
- Joint Staff, J-8 Deputy Director for Requirements (DOR) memorandum, April 24, 2015
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 - Directed Requirement for Limited Interim Missile Warning System to Detect Enemy Man Portable Air Defense Systems, November 16, 2018
 - Aircraft Survivability Equipment (ASE) Modernization Fielding Guidance, Change 1, November 19, 2018

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021	FY 2022
<p>Title: CMWS Product Development and Management Services</p> <p>Description: RDTE funding supports continuing development engineering threat and vulnerability analysis, SEPM, and integration with other ASE Systems.</p> <p>FY 2021 Plans: FY 2021 Base RDTE dollars in the amount of \$3.589 million will fund Future Sensor and Algorithm Analysis, Threat and Vulnerability Analysis, SEPM, analyze machine learning capabilities, and Model Based Systems Engineering (MBSE).</p> <p>FY 2022 Plans: FY 2022 Base RDTE dollars in the amount of \$8.149 million will fund Future Sensor and Algorithm Analysis including potential for incorporation of machine learning features, Threat and Vulnerability Analysis, SEPM, and MBSE.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: FY 2022 includes increased funding for potential incorporation of machine learning features.</p>	5.547	3.586	8.149
<p>Title: Phase 3 CIRCM QRC OCO</p> <p>Description: Phase 3 CIRCM QRC will achieve a reduction in Size, Weight, and Power (SWaP).</p>	2.220	-	-

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Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0605051A / Aircraft Survivability Development	Project (Number/Name) ER8 / Common Missile Warning System (CMWS)

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021	FY 2022
<p>Title: Phase 4 LIMWS QRC</p> <p>Description: Phase 4 LIMWS is a follow-on bridging solution to the JUONS SO-0010 to provide a greater capability than the current POR, CMWS, until the future POR is available. LIMWS is a Chief of Staff of the Army approved Directed Requirement issued by Army G-8 on March 26, 2017. LIMWS QRC provides an enhanced missile warning system to detect emerging and evolving enemy Man Portable Air Defense Systems (MANPADS) threats.</p> <p>FY 2021 Plans: FY 2021 OCO RDTE dollars in the amount of \$64.625 million funds development, engineering support and test of platform integration hardware and software for Army and Special Operations aircraft.</p> <p>FY 2022 Plans: FY 2022 Direct War/Enduring Operation RDTE dollars in the amount of \$19.125 million are required to fund development and testing of software and A-Kits for integration onto Army and Special Operations Aircraft as well as software, firmware, and hardware updates for Conventional Army Aircraft. Supports preliminary analysis for FVL integration. LIMWS will use MBSE models to support integration onto FVL aircraft variants.</p> <p>FY 2021 to FY 2022 Increase/Decrease Statement: Reduction due to the completion of the Army lead platform development, lead program testing and completion of SOA platform software builds.</p>	75.200	64.494	19.125
Accomplishments/Planned Programs Subtotals	82.967	68.080	27.274

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2020</u>	<u>FY 2021</u>	<u>FY 2022</u> <u>Base</u>	<u>FY 2022</u> <u>OCO</u>	<u>FY 2022</u> <u>Total</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>FY 2026</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• AZ3517: CMWS	144.218	159.729	148.570	-	148.570	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

CMWS: Procurement of US Government CMWS A-Kit and B-Kits are complete. CMWS is managed as Mission Equipment for deploying units and fielded as directed by Army G-3/5/7. The CMWS program will continue to be supported through a five year services-only Cost Plus Fixed Fee or Cost Plus Incentive Fee contract, with services to begin by September 2019.

Phase 2a JUONS DoN LAIRCM and Phase 3 CIRCM QRC: JUONS SO-0010 acquisition strategy includes aircraft prime contractor engineering support contracted to a Government test organization. Aircraft integration for JUONS will be handled through government operated organizations and industry partners.

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Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0605051A / <i>Aircraft Survivability Development</i>	Project (Number/Name) ER8 / <i>Common Missile Warning System (CMWS)</i>
<p>Phase 4 LIMWS QRC: Acquisition strategy included a full and open competition for selection of prime vendor for development of B-Kits, development of A-Kits, and support testing for the lead program. Additional platform A-Kit development will be handled by government organizations, small business and industry partners.</p> <p>Threat and Vulnerability analysis efforts will be used to determine if an algorithm update is required to maintain missile warning threat overmatch and provide input to improve US Government authoritative threat modeling updates.</p> <p>Future Sensor and Algorithm Analysis development equally supports MANPADS and Hostile Fire overmatch through evaluation of emerging sensor technologies and advances in algorithm techniques such as machine learning. This analysis identifies opportunities to optimize performance and modernize fielded systems in order to maintain relevance for the future. The CMWS machine learning analysis will explore the multitude of machine learning algorithms to determine the feasibility and applicability of applying them to the CMWS UV phenomenology environment. The goal is to address the CMWS areas of performance that could be improved with the use of machine learning algorithms. This a collaborative effort between industry, Army Futures Command, and an University Accredited Research Center.</p> <p>CMWS SEPM is necessary due to the nature of emerging and current threat(s). Threat(s) analyses include, when required, collaboration support with intelligence organizations, course of action planning, root cause investigations, threat and laboratory hardware maintenance, and lab tools upgrade to support specific performance analyses.</p> <p>Development of MBSE models of CMWS and LIMWS, which will align to Program Executive Office Aviation (PEO AVN) system engineering models, will be used to support integration of ASE products onto FARA and FLRAA aircraft variants. Continued MBSE development supports improved performance, weight reduction and testing.</p>		

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army **Date:** May 2021

Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0605051A / Aircraft Survivability Development	Project (Number/Name) ER8 / Common Missile Warning System (CMWS)
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Management Services (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 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			
CMWS Systems Engineering Program Management	Various	Various : PM ASE, HSV, AL	9.471	0.549	Jan 2020	0.750	Jan 2020	0.800	Jan 2022	-		0.800	Continuing	Continuing	Continuing
Advanced Missile Warning System Systems Engineering Program Management	TBD	TBD : TBD	2.000	-		-		-		-		-	0.000	2.000	-
JUONS SO-0010 Systems Engineering Program Management	Various	Various : PM ASE, HSV, AL	1.627	-		-		-		-		-	0.000	1.627	-
CIRCM QRC Systems Engineering Program Management	Various	Various : PM ASE, HSV, AL	8.144	-		-		-		-		-	Continuing	Continuing	Continuing
LIMWS - SEPM	Various	Various : PM ASE, HSV, AL	6.856	-		-		-		-		-	0.000	6.856	-
SBIR / STTR Transfer	TBD	Various : Various	0.212	-		-		-		-		-	0.000	0.212	-
Subtotal			28.310	0.549		0.750		0.800		-		0.800	Continuing	Continuing	N/A

Product Development (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 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			
CMWS tier 2/3 Upgrades	Various	Various : -	2.000	-		-		-		-		-	Continuing	Continuing	Continuing
CMWS Threat Analysis Database Design	Various	BAE : Various	0.455	-		-		-		-		-	0.000	0.455	-
CMWS Threat Analysis Database (TAD)	Various	BAE : Various	6.119	-		-		-		-		-	0.000	6.119	-
CMWS Enhanced Sensor Study & Evaluation	Various	Various : -	11.466	-		-		-		-		-	0.000	11.466	-
CMWS Data Modeling	TBD	Various : Various	0.688	-		-		-		-		-	0.000	0.688	-
CMWS Future Sensor and Algorithm Analysis	Various	Various : TBD	4.558	2.112	Mar 2020	1.282	Mar 2020	3.351	Mar 2022	-		3.351	0.000	11.303	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army												Date: May 2021			
Appropriation/Budget Activity 2040 / 5				R-1 Program Element (Number/Name) PE 0605051A / Aircraft Survivability Development				Project (Number/Name) ER8 / Common Missile Warning System (CMWS)							
Product Development (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
CMWS Prime Contractor-- Integration Engineering	TBD	TBD, TBD : TBD	7.787	-		-		-		-		-	Continuing	Continuing	Continuing
CMWS Aircraft Integration	TBD	Various : Various	19.974	-		-		-		-		-	Continuing	Continuing	Continuing
CMWS Software	TBD	Various : Various	3.000	-		-		-		-		-	Continuing	Continuing	Continuing
JUONS SO-0010 Prime Contractor -- Integration Engineering	Various	Various : Various	8.842	-		-		-		-		-	0.000	8.842	-
JUONS SO-0010 Software	Various	Various : Various	1.534	-		-		-		-		-	0.000	1.534	-
JUONS SO-0010 Training	Various	Various : Various	0.200	-		-		-		-		-	0.000	0.200	-
CIRCM QRC Development Engineering	Various	Northrup Grumman : Rolling Meadow, IL	5.100	-		-		-		-		-	0.000	5.100	-
CIRCM QRC System Development and Qualification	Various	Various : Various	53.474	-		-		-		-		-	Continuing	Continuing	Continuing
CIRCM QRC Aircraft Integration	Various	Various : Various	24.223	-		-		-		-		-	Continuing	Continuing	Continuing
Limited Interim Missile Warning System (LIMWS) - Development Engineering	Various	Various : PM ASE, HSV, AL	129.091	37.151	Mar 2020	45.454	Mar 2021	10.781	Mar 2022	-		10.781	Continuing	Continuing	-
CMWS Threat and Vulnerability Analysis	Various	Various : TBD	5.463	2.886	Mar 2020	1.554	Mar 2020	3.998	Mar 2022	-		3.998	Continuing	Continuing	Continuing
Subtotal			283.974	42.149		48.290		18.130		-		18.130	Continuing	Continuing	N/A
Support (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
LIMWS - Matrix Support	Various	Various : PM ASE, HSV, AL	6.745	0.094	Jan 2020	2.170	Jan 2021	-		-		-	0.000	9.009	-
LIMWS - Contractor Support	Various	Various : PM ASE, HSV, AL	6.032	-		3.797	Jan 2021	2.000	Jan 2022	-		2.000	Continuing	Continuing	Continuing

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army												Date: May 2021			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
2040 / 5				PE 0605051A / Aircraft Survivability Development				ER8 / Common Missile Warning System (CMWS)							
Support (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Subtotal			12.777	0.094		5.967		2.000		-		2.000	Continuing	Continuing	N/A
Test and Evaluation (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
CMWS Test and Evaluation	TBD	Various : Various	16.156	-		-		-		-		-	Continuing	Continuing	Continuing
JUONS SO-0010 Test and Evaluation	Various	Various : Various	26.709	-		-		-		-		-	Continuing	Continuing	-
CIRCM QRC Test and Evaluation/Tech Manuals	Various	Various : Various	32.830	2.220	Mar 2020	-		-		-		-	Continuing	Continuing	Continuing
LIMWS - Government Testing	Various	Various : PM ASE, HSV, AL	22.833	37.955	Mar 2020	13.073	Mar 2021	6.344	Mar 2022	-		6.344	Continuing	Continuing	-
Subtotal			98.528	40.175		13.073		6.344		-		6.344	Continuing	Continuing	N/A
Project Cost Totals			423.589	82.967		68.080		27.274		-		27.274	Continuing	Continuing	N/A
Remarks															
LIMWS Matrix Support transitions to APA in FY22.															

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Exhibit R-4, RDT&E Schedule Profile: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0605051A / Aircraft Survivability Development	Project (Number/Name) ER8 / Common Missile Warning System (CMWS)

Event Name	FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025				FY 2026			
	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
CMWS Threat and Vulnerability Analysis	[Redacted]																											
CMWS Future Sensor and Algorithm Analysis	[Redacted]																											
Phase 3 ATWCIRCM QRC Engineering, Integration, and Test	[Redacted]																											
Phase 4 LIMWS QRC Development Engineering and Test	[Redacted]																											

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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0605051A / Aircraft Survivability Development	Project (Number/Name) ER8 / Common Missile Warning System (CMWS)

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
CMWS System Dev/Tier 2 and 3 Upgrades	2	2011	4	2019
CMWS Gen 3 Production	3	2012	4	2016
CMWS Threat Analysis Database (TAD)	2	2012	4	2019
CMWS Vulnerability Analysis and Assessment of Technology	2	2015	4	2019
CMWS Threat and Vulnerability Analysis	1	2020	4	2030
CMWS Future Sensor and Algorithm Analysis	1	2017	4	2030
Phase 3 ATW/CIRCM QRC Engineering, Integration, and Test	2	2016	1	2020
Phase 4 LIMWS QRC Development Engineering and Test	3	2017	4	2030