Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Army											Date: February 2020	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*					R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*							
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
Total Program Element	-	91.749	179.676	156.834	-	156.834	268.981	314.698	253.827	254.563	0.000	1,520.328
AX3: *Technology Maturation Initiatives*	-	0.000	0.000	13.986	-	13.986	138.114	296.715	253.827	254.563	0.000	957.205
AX4: *Computational Prototyping Environment (CPE)*	-	0.000	3.966	5.421	-	5.421	6.912	0.000	0.000	0.000	0.000	16.299
AX5: *Next Generation Close Combat Missile*	-	0.000	9.000	4.995	-	4.995	0.000	0.000	0.000	0.000	0.000	13.995
AX6: *Active Protection Systems Integration*	-	0.000	7.400	10.490	-	10.490	0.000	0.000	0.000	0.000	0.000	17.890
AX7: *Multi-Mission High Energy Laser (MMHEL) Sys Demo*	-	0.000	18.650	8.142	-	8.142	0.000	0.000	0.000	0.000	0.000	26.792
AX8: *Adv Leth and Accuracy Sys for Med Calber (ALAS-MC)*	-	0.000	27.200	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	27.200
AX9: *Adv Mobility Experimental Prototype Adv Tech*	-	0.000	10.500	15.785	-	15.785	10.490	7.193	0.000	0.000	0.000	43.968
AY1: *MUM-T Platform Enabler*	-	0.000	7.200	4.496	-	4.496	4.196	0.000	0.000	0.000	0.000	15.892
AY2: *Army Operational Fires*	-	0.000	18.900	28.372	-	28.372	38.336	10.790	0.000	0.000	0.000	96.398
AY3: *Strategic Long Range Cannon*	-	0.000	76.860	65.147	-	65.147	70.933	0.000	0.000	0.000	0.000	212.940
DS3: *Technology Maturation Initiatives*	-	91.749	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	91.749

A. Mission Description and Budget Item Justification

This Program Element (PE) funds experimental prototyping and demonstration of selected technology enabled capabilities to support advanced ground systems, aviation systems, command, control, communications & reconnaissance systems and equipment, precision weapons, High Energy Laser (HEL) systems, and Soldier equipment. Funding facilitates maturation and demonstration of advanced technologies and systems in relevant environments and tactical/operational scenarios as well as the maturation and demonstration of a robust Virtual Proving Ground (VPG) for rapid, accurate, and computational prototyping of major Army platforms. Benefits include maturing technologies to a goal of Technology Readiness Level (TRL) 7, informing emerging requirements for future programs of record, and reducing technology risk in order to transition of leap-ahead capabilities into acquisition programs. Technology Maturation Initiative efforts mature and integrate advanced component technologies into system and sub-system technology demonstrators and experimental prototypes, which are then validated and transitioned to priority

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Army	Date: February 2020
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0604115A *I Technology Maturation Initiatives*

Army experimentation efforts and programs of record. This PE provides the Army with an improved mechanism for enabling greater competition in the latter stages of technology maturation and establishes a closer alignment between Science and Technology (S&T) efforts and acquisition programs.

The cited work is consistent with the Under Secretary of Defense, Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by the United States (U.S.) Army Futures Command (AFC), the Engineer Research Development Center (ERDC), and U.S. Army Space and Missile Defense Command/Army Forces Strategic Command (SMDC/ARSTRAT).

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	95.229	196.676	156.986	-	156.986
Current President's Budget	91.749	179.676	156.834	-	156.834
Total Adjustments	-3.480	-17.000	-0.152	-	-0.152
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-17.000			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-3.480	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-0.152	-	-0.152

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX3 / *Technology Maturation Initiatives*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AX3: *Technology Maturation Initiatives*	-	0.000	0.000	13.986	-	13.986	138.114	296.715	253.827	254.563	0.000	957.205
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

This is a new start in FY2021.

This Project is a New Start in Fiscal Year 2021 (FY21).

A. Mission Description and Budget Item Justification

This Project funds the Technology Maturation Initiative, which matures and integrates component technologies into early system and sub-system experimental prototypes for demonstration in relevant environments and tactical/operational scenarios. The Technology Maturation Initiative takes emerging Science and Technology (S&T) products to a goal of Technology Readiness Level (TRL) 7, integrating them into technology demonstrators and experimental prototypes that inform requirements and reduce the risk of technology insertion for future acquisition programs. This Initiative streamlines the development and insertion of mature technologies that support advanced ground systems; aviation systems; command, control, communication & reconnaissance systems and equipment; precision weapons; High Energy Laser (HEL) systems; and Soldier equipment. It provides the Army an improved mechanism for incorporating innovative technologies and advanced capabilities in the early stages of acquisition program planning, and more closely aligns high-priority S&T products and future Programs of Record.

Army senior leadership approves Technology Maturation Initiative projects prior to budget year programming based on priority and opportunity, ensuring that demonstrations have a high potential for filling capability gaps and transitioning. Approved Technology Maturation Initiative projects are typically 2-4 years in duration and are budgeted under Projects AX4, AX5, AX6, AX7, AX8, AX9, AY1, AY2, and AY3.

The cited work is consistent with the Under Secretary of Defense, Research and Engineering priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Future Vertical Lift (FVL) Helmet Mounted Display	-	-	3.900
Description: This effort will integrate and demonstrate a TRL 7 rotorcraft Helmet Mounted Display (HMD) compatible with current 56P helmets and FVL distributed aperture systems (DASs). This will enable heads up, eyes out pilotage and improve situational awareness (SA) and maneuver for FVL pilots in all conditions. The HMD will have a head tracker system that is self-contained and self-calibrating.			
FY 2021 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX3 / *Technology Maturation Initiatives*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Will mature and integrate novel HMDs with high bright full color high resolution organic light-emitting diodes (OLEDs), low cost free-form prism optics, and low cost micro complementary metal?oxide?semiconductor (CMOS) cameras optimized for utilization by Army aviators in all pilotage conditions; and mature inertial measurement unit (IMU) technologies for integration with head tracking hardware/software. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** This FY21 effort was approved by the Army Prototyping Board to support the Army's Modernization Priority for Future Vertical Lift.			
Title: Large Caliber Armament System Prototype ***Description:*** This effort will integrate and demonstrate a TRL 7 lightweight armament system for current and future combat platforms. ***FY 2021 Plans:*** Will mature and integrate 120mm reduced-recoil armament system in a test bed configuration to inform Next Generation Combat Vehicle requirements; will fabricate turret and ammunition and handling systems for integration. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** This FY21 effort was approved by the Army Prototyping Board to support the Army's Modernization Priority for Next Generation Combat Vehicles.	-	-	10.086
Accomplishments/Planned Programs Subtotals	-	-	13.986

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX3 / *Technology Maturation Initiatives*	

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Future Vertical Lift Helmet Mounted Display (FVL HMD)	C/Various	AFC : Fort Belvoir, VA	-	-		-		3.900		-		3.900	13.000	16.900	-
Large Caliber Armament System Prototype	C/Various	AFC : Picatinny, NJ	-	-		-		10.086		-		10.086	18.400	28.486	-
		Subtotal	-	-		-		13.986		-		13.986	31.400	45.386	N/A

	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		0.000		13.986		-		13.986	31.400	45.386	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX3 / *Technology Maturation Initiatives*

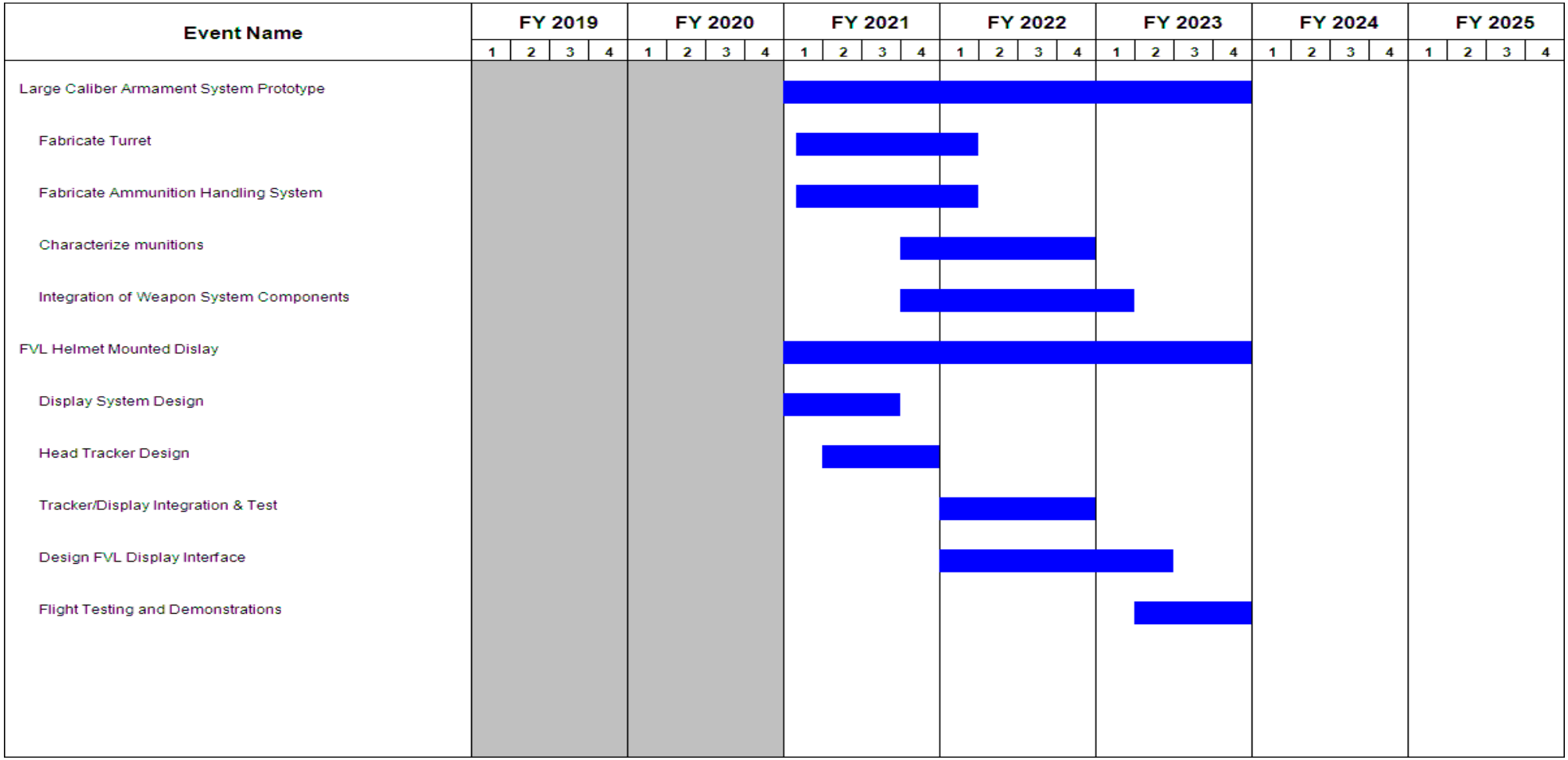

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX3 / *Technology Maturation Initiatives*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Large Caliber Armament System Prototype	1	2021	4	2023
Fabricate Turret	1	2021	1	2022
Fabricate Ammunition Handling System	1	2021	1	2022
Characterize munitions	4	2021	4	2022
Integration of Weapon System Components	4	2021	1	2023
FVL Helmet Mounted Dislay	1	2021	4	2023
Display System Design	1	2021	3	2021
Head Tracker Design	2	2021	4	2021
Tracker/Display Integration & Test	1	2022	4	2022
Design FVL Display Interface	1	2022	2	2023
Flight Testing and Demonstrations	2	2023	4	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX4 / *Computational Prototyping Environment (CPE)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AX4: *Computational Prototyping Environment (CPE)*	-	0.000	3.966	5.421	-	5.421	6.912	0.000	0.000	0.000	0.000	16.299
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year 2020 (FY20) this Project was realigned from:
Program Element (PE) 0604115A Technology Maturation Initiatives
* Project DS3 Technology Maturation Initiatives

A. Mission Description and Budget Item Justification

This Project funds the development and demonstration of a robust Virtual Proving Ground (VPG) for rapid, accurate, and computational prototyping of major Army platforms. Computation Prototyping Environment (CPE) provides the ability to validate platform design variations in a VPG, in a way that identifies potential performance and design failures, and assesses mitigating solutions and trades prior to cost-bearing production and manufacturing. Activities under this Project include the maturation and integration of physics-based, computational modeling with new advances in deep learning in order to provide the ability to virtually explore design tradespaces and understand possible defeat strategies. This Project leverages recent Department of Defense (DOD) advancements in large data tradespace analytics, high-fidelity physics-based modeling, deep learning techniques, high-performance computing capabilities, and inverse modeling approaches to enable rapid computational prototyping to inform emerging acquisition programs.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. Funding has been realigned to reflect the FY20 financial restructure and Army Modernization Priorities.

Work in this Project is performed by the Engineer Research and Development Center (ERDC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Computational Prototyping Environment (CPE)	-	3.923	5.421
Description: This effort matures and integrates physics-based, computational modeling with new advances in deep learning in order to demonstrate a robust VPG that provides the ability to virtually explore design tradespaces and understand possible defeat strategies for prototype Army platforms. Demonstrates rapid computational prototyping to inform emerging acquisition programs through large data tradespace analytics, high-fidelity physics-based modeling, deep learning techniques, high-performance computing capabilities, and inverse modeling approaches. CAT capabilities will be piloted to support and inform Army Future Vertical Lift (FVL) platform designs.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX4 / *Computational Prototyping Environment (CPE)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Will integrate physical test data from Future Vertical Lift platforms into prototype VPG to validate computational models. Will leverage DOD high-performance computing to begin integration of artificial intelligence and machine learning algorithms into VPG. Develop framework for incorporating environmental and mission relevant data to virtual proving ground. Develop data repository for physical test data, computational models, and operation environments. ***FY 2021 Plans:*** Will continue to develop data repository for physical test data, computational models, and operational environments linked to High Performance Computing environment; improve the FVL VPG to model candidate Future Attack Reconnaissance Aircraft (FARA) designs during maneuver and improve the VPG to include different operationally relevant environmental conditions; improve machine learning techniques to drive engineering analysis of FVL systems. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Planned program progression.			
Title: FY 2020 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.043	-
Accomplishments/Planned Programs Subtotals	-	3.966	5.421

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX4 / *Computational Prototyping Environment (CPE)*	

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FY 2020 SBIR/STTR Transfer	TBD	Various : Various	-	-		0.043		-		-		-	0.000	0.043	-
		Subtotal	-	-		0.043		-		-		-	0.000	0.043	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Computational Prototyping Environment	C/Various	ERDC : Vicksburg, MS	-	-		3.923		5.421		-		5.421	6.918	16.262	-
		Subtotal	-	-		3.923		5.421		-		5.421	6.918	16.262	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		3.966		5.421		-		5.421	6.918	16.305	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX4 / *Computational Prototyping Environment (CPE)*

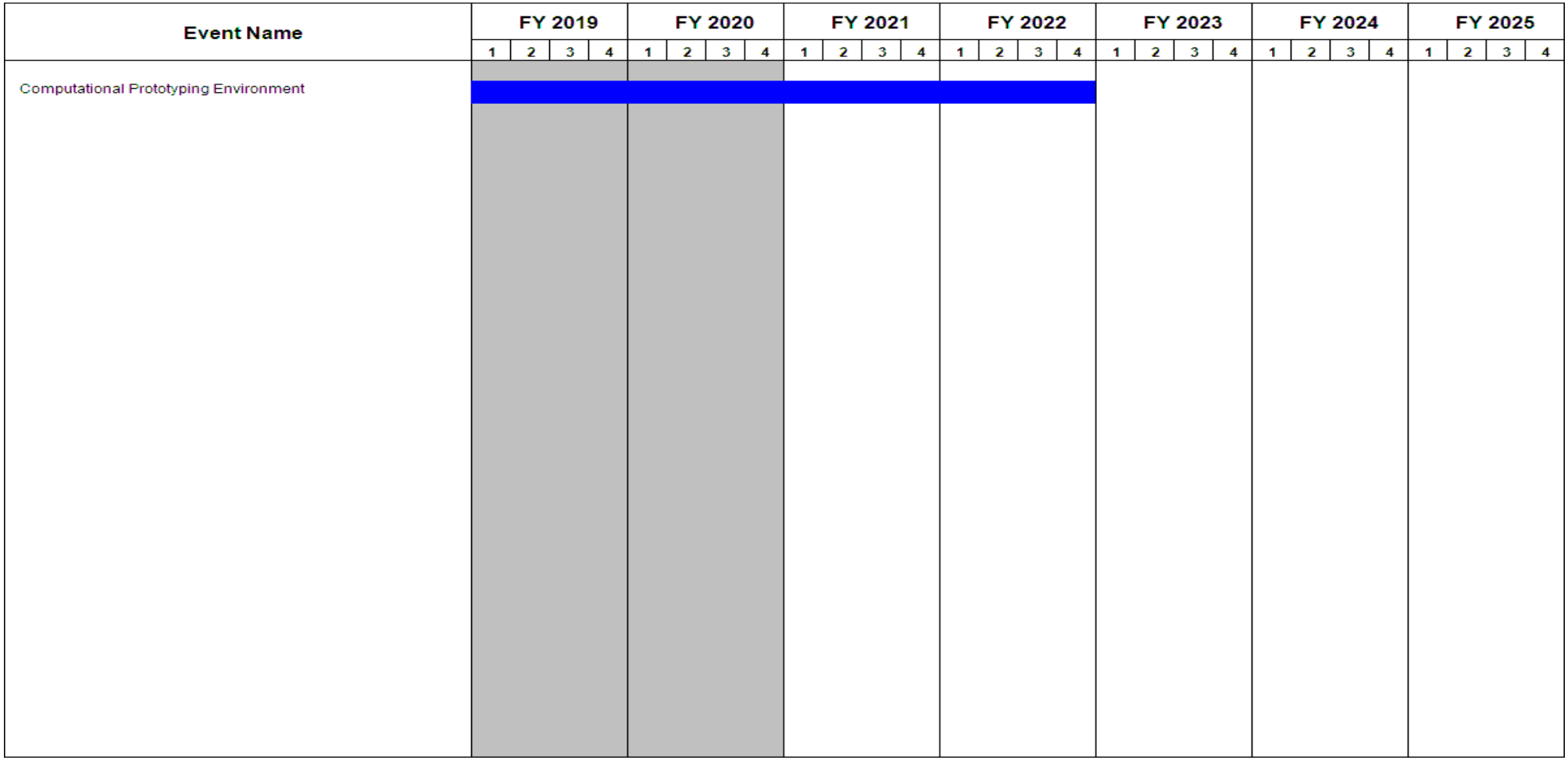

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX4 / *Computational Prototyping Environment (CPE)*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Computational Prototyping Environment	3	2018	4	2022

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX5 / *Next Generation Close Combat Missile*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AX5: *Next Generation Close Combat Missile*	-	0.000	9.000	4.995	-	4.995	0.000	0.000	0.000	0.000	0.000	13.995
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year 2020 (FY20) this Project was realigned from:
Program Element (PE) 0604115A Technology Maturation Initiatives
* Project DS3 Technology Maturation Initiatives

A. Mission Description and Budget Item Justification

This Project demonstrates a prototype close combat missile with a multi-pulse, boost-sustain flight propulsion system providing extended range and decreased time of flight. Activities mature proof-of-principle hardware into an integrated tactical-representative design, and demonstrate a prototype missile with lethality overmatch of emerging threats. Early prototyping work concludes in Fiscal Year 2021 (FY21) to mature technology and demonstrate needed Warfighter capability in advance of acquisition program of record.

Work in this PE complements PE 0603462A (Next Generation Combat Vehicle Advanced Technology.

Funding has been realigned to reflect the FY20 financial restructure and Army Modernization Priorities.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the United States (U.S.) Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Next Generation Close Combat Missile	-	9.000	4.995
Description: This effort demonstrates a prototype close combat missile with a multi-pulse, boost-sustain flight propulsion system providing extended range and decreased time of flight. ***FY 2020 Plans:*** Will optimize, integrate, and conduct experimental testing of the prototype propulsion subsystem component hardware (Electro-Mechanical Control Actuation System, Airframe, Launch Motor, and a Boost-Sustain Propulsion Section). Will conduct wind tunnel			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX5 / *Next Generation Close Combat Missile*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
testing to verify predicted aerodynamic and control surface performance. Will exercise subsystem performance models in an integrated flight simulation and mature flight software. ***FY 2021 Plans:*** Will evaluate performance of propulsion system components, integrated in a tactically-representative missile, through flight demonstration; transition designs, documentation and data to Program Executive Office Missiles and Space. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Planned program progression.			
Accomplishments/Planned Programs Subtotals	-	9.000	4.995

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX5 / *Next Generation Close Combat Missile*	

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Next Generation Close Combat Missile	Various	AvMC : Huntsville, AL	-	-		9.000		4.995		-		4.995	0.000	13.995	-
		Subtotal	-	-		9.000		4.995		-		4.995	0.000	13.995	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		9.000		4.995		-		4.995	0.000	13.995	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX5 / *Next Generation Close Combat Missile*

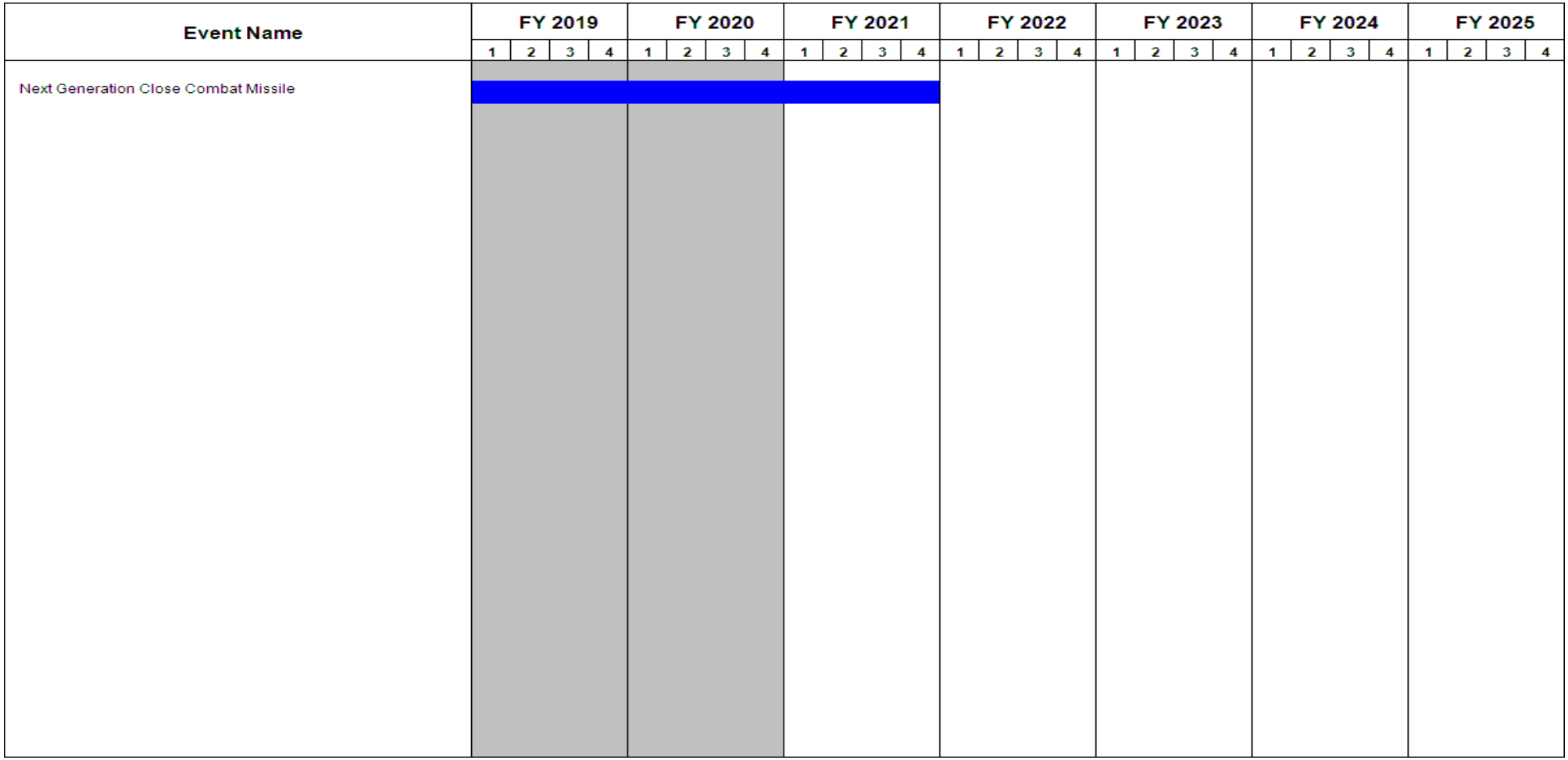

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX5 / *Next Generation Close Combat Missile*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Next Generation Close Combat Missile	1	2019	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX6 / *Active Protection Systems Integration*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AX6: *Active Protection Systems Integration*	-	0.000	7.400	10.490	-	10.490	0.000	0.000	0.000	0.000	0.000	17.890
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0604115A Technology Maturation Initiatives
* Project DS3 Technology Maturation Initiatives

A. Mission Description and Budget Item Justification

This Project matures, integrates, and demonstrates protection and survivability technologies as part of active protection systems (APS) prototyping for the Army's combat vehicles. Activities integrate complimentary survivability technologies to enable layers of enhanced protection capability, providing greater survivability against current and emerging advanced threats. This Project demonstrates a suite of technologies on a fielded combat vehicle platform using an APS common architecture, and defines component interface standards and specifications that enable adaptive APS solutions. Activities support the Army's APS strategy to maintain or reduce vehicle weight by reducing reliance on armor with other means such as sensing, warning, hostile fire detection, and active countermeasures.

Work in this Project is coordinated with PE 0603462A (Next Generation Combat Vehicle Advanced Technology) and transitions to PE 0604852A (Suite of Vehicle Protection Systems - EMD).

Funding has been realigned to reflect the FY20 financial restructure and Army Modernization Priorities.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work is performed by the United States (U.S.) Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Agile Layered Protection: APS Integration Advanced Technology Demonstrator	-	7.400	10.490
Description: Activities integrate and demonstrate mature APS technologies layered through a common architecture on an Army ground combat vehicle platform, addressing technical and integration challenges for a system designed to address both current and emerging advanced threats. Selects and integrates mature component technologies that are best suited to optimize added capability for the ATD platform. Demonstrates a suite of APS technologies and effects that optimize performance levels			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX6 / *Active Protection Systems Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
for survivability and protection through advanced threat detection, multiple threat defeat systems, and improved situational awareness. ***FY 2020 Plans:*** Will continue to integrate selected APS technologies onto the combat vehicle platform demonstrator. Will validate the integrated APS system function on the demonstrator, and test and evaluate the platform vehicle to ensure the added suite of technologies does not introduce unintended degraded performance to the vehicle?s mission. Upon completion of testing, results will inform vehicle Product Manager?s acquisition planning for the APS protection suite. Will continue the vehicle protection layering approach and select additional (mature) APS component technologies for integration, offering incremental improvement options for protection and survivability for the vehicle platform. ***FY 2021 Plans:*** Will continue maturing the combat vehicle protection layering approach, integrating additional protection and survivability capabilities based on selection of mature technologies in FY20; optimize, design, and demonstrate integration of selected protection technologies on the combat vehicle platform demonstrator to validate integration; test the combat vehicle platform demonstrator to ensure the added technologies do not degrade the vehicle?s or previously tested technologies? performance. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Planned program progression.			
Accomplishments/Planned Programs Subtotals	-	7.400	10.490

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX6 / *Active Protection Systems Integration*	

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineer Integration of APS Layered Protection	C/Various	Various : Various	-	-		4.400		-		-		-	0.000	4.400	-
Validation of APS Layered Protection	Various	Various : Various	-	-		2.000		-		-		-	0.000	2.000	-
Integration of added APS Layered Protection	C/Various	Various : Various	-	-		1.000		4.990		-		4.990	0.000	5.990	-
Validation of added APS Layered Protection	C/Various	AFC : Warren, MI	-	-		-		5.500		-		5.500	0.000	5.500	-
		Subtotal	-	-		7.400		10.490		-		10.490	0.000	17.890	N/A

	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		7.400		10.490		-		10.490	0.000	17.890	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX6 / *Active Protection Systems Integration*

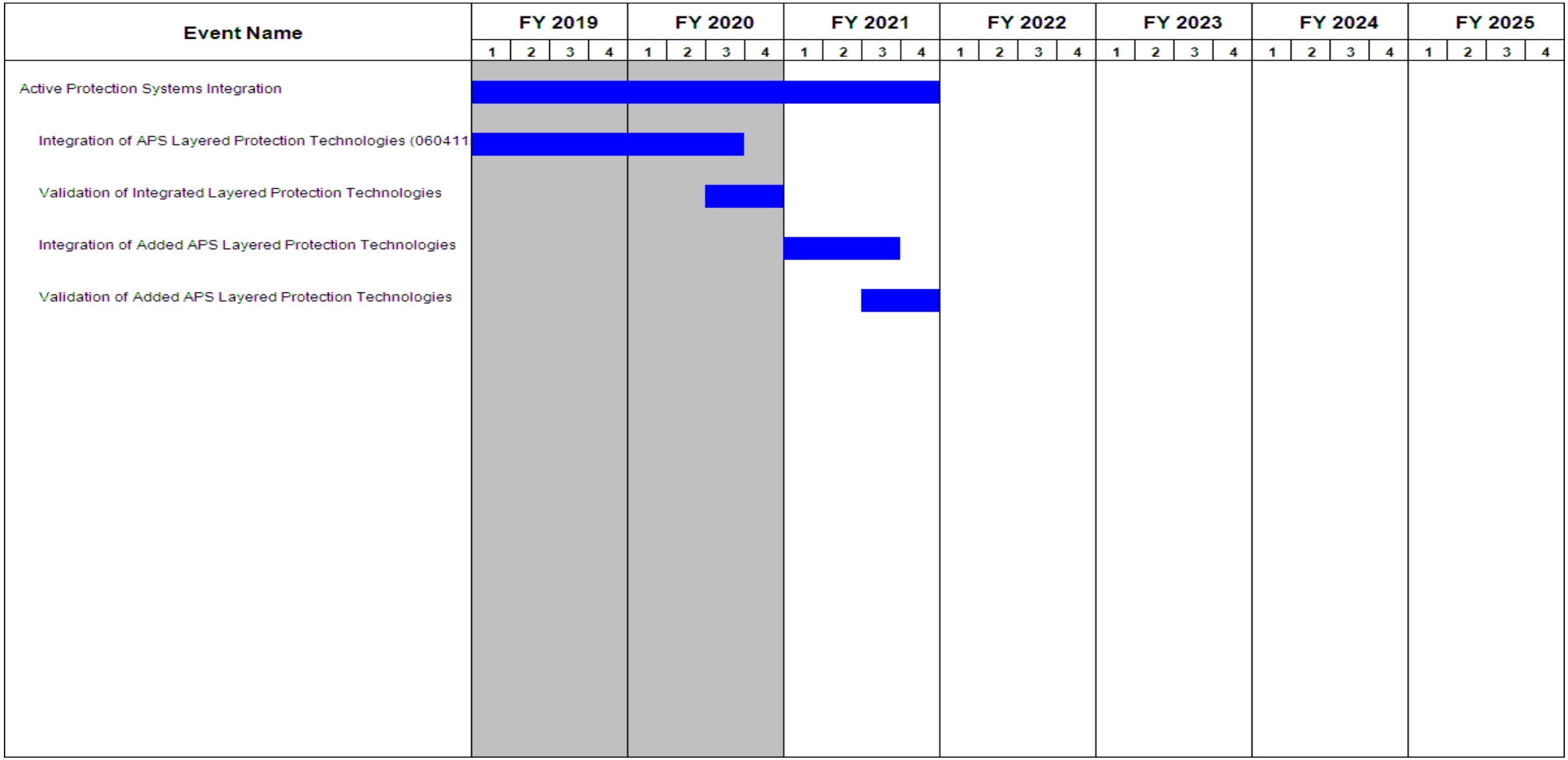

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX6 / *Active Protection Systems Integration*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Active Protection Systems Integration	1	2019	4	2021
Integration of APS Layered Protection Technologies (0604115A, DS3 in FY 2019)	1	2019	3	2020
Validation of Integrated Layered Protection Technologies	3	2020	4	2020
Integration of Added APS Layered Protection Technologies	1	2021	3	2021
Validation of Added APS Layered Protection Technologies	3	2021	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX7 / *Multi-Mission High Energy Laser (MMHEL) Sys Demo*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AX7: *Multi-Mission High Energy Laser (MMHEL) Sys Demo*	-	0.000	18.650	8.142	-	8.142	0.000	0.000	0.000	0.000	0.000	26.792
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

This is a new start in FY2021.

In Fiscal Year 2020 (FY20) this Project was realigned from:
Program Element (PE) 0604115A Technology Maturation Initiatives
* Project DS3 Technology Maturation Initiatives

A. Mission Description and Budget Item Justification

This Project matures and demonstrates an integrated a 50 kilowatt (kW)-class laser weapon system into a Stryker platform, providing a system-level, High Energy Laser (HEL) experimental prototype for demonstration in realistic operating environments. These demonstrations will inform requirements, decrease risk for future Army HEL acquisition programs, and support the future development of warfighter Tactics/Techniques/Procedures and Concept of Operations. HEL weapon systems are expected to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems and without the need to stockpile ordnance. A 50 kW-class laser weapon system has the potential to engage and defeat rockets, artillery, mortars (RAM); unmanned aerial vehicles (UAVs); sensors; and optics for maneuvering Brigade Combat Teams (BCTs). Demonstrations will also inform potential future capability to defeat both fixed- and rotary-wing manned aircraft. Leveraging Government investments and Industry technology advancements, will review and select existing HEL subsystem designs for integration into a Stryker combat vehicle; will conduct integration and demonstration of a system-level HEL experimental prototype; and will provide assessment of technical performance in an operational environment. This effort informs application of laser weapons to other combat platforms and rapid prototyping to units-of-action to meet emerging threats expressed in the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the Rapid Capabilities and Critical Technologies Office (RCCTO).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Multi-Mission High Energy Laser (MMHEL) Integration and Demonstration	-	17.804	8.142
Description: This effort matures, integrates, and demonstrates HEL technologies on Army Stryker vehicles to inform Maneuver-Short Range Air Defense (M-SHORAD) requirements and reduce risk for M-SHORAD. The goal is to protect maneuvering forces from RAM and Unmanned Aerial System (UAS) threats.			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX7 / *Multi-Mission High Energy Laser (MMHEL) Sys Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
FY 2020 Plans: Will complete procurement and integration of system hardware; will complete evaluation of subsystems against performance parameters; will continue integrating initial firing doctrine as well as Battle Management, Communications, Command, Control, Computer, and Intelligence software; will begin planning technology readiness level 7 demonstration, procure targets for the demonstration; and begin the system level test/fix/test process of MMHEL. ***FY 2021 Plans:*** Will complete integration of system hardware, weapon fire control software, Forward Area Air Defense Command and Control (FAADC2), and Intelligence software; conduct full system level test/fix/test process; system verification and acceptance testing; prepare for and execute a technology readiness level 7 demonstration; and prepare for and execute system performance testing to inform Capability Developer?s requirement, Concept of Operations (CONOPS) and training development. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Planned program progression.			
Title: FY 2020 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.846	-
Accomplishments/Planned Programs Subtotals	-	18.650	8.142

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX7 / *Multi-Mission High Energy Laser (MMHEL) Sys Demo*	

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FY 2020 SBIR/STTR Transfer	TBD	Various : Various	-	-		0.846		-		-		-	0.000	0.846	-
		Subtotal	-	-		0.846		-		-		-	0.000	0.846	N/A

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Multi-Mission High Energy Laser (MMHEL) Integration and Demonstration	C/Various	SMDTC : Huntsville, AL	-	-		17.804		8.142		-		8.142	0.000	25.946	-
		Subtotal	-	-		17.804		8.142		-		8.142	0.000	25.946	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		18.650		8.142		-		8.142	0.000	26.792	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX7 / *Multi-Mission High Energy Laser (MMHEL) Sys Demo*

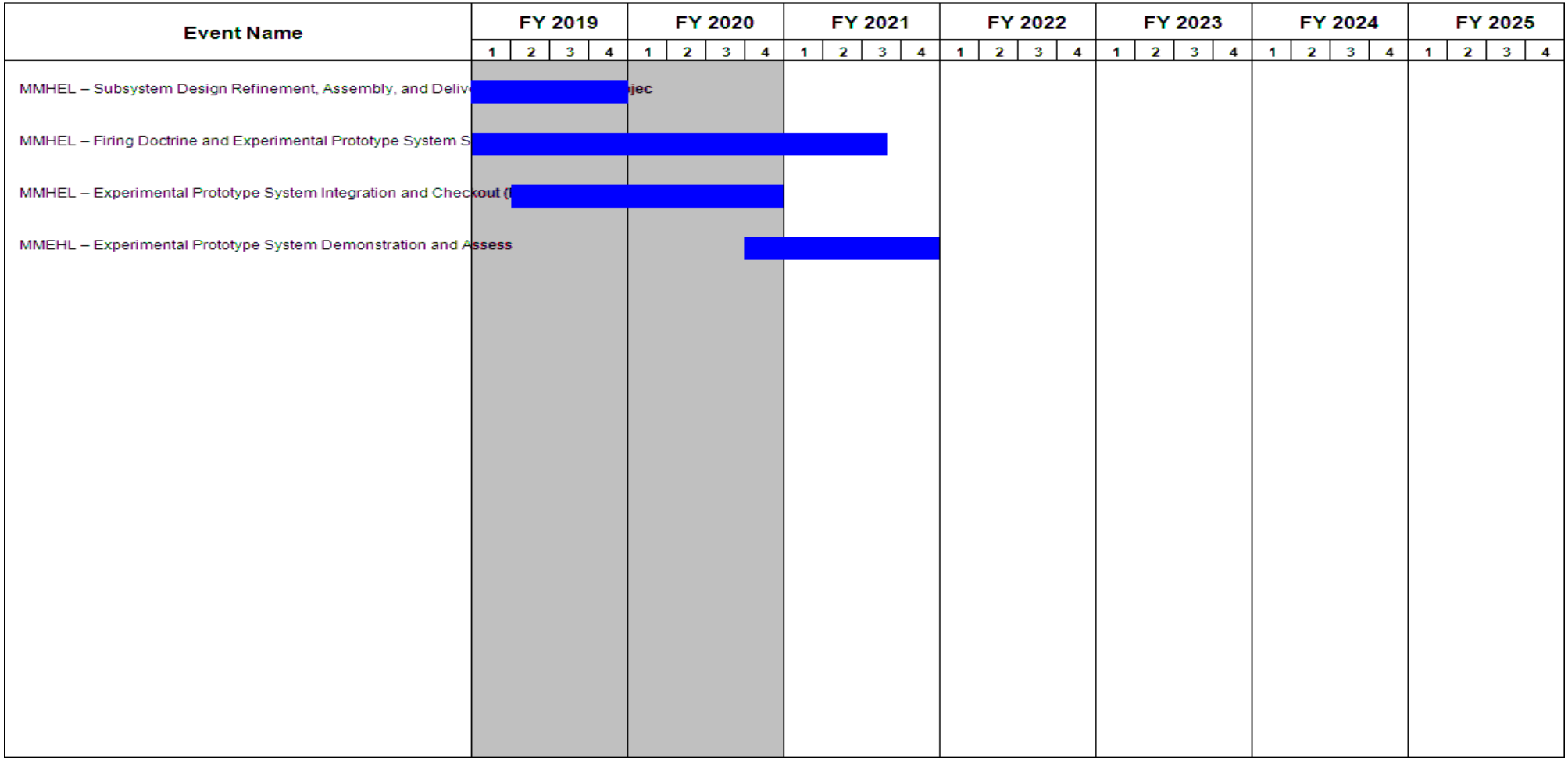

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX7 / *Multi-Mission High Energy Laser (MMHEL) Sys Demo*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Multi-Mission High Energy Laser (MMHEL) ? System-Level Design (PE 0604115A, Proj	3	2018	4	2018
MMHEL ? Subsystem Design Refinement, Assembly, and Delivery (PE 0604115A, Projec	4	2018	4	2019
MMHEL ? Firing Doctrine and Experimental Prototype System Software (PE 0604115A	1	2019	3	2021
MMHEL ? Experimental Prototype System Integration and Checkout (PE 0604115A, Pro	2	2019	4	2020
MMEHL ? Experimental Prototype System Demonstration and Assess	4	2020	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX8 / *Adv Leth and Accuracy Sys for Med Calber (ALAS-MC)*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AX8: *Adv Leth and Accuracy Sys for Med Calber (ALAS-MC)*	-	0.000	27.200	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	27.200
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In Fiscal Year 2020 (FY20) this Project was realigned from:
Program Element (PE) 0604115 Technology Maturation Initiatives
* Project DS3 Technology Maturation Initiatives

This Project completes in FY20.

A. Mission Description and Budget Item Justification

This Project matures and integrates next-generation 50mm weapon system technologies transitioned from under the Advanced Lethality and Accuracy System for Medium Caliber (ALAS-MC) advanced technology development effort into a vehicle-agnostic combat turret to inform requirements for the Next Generation Combat Vehicle (NGCV). This Project integrates and assesses critical ALAS-MC 50mm technology components for on-the-move engagement of moving personnel and materiel targets, bringing the subsystem to Technology Readiness Level (TRL) 7. Under Advanced Targeting and Lethality Automated System (ATLAS), this Project matures and integrates advanced Artificial Intelligence/Machine Learning (AI/ML) algorithms to enable aided target detection/recognition capability for NGCV using next generation, multi-spectral electro-optical and infrared (EO/IR) targeting sensors. AI/ML algorithms are integrated with real-time intelligent fire control and mission planning interfaces to demonstrate automated turret capabilities, and provide overmatch via reduced target acquisition and engagement timelines.

Work in this Project is related to and fully integrated with the efforts funded in PE 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BF5 (Adv Lethality & Accuracy Sys for Med Cal Adv Tech); and Project BG1 (Sensors for Auto Oper and Survivability Adv Tech.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the United States (U.S.) Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Advanced Lethality and Accuracy System for Med Cal (ALAS-MC)	-	5.000	-
Description: This effort matures and integrates the next generation 50mm weapon system technologies transitioned from the ALAS-MC advanced technology development effort into vehicle- agnostic combat turret to inform requirements for the Next Generation Combat Vehicle.			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX8 / *Adv Leth and Accuracy Sys for Med Calber (ALAS-MC)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
FY 2020 Plans: Will mature next generation 50mm armament and fire control systems to TRL 7 by integrating and assessing 50mm component technologies for on-the-move engagement of moving personnel and materiel targets. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** ALAS-MC effort completes in FY20.			
Title: Advanced Targeting and Lethality Automated System (ATLAS) ***Description:*** The ATLAS effort matures, integrates, and demonstrates novel algorithms and sensor enhancements in a Next Generation Combat Vehicle (NGCV) vehicle agnostic, robotic turret. It integrates autonomous, wide-area search sensors and gimballed targeting sensors with real-time computer aided detection, recognition, and identification of threats for significantly decreased time to engagement. It integrates target acquisition with intelligent fire control system to demonstrate an end-to-end engagement system on NGCV platforms, and enable experimentation and soldier touch-points with robotic turret concepts. ***FY 2020 Plans:*** Will mature synthetic, augmented, and real threat data sets to train and test automated target recognition (ATR) algorithms in a variety of complex, cluttered environments. Will execute initial demonstration of advanced targeting sensors with embedded ATR processing in a relevant test environment using a stationary vehicle. Will develop and demonstrate sensor and algorithm integration approaches with intelligent fire control systems. Synthetic imagery development and data collections will inform on-the-move target detection and recognition algorithms for a wider variety of environments. Will develop and mature moving and stationary target indicators. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** ATLAS effort completes in FY20.	-	20.965	-
Title: FY 2020 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	1.235	-
Accomplishments/Planned Programs Subtotals	-	27.200	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX8 / *Adv Leth and Accuracy Sys for Med Calber (ALAS-MC)*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX8 / *Adv Leth and Accuracy Sys for Med Caliber (ALAS-MC)*	

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FY 2020 SBIR/STTR Transfer	TBD	Various : Various	-	-		1.235		-		-		-	0.000	1.235	-
		Subtotal	-	-		1.235		-		-		-	0.000	1.235	N/A

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
ALAS-MC: Procure Ammo Rounds H/W	C/Various	ARDEC : Picatinny, NJ	-	-		3.700		-		-		-	0.000	3.700	-
ALAS-MC: Control Unit	C/Various	ARDEC : Picatinny, NJ	-	-		0.300		-		-		-	0.000	0.300	-
ALAS-MC: Test Hardware	TBD	ARDEC : Picatinny, NJ	-	-		0.200		-		-		-	0.000	0.200	-
ATLAS: System Design	TBD	CERDEC : Fort Belvoir, VA	-	-		5.000		-		-		-	0.000	5.000	-
ATLAS: Artificial Intelligence/Machine Learning Development	TBD	CERDEC : Fort Belvoir, VA	-	-		6.500		-		-		-	0.000	6.500	-
ATLAS: Data Collection and Synthetic Data	TBD	CERDEC : Fort Belvoir, VA	-	-		8.065		-		-		-	0.000	8.065	-
ATLAS: Integration and Test	TBD	CERDEC : Fort Belvoir, VA	-	-		1.400		-		-		-	0.000	1.400	-
		Subtotal	-	-		25.165		-		-		-	0.000	25.165	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
ALAS-MC	TBD	ARDEC : Picatinny, NJ	-	-		0.800		-		-		-	0.000	0.800	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX8 / *Adv Leth and Accuracy Sys for Med Calber (ALAS-MC)*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	-	-		0.800		-		-		-	0.000	0.800	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		27.200		-		-		-	0.000	27.200	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX8 / *Adv Leth and Accuracy Sys for Med Calber (ALAS-MC)*

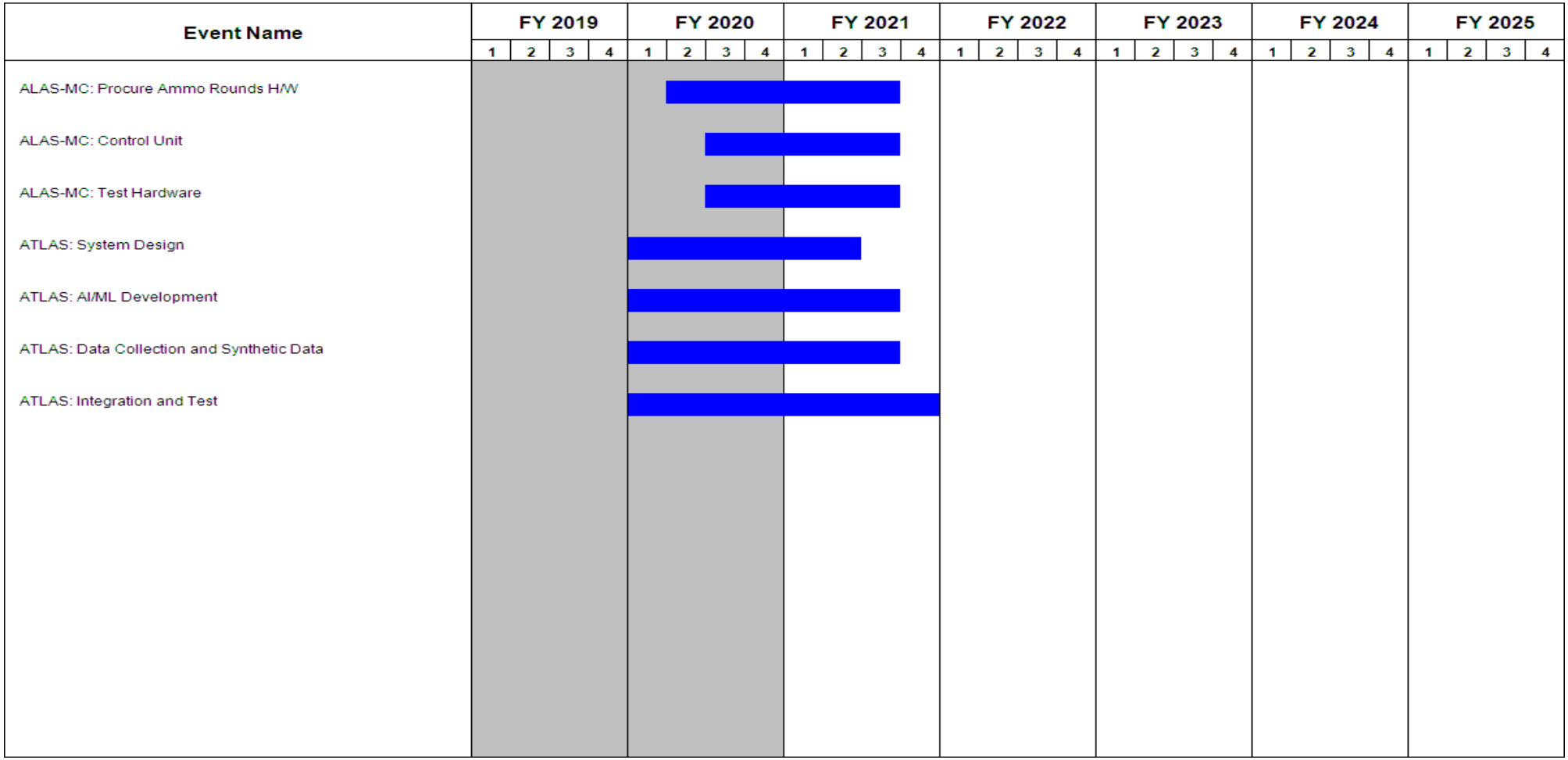

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX8 / *Adv Leth and Accuracy Sys for Med Calber (ALAS-MC)*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
ALAS-MC: Procure Ammo Rounds H/W	2	2020	3	2021
ALAS-MC: Control Unit	3	2020	3	2021
ALAS-MC: Test Hardware	3	2020	3	2021
ATLAS: System Design	1	2020	2	2021
ATLAS: AI/ML Development	1	2020	3	2021
ATLAS: Data Collection and Synthetic Data	1	2020	3	2021
ATLAS: Integration and Test	1	2020	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX9 / *Adv Mobility Experimental Prototype Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AX9: *Adv Mobility Experimental Prototype Adv Tech*	-	0.000	10.500	15.785	-	15.785	10.490	7.193	0.000	0.000	0.000	43.968
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project integrates and demonstrates advanced powertrain, power generation, and running gear technologies into a prototype ground combat vehicle. Advanced Mobility Experimental Prototype activities will demonstrate increased mobility, increased maneuver speeds, reduced fuel demands, and onboard power generation available for advanced lethality and protection technologies. The experimental prototype will be evaluated in realistic operating environment to validate performance and capability enhancements to inform ground combat vehicle programs of record.

This work is coordinated with PE 0603462A (Next Generation Combat Vehicle Advanced Technology) / BG4 (Adv Mobility Experimental Prototype Adv Tech Demo).

The cited work is consistent with the Under Secretary of Defense, Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the United States (U.S.) Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Advanced Mobility Experimental Prototype	-	10.023	15.785
Description: Efforts integrate and demonstrate advanced powertrain, power generation, running gear technologies, and unmanned robotic technologies into a ground combat vehicle to demonstrate reduced percentage of no-go terrain for ground vehicles, increased maneuver speeds across all traversable terrain, reduced fuel demands thus extending operation time between resupply, and onboard power generation to enable the integration of energy based capabilities such as directed energy weapons and electromagnetic armor. This effort mitigates risk for the Self-Propelled Howitzer.			
FY 2020 Plans: Will fabricate powertrain, power generation, and running gear technologies. Will develop designs for integration onto a surrogate combat vehicle platform, minimizing modifications to surrogate structure. Will develop and mature air induction/filtration, exhaust system, fuel cooling, final drives, and controls.			
FY 2021 Plans: Will continue to develop and mature air induction/filtration, exhaust system, fuel cooling, final drives, and controls to integrate into experimental prototype; integrate higher capacity engine and transmission as well as improved track and suspension into a			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX9 / *Adv Mobility Experimental Prototype Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
medium weight-class combat vehicle; demonstrate operational benefits of leader follower autonomous capability for unmanned combat vehicle formations. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Planned program progression.			
Title: FY 2020 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.477	-
Accomplishments/Planned Programs Subtotals	-	10.500	15.785

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AX9 / *Adv Mobility Experimental Prototype Adv Tech*	

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FY 2020 SBIR/STTR Transfer	TBD	Various : Various	-	-		0.477		-		-		-	0.000	0.477	-
		Subtotal	-	-		0.477		-		-		-	0.000	0.477	N/A

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Design and Integration of Components	C/Various	GVSC : Warren, MI	-	-		0.900		6.100		-		6.100	5.000	12.000	-
Develop air handling, cooling system, final drives & controls	C/Various	GVSC : Warren, MI	-	-		2.900		-		-		-	0.000	2.900	-
Fabricate Powertrain Technologies	C/Various	GVSC : Warren, MI	-	-		3.400		-		-		-	0.000	3.400	-
Fabricate Advanced Running Gear	C/Various	GVSC : Warren, MI	-	-		2.400		-		-		-	0.000	2.400	-
Design Integration for Surrogate Platform	C/Various	GVSC : Warren, MI	-	-		0.423		-		-		-	0.000	0.423	-
Component Fabrication	TBD	GVSC : Warren, MI	-	-		-		7.155		-		7.155	7.700	14.855	-
Capability Demonstration	TBD	GVSC : Warren, MI	-	-		-		2.530		-		2.530	5.000	7.530	-
		Subtotal	-	-		10.023		15.785		-		15.785	17.700	43.508	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		10.500		15.785		-		15.785	17.700	43.985	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX9 / *Adv Mobility Experimental Prototype Adv Tech*

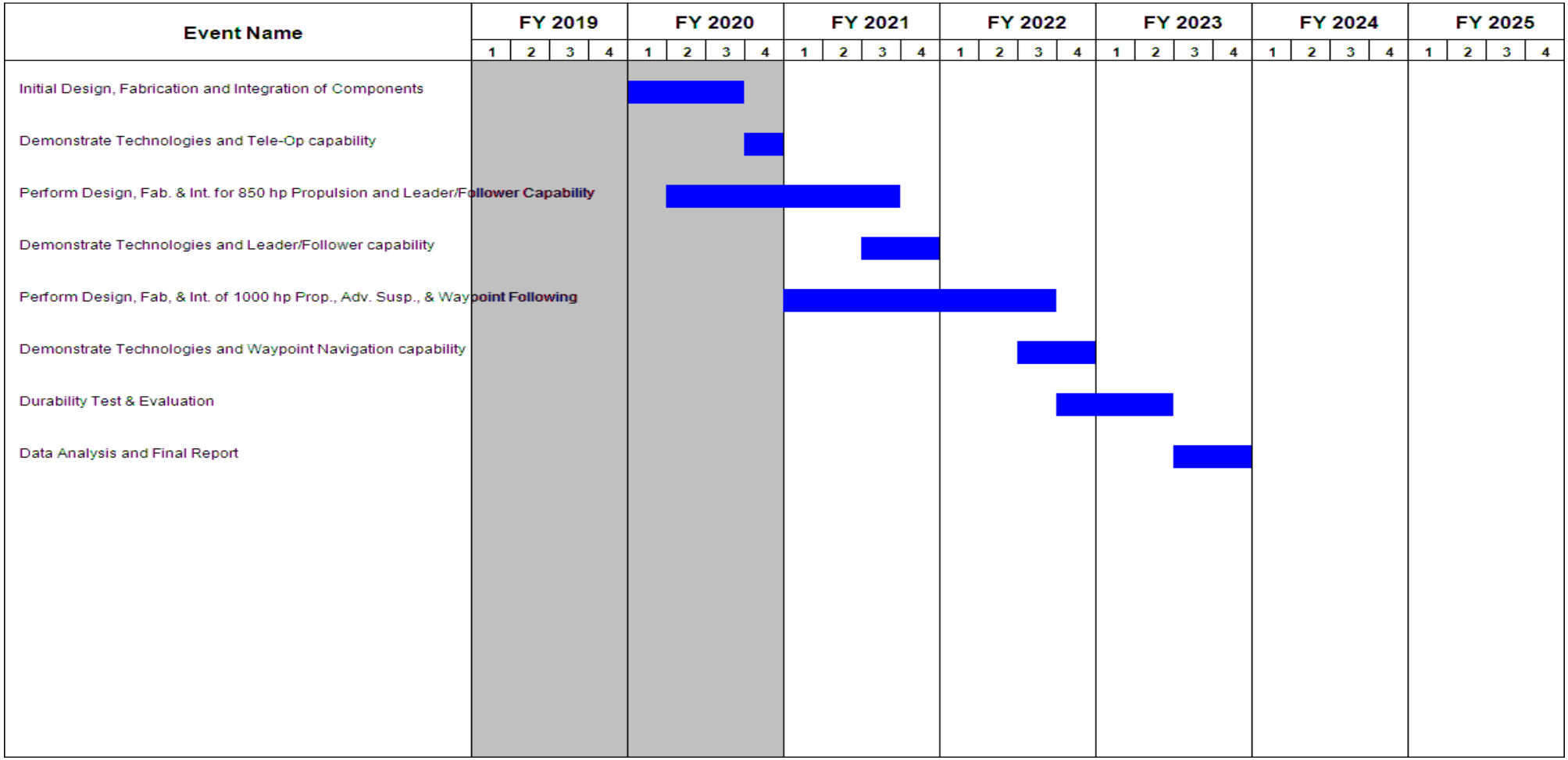

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AX9 / *Adv Mobility Experimental Prototype Adv Tech*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Initial Design, Fabrication and Integration of Components	1	2020	3	2020
Demonstrate Technologies and Tele-Op capability	4	2020	4	2020
Perform Design, Fab. & Int. for 850 hp Propulsion and Leader/Follower Capability	2	2020	3	2021
Demonstrate Technologies and Leader/Follower capability	3	2021	4	2021
Perform Design, Fab, & Int. of 1000 hp Prop., Adv. Susp., & Waypoint Following	1	2021	3	2022
Demonstrate Technologies and Waypoint Navigation capability	3	2022	4	2022
Durability Test & Evaluation	4	2022	2	2023
Data Analysis and Final Report	3	2023	4	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AY1 / *MUM-T Platform Enabler*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AY1: *MUM-T Platform Enabler*	-	0.000	7.200	4.496	-	4.496	4.196	0.000	0.000	0.000	0.000	15.892
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project will mature and demonstrate Manned Unmanned Teaming (MUMT) technologies in a realistic operating environment to drive down risk in three critical areas for ground MUMT: remote lethality, unmanned maneuver and network. These major technical hurdles will be addressed by integrating mature technologies into the MUMT Campaign of Learning through three, synergistic integration efforts: Unmanned Aerial Vehicle (UAV)/ground platform integration, a transportable MUMT simulation environment, and an advanced interface for the Warfighter.

Work within this Project supports the Army Modernization Priority for Next Generation Combat Vehicle.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the United States (U.S.) Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Unmanned Aerial Vehicle / Ground Platform Integration	-	3.886	4.496
Description: This effort matures and demonstrates in an operational environment technologies that address critical capability challenges related to the integration of UAVs and ground vehicle platforms. This effort also improves human-machine interactions through an intuitive Warfighter Machine Interface (WMI) between operators and unmanned platforms. The end state is to analyze the operational impact of multiple advanced enabling technologies to reduce risk in critical capabilities that support MUMT operations.			
FY 2020 Plans: Will conduct task and workflow analysis for the integration of electro-optic sensors, a communications repeater, and advanced WMI to improve situational awareness and network communications. Will select baseline platforms for the ground and aerial vehicles. Will mature the demonstrator technology by optimizing subsystem performance during hardware and software integration on the vehicle platform. Will conduct engineering demonstration of integrated technologies to validate approach prior to operational demonstrations.			
FY 2021 Plans: Will mature the required subsystems based on lessons learned from engineering demonstration and standardize interfaces for UAV to ground platform integration using simulators developed in FY20; conduct operational demonstrations with users to			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AY1 / *MUM-T Platform Enabler*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
evaluate the effectiveness of the integrated solution against their operational needs, shape future engineering work, and inform requirements development. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** This increase is to focus on UAV capabilities work in FY 2021.			
Title: Transportable Manned Unmanned Teaming Simulation ***Description:*** This effort provides an immersive, transportable MUMT simulation environment in order to gather insights from diverse user groups to shape and inform MUMT Tactics, Techniques and Procedures (TTPs). Specifically, it provides the capability to optimize Warfighter Machine Interface (WMI) implementations and advanced payloads for multiple MUMT scenarios. The end state is to provide Soldiers across the fighting echelon, from command to end user, the requisite knowledge to formulate the appropriate Concept of Operations (CONOPS) 7.200 for MUMT in order to operate and fight disbursed against near-peer adversaries with greater lethality and force projection. ***FY 2020 Plans:*** Will design and begin development of a realistic, transportable simulator to virtually assess the control vehicle layout under various conditions and modes. Will mature the simulation environment and associated technologies in preparation for user virtual assessments to shape and inform MUMT TTPs. Will develop scenarios for virtual simulation that will engage the user base on software improvements to the WMI. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The decrease is due to the completion of the transportable simulators work in FY20. These simulators will be used to facilitate integration of standard user interfaces for unmanned platforms under the 'Unmanned Aerial Vehicle (UAV) / Ground Platform Integration' bullet for the remainder of this project.	-	2.987	-
Title: FY 2020 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 Plans:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638	-	0.327	-
Accomplishments/Planned Programs Subtotals	-	7.200	4.496

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AY1 / *MUM-T Platform Enabler*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AY1 / *MUM-T Platform Enabler*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FY 2020 SBIR/STTR Transfer	TBD	Various : Various	-	-		0.327		-		-		-	0.000	0.327	-
		Subtotal	-	-		0.327		-		-		-	0.000	0.327	N/A

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
UAV / Ground Platform Integration	C/Various	TARDEC : Warren, MI	-	-		3.886		4.496		-		4.496	4.200	12.582	-
Transportable Simulator	C/Various	TARDEC : Warren, MI	-	-		2.987		-		-		-	0.000	2.987	-
		Subtotal	-	-		6.873		4.496		-		4.496	4.200	15.569	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		7.200		4.496		-		4.496	4.200	15.896	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AY1 / *MUM-T Platform Enabler*

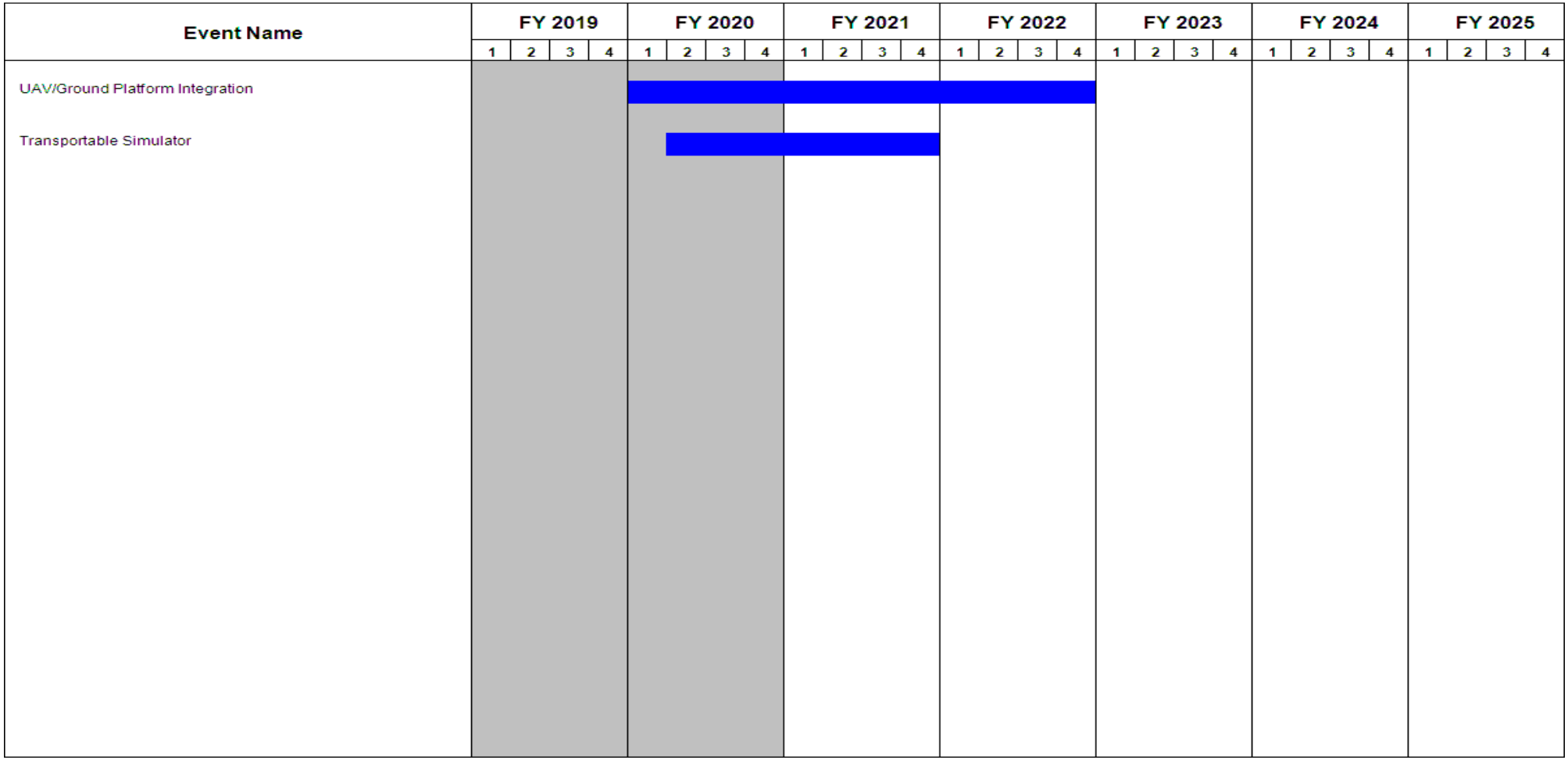

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AY1 / *MUM-T Platform Enabler*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
UAV/Ground Platform Integration	1	2020	4	2022
Transportable Simulator	2	2020	4	2021

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AY2 / *Army Operational Fires*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AY2: *Army Operational Fires*	-	0.000	18.900	28.372	-	28.372	38.336	10.790	0.000	0.000	0.000	96.398
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and demonstrates a ground-launched, treaty-compliant weapon system capable of destroying critical relocatable, time sensitive targets in contested Anti-Access/Area Denied (A2/AD) environments. Activities include system-level prototyping to extend the range of Army fires well beyond 499km to complement other fires developments.

Work in this Project complements PE 0603464A (Long Range Precision Fires Advanced Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the United States (U.S.) Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Army Operational Fires	-	18.042	28.372
Description: This effort matures and demonstrates a ground-launched, treaty-compliant weapon system capable of destroying critical relocatable, time sensitive targets in contested A2/AD environments. ***FY 2020 Plans:*** Will develop system architecture and interfaces; will initiate fire control software development; and perform sub-system testing and evaluation of solid rocket booster and launch platform hardware. ***FY 2021 Plans:*** Will mature fire control software development and launch platform hardware development; conduct end to end propulsion system integration and testing of developed propulsion booster system; and conduct system level critical design review (CDR) in preparation for final flight test hardware fabrication. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Planned program progression.			
Title: FY 2020 SBIR/STTR Transfer	-	0.858	-
Description: Funding transferred in accordance with Title 15 USC ?638			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AY2 / *Army Operational Fires*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
FY 2020 Plans: Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	-	18.900	28.372

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AY2 / *Army Operational Fires*	

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FY 2020 SBIR/STTR Transfer	TBD	Various : Various	-	-		0.858		-		-		-	0.000	0.858	-
		Subtotal	-	-		0.858		-		-		-	0.000	0.858	N/A

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Army Operational Fires	C/Various	AvMC : Huntsville, AL	-	-		18.042		28.372		-		28.372	52.700	99.114	-
		Subtotal	-	-		18.042		28.372		-		28.372	52.700	99.114	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		18.900		28.372		-		28.372	52.700	99.972	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AY2 / *Army Operational Fires*

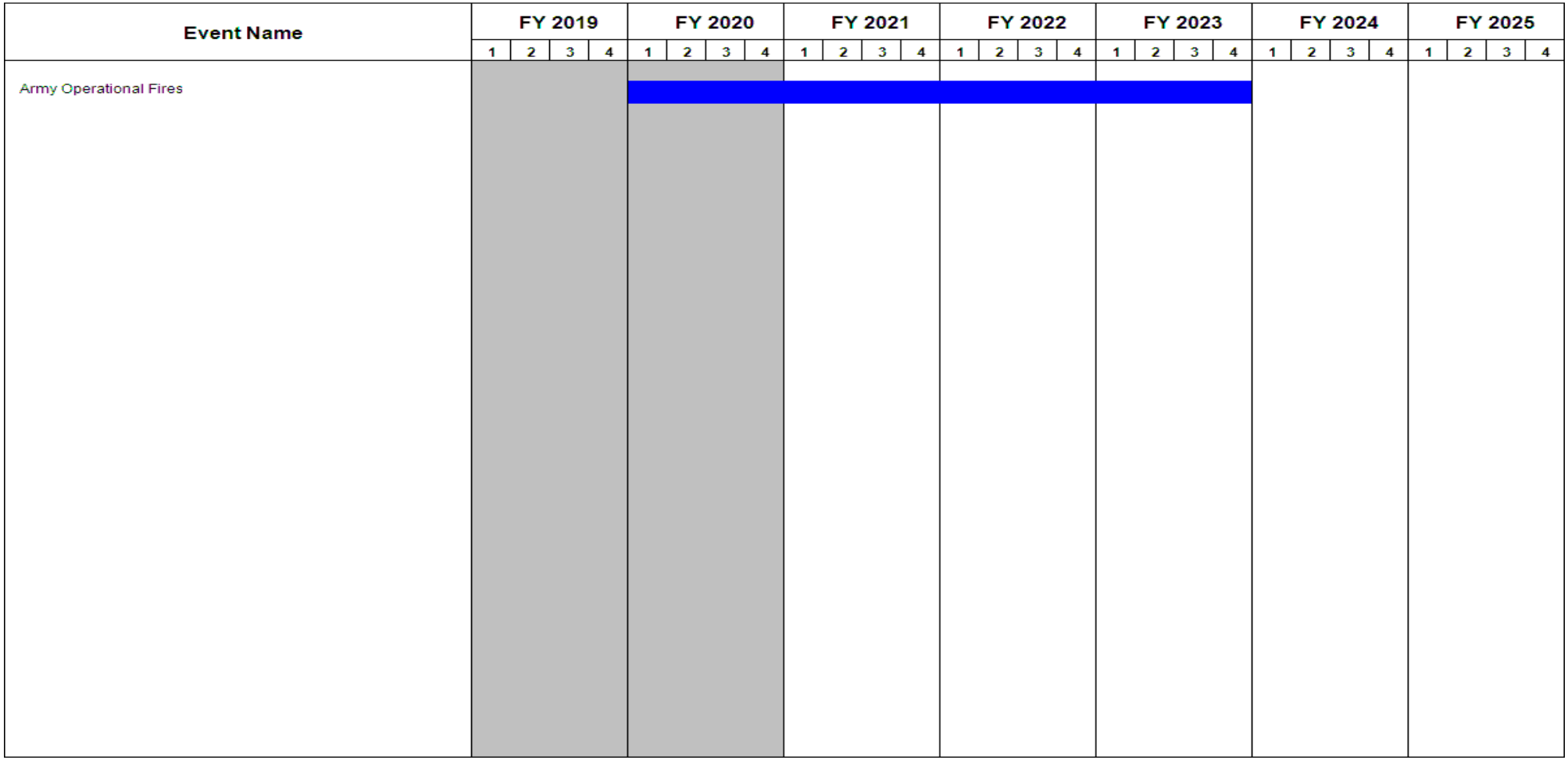

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AY2 / *Army Operational Fires*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Army Operational Fires	1	2020	4	2023

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AY3 / *Strategic Long Range Cannon*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AY3: *Strategic Long Range Cannon*	-	0.000	76.860	65.147	-	65.147	70.933	0.000	0.000	0.000	0.000	212.940
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project matures and integrates long-range armament technologies for both weapons and munitions to demonstrate potential deep strike objective capabilities from future cannon artillery systems. It will demonstrate revolutionary performance to support Long Range Fires by further developing, integrating, and demonstrating enhanced lethality and range extension solutions for cannon system performance with maximum effects. Strategic Long Range Cannon (SLRC) activities include integrating component technologies into sub-system and system-level experimental prototypes for novel cannon, munition, and fire control, including guidance and propulsion.

Extended Range Cannon Artillery (ERCA) activities mature, integrate, and demonstrate a novel sub-system for ammunition handling and a long-range artillery projectile to support prototyping and experimentation of a next-generation, extended range armaments system that will provide significantly increased range and accuracy without an increase in platform weight.
The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the Unites States (U.S.) Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Strategic Long Range Cannon	-	60.696	65.147
Description: This effort will integrate and prototype subsystem technologies to further enhance range, lethality, and precision enablers for extended range cannon and munition systems.			
FY 2020 Plans: Will scale up cannon and projectile technology components and fabricate sub-system prototype hardware leveraging activities and information gained under 0603464A (Long Range Precision Fires Advanced Technology) / Project AE6 (Strategic Long Range Cannon Advanced Technology). Will integrate test hardware and conduct subsystem testing and experimentation.			
FY 2021 Plans: Will mature critical sub-system technologies with major engineering tests on high risk components such as the rocket motor; will conduct static warhead testing to demonstrate performance against targets of interest; will conduct system integration			

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AY3 / *Strategic Long Range Cannon*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
and technology maturation for SLRC to include designs for long lead prototypes to be used in upcoming major system level demonstrations; will scale and perform prototyping on components including objective cannon, gun carriage, and test platform. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Planned program progression.			
Title: Extended Range Cannon Artillery Autoloader ***Description:*** This effort matures, integrates, and demonstrates a novel technology sub-system prototype for ammunition handling to support the prototyping of a next-generation, extended range armaments system that will provide significantly increased range and accuracy without an increase in platform weight. ***FY 2020 Plans:*** Will mature and integrate ammunition handling automation technologies into a sub-system prototype for demonstration and validation of performance. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** ERCA Autoloader effort ends after FY20.	-	9.837	-
Title: Extended Range Cannon Artillery Projectile ***Description:*** This effort integrates component technologies that provide optimized range, precision, counter-measure, and payload into a long-range artillery projectile sub-system for demonstration and experimentation. Activities support the maturation and prototyping of a next-generation, extended range armaments system that will provide significantly increased range and accuracy without an increase in platform weight. ***FY 2020 Plans:*** Will mature and integrate enabling component technologies into long-range artillery projectile sub-system. Will demonstrate and validate increased range, sensor optimization and integration, and improved performance for armor and counter-battery defeat at extended ranges in contested and Global Positioning Satellite (GPS)-denied environments. ***FY 2020 to FY 2021 Increase/Decrease Statement:*** ERCA Projectile effort ends after FY20.	-	2.837	-
Title: FY 2020 SBIR/STTR Transfer ***Description:*** Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 Plans:***	-	3.490	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AY3 / *Strategic Long Range Cannon*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Funding transferred in accordance with Title 15 USC ?638 ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Funding transferred in accordance with Title 15 USC ?638			
Accomplishments/Planned Programs Subtotals	-	76.860	65.147

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AY3 / *Strategic Long Range Cannon*	

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FY 2020 SBIR/STTR Transfer	TBD	Various : Various	-	-		3.490		-		-		-	0.000	3.490	-
		Subtotal	-	-		3.490		-		-		-	0.000	3.490	N/A

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Strategic Long Range Cannon	C/Various	ARDEC : Picatinny, NJ	-	-		60.696		65.147		-		65.147	71.000	196.843	-
Extended Range Cannon Artillery (ERCA) Autoloader	C/Various	ARDEC : Picatinny, NJ	-	-		9.837		-		-		-	0.000	9.837	-
Extended Range Cannon Artillery (ERCA) Projectile	C/Various	ARDEC : Picatinny, NJ	-	-		2.837		-		-		-	0.000	2.837	-
		Subtotal	-	-		73.370		65.147		-		65.147	71.000	209.517	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Dismounted Man-Portable Air Defense System (MANPADS) Experiment	Option/ Various	PEO M&S, PM Cruise MIssile Defense System : Huntsville, AL	-	-		-		0.000		-		0.000	-	-	-
		Subtotal	-	-		-		0.000		-		0.000	-	-	N/A

	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		76.860		65.147		-		65.147	71.000	213.007	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) AY3 / *Strategic Long Range Cannon*	

	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AY3 / *Strategic Long Range Cannon*

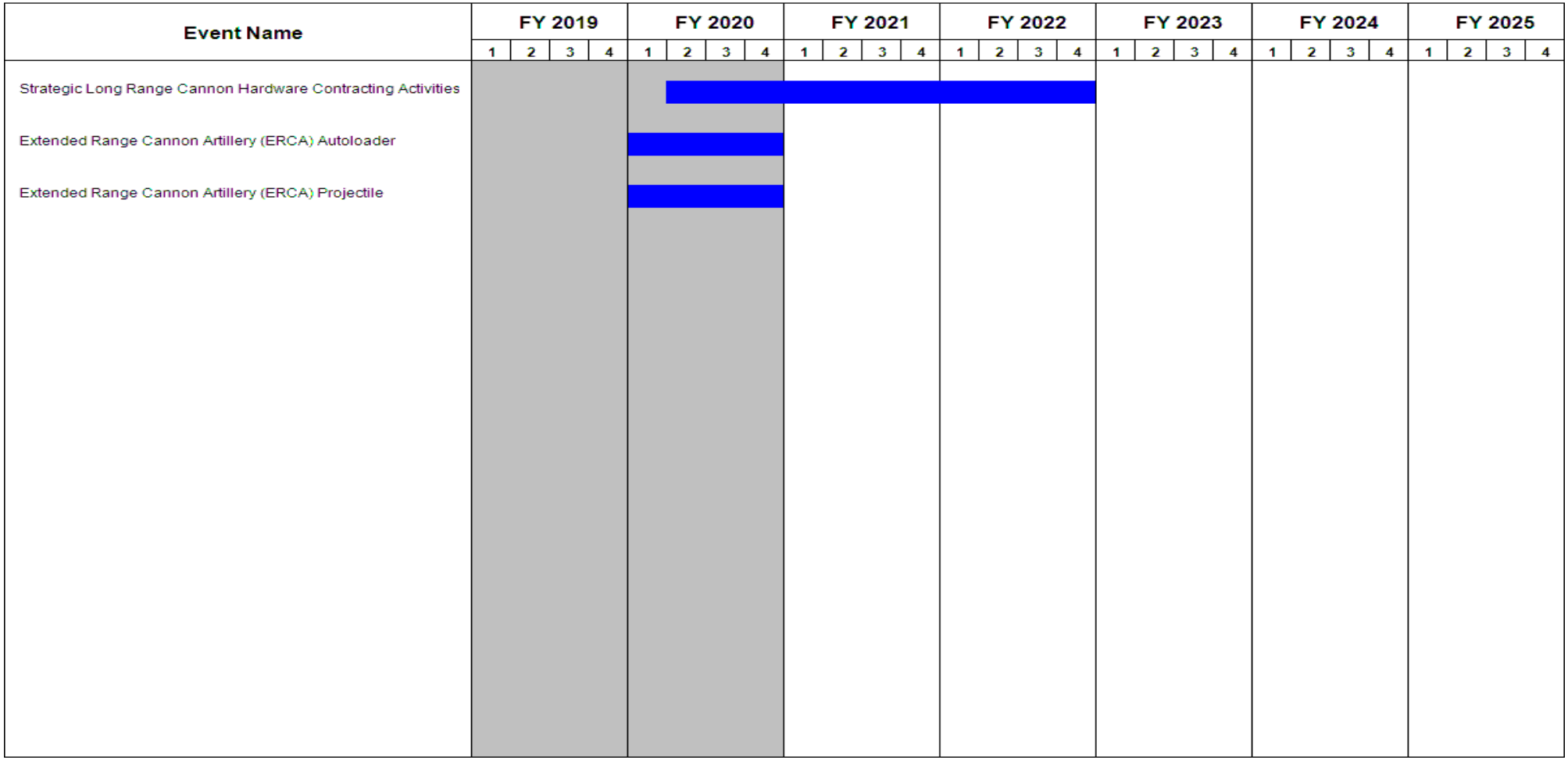

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** AY3 / *Strategic Long Range Cannon*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Strategic Long Range Cannon Hardware Contracting Activities	2	2020	4	2022
Extended Range Cannon Artillery (ERCA) Autoloader	1	2020	4	2020
Extended Range Cannon Artillery (ERCA) Projectile	1	2020	4	2020

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) DS3 / *Technology Maturation Initiatives*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
DS3: *Technology Maturation Initiatives*	-	91.749	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	91.749
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Beginning in Fiscal Year (FY) 2020, Program Element (PE) 0604115A (Technology Maturation Initiatives) / Project DS3 (Technology Maturation Initiatives) has been realigned to:
PE 0604115A Technology Maturation Initiatives:
* Project AX3 Technology Maturation Initiatives
* Project AX4 Computational Prototyping Environment (CPE)
* Project AX5 Next Generation Close Combat Missile
* Project AX6 Active Protection Systems Integration
* Project AX7 Multi-Mission High Energy Laser (MMHEL) Sys Demo
* Project AX8 Adv Leth and Accuracy Sys for Med Calber ALAS-MC
* Project AX9 Adv Mobility Experimental Prototype Adv Tech
* Project AY1 MUM-T Platform Enabler
* Project AY2 Army Operational Fires
* Project AY3 Strategic Long Range Cannon

A. Mission Description and Budget Item Justification

This Project funds the maturation, integration, and demonstration of advanced technology demonstrators and experimental prototypes to support advanced ground systems; aviation systems; command, control, communication & reconnaissance systems and equipment; precision weapons, High Energy Laser (HEL) systems; and Soldier equipment. Technology Maturation Initiative (TMI) efforts mature and integrate component technologies into early system and sub-system experimental prototypes for demonstration in relevant environments and tactical/operational scenarios, taking technologies to a goal of Technology Readiness Level (TRL) 7. Technology demonstrators and experimental prototypes are validated and transitioned to priority Army experimentation and acquisition efforts to inform requirements for future programs of record and reduce the risk of technology insertion. These efforts are typically 2-4 years in duration, and are approved by Army senior leadership based on priority and opportunity, to ensure that demonstrations have high potential for filling capability gaps and transitioning. Activities include the maturation, integration, and demonstration of HEL prototype weapons performance on a combat platform in realistic operational environments in support of the Army's objective capability for Maneuver-Short Range Air Defense (M-SHORAD). A 50 kilowatt (kW)-class laser weapon system has the potential to engage and defeat rockets, artillery, mortars (RAM), unmanned aerial systems(UASs), sensors, and optics for maneuvering brigade combat teams (BCTs). Activities also include sub-system prototyping and integration of leap-ahead ground combat vehicle powertrain technologies; and integration and demonstration of key Active Protection System (APS) components to provide modular and layered vehicle protection effects (hard-kill and soft-kill), enabling power projection and enhanced survivability. Computational Prototyping Environment (CPE) efforts include demonstration of physics-based, computational modeling integrated with new advances in deep learning to explore

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** DS3 / *Technology Maturation Initiatives*

design tradespaces and understand defeat strategies for prototype platforms. This Project provides the Army with an improved mechanism for enabling greater competition in the latter stages of technology maturation and establishing a closer alignment between Science and Technology (S&T) efforts and acquisition programs.

The cited work is consistent with the Under Secretary of Defense, Research and Engineering priority focus areas and the Army Modernization Strategy. Work in this Project is performed by the Army Futures Command (AFC); the United States Army Space and Missile Defense Command/Army Forces Strategic Command (SMDC/ ARSTRAT); and the Engineer Research and Development Center (ERDC).

Funding has been realigned to reflect the FY20 financial restructure and Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
Title: Vehicle Survivability Subsystem Demonstrator ***Description:*** The Vehicle Survivability Subsystem effort integrates and demonstrates cost effective, lightweight designs for the optimization of hull, frame, body, cab and armor technologies to achieve survivability systems weight reductions of 10-15% and increased vehicle survivability against advanced and emerging threats.	7.373	-	-
Title: Advanced Powertrain Subsystem Demonstrator ***Description:*** The Advanced Powertrain Subsystem Demonstrator effort fabricates, integrates, and demonstrates next generation, scalable combat vehicle powertrain technologies into a high power dense and more fuel efficient combat vehicle powertrain. This powertrain will demonstrate advancements in engine and transmission subsystem components specific for military platforms in order to provide an integrated advanced propulsion system .	10.612	-	-
Title: Active Protection Systems Integration and Demonstration ***Description:*** This effort synchronizes emerging S&T products with the Vehicle Protection Suite (VPS) Program of Record and matures key APS technologies to a Technology Readiness Level 7 for integration onto current and future ground platforms. It matures Modular Active Protection Framework (MAF)-compliant effectors and sensors, and integrates them onto ground combat vehicles for prototype system test and demonstration. It conducts independent evaluation to inform system development processes that ensure safety compliance for future VPS increment upgrades as new threats emerge.	7.416	-	-
Title: Multi-Mission High Energy Laser (MMHEL) ***Description:*** This effort matures and integrates a 50 kW-class laser system into a Stryker platform, providing a system-level, HEL experimental prototype for demonstration in realistic operating environments. These demonstrations will inform requirements, decrease risk for future Army HEL acquisition programs, and support the future development of warfighter Tactics/Techniques/ Procedures (TTPs) and Concept of Operations (CONOPS). HEL weapon systems are expected to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems and without the need to stockpile ordnance. A 50 kW-class laser weapon system has the potential to engage and defeat RAM; Unmanned Aerial Vehicles (UAVs); sensors;	54.658	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** DS3 / *Technology Maturation Initiatives*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2019	FY 2020	FY 2021
and optics for maneuvering BCTs. Demonstrations will also inform potential future capability to defeat both fixed- and rotary-wing manned aircraft. Leveraging Government investments and Industry technology advancements, will review and select existing HEL subsystem designs for integration into a Stryker vehicle; will conduct integration and demonstration of a system-level HEL experimental prototype; and will provide assessment of technical performance in an operational environment.			
Title: Next Generation Close Combat Missile ***Description:*** The Next Generation Close Combat Missile (NG CCM) effort demonstrates a prototype close combat missile with a multi-pulse, boost-sustain flight propulsion system providing extended range and decreased time of flight. Activities mature proof-of-principle hardware into an integrated tactical-representative design and demonstrate a prototype missile with lethality overmatch of emerging threats to address near-term Warfighter needs, in advance of acquisition program of record.	9.430	-	-
Title: Computational Prototyping Environment ***Description:*** The CPE effort creates an integrated, robust, and verified system that leverages recent Department of Defense advancements in large data tradespace analytics, high-fidelity physics-based modeling, deep learning techniques, high performance computing capabilities, and inverse modeling approaches. The CPE demonstrates the early developmental verification and validation of selected weapons platform variations in a way that accurately identifies potential performance and design failures, while also testing and mitigating solutions and multiple trades in a Virtual Proving Ground (VPG) prior to cost-bearing production and manufacturing. CPE efforts facilitate rapid, accurate, and computational prototyping in a robust VPG for early performance verification of new capabilities.	2.241	-	-
Title: FY 2018 NDAA SEC 825 MDAP Cost Overrun ***Description:*** FY 2018 NDAA SEC 825 MDAP Cost Overrun	0.019	-	-
Accomplishments/Planned Programs Subtotals	91.749	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Activities are conducted both in-house and through competitively awarded contracts using best value source selection procedures. Multiple competitive contracts will be awarded. The Other Transaction Agreement (OTA) # W15QKN-14-9-1001 Initiative (Task Order) DOTC-16-01-INIT-0302 will be the primary contract vehicle for the MMHEL effort.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) DS3 / *Technology Maturation Initiatives*	

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FY 2018 NDAA SEC 825 MDAP Cost Overrun	Allot	N/A : N/A	-	0.019		-		-		-		-	0.000	0.019	-
		Subtotal	-	0.019		-		-		-		-	0.000	0.019	N/A

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Vehicle Survivability Subsystem Demonstrator	C/Various	Various : Various	21.814	7.373		-		-		-		-	0.000	29.187	-
Advanced Powertrain Subsystem Demonstrator	C/Various	Various : Various	26.945	10.612		-		-		-		-	0.000	37.557	-
Modular Active Protection Systems (MAPS) Demonstrations	C/Various	Various : Various	29.714	-		-		-		-		-	0.000	29.714	-
Active Protection Systems (APS) Integration	C/Various	Various : Various	-	7.416		-		-		-		-	0.000	7.416	-
Multi-Mission High Energy Laser (MMHEL)	C/Various	Various : Huntsville, AL	78.684	54.658		-		-		-		-	0.000	133.342	-
MMHEL Integration and Demonstration (CA)	C/Various	Various : Huntsville, AL	35.000	-		-		-		-		-	0.000	35.000	-
Computational Prototyping Environment	C/Various	Various : Various	1.000	2.241		-		-		-		-	0.000	3.241	-
Next Generation Close Combat Missile	C/Various	Various : Various	-	9.430		-		-		-		-	0.000	9.430	-
		Subtotal	193.157	91.730		-		-		-		-	0.000	284.887	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	193.157	91.749		0.000		-		-		-	0.000	284.906	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army			Date: February 2020
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0604115A / *Technology Maturation Initiatives*	Project (Number/Name) DS3 / *Technology Maturation Initiatives*	

	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** DS3 / *Technology Maturation Initiatives*

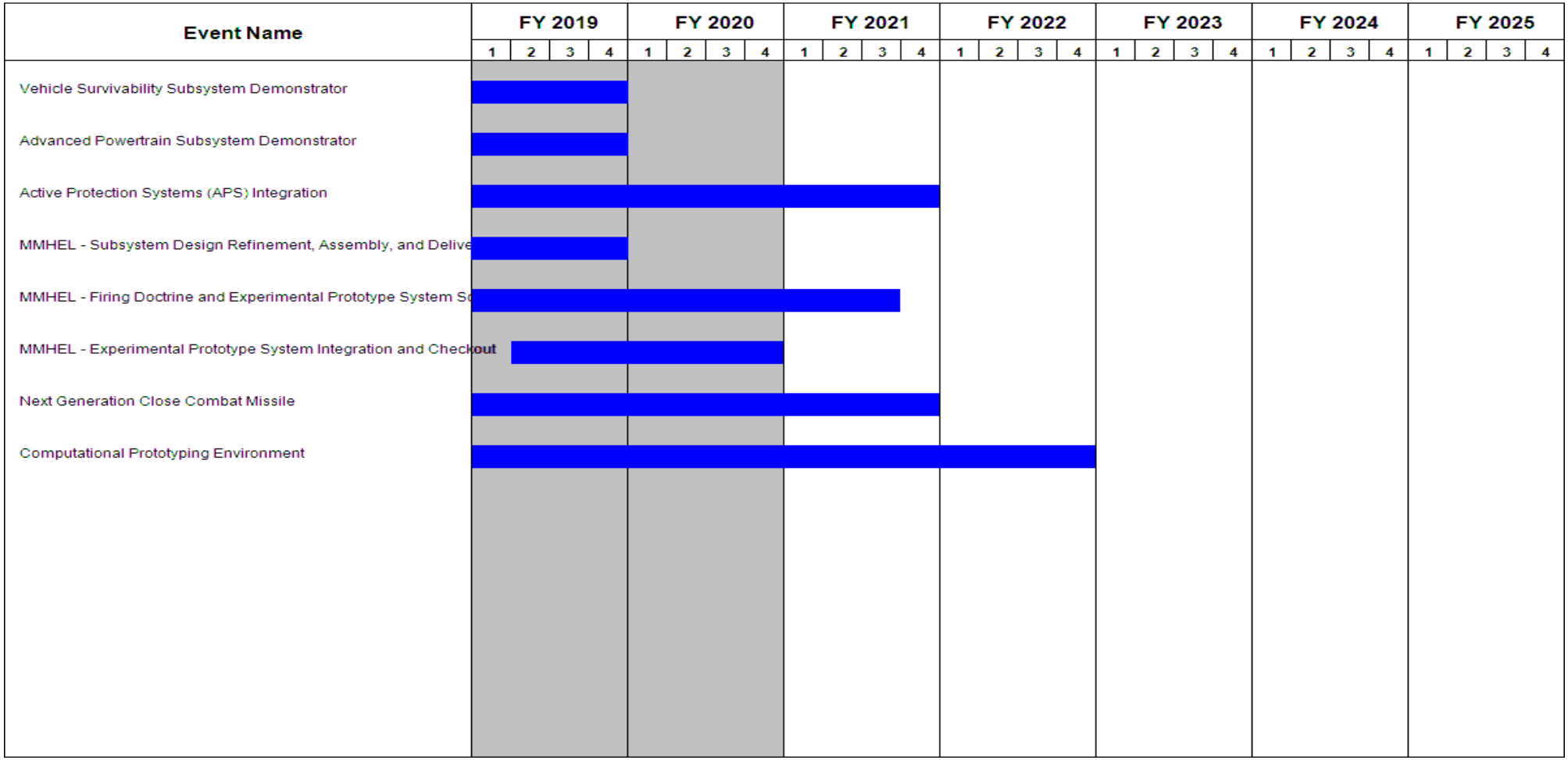

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Army		Date: February 2020
Appropriation/Budget Activity 2040 / 4	**R-1 Program Element (Number/Name)** PE 0604115A / *Technology Maturation Initiatives*	**Project (Number/Name)** DS3 / *Technology Maturation Initiatives*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Vehicle Survivability Subsystem Demonstrator	1	2017	4	2019
Advanced Powertrain Subsystem Demonstrator	1	2017	4	2019
Modular Active Protection Systems (MAPS) Demonstrations	1	2017	4	2018
Active Protection Systems (APS) Integration	1	2019	4	2021
Multi-Mission High Energy Laser (MMHEL) - System-Level Design	1	2018	3	2018
MMHEL - Subsystem Design Refinement, Assembly, and Delivery	4	2018	4	2019
MMHEL - Firing Doctrine and Experimental Prototype System Software	1	2019	3	2021
MMHEL - Experimental Prototype System Integration and Checkout	2	2019	4	2020
Next Generation Close Combat Missile	1	2019	4	2021
Computational Prototyping Environment	1	2018	4	2022

Note

N/A