Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army											Date: May 2021	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 7: *Operational Systems Development*					R-1 Program Element (Number/Name) PE 0607131A / *Weapons and Munitions Product Improvement Programs*							
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
Total Program Element	-	14.222	19.666	22.828	-	22.828	-	-	-	-	-	-
CP2: *Precision Fire Technology Improvements*	-	-	-	8.210	-	8.210	-	-	-	-	-	-
ER2: *Close Combat Technology*	-	1.972	6.518	3.468	-	3.468	-	-	-	-	-	-
ER5: *Indirect Fire and Fuze Technology*	-	4.076	4.712	4.463	-	4.463	-	-	-	-	-	-
ER6: *Direct Fire Technology*	-	8.174	8.436	6.687	-	6.687	-	-	-	-	-	-

Note

In Fiscal Year (FY) 2022, Project CP2, Precision Fire Technology Improvements is a New Start.

A. Mission Description and Budget Item Justification

Project CP2 Precision Fire Technology Improvements supports required Precision Munitions and Fuze assessment and improvement initiatives to support increased rates of fire for items that have been fielded or in full rate production, such as the M1155 Enhanced Portable Inductive Artillery Fuze Setter (EPIAFS), Excalibur and Precision Guidance Kit (PGK). Efforts will identify, characterize, study, analyze, test and develop Precision Munition and Fuze technologies to increase range, lethality, effectiveness, survivability and accuracy. Fiscal Year (FY) 2022 funding will support preliminary fuze setter trade studies and improvement activities on setter technologies to inform requirements and the setter modernization roadmap. FY 2022 funding will also support the Excalibur high pressure setback testing and safety margin improvement initiatives that will ensure survivability and reliability with the Extended Range Cannon Artillery (ERCA) system in support of the Army's modernization priorities.

Project ER2 Close Combat Technology project includes development efforts to upgrade Close Combat technologies, energetics, and munitions, such as counter explosives, grenades, demolitions, shoulder launched munitions, pyrotechnic simulators, countermeasure flares, non-lethal ammunition/systems, networked munitions and mines, that have been fielded or have received approval for full rate production. This program will identify, characterize, study, analyze, test and develop technologies to resolve close combat munition reliability, safety, environmental, storage, standardization, obsolescence and manufacturing/producibility issues. Fiscal Year (FY) 2022 funds will resource improvements to the following grenade efforts: M67 (G881) Insensitive Munition (IM) Replacement, and M98/M99 Non-Lethal 66mm Grenades, and Volcano Countermeasure Testing

Project ER5 Indirect Fire and Fuze Technology Project includes product improvement development efforts to upgrade indirect fire weapon systems and munitions that have already been fielded and/or are in production. Efforts include improved target engagement, increased reliability, availability, maintainability, and safety, standardization and interoperability with weapons and munitions of Allied Nations, defense exportability features, reduction of failure mechanisms, and supply chain risk by introducing new and alternative technology and materiel solutions, improvement of manufacturing methods and their associated production processes, new capabilities in response to the evolving and emerging threats and countermeasures, and reduction/elimination of potential environmental and health risks associated with

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army	Date: May 2021
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0607131A *I Weapons and Munitions Product Improvement Programs*

these products. Fiscal Year (FY) 2022 funding will complete a long range precision fires artillery fuze compatibility study to determine compatibility with production fuzes; conduct analysis on mortar training fuzes for ballistic flight performance improvements; conduct analysis on production fuze TDPs to preclude potential single point and critical suppliers issues; investigate improved proximity fuze radar transceivers for proximity mortar fuzes to increase performance and survivability; integrate extended range precision artillery fuzing power sources prototypes to support extended flight durations; and implement hand grenade safety improvements integrating electronic and energetic technologies that will also improve insensitive munition capability. FY 2022 funding will also support the continued studies and analysis (Key Parameter Development and Management (KPDM) and Model Based Systems Engineering (MBSE)) efforts supporting indirect fire artillery ammunition and mortar ammunition developmental product improvement initiatives to increase range, lethality, effectiveness, survivability and accuracy .

Project ER6 Direct Fire Technology funding will be used to support direct fire ammunition from small caliber ammunition, 40 millimeter (mm) grenade, medium caliber cannon ammunition and large caliber ammunition enhancements to lethality, effectiveness, survivability, accuracy and general product improvements. Fiscal Year (FY) 2022 funds support lethality and safety improvements to 40mm ammunition, making a number of improvements to training ammunition, performing improvements to small caliber primers to make the primers more environmentally friendly, optimize handgun ammunition, explore precision sniper improvements and continuing the effort to reduce Soldier load by developing lightweight small caliber ammunition. FY 2022 also includes examination and implementation of improvements to 105mm and 120mm tank ammunition.

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	15.645	20.409	14.799	-	14.799
Current President's Budget	14.222	19.666	22.828	-	22.828
Total Adjustments	-1.423	-0.743	8.029	-	8.029
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.780	-			
• SBIR/STTR Transfer	-0.643	-0.743			
• Adjustments to Budget Years	-	-	8.029	-	8.029

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0607131A / *Weapons and Munitions Product Improvement Programs*	Project (Number/Name) CP2 / *Precision Fire Technology Improvements*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
CP2: *Precision Fire Technology Improvements*	-	-	-	8.210	-	8.210	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

This is a new start in FY 2022.

In Fiscal Year (FY) 2022, Project CP2, Precision Fire Technology Improvements is a New Start.

A. Mission Description and Budget Item Justification

This Project supports required Precision Munitions and Fuze assessment and improvement initiatives to support increased rates of fire for items that have been fielded or in full rate production, such as the M1155 Enhanced Portable Inductive Artillery Fuze Setter (EPIAFS), Excalibur and Precision Guidance Kit (PGK). Efforts will identify, characterize, study, analyze, test and develop Precision Munition and Fuze technologies to increase range, lethality, effectiveness, survivability and accuracy. FY 2022 funding will support preliminary fuze setter trade studies and improvement activities on setter technologies to inform requirements and the setter modernization roadmap. FY 2022 funding will also support the Excalibur high pressure setback testing and safety margin improvement initiatives that will ensure survivability and reliability with the Extended Range Cannon Artillery (ERCA) system in support of the Army's modernization priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Enhanced Portable Inductive Artillery Fuze Setter (EPIAFS) Modernization	-	-	3.270
Description: The effort supports fuze setting system requirements based on legacy and developmental platforms and munitions for 155mm Artillery systems. Efforts support development of comprehensive technology plan for Increased Range and Increased Rate of Fire improvements related to the ERCA weapon system as well as other Artillery Modernization efforts. ***FY 2022 Plans:*** FY 2022 funding will support preliminary fuze setter trade studies and improvement activities on setter technologies to inform requirements and the setter modernization roadmap. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Increase in FY 2022 due to initiation of EPIAFS Modernization effort.			
Title: Excalibur Ib Modernization	-	-	4.940
Description: This effort will complete a series of Excalibur Ib safety and reliability test activities to ensure survivability at higher pressures in the ERCA system.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 2022 Plans: FY 2022 funding will support the Excalibur high pressure setback testing and safety margin improvement initiatives that will ensure survivability and reliability with the ERCA system in support of the Army's modernization priorities. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Increase in FY 2022 due to initiation of Excalibur Ib Modernization effort.			
Accomplishments/Planned Programs Subtotals	-	-	8.210

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The EPIAFS Modernization effort will utilize US Government labor and development capabilities to accomplish trade studies and Other Transaction Agreement (OTA) contracts for development of promising fuze setting concepts. Upon completion, efforts will transition to production as Engineering Change Proposals (ECPs) to be integrated into existing production contracts as they become available.

The Excalibur Ib Modernization effort will utilize existing Engineering Services contract with Raytheon Missiles and Defense as well as various Federal Acquisition Regulation (FAR) contracts to support modernization activities. Upon successful completion, improvements will be integrated via Engineering Change Proposal (ECP) in the Excalibur Ib production contract.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army			Date: May 2021
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Excalibur Ib Modernization Component Hardware	Various	To Be Determined : TBD	-	-		-		0.286	Jan 2022	-		0.286	0.000	0.286	-
Excalibur Ib Modernization Hardware	SS/CPFF	Raytheon Missiles and Defense (RMD) : Tuscon, AZ	-	-		-		1.329	Apr 2022	-		1.329	0.000	1.329	-
EPIAFS Modernization Development and Hardware	Various	To Be Determined : TBD	-	-		-		1.000	Jun 2022	-		1.000	0.000	1.000	-
		Subtotal	-	-		-		2.615		-		2.615	0.000	2.615	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Excalibur Ib Modernization Engineering Support	MIPR	Combat Capabilities Development Command Armaments Center (DEVCOM AC) : Picatinny Arsenal, NJ	-	-		-		0.600	Nov 2021	-		0.600	0.000	0.600	-
EPIAFS Modernization Engineering Support	MIPR	Combat Capabilities Development Command Armaments Center (DEVCOM AC) : Picatinny Arsenal, NJ	-	-		-		1.870	Nov 2021	-		1.870	0.000	1.870	-
EPIAFS Modernization Platform/Fire Control Integration Support	MIPR	Combat Capabilities Development Command Armaments Center (DEVCOM AC) : Picatinny Arsenal, NJ	-	-		-		0.100	Nov 2021	-		0.100	0.000	0.100	-
EPIAFS Modernization Cybersecurity Support	MIPR	Combat Capabilities Development	-	-		-		0.100	Nov 2021	-		0.100	0.000	0.100	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army			Date: May 2021
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Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Command Armaments Center (DEVCOM AC) : Picatinny Arsenal, NJ													
		Subtotal	-	-		-		2.670		-		2.670	0.000	2.670	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Excalibur Ib High Pressure Setback Testing	MIPR	Army Test and Evaluation Command (ATEC), Yuma Proving Grounds : Yuma, AZ	-	-		-		0.525	May 2022	-		0.525	0.000	0.525	-
Excalibur Ib Safety Margin and Reliability Testing	MIPR	Army Test and Evaluation Command (ATEC), Yuma Proving Grounds : Yuma, AZ	-	-		-		2.200	Jun 2022	-		2.200	0.000	2.200	-
EPIAFS Modernization Environmental Testing	MIPR	Combat Capabilities Development Command Armaments Center (DEVCOM AC) : Picatinny Arsenal, NJ	-	-		-		0.100	Aug 2022	-		0.100	0.000	0.100	-
EPIAFS Modernization Firing Testing	MIPR	Combat Capabilities Development Command Armaments Center (DEVCOM AC) : Picatinny Arsenal, NJ	-	-		-		0.100	Aug 2022	-		0.100	0.000	0.100	-
		Subtotal	-	-		-		2.925		-		2.925	0.000	2.925	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army			Date: May 2021
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	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		0.000		8.210		-		8.210	0.000	8.210	N/A

Remarks

EPIAFS = Enhanced Portable Inductive Artillery Fuze Setter

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** CP2 / *Precision Fire Technology Improvements*

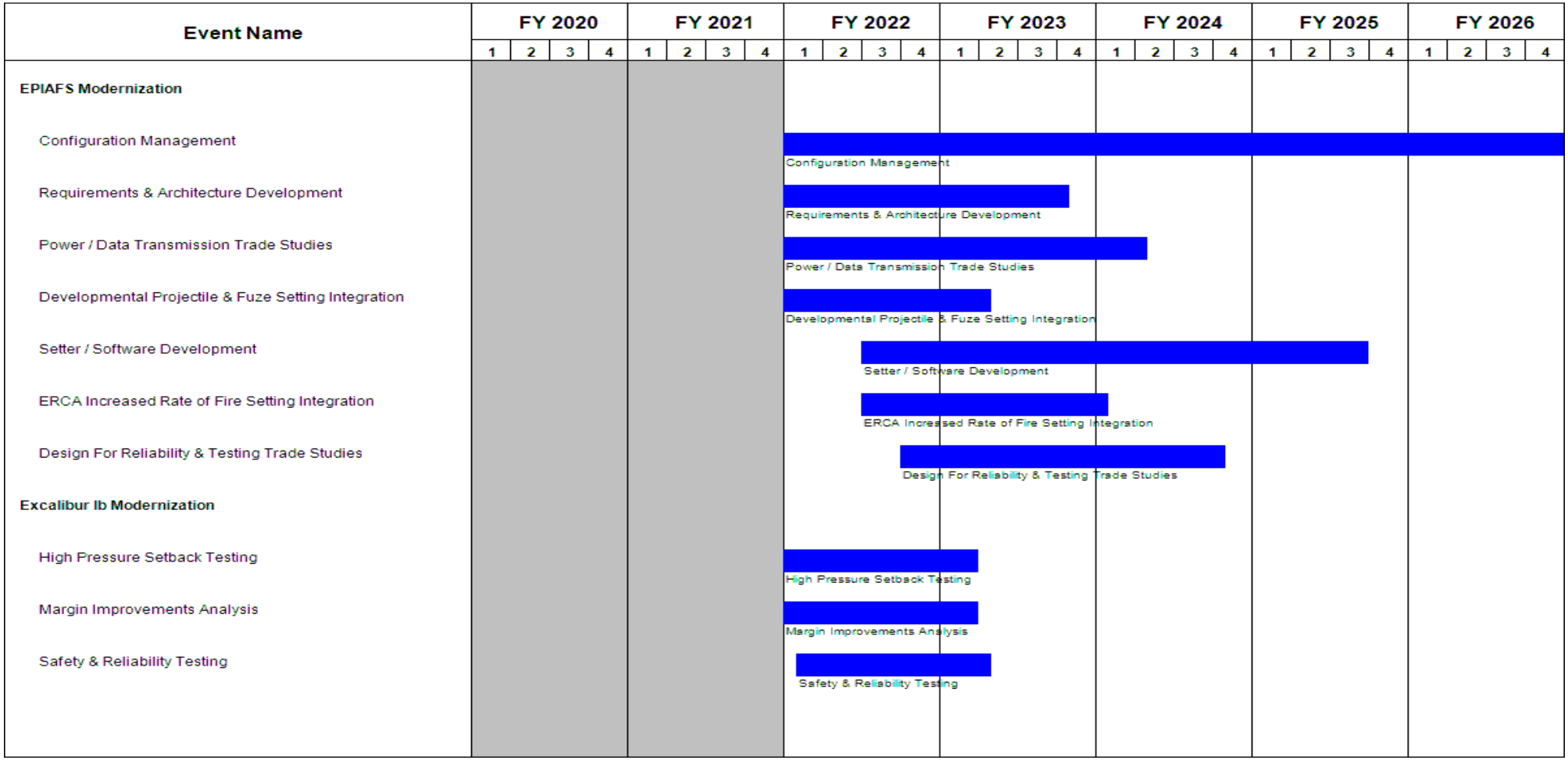

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** CP2 / *Precision Fire Technology Improvements*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
EPIAFS Modernization	1	2022	4	2026
Configuration Management	1	2022	4	2026
Requirements & Architecture Development	1	2022	4	2023
Power / Data Transmission Trade Studies	1	2022	2	2024
Developmental Projectile & Fuze Setting Integration	1	2022	2	2023
Setter / Software Development	3	2022	3	2025
ERCA Increased Rate of Fire Setting Integration	3	2022	1	2024
Design For Reliability & Testing Trade Studies	4	2022	4	2024
Excalibur Ib Modernization	1	2022	4	2022
High Pressure Setback Testing	1	2022	1	2023
Margin Improvements Analysis	1	2022	1	2023
Safety & Reliability Testing	1	2022	2	2023

Note

EPIAFS = Enhanced Portable Inductive Artillery Fuze Setter
ERCA = Extended Range Cannon Artillery

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0607131A / *Weapons and Munitions Product Improvement Programs*	Project (Number/Name) ER2 / *Close Combat Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
ER2: *Close Combat Technology*	-	1.972	6.518	3.468	-	3.468	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project ER2 Close Combat Technology includes development efforts to upgrade Close Combat technologies, energetics, and munitions, such as counter explosives, grenades, demolitions, shoulder launched munitions, pyrotechnic simulators, countermeasure flares, non-lethal ammunition/systems, and networked munitions and mines, that have been fielded or have received approval for full rate production. FY 2022 funding will allow the project to identify, characterize, study, analyze, test and develop technologies to resolve close combat munition reliability, safety, environmental, storage, standardization, obsolescence and manufacturing/producibility issues.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: M67 (G881) Fragmentation Hand Grenade	0.096	3.184	1.334
Description: The M67 Hand Grenade uses the M213 fuze which does not meet Insensitive Munitions (IM) requirements. This effort will evaluate potential foreign fuze candidates as a replacement to the current M213 fuze. This new fuze will be qualified for incorporation into the M67 design and the TDP will be updated.			
FY 2021 Plans: FY 2021 supports the hardware build and initial integration testing efforts for the replacement fuze into the M67 Grenade.			
FY 2022 Plans: FY 2022 will finalize development of the replacement fuze to be integrated into the M67 fragmentation hand grenade and will fund the hardware build to support qualification testing planned for FY 2023.			
FY 2021 to FY 2022 Increase/Decrease Statement: FY 2022 will continue with development and integration testing.			
Title: M330 Obscuration Grenade	0.800	0.950	1.115
Description: This effort supports the Design/Type Classification/Production Prove Out of an improved obscurant grenade that provides the warfighter with screening performance approaching that of the legacy AN-M8 smoke grenade, using a different smoke formulation than the legacy's grenade's Hexachloroethane (HC). The use of HC has been restricted inside and outside the Continental United States (CONUS/OCONUS) due to its toxic effects. The legacy AN-M8 grenade is limited to use in contingency operations only. The M83 training smoke grenade is currently used in lieu of the AN-M8 in both training and tactical operations, but does not give screening performance comparable to the legacy AN-M83. Soldiers must use two or three M8 grenades to produce obscuration effects comparable to a single AN-M8 grenade.			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER2 / *Close Combat Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 2021 Plans: FY 2021 finalizes technical requirements. Redesign internal components and retest final configuration. Complete DVT test plan. Award PBA facilitization production line contract ***FY 2022 Plans:*** FY 2022 will complete grenade specification. Complete Draft Technical Data Package (TDP) and Initial Engineering Change Proposal (ECP). Procure Design Verification Testing (DVT) components. Complete Qualification Plan for product release ECP. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** FY 2021 funding primarily used to support testing. FY 2022 request will primarily support program documentation and procuring hardware for DVT.			
Title: MICLIC Trainer Product Improvement ***Description:*** This effort will develop a replacement for the current M68 Mine Clearing Line Charge (MICLIC) training round which has proven to be expensive and difficult to utilize. The M68 trainer is designed to be fired 3 times but repacking the inert line charge into its ?tub? after a firing event is a manpower intensive and time consuming endeavor, which leads to an ineffective training experience for soldiers. This effort will explore concepts and qualify a solution that provides a realistic training experience for the soldier, reduces the scope of or eliminates the repacking task, and is more cost effective than the current system. ***FY 2022 Plans:*** FY2022 funding supports the analysis of requirements, initial concept development, modeling and simulation and convergence on an initial design to be followed by the development of a prototype design for later procurement and testing. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** FY 2022 funding required to initiate the MICLIC Trainer Product Improvement effort.	-	-	0.550
Title: Volcano Countermeasure Testing ***Description:*** The Family of Scatterable Mines (FASCAM)/Volcano use electronic sensors to detect vehicles and engage them. New foreign and domestic electronic counter-measure systems have been developed which may breach a field at a much higher speed than legacy mechanical breachers. This testing will assess the speed and range of electronic breaching Volcano. The program will also characterize newer electronic munition sensors for their ability to resist these new defeat systems. ***FY 2021 Plans:*** FY 2021 will begin the characterization of newer electronic munition sensors. ***FY 2022 Plans:***	-	0.250	0.269

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER2 / *Close Combat Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 2022 will conduct speed and range testing and characterization of newer electronic munition sensors. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Volcano Countermeasure testing is a new start for FY 2022 and will support testing and characterization efforts.			
Title: M18 Smoke Grenade Dye ***Description:*** Smoke Grenade Dyes are a key component of the M18 Color Smoke Hand Grenades (Green, Yellow, Red, Violet) and are among items at risk for future production. The anthraquinone-based intermediates necessary for dye production are foreign-sourced (non-NTIB). No alternative dye formulation has successfully been identified to date. This represents a single point failure for the Army. This effort seeks to prove out a pilot-scale process to synthesize the necessary intermediates that could lead to a producer within the NTIB. ***FY 2021 Plans:*** FY 2021 supports a Feasibility Demonstration for the red and violet dyes. This will be followed by Government testing of the dyes and a decision about whether to proceed with the remainder of the effort. ***FY 2022 Plans:*** FY 2022 will support the completion of government testing ahead of a planned production system. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** FY 2022 funding is required to complete testing efforts.	-	0.250	0.200
Title: M111 Offensive Hand Grenade - Alternative Explosive Fill ***Description:*** This effort will qualify an alternative explosive fill for the M111 Offensive Hand Grenade, which replaces the MK3A2 Offensive Hand Grenade. The alternate fill will mitigate availability risk of the current M111 fill, PAX-3, which is a single point failure within the production of the M111 Offensive Hand Grenade. ***FY 2021 Plans:*** Conduct qualification testing of prototypes to determine safety, viability, and effectiveness of an alternative explosive fill, which can be incorporated into the M111 design. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** No budget request in FY 2022. The M111 alternate fill qualification effort will conclude in FY 2021, and can be incorporated into follow on production.	0.760	1.339	-
Title: M82 Simulant Smoke Practice Grenade	0.316	0.545	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Description: This effort is to address performance issues with the current M82 design. This modification includes design improvements, which will be validated through testing. Technical Data Package (TDP) will be updated to implement changes. ***FY 2021 Plans:*** FY 2021 supports prototype grenades testing, data analysis, and final Technical Data Package (TDP) updates to be incorporated into M82 production. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** No budget request in FY 2022. The M82 development effort will conclude in FY 2021 and will be incorporated into follow on production.			
Accomplishments/Planned Programs Subtotals	1.972	6.518	3.468

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• E33010: *GRENADE, HAND OFFENSIVE, M111*	-	5.694	11.218	-	11.218	-	-	-	-	-	-
• E32000: *GRENADE, Hand, Frag, Delay, M67*	5.058	3.536	3.358	-	3.358	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

The strategy for the legacy M67 Fragmentation Hand Grenade is to acquire and test an Insensitive Munitions (IM) complaint M213 fuze replacement to be incorporated into the M67 offensive hand grenade. The new design will be qualified in order to mitigate the insensitive munition hazards associated with the explosive fill and the fuze technology. Follow-on procurement efforts will be competitive pending market research.

The strategy for the M330 is to qualify an alternative fill due to obsolescence and manufacturability driven changes required to provide smoke for use by Soldiers to meet existing validated requirements. Once the smoke fill is qualified, the plan is to conduct qualification testing, implement final design into technical data package, and prepare for production.

The strategy for the M68 MICLIC Trainer Improvement effort is to identify or design a trainer concept, leverage modeling and simulation, and build prototypes to be used for qualification testing ahead of a production decision.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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The strategy for Volcano characterization is to test the speed and range of current Volcano electronic sensors using government testing facilities to inform future countermeasure development.

The strategy for the M18 Smoke Grenade is to utilize an Other Transaction Authority (OTA) contract to demonstrate a novel method of colored smoke dye production.

The strategy for the M111 is to qualify an alternate explosive fill for the M111 Offensive Hand Grenade, which replaces the MK3A2 Offensive Hand Grenade. The alternate fill solution mitigates availability risk of PAX-3, which is a single point failure within the production of the M111 Offensive Hand Grenade. The alternate fill, once qualified, will be implemented into the Grenade Consolidation Contract via an Engineering Change Proposal (ECP).

The M82 program is updating the design of specific parts to make it more producible and will be proving out the design for use in future production efforts.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army			Date: May 2021
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
M67 (G881) Fragmentation Hand Grenade	MIPR	DEVCOM Armaments Center : Picatinny Arsenal, NJ	-	-		0.959	May 2021	0.596	Oct 2021	-		0.596	Continuing	Continuing	-
M330 Enhanced Obscuration Grenade Hardware	MIPR	Pine Bluff Arsenal : White Hall, AR	-	0.190	Jan 2021	-		0.040	Jan 2022	-		0.040	0.000	0.230	-
M18 Smoke Grenade	C/FFP	TBD : TBD	-	-		0.170	Apr 2021	-		-		-	0.000	0.170	-
M111, Offensive Hand Grenade	C/FFP	Battelle Memorial Institute : Columbus, OH	0.873	0.262	Mar 2020	-		-		-		-	0.000	1.135	-
M67 Fragmentation Grenade	C/FFP	Battelle Memorial Institute : Columbus, OH	0.251	0.096	Jul 2020	-		-		-		-	0.000	0.347	-
M82 Simulant Smoke Practice Grenade	MIPR	Pine Bluff Arsenal : White Hall, AR	-	0.316	Jul 2020	-		-		-		-	0.000	0.316	-
M330 Enhanced Obscuration Grenade	MIPR	DEVCOM Armaments Center : Picatinny Arsenal, NJ	0.265	-		-		-		-		-	0.000	0.265	-
		Subtotal	1.389	0.864		1.129		0.636		-		0.636	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
M67 (G881) Fragmentation Hand Grenade	MIPR	DEVCOM Armaments Center : Picatinny Arsenal, NJ	-	-		0.725	Feb 2021	0.738	Oct 2021	-		0.738	Continuing	Continuing	-
M330 Enhanced Obscuration Grenade	MIPR	DEVCOM Armaments Center : Picatinny Arsenal, NJ	0.265	0.129	Nov 2020	0.598	Nov 2020	0.736	Nov 2021	-		0.736	Continuing	Continuing	-
M330 Enhanced Obscuration Grenade	MIPR	DEVCOM Chemical Biological Center : Edgewood, MD	0.890	0.481	Nov 2020	-		0.339	Jan 2022	-		0.339	0.850	2.560	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army			Date: May 2021
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Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
M68 MICLIC Trainer	TBD	DEVCOM Armaments Center : Picatinny Arsenal, NJ	-	-		-		0.300	Oct 2021	-		0.300	0.000	0.300	-
M111, Offensive Hand Grenade	MIPR	DEVCOM Armaments Center : Picatinny Arsenal, NJ	3.220	0.418	Jan 2020	0.389	Mar 2021	-		-		-	0.182	4.209	-
M111, Offensive Hand Grenade	MIPR	Letterkenny Army Depot : Chambersburg, PA	0.038	0.001	Mar 2020	-		-		-		-	0.000	0.039	-
M111, Offensive Hand Grenade Demil	MIPR	Tooele Army Depot : Tooele, UT	-	0.070	Mar 2020	-		-		-		-	0.000	0.070	-
M111, Offensive Hand Grenade Shipping	Allot	Shipping : Picatinny Arsenal, NJ	-	0.009	Jan 2020	-		-		-		-	0.000	0.009	-
M82 Simulant Smoke Practice Grenade	MIPR	DEVCOM Armaments Center : Picatinny Arsenal. NJ	0.265	-		-		-		-		-	0.000	0.265	-
M82 Simulant Smoke Practice Grenade	MIPR	DEVCOM Chemical Biological Center : Edgewood, MD	0.095	-		-		-		-		-	0.000	0.095	-
		Subtotal	4.773	1.108		1.712		2.113		-		2.113	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Volcano Countermeasure Testing	MIPR	DEVCOM Armaments Center : Picatinny Arsenal, NJ	-	-		0.250	Dec 2020	0.269	Jan 2022	-		0.269	0.000	0.519	-
M18 Prototype Testing	MIPR	Pine Bluff Arsenal : White Hall, AR	-	-		0.075	Aug 2021	0.200	Oct 2021	-		0.200	0.000	0.275	-
M68 MICLIC Modeling and Simulation	MIPR	Various : Various	-	-		-		0.250	Mar 2022	-		0.250	0.000	0.250	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army			Date: May 2021
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Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
M67 Testing	MIPR	DEVCOM Armaments Center : Picatinny Arsenal, NJ	-	-		1.500	Aug 2021	-		-		-	0.000	1.500	-
M111, Offensive Hand Grenade	MIPR	Redstone Test Center : Redstone Arsenal, AL	0.037	-		0.334	May 2021	-		-		-	0.000	0.371	-
M111, Offensive Hand Grenade	MIPR	Yuma Test Center : Yuma Proving Grounds, AZ	-	-		0.373	May 2021	-		-		-	0.000	0.373	-
M111, Offensive Hand Grenade	MIPR	Aberdeen Test Center : Aberdeen Proving Grounds, NJ	0.351	-		0.600	May 2021	-		-		-	0.000	0.951	-
M82 Simulant Smoke Practice Grenade	MIPR	Pine Bluff Arsenal : Pine Bluff Arsenal, Arkansas	0.495	-		0.545	Nov 2020	-		-		-	0.000	1.040	-
		Subtotal	0.883	-		3.677		0.719		-		0.719	0.000	5.279	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	7.045	1.972		6.518		3.468		-		3.468	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Army		Date: May 2021
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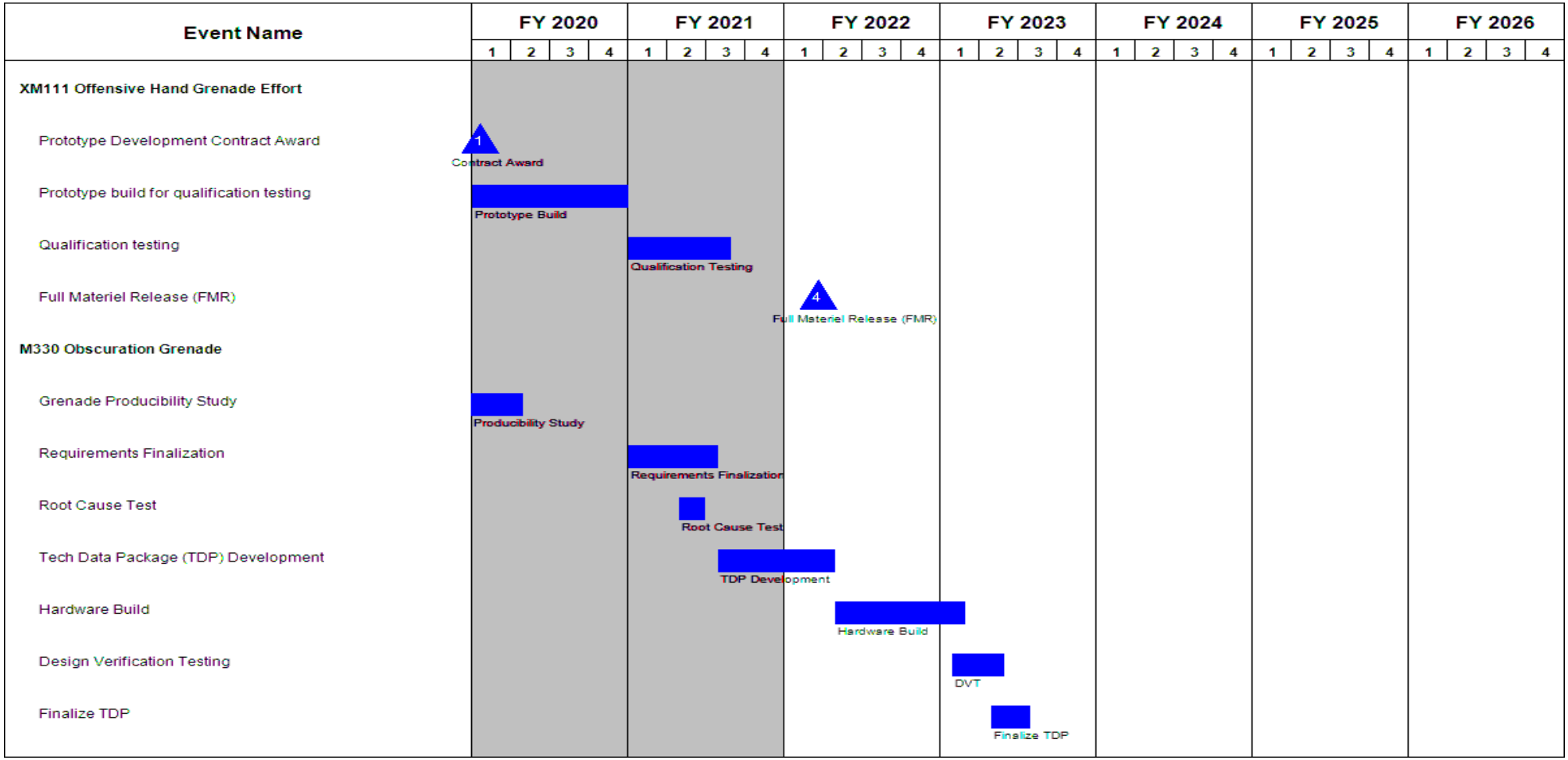

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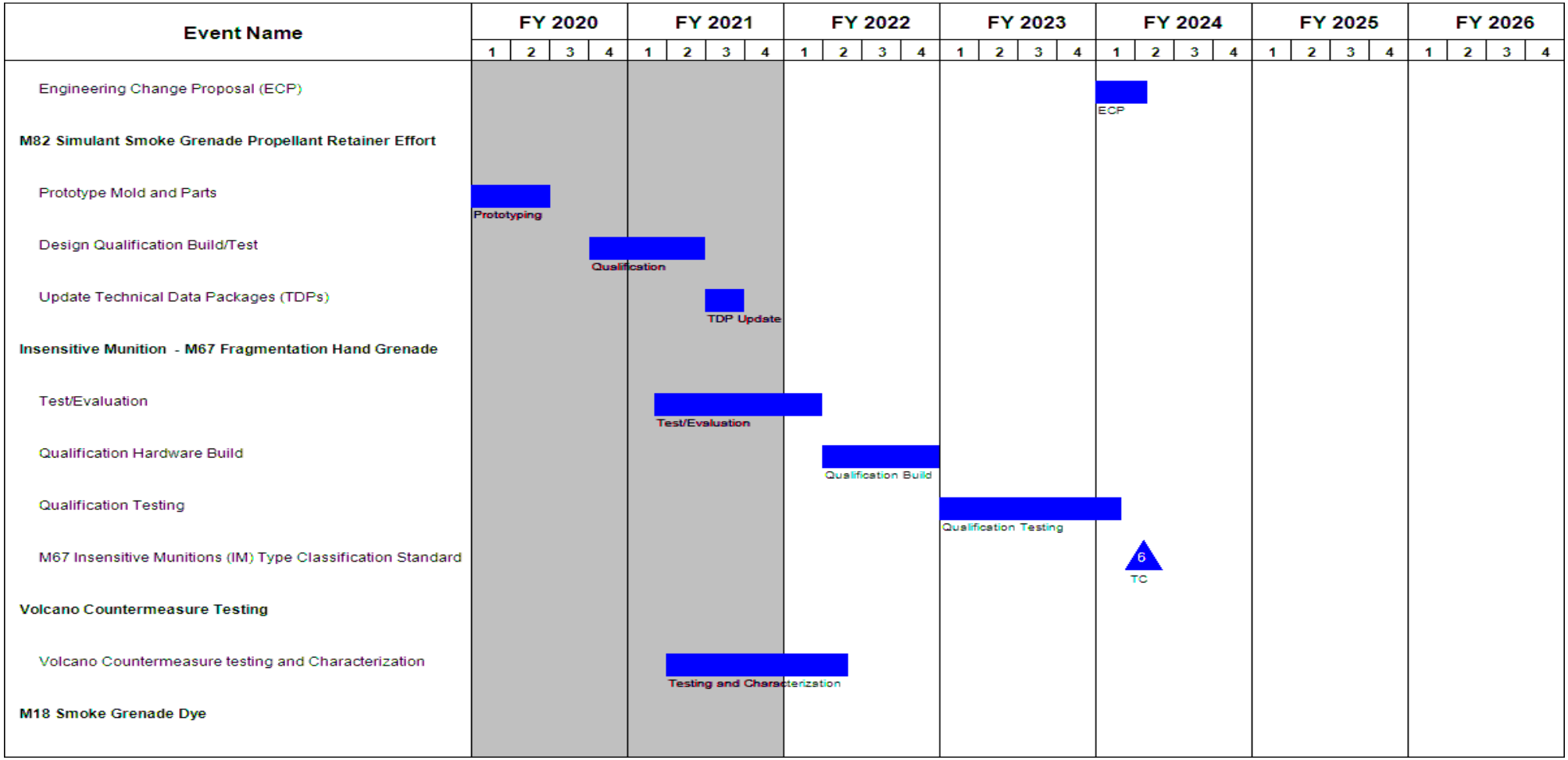

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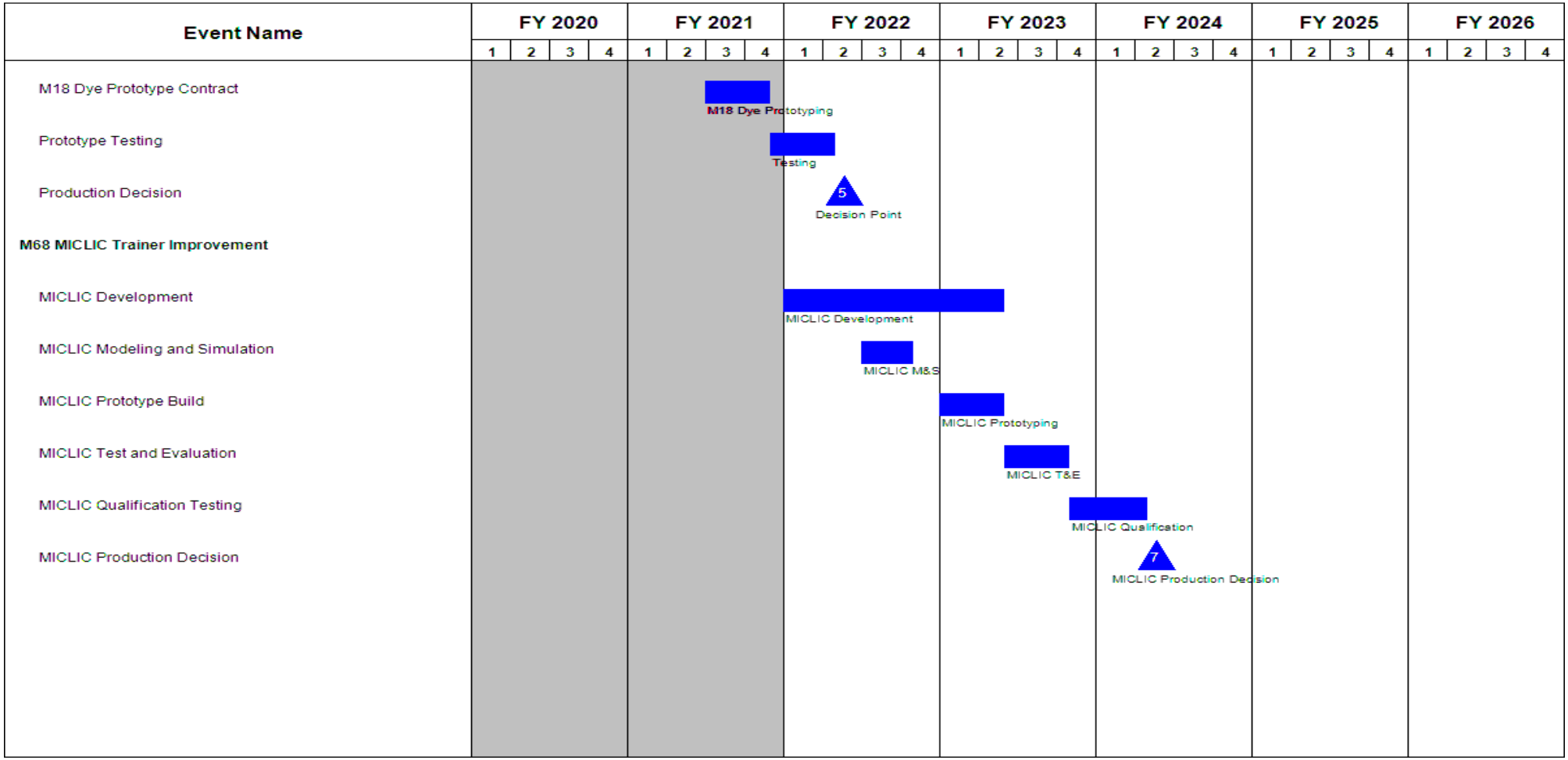

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Army		Date: May 2021
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Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
XM111 Offensive Hand Grenade Effort	1	2017	4	2020
Testing Insensitive Munitions (IM), E3	3	2018	1	2019
Limited User Assessment (LUA)	4	2018	1	2019
Type Classification (TC) Documentation	2	2018	3	2019
Type Classification	4	2019	4	2019
Prototype Development Contract Award	1	2020	1	2020
Prototype build for qualification testing	1	2020	4	2020
Qualification testing	1	2021	3	2021
Full Materiel Release (FMR)	1	2022	1	2022
M330 Obscuration Grenade	1	2017	4	2020
Hexachloroethane Titanium Oxide (HX) Toxicity Study	1	2017	1	2019
AN-M8A1 Ecological Study	4	2018	1	2019
Starter Cup Development	2	2018	3	2019
Technical Data Package (TDP) Scrub	1	2019	1	2019
Fuze Assessment	2	2019	3	2019
Trade Analysis & Requirements. Validation	2	2019	4	2019
Grenade Producibility Study	2	2019	1	2020
Requirements Finalization	1	2021	3	2021
Root Cause Test	2	2021	2	2021
Tech Data Package (TDP) Development	3	2021	2	2022
Hardware Build	2	2022	1	2023
Design Verification Testing	1	2023	2	2023

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Army		Date: May 2021
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	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Finalize TDP	2	2023	3	2023
Engineering Change Proposal (ECP)	1	2024	2	2024
M82 Simulant Smoke Grenade Propellant Retainer Effort	1	2017	4	2020
Propellant Retainer Development	1	2019	2	2019
Prototype Mold and Parts	2	2019	2	2020
Design Qualification Build/Test	4	2020	2	2021
Update Technical Data Packages (TDPs)	3	2021	3	2021
Insensitive Munition - M67 Fragmentation Hand Grenade	1	2021	4	2027
Test/Evaluation	1	2021	1	2022
Qualification Hardware Build	2	2022	4	2022
Qualification Testing	1	2023	1	2024
M67 Insensitive Munitions (IM) Type Classification Standard	2	2024	2	2024
Volcano Countermeasure Testing	1	2022	1	2022
Volcano Countermeasure testing and Characterization	2	2021	2	2022
M18 Smoke Grenade Dye	1	2021	1	2023
M18 Dye Prototype Contract	3	2021	4	2021
Prototype Testing	4	2021	2	2022
Production Decision	2	2022	2	2022
M68 MICLIC Trainer Improvement	1	2022	1	2022
MICLIC Development	1	2022	2	2023
MICLIC Modeling and Simulation	3	2022	4	2022
MICLIC Prototype Build	1	2023	2	2023
MICLIC Test and Evaluation	2	2023	4	2023
MICLIC Qualification Testing	4	2023	2	2024
MICLIC Production Decision	2	2024	2	2024

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0607131A / *Weapons and Munitions Product Improvement Programs*	Project (Number/Name) ER5 / *Indirect Fire and Fuze Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
ER5: *Indirect Fire and Fuze Technology*	-	4.076	4.712	4.463	-	4.463	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project supports the identification, study, analysis, and integration of in production and fielded fuzing technologies and safe arm devices. The Project implements new technologies into fuzing systems to preclude obsolescence, maximize standardization, enhance performance, and improve the safety and exportability of existing munitions. The Project addresses two major areas: (1) analysis and (2) block upgrades. Analysis efforts will identify second sources for fuzing systems that may reduce costs as a result of competition, and maintain production when sources or parts are no longer available. It will also allow for the performance enhancement of current ammunition items by conducting studies of major fuze components to detect, identify, and, if possible, correct latent defects. Block upgrades will identify and support studies on fuze improvements, implement fuze technology enhancements, and increase commonality of fuze components and requirements. Upgrades will enable the introduction of the latest technologies into fuzing, keep the fuze design current to avoid obsolescence issues, and add capabilities. Fiscal Year (FY) 2022 funding will support the transition and incorporation of Engineering Change Proposals (ECPs) to production fuze's Technical Data Packages (TDPs) for the next generation mortar proximity fuze microcontroller implementing portable software; an improved hand grenade fuze body to increase producibility and safety; and an enhanced M739A1 impact delay module upgrade to increase safety and performance. The FY2022 funding will complete a long range precision fires artillery fuze compatibility study to determine compatibility with production fuzes. The FY 2022 funding will conduct analysis on mortar training fuzes for ballistic flight performance improvements; conduct analysis on production fuze TDPs to preclude potential single point and critical suppliers issues; investigate improved proximity fuze radar transceivers for proximity mortar fuzes to increase performance and survivability; integrate extended range precision artillery fuzing power sources prototypes to support extended flight durations; and implement hand grenade safety improvements integrating electronic and energetic technologies that will also improve insensitive munition capability.

This Project also supports indirect fire artillery ammunition and mortar ammunition developmental product improvement initiatives to increase range, lethality, effectiveness, survivability and accuracy that will be incorporated into production via ECP. FY 2022 funding will support the continued studies and analysis (Key Parameter Development and Management (KPDM) and Model Based Systems Engineering (MBSE)).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Fuze Technology Integration (FTI)	2.612	2.263	2.321
Description: This project implements new and mature technologies into fuzing systems to preclude obsolescence, maximize standardization, enhance performance, and improve the safety and exportability of existing munitions. The FTI project addresses two major areas: (1) analysis/risk mitigation and (2) block upgrades. Analysis efforts will identify second sources for fuzing systems that may reduce costs by providing competition and maintain production when sources or parts are no longer available. It will also allow for the performance enhancement of current ammunition items by conducting studies of major fuze components to detect, identify, and correct latent defects. The second major area is block upgrades, which will identify and perform studies on			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
improvements to fuzes, increase commonality of fuze components and requirements. Block upgrades will enable the introduction of the latest technologies into fuzing, keep the fuzing design current to avoid obsolescence issues and add capabilities. ***FY 2021 Plans:*** Analysis / Risk Mitigation: Will conduct engineering tests on the next generation micro-controller to modernize and replace a one-time programmable component for mortar proximity fuzes, will transition prototype replacement electronic transceivers into indirect fire fuzes and generate Engineering Change Proposals (ECPs) to incorporate into the Technical Data Packages (TDPs). Will also conduct analysis on alternative suppliers for critical fuzing components. Block Upgrades: Will conduct engineering tests of enhanced fuze delay mode designs on the M739A1 Point Detonation (PD) fuze for increased safety and improved performance, will conduct laboratory evaluations on the hand grenade fuzes to reduce the number of critical defects that will improve producibility and increase safety, will conduct studies of airburst fuzing technologies for medium and large caliber munitions, and will conduct analysis and laboratory evaluations on mortar training fuzes for increased safety and improved performance. ***FY 2022 Plans:*** Analysis/Risk Mitigation: Will conduct engineering tests on the next generation micro-controller to modernize and replace a one-time programmable component for mortar proximity fuzes; will conduct analysis and laboratory evaluations on mortar training fuzes for increased safety and improved performance; will conduct analysis on conventional artillery fuzes for compatibility with Long Range Precision Fires (LRPF) munitions and requirements; will conduct analysis on alternative suppliers for critical fuzing components. Block Upgrades: Will conduct engineering tests of enhanced fuze delay mode designs on the M739A1 Point Detonation (PD) fuze for increased safety and improved performance; will conduct laboratory evaluations on the hand grenade fuzes to reduce the number of critical defects that will improve producibility and increase safety; investigate proximity fuze alternative transceivers for proximity mortar fuzes to increase capability, performance, and survivability; hand grenade safety improvements integrating electronic and energetic technologies that will also improve insensitive munition capability; integrate extended range precision artillery fuzing power sources prototypes to support extended flight durations. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Increase in funding in FY 2022 due to additional Fuze Technology Integration projects that have been identified for execution.			
Title: Ammunition Range and Reliability Improvements ***Description:*** This Project explores possibilities of increasing range, enhancing reliability, and increasing performance of Artillery and Mortar ammunition. This effort supports analysis efforts to identify improvement areas to key parameters.	0.300	2.373	2.142

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 2021 Plans: FY 2021 funding supports the studies and analysis (Key Parameter Development and Management (KPDM) and Model Based Systems Engineering (MBSE)). ***FY 2022 Plans:*** FY 2022 funding will support the continued studies and analysis (Key Parameter Development and Management (KPDM) and Model Based Systems Engineering (MBSE)). ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Increase in funding in FY 2022 required for enhancement studies and analysis on Artillery and Mortar ammunition. Studies and analysis conducted will aim to increase performance.			
Title: Mortar Smoke Development ***Description:*** This Project supports the incorporation of the new Hexachloroethane Zinc Oxide (HC) smoke fill formulation while utilizing the existing illumination shell body configuration to support mortar smoke training for US Army Europe (USAREUR). The HC smoke fill formulation is less toxic and less incendiary than the current Mortar Red Phosphorus (RP) or White Phosphorous (WP) Smoke rounds and will reduce risk of unintended collateral damage or environmentally hazardous waste. USAREUR has yearly requirements for procurement of smoke mortar cartridges across all calibers to be used for training, but is prohibited from training with the current WP or RP smoke munitions in Europe due to environmental restrictions. This effort does not have an FY 2022 budget request. ***FY 2021 Plans:*** FY 2021 funding supports the completion of 120mm mortar ammunition HC smoke fill formulation development activities. Engineering efforts are focused on development of a smoke canister design that will promote effective smoke production and screening while being adapted to existing mortar cartridge carrier designs. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Decrease in funding in FY 2022 due to the completion of 120mm smoke mortar development activities.	1.164	0.076	-
Accomplishments/Planned Programs Subtotals	4.076	4.712	4.463

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
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D. Acquisition Strategy

Fuze Technology Integration (FTI) will improve current production munitions by exploiting existing fuzing technologies and inserting them into current fielded and/or production fuzes, providing safer, more producible, and more lethal fuzing solutions. FTI develops second source suppliers and resolves component obsolescence issues to mitigate risk and prevent production interruptions in order to continue to provide safer, more reliable munitions for the Warfighter with significant risk reduction to production fuzes also benefiting the U.S. Taxpayer. The effort is a continuation of studies, analysis, evaluations, and insertion of fuzing technologies and safe and arm devices in production and fielded fuzes. This program will implement these technologies into fuzing systems to preclude component obsolescence, maximize standardization, enhance performance, and improve the safety, reliability, and exportability of existing munitions. FTI utilizes both the DoD Ordnance Technology Consortium (DOTC) Other Transaction Agreement (OTA) to produce prototypes of the fuze technologies and devices, and Federal Acquisition Regulation (FAR) based contracts to implement proven efforts into production fuzes.

The Ammunition Range and Reliability Improvements effort is utilizing incrementally funded product improvement development contracts. Upon completion, efforts will transition to production as Engineering Change Proposals (ECPs) to be integrated into existing production contracts.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army			Date: May 2021
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Fuze Technology Integration Development	MIPR	DoD Ordnance Technology Consortium (DOTC) : Various	3.459	1.768	Oct 2019	1.350	Oct 2020	1.350	Nov 2021	-		1.350	0.000	7.927	-
Ammunition Range and Lethality Improvements	MIPR	TBD : TBD	-	-		1.871	Mar 2021	1.720	Dec 2021	-		1.720	0.000	3.591	-
Mortar Smoke Development	MIPR	Government Owned Government Operated (GOGO) Facilities : Various	0.357	0.347	Mar 2020	-		-		-		-	0.000	0.704	-
		Subtotal	3.816	2.115		3.221		3.070		-		3.070	0.000	12.222	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Fuze Technology Integration Engineering Support	MIPR	Combat Capabilities Development Command Armaments Center (DEVCOM AC) : Picatinny Arsenal, NJ	3.283	0.844	Oct 2019	0.913	Oct 2020	0.921	Nov 2021	-		0.921	0.000	5.961	-
Ammunition Range and Lethality Improvements	MIPR	Combat Capabilities Development Command Armaments Center (DEVCOM AC) : Picatinny Arsenal, NJ	-	0.300	Mar 2020	0.502	Mar 2021	0.422	Dec 2021	-		0.422	0.000	1.224	-
Mortar Smoke Development Engineering Support	MIPR	Combat Capabilities Development Command Armaments Center (DEVCOM AC) : Picatinny Arsenal, NJ	0.553	0.566	Feb 2020	0.076	Nov 2020	-		-		-	0.000	1.195	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army			Date: May 2021
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Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Mortar Smoke Development Engineering Support	MIPR	Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) : Army Research Laboratory, MD	0.212	0.170	Feb 2020	-		-		-		-	0.000	0.382	-
		Subtotal	4.048	1.880		1.491		1.343		-		1.343	0.000	8.762	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Fuze Technology Integration Ballistic Testing	MIPR	Army Test and Evaluation Command (ATEC) : Yuma Proving Ground, AZ	0.100	-		-		0.050	Mar 2022	-		0.050	0.000	0.150	-
Mortar Smoke Testing	MIPR	Army Test and Evaluation Command (ATEC) : Yuma Proving Ground, AZ	0.199	0.081	Sep 2020	-		-		-		-	0.000	0.280	-
		Subtotal	0.299	0.081		-		0.050		-		0.050	0.000	0.430	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	8.163	4.076		4.712		4.463		-		4.463	0.000	21.414	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Army		Date: May 2021
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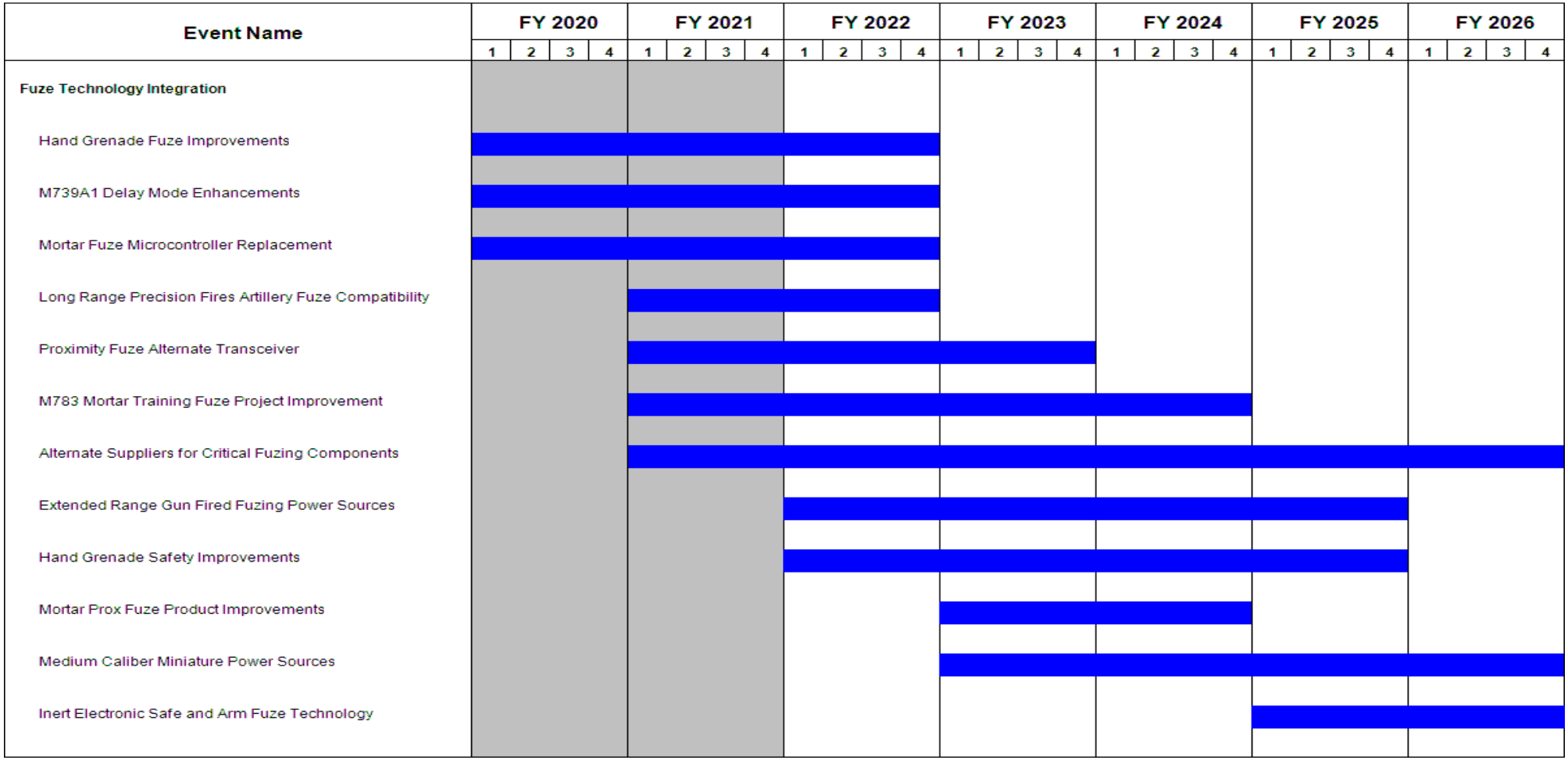

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Army		Date: May 2021
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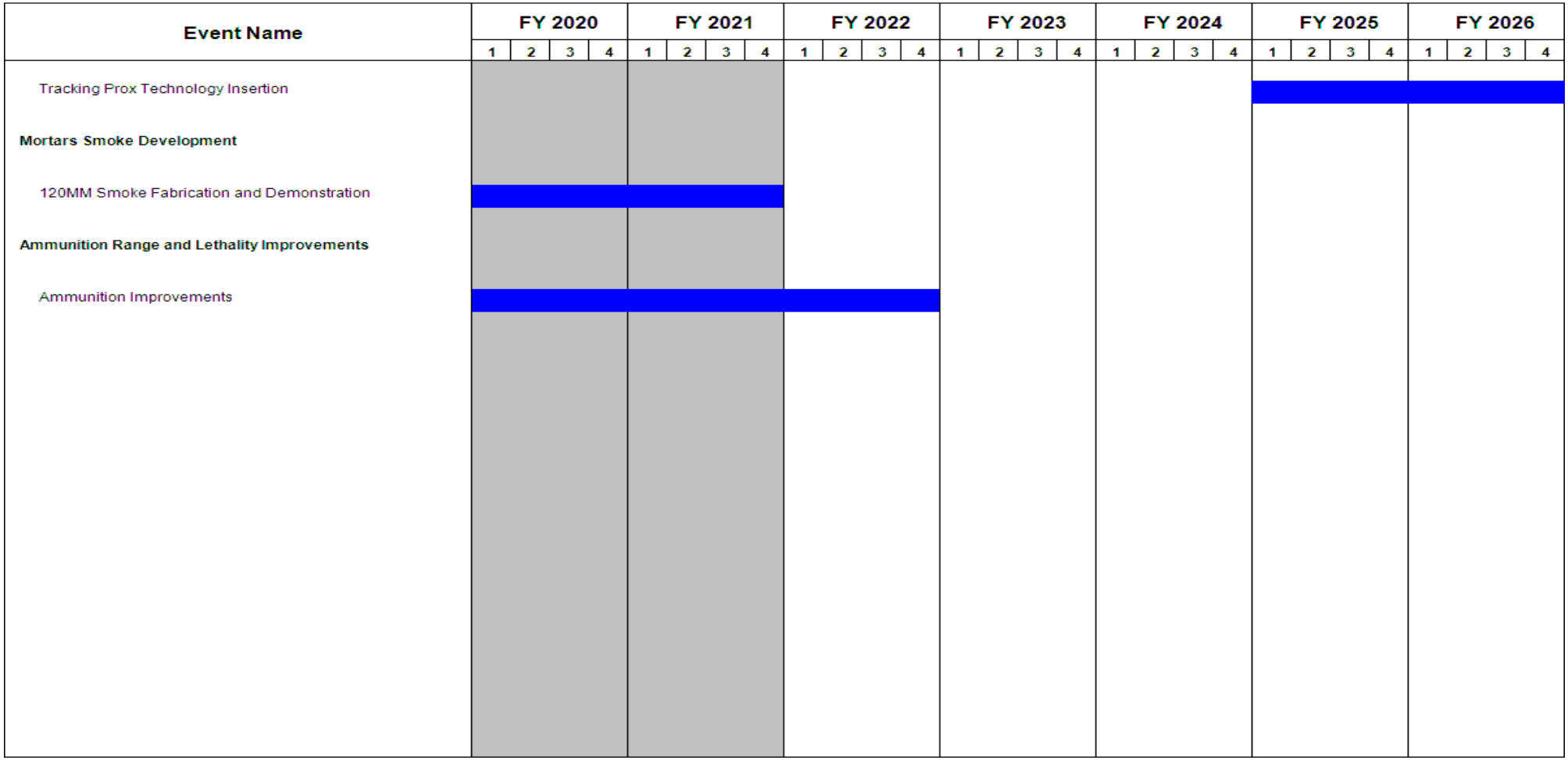

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER5 / *Indirect Fire and Fuze Technology*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Fuze Technology Integration	1	2016	4	2027
Hand Grenade Fuze Improvements	1	2016	4	2022
M739A1 Delay Mode Enhancements	1	2019	4	2022
Mortar Fuze Microcontroller Replacement	1	2020	4	2022
Long Range Precision Fires Artillery Fuze Compatibility	1	2021	4	2022
Proximity Fuze Alternate Transceiver	1	2021	4	2023
M783 Mortar Training Fuze Project Improvement	1	2021	4	2024
Alternate Suppliers for Critical Fuzing Components	1	2021	4	2026
Extended Range Gun Fired Fuzing Power Sources	1	2022	4	2025
Hand Grenade Safety Improvements	1	2022	4	2025
Mortar Prox Fuze Product Improvements	1	2023	4	2024
Medium Caliber Miniature Power Sources	1	2023	4	2026
Inert Electronic Safe and Arm Fuze Technology	1	2025	4	2027
Tracking Prox Technology Insertion	1	2025	4	2027
Mortars Smoke Development	1	2020	4	2021
120MM Smoke Fabrication and Demonstration	1	2019	4	2021
Ammunition Range and Lethality Improvements	1	2020	4	2022
Ammunition Improvements	1	2020	4	2022

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0607131A / *Weapons and Munitions Product Improvement Programs*	Project (Number/Name) ER6 / *Direct Fire Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
ER6: *Direct Fire Technology*	-	8.174	8.436	6.687	-	6.687	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Direct Fire Technology funding will be used to support direct fire ammunition from small caliber ammunition, medium caliber ammunition and large caliber ammunition enhancements to lethality, effectiveness, survivability, accuracy and general product improvements. Fiscal Year (FY) 2022 funds support a number of small caliber ammunition projects including improvements to training ammunition; improvements to make small caliber primers more environmentally friendly; optimization of handgun ammunition; exploring precision sniper improvements and continuing the effort to reduce Soldier load by developing lightweight ammunition. Improvements to medium caliber ammunition include lethality and safety enhancements on 40mm ammunition. Improvements to 105mm and 120mm tank ammunition include examination and implementation of performance enhancement and improvements to tracer, combustible cartridge case and 105mm Advanced Multipurpose (AMP).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Small Caliber Ammunition Product Improvements	5.612	5.558	4.451
Description: Develop, demonstrate, and qualify improvements for 5.56mm, 7.62mm, .50 cal, Next Generation Squad Weapon ammunition, Precision Sniper ammunition and Handgun ammunition to achieve an increase in overall lethality and effectiveness.			
FY 2021 Plans: FY 2021 funding supports Phase III development contract to build lightweight 7.62mm ammunition (that will provide an ammunition weight savings of ten to fifty percent to the M240 gunner, assistant gunner, and ammo bearer), performing Validation Testing, conducting and Limited User Evaluation (LUE), and accomplishing the Engineering Change Proposal (ECP) in preparation for Low-Rate Initial Production (LRIP). FY 2021 also supports Phase I development efforts for the lightweight .50 Caliber ammunition (that will provide an ammunition weight savings of ten to fifty percent to the M2 gunner, assistant gunner, and ammo bearer) variant, performing Validation Testing, conducting a Limited User Evaluation, and conducting a Critical Design Review (CDR). FY 2021 funding supports the prove out of the prototype manufacturing to automate line (to reduce human exposure and reduce environmental waste) and integrate environmentally friendly lead free primers (new composition to address lead health concerns) for multiple small caliber ammunition variants and performing Pre Production Qualification Testing (PPQT) activities for the 5.56mm/7.62mm ammunition. Commercial primer testing will also be done to determine extreme temperature sensitivity and overall reliability. FY 2021 supports M118LRA1 development, refinement, and improvement of performance manufacturability, and test and evaluation though the employment of advanced simulations and experiments techniques (aerodynamic, propulsion, terminal, and structural) across the entire ballistic range.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER6 / *Direct Fire Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 2022 will support Phase II development efforts for the lightweight case .50 Caliber ammunition variant, award Phase II down-select contract, prepare fielding documents, conduct a Critical Design Review (CDR). FY 2022 will support Phase III down-select to one concept for lightweight case 7.62mm ammunition variant and also conducting aging studies, obtaining safety release confirmation, conducting limited user evaluation, verification testing and preparing documents for engineering change proposal (ECP) in FY 2023. FY 2022 will support purchasing prototype equipment for the green primer pilot-line and pre-production qualification testing (PPQT) for 7.62mm green primer. FY 2022 will support improved dispersion and lethality for precision sniper ammunition particularly M1158. FY 2022 will support optimization and qualification testing to field handgun improvements such as Enhanced Ball Round (EBR) and Breeching capability. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** All Small Caliber Ammunition improvements are now incorporated into this funding line.			
Title: Medium Caliber Ammunition Product Improvements ***Description:*** Develop, demonstrate, and qualify improvements for 20mm, 25mm, 30mm, and 40mm ammunition. 40mm M433E1 will improve lethality (fragmentation) of the M433 grenade. The 40mm M550 fuze replacement will replace the single stage fuze with a dual spinlock fuze to improve safety and performance reliability. Improve safety, performance and reliability issues on the 20mm M940 ammunition. ***FY 2021 Plans:*** FY 2021 the Government will complete the M433E1 Pre Production Qualification Test (PPQT) to assess safety and performance increases and support the Type Classification documentation. FY 2021 the Government will investigate 20mm ammunition safety, performance and reliability issues to achieve an increase in overall lethality and effectiveness including analysis of the self-destruct feature. Testing on the 20mm M940 conversion from metal to plastic rotating band technology to reduce barrel wear on the M61 gun. ***FY 2022 Plans:*** FY 2022 supports finalizing type classification, full materiel release, and the technical data package for M433E1 and M550 fuze improvement. FY 2022 the Government will investigate 20mm ammunition safety, performance and reliability issues to achieve an increase in overall lethality and effectiveness including analysis of the self-destruct feature. Testing on the 20mm M940 conversion from metal to plastic rotating band technology to reduce barrel wear on the M61 gun. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** All Medium Caliber Ammunition product improvements are now incorporated into this funding line.	0.681	1.495	1.033
Title: Tank Ammunition Product Improvements ***Description:*** Develop and test potential improvements to 105mm and 120mm gun system ammunition.	1.881	1.383	1.203

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER6 / *Direct Fire Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
FY 2021 Plans: FY 2021 funding will support continuing various 105mm and 120mm tank ammunition improvement efforts, including tracer improvements, combustible cartridge case design and fabrication improvements, and continuing efforts to assess the 105mm Advanced Multipurpose (AMP) cartridge/solution. Evaluate 105mm candidate cartridges, perform warhead lethality studies, modeling and simulation, conduct fuze assessment studies, perform propulsion system evaluation, assess fabrication improvements, and perform integration and testing of tank cartridges. ***FY 2022 Plans:*** FY 2022 funding supports continuing various 105mm and 120mm tank ammunition improvement efforts, including tracer improvements, combustible cartridge case design and fabrication improvements, and continuing efforts to assess the 105mm Advanced Multipurpose (AMP) cartridge/solution. Evaluate 105mm candidate cartridges, perform warhead lethality studies, modeling and simulation, conduct fuze assessment studies, perform propulsion system evaluation, assess fabrication improvements, and perform integration and testing of tank cartridges. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** All Tank Ammunition improvements are now incorporated into this funding line.			
Accomplishments/Planned Programs Subtotals	8.174	8.436	6.687

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The acquisition strategy for small, medium and large caliber product improvements is that all contracts will be full and open competition.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0607131A / *Weapons and Munitions Product Improvement Programs*	Project (Number/Name) ER6 / *Direct Fire Technology*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
M433 Warhead Improvement - Contract 1	Option/ FFP	AMTEC Corporation : Janesville, WI	-	0.232	Jun 2020	-		-		-		-	0.000	0.232	-
Lightweight Case Ammunition - Contract 1	C/FFP	To Be Determined : To Be Determined	-	-		1.500	Aug 2021	1.540	Mar 2022	-		1.540	Continuing	Continuing	Continuing
Lightweight Case Ammunition - Contract 2	Option/ FFP	Olin Winchester : Independence, Missouri	-	-		0.600	Jun 2021	-		-		-	Continuing	Continuing	Continuing
Green Primer - Contract 1	C/FFP	Innovative Materials & Processes (IMP), LLC : Rapid City, South Dakota	-	0.117	May 2020	0.075	May 2021	-		-		-	0.000	0.192	-
Green Primer - Contract 2	C/FFP	Northrop Grumman Innovation Systems : Independence, Missouri	-	0.129	Mar 2020	-		0.700	Mar 2022	-		0.700	Continuing	Continuing	Continuing
Green Primer - Contract 3	C/FFP	Franklin Engineering : Franklin, Tennessee	-	0.278	Aug 2020	-		-		-		-	0.000	0.278	-
M118LRA1 - Contract 1	C/FFP	Vista : Anoka, Minnesota	-	0.548	Aug 2020	0.210	Feb 2021	-		-		-	0.000	0.758	-
Tank Ammunition Foam Celluloid Contract	C/FFP	Polymer Processing Institute : Newark, New Jersey	-	0.391	Mar 2020	0.600	Mar 2021	0.200	Jan 2022	-		0.200	Continuing	Continuing	Continuing
Tank Improvements 105mm HE - Contract 1	C/FFP	Northrop Grumman Innovation Systems : Plymouth, Minnesota	-	0.506	Sep 2020	-		-		-		-	0.000	0.506	-
Tank Improvements 105mm HE - Contract 2	C/FFP	General Dynamics : St. Petersburg, Florida	-	0.489	Sep 2020	-		-		-		-	0.000	0.489	-
Tank Ammunition 105mm HE - Contract 3	Option/ FFP	IMI Systems, LTD : Ramat Hasharon, Israel	-	-		0.275	Apr 2021	-		-		-	0.000	0.275	-
		Subtotal	-	2.690		3.260		2.440		-		2.440	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0607131A / *Weapons and Munitions Product Improvement Programs*	Project (Number/Name) ER6 / *Direct Fire Technology*	

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
CCDC Armaments Center Support	MIPR	CCDC Armaments Center : Picatinny Arsenal, New Jersey	4.202	3.304	Nov 2019	2.536	Nov 2020	2.947	Nov 2021	-		2.947	Continuing	Continuing	Continuing
Ammunition Demilitarization	MIPR	Toole Army Depot : Toole, Utah	0.200	0.200	Dec 2020	-		-		-		-	0.000	0.400	-
		Subtotal	4.402	3.504		2.536		2.947		-		2.947	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Army Research Lab (ARL)	MIPR	CCDC Army Research Lab (ARL) : Aberdeen, Maryland	0.585	1.820	Jan 2020	0.900	Dec 2020	0.800	Jan 2022	-		0.800	Continuing	Continuing	Continuing
Aberdeen Test Center (ATC)	MIPR	Aberdeen Test Center (ATC) : Aberdeen, Maryland	1.965	0.035	Jan 2020	1.320	Jan 2021	0.500	Jan 2022	-		0.500	Continuing	Continuing	Continuing
Ballistic Support Office (BSO at LCAAP)	MIPR	Joint Munitions Command (JMC) : Independence, Missouri	-	0.125	Jun 2020	0.220	Jan 2021	-		-		-	0.000	0.345	-
Yuma Proving Ground	MIPR	Yuma Proving Ground : Yuma, Arizona	-	-		0.200	Mar 2021	-		-		-	0.000	0.200	-
		Subtotal	2.550	1.980		2.640		1.300		-		1.300	Continuing	Continuing	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	6.952	8.174		8.436		6.687		-		6.687	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER6 / *Direct Fire Technology*

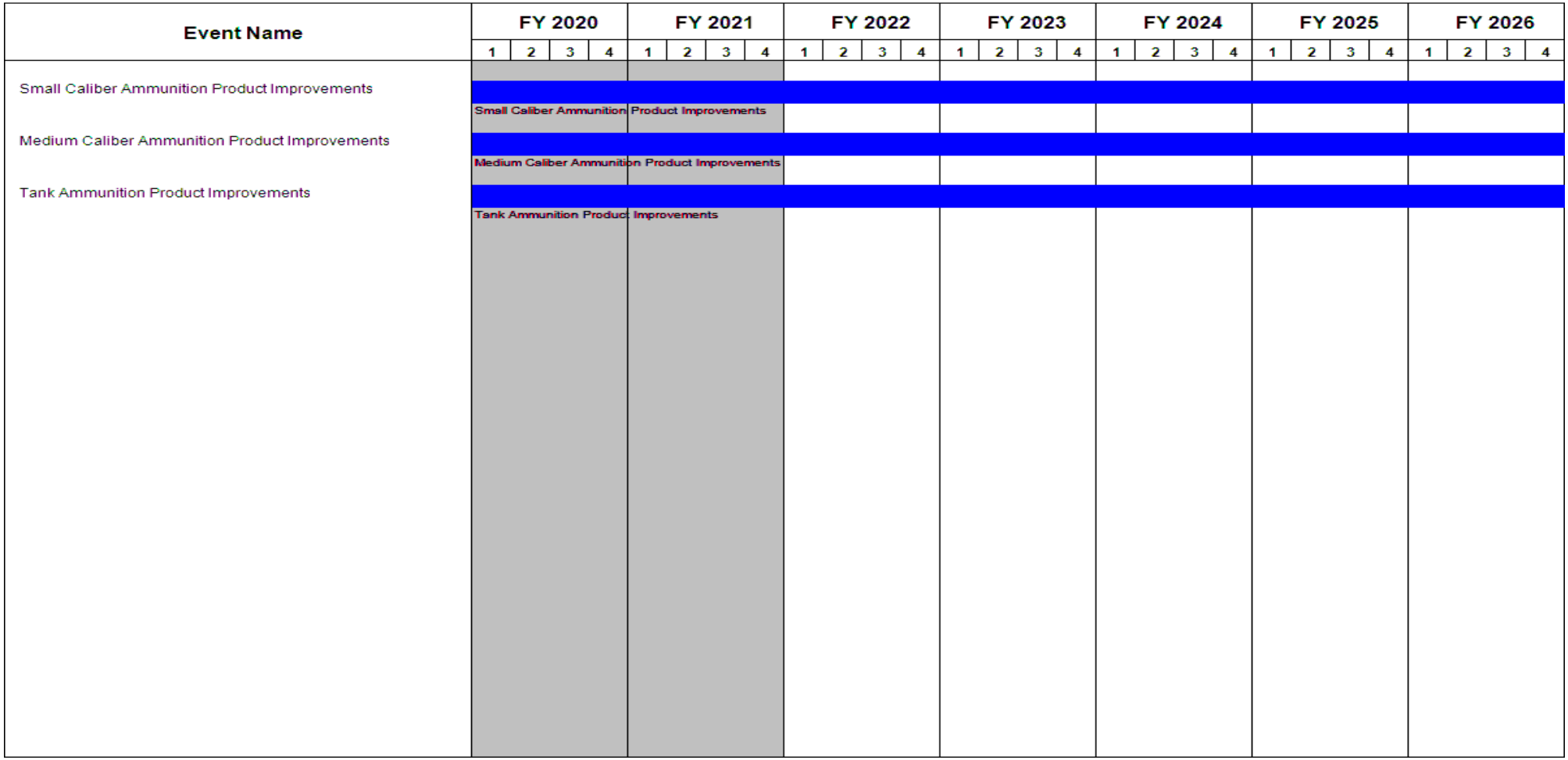

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER6 / *Direct Fire Technology*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Small Caliber Ammunition Product Improvements	1	2018	4	2033
Medium Caliber Ammunition Product Improvements	1	2018	4	2033
Tank Ammunition Product Improvements	1	2018	4	2033