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Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity					R-1 Program Element (Number/Name)							
2040: Research, Development, Test & Evaluation, Army / BA 4: Advanced Component Development & Prototypes (ACD&P)					PE 0603639A / Tank and Medium Caliber Ammunition							
COST (\$ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
Total Program Element	-	45.448	41.921	82.146	-	82.146	50.948	58.995	55.524	51.336	Continuing	Continuing
694: Medium Caliber Ammunition	-	8.960	1.482	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.442
BQ4: 155mm Artillery Propulsion XM654	-	0.000	0.000	7.200	-	7.200	0.000	0.000	0.000	0.000	0.000	7.200
EB8: OWL for Small Caliber Ammunition	-	4.097	2.174	2.000	-	2.000	0.000	0.000	0.000	0.000	0.000	8.271
EB9: Aviation Airborne Expandable Countermeasures	-	8.500	2.471	3.186	-	3.186	4.500	6.060	0.000	0.000	0.000	24.717
EC2: Adv Armor-Piercing (ADVAP) for Small Cal Ammo	-	0.000	3.755	6.821	-	6.821	0.000	0.000	0.000	0.000	0.000	10.576
EC3: Ammunition Logistics Prototyping	-	1.677	1.313	1.525	-	1.525	1.715	2.170	1.800	1.836	0.000	12.036
EL7: Reduced Range Ammunition	-	3.429	7.609	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	11.038
EL8: LIGHTWEIGHT CARTRIDGE CASE FOR SMALL CALIBER	-	2.870	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.870
EU3: .50 Caliber All-Purpose Tactical Cartridge (APTC)	-	0.000	0.000	4.250	-	4.250	0.000	0.000	0.000	0.000	0.000	4.250
FA5: Assured Precision Weapons and Munitions	-	12.480	14.322	31.267	-	31.267	29.907	31.000	31.000	25.000	Continuing	Continuing
FG1: Cannon-Delivered Area Effects Munitions (C-DAEM)	-	0.960	4.941	25.897	-	25.897	14.826	19.765	22.724	24.500	Continuing	Continuing
XT5: 30mm Anti-Personnel and Counter UAS	-	2.475	3.854	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	6.329

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<b>Note</b> In FY 2020, Program Element 0603639A, Project BQ4, 155mm Artillery Propulsion XM654, will transition from Budget Activity 03, PE 0603004A, Project 232, Advanced Lethality & Survivability Demo. This Project is not a New Start. In FY 2020, Program Element 0603639A, Project EU3, 50 Caliber All-Purpose Tactical Cartridge (APTC), is a New Start.		
<b>A. Mission Description and Budget Item Justification</b> The Tank and Medium Caliber Ammunition Program Element (PE) encompasses a comprehensive program to develop, rapidly transition to production, and field advanced weapons and munitions for small, medium and large caliber munitions, tank ammunition, mortar ammunition, cannon artillery ammunition, and close combat system items. These projects will ensure continued battlefield overmatch and lethality of U.S. maneuver forces against the full range of modern battlefield threats. To achieve this, the Tank and Medium Caliber Ammunition Program will identify and develop promising technologies through competitive development and streamlined acquisition procedures.  Project 694, Medium Caliber Ammunition: Develop 30x113mm self-destructing airburst munitions and qualify 30x113mm linked ammunition for ground vehicles. Increase precision and lethality capability to defeat personnel and materiel targets as well as support the Joint Urgent Operational Need (JUON CC-0558) to counter the rapidly evolving threat of Unmanned Aerial Systems. This effort will qualify the links for use with existing M788 and M789 ammunition and develop self-destructing and airburst capable munitions fired from the Lightweight 30x113mm Link Fed Chain Gun. There is no funding requested in FY 2020.  Project BQ4, 155mm Artillery Propulsion XM654: The XM654E2 Supercharge is a unitary top-zone 155mm propelling charge optimized and required for use with 58-caliber XM907E2 Extended Range Cannon with Slide-block breech for use with the XM1299 Extended Range Cannon Artillery (ERCA) Self-propelled Howitzer (SPH). It will achieve lethality overmatch at ranges of approximately 70km from XM907E2 Extended Range Cannon with developmental extended range projectiles, and will increase range with legacy projectiles by thirty percent. The XM654E2 Supercharge is composed of combustible cases with integral metal Stub Case utilizing existing electrically initiated Tank Primer and advanced artillery propellant. Knowledge points will determine compatibility with automated ammunition handling systems. FY 2020 funds will support design risk reduction and prototype maturation towards Engineering Manufacturing and Development (EMD) to support ERCA SPH Increment 2 to support of the Army's modernization priorities in support of the National Defense Strategy.  Project EB8, OWL for Small Caliber: The One Way Luminescence (OWL) project is a critical technology development in response to the 7.62mm and 5.56mm Families of Ammunition Capabilities Development Documents (CDD) and .50 caliber munitions CDD. Current small caliber ammunition tracer rounds are a pyrotechnic tracer mix which allows enemy forces to see the trace round and track its trajectory back to the shooter. The OWL project's objective is to develop and field a full day/night tracer round to replace the current pyrotechnic cartridges with trace cartridges that are only visible to the shooter and soldiers in close proximity, increasing soldier survivability. 7.62mm and 5.56mm are the immediate focus followed by a similar development strategy for .50 caliber cartridges. FY 2020 funding supports continued testing and evaluation of the 5.56mm OWL prototype solutions in order to mature the Technology Readiness Level (TRL).  Project EB9, Aviation Airborne Expandable Countermeasures: This project supports the advanced development activities and technology demonstrations of the Aviation Airborne Expendable Countermeasure (AAECM). These advanced decoys are necessary to address emerging threats and capabilities deficiencies in Army aircraft protection and the safety of its aircrews against advanced Man-Portable Air Defense Systems (MANPADS) and shoulder launched Surface-to-Air Missiles		

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<b>Exhibit R-2, RDT&amp;E Budget Item Justification:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army / BA 4: Advanced Component Development &amp; Prototypes (ACD&amp;P)</i>	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	
<p>(SAM) systems. These efforts will evaluate integrated technologies and countermeasure prototype systems in realistic operating test environments. Prototypes will help expedite technology transition from the laboratory to operational use by demonstrating component and subsystem maturity prior to integration into major and complex Army aircraft platforms. These expendable countermeasures systems are an essential part of survivability equipment for Army aircraft. Army RDT&amp;E efforts are coordinated with the PEO Aviation and its platform program managers and with PM Aircraft Survivability Equipment (ASE) to address emerging Joint Urgent Operational Need Statement (JUONS) CC-0558 Counter - Unmanned Aerial Systems (CUAS). Continue to develop and prepare documentation for Milestone A decision for the Radar Guided decoy. This decoy is designed to defeat specific threat types. Details of their operation is classified. Conduct initial developmental/operational testing on XM215 and RF Countermeasures (CM).</p> <p>Project EC2, The Advanced Armor-Piercing (ADVAP) project is a critical technology development in response to the 7.62mm and 5.56mm Family of Ammunition Capabilities Development Documents (CDD) and the Soldier Lethality Cross Functional Team (SL CFT) Initial Capability Document (ICD) which outlines the requirements for new ammunition to support the rapid prototyping/development of the Next Generation Squad Weapons (NGSW) under Section 804 Authority. New ADVAP ammunition is designed to provide overmatch capability to defeat advanced light armored threats within typical machine gun engagement ranges. The nomenclature for the 7.62mm ADVAP is XM1158.</p> <p>The Next Generation Squad Weapons (NGSW) ammunition has a similar objective to the 7.62mm ADVAP which is to defeat hard targets. The NGSW ammunition is split into two initial variants, the General Purpose (GP) and the Special Purpose (SP). The nomenclature for the GP ammunition is XM1186 and the nomenclature for the SP ammunition is XM1184. The overall objective of the ADVAP project is to develop and Full Materiel Release (FMR) both 7.62mm XM1158 cartridge for the M240 machine gun and ADVAP ammunition in calibers below 7.62mm.</p> <p>FY 2020 funding supports continuing rapid prototyping/development of the Next Generation Squad Weapons (NGSW) Special Purpose (SP) projectile, building prototypes and maturing prototypes to provide to the weapon system contractors for performance evaluation, conducting a Critical Design Review (CDR), and conducting prototype testing. FY 2020 funding also supports conducting a Preliminary Design Review (PDR) for the SP projectile and performing activities to increase prototype capacity to support planned weapon system testing.</p> <p>Project EC3, Ammunition Logistics Prototyping: This Project supports the future force by improving the distribution, management, reliability and survivability of ammunition through the advanced development, integration, and demonstration of logistics system enablers. These enablers will improve the efficiency and effectiveness of ammunition operations, to include retrograde, while reducing the logistics footprint on the battlefield. Technology areas addressed include handling, distribution, and management (strategic and tactical), prognostics, diagnostics, and asset visibility, explosives safety, and adaptive and environmentally friendly packaging and palletization. The efficient deployment and sustainment of reliable ammunition is vital to success on the battlefield. This Project enhances the operational effectiveness of the ammunition logistics system to ensure the distribution of reliable ammunition to the warfighter. FY 2020 funding will be used to complete verification testing and an operational demonstration for the environmental health monitoring system. FY 2020 funding will also be used to continue verification testing of a type two prototype next generation temperature/humidity sensor with batch interrogation and historical data retention capabilities, which will be used for assessing munitions reliability.</p>		

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<b>Exhibit R-2, RDT&amp;E Budget Item Justification:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army / BA 4: Advanced Component Development &amp; Prototypes (ACD&amp;P)</i>	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	
<p>Project EL7, Reduced Range Ammunition: The small caliber Reduced Range Ammunition (RRA) project is a critical technology development in response to the 7.62mm and .50 caliber Capabilities Development Documents (CDD). The overall objective of Reduced Range Ammunition is to provide training ammunition suitable for use on military installations with Surface Danger Zone (SDZ) restrictions. The relatively long maximum range of the 7.62mm and .50 caliber service ammunition poses challenges on training ranges in range restricted areas. Reduce Range Ammunition will mitigate a training gap on installations by providing a materiel solution that meets training needs while shortening and condensing the surface danger zone. This will allow soldiers to train with 7.62mm and .50 caliber weapons on restricted ranges. The Reduced Range Ammunition cartridge design will be compatible with all Army 7.62mm and .50 caliber weapons but specifically optimized to work in the M240 and M2 Machine Guns. There is no funding requested in FY 2020.</p> <p>Project EL8, Lightweight Cartridge Case for Small Caliber: The Lightweight Small Caliber Ammunition (LSCA) Project is a critical technology development in response to the 7.62mm Capabilities Development Documents (CDD). The goal of the LSCA Project is to reduce the total Soldier load through reduction in ammunition weight. The Lightweight Small Caliber Ammunition Project will develop and field 7.62mm lightweight small caliber ammunition cartridges that will provide the same capabilities as the M80A1 and M62A1 cartridges. The Lightweight Small Caliber Ammunition cartridge will be designed to be compatible with all Army 7.62mm weapon systems, but optimized to work in the M240 Machine Gun. No funding requested in FY 2020.</p> <p>Project EU3, .50 Caliber All-Purpose Tactical Cartridge (APTC): The All-Purpose Tactical Cartridge (APTC) project is a critical technology development in response to the .50 caliber Munitions Capabilities Development Documents (CDD). The overall objective of All-Purpose Tactical Cartridge is to deliver a single round that replaces and improves current legacy .50 caliber ammunition. The All-Purpose Tactical Cartridge will be compatible with all Army .50 caliber weapons but specifically optimized to work in the M2 Machine Guns. FY 2020 funding supports Technology Maturation and Risk Reduction (TMRR) in preparation for a Technology Readiness Level (TRL) 6, conducting a Materiel Development Decision (MDD), and conducting Design Verification Tests.</p> <p>Project FA5, The Assured Precision Weapons and Munitions (APWM) -FA5 Project is focused on advanced risk mitigation, technology integration, prototyping, and product support to identify, evaluate, mature, test, and demonstrate various assured precision prototype technologies in weapon and munitions components and subsystems within a complex system of systems environment. The Assured Precision Weapons and Munitions Project reinforces the National Defense Strategy's major lines of effort through technology development and prototyping that increase lethality and ensure future combat overmatch success of the Joint Force against peer/near-peer adversaries as well as improving program performance and affordability for multiple weapons and munitions Programs of Record (PoRs) via Joint Lethality Positioning, Navigation and Timing (PNT) and Army M-Code GPS coordinated efforts. The Assured Precision Weapons and Munitions Project directly supports Army Modernization Priorities in support of the National Defense Strategy. Funding will support engagement by Weapons and Munitions PNT experts in the development, evaluation, and technology delivery activities of the Air Force's M-Code GPS and Army's Assured PNT programs. Funding will also enable component and subsystem architecture input essential for precision weapons and munitions operating in a system of-systems environment, Army M-Code GPS technology integration and evaluation, and maturation of alternative positioning, navigation and timing related technologies to enable informed Assured PNT related program of record milestone and Army cross-functional modernization decisions.</p> <p>Project FG1, Cannon-Delivered Area Effects Munitions (C-DAEM): The Cannon-Delivered Area Effects Munitions (C-DAEM) Project is a two increment approach to provide U.S. ground forces with the capability to engage area personnel through armored targets, while denying threat forces full operational freedom within the targeted area. An Analysis of Alternatives (AoA) was completed in January 2018. The purpose of the C-DAEM AoA was to inform acquisition and investment decisions by the</p>		

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<b>Appropriation/Budget Activity</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army I BA 4: Advanced Component Development &amp; Prototypes (ACD&amp;P)</i>	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>
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Army regarding replacement of the current stockpile of 155mm Dual Purpose Improved Conventional Munitions (DPICM) with Department of Defense policy compliant munitions and address anti-armor and extended range capability requirements identified in the C-DAEM Initial Capabilities Document (ICD). The Army validated a two increment solution for C-DAEM. Increment I will destroy infantry fighting vehicles, self-propelled howitzers, and tanks. Increment II will destroy personnel, materiel, air defense artillery and rocket launchers. Increment I and II will be developed simultaneously. FY 2020 resources will fund the competitive demonstrations for Increment I, as well as early detailed design testing supporting the qualification of Increment II to support the Army's modernization priorities in support of the National Defense Strategy.

Project XT5, 30mm Anti-Personnel and Counter UAS: Lightweight 30x113mm (LW30) Airburst is a new capability identified as a Warfighter requirement in the Capability Production Document (CPD), AH-64E Helicopter, Increment 1, Version 6. The LW30 airburst cartridge improves the ability of the Warfighter to effectively engage anti-personnel/materiel targets due to increased lethality. Airburst capability provides the user with a much higher probability of achieving a first burst kill against enemy personnel targets in the open. The LW30 will retain its dual purpose warhead, allowing it to continue to defeat light armored threats through point detonation. The cartridge provides increased lethal effects against personnel and soft-skin vehicular targets increasing Soldier Survivability on the ground during troops in contact engagements and decreases the required number of rounds to reach the desired lethal effects. There is no funding requested in FY 2020.

<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>
Previous President's Budget	41.452	41.974	43.272	-	43.272
Current President's Budget	45.448	41.921	82.146	-	82.146
Total Adjustments	3.996	-0.053	38.874	-	38.874
• Congressional General Reductions	-0.026	-0.053			
• Congressional Directed Reductions	-10.000	-			
• Congressional Rescissions	-	-			
• Congressional Adds	10.450	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	4.804	-			
• SBIR/STTR Transfer	-1.232	-			
• Adjustments to Budget Years	-	-	38.874	-	38.874

**Change Summary Explanation**

FY 2020 increase of \$20.674 million to support the Army's modernization priorities in support of the National Defense Strategy.  
 FY 2018 Congressional increase of \$8.000 million to Project 694, Medium Caliber Ammunition.  
 FY 2018 Congressional increase of \$2.450 million to Project EB9, Aviation Airborne Expandable Countermeasures.  
 FY 2018 Congressional decrease of \$10.000 million to Project EU1, Enhanced Lethality Cannon Munitions.

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army										<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition				<b>Project (Number/Name)</b> 694 / Medium Caliber Ammunition			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
694: Medium Caliber Ammunition	-	8.960	1.482	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.442
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**Note**

Program Element (PE) 0603639A, Project 694, Medium Caliber Ammunition funds 30x113mm ammunition development and improvement efforts beginning in FY 2018.

**A. Mission Description and Budget Item Justification**

Develop 30x113mm self-destructing airburst munitions and qualify 30x113mm linked ammunition for ground vehicles. Increase precision and lethality capability to defeat personnel and materiel targets as well as support the Joint Urgent Operational Need (JUON CC-0558) to counter the rapidly evolving threat of Unmanned Aerial Systems. This effort will qualify the links for use with existing M788 and M789 ammunition and develop self-destructing and airburst capable munitions fired from the Lightweight 30x113mm Link Fed Chain Gun. There is no FY 2020 request.

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

	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b>Title:</b> Linked 30x113mm Ammunition Qualification and Airburst Development	8.960	1.435	-
<b>Description:</b> Qualify linked 30x113mm ammunition and develop self-destructing and airburst capable munitions.			
<b>FY 2019 Plans:</b> FY 2019 funds will be used to purchase links and linked ammunition necessary to conduct weapon system integration, testing and evaluation, and to support the Urgent Materiel Release (UMR) of the 30x113mm self destruct munitions and development of an airbursting munition.			
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Program will complete testing in FY 2019.			
<b>Title:</b> FY 2019 SBIR / STTR Transfer	-	0.047	-
<b>FY 2019 Plans:</b> FY 2019 SBIR / STTR Transfer			
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> FY 2019 SBIR / STTR Transfer			
<b>Accomplishments/Planned Programs Subtotals</b>	8.960	1.482	-

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> 694 / <i>Medium Caliber Ammunition</i>

**C. Other Program Funding Summary (\$ in Millions)**  
N/A

**Remarks**

**D. Acquisition Strategy**

An other transaction agreement (OTA) contract will be used to purchase links for the 30x113mm ammunition. Linked ammunition deliveries will be synchronized with test schedules for ammunition/weapon qualification and Remote Weapon Station (RWS)/vehicle system integration. Ammunition qualification tests and weapon qualification tests will be conducted in FY 2019. Purchase of linked M788 and M789 cartridges will transition to competitive procurement by FY 2020. Efforts to develop a self-destructing airburst capable munition and a guided 30x113mm munition will also be conducted.

**E. Performance Metrics**

N/A

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> 694 / Medium Caliber Ammunition
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<b>Product Development (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
30x113mm Self Destruct and Airburst Ammo Development Contract	C/CPFF	Northrop Grumman Innovation Systems (NGIS) : Plymouth, MN	-	7.771	Aug 2018	0.635	Jan 2019	-		-		-	0.000	8.406	-
30x113mm Linked Ammo Development Contract	C/CPFF	Northrop Grumman Innovation Systems (NGIS) : Plymouth, MN	-	0.052	Aug 2018	-		-		-		-	0.000	0.052	-
30x113mm Ammo Fuze Development	C/CPFF	Electronics Development Corporation (EDC) : Columbia, MD	-	0.207	Jun 2018	-		-		-		-	0.000	0.207	-
Program Manager Maneuver Ammunition Systems (PM MAS)	MIPR	PM MAS : Picatinny, NJ	-	0.230	Oct 2017	-		-		-		-	0.000	0.230	-
FY 2019 SBIR / STTR Transfer	TBD	TBD : TBD	-	-		0.047		-		-		-	0.000	0.047	-
<b>Subtotal</b>			-	8.260		0.682		-		-		-	0.000	8.942	N/A

<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
30x113mm Ammo Armament Research Development and Engineering Center (ARDEC)	MIPR	Armament Research Development and Engineering Center (ARDEC) : Picatinny, NJ	-	-		0.200	Nov 2018	-		-		-	0.000	0.200	-
<b>Subtotal</b>			-	-		0.200		-		-		-	0.000	0.200	N/A





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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date: March 2019</b>
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> 694 / <i>Medium Caliber Ammunition</i>

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
30x113mm Ammo Development Contract Award					▲ 1	30x113mm Ammo Contract Award																						
30x113mm Ammo Development					■	30x113mm Ammo Development																						
30x113mm Proximity Ammo Demonstration									▲ 2	30x113mm Prox Ammo Demo																		
30x113mm Self Destruct Safety Certification Test									■	30x113mm Self Destruct Safety Cert																		
30x113mm Self Destruct System Integration Testing									■	30x113mm Self Destruct Integration Testing																		
30x113mm Self Destruct Ammo Urgent Material Release									▲ 3	30x113mm Self Destruct UMR																		

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> 694 / <i>Medium Caliber Ammunition</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
30x113mm Ammo Development Contract Award	4	2018	4	2018
30x113mm Ammo Development	4	2018	3	2019
30x113mm Proximity Ammo Demonstration	4	2019	4	2019
30x113mm Self Destruct Safety Certification Test	2	2019	3	2019
30x113mm Self Destruct System Integration Testing	3	2019	4	2019
30x113mm Self Destruct Ammo Urgent Material Release	4	2019	4	2019

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army										<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition				<b>Project (Number/Name)</b> BQ4 / 155mm Artillery Propulsion XM654			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
BQ4: 155mm Artillery Propulsion XM654	-	0.000	0.000	7.200	-	7.200	0.000	0.000	0.000	0.000	0.000	7.200
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**Note**

In FY 2020, this Project will transition from Budget Activity 03, PE 0603004A, Project 232, Advanced Lethality & Survivability Demo. This Project is not a New Start.

**A. Mission Description and Budget Item Justification**

The XM654E2 Supercharge is a unitary top-zone 155mm propelling charge optimized and required for use with 58-caliber XM907E2 Extended Range Cannon with Slide-block breech for use with the XM1299 Extended Range Cannon Artillery (ERCA) Self-propelled Howitzer (SPH). It will achieve lethality overmatch at ranges of approximately 70km from XM907E2 Extended Range Cannon with developmental extended range projectiles, and will increase range with legacy projectiles by thirty percent. The XM654E2 Supercharge is composed of combustible cases with integral metal Stub Case utilizing existing electrically initiated Tank Primer and advanced artillery propellant. Knowledge points will determine compatibility with automated ammunition handling systems. FY 2020 funds will support design risk reduction and prototype maturation towards Engineering Manufacturing and Development (EMD) to support ERCA SPH Increment 2 and in support of the Army's modernization priorities in support of the National Defense Strategy.

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

	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b>Title:</b> 155mm Artillery Propulsion XM654 Supercharge	-	-	7.200
<b>Description:</b> Unitary top-zone propelling charge for XM907E2 Extended Range Cannon with Slide-block breech for use with ERCA INC 2 to regain range overmatch for 155mm artillery.			
<b>FY 2020 Plans:</b> Perform charge establishment and charge uniformity in preparation for ballistic testing including preliminary blast overpressure and charge verification across operational temperatures. Perform packaging rough handling testing. Evaluate risk reduction activities prior to Milestone B.			
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Increase in funds from FY 2019 to FY 2020 due to continuation of XM654E2 Supercharge efforts from Science & Technology (S&T) for risk reduction and prototype maturation. This Project is not a New Start.			
<b>Accomplishments/Planned Programs Subtotals</b>	-	-	7.200

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> BQ4 / <i>155mm Artillery Propulsion XM654</i>

**C. Other Program Funding Summary (\$ in Millions)**

<u>Line Item</u>	<u>FY 2018</u>	<u>FY 2019</u>	<u>FY 2020</u>			<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• 232: <i>Advanced Lethality &amp; Survivability Demo</i>	99.265	70.340	0.000	-	0.000	-	-	-	-	0.000	169.605

**Remarks**

In FY 2020, this Project will transition from Budget Activity 03, PE 0603004A, Project 232, Advanced Lethality & Survivability Demo. This Project is not a New Start. In FY 2021, this Project will transition to Budget Activity 05, PE 0604802A Project BQ3, 155mm Artillery Propulsion XM654. A Procurement Ammunition, Army funding line will be established in FY 2025.

**D. Acquisition Strategy**

The XM654E2 Supercharge Technology Maturation and Risk Reduction (TMRR) effort will consist of critical technology prototyping, testing, and demonstration. The Project will utilize the Defense Ordnance Technology Consortium (DOTC) Other Transaction Agreement (OTA) for the integration of components such as propellant, combustible case, igniter and stub case into developmental extended range projectiles and fuzes. After achieving Milestone B, the XM654E2 Supercharge Project will conduct competitive Engineering Manufacturing and Development (EMD) tasks aimed at meeting the validated requirement in preparation for Low Rate Initial Production (LRIP).

**E. Performance Metrics**

N/A

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> BQ4 / 155mm Artillery Propulsion XM654
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<b>Management Services (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Program Management	Various	Office of the Project Manager (PM) Combat Ammunition Systems (CAS) : Picatinny Arsenal, NJ	-	-		-		0.150	Oct 2019	-		0.150	0.000	0.150	-
<b>Subtotal</b>			-	-		-		0.150		-		0.150	0.000	0.150	N/A

**Remarks**  
Program Management includes Supercharge travel and milestone documentation support.

<b>Product Development (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Supercharge Prototype Hardware	MIPR	DoD Ordnance Technology Consortium (DOTC) : TBD	-	-		-		1.339	Oct 2019	-		1.339	0.000	1.339	-
Developmental Projectile/ Fuze Hardware	MIPR	DoD Ordnance Technology Consortium (DOTC) : TBD	-	-		-		1.030	Oct 2019	-		1.030	0.000	1.030	-
<b>Subtotal</b>			-	-		-		2.369		-		2.369	0.000	2.369	N/A

<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Engineering Support	MIPR	Armament Research Development Engineering Center (ARDEC) : Picatinny Arsenal, NJ	-	-		-		4.281	Oct 2019	-		4.281	0.000	4.281	-

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> BQ4 / 155mm Artillery Propulsion XM654
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<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
<b>Subtotal</b>			-	-		-		4.281		-		4.281	0.000	4.281	N/A

**Remarks**  
Engineering support required for ongoing XM654E2 design risk reduction and prototype maturation efforts.

<b>Test and Evaluation (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Supercharge Prototype Testing	MIPR	Army Test & Evaluation Command (ATEC) : Yuma, AZ	-	-		-		0.400	Oct 2019	-		0.400	0.000	0.400	-
<b>Subtotal</b>			-	-		-		0.400		-		0.400	0.000	0.400	N/A

	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
<b>Project Cost Totals</b>	-	-	0.000	7.200	-	7.200	0.000	7.200	N/A

**Remarks**

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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> BQ4 / <i>155mm Artillery Propulsion XM654</i>

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Supercharge Prototyping									Prototyping																			
Supercharge Prototype Testing									Testing																			



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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> BQ4 / <i>155mm Artillery Propulsion XM654</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Supercharge Prototyping	1	2020	4	2020
Supercharge Prototype Testing	1	2020	4	2020

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army										<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition				<b>Project (Number/Name)</b> EB8 / OWL for Small Caliber Ammunition			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
EB8: OWL for Small Caliber Ammunition	-	4.097	2.174	2.000	-	2.000	0.000	0.000	0.000	0.000	0.000	8.271
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**Note**

The small caliber One Way Luminescence (OWL) technology applies to multiple calibers. In FY 2019, Budget Activity 4 (BA4) Program Element (PE) 0603639A, Project EB8, 7.62mm OWL transitions to Budget Activity 5 (BA5) PE 0604802A, Project EP4, 7.62mm OWL. In FY 2021, BA4 PE 0603639A, Project EB8, 5.56mm OWL transitions to BA5 PE 0604802A, Project EP4, 5.56mm OWL

**A. Mission Description and Budget Item Justification**

The One Way Luminescence (OWL) project is a critical technology development in response to the 7.62mm and 5.56mm Families of Ammunition Capabilities Development Documents (CDD) and .50 caliber munitions CDD. Current small caliber ammunition tracer rounds are a pyrotechnic tracer mix which allows enemy forces to see the trace round and track its trajectory back to the shooter. The OWL project's objective is to develop and field a full day/night tracer round to replace the current pyrotechnic cartridges with trace cartridges that are only visible to the shooter and soldiers in close proximity, increasing soldier survivability. 7.62mm and 5.56mm are the immediate focus followed by a similar development strategy for .50 caliber cartridges. FY 2020 funding supports continued testing and evaluation of the 5.56mm OWL prototype solutions in order to mature the Technology Readiness Level (TRL).

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

	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b>Title:</b> Technology Maturation and Risk Reduction (TMRR)	4.097	2.104	2.000
<b>Description:</b> One Way Luminescence (OWL) will develop and demonstrate a full day/night tracer technology that eliminates the shortcomings of current legacy tracers.			
<b>FY 2019 Plans:</b> FY 2019 efforts will continue activities to mature 5.56mm Technology Readiness Level (TRL). The 5.56mm efforts include development, procurement, and testing of multiple competing prototype solutions to reduce risk in meeting user requirements. Funding will also support exploring implementation of OWL technology in .50 Caliber and other small caliber ammunition.			
<b>FY 2020 Plans:</b> FY 2020 efforts will continue activities to mature 5.56mm Technology Readiness Level (TRL). Plans include testing 5.56mm prototype solutions in preparation for TRL 6. Evaluate .50 Caliber and other small caliber ammunition OWL technology/prototype ammunition and mature TRLs.			
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EB8 / <i>OWL for Small Caliber Ammunition</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
Technology maturation of the 5.56mm OWL started in FY 2018. The FY 2020 funding furthers the planned development of the 5.56mm and other small caliber OWL technology.			
<b>Title:</b> FY 2019 SBIR / STTR Transfer	-	0.070	-
<b>FY 2019 Plans:</b> FY 2019 SBIR / STTR Transfer			
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> FY 2019 SBIR / STTR Transfer			
<b>Accomplishments/Planned Programs Subtotals</b>	4.097	2.174	2.000

<b>C. Other Program Funding Summary (\$ in Millions)</b>											
<b>Line Item</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
• EP4: <i>One-Way Luminescence for Small Caliber Ammo</i>	-	6.077	8.547	-	8.547	12.391	5.387	6.500	3.000	0.000	41.902

**Remarks**  
Budget Activity 5 (BA5) Program Element (PE) 0604802A, Project EP4

**D. Acquisition Strategy**  
The One Way Luminescence (OWL) technology will be integrated into the M80A1 trace ammunition production. The OWL concept will be developed through Government and Industry prototyping efforts. A Technology Readiness Assessment (TRA) was conducted in FY 2015 and FY 2016 to measure the progress of the designs. The FY 2017 and FY 2018 TRAs were conducted to evaluate the Industry and Government concepts in order to proceed with the 7.62mm Engineering and Manufacturing Development (EMD) in FY 2019. The 5.56mm and .50 caliber cartridges will follow the 7.62mm schedule with Engineering and Manufacturing Development (EMD) scheduled to commence in FY 2021 for the 5.56mm variant. The new 5.56mm tracer cartridges will replace the legacy 5.56mm M856A1 tracer.

**E. Performance Metrics**  
N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army												Date: March 2019			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
2040 / 4				PE 0603639A / Tank and Medium Caliber Ammunition				EB8 / OWL for Small Caliber Ammunition							
Product Development (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Manager Maneuver Ammunition Systems (PM MAS)	Various	Program Manager Maneuver Ammunition Systems (PM MAS) : Picatinny, NJ	0.370	0.022	Oct 2017	-		-		-		-	0.600	0.992	-
Physical Optics Corporation	C/FFP	Physical Optics Corporation : Torrance, CA	1.080	-		-		-		-		-	0.000	1.080	-
Battelle Memorial Institute	C/FFP	Battelle Memorial Institute : Columbus, OH	0.716	-		-		-		-		-	0.000	0.716	-
Tooling	Option/FFP	SAVIT Corporation : Rockaway, NJ	0.209	0.392	Oct 2017	-		-		-		-	0.000	0.601	-
Tooling Development	Option/CPFF	JAK Tool Engineering Solutions : Cranbury, NJ	-	-		0.800	Feb 2019	0.250	Feb 2020	-		0.250	0.000	1.050	Continuing
Prototype Development Contract 1	Option/CPFF	General Dynamics : Florham Park, NJ	-	0.515	Jul 2018	-		0.400	Feb 2020	-		0.400	0.000	0.915	Continuing
Prototype Development Contract 2	Option/CPFF	Nammo Tally : Mesa, AZ	-	0.515	Jul 2018	-		0.400	Feb 2020	-		0.400	0.000	0.915	Continuing
Projectile Development	MIPR	Armament Research Development and Engineering Center (ARDEC) : Picatinny Arsenal, NJ	-	0.125	Oct 2017	-		-		-		-	0.000	0.125	-
FY 2019 SBIR / STTR Transfer	TBD	TBD : TBD	-	-		0.070		-		-		-	0.000	0.070	-
<b>Subtotal</b>			2.375	1.569		0.870		1.050		-		1.050	0.600	6.464	N/A

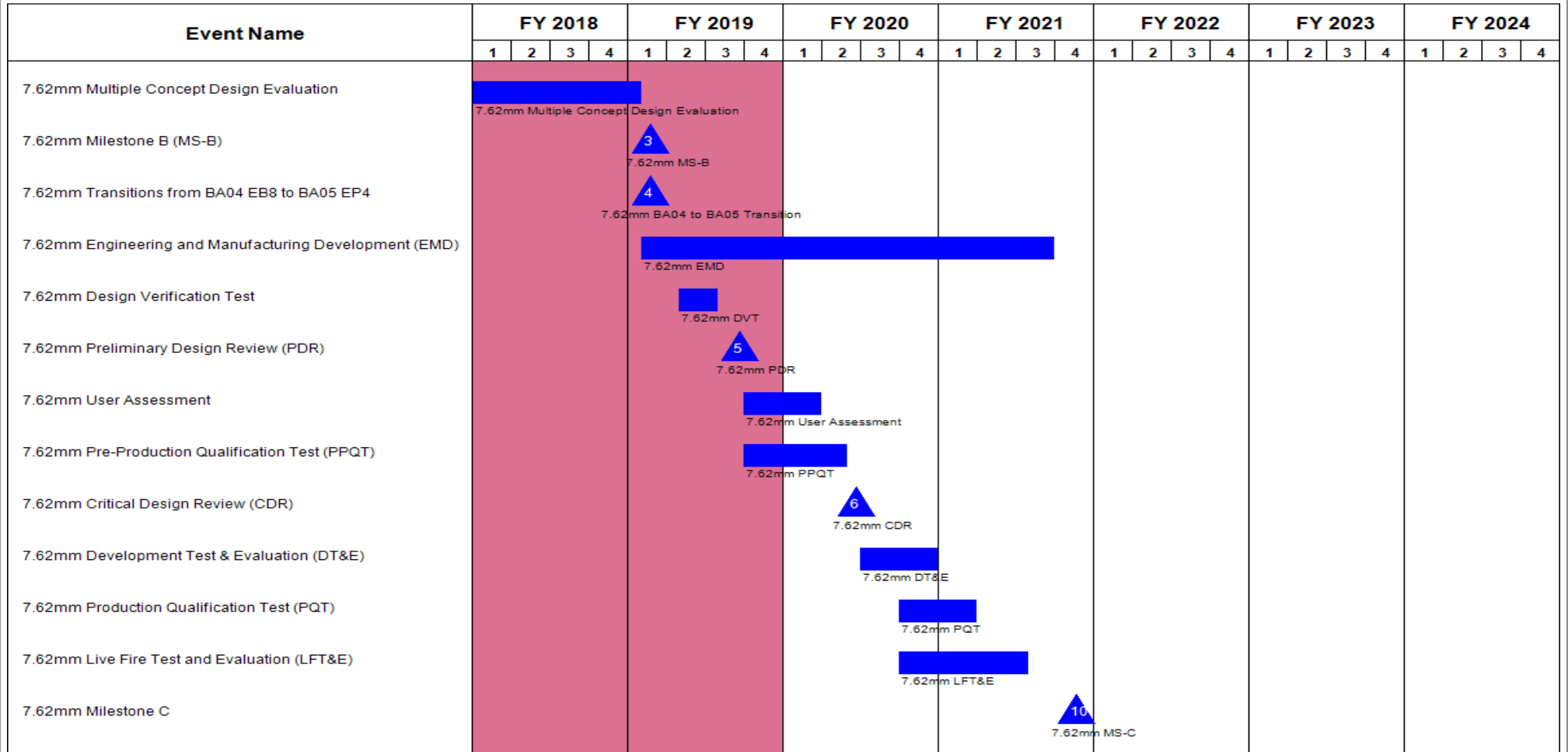
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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army												Date: March 2019			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
2040 / 4				PE 0603639A / Tank and Medium Caliber Ammunition				EB8 / OWL for Small Caliber Ammunition							
Support (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Armament Research Development and Engineering Center (ARDEC)	MIPR	Armament Research Development and Engineering Center (ARDEC) : Picatinny, NJ	3.269	2.203	Oct 2017	1.254	Oct 2018	0.575	Oct 2019	-		0.575	2.498	9.799	Continuing
<b>Subtotal</b>			3.269	2.203		1.254		0.575		-		0.575	2.498	9.799	N/A
Test and Evaluation (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Army Research Lab (ARL)	MIPR	Army Research Lab (ARL) : Aberdeen, MD	0.278	-		0.030	Oct 2018	0.040	Oct 2019	-		0.040	1.500	1.848	Continuing
Army Corps of Engineers	MIPR	Army Corps of Engineers : Vicksburg, MO	0.313	0.075	Apr 2018	-		0.035	Oct 2019	-		0.035	1.500	1.923	Continuing
Night Vision Labs (NVL)	MIPR	Night Vision Labs (NVL) : Fort Belvoir, VA	0.040	-		-		-		-		-	0.000	0.040	-
US Army Aberdeen Test Center (ATC)	MIPR	US Army Aberdeen Test Center (ATC) : Aberdeen, MD	0.101	-		-		-		-		-	0.000	0.101	-
Army Joint Munitions Command	MIPR	Army Joint Munitions Command : Rock Island, IL	0.154	0.050	Oct 2017	0.020	Oct 2018	0.050	Oct 2019	-		0.050	0.000	0.274	-
Naval Air Warfare Center	MIPR	Naval Air Warfare Center : Patuxent River, MD	0.137	-		-		-		-		-	0.000	0.137	-
Prototype testing	Option/FFP	Double B Enterprises : Malvern, IA	-	0.200	Jan 2018	-		0.250	Feb 2020	-		0.250	0.000	0.450	Continuing
<b>Subtotal</b>			1.023	0.325		0.050		0.375		-		0.375	3.000	4.773	N/A



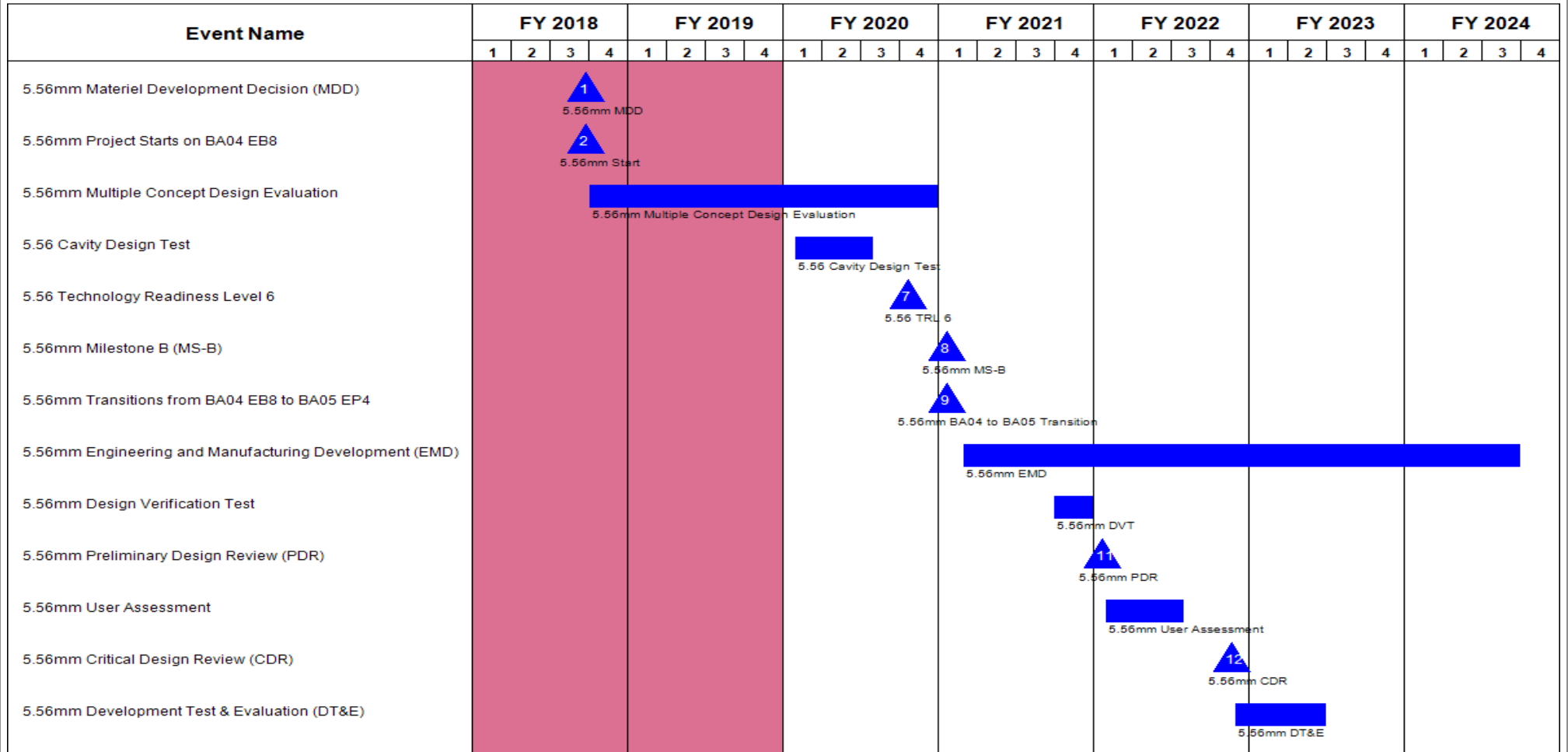
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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EB8 / <i>OWL for Small Caliber Ammunition</i>



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


<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> EB8 / OWL for Small Caliber Ammunition





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<b>Exhibit R-4, RDT&amp;E Schedule Profile:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EB8 / <i>OWL for Small Caliber Ammunition</i>

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024											
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4								
5.56mm Production Qualification Testing (PQT)																									 5.56mm PQT											
5.56mm Live-Fire Test and Evaluation (LFT&E)																													 5.56mm LFT&E							
5.56mm Milestone C (MS-C)																																	 .50 caliber Concept Design Evaluation			
.50 caliber Concept Design Evaluation																																				
	 13 5.56mm																																			

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EB8 / <i>OWL for Small Caliber Ammunition</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
7.62mm Multiple Concept Design Evaluation	1	2015	1	2019
7.62mm Milestone B (MS-B)	1	2019	1	2019
7.62mm Transitions from BA04 EB8 to BA05 EP4	1	2019	1	2019
7.62mm Engineering and Manufacturing Development (EMD)	1	2019	3	2021
7.62mm Design Verification Test	2	2019	3	2019
7.62mm Preliminary Design Review (PDR)	3	2019	3	2019
7.62mm User Assessment	4	2019	1	2020
7.62mm Pre-Production Qualification Test (PPQT)	4	2019	2	2020
7.62mm Critical Design Review (CDR)	2	2020	2	2020
7.62mm Development Test & Evaluation (DT&E)	3	2020	4	2020
7.62mm Production Qualification Test (PQT)	4	2020	1	2021
7.62mm Live Fire Test and Evaluation (LFT&E)	4	2020	3	2021
7.62mm Milestone C	4	2021	4	2021
5.56mm Materiel Development Decision (MDD)	3	2018	3	2018
5.56mm Project Starts on BA04 EB8	3	2018	3	2018
5.56mm Multiple Concept Design Evaluation	4	2018	4	2020
5.56 Cavity Design Test	1	2020	3	2020
5.56 Technology Readiness Level 6	4	2020	4	2020
5.56mm Milestone B (MS-B)	1	2021	1	2021
5.56mm Transitions from BA04 EB8 to BA05 EP4	1	2021	1	2021
5.56mm Engineering and Manufacturing Development (EMD)	1	2021	3	2024
5.56mm Design Verification Test	4	2021	4	2021

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**Exhibit R-4A, RDT&E Schedule Details:** PB 2020 Army **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EB8 / <i>OWL for Small Caliber Ammunition</i>
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Events	Start		End	
	Quarter	Year	Quarter	Year
5.56mm Preliminary Design Review (PDR)	1	2022	1	2022
5.56mm User Assessment	1	2022	3	2022
5.56mm Critical Design Review (CDR)	4	2022	4	2022
5.56mm Development Test & Evaluation (DT&E)	4	2022	2	2023
5.56mm Production Qualification Testing (PQT)	4	2023	1	2024
5.56mm Live-Fire Test and Evaluation (LFT&E)	4	2023	1	2024
5.56mm Milestone C (MS-C)	4	2024	4	2024
.50 caliber Concept Design Evaluation	1	2020	3	2020

**Note**

As the technology matures, the One Way Luminescence (OWL) projects transitions from Budget Activity 4 (BA4) PE 0603639A, Project EB8 to Budget Activity 5 (BA5) PE 0604802A, Project EP4.

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army										<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition				<b>Project (Number/Name)</b> EB9 / Aviation Airborne Expandable Countermeasures			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
EB9: Aviation Airborne Expandable Countermeasures	-	8.500	2.471	3.186	-	3.186	4.500	6.060	0.000	0.000	0.000	24.717
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**A. Mission Description and Budget Item Justification**

This project supports the advanced development activities and technology demonstrations of the Aviation Airborne Expendable Countermeasure (AAECM). These advanced decoys are necessary to address emerging threats and capabilities deficiencies in Army aircraft protection and the safety of its aircrews against advanced Man-Portable Air Defense Systems (MANPADS) and shoulder launched Surface-to-Air Missiles (SAM) systems. These efforts will evaluate integrated technologies and countermeasure prototype systems in realistic operating test environments. Prototypes will help expedite technology transition from the laboratory to operational use by demonstrating component and subsystem maturity prior to integration into major and complex Army aircraft platforms. These expendable countermeasures systems are an essential part of survivability equipment for Army aircraft. Army RDT&E efforts are coordinated with the PEO Aviation and its platform PMs with PM Aircraft Survivability Equipment (ASE) to address emerging Joint Urgent Operational Need Statement (JUONS) CC-0558 Counter - Unmanned Aerial Systems (CUAS). Continue to develop and prepare documentation for Milestone A decision for the Radar Guided decoy. This decoy is designed to defeat specific threat types. Details of their operation is classified. Conduct initial developmental/operational testing on XM215 and RF Countermeasures (CM).

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

	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b>Title:</b> Expendable Countermeasures to Guided Missile Threats	8.500	2.392	3.186
<b>Description:</b> This program will develop expendable countermeasure (CM) decoys which will protect Army aircraft from surface-to-air missiles.			
<b>FY 2019 Plans:</b> Conduct demonstration efforts and flight testing on XM215 Countermeasures (CM) and Radio Frequency (RF) CM based on modeling and simulation efforts. Conduct flight testing for both XM215 and RF Passive countermeasure solutions.			
<b>FY 2020 Plans:</b> Conduct optimization for the XM215 during Technology Maturation & Risk Reduction (TMRR), System Requirements Review (SRR) and flight testing. Continue maturing prototype design and technology and Pre-Engineering and Manufacturing Development (EMD) review. Prepare Initial documentation to support Milestone B for RF Countermeasures. Conduct Pre-EMD review and Preliminary Design Review (PDR) for RF Countermeasures.			
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Funding is increasing commensurate with additional support and analysis required as the program progresses.			
<b>Title:</b> FY 2019 SBIR / STTR Transfer	-	0.079	-

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EB9 / <i>Aviation Airborne Expandable Countermeasures</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b><i>FY 2019 Plans:</i></b> FY 2019 SBIR / STTR Transfer			
<b><i>FY 2019 to FY 2020 Increase/Decrease Statement:</i></b> FY 2019 SBIR / STTR Transfer			
<b>Accomplishments/Planned Programs Subtotals</b>	8.500	2.471	3.186

<b>C. Other Program Funding Summary (\$ in Millions)</b>											
<u>Line Item</u>	<u>FY 2018</u>	<u>FY 2019</u>	<u>FY 2020</u> <u>Base</u>	<u>FY 2020</u> <u>OCO</u>	<u>FY 2020</u> <u>Total</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• EP7: <i>Aviation Airborne Expendable Countermeasures</i>	-	7.213	4.920	-	4.920	4.480	8.250	-	-	0.000	24.863

**Remarks**

**D. Acquisition Strategy**  
 A Technical Development Strategy (TDS) for the development and production of Flare, Aircraft: Countermeasure XM215 and Radar Frequency (RF) Decoys under the Aviation Airborne Expendable Countermeasure (AAECM) program for the United States (U.S.) Army will be used. Prototyping contracts will be awarded competitively under the Department of Defense (DoD) Ordnance Technology Consortium (DOTC) Section 845 Other Transaction Authority (OTA) contract mechanism.

**E. Performance Metrics**

N/A

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> EB9 / Aviation Airborne Expandable Countermeasures
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<b>Management Services (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Program Management	MIPR	PM Close Combat Systems : Picatinny Arsenal	0.455	-		-		-		-		-	0.000	0.455	-
<b>Subtotal</b>			0.455	-		-		-		-		-	0.000	0.455	N/A

<b>Product Development (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Prototype Development XM215 (1)	C/FFP	ACC : Picatinny Arsenal	2.046	0.592	Oct 2018	-		1.450	May 2020	-		1.450	0.000	4.088	-
Prototype Development XM215 (2)	C/FFP	ACC : Picatinny Arsenal	-	0.412	Oct 2018	-		-		-		-	0.000	0.412	-
Prototype Development XM215 (3)	C/FFP	ACC : Picatinny Arsenal	-	0.515	Aug 2018	-		-		-		-	0.000	0.515	-
Prototype Development XM215 (4)	C/FFP	ACC : Picatinny Arsenal	-	0.206	Oct 2018	-		-		-		-	0.000	0.206	-
Prototype Development XM215 (5)	C/FFP	ACC : Picatinny Arsenal	-	0.250	Jan 2019	-		-		-		-	0.000	0.250	-
Prototype Development RF	C/FFP	ACC : Picatinny Arsenal	-	0.773	Sep 2018	1.300	Jun 2019	-		-		-	0.000	2.073	-
FY 2019 SBIR / STTR Transfer	TBD	TBD : TBD	-	-		0.079		-		-		-	0.000	0.079	-
<b>Subtotal</b>			2.046	2.748		1.379		1.450		-		1.450	0.000	7.623	N/A

<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Engineering Support XM215	MIPR	ARDEC : Picatinny Arsenal	1.719	0.468	Sep 2018	-		0.280	Dec 2019	-		0.280	0.000	2.467	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army												Date: March 2019			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
2040 / 4				PE 0603639A / Tank and Medium Caliber Ammunition				EB9 / Aviation Airborne Expandable Countermeasures							
Support (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering Support RF	MIPR	ARDEC : Picatinny Arsenal	-	0.650	Sep 2018	-		0.456	Dec 2019	-		0.456	0.000	1.106	-
HILT T-SPIL	MIPR	TBB : China Lake CA	-	0.300		-		-		-		-	0.000	0.300	-
<b>Subtotal</b>			1.719	1.418		-		0.736		-		0.736	0.000	3.873	N/A
Test and Evaluation (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Flight Test and Evaluation XM215	MIPR	TBD : TBD	0.950	1.782	Feb 2019	1.092	Apr 2019	-		-		-	0.000	3.824	-
Modeling & Simulation	MIPR	ARDEC : Picatinny Arsenal	-	1.072	Jun 2018	-		-		-		-	0.000	1.072	-
AOA Development	MIPR	AMSAA : APG, MD	0.261	-		-		-		-		-	0.000	0.261	-
AOA Development	MIPR	TRAC : Ft Leavenworth, KS	0.550	-		-		-		-		-	0.000	0.550	-
Flight Test and Evaluation RF	MIPR	PAX River : PAX River	-	0.705	Jun 2018	-		1.000	Apr 2020	-		1.000	0.000	1.705	-
Modeling & Simulation RF	MIPR	AFRL : AFRL	-	0.550		-		-		-		-	0.000	0.550	-
Modeling & Simulation RF	MIPR	ARDEC : Picatinny Arsenal	-	0.225	Aug 2018	-		-		-		-	0.000	0.225	-
<b>Subtotal</b>			1.761	4.334		1.092		1.000		-		1.000	0.000	8.187	N/A
<b>Project Cost Totals</b>			5.981	8.500		2.471		3.186		-		3.186	0.000	20.138	N/A
<b>Remarks</b>															

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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>			<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EB9 / <i>Aviation Airborne Expandable Countermeasures</i>	

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024							
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
Matériel Development Documentation and Decision for XM215	■																															
Analysis of Alternatives	■																															
Demonstration Contract Preparation XM215				■																												
Milestone A XM215												▲ 2																				
Demonstration Down Select XM215												▲ 4																				
Prototyping XM215													■																			
Testing Efforts (Stability/Heat/Cold) XM 215													■																			
Flight Testing XM 215																																
Milestone B XM215																																
Demonstration Contract Preparation RF Countermeasure				■																												
Milestone A RF Countermeasure												▲ 3																				
Contract Award RF Countermeasure				▲ 1																												
Demonstrations RF Countermeasure												■																				



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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EB9 / <i>Aviation Airborne Expandable Countermeasures</i>

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Prototype Development RF Countermeasure																												
Flight Testing RF Countermeasure																												
Data Analysis RF Countermeasure																												
Milestone B RF Countermeasure																												

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EB9 / <i>Aviation Airborne Expandable Countermeasures</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Matériel Development Documentation and Decision for XM215 CM	2	2016	2	2018
Analysis of Alternatives	3	2017	3	2018
Demonstration Contract Preparation XM215	4	2018	4	2018
Milestone A XM215	1	2019	1	2019
Demonstration Down Select XM215	3	2019	3	2019
Prototyping XM215	1	2019	2	2020
Testing Efforts (Stability/Heat/Cold) XM 215	2	2019	4	2020
Flight Testing XM 215	3	2020	3	2020
Milestone B XM215	4	2020	4	2020
Demonstration Contract Preparation RF Countermeasure	4	2018	4	2018
Milestone A RF Countermeasure	1	2019	1	2019
Contract Award RF Countermeasure	1	2019	1	2019
Demonstrations RF Countermeasure	1	2019	2	2019
Prototype Development RF Countermeasure	3	2019	4	2019
Flight Testing RF Countermeasure	4	2019	4	2019
Data Analysis RF Countermeasure	4	2019	3	2020
Milestone B RF Countermeasure	3	2020	3	2020

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army										<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition				<b>Project (Number/Name)</b> EC2 / Adv Armor-Piercing (ADVAP) for Small Cal Ammo			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
EC2: Adv Armor-Piercing (ADVAP) for Small Cal Ammo	-	0.000	3.755	6.821	-	6.821	0.000	0.000	0.000	0.000	0.000	10.576
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**Note**

The small caliber Advanced Armor-Piercing (ADVAP) technology has been under development since 2015 and applies to multiple calibers of ammunition. In FY 2017, the funding transitioned from Budget Activity (BA) 04 Program Element (PE) 0603639A, Project EC2 to BA 05, PE 0604802A, Project EP5, Adv Armor-Piercing (ADVAP) for Small Cal Ammo to continue the development of ADVAP 7.62mm ammunition. A follow-on effort to support ADVAP ammunition calibers below 7.62mm commences in FY 2019 under the BA 4, PE 0603639A, Project EC2 Adv Armor-Piercing (ADVAP) Small Cal Ammo. In FY 2021, PE 0603639A, Project EC2, ADVAP will be re-aligned to PE 0604601 Project EV9 prior to the PB 2021 submission to continue development efforts on ADVAP ammunition in calibers below 7.62mm. The effort is not a new start.

**A. Mission Description and Budget Item Justification**

The Advanced Armor-Piercing (ADVAP) project is a critical technology development in response to the 7.62mm and 5.56mm Family of Ammunition Capabilities Development Documents (CDD) and the Soldier Lethality Cross Functional Team (SL CFT) Initial Capability Document (ICD) which outlines the requirements for new ammunition to support the rapid prototyping/development of the Next Generation Squad Weapons (NGSW) under Section 804 Authority. New ADVAP ammunition is designed to provide overmatch capability to defeat advanced light armored threats within typical machine gun engagement ranges. The nomenclature for the 7.62mm ADVAP is XM1158.

The Next Generation Squad Weapons (NGSW) ammunition has a similar objective to the 7.62mm ADVAP which is to defeat hard targets. The NSGW ammunition is split into two initial variants, the General Purpose (GP) and the Special Purpose (SP). The nomenclature for the GP ammunition is XM1186 and the nomenclature for the SP ammunition is XM1184. The overall objective of the ADVAP project is to develop and Full Materiel Release (FMR) both 7.62mm XM1158 cartridge for the M240 machine gun and ADVAP ammunition in calibers below 7.62mm.

FY 2020 funding supports continuing rapid prototyping/development of the Next Generation Squad Weapons (NGSW) Special Purpose (SP) projectile, building prototypes and maturing prototypes to provide to the weapon system contractors for performance evaluation, conducting a Critical Design Review (CDR), and conducting prototype testing. FY 2020 funding also supports conducting a Preliminary Design Review (PDR) for the SP projectile and performing activities to increase prototype capacity to support planned weapon system testing.

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

	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b>Title:</b> Small Caliber Ammunition Rapid Prototyping	-	3.634	6.821

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EC2 / <i>Adv Armor-Piercing (ADVAP) for Small Cal Ammo</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<p><b>Description:</b> Develop, demonstrate, and qualify small caliber ADVAP cartridges that can defeat threat targets and provide overmatch capability versus a broad spectrum of hard targets.</p> <p><b>FY 2019 Plans:</b> FY 2019 efforts will be focused on rapid prototyping/development of the General Purpose (GP) and Special Purpose (SP) projectile to include building and evaluating projectile prototypes to refine concepts and mature the Technology Readiness Level (TRL), conducting a GP Preliminary Design Review (PDR), and preparing for insertion into the rapid prototyping for the Next Generation Squad Weapon system development.</p> <p><b>FY 2020 Plans:</b> FY 2020 efforts are focused on continuing rapid prototyping/development of the SP projectile, building prototypes and maturing prototypes to provide to the weapon system contractors for performance evaluation, conducting a Critical Design Review (CDR), and conducting prototype testing. Also, conducting a Preliminary Design Review (PDR) for the SP projectile and performing activities to increase prototype capacity to support planned weapon system testing beginning in FY 2021 and FY 2022.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> FY 2019 to FY 2020 increase needed to fund planned rapid prototyping activities for both the GP and SP ammunition.</p>			
<p><b>Title:</b> FY 2019 SBIR / STTR Transfer</p> <p><b>FY 2019 Plans:</b> FY 2019 SBIR / STTR Transfer</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> FY 2019 SBIR / STTR Transfer</p>	-	0.121	-
<b>Accomplishments/Planned Programs Subtotals</b>	-	3.755	6.821

<b>C. Other Program Funding Summary (\$ in Millions)</b>											
<u>Line Item</u>	<u>FY 2018</u>	<u>FY 2019</u>	<u>FY 2020</u> <u>Base</u>	<u>FY 2020</u> <u>OCO</u>	<u>FY 2020</u> <u>Total</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• EP5: <i>Adv Armor-Piercing (ADVAP) for Small Caliber Ammo</i>	13.318	16.748	0.000	-	0.000	-	-	-	-	0.000	30.066
• FL4: <i>Small Caliber Ammo for Next Gen Squad Weapons</i>	-	-	22.880	-	22.880	30.630	28.750	25.000	11.750	0.000	119.010

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EC2 / <i>Adv Armor-Piercing (ADVAP) for Small Cal Ammo</i>

**C. Other Program Funding Summary (\$ in Millions)**

<u>Line Item</u>	<u>FY 2018</u>	<u>FY 2019</u>	<u>FY 2020</u> <u>Base</u>	<u>FY 2020</u> <u>OCO</u>	<u>FY 2020</u> <u>Total</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
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**Remarks**

These funding lines support Engineering & Manufacturing Development (EMD) activities for the 7.62mm ADVAP ammunition and rapid prototyping/development of General Purpose (GP) and Special Purpose (SP) ammunition for the Next Generation Squad Weapon (NGSW) systems. Other Program Funding in Budget Activity 05 (BA05) PE 0604802A, Project EP5 and Budget Activity 05 (BA05) PE 0604802A, Project FL4.

**D. Acquisition Strategy**

The ADVAP ammunition programs will use a Government developed design and manufacturing process. Multiple component contracts will be awarded to purchase raw materials and equipment. In FY 2016, the ADVAP effort accomplished design optimization, manufactured prototypes, and demonstrated TRL 6 for XM1158. Milestone (MS) B occurred in 1st Quarter FY 2017 leading to fabrication and testing of qualification hardware for the 7.62mm cartridge. Follow-on developmental efforts for the ADVAP ammunition calibers below 7.62mm will utilize rapid prototyping acquisition strategy under Section 804 Authority. The project will utilize Government developed projectile designs that will be delivered to development contractors as Government Furnished Material (GFM). The Government will select up to three contractors for the weapon system development and down-select to a single contractor in FY 2021, prior to production contract award.

**E. Performance Metrics**

N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army												Date: March 2019				
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)								
2040 / 4				PE 0603639A / Tank and Medium Caliber Ammunition				EC2 I Adv Armor-Piercing (ADVAP) for Small Cal Ammo								
Product Development (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total				
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract	
Program Manager Maneuver Ammunition Systems (PM MAS)	Various	Picatinny Arsenal : New Jersey	0.658	-		-		-		-		-	0.600	1.258	-	
Prototype Manufacturing	C/FFP	Jet Industrial : New Jersey	1.039	-		-		-		-		-	2.600	3.639	-	
Phase 1 Propellant Development	C/FFP	ATK : Virginia	0.141	-		-		-		-		-	0.000	0.141	-	
Projectile Development	Option/CPFF	Northrop Grumman Innovation Systems : Independence, MO	-	-		2.825	Jan 2019	3.200	Jan 2020	-		-	3.200	Continuing	Continuing	Continuing
FY 2019 SBIR / STTR Transfer	TBD	TBD : TBD	-	-		0.121		-		-		-	0.000	0.121	-	
<b>Subtotal</b>			1.838	-		2.946		3.200		-		-	3.200	Continuing	Continuing	N/A
Support (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total				
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract	
Armament Research Development and Engineering Center (ARDEC)	MIPR	Picatinny Arsenal : New Jersey	6.387	-		0.659	Oct 2018	1.921	Oct 2019	-		-	1.921	Continuing	Continuing	Continuing
Army Research Lab (ARL)	MIPR	Aberdeen : Maryland	1.000	-		-		1.000	Oct 2019	-		-	1.000	Continuing	Continuing	Continuing
<b>Subtotal</b>			7.387	-		0.659		2.921		-		-	2.921	Continuing	Continuing	N/A
Test and Evaluation (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total				
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract	
Army Research Lab (ARL)	MIPR	Aberdeen : Maryland	3.200	-		0.150	Oct 2018	0.500	Oct 2019	-		-	0.500	Continuing	Continuing	Continuing
U.S. Army Aberdeen Test Center	TBD	Aberdeen : Maryland	-	-		-		0.200	Oct 2019	-		-	0.200	Continuing	Continuing	Continuing



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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> EC2 / Adv Armor-Piercing (ADVAP) for Small Cal Ammo

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024							
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
NGSW Ammo Rapid Prototyping					NGSW Ammo RP																											
NGSW Ammo Initial Product Review 1 (IPR 1) Special Purpose									1 ▲ NGSW Ammo IPR 1 SP																							
NGSW Ammo Preliminary Design Review General Purpose (PDR-GP)									2 ▲ NGSW Ammo PDR-GP																							
NGSW Ammo Initial Product Review 2 (IPR 2) Special Purpose									3 ▲ NGSW Ammo IPR 2 SP																							
NGSW Ammo Preliminary Design Review Special Purpose (PDR-SP)													4 ▲ NGSW Ammo PDR-SP																			
NGSW Ammo Critical Design Review General Purpose (CDR-GP)																	5 ▲ NGSW Ammo CDR-GP															
NGSW Ammo Prototype Test 1																					6 ■ NGSW Ammo PT1											
NGSW Ammo Initial Product Review 3 (IPR 3) Special Purpose																	7 ▲ NGSW Ammo IPR 3 SP															
NGSW Ammo Full Materiel Release (FMR) Transitions from BA04 EC2 to BA05 FL4																					8 ▲ NGSW Ammo FMR BA04 to BA05 Transition											
NGSW Ammo Critical Design Review Special Purpose (CDR-SF)																	9 ■ NGSW Ammo CDR-SF															
NGSW Ammo Prototype Test 2																	10 ■ NGSW Ammo PT2															
NGSW Ammo Urgent Materiel Release General Purpose (UMR GP)																									9 ▲ NGSW Ammo UMR GP							
NGSW Ammo Urgent Materiel Release Special Purpose (UMR SP)																									10 ▲ NGSW Ammo UMR SP							



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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EC2 / <i>Adv Armor-Piercing (ADVAP) for Small Cal Ammo</i>

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024																											
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4																								
NGSW Ammo Rapid Fielding																																																				
NGSW Ammo Production Qualification Testing Special Purpose (PQT SP)																																																				
NGSW Ammo Full Materiel Release (FMR)																																																				

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EC2 / <i>Adv Armor-Piercing (ADVAP) for Small Cal Ammo</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
NGSW Ammo Rapid Prototyping	1	2019	2	2024
NGSW Ammo Initial Product Review 1 (IPR 1) Special Purpose	2	2019	2	2019
NGSW Ammo Preliminary Design Review General Purpose (PDR-GP)	3	2019	3	2019
NGSW Ammo Initial Product Review 2 (IPR 2) Special Purpose	4	2019	4	2019
NGSW Ammo Preliminary Design Review Special Purpose (PDR-SP)	2	2020	2	2020
NGSW Ammo Critical Design Review General Purpose (CDR-GP)	3	2020	3	2020
NGSW Ammo Prototype Test 1	3	2020	4	2020
NGSW Ammo Initial Product Review 3 (IPR 3) Special Purpose	4	2020	4	2020
NGSW Ammo Full Materiel Release (FMR) Transitions from BA04 EC2 to BA05 FL4	2	2021	2	2021
NGSW Ammo Critical Design Review Special Purpose (CDR-SP)	2	2021	2	2021
NGSW Ammo Prototype Test 2	2	2021	3	2021
NGSW Ammo Urgent Materiel Release General Purpose (UMR GP)	4	2022	4	2022
NGSW Ammo Urgent Materiel Release Special Purpose (UMR SP)	4	2022	4	2022
NGSW Ammo Rapid Fielding	4	2022	1	2026
NGSW Ammo Production Qualification Testing Special Purpose (PQT SP)	1	2023	2	2023
NGSW Ammo Full Materiel Release (FMR)	2	2024	2	2024

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army										<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition				<b>Project (Number/Name)</b> EC3 / Ammunition Logistics Prototyping			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
EC3: Ammunition Logistics Prototyping	-	1.677	1.313	1.525	-	1.525	1.715	2.170	1.800	1.836	0.000	12.036
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**A. Mission Description and Budget Item Justification**

This Project supports the future force by improving the distribution, management, reliability and survivability of ammunition through the advanced development, integration, and demonstration of logistics system enablers. These enablers will improve the efficiency and effectiveness of ammunition operations, to include retrograde, while reducing the logistics footprint on the battlefield. Technology areas addressed include handling, distribution, and management (strategic and tactical), prognostics, diagnostics, and asset visibility, explosives safety, and adaptive and environmentally friendly packaging and palletization. The efficient deployment and sustainment of reliable ammunition is vital to success on the battlefield. This Project enhances the operational effectiveness of the ammunition logistics system to ensure the distribution of reliable ammunition to the warfighter. FY 2020 funding will be used to complete verification testing and an operational demonstration for the environmental health monitoring system. FY 2020 funding will also be used to continue verification testing of a type two prototype next generation temperature/humidity sensor with batch interrogation and historical data retention capabilities, which will be used for assessing munitions reliability.

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

	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b>Title:</b> Munitions Health and Inventory Monitoring Systems	1.177	0.856	1.025
<b>Description:</b> Performance and reliability of certain munitions can be degraded by the environmental exposure history they experience during their lifetime. This Project will develop simple to complex environmental health and inventory monitoring systems to improve reliability and asset visibility and enable effective Condition Based Management for Ammunition.			
<b>FY 2019 Plans:</b> Complete verification testing and an operational demonstration for the environmental health monitoring system. Continue verification testing of a next generation temperature/humidity sensor with batch interrogation and historical data retention capabilities, which will be used for assessing munitions reliability.			
<b>FY 2020 Plans:</b> Conduct an extended operational demonstration of the environmental health monitoring system to enable condition based management of ammunition. Continue verification testing of a type II prototype next generation temperature/humidity sensor with batch interrogation and historical data retention capabilities for the assessment of munition reliability and complete an operational demonstration of the type I prototype. Complete operational demonstration of the low cost thermal indicator, which provides passive lifetime temperature exposure sensing.			
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EC3 / <i>Ammunition Logistics Prototyping</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
FY 2020 funding is slightly higher than FY 2019 due to an anticipated increase in labor and material costs.				
<p><b>Title:</b> Munitions Containerization Systems</p> <p><b>Description:</b> For each family of munitions containers, optimize prototype container systems for automation compatibility, combat unit load quantity, sustainability/recyclability, Insensitive Munitions/explosives safety, environmental protection, load reconfiguration, unitization, and standardized interfaces. This will improve ammunition distribution efficiency while minimizing environmental and operational impacts.</p> <p><b>FY 2019 Plans:</b> Perform design verification prototype testing and award contract to produce production representative polymer containers in preparation for qualification testing with 5.56 mm ammunition.</p> <p><b>FY 2020 Plans:</b> Perform qualification testing of production representative rectangular polymer container for family of 5.56 mm ammunition. Perform advanced development and prototype demonstration of the plastic cylindrical container in a realistic operating environment.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> FY 2020 funding is slightly higher than FY 2019 due to anticipated increases in labor and material costs.</p>		0.500	0.415	0.500
<p><b>Title:</b> FY2019 SBIR/STTR Transfer</p> <p><b>Description:</b> FY 2019 SBIR/STTR Transfer</p> <p><b>FY 2019 Plans:</b> FY 2019 SBIR/STTR Transfer</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> FY 2019 SBIR/STTR Transfer</p>		-	0.042	-
<b>Accomplishments/Planned Programs Subtotals</b>		1.677	1.313	1.525
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EC3 / <i>Ammunition Logistics Prototyping</i>

**D. Acquisition Strategy**

Munitions Health Monitoring and Munitions Containerization systems will be developed through government and industry prototype efforts. In FY 2020, a Technology Readiness Assessment will be conducted to measure the progress of the designs.

**E. Performance Metrics**

N/A

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> EC3 / Ammunition Logistics Prototyping
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<b>Product Development (\$ in Millions)</b>				<b>FY 2018</b>		<b>FY 2019</b>		<b>FY 2020 Base</b>		<b>FY 2020 OCO</b>		<b>FY 2020 Total</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</b>
<b>Cost Category Item</b>	<b>Contract Method &amp; Type</b>	<b>Performing Activity &amp; Location</b>	<b>Prior Years</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>			
Contract - Low Cost Thermal Indicator	C/FFP	Innosense : Torrance, CA	1.630	0.509		0.200		0.200	Dec 2019	-		0.200	0.000	2.539	-
Contract - RRAPDS	C/FFP	Phase IV : Boulder, CO	1.053	0.099	Sep 2018	0.400	Jun 2019	-		-		-	0.000	1.552	-
Contract-Plastic Cylindrical Container	C/FFP	SAVIT : Rockaway, NJ	0.550	0.097	Sep 2018	0.150		0.275	Mar 2020	-		0.275	0.000	1.072	-
Contract-Insensitive Munitions	C/TBD	TBD : TBD	0.576	-		-		-		-		-	0.000	0.576	-
Next Generation Temperature Humidity Indicator	C/FFP	AGM : Tuscon, AZ	0.200	0.206	May 2018	0.050		0.400	Dec 2019	-		0.400	0.000	0.856	-
<b>Subtotal</b>			4.009	0.911		0.800		0.875		-		0.875	0.000	6.595	N/A

<b>Support (\$ in Millions)</b>				<b>FY 2018</b>		<b>FY 2019</b>		<b>FY 2020 Base</b>		<b>FY 2020 OCO</b>		<b>FY 2020 Total</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</b>
<b>Cost Category Item</b>	<b>Contract Method &amp; Type</b>	<b>Performing Activity &amp; Location</b>	<b>Prior Years</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>			
ARDEC	MIPR	Picatinny Arsenal : NJ	2.827	0.766	May 2018	0.513	Dec 2018	0.400	Dec 2019	-		0.400	0.000	4.506	-
<b>Subtotal</b>			2.827	0.766		0.513		0.400		-		0.400	0.000	4.506	N/A

<b>Test and Evaluation (\$ in Millions)</b>				<b>FY 2018</b>		<b>FY 2019</b>		<b>FY 2020 Base</b>		<b>FY 2020 OCO</b>		<b>FY 2020 Total</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</b>
<b>Cost Category Item</b>	<b>Contract Method &amp; Type</b>	<b>Performing Activity &amp; Location</b>	<b>Prior Years</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>			
Yuma Proving Ground	MIPR	Yuma : AZ	0.086	-		-		-		-		-	0.000	0.086	-
Test and Eval	MIPR	TBD : TBD	0.150	-		-		0.250	Mar 2020	-		0.250	0.000	0.400	-
<b>Subtotal</b>			0.236	-		-		0.250		-		0.250	0.000	0.486	N/A



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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date: March 2019</b>
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> EC3 / Ammunition Logistics Prototyping

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Advanced Concept Development-Munitions Health Monitoring-1	RRAPDS-Phase 1																											
Advanced Concept Development-Munitions Health Monitoring-1A																									RRAPDS-Phase 2			
Advanced Concept Development-Munitions Health Monitoring-2	Low Cost Thermal Indicator																											
Advanced Concept Development-Munitions Containerization-1					Munitions Containerization-Plastic Cylindrical Container																							
Advanced Concept Development-Munitions Containerization-1A																					Munitions Containerization-Plastic Rectangular Container							
Advanced Concept Development-Munitions Health Monitoring-3	Next Generation Temperature/Humidity Sensor																											



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<b>Exhibit R-4A, RDT&amp;E Schedule Details: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EC3 / <i>Ammunition Logistics Prototyping</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Advanced Concept Development-Munitions Health Monitoring-1	2	2015	4	2020
Advanced Concept Development-Munitions Health Monitoring-1A	1	2021	4	2023
Advanced Concept Development-Munitions Health Monitoring-2	2	2015	4	2022
Advanced Concept Development-Munitions Containerization-1	4	2018	4	2021
Advanced Concept Development-Munitions Containerization-1A	1	2020	4	2021
Advanced Concept Development-Insensitive Munitions	1	2016	4	2017
Advanced Concept Development-Munitions Health Monitoring-3	3	2017	4	2023

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army										<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition				<b>Project (Number/Name)</b> EL7 / Reduced Range Ammunition			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
EL7: Reduced Range Ammunition	-	3.429	7.609	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	11.038
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**Note**

The small caliber Reduced Range Ammunition (RRA) technology applies to multiple calibers. As the technology matures in FY 2019, Program Element (PE) 0603639A, Project EL7, Reduced Range Ammunition for the 7.62mm variant transitions to PE 0604802A, Project EP3, Reduced Range Ammunition - Small Caliber. In FY 2020, the .50 Caliber variant will transition from PE 0603639A, Project EL7 to PE 0604802A, Project EP3.

**A. Mission Description and Budget Item Justification**

The small caliber Reduced Range Ammunition (RRA) project is a critical technology development in response to the 7.62mm and .50 caliber Capabilities Development Documents (CDD). The overall objective of RRA is to provide training ammunition suitable for use on military installations with Surface Danger Zone (SDZ) restrictions. The relatively long maximum range of the 7.62mm and .50 caliber service ammunition poses challenges on training ranges in range restricted areas. RRA will mitigate a training gap on installations by providing a materiel solution that meets training needs while shortening and condensing the SDZ. This will allow soldiers to train with 7.62mm and .50 caliber weapons on restricted ranges. The RRA cartridge design will be compatible with all Army 7.62mm and .50 caliber weapons but specifically optimized to work in the M240 and M2 Machine Guns. There is no funding requested in FY 2020.

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

	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b>Title:</b> Technology Maturation and Risk Reduction (TMRR)	3.429	7.331	-
<b>Description:</b> Develop, demonstrate, and qualify small caliber 7.62mm and .50 caliber ammunition that will provide a reduced range training capability to the M240 and M2 gunners.			
<b>FY 2019 Plans:</b> FY 2019 primary activities will focus on further assessment of .50 Cal prototypes including leveraging lessons learned from the USMC prototypes, Technology Readiness Level (TRL) 6 assessment, conducting System Readiness Review (SRR), preparation activities for Preliminary Design Review (PDR), preparing documentation for the .50 Milestone B, and preparing contract documentation for the Engineering and Manufacturing Development (EMD) contract.			
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Effort transitions from Program Element (PE) 0603639A, Project EL7 to PE 0604802A, Project EP3 in FY 2020.			
<b>Title:</b> FY 2019 SBIR / STTR Transfer	-	0.278	-
<b>FY 2019 Plans:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army	<b>Date:</b> March 2019
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<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EL7 / <i>Reduced Range Ammunition</i>
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
FY 2019 SBIR / STTR Transfer			
<b><i>FY 2019 to FY 2020 Increase/Decrease Statement:</i></b> FY 2019 SBIR / STTR Transfer			
<b>Accomplishments/Planned Programs Subtotals</b>	3.429	7.609	-

<b>C. Other Program Funding Summary (\$ in Millions)</b>											
<b>Line Item</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
• EP3: <i>Reduced Range Ammunition - Small Caliber</i>	-	2.470	8.376	-	8.376	15.000	15.250	13.200	-	0.000	54.296

**Remarks**  
The 7.62mm effort under Budget Activity 04 Element (PE) 0603639A, Project EL7, Reduced Range Ammunition (RRA), transitions in FY 2019 to Budget Activity 05 PE 0604802A, Project EP3. PE 0604802A, Project EP3, RRA funding continues the development work of 7.62mm and supports Engineering and Manufacturing Development (EMD) beginning in FY 2019. The funding line also continues development work on the .50 Caliber variant which transitions from PE 0603639A, Project EL7 to PE 0604802A, Project EP3 in FY 2020.

**D. Acquisition Strategy**  
After 7.62mm Milestone (MS) B in FY 2019, the Government intends to award Engineering and Manufacturing Development (EMD) contracts. The Government will then award a competitive contract for 7.62mm Pre-Production Qualification Testing (PPQT) hardware in FY 2020 and down-select to a single contractor to complete EMD. The .50 Caliber program follows a similar strategy. After .50 Caliber Reduced Range Ammunition (RRA) MS B in FY 2020, the Government intends to award a competitive EMD contract.

**E. Performance Metrics**  
N/A

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> EL7 / Reduced Range Ammunition
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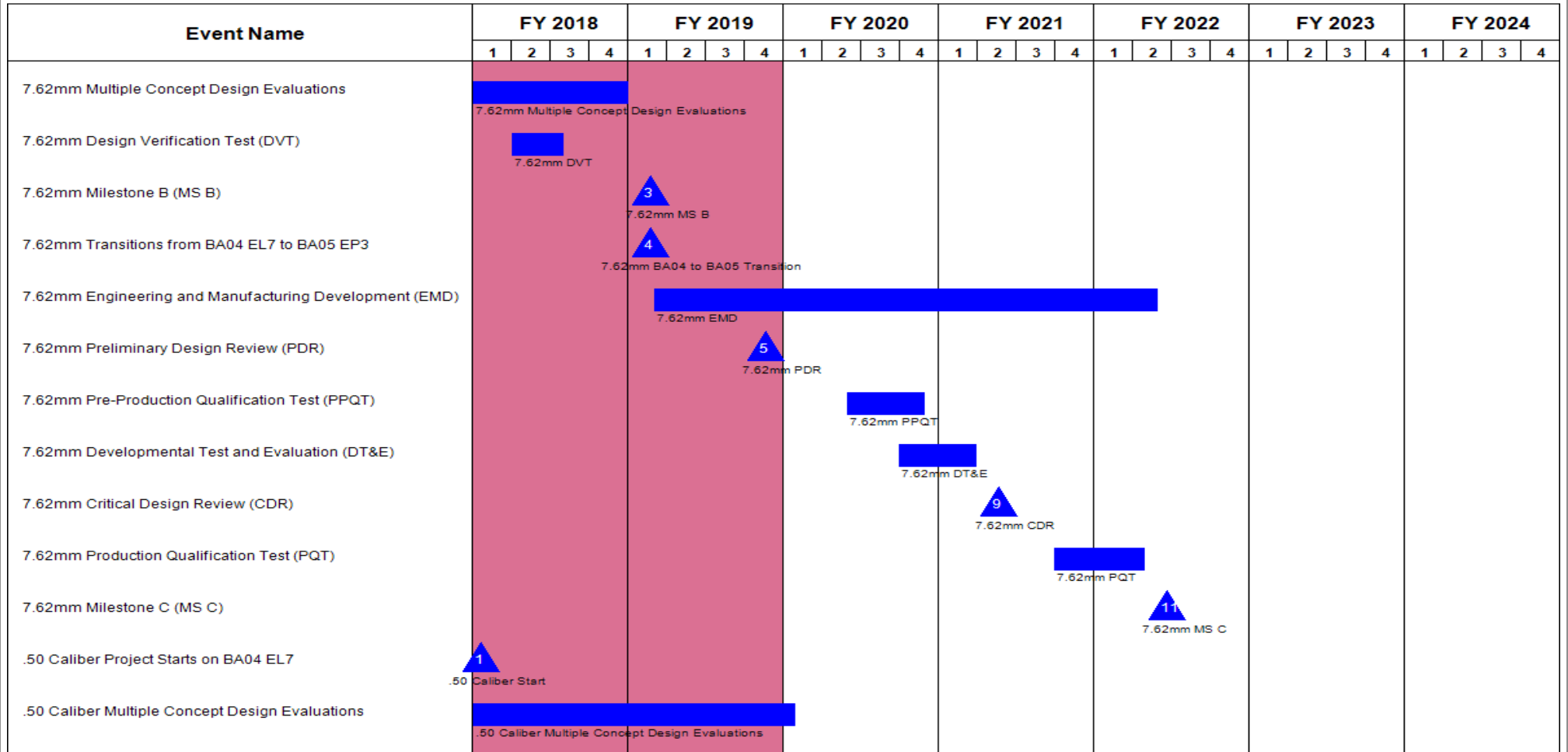
<b>Product Development (\$ in Millions)</b>				<b>FY 2018</b>		<b>FY 2019</b>		<b>FY 2020 Base</b>		<b>FY 2020 OCO</b>		<b>FY 2020 Total</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</b>
<b>Cost Category Item</b>	<b>Contract Method &amp; Type</b>	<b>Performing Activity &amp; Location</b>	<b>Prior Years</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>			
Program Manager Maneuver Ammunition Systems (PM MAS)	Various	Picatinny Arsenal : New Jersey	0.060	0.160	Oct 2017	-		-		-		-	0.000	0.220	-
Prototype	C/FFP	PTI : Clifton, NJ	0.157	-		-		-		-		-	0.000	0.157	-
Hardware	C/Various	Armament Research, Development and Engineering Center (ARDEC) : Picatinny Arsenal, New Jersey	0.112	-		-		-		-		-	0.000	0.112	-
Prototype Development	Option/ FFP	Booz Allen Hamilton : Dover, NJ	-	0.312	Dec 2017	-		-		-		-	0.000	0.312	-
Development Contract # 1	C/FFP	To Be Determined : To Be Determined	-	-		1.500	Jan 2019	-		-		-	0.000	1.500	-
Development Contract # 2	C/FFP	To Be Determined : To Be Determined	-	-		1.500	Jan 2019	-		-		-	0.000	1.500	-
Development Contract # 3	C/FFP	To Be Determined : To Be Determined	-	-		1.500	Jan 2019	-		-		-	0.000	1.500	-
FY 2019 SBIR / STTR Transfer	TBD	TBD : TBD	-	-		0.278		-		-		-	0.000	0.278	-
<b>Subtotal</b>			0.329	0.472		4.778		-		-		-	0.000	5.579	N/A

<b>Support (\$ in Millions)</b>				<b>FY 2018</b>		<b>FY 2019</b>		<b>FY 2020 Base</b>		<b>FY 2020 OCO</b>		<b>FY 2020 Total</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</b>
<b>Cost Category Item</b>	<b>Contract Method &amp; Type</b>	<b>Performing Activity &amp; Location</b>	<b>Prior Years</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>			
Armament Research Development and Engineering Center (ARDEC)	MIPR	Picatinny Arsenal : New Jersey	0.666	2.467	Oct 2017	1.631	Oct 2018	-		-		-	0.000	4.764	-
Army Research Lab (ARL)	MIPR	Aberdeen Proving Ground : Maryland	0.180	0.250	Mar 2018	0.800	Oct 2018	-		-		-	0.000	1.230	-
<b>Subtotal</b>			0.846	2.717		2.431		-		-		-	0.000	5.994	N/A



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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EL7 / <i>Reduced Range Ammunition</i>



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<b>Exhibit R-4, RDT&amp;E Schedule Profile:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> EL7 / Reduced Range Ammunition

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
.50 Caliber Materiel Development Decision (MDD)	▲ 2																											
.50 Caliber Design Verification Test (DVT)					■																							
.50 Caliber Milestone B (MS B)									▲ 6																			
.50 Caliber Transitions from BA04 EL7 to BA05 EP3									▲ 7																			
.50 Caliber Engineering and Manufacturing Development (EMD)									■																			
.50 Caliber Preliminary Design Review (PDR)													▲ 8															
.50 Caliber Pre-Production Qualification Test (PPQT)													■															
.50 Caliber Critical Design Review (CDR)																	▲ 10											
.50 Caliber Production Qualification Test (PQT)																					■							
.50 Caliber Milestone C (MS C)																									▲ 12			

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EL7 / <i>Reduced Range Ammunition</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
7.62mm Multiple Concept Design Evaluations	1	2017	4	2018
7.62mm Design Verification Test (DVT)	2	2018	3	2018
7.62mm Milestone B (MS B)	1	2019	1	2019
7.62mm Transitions from BA04 EL7 to BA05 EP3	1	2019	1	2019
7.62mm Engineering and Manufacturing Development (EMD)	1	2019	2	2022
7.62mm Preliminary Design Review (PDR)	4	2019	4	2019
7.62mm Pre-Production Qualification Test (PPQT)	2	2020	4	2020
7.62mm Developmental Test and Evaluation (DT&E)	4	2020	1	2021
7.62mm Critical Design Review (CDR)	2	2021	2	2021
7.62mm Production Qualification Test (PQT)	4	2021	2	2022
7.62mm Milestone C (MS C)	2	2022	2	2022
.50 Caliber Project Starts on BA04 EL7	1	2018	1	2018
.50 Caliber Multiple Concept Design Evaluations	1	2018	1	2020
.50 Caliber Materiel Development Decision (MDD)	2	2018	2	2018
.50 Caliber Design Verification Test (DVT)	2	2019	3	2019
.50 Caliber Milestone B (MS B)	1	2020	1	2020
.50 Caliber Transitions from BA04 EL7 to BA05 EP3	1	2020	1	2020
.50 Caliber Engineering and Manufacturing Development (EMD)	1	2020	2	2023
.50 Caliber Preliminary Design Review (PDR)	4	2020	4	2020
.50 Caliber Pre-Production Qualification Test (PPQT)	4	2020	2	2021
.50 Caliber Critical Design Review (CDR)	4	2021	4	2021
.50 Caliber Production Qualification Test (PQT)	1	2022	3	2022



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**Exhibit R-4A, RDT&E Schedule Details:** PB 2020 Army **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EL7 / <i>Reduced Range Ammunition</i>
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Events	Start		End	
	Quarter	Year	Quarter	Year
.50 Caliber Milestone C (MS C)	2	2023	2	2023

**Note**

As the technology matures, the Reduced Range Ammunition (RRA) projects transition from Budget Activity 04 (BA04) PE 0603639A, Project EL7 to Budget Activity 05 (BA05) PE 0604802A, Project EP3.

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**Exhibit R-2A, RDT&E Project Justification:** PB 2020 Army **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> EL8 / LIGHTWEIGHT CARTRIDGE CASE FOR SMALL CALIBER
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COST (\$ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
EL8: LIGHTWEIGHT CARTRIDGE CASE FOR SMALL CALIBER	-	2.870	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.870
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**Note**

The Lightweight Small Caliber Ammunition (LSCA) cartridge case technology will be applied to multiple calibers. The project involves developing and qualifying lightweight cartridge case, starting with 7.62mm ammunition, to replace current brass cartridge case. In FY 2019, Program Element (PE) 0603639A, Project EL8, Lightweight Cartridge Case for Small Caliber transitions to PE 0607131A, Project ER6, Direct Fire Technology.

**A. Mission Description and Budget Item Justification**

The Lightweight Small Caliber Ammunition (LSCA) Project is a critical technology development in response to the 7.62mm Capabilities Development Documents (CDD). The goal of the LSCA Project is to reduce the total Soldier load through reduction in ammunition weight. The LSCA Project will develop and field 7.62mm LSCA cartridges that will provide the same capabilities as the M80A1 and M62A1 cartridges. The LSCA cartridge will be designed to be compatible with all Army 7.62mm weapon systems, but optimized to work in the M240 Machine Gun. No funding requested in FY 2020.

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

	FY 2018	FY 2019	FY 2020
<b>Title:</b> 7.62mm Technology Maturation & Risk Reduction (TMRR) for Lightweight Small Caliber Ammunition (LSCA)	2.870	-	-
<b>Description:</b> Develop, demonstrate, and qualify a Lightweight Small Caliber Ammunition (LSCA) 7.62mm capability that will provide 10 to 50% ammunition weight savings.			
<b>Accomplishments/Planned Programs Subtotals</b>	2.870	-	-

**C. Other Program Funding Summary (\$ in Millions)**

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• ER6: Direct Fire Technology	8.354	12.591	8.525	-	8.525	5.729	6.592	6.413	2.989	Continuing	Continuing

**Remarks**

The funding lines continue work on the 7.62mm ammunition which transitions to Budget Activity 07, Program Element 0607131A, Project ER6, Direct Fire Technology in FY 2019.

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Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 4	R-1 Program Element (Number/Name) PE 0603639A / Tank and Medium Caliber Ammunition	Project (Number/Name) EL8 / LIGHTWEIGHT CARTRIDGE CASE FOR SMALL CALIBER

**D. Acquisition Strategy**

Multiphase development contracts. Phase I and Phase II include development and evaluation of multiple designs/concepts. The Government intends to down-select to one design for Phase III in FY 2019 to manufacture test hardware to support Validation Testing planned for FY 2020. Low Rate Initial Production award will occur in FY 2021.

**E. Performance Metrics**

N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army												Date: March 2019			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
2040 / 4				PE 0603639A / Tank and Medium Caliber Ammunition				EL8 / LIGHTWEIGHT CARTRIDGE CASE FOR SMALL CALIBER							
Product Development (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Manager Maneuver Ammunition Systems (PM MAS)	Various	Picatinny Arsenal : New Jersey	0.251	0.230	Oct 2017	-		-		-		-	0.000	0.481	Continuing
Lightweight Case Phase 1 Development Contract	C/FFP	Orbital ATK : Missouri	0.636	-		-		-		-		-	0.000	0.636	Continuing
Lightweight Case Phase 2 Development Contract	C/CPFF	PCP Ammunition : Vero Beach, FL	-	0.685	Sep 2018	-		-		-		-	0.000	0.685	Continuing
Research	MIPR	United States Military Academy : New York	0.150	-		-		-		-		-	0.000	0.150	Continuing
Phase 2 Case Development	C/FP	Nammo Talley : Mesa, Arizona	0.783	-		-		-		-		-	0.000	0.783	Continuing
Modeling & Simulation	Option/CPFF	Concurrent Technologies Corporation (CTC) : New Jersey	0.261	0.180	Apr 2018	-		-		-		-	0.000	0.441	Continuing
Lightweight Case Manufacturing Evaluation	SS/FP	Orbital ATK : Plymouth, Minnesota	0.316	-		-		-		-		-	0.000	0.316	Continuing
Lightweight case manufacturing evaluation	SS/FFP	Northrop Grumman Innovation Systems : Independence, MO	-	0.016	Feb 2018	-		-		-		-	0.000	0.016	Continuing
Lightweight ammunition links development	Option/CPFF	Northrop Grumman Innovation Systems : Independence, MO	-	0.309	Sep 2018	-		-		-		-	0.000	0.309	Continuing
<b>Subtotal</b>			2.397	1.420		-		-		-		-	0.000	3.817	N/A
Support (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Armament Research Development and Engineering Center (ARDEC)	MIPR	Picatinny Arsenal : New Jersey	0.660	1.375	Oct 2017	-		-		-		-	0.000	2.035	Continuing

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army												Date: March 2019			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
2040 / 4				PE 0603639A / Tank and Medium Caliber Ammunition				EL8 / LIGHTWEIGHT CARTRIDGE CASE FOR SMALL CALIBER							
Support (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
<b>Subtotal</b>			0.660	1.375		-		-		-		-	0.000	2.035	N/A
Test and Evaluation (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
US Army Aberdeen Test Center (ATC)	MIPR	Aberdeen Proving Ground : Maryland	0.039	-		-		-		-		-	0.000	0.039	Continuing
Temperature testing	MIPR	Armament Research Development and Engineering Center : New Jersey	0.010	-		-		-		-		-	0.000	0.010	Continuing
Army Joint Munitions Command Testing	MIPR	Army Joint Munitions Command : Illinois	-	0.075	Jun 2018	-		-		-		-	0.000	0.075	Continuing
<b>Subtotal</b>			0.049	0.075		-		-		-		-	0.000	0.124	N/A
<b>Project Cost Totals</b>			3.106	2.870		0.000		-		-		-	0.000	5.976	N/A
<b>Remarks</b>															

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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> EL8 / LIGHTWEIGHT CARTRIDGE CASE FOR SMALL CALIBER

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
7.62mm Phase II	[Redacted]				[Redacted]																							
7.62mm Systems Requirement Review (SRR)	1				2																							
7.62mm Lightweight Ammo Transitions from BA04 EL8 to BA07 ER6					3																							
Down Select to 7.62mm Phase III					4																							
7.62mm Phase III					[Redacted]																							
7.62mm Preliminary Design Review (PDR)					5																							
7.62mm Preliminary Validation Testing									6																			
7.62mm Critical Design Review (CDR)									7																			
7.62mm Validation Testing													8															
7.62mm Limited User Evaluation (LUE)													9															
7.62mm Engineering Change Proposal																	10											
7.62mm Low Rate Initial Production (LRIP) Award																					11							

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EL8 / <i>LIGHTWEIGHT CARTRIDGE CASE FOR SMALL CALIBER</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
7.62mm Source Selection Evaluation	2	2017	4	2017
7.62mm Phase II	4	2017	4	2018
7.62mm Systems Requirement Review (SRR)	1	2018	1	2018
7.62mm Lightweight Ammo Transitions from BA04 EL8 to BA07 ER6	1	2019	1	2019
Down Select to 7.62mm Phase III	1	2019	1	2019
7.62mm Phase III	1	2019	2	2021
7.62mm Preliminary Design Review (PDR)	2	2019	2	2019
7.62mm Preliminary Validation Testing	4	2019	1	2020
7.62mm Critical Design Review (CDR)	3	2020	3	2020
7.62mm Validation Testing	1	2021	3	2021
7.62mm Limited User Evaluation (LUE)	1	2021	2	2021
7.62mm Engineering Change Proposal	3	2021	3	2021
7.62mm Low Rate Initial Production (LRIP) Award	4	2021	4	2021

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army										<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition				<b>Project (Number/Name)</b> EU3 / .50 Caliber All-Purpose Tactical Cartridge (APTC)			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
EU3: .50 Caliber All-Purpose Tactical Cartridge (APTC)	-	0.000	0.000	4.250	-	4.250	0.000	0.000	0.000	0.000	0.000	4.250
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**Note**

The small caliber All-Purpose Tactical Cartridge (APTC) Project is a new start in FY 2020. In FY 2021, the project will transition to Budget Activity 05 (BA05) Program Element (PE) 0604802A, Project EU5, .50 Caliber All-Purpose Tactical Cartridge (APTC) to continue development work and support Engineering and Manufacturing Development (EMD).

**A. Mission Description and Budget Item Justification**

The All-Purpose Tactical Cartridge (APTC) project is a critical technology development in response to the .50 caliber Munitions Capabilities Development Documents (CDD). The overall objective of All-Purpose Tactical Cartridge is to deliver a single round that replaces and improves current legacy .50 caliber ammunition. The All-Purpose Tactical Cartridge will be compatible with all Army .50 caliber weapons but specifically optimized to work in the M2 Machine Guns. FY 2020 funding supports Technology Maturation and Risk Reduction (TMRR) in preparation for a Technology Readiness Level (TRL) 6, conducting a Materiel Development Decision (MDD), and conducting Design Verification Tests.

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

	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b>Title:</b> Technology Maturation and Risk Reduction (TMRR)	-	-	4.250
<b>Description:</b> Develop, demonstrate, and qualify new .50 Caliber ammunition to replace and/or improve current legacy .50 Caliber variants.			
<b>FY 2020 Plans:</b> Build, evaluate, and refine .50 Caliber APTC concepts/prototypes and perform Milestone B preparation activities. Evaluate M8 Armor Piercing Incendiary (API), M20 API Trace, M903 Saboted Light Armor Penetrator (SLAP), and M962 SLAP Trace ammunition for improvements that would satisfy the .50 APTC requirement.			
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Project is a new start beginning in FY 2020.			
<b>Accomplishments/Planned Programs Subtotals</b>	-	-	4.250



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EU3 / <i>.50 Caliber All-Purpose Tactical Cartridge (APTC)</i>

**C. Other Program Funding Summary (\$ in Millions)**

<u>Line Item</u>	<u>FY 2018</u>	<u>FY 2019</u>	<u>FY 2020</u>			<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• EU5: <i>.50 Caliber All-Purpose Tactical cartridge (APTC)</i>	-	-	0.000	-	0.000	8.500	9.400	-	-	0.000	17.900

**Remarks**

The effort under Budget Activity 04, Program Element (PE) 0603639A, Project EU3, .50 Caliber APTC, transitions in FY 2021 to Budget Activity 05, PE 0604802A, Project EU5. PE 0604802A, Project EU5 .50 Caliber APTC. Funding continues the development work and supports Engineering and Manufacturing Development (EMD) beginning in FY 2021.

**D. Acquisition Strategy**

Evaluate competing concepts/prototypes from contractors and Government. In FY 2021, the Government intends to down-select to two competing contractors to begin Engineering and Manufacturing Development (EMD). In FY 2022, the Government intends to down-select to a single EMD contractor to complete final qualification and testing in preparation for the transition to production in FY 2023.

**E. Performance Metrics**

N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army												Date: March 2019			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
2040 / 4				PE 0603639A / Tank and Medium Caliber Ammunition				EU3 / .50 Caliber All-Purpose Tactical Cartridge (APTC)							
<b>Product Development (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Prototype Development	C/CPPF	To be Determined : To be Determined	-	-		-		2.500	Jan 2020	-		2.500	Continuing	Continuing	Continuing
<b>Subtotal</b>			-	-		-		2.500		-		2.500	Continuing	Continuing	N/A
<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Armament Research Development and Engineering Center	MIPR	Armament Research Development and Engineering Center (ARDEC) : New Jersey	-	-		-		1.000	Oct 2019	-		1.000	Continuing	Continuing	Continuing
<b>Subtotal</b>			-	-		-		1.000		-		1.000	Continuing	Continuing	N/A
<b>Test and Evaluation (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Verification Testing	MIPR	Army Research Lab (ARL) : Maryland	-	-		-		0.750	Jan 2020	-		0.750	Continuing	Continuing	Continuing
<b>Subtotal</b>			-	-		-		0.750		-		0.750	Continuing	Continuing	N/A
<b>Project Cost Totals</b>			-	-		0.000		4.250		-		4.250	Continuing	Continuing	N/A
<b>Remarks</b>															

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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> EU3 / .50 Caliber All-Purpose Tactical Cartridge (APTC)

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024								
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4					
APTC Materiel Development Decision (MDD)									▲ 1 APTC MDD																								
APTC Advanced Concept Development																	■ APTC Advanced Concept Development																
APTC Prototype Development & Evaluation																	■ APTC Prototype Development & Evaluation																
APTC Design Verification Test (DVT) 1																	■ APTC DVT 1																
APTC Preliminary Design Review (PDR)																	▲ 2 APTC PDR																
APTC Milestone B																	▲ 3 APTC MS B																
APTC Transitions from BA04 EU3 to BA05 EU5																	▲ 4 APTC BA04 to BA05 Transition																
APTC Engineering & Manufacturing Development (EMD)																	■ APTC EMD																
APTC Pre-Production Qualification Testing (PPQT)																	■ APTC PPQT																
APTC Critical Design Review (CDR)																	▲ 5 APTC CDR																
APTC Design Verification Test (DVT) 2																	■ APTC DVT 2																
APTC Production Qualification Testing (PQT)																	■ APTC PQT																
APTC Milestone C (MS C)																	▲ 6 APTC MS C																

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> EU3 / <i>.50 Caliber All-Purpose Tactical Cartridge (APTC)</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
APTC Materiel Development Decision (MDD)	1	2020	1	2020
APTC Advanced Concept Development	1	2020	1	2021
APTC Prototype Development & Evaluation	1	2020	1	2021
APTC Design Verification Test (DVT) 1	2	2020	3	2020
APTC Preliminary Design Review (PDR)	4	2020	4	2020
APTC Milestone B	1	2021	1	2021
APTC Transitions from BA04 EU3 to BA05 EU5	1	2021	1	2021
APTC Engineering & Manufacturing Development (EMD)	2	2021	4	2022
APTC Pre-Production Qualification Testing (PPQT)	4	2021	4	2021
APTC Critical Design Review (CDR)	2	2022	2	2022
APTC Design Verification Test (DVT) 2	2	2021	3	2021
APTC Production Qualification Testing (PQT)	3	2022	4	2022
APTC Milestone C (MS C)	1	2023	1	2023

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army										<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition				<b>Project (Number/Name)</b> FA5 / Assured Precision Weapons and Munitions			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
FA5: Assured Precision Weapons and Munitions	-	12.480	14.322	31.267	-	31.267	29.907	31.000	31.000	25.000	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**A. Mission Description and Budget Item Justification**

The Assured Precision Weapons and Munitions (APWM) -FA5 Project is focused on advanced risk mitigation, technology integration, prototyping, and product support to identify, evaluate, mature, test, and demonstrate various assured precision prototype technologies in weapon and munitions components and subsystems within a complex system of systems environment. The Assured Precision Weapons and Munitions Project reinforces the National Defense Strategy's major lines of effort through technology development and prototyping that increase lethality and ensure future combat overmatch success of the Joint Force against peer/near-peer adversaries as well as improving program performance and affordability for multiple weapons and munitions Programs of Record (PoRs) via Joint Lethality Positioning, Navigation and Timing (PNT) and Army M-Code GPS coordinated efforts. The Assured Precision Weapons and Munitions Project directly supports Army Modernization Priorities in support of the National Defense Strategy. Funding will support engagement by Weapons and Munitions PNT experts in the development, evaluation, and technology delivery activities of the Air Force's M-Code GPS and Army's Assured PNT programs. Funding will also enable component and subsystem architecture input essential for precision weapons and munitions operating in a system-of-systems environment, Army M-Code GPS technology integration and evaluation, and maturation of alternative positioning, navigation and timing related technologies to enable informed Assured PNT related program of record milestone and Army cross-functional modernization decisions.

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

	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b>Title:</b> Assured Precision Weapons and Munitions Integrated Product Support - Joint Lethality PNT SME WIPT & Program Management	2.380	2.255	3.574
<b>Description:</b> Provide assured precision weapons and munitions technical subject matter expertise and support to the Joint oversight board for assured precision weapons and munitions. Provide overall APWM Project Program Management support.			
<b>FY 2019 Plans:</b> The subject matter experts will continue coordinating with and supporting the development and technology delivery activities of the Air Force's Military GPS User Equipment (MGUE) Program and the Army's Assured Positioning, Navigation and Timing (A-PNT) program including participation in design reviews, evaluation and formal feedback on technology and systems requirements and performance, component and subsystem architecture input essential for precision weapons and munitions operating in a system-of-systems environment, and configuration management of the evolving Joint Common GPS Specification and Interface Control Document for Precision Guided Munitions (PGMs). Specific support focus includes requirements for Military GPS User Equipment (MGUE) Increment 2 (aka Next Generation) and alternative Positioning, Navigation and Timing (PNT) technology maturity.			
<b>FY 2020 Plans:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> FA5 / <i>Assured Precision Weapons and Munitions</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<p>The subject matter experts will continue coordinating with and supporting the development and technology delivery activities of the Air Force's Military GPS User Equipment (MGUE) program and the Army's Assured Positioning, Navigation and Timing (PNT) program including participation in design reviews, evaluation and formal feedback on technology and systems requirements and performance, component and subsystem architecture input essential for precision weapons and munitions operating in a system-of-systems environment, and configuration management of the evolving Joint Common GPS Specification and Interface Control Document for Precision Guided Munitions (PGMs). Specific support focus includes requirements for Military GPS User Equipment (MGUE) Increment 2 and alternative Positioning, Navigation and Timing (PNT) technology maturity.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Increase is due to scope of work and ramp up of Military GPS User Equipment (MGUE) Increment 2 and alternative PNT related equities affecting the lethality community. Additional subject matter support (SME) support is required to initialize the framework and requirements for development of these Assured Positioning, Navigation and Timing (A-PNT) technologies to be demonstrated within Lethality Programs of Record (PoRs). Additional program management support required to manage increased project scope and funding starting in FY 2020.</p>				
<p><b>Title:</b> Assured PNT related Integration Risk Mitigation - Implement Zero-Age-of-Data (ZAOD)</p> <p><b>Description:</b> Mature and test Zero-Age-of-Data (ZAOD) for improved measurement accuracy of Network Assisted GPS data provided to Users.</p>		0.500	-	-
<p><b>Title:</b> Assured PNT related Integration Risk Mitigation - A-PNT for Family of Scatterable Mines (FASCAM) Replacement</p> <p><b>Description:</b> Evaluate, mature and test Assured-Position, Navigation, and Timing (A-PNT) system/subsystem components for terrain shaping enabling technologies.</p> <p><b>FY 2019 Plans:</b> Initiate analysis and evaluation of various assured precision prototype technologies for future terrain shaping enabling technologies to support the program of record in their Analysis of Alternatives (AoA).</p> <p><b>FY 2020 Plans:</b> Down-select assured precision technologies including alternative Positioning, Navigation and Timing (PNT) technologies for future terrain shaping Program of Record (PoR) communication capabilities through modeling and simulation based verification to initiate corresponding technology demonstrations.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b></p>		-	0.767	2.081

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> FA5 / <i>Assured Precision Weapons and Munitions</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
Additional funding is required to support increasing level of work involved in evaluating and maturing Assured Positioning, Navigation and Timing (A-PNT) technologies for down selection.				
<p><b>Title:</b> Assured PNT related Integration Risk Mitigation - Network Assisted A-PNT (NA2) for Weapons &amp; Munitions Phase 1</p> <p><b>Description:</b> Evaluate, mature and demonstrate technologies for modifying Network Assisted GPS (NA GPS) and associated data exchange that support Alternative Positioning, Navigation and Timing (PNT) and M-Code for Weapons and Munitions.</p> <p><b>FY 2019 Plans:</b> Software development and test for an initial updated Network Assisted GPS prototype that incorporates Alternative Positioning, Navigation and Timing (PNT) and M-Code in Phase 1.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Decrease due to Phase 1 of Network Assisted Assured-PNT (NA2) for Weapons and Munitions will be completed and technologies down selected for future implementation in Phase 2 upgrades.</p>		4.200	6.300	-
<p><b>Title:</b> Assured PNT related Integration Risk Mitigation - NA2 for Weapons and Munitions Phase 2</p> <p><b>Description:</b> Perform Network Assisted Assured-PNT (NA2) systems of systems capability integration and pre-system qualification integration risk reduction activities. Improve initial prototype NA2 capability and initiate improved prototype for subsequent transition to corresponding program of records. Inform future Navigational Warfare (NAVWAR) and alternative Positioning, Navigation and Timing (PNT) related weapons and munitions platform dependencies.</p> <p><b>FY 2020 Plans:</b> Include down-selected alternative Positioning, Navigation and Timing (PNT) technologies from initial Network Assisted Assured-PNT phase 1 prototype into improved phase 2 Network Assisted Assured-PNT system of system prototype solution. Perform Network Assisted Assured-PNT systems of systems capability integration and pre-system qualification integration risk reduction activities and finalize prototype software solutions.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Phase 2 of Network Assisted Assured-PNT for Weapons and Munitions begins in FY 2020 and will take two years. This effort builds upon the results and technology down-selects of Network Assisted Assured-PNT Phase 1.</p>		-	-	5.672
<p><b>Title:</b> Assured PNT related Integration Risk Mitigation - NA2 for Guided Rocket/Missile Launcher Systems</p> <p><b>Description:</b> Perform software development and prototyping activities to demonstrate Network Assisted Assured-PNT capability for Rocket/Missile artillery launcher systems. Integrate and demonstrate upgraded artillery launcher system into the Network Assisted Assured-PNT systems of systems networked capability to reduce subsequent program of record fielding risks.</p>		-	-	3.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> FA5 / <i>Assured Precision Weapons and Munitions</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<p><b><i>FY 2020 Plans:</i></b> Conduct requirements refinement activities and initiate software development and prototyping activities to provide initial Network Assisted Assured-PNT (NA2) capability for Rocket/Missile artillery launcher systems. Initiate prototyping risk mitigation activities for Rocket/Missile artillery launcher systems.</p> <p><b><i>FY 2019 to FY 2020 Increase/Decrease Statement:</i></b> Effort starts in FY 2020 and will take two years. Effort leverages results of Network Assisted Assured-PNT (NA2) Phase 1.</p>				
<p><b><i>Title:</i></b> Assured PNT related Weapons &amp; Munitions Prototyping - A-PNT upgrades for PGM Fuze Setter</p> <p><b><i>Description:</i></b> Develop, prototype, and evaluate required emerging Assured-PNT technology enhancements to the Precision Guided Munition (PGM) Fuze Setter needed to enable continued performance Precision Guided Munitions in a realistic operational threat environment.</p> <p><b><i>FY 2019 Plans:</i></b> Software development, integration and test for an upgraded Precision Guided Munition (PGM) Fuze Setter incorporates M-Code to enable continued performance of Precision Guided Munitions in a threat environment. Program transitions to program of record in FY 2020.</p> <p><b><i>FY 2019 to FY 2020 Increase/Decrease Statement:</i></b> Prototyping effort will be completed. Program transitions to program of record in FY 2020.</p>		3.500	2.137	-
<p><b><i>Title:</i></b> Assured PNT related Weapons &amp; Munitions Prototyping - A-PNT upgrades for Towed Howitzer Platforms</p> <p><b><i>Description:</i></b> Prototype and evaluate Military GPS User Equipment (MGUE) Increment 1 (M-Code) GPS receiver cards in the M777A2 and M119A3 Towed Howitzer Platforms and evaluate technologies for providing Assured-PNT to Precision Guided Munitions.</p> <p><b><i>FY 2019 Plans:</i></b> Update GPS receiver interfaces on fire platforms, integrate and test prototype Military GPS User Equipment (MGUE) Inc 1 cards interoperability, and assess corresponding performance impacts.</p> <p><b><i>FY 2019 to FY 2020 Increase/Decrease Statement:</i></b> Demonstration of prototype Military GPS User Equipment (MGUE) Inc 1 cards in Towed Howitzer Platforms will be completed.</p>		1.100	0.472	-
<p><b><i>Title:</i></b> Assured PNT related Weapons &amp; Munitions Prototyping - Alternative Navigation Technologies (AltNav) Phase 1</p> <p><b><i>Description:</i></b> Develop, prototype, and evaluate non-Global Positioning System Radio Frequency (Non-GPS RF) Navigation prototype systems for indirect fires, including Long Range Precision Fires.</p>		0.800	1.866	-



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> FA5 / <i>Assured Precision Weapons and Munitions</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<p><b>FY 2019 Plans:</b> Prototyping and evaluation of non-Global Positioning System Radio Frequency (Non-GPS RF) Navigation prototype systems in a modeling and simulation environment that can meet current navigation and timing requirements without access to GPS or in a GPS degraded environment.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Initial Phase 1 demonstrations of non-Global Positioning System Radio Frequency (Non-GPS RF) in modeling and simulation environment will be completed.</p>				
<p><b>Title:</b> Assured PNT related Weapons &amp; Munitions Prototyping - AltNav Technologies (AltNav) Phase 2</p> <p><b>Description:</b> Design and develop a prototype Alternative Navigation (AltNav) hardware and software capability for precision guided munition applications. Demonstrate and conduct performance assessments of potential hardware and software solutions to support Artillery integration efforts as well as inform future Space-based PNT related alternatives for the Land Combat domain.</p> <p><b>FY 2020 Plans:</b> Design and develop an Alternative Navigation (AltNav) capable hardware and software prototype for Precision Guided Munition (PGM) applications to demonstrate and quantify AltNav performance. Perform integration efforts with the hardware and software prototype to conduct a ride-along performance evaluation of AltNav in a PGM environment.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> AltNav Phase 2 begins in FY20 will take two years. This prototyping effort builds upon the modeling and simulation results of AltNav Phase 1.</p>		-	-	5.140
<p><b>Title:</b> Assured PNT related Weapons &amp; Munitions Prototyping - Location Azimuth Determinations System (LADS)</p> <p><b>Description:</b> Development and integration of prototype LADS to demonstrate an assured weapon survey capability within the M777A2 and M119A3 Howitzer Platforms.</p> <p><b>FY 2020 Plans:</b> Development and integration of prototype LADS into the M777A2 and M119A3 Howitzer Platforms.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> This effort begins in FY20.</p>		-	-	1.400
<p><b>Title:</b> Army M-Code Technology Integration and Evaluation</p> <p><b>Description:</b> Provide technical assessment, coordination, and engineering support related to the development, prototyping, integration, and evaluation of Air Force's Military GPS User Equipment (MGUE) technology deliverables across all Army</p>		-	-	9.200

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> FA5 / <i>Assured Precision Weapons and Munitions</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<p>Weapons and Munitions, including participation in design reviews, testing, evaluation, and formal feedback on technology, component-level, card-level, sub-system-level, and systems-level requirements and performance. Reduce risk, support, and inform M-Code GPS related Army cross-functional modernization decisions for weapons and munitions operating in a peer/near threat system-of-systems environment as well as identifying complementary PNT solutions when M-Code GPS is not solely sufficient to enable Combat Overmatch.</p> <p><b>FY 2020 Plans:</b> Establish an Army M-Code GPS Weapons and Munitions Integrated Product Team (IPT). Initiate the definition, documentation, and representation of requirement and performance based needs for Army Weapons and Munitions to influence the Air Force's Military GPS User Equipment (MGUE) technology investments, including low power and high performance cross-functional Land Combat applications. Establish a centralized Army evaluation and experimentation mechanism to assess the effectiveness of M-Code GPS focused weapon and munition platform capabilities operating in a peer/near PNT threat system-of-systems environment.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> This effort begins in FY20.</p>				
<p><b>Title:</b> MGUE Inc 2 with PGK AJ</p> <p><b>Description:</b> Influence next generation Military GPS User Equipment (MGUE) development to ensure precision guided munition needs and requirements are met with the Air Force's next generation MGUE. Integrate and test next generation MGUE into the Precision Guidance Kit - Anti Jam (PGK-AJ) to verify and validate needs and requirements are met by next generation MGUE.</p> <p><b>FY 2020 Plans:</b> Finalize next generation Precision Guided Munition (PGM) Military GPS User Equipment (MGUE) technical requirements document for use by the MGUE program. Attend technical interchange meetings with MGUE vendors to influence MGUE designs to meet Precision Guided Munitions needs and requirements for next generation performance. Perform risk reduction analysis and activities of MGUE vendor designs.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> This effort is a new start in FY 2020. FY 2020 is the fiscal year in which the Military GPS User Equipment (MGUE) developers will start significant design work to meet the requirements of the MGUE Precision Guided Munitions (PGM) technical requirements document.</p>		-	-	1.200
<p><b>Title:</b> FY 2019 SBIR/STTR Transfer</p> <p><b>Description:</b> FY 2019 SBIR/STTR Transfer</p>		-	0.525	-

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army	<b>Date:</b> March 2019
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<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> FA5 / <i>Assured Precision Weapons and Munitions</i>
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b><i>FY 2019 Plans:</i></b> FY 2019 SBIR/STTR Transfer			
<b><i>FY 2019 to FY 2020 Increase/Decrease Statement:</i></b> FY 2019 SBIR/STTR Transfer			
<b>Accomplishments/Planned Programs Subtotals</b>	12.480	14.322	31.267

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

Acquisition Strategy: The Assured Precision Weapons and Munitions Project will utilize a combination of the Defense Ordnance Technology Consortium (DOTC) Section 845 Other Transaction Authority (OTA) contract mechanism and In-House government development and engineering capabilities to obtain prototypes and demonstrate/evaluate the maturity and integration risk of the M-Code GPS on Precision Munitions and Weapons as well as other alternative PNT related capabilities.

**E. Performance Metrics**

N/A

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> FA5 / Assured Precision Weapons and Munitions
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<b>Product Development (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
PGM MGUE AS Risk Reduction	MIPR	DoD Ordnance Technology Consortium (DOTC) - TBD, Various : Various	7.785	-		-		-		-		-	0.000	7.785	-
Assured PNT related Weapons Integration Risk Mitigation	MIPR	DoD Ordnance Technology Consortium (DOTC) - TBD, Various : Various	-	3.265	Dec 2017	3.585	Dec 2018	4.453	Dec 2019	-		4.453	Continuing	Continuing	Continuing
Assured PNT related Weapons Integration Prototyping	MIPR	DoD Ordnance Technology Consortium (DOTC) - TBD, Various : Various	-	2.000	Dec 2017	2.000	Dec 2018	1.400	Dec 2019	-		1.400	Continuing	Continuing	Continuing
Assured PNT related Munitions Integration Risk Mitigation	MIPR	DoD Ordnance Technology Consortium (DOTC) - TBD, Various : Various	-	2.500	Dec 2017	2.500	Dec 2018	4.700	Dec 2019	-		4.700	Continuing	Continuing	Continuing
Assured PNT related Munitions Integration Prototyping	MIPR	DoD Ordnance Technology Consortium (DOTC) - TBD, Various : Various	-	2.000	Dec 2017	2.000	Dec 2018	4.740	Dec 2019	-		4.740	Continuing	Continuing	Continuing
Army M-Code Technology Integration and Evaluation	MIPR	Various : Various	-	-		-		6.650	Dec 2019	-		6.650	Continuing	Continuing	Continuing
<b>Subtotal</b>			7.785	9.765		10.085		21.943		-		21.943	Continuing	Continuing	N/A

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> FA5 / Assured Precision Weapons and Munitions
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<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Program Management	Various	Joint Program Executive Office Armaments and Ammunition (JPEO A&A) : Picatinny Arsenal, NJ	0.508	0.505	Dec 2017	1.180	Dec 2018	1.269	Dec 2019	-		1.269	Continuing	Continuing	Continuing
Assured Precision Weapons and Munitions IPT Support	MIPR	Various : Various	1.106	1.755	Dec 2017	1.075	Dec 2018	2.305	Dec 2019	-		2.305	Continuing	Continuing	Continuing
Assured Technologies Engineering Support	MIPR	Armament Research, Development and Engineering Center (ARDEC) : Picatinny Arsenal, NJ	0.380	0.455	Dec 2017	0.657	Dec 2018	1.200	Dec 2019	-		1.200	Continuing	Continuing	Continuing
Assured Technologies Engineering Support	MIPR	Communication Electronics Research, Development and Engineering Center (CERDEC) : Aberdeen Proving Ground, MD	-	-		0.800	Dec 2018	0.800	Dec 2019	-		0.800	Continuing	Continuing	Continuing
Army M-Code Technology Integration and Evaluation Support	MIPR	Various : Various	-	-		-		2.550	Dec 2019	-		2.550	Continuing	Continuing	Continuing
MGUE Inc 2 for PGK AJ Engineering Support	MIPR	Armament Research, Development and Engineering Center (ARDEC) : Picatinny Arsenal, NJ	-	-		-		1.200	Dec 2019	-		1.200	Continuing	Continuing	Continuing
FY 2019 SBIR/STTR Transfer	Various	Various : Various	-	-		0.525		-		-		-	Continuing	Continuing	Continuing
<b>Subtotal</b>			1.994	2.715		4.237		9.324		-		9.324	Continuing	Continuing	N/A

**Remarks**  
Program Management support increases by \$0.614 million due to increased project scope in FY 2020. Support consists of travel and other non-labor costs.



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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> FA5 / <i>Assured Precision Weapons and Munitions</i>

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Integrated Product Support - Joint Lethality PNT SME WIPT & Pr	[Redacted]																											
Integration Risk Mitigation - Implement Zero-Age-of-Data (ZAOD	[Redacted]				[Redacted]																							
Integration Risk Mitigation - Family of Scatterable Mines (FASCAM) Replacement	[Redacted]				[Redacted]				[Redacted]																			
Integration Risk Mitigation - NA2 for Weapons & Munitions Phas	[Redacted]				[Redacted]				[Redacted]																			
Integration Risk Mitigation - NA2 for Weapons & Munitions Phase 2	[Redacted]				[Redacted]				[Redacted]				[Redacted]															
Integration Risk Mitigation - NA2 for Rocket/Missile Launcher	[Redacted]				[Redacted]				[Redacted]				[Redacted]															
Integration Risk Mitigation - Fire System-of-Systems APNT related C2 & AS	[Redacted]				[Redacted]				[Redacted]				[Redacted]				[Redacted]											
Integration Risk Mitigation - Next Generation PNT Technologies Phase 1	[Redacted]				[Redacted]				[Redacted]				[Redacted]				[Redacted]				[Redacted]				[Redacted]			
Weapons & Munitions Prototyping - APNT upgrades for PGM Fu	[Redacted]				[Redacted]				[Redacted]				[Redacted]															
Weapons & Munitions Prototyping - APNT upgrades for Towed H	[Redacted]				[Redacted]				[Redacted]				[Redacted]															
Weapons & Munitions Prototyping - Alternative Navigation Techn	[Redacted]				[Redacted]				[Redacted]				[Redacted]															
Weapons & Munitions Prototyping - Alternative Navigation Technologies Phase 2	[Redacted]				[Redacted]				[Redacted]				[Redacted]				[Redacted]											
Weapons & Munitions Prototyping - Location Azimuth Determinations System (LADS)	[Redacted]				[Redacted]				[Redacted]				[Redacted]															

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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> FA5 / <i>Assured Precision Weapons and Munitions</i>

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Weapons & Munitions Prototyping - Next Generation PNT Technologies Phase 1																												
Army M-Code Technology Integration and Evaluation																												
MGUE INC 2 for PGK AJ																												



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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> FA5 / <i>Assured Precision Weapons and Munitions</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Integrated Product Support - Joint Lethality PNT SME WIPT & Program Management	1	2017	4	2028
Integration Risk Mitigation - Implement Zero-Age-of-Data (ZAOD)	1	2018	4	2018
Integration Risk Mitigation - Family of Scatterable Mines (FASCAM) Replacement	1	2019	4	2020
Integration Risk Mitigation - NA2 for Weapons & Munitions Phase 1	1	2018	4	2019
Integration Risk Mitigation - NA2 for Weapons & Munitions Phase 2	1	2020	4	2021
Integration Risk Mitigation - NA2 for Rocket/Missile Launcher	1	2020	4	2021
Integration Risk Mitigation - Fire System-of-Systems APNT related C2 & AS	1	2021	4	2022
Integration Risk Mitigation - Next Generation PNT Technologies Phase 1	1	2023	4	2024
Weapons & Munitions Prototyping - APNT upgrades for PGM Fuze Setter	1	2018	4	2019
Weapons & Munitions Prototyping - APNT upgrades for Towed Howitzer Platforms	1	2018	4	2019
Weapons & Munitions Prototyping - Alternative Navigation Technologies Phase 1	1	2018	4	2019
Weapons & Munitions Prototyping - Alternative Navigation Technologies Phase 2	1	2020	4	2021
Weapons & Munitions Prototyping - Location Azimuth Determinations System (LADS)	1	2020	4	2020
Weapons & Munitions Prototyping - Next Generation PNT Technologies Phase 1	1	2022	4	2023
Army M-Code Technology Integration and Evaluation	1	2020	4	2028
MGUE INC 2 for PGK AJ	1	2020	4	2027

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army										<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition				<b>Project (Number/Name)</b> FG1 / Cannon-Delivered Area Effects Munitions (C-DAEM)			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
FG1: Cannon-Delivered Area Effects Munitions (C-DAEM)	-	0.960	4.941	25.897	-	25.897	14.826	19.765	22.724	24.500	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**Note**

FY 2020 funding increase supports the Army's modernization priorities and development efforts to replace the current 155mm Dual Purpose Improved Conventional Munitions (DPICM) stockpile with DoD policy compliant munitions in support of the National Defense Strategy.

**A. Mission Description and Budget Item Justification**

The Cannon-Delivered Area Effects Munitions (C-DAEM) Project is a two increment approach to provide U.S. ground forces with the capability to engage area personnel through armored targets, while denying threat forces full operational freedom within the targeted area. An Analysis of Alternatives (AoA) was completed in January 2018. The purpose of the C-DAEM AoA was to inform acquisition and investment decisions by the Army regarding replacement of the current stockpile of 155mm Dual Purpose Improved Conventional Munitions (DPICM) with DoD policy compliant munitions and address anti-armor and extended range capability requirements identified in the C-DAEM Initial Capabilities Document (ICD). The Army validated a two increment solution for C-DAEM. Increment I will destroy infantry fighting vehicles, self-propelled howitzers, and tanks. Increment II will destroy personnel, materiel, air defense artillery and rocket launchers. Increment I and II will be developed simultaneously. FY 2020 resources will fund the competitive demonstrations for Increment I, as well as early detailed design testing supporting the qualification of Increment II to support the Army's modernization priorities in support of the National Defense Strategy.

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

	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b>Title:</b> C-DAEM Analysis of Alternatives (AoA), Capability Development Document (CDD), & Milestone A Support	0.960	1.960	-
<b>Description:</b> The purpose of the C-DAEM Alternatives of Analysis (AoA) was to inform acquisition and investment decisions by Army leadership to replace the current stockpile of 155mm Dual Purpose Improved Conventional Munitions (DPICM) with Department of Defense policy compliant munitions and address anti-armor and extended range capability requirements identified in the C-DAEM Initial Capabilities Document (ICD).			
<b>FY 2019 Plans:</b> FY 2019 supports the preparation and release of a Request for Proposals (RFP) for technologies and capabilities identified through the Analysis of Alternatives (AoA), as well as the development of the Capabilities Development Document (CDD) for each technology.			
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> FG1 / <i>Cannon-Delivered Area Effects Munitions (C-DAEM)</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
Decrease in funding due to achieved knowledge points of research and development efforts in support of C-DAEM Increments I and II.				
<p><b>Title:</b> C-DAEM Increment I</p> <p><b>Description:</b> C-DAEM Increment I will destroy infantry fighting vehicles, self-propelled howitzers, and tanks.</p> <p><b>FY 2020 Plans:</b> FY 2020 will support a competitive demonstration phase to identify the most promising candidate(s) that address medium to heavy armored targets.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Increase in funding in FY 2020 is based on the AoA and C-DAEM strategy per the April 2018 AROC decision for a two increment solution.</p>		-	-	17.000
<p><b>Title:</b> C-DAEM Increment II</p> <p><b>Description:</b> C-DAEM Increment II will destroy personnel, materiel, air defense artillery and rocket launchers.</p> <p><b>FY 2019 Plans:</b> FY2019 funds will be used to purchase prototypes to support Increment II TMRR phase testing.</p> <p><b>FY 2020 Plans:</b> FY 2020 funds will support the early design testing of candidates the Alternative of Analysis (AoA) had recommended addressing the personnel to medium armored target set.</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Increase in funding to cover Increment II prototype hardware and design testing.</p>		-	2.800	8.897
<p><b>Title:</b> FY 2019 SBIR / STTR Transfer</p> <p><b>FY 2019 Plans:</b> FY 2019 SBIR / STTR Transfer</p> <p><b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> FY 2019 SBIR / STTR Transfer</p>		-	0.181	-
<b>Accomplishments/Planned Programs Subtotals</b>		0.960	4.941	25.897
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> FG1 / <i>Cannon-Delivered Area Effects Munitions (C-DAEM)</i>
<b>C. Other Program Funding Summary (\$ in Millions)</b>		
<b>Remarks</b> In FY 2021, this Project will transition to Budget Activity 05, PE 0604802A Project FJ4, Cannon-Delivered Area Effects Munitions (C-DAEM). A Procurement Ammunition, Army C-DAEM funding line will be established in FY 2023.		
<b>D. Acquisition Strategy</b> C-DAEM will employ an evolutionary acquisition approach to efficiently transition the unique ammunition products as they become available. The Analysis of Alternatives (AoA) completed on 31 January 2018 qualified a dramatic enhancement of operational Fires effectiveness, efficiency, and maneuver support when cannon artillery was equipped with a dedicated extended range, anti-armor projectile. In FY 2019, C-DAEM is reducing risk by beginning prototype testing and evaluation in parallel to decomposing the AoA results into selection criteria. C-DAEM will use the selection criteria to sponsor a competitive demonstration for this first increment (medium to heavy armor) to streamline the acquisition process by leveraging Section 815 of the National Defense Authorization Act (NDAA) for FY 2016. C-DAEM will use the Defense Ordnance Technology Consortium (DOTC) Other Transaction Agreement (OTA) to commission the demonstration phase in FY 2020. For following increments to address personnel to medium armored targets, C-DAEM will use DOTC OTA to execute risk reduction testing in FY 2020 in parallel to the Increment I demonstrations. C-DAEM will then be in position to proceed to qualification testing of the next promising candidates to update plans for the next capability.		
<b>E. Performance Metrics</b> N/A		

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> FG1 / Cannon-Delivered Area Effects Munitions (C-DAEM)
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<b>Management Services (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Program Management	Various	Office of the Project Manager (PM) Combat Ammunition Systems (CAS) : Picatinny Arsenal, NJ	-	0.410	May 2018	0.935	Nov 2018	0.935	Nov 2019	-		0.935	Continuing	Continuing	Continuing
<b>Subtotal</b>			-	0.410		0.935		0.935		-		0.935	Continuing	Continuing	N/A

**Remarks**  
Program Management includes C-DAEM travel and milestone documentation support.

<b>Product Development (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Increment I TMRR Phase	MIPR	DoD Ordnance Technology Consortium (DOTC) : TBD	-	-		-		17.000	Dec 2019	-		17.000	Continuing	Continuing	Continuing
Increment II Prototype Hardware	MIPR	DoD Ordnance Technology Consortium (DOTC) : TBD	-	-		2.400	Feb 2019	4.164	Dec 2019	-		4.164	Continuing	Continuing	Continuing
FY 2019 SBIR / STTR Transfer	TBD	TBD : TBD	-	-		0.181		-		-		-	0.000	0.181	-
<b>Subtotal</b>			-	-		2.581		21.164		-		21.164	Continuing	Continuing	N/A

<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Engineering Support	MIPR	Armament Research Development Engineering Center	-	0.550	May 2018	1.025	Nov 2018	1.798	Oct 2019	-		1.798	Continuing	Continuing	Continuing

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> FG1 / Cannon-Delivered Area Effects Munitions (C-DAEM)
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<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
		(ARDEC) : Picatinny Arsenal, NJ													
<b>Subtotal</b>			-	0.550		1.025		1.798		-		1.798	Continuing	Continuing	N/A

**Remarks**  
Additional Engineering Support required in FY 2020 in support of Increment I competitive demonstration and Increment II prototyping and design testing efforts.

<b>Test and Evaluation (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Increment II Testing	MIPR	Army Test & Evaluation Command (ATEC) : Yuma, AZ	-	-		0.400	Feb 2019	2.000	Mar 2020	-		2.000	Continuing	Continuing	Continuing
<b>Subtotal</b>			-	-		0.400		2.000		-		2.000	Continuing	Continuing	N/A

	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract	
<b>Project Cost Totals</b>		-	0.960	4.941	25.897	-	25.897	Continuing	Continuing	N/A

**Remarks**  
Increment I will destroy infantry fighting vehicles, self-propelled howitzers, and tanks.  
Increment II will destroy personnel, materiel, air defense artillery and rocket launchers.

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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> FG1 / <i>Cannon-Delivered Area Effects Munitions (C-DAEM)</i>

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
Increment I Milestone A					▲ 1 MS-A																								
Increment I TMRR Competitive Demonstration / EMD									TMRR / EMD																				
Increment I Preliminary Design Review (PDR)													▲ 2 PDR																
Increment I Milestone B																	▲ 5 MS-B												
Increment I Critical Design Review (CDR)																					▲ 7 CDR								
Increment I Milestone C																									▲ 9 MS-C				
Increment II Prototyping									Prototyping																				
Increment II Early Design Testing and Live Fire Demonstration													Early Design Testing and Live Fire Demonstration																
Increment II Preliminary Design Review (PDR)													▲ 3 PDR																
Increment II Milestone B																	▲ 4 MS-B												
Increment II Production Qualification Testing (PQT)																	PQT												
Increment II Critical Design Review (CDR)																					▲ 6 CDR								
Increment II Milestone C																									▲ 8 MS-C				

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> FG1 / <i>Cannon-Delivered Area Effects Munitions (C-DAEM)</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Increment I Milestone A	1	2019	1	2019
Increment I TMRR Competitive Demonstration / EMD	1	2019	3	2024
Increment I Preliminary Design Review (PDR)	4	2020	4	2020
Increment I Milestone B	4	2021	4	2021
Increment I Critical Design Review (CDR)	2	2022	2	2022
Increment I Milestone C	4	2024	4	2024
Increment II Prototyping	2	2019	4	2019
Increment II Early Design Testing and Live Fire Demonstration	4	2019	4	2020
Increment II Preliminary Design Review (PDR)	4	2020	4	2020
Increment II Milestone B	1	2021	1	2021
Increment II Production Qualification Testing (PQT)	1	2021	1	2024
Increment II Critical Design Review (CDR)	2	2022	2	2022
Increment II Milestone C	2	2024	2	2024

**Note**

C-DAEM Increments I and II will be pursued simultaneously. Increment I will destroy infantry fighting vehicles, self-propelled howitzers, and tanks. Increment II will destroy personnel, materiel, air defense artillery and rocket launchers.



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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army										<b>Date:</b> March 2019		
<b>Appropriation/Budget Activity</b> 2040 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition				<b>Project (Number/Name)</b> XT5 / 30mm Anti-Personnel and Counter UAS			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020 Base</b>	<b>FY 2020 OCO</b>	<b>FY 2020 Total</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
XT5: 30mm Anti-Personnel and Counter UAS	-	2.475	3.854	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	6.329
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**A. Mission Description and Budget Item Justification**

Lightweight 30x113mm (LW30) Airburst is a new capability identified as a Warfighter requirement in the Capability Production Document (CPD), AH-64E Helicopter, Increment 1, Version 6. The LW30 airburst cartridge improves the ability of the warfighter to effectively engage anti-personnel/materiel targets due to increased lethality. Airburst capability provides the user with a much higher probability of achieving a first burst kill against enemy personnel targets in the open. The LW30 will retain its dual purpose warhead, allowing it to continue to defeat light armored threats through point detonation. The cartridge provides increased lethal effects against personnel and soft-skin vehicular targets increasing Soldier Survivability on the ground during troops in contact engagements and decreases the required number of rounds to reach the desired lethal effects. There is no funding requested in FY 2020.

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

	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>
<b>Title:</b> Technology Maturation and Risk Reduction (TMRR)	2.475	3.730	-
<b>Description:</b> Demonstrating Technology Readiness Level 6 and achieving pre-Milestone (MS) B approval.			
<b>FY 2019 Plans:</b> FY 2019 activities include continuing activities to reduce risk and mature technology with a goal of a Technology Readiness Level 6 demonstration of the ability to select airburst or point detonating (PD) functionality when fired from a M230 ground mounted weapon system. Vendors will continue to develop the critical technologies to be designed and tested at the sub-system level for integration into the M789 round. The main effort in FY 2019 will focus on ammunition and system integration which will culminate with the demonstration of a proximity airburst round fired from a ground mounted weapon.			
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> Decrease in funding due to completion of Technology Maturation and Risk Reduction project in FY 2019.			
<b>Title:</b> FY 2019 SBIR / STTR Transfer	-	0.124	-
<b>FY 2019 Plans:</b> FY 2019 SBIR / STTR Transfer			
<b>FY 2019 to FY 2020 Increase/Decrease Statement:</b> FY 2019 SBIR / STTR Transfer			
<b>Accomplishments/Planned Programs Subtotals</b>	2.475	3.854	-

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> XT5 / <i>30mm Anti-Personnel and Counter UAS</i>

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

The development of the Lightweight 30mm (LW30, 30mmx113mm) Airburst cartridge during the Technology Maturation and Risk Reduction (TMRR) phase will occur via an Other Transaction Authority (OTA) award and a Technology Readiness Level (TRL) 6. The TMRR effort will consist of critical technology prototyping, testing, and demonstrating in the relevant environment.

**E. Performance Metrics**

N/A

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army** **Date:** March 2019

<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / Tank and Medium Caliber Ammunition	<b>Project (Number/Name)</b> XT5 / 30mm Anti-Personnel and Counter UAS
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<b>Product Development (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
30mm Prototype Design	C/CPFF	General Dynamics : Marion, IL	-	2.475	Jul 2018	2.630	Jan 2019	-		-		-	0.000	5.105	-
FY 2019 SBIR / STTR Transfer	TBD	TBD : TBD	-	-		0.124		-		-		-	0.000	0.124	-
<b>Subtotal</b>			-	2.475		2.754		-		-		-	0.000	5.229	N/A

<b>Support (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Armament Research, Development, and Engineering Center (ARDEC)	MIPR	Armament Research Development and Engineering Center (ARDEC) : Picatinny, NJ	-	-		0.350	Dec 2018	-		-		-	0.000	0.350	-
<b>Subtotal</b>			-	-		0.350		-		-		-	0.000	0.350	N/A




<b>Test and Evaluation (\$ in Millions)</b>				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Test Readiness Level 6 (TRL6) Demonstration	MIPR	Aberdeen Test Center (ATC) : Aberdeen, MD	-	-		0.750	Aug 2019	-		-		-	0.000	0.750	-
<b>Subtotal</b>			-	-		0.750		-		-		-	0.000	0.750	N/A

			Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
<b>Project Cost Totals</b>			-	2.475	3.854	-	-	-	0.000	6.329	N/A

**Remarks**

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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2020 Army</b>		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> XT5 / <i>30mm Anti-Personnel and Counter UAS</i>

Event Name	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Technology Maturation and Risk Reduction (TMRR)	TMRR																											
Contract Award					 Contract Award																							
30mm Prototype Development					 30mm Prototype Development																							
Technology Readiness Level (TRL) 6 Demonstration									 TRL6 Demo																			

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2020 Army		<b>Date:</b> March 2019
<b>Appropriation/Budget Activity</b> 2040 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603639A / <i>Tank and Medium Caliber Ammunition</i>	<b>Project (Number/Name)</b> XT5 / <i>30mm Anti-Personnel and Counter UAS</i>

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Technology Maturation and Risk Reduction (TMRR)	1	2018	4	2019
Contract Award	4	2018	4	2018
30mm Prototype Development	4	2018	4	2019
Technology Readiness Level (TRL) 6 Demonstration	4	2019	4	2019