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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Army											Date: February 2020	
Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army / BA 2: Applied Research					R-1 Program Element (Number/Name) PE 0602147A / Long Range Precision Fires Technology							
COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	-	0.000	120.327	60.553	-	60.553	65.959	56.015	54.169	72.394	0.000	429.417
AE7: Land-Based Anti-Ship Missile (LBASM) Technology	-	0.000	11.420	22.677	-	22.677	14.227	0.000	0.000	0.000	0.000	48.324
AF1: Long Range Maneuverable Fires (LRMF) Technology*	-	0.000	0.000	0.000	-	0.000	5.095	7.094	7.267	8.285	0.000	27.741
AF3: Extended Range Propulsion Technology	-	0.000	5.596	6.595	-	6.595	10.008	11.114	10.857	27.789	0.000	71.959
AF5: Simulation and Aerostructures Technology	-	0.000	1.376	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.376
AF6: Structures Technology	-	0.000	1.195	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.195
AF7: Warhead Integration Technology	-	0.000	1.681	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.681
AF8: Affordable Extended Range Precision Technology	-	0.000	0.288	8.491	-	8.491	8.792	9.391	9.623	8.850	0.000	45.435
AF9: Precision and Accuracy Technology	-	0.000	8.230	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.230
AG1: Missile Electronics Technology	-	0.000	3.021	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.021
AG2: Information and Signal Processing Technology	-	0.000	1.602	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.602
AG4: Extended Range Artillery Munition Suite Technology	-	0.000	6.806	8.667	-	8.667	11.889	12.126	13.572	14.490	0.000	67.550
AG6: Energetic Materials and Advanced Processing Techno	-	0.000	6.607	3.430	-	3.430	3.511	3.581	0.000	0.000	0.000	17.129
AG8: Advanced Energetics Technology	-	0.000	10.098	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.098
AG9: Multiple Simul Engagement Technologies (MSET) Tech	-	0.000	2.062	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.062

**UNCLASSIFIED**

<b>Exhibit R-2, RDT&amp;E Budget Item Justification: PB 2021 Army</b>										<b>Date: February 2020</b>		
<b>Appropriation/Budget Activity</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army / BA 2: Applied Research</i>					<b>R-1 Program Element (Number/Name)</b> PE 0602147A / <i>Long Range Precision Fires Technology</i>							
AH2: <i>Single Multi-mission Attack Missile (SMAM) Technol</i>	-	0.000	1.264	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.264
AH4: <i>Precision and Coop Weapons in a Denied Env Tech</i>	-	0.000	9.121	9.628	-	9.628	9.822	10.042	10.154	10.257	0.000	59.024
BN5: <i>Fuze and Power for Munitions</i>	-	0.000	0.960	1.065	-	1.065	2.615	2.667	2.696	2.723	0.000	12.726
BO9: <i>WEAPONS &amp; MUNITIONS TECH PROGRAM INITIATIVE (CA)</i>	-	0.000	49.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	49.000

\*This project's R-2a exhibit has been suppressed due to funding not beginning until after FY 2021

**Note**

In Fiscal Year (FY) 2020, this Program Element (PE) was realigned with continuity of effort from the following PEs:

- \* 0602303A Missile Technology
- \* 0602618A Ballistics Technology
- \* 0602624A Weapons and Munitions Advanced Technology

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

Work in this PE investigates and develops Long Range Precision Fires (LRPF) technologies to destroy, neutralize, or suppress the enemy by cannon artillery and missile fire and enable integration of fire support assets into combined arms operations. Major Focus Areas for LRPF Science and Technology include: Missiles, Cannon Artillery, and Supporting LRPF Technologies covering Strategic, Operational and Tactical Fires Lines of Effort. LRPF Missiles Applied Research investigates and develops a broad range of Missile technologies to enhance Army integrated LRPF capabilities at extended range. Cannon Artillery Applied Research investigates and develops critical technologies to increase range, precision, and both point and area effects for cannon artillery. Supporting LRPF Technologies Applied Research investigates and develops a broad range of component technologies to address weapon cost drivers and enhance performance of future LRPF munitions and systems.

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

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

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

**UNCLASSIFIED**

**Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Army** **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040: <i>Research, Development, Test &amp; Evaluation, Army / BA 2: Applied Research</i>	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / <i>Long Range Precision Fires Technology</i>
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<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>
Previous President's Budget	0.000	74.327	74.097	-	74.097
Current President's Budget	0.000	120.327	60.553	-	60.553
Total Adjustments	0.000	46.000	-13.544	-	-13.544
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-3.000			
• Congressional Rescissions	-	-			
• Congressional Adds	-	49.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-13.544	-	-13.544

**Congressional Add Details (\$ in Millions, and Includes General Reductions)**

**Project:** BO9: *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)*

- Congressional Add: *Composite Cannon Tubes and Propulsion Technology*
- Congressional Add: *Hybrid Projectile Technology*
- Congressional Add: *Additive Manufacturing to Support Optimized Fires*
- Congressional Add: *Program Increase*
- Congressional Add: *Novel Printed Armament Components*

Congressional Add Subtotals for Project: BO9

Congressional Add Totals for all Projects

	<b>FY 2019</b>	<b>FY 2020</b>
	-	10.000
	-	6.000
	-	5.000
	-	20.000
	-	8.000
Congressional Add Subtotals for Project: BO9	-	49.000
Congressional Add Totals for all Projects	-	49.000

**Change Summary Explanation**

FY20 increase is the result of Congressional Adds.

FY21 decrease due to realignment in support of higher priority Army Science and Technology (S&T) efforts including realignment of foundational Advanced Energetics work to PE 0602141A (Lethality Technology)/Project AH9 (Advanced Warheads).

**UNCLASSIFIED**

**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AE7 / Land-Based Anti-Ship Missile (LBASM) Technology
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
<i>AE7: Land-Based Anti-Ship Missile (LBASM) Technology</i>	-	0.000	11.420	22.677	-	22.677	14.227	0.000	0.000	0.000	0.000	48.324

**Note**

In Fiscal Year (FY) 2020 this Project was realigned from:  
 Program Element (PE) 0602303A Missile Technology:  
 \*Project 214 Missile Technology

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating and developing critical technologies to detect, engage, and defeat moving land or maritime surface targets under all conditions, and technologies for Precision Strike Missile (PrSM) payloads.

Work in this Project complements PE 0603464A (Long Range Precision Fires Advanced Technology) / AE8 (Land Based Anti-Ship Missile (LBASM) Advanced Tech.

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

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

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

<b>Title:</b> Land Based Anti-Ship Missile (LBASM) Technology	FY 2019	FY 2020	FY 2021
<p><b>Description:</b> Investigate and develop critical technologies that enable High Mobility Artillery Rocket System (HIMARS) and Multiple Launch Rocket System (MLRS) rocket/missile artillery systems to destroy enemy air defenses in the land and the maritime domains.</p> <p><b>FY 2020 Plans:</b> Will continue development of multi-mode seeker technologies for precision engagement of cross-domain threats in GPS denied or degraded environments. These technologies include miniaturization of radio frequency and imaging infrared sensors; advanced image processing to enable target classification and aim point selection for both land and maritime targets.</p> <p><b>FY 2021 Plans:</b></p>	-	10.902	10.089

**UNCLASSIFIED**

<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AE7 / Land-Based Anti-Ship Missile (LBASM) Technology		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<p>Will evaluate the performance of the multi-mode seeker component technologies through conducting experiments with seeker hardware in the loop to mature tracking, identification and aim-point algorithms; will design payload concept evaluation to determine lethality against both land and maritime targets.</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Decrease in funding associated with the development of the seeker technologies ramping down, and integration and testing ramping up in PE603464A (Long Range Precision Fires) / AE8 (Land-Based Anti-Ship Missile (LBASM) Advanced Tech) effort.</p> <p><b>Title:</b> Precision Strike Missile Modular Payload Technology</p> <p><b>Description:</b> Investigate and develop critical technologies for the delivery of dedicated Army intelligence, surveillance and reconnaissance (ISR) payloads and attack capabilities via long range missiles. Technology examples include: ISR sensor and associated signal processing technologies for target acquisition, identification, and engagement; datalink and communications technologies to transmit targetable data; compact propulsion technologies to enable loiter time on station; and payload dispensing technologies for deploying these payloads from high speed long range missiles.</p> <p><b>FY 2021 Plans:</b> Will conduct trade studies to develop the system concept and derive system level technology requirements for the payload subsystems including ISR sensor, datalink, propulsion, and deployment mechanization; will identify critical technologies associated with each subsystem, and will initiate the development of preliminary designs for each subsystem to support required payload capabilities.</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> In Fiscal Year 2021, effort realigned from existing missile technology development in:</p> <ul style="list-style-type: none"> <li>PE 0602147A Long Range Precision Fires Technology</li> <li>*Project AF5 Simulation and Aerostructures Technology</li> <li>*Project AF9 Precision and Accuracy Technology</li> <li>*Project AG2 Information and Signal Processing Technology</li> <li>*Project AF6 Structures Technology</li> <li>*Project AF7 Warhead Integration Technology</li> <li>*Project AG1 Missile Electronics Technology</li> <li>*Project AF8 Affordable Extended Range Precision Technology</li> </ul> <p>PE 0603464A Long Range Precision Fires Advanced Technology</p>		-	-	12.588

**UNCLASSIFIED**

<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / <i>Long Range Precision Fires Technology</i>	<b>Project (Number/Name)</b> AE7 / <i>Land-Based Anti-Ship Missile (LBASM) Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
*Project AF4 Missile Simulation				
<b>Title:</b> FY 2020 SBIR/STTR Transfer		-	0.518	-
<b>Description:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>Accomplishments/Planned Programs Subtotals</b>		-	11.420	22.677
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b>				
N/A				

**UNCLASSIFIED**

**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AF3 / Extended Range Propulsion Technology
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
<i>AF3: Extended Range Propulsion Technology</i>	-	0.000	5.596	6.595	-	6.595	10.008	11.114	10.857	27.789	0.000	71.959

**Note**

In Fiscal Year (FY) 2020 this Project was realigned from:  
 Program Element (PE) 0602303A Missile Technology:  
 \*Project 214 Missile Technology

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by designing, fabricating, and investigating missile enabling propulsion technologies to enable range extension and/or block speed improvement for long range applications; and enables improvement in High Performance Propellants (HPP) via gains in energy density and burn rate control.

Work in this Project complements PE 0603464A (Long Range Precision Fires Advanced Technology) / Project AF2 (Long Range Maneuverable Fires (LRMF) Advanced Tech).

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

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

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

<b>Title:</b> Extended Range Propulsion Technology	FY 2019	FY 2020	FY 2021
<b>Description:</b> Designs, fabricates, and investigates missile enabling propulsion technologies to enable significant range extension and/or block speed improvement for long range applications and enables improvement in HPP via gains in energy density and burn rate control.	-	5.342	6.595
<b>FY 2020 Plans:</b> Will continue the design and develop of variable thrust/impulse control sub- system technologies that can efficiently operate over extended duty cycles, altitudes, and tactical temperatures providing enhanced controllability for high speed, high altitude missile applications; Will investigate and develop low cost integral air-breathing propulsion technology that enables significant range extension and/or block speed improvement for long range multi-domain fires applications.			
<b>FY 2021 Plans:</b>			

**UNCLASSIFIED**

<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AF3 / Extended Range Propulsion Technology		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<p>Will design air breathing propulsion component technology for cannon and rocket/missile artillery systems range extension; will investigate advanced technologies to increase the amount of energy delivered from the same form factor; investigate propellant processing techniques that can reduce manufacturing time and cost; investigate advanced propellant formulations and plume signature management technologies that can increase the survivability of long range fires platforms while maintaining or improving performance.</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> FY21 funding increase due to fabrication of technology components and evaluation of advanced propellant formulations.</p>				
<p><b>Title:</b> FY 2020 SBIR/STTR Transfer</p> <p><b>Description:</b> Funding transferred in accordance with Title 15 USC ?638</p> <p><b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638</p>		-	0.254	-
<b>Accomplishments/Planned Programs Subtotals</b>		-	5.596	6.595
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b>				
N/A				

**UNCLASSIFIED**

**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AF5 / Simulation and Aerostructures Technology
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
<i>AF5: Simulation and Aerostructures Technology</i>	-	0.000	1.376	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.376

**Note**

In Fiscal Year 2020 (FY20) this Project was realigned from:  
 Program Element (PE) 0602303A Missile Technology:  
 \* Project 214 Missile Technology

In FY21 this Project is realigned to:  
 PE 0602147A Long Rang Precision Fires Technology:  
 \* Project AE7 Land-Based Anti-Ship Missile (LBASM) Technology

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating and developing novel aerodynamic modeling and aerostructures to support extended range and maneuvering missile applications in high aerodynamic and thermal loading environments.

Work in this Project complements PE 0603464A (Long Range Precision Fires Advanced Technology) / Project AE8 (Land Based Anti-Ship Missile (LBASM) Advanced Tech, and Project AF2 Long Range Maneuverable Fires (LRMF) Advanced Tech.

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

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

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

<b>Title:</b> Simulation and Aerostructures Technology	FY 2019	FY 2020	FY 2021
<b>Description:</b> Investigate and develop novel aerodynamic modeling and aerostructures to support extended range and maneuvering missile applications in high aerodynamic and thermal loading environments.	-	1.313	-
<b>FY 2020 Plans:</b>			

**UNCLASSIFIED**

<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AF5 / Simulation and Aerostructures Technology		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<p>Will develop aero-structural-propulsion design and analysis tools for the design and optimization of very high speed missile airframes and air inlets operating in low density flows at high altitude. These tools are critical for the development of very high speed missile concepts and to guide the design of this class of missile systems.</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> FY21 Funding realigned to PE 0602147A (Long Rang Precision Fires Technology)/Project AE7 (Land-Based Anti-Ship Missile Technology).</p> <p><b>Title:</b> FY 2020 SBIR/STTR Transfer</p> <p><b>Description:</b> Funding transferred in accordance with Title 15 USC ?638</p> <p><b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638</p>				
		-	0.063	-
<b>Accomplishments/Planned Programs Subtotals</b>		-	1.376	-
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b>				
N/A				

**UNCLASSIFIED**

**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AF6 / Structures Technology
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AF6: Structures Technology	-	0.000	1.195	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.195

**Note**

In Fiscal Year 2020 (FY20) this Project was realigned from:  
 Program Element (PE) 0602303A Missile Technology:  
 \* Project 214 Missile Technology

In FY21 this Project is realigned to:  
 PE 0602147A Long Rang Precision Fires Technology:  
 \* Project AE7 Land-Based Anti-Ship Missile (LBASM) Technology

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating advanced materials supporting survivable, high-speed missiles and identifying approaches of to reduce weight and size of missile structures using advanced materials and manufacturing techniques.

Work in this Project complements PE 0603464/AE8 LBASM Advanced Technology; PE 0602147/AF1 LRMF Technology, and PE 0603464/AF2 LRMF Advanced Technology.

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

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

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

<b>Title:</b> Structures Technology	FY 2019	FY 2020	FY 2021
<b>Description:</b> Investigate advanced materials supporting survivable, high-speed missiles; identify approaches of for reducing weight and size of missile structures using advanced materials and manufacturing techniques.	-	1.140	-
<b>FY 2020 Plans:</b> Will continue to investigate, analyze and design high temperature, high- strength materials for structural airframe and conformal radio frequency and imaging infrared window/dome applications for high flight speed missile applications.			
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b>			

**UNCLASSIFIED**

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<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AF6 / Structures Technology		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
FY 2021 funding realigned to PE 0602147A (Long Rang Precision Fires Technology)/Project AE7 (Land-Based Anti-Ship Missile Technology).				
<b>Title:</b> FY 2020 SBIR/STTR Transfer		-	0.055	-
<b>Description:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>Accomplishments/Planned Programs Subtotals</b>		-	1.195	-
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b>				
N/A				

**UNCLASSIFIED**

**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AF7 / Warhead Integration Technology
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
<i>AF7: Warhead Integration Technology</i>	-	0.000	1.681	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.681

**Note**

In Fiscal Year 2020 (FY20) this Project was realigned from:  
 Program Element (PE) 0602303A Missile Technology:  
 \* Project 214 Missile Technology

In FY21 this Project is realigned to:  
 PE 0602147A Long Rang Precision Fires Technology:  
 \* Project AE7 Land-Based Anti-Ship Missile (LBASM) Technology

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating advanced warhead subsystem integration techniques for future missile systems.

Work in this Project complements PE 0603464A (Long Range Precision Fires Advanced Technology) / AE8 (Land-Based Anti-Ship Missile (LBASM) Advanced Tech); PE 0602147A (Long Range Precision Fires Technology) / AF1 (Long Range Maneuverable Fires (LRMF) Technology) and PE 0603464A (Long Range Precision Fires Advanced Technology) / AF2 (Long Range Maneuverable Fires (LRMF) Advanced Tech)

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

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

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

<b>Title:</b> Warhead Integration Technology	FY 2019	FY 2020	FY 2021
<b>Description:</b> Investigate advanced warhead subsystem integration techniques for future missile systems.	-	1.605	-
<b>FY 2020 Plans:</b>			

**UNCLASSIFIED**

<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AF7 / Warhead Integration Technology		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
Will complete development of a multi-role lethality for multi-role systems analysis tool to be used to predict probability of kill for multiple-purpose warhead configurations against cross-domain targets. Will investigate and design multi-effects warhead and fuze component technologies for very high speed missile terminal target engagement.				
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Beginning in FY21, this effort realigned to Project AE7 Land Based Anti-Ship Missile Technology within this PE.				
<b>Title:</b> FY 2020 SBIR/STTR Transfer		-	0.076	-
<b>Description:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>Accomplishments/Planned Programs Subtotals</b>		-	1.681	-
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army										<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology				<b>Project (Number/Name)</b> AF8 / Affordable Extended Range Precision Technology			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
AF8: Affordable Extended Range Precision Technology	-	0.000	0.288	8.491	-	8.491	8.792	9.391	9.623	8.850	0.000	45.435

**Note**

In Fiscal Year (FY) 2020 this Project was realigned from:  
 Program Element (PE) 0602303A Missile Technology:  
 \*Project 214 Missile Technology

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating the design and fabrication of components and subsystems critical to produce affordable extended range precision missiles as well as critical component technologies including: advanced propulsion, seekers/sensors, fire control, datalink, guidance, navigation and controls, airframes, and additional high payoff areas.

Work in this Project complements PE 0603464A (Long Range Precision Fires Advanced Technology) / AE8 (Land-Based Anti-Ship Missile (LBASM) Advanced Tech); PE 0602147A (Long Range Precision Fires Technology) / AF1 (Long Range Maneuverable Fires (LRMF) Technology) and PE 0603464A (Long Range Precision Fires Advanced Technology) / AF2 (Long Range Maneuverable Fires (LRMF) Advanced Tech)

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

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

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

<b>Title:</b> Affordable Extended Range Precision Technology	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<b>Description:</b> Investigate the design and fabrication of components and subsystems critical to produce affordable extended range precision missiles; Critical component technologies including: advanced propulsion, seekers/sensors, fire control, datalink, guidance, navigation and controls, and airframes.	-	0.275	-
<b>FY 2020 Plans:</b> Will complete trade studies for affordable discriminate extended range precision missiles for long-range indirect fires capabilities.			
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AF8 / Affordable Extended Range Precision Technology		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
In FY21, research efforts area are being realigned to the Long Range Precision Fires (LRPF) High Payoff Missile Technology effort within this Project.				
<p><b>Title:</b> LRPF High Payoff Missile Technology</p> <p><b>Description:</b> Identify and explore potential breakthrough technologies to mitigate or eliminate warfighter gaps in Long Range Precision Fires to gain overmatch against potential peer and near-peer adversaries.</p> <p><b>FY 2021 Plans:</b> Will analyze and develop integrated board level sensor-on-a-chip utilizing advanced thermal management techniques to improve signal processing and reduce size and weight of future missile seekers; will investigate advanced materials modeling/optimization techniques and emerging high temperature materials to reduce weight and further extend the range of long range missiles; will investigate advanced navigation and alternate navigation approaches that greatly reduce or eliminate the need for GPS for precision guidance of long range missiles in contested environments; and will research long range, low altitude datalink technologies and communication architectures.</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding increase to advance critical technologies required for future missile efforts in the Long Range Precision Fires Army Modernization Priority area.</p>		-	-	8.491
<p><b>Title:</b> FY 2020 SBIR/STTR Transfer</p> <p><b>Description:</b> Funding transferred in accordance with Title 15 USC ?638</p> <p><b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638</p>		-	0.013	-
<b>Accomplishments/Planned Programs Subtotals</b>		-	0.288	8.491
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b>				
N/A				

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**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AF9 / Precision and Accuracy Technology
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AF9: Precision and Accuracy Technology	-	0.000	8.230	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	8.230

**Note**

In Fiscal Year 2020 (FY20) this Project was realigned from:  
 Program Element (PE) 0602303A Missile Technology:  
 \* Project 214 Missile Technology

In FY21 this Project is realigned to:  
 PE 0602147A Long Rang Precision Fires Technology:  
 \* Project AE7 Land-Based Anti-Ship Missile (LBASM) Technology

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating and developing advanced missile seekers, sensors, and software/algorithms to increase affordability and performance of missiles for precision at extended ranges. This Project also investigates and develops advanced technologies for effective guidance and navigation of precision missiles through unique navigation technologies and algorithms aimed at reducing size, weight, power and cost.

Work in this Project complements PE 0603464A / AE8 (Land-Based Anti-Ship Missile Advanced Technology)

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

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

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

	FY 2019	FY 2020	FY 2021
<b>Title:</b> Precision and Accuracy Technology	-	7.856	-
<b>Description:</b> Investigate and develop advanced missile seekers, sensors, and software/algorithms to increase affordability and performance of missiles for precision at extended ranges. This effort investigates and develops advanced technologies for effective guidance and navigation of precision missiles through unique navigation technologies and algorithms aimed at reducing size, weight, power and cost.			
<b>FY 2020 Plans:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AF9 / Precision and Accuracy Technology		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<p>Will investigate and develop advanced radio frequency and infrared sensor; target acquisition, discrimination, and classification algorithms and processes; and guidance technologies that: reduce size, weight, and power; decrease processing time; lower cost; increase target acquisition range; and ensure accurate long range, high speed missile target engagement in a jammed and complex operating environment; Will investigate and develop advanced position, navigation, and timing technologies, including: improved performance inertial measurement technology with reduced size, weight, power, and cost; celestial navigation technology; and vision based technology that ensures accurate long range, high speed missile target engagement in jammed and complex operating environments.</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Beginning in FY21 this effort is realigned to Project AE7 Land-Based Anti-Ship Missile Technology within this PE.</p>				
<p><b>Title:</b> FY 2020 SBIR/STTR Transfer</p> <p><b>Description:</b> Funding transferred in accordance with Title 15 USC ?638</p> <p><b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638</p>		-	0.374	-
<b>Accomplishments/Planned Programs Subtotals</b>		-	8.230	-
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b>				
N/A				

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army										<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology				<b>Project (Number/Name)</b> AG1 / Missile Electronics Technology			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
AG1: <i>Missile Electronics Technology</i>	-	0.000	3.021	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.021

**Note**

In Fiscal Year 2020 (FY20) this Project was realigned from:  
 Program Element (PE) 0602303A Missile Technology:  
 \* Project 214 Missile Technology

In FY21 this Project is realigned to:  
 PE 0602147A Long Rang Precision Fires Technology:  
 \* Project AE7 Land-Based Anti-Ship Missile (LBASM) Technology

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating and developing technologies and techniques to miniaturize guidance electronics for advanced missile systems.

Work in this Project complements PE 0602147A (Long Range Precision Fires Technology) and PE 0603464A (Long Range Precision Fires Advanced Technology).

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

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

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

<b>Title:</b> Missile Electronics Technology	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<b>Description:</b> Investigates and develops technologies and techniques to miniaturize guidance electronics for advanced missile	-	2.884	-
<b>FY 2020 Plans:</b> Will investigate and develop advanced thermal management techniques; electronics wire bonding fabrication and assembly techniques; and battery chemistry optimization and high yield energy harvesting technologies for reduced size, weight, and power of multi-mode sensors for cross-domain target acquisition, discrimination and engagement.			
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / <i>Long Range Precision Fires Technology</i>	<b>Project (Number/Name)</b> AG1 / <i>Missile Electronics Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
Beginning in FY21 this effort is realigned to Project AE7 Land-Based Anti-Ship Missile Technology within this PE.				
<b>Title:</b> FY 2020 SBIR/STTR Transfer		-	0.137	-
<b>Description:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>Accomplishments/Planned Programs Subtotals</b>		-	3.021	-
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b>				
N/A				

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army										<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology			<b>Project (Number/Name)</b> AG2 / Information and Signal Processing Technology				
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
AG2: Information and Signal Processing Technology	-	0.000	1.602	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.602

**Note**

In Fiscal Year 2020 (FY20) this Project was realigned from:  
 Program Element (PE) 0602303A Missile Technology:  
 \* Project 214 Missile Technology

In FY21 this Project is realigned to:  
 PE 0602147A Long Rang Precision Fires Technology:  
 \* Project AE7 Land-Based Anti-Ship Missile (LBASM) Technology

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating and developing image processing technologies and techniques for enhanced target acquisition and engagement and investigating improved secure, digital missile communication with ground and other systems.

Work in this Project complements PE 0602147A (Long Range Precision Fires Technology) and PE 0603464A (Long Range Precision Fires Advanced Technology).

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

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

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

	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<b>Title:</b> Information and Signal Processing Technology	-	1.529	-
<b>Description:</b> This effort investigates and develops image processing technologies and techniques for enhanced target acquisition and engagement and investigates improved secure, digital missile communication with ground and other systems.			
<b>FY 2020 Plans:</b> Will continue to investigate and develop advanced algorithms and signal processing techniques for enhanced target acquisition and engagement in contested and complex anti-access / area-denial (A2/AD) environments.			
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / <i>Long Range Precision Fires Technology</i>	<b>Project (Number/Name)</b> AG2 / <i>Information and Signal Processing Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
Beginning in FY21 this effort is realigned to Project AE7 Land-Based Anti-Ship Missile Technology within this PE.				
<b>Title:</b> FY 2020 SBIR/STTR Transfer		-	0.073	-
<b>Description:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>Accomplishments/Planned Programs Subtotals</b>		-	1.602	-
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b>				
N/A				

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**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology				<b>Project (Number/Name)</b> AG4 / Extended Range Artillery Munition Suite Technology			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
AG4: <i>Extended Range Artillery Munition Suite Technology</i>	-	0.000	6.806	8.667	-	8.667	11.889	12.126	13.572	14.490	0.000	67.550

**Note**

In Fiscal Year (FY) 2020 this Project was realigned from:  
 Program Element (PE) 0602624 Weapons and Munitions Technology  
 \* Project H18 Weapons and Munitions Technologies

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating critical enabling component technologies and designing high precision terminal guidance in denied environments, capable of surviving high gun shock loads, at extended ranges, and automated cannon artillery technologies to increase operational tempo and unburden the soldier.

Work in this Project complements PE 0603464A Long Range Precision Fires Advanced Technology / AG5 (Extended Range Artillery Munition Suite Advanced Technology).

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

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

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

<b>Title:</b> Precision At Range Technologies	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<b>Description:</b> Investigates technologies that provide affordable precision capabilities for projectiles fired into Global Positioning System (GPS) denied environments.	-	2.794	3.151
<b>FY 2020 Plans:</b> Will assess component level enabling technologies for passive seekers to include Infrared (IR) focal plane arrays and associated optics capable of surviving gun shock loading and perform as required. In addition to the terminal seeker hardware development activities, target detection algorithm as well performance modeling of such algorithms will be conducted in support of the terminal seeker development for Extended Range Artillery Projectiles (e.g. XM1155).			
<b>FY 2021 Plans:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AG4 / Extended Range Artillery Munition Suite Technology		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<p>Will investigate critical passive seeker component technologies, including IR focal plane arrays and associated optics, for viability of operation in anticipated gun shock loading environments; develop terminal seeker component hardware for future integration with extended range artillery munitions; investigate target detection algorithms for terminal seeker development for extended range munitions (e.g. XM1155); conduct component level experiments to validate modeled performance through captive flight testing; design and develop component technologies to provide increased range, sensor optimization, improved algorithms and refined guidance and navigation system design concepts for future artillery munitions.</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding change reflects planned lifecycle of this effort.</p>				
<p><b>Title:</b> Extended Range Artillery Munition Suite Enabling Technologies</p> <p><b>Description:</b> This effort develops, matures and integrates a gun hardened suite of components (software, sensors, navigation and communications) to enable the application of distributed, cooperative and collaborative tactics for munitions and Radio Frequency (RF) seeking components.</p> <p><b>FY 2020 Plans:</b> Will design and develop component technologies for extended range artillery projectiles (e.g. XM1155) in the areas of increased range, sensor optimization, improved algorithms and refined guidance and navigation system design concepts.</p> <p><b>FY 2021 Plans:</b> Will mature component technologies for extended range artillery projectiles (e.g. XM1155) through improved algorithms and refined guidance and navigation system design concepts; conduct component level experiments to validate modeled performance; determine relevant conditions to enable intra-munition communications, enhancing probability of kill ratios and increasing effectiveness against targets in highly cluttered environments.</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding realigned to focus on Optionally Manned Artillery Platform Technology</p>		-	3.703	1.997
<p><b>Title:</b> Optionally Manned Artillery Platform Technology</p> <p><b>Description:</b> This effort designs and develops cannon artillery automation technologies including automated fuze/fuze setting technologies, automated prognostics/diagnostics, automated and rapid rearm technologies, and automated ammunition inventory to increase operational tempo of current and future cannon artillery systems to unburden the soldier</p> <p><b>FY 2021 Plans:</b> Will investigate cannon artillery automation technologies; Will investigate automated fuze/fuze setting technologies to decrease fuze setting times and increase the rate of fire for precision projectiles; Will investigate automated prognostics/diagnostics to</p>		-	-	3.519

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AG4 / Extended Range Artillery Munition Suite Technology		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
enable automated operations; Will investigate automated and rapid rearm technologies including automated ammunition inventory to decrease operational down-time and unburden the soldier. <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding increase to investigate cannon artillery automation technologies				
<b>Title:</b> FY 2020 SBIR/STTR Transfer <b>Description:</b> Funding transferred in accordance with Title 15 USC ?638 <b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638 <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638		-	0.309	-
<b>Accomplishments/Planned Programs Subtotals</b>		-	6.806	8.667
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army										<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology				<b>Project (Number/Name)</b> AG6 / Energetic Materials and Advanced Processing Techno			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
AG6: <i>Energetic Materials and Advanced Processing Techno</i>	-	0.000	6.607	3.430	-	3.430	3.511	3.581	0.000	0.000	0.000	17.129

**Note**

In Fiscal Year (FY) 2020 this Project was realigned from:  
 Program Element (PE) 0602624A Weapons and Munitions Technology:  
 \* Project H18 Weapons and Munitions Technologies  
 \* Project H28 Warheads/Energetics Technologies

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating critical component technology of propellants and energetic materials to increase the range of artillery and mortar rocket assisted projectiles.

Work in this Project complements PE 0602141A (Lethality Technology) / AH9 (Advanced Warheads Technology) and PE 0603464A (Long Range Precision Fires Advanced Technology) / AG5 (Extended Range Artillery Munition Suite Advanced Technology).

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

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

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

	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<b>Title:</b> Novel Propulsion	-	3.163	-
<b>Description:</b> This effort explores propellant technologies such as powder co-extrusion and grain coatings, while retaining insensitive properties, for employment in gun launch environments as well as directional thrusters including those that deliver a broad spectrum of effects. It also conducts experiments with these propellants to increase the range of artillery and mortar rocket assisted projectiles.			
<b>FY 2020 Plans:</b> Will continue design and development of material synthesis and formulation to support development of encapsulated propellant; will investigate novel burn rate modifiers and enhancers in conjunction with high-energy propellant formulations; fund research to advance maturity of detonation based gun propulsion; conduct experiments and further development on configuration and			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AG6 / Energetic Materials and Advanced Processing Techno		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
formulation of electrically controlled energetic materials (ECEM); fund research of next generation post launch propulsion on gun launched concepts for extended range. <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding realigned to the Scale-up of Insensitive Energetic Materials effort within this Project.				
<b>Title:</b> Scale-up of Insensitive Energetic Materials <b>Description:</b> Conduct research to advance the maturity of disruptive energetic materials. <b>FY 2020 Plans:</b> Will develop modeling and simulation tools required for advanced energetic materials; will investigate the synthesis and fabrication of energetic materials that are applicable to a wide range of additive manufacturing processing technologies; design and develop new processing methods for of novel energetic materials in unique geometries; fund research to investigate embedded ignition for additively manufactured gun propulsion charges. <b>FY 2021 Plans:</b> Will design synthesis processes for the fabrication of energetic materials applicable to a wide range of additive manufacturing technologies; will design embedded ignition for additively manufactured gun propulsion charges; will conduct experiments of ECEM formulations; will investigate next generation post launch propulsion concepts to achieve extended range. <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding increase to support additional development and experiments of insensitive materials.		-	3.144	3.430
<b>Title:</b> FY 2020 SBIR/STTR Transfer <b>Description:</b> Funding transferred in accordance with Title 15 USC ?638 <b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638 <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638		-	0.300	-
<b>Accomplishments/Planned Programs Subtotals</b>		-	6.607	3.430
<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 2021 Army		<b>Date:</b> February 2020
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / <i>Long Range Precision Fires Technology</i>	<b>Project (Number/Name)</b> AG6 / <i>Energetic Materials and Advanced Processing Techno</i>

**D. Acquisition Strategy**

N/A

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army										<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology				<b>Project (Number/Name)</b> AG8 / Advanced Energetics Technology			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
AG8: <i>Advanced Energetics Technology</i>	-	0.000	10.098	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.098

**Note**

In Fiscal Year 2020 (FY20) this Project was realigned from:  
 Program Element (PE) 0602624A Weapons and Munitions Technology:  
 \* Project H28 Warheads/Energetics Technology

In FY21 this Project is realigned to:  
 PE 0602141A Lethality Technology:  
 \* Project AH9 Advanced Warheads Technology

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating critical component technology of materials and novel processing techniques for future explosives and propulsion applications that enable an increase in range, lethality, and utility of ammunitions.

Work in this Project complements PE 0602141A (Lethality Technology) / AH9 (Advanced Warheads Technology), PE 0602147A (Long Range Precision Fires Technology) / AG6 (Energetic Materials and Advanced Processing Techno), and PE 0603464A (Long Range Precision Fires Advanced Technology) / AG7 (Energetic Materials and Adv Processing Adv Tech).

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

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

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

<b>Title:</b> Advanced Energetics	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<b>Description:</b> This effort develops advanced energetic materials and novel processing techniques for future explosives and propulsion applications that enable an increase in range, lethality, and utility of ammunitions.	-	9.639	-
<b>FY 2020 Plans:</b> Will mature technologies focused in nano-energetics designs for use in melt-cast formulations; will mature the polymer kinetics for amorphous energetics; will investigate next-generation melt-cast and cast-cure ingredients for higher energy formulations; investigate reaction kinetics for ingredient synthesis applicable to advanced flow reactors; investigate energetic materials			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / <i>Long Range Precision Fires Technology</i>	<b>Project (Number/Name)</b> AG8 / <i>Advanced Energetics Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
applicable for novel energy release mechanisms; design and develop processing parameters necessary to produce energetic materials for additive manufacturing; develop novel modeling and simulation tools required to accurately predict energetic materials performance in novel and unique geometries.				
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Beginning in FY21, effort realigned under PE 0602141A (Lethality Technology) / AH9 (Advanced Warheads Technology).				
<b>Title:</b> FY 2020 SBIR/STTR Transfer		-	0.459	-
<b>Description:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638				
<b>Accomplishments/Planned Programs Subtotals</b>		-	10.098	-
<b>C. Other Program Funding Summary (\$ in Millions)</b>				
N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b>				
N/A				

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**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AG9 / Multiple Simul Engagement Technologies (MSET) Tech
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AG9: Multiple Simul Engagement Technologies (MSET) Tech	-	0.000	2.062	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.062

**Note**

In Fiscal Year 2020 (FY20) this Project was realigned from:  
 Program Element (PE) 0602303A Missile Technology  
 \* Project 214 Missile Technology

In FY21 this Project is realigned to:  
 PE 0602148A Future Vertical Lift Technology  
 \* Project AK4 Multi-Role Small Guided Missile Tech

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating critical component technology and designs for future missiles that provide simultaneous multiple launch, control, and supervised autonomous terminal engagement of multiple missiles against stationary and moving hard/soft targets, image-based target discrimination/shared SA/lock-on, and multi-missile control digital datalink with inter-missile cooperative networked communications.

Work in this Project complements PE 0603464A (Long Range Precision Fires Advanced Technology) / AF4 (Missile Simulation Advanced Technology).

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

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

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

<b>Title:</b> Multiple Simultaneous Engagement Technologies (MSET) Technology	FY 2019	FY 2020	FY 2021
<b>Description:</b> Investigate critical component technology and designs for future missiles that provide simultaneous multiple launch, control, and supervised autonomous terminal engagement of multiple missiles against stationary and moving hard/soft targets, image-based target discrimination/shared situation awareness/lock-on, and multi-missile control digital datalink with inter-missile cooperative networked communications.	-	1.969	-
<b>FY 2020 Plans:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / <i>Long Range Precision Fires Technology</i>	<b>Project (Number/Name)</b> AG9 / <i>Multiple Simul Engagement Technologies (MSET) Tech</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
Will develop missile MSET system architecture and user-validated concept of operations, and conduct technology and component trade studies. <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Beginning in FY21, effort under PE 0602148A Future Vertical Lift Technology / Project AK4 Multi-Role Small Guided Missile Tech. <b>Title:</b> FY 2020 SBIR/STTR Transfer <b>Description:</b> Funding transferred in accordance with Title 15 USC ?638 <b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638 <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638				
		-	0.093	-
<b>Accomplishments/Planned Programs Subtotals</b>		-	2.062	-
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				

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**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AH2 / Single Multi-mission Attack Missile (SMAM) Technol
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AH2: Single Multi-mission Attack Missile (SMAM) Technol	-	0.000	1.264	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.264

**Note**

In Fiscal Year 2020 (FY20) this Project was realigned from:  
 Program Element (PE) 0602303A Missile Technology  
 \* Project 214 Missile Technology

In FY21, this Project is Eliminated.

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating critical component technology and designs for future missiles that provide expeditionary, scalable, precision strike and loiter capability to rapidly defeat hard targets and swarming or disbursed threats; Provides the missile technology path to supervised autonomous target detection and cooperative engagement/manned-unmanned teaming for offensive, multiple simultaneous engagement capabilities.

Work in this Project complements PE 0603464A (Long Range Precision Fires Advanced Technology) / AH3 (Single Multi-mission Attack Missile Adv Tech) and PE 0603464 (Long Range Precision Fires Advanced Technology) / AH1 (Multiple Simultaneous Engagement Technologies (MSET) Advanced Technology).

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

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

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

<b>Title:</b> Single Multi-mission Attack Missile (SMAM) Technology	FY 2019	FY 2020	FY 2021
<b>Description:</b> This effort investigates critical component technology and designs for future missiles that provide expeditionary, scalable, precision strike and loiter capability to rapidly defeat hard targets and swarming or disbursed threats; Provides the missile technology path to supervised autonomous target detection and cooperative engagement/manned-unmanned teaming for offensive, multiple simultaneous engagement capabilities.	-	1.207	-
<b>FY 2020 Plans:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AH2 / Single Multi-mission Attack Missile (SMAM) Technol		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
Will complete development and lab validation of radio module for extended range digital datalink with anti-jam capability to enable operation in contested environments. <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Effort ends in FY 2020.				
<b>Title:</b> FY 2020 SBIR/STTR Transfer <b>Description:</b> Funding transferred in accordance with Title 15 USC ?638 <b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638 <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638		-	0.057	-
<b>Accomplishments/Planned Programs Subtotals</b>		-	1.264	-
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				

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**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AH4 / Precision and Coop Weapons in a Denied Env Tech
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
AH4: Precision and Coop Weapons in a Denied Env Tech	-	0.000	9.121	9.628	-	9.628	9.822	10.042	10.154	10.257	0.000	59.024

**Note**

In Fiscal Year (FY) 2020 this Project was realigned from:  
 Program Element (PE) 062618A Ballistics Technology:  
 \* Project H80 Survivability and Lethality Technology

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

This Project investigates technologies to deliver accurate fires from extended ranges in denied environments and informs future close- and deep-range Long Range Precision Fires capabilities (e.g., Extended Range Cannon Artillery, Precision Strike Missile). Work in this PE researches technologies for navigation of munitions without Global Positioning System (GPS) and flying munitions to much greater distances against advanced threat Area Denial Assets by delivering navigation technology for multiple munitions with complementary sensors and maneuverability technology for munitions with enhanced lift and control characteristics.

Work in this Project transitions foundational understating obtained in PE 0601102A (Defense Research Sciences) / AA7 (Mechanics and Ballistics) and complements PE 0602141A (Lethality Technology) / AH5 (Projectile and Multi-Function Warhead Technologies), Project AH6 (Disruptive Energetics and Propulsion Technologies), Project AH7 (Lethal and Scalable Effects Technologies), and Project AH8 (Lethality Materials and Processes Technology).

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

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

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

	FY 2019	FY 2020	FY 2021
<b>Title:</b> Munition Navigation Technology in Contested Environments	-	4.601	5.095
<b>Description:</b> This effort investigates, designs, and transitions technologies to improve navigation (e.g., better accuracy, more information/aim-point refinement, reduce GPS dependency) of munitions subject to denied environments (e.g., electro-magnetic spectrum contested, counter-measures). Key technologies include algorithms for image processing, state estimation, and communications, embedded processing and electronics, and sensors (e.g., inertial, imagers with optics, software-defined radios and antennae).			
<b>FY 2020 Plans:</b> Will demonstrate technologies for improved navigation in gun firings with open-loop maneuvers; will develop data-driven and model-based image processing, state estimation, and communications algorithms in simulation and verify implementation in			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AH4 / Precision and Coop Weapons in a Denied Env Tech		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<p>common software/hardware-in-the-loop environment; Design guidance electronics with apertures, characterize static and dynamic performance, and validate mechanical/thermal survivability in lab.</p> <p><b>FY 2021 Plans:</b> Will design collaborative navigation and guidance algorithms with improved realism of collaborative munitions engagement modeling and simulation; will develop sensor fusion state estimation and machine learning algorithms for object detection using image databases on real-time processors to provide mid-course navigation and terminal guidance in contested environments; will validate mid-course and terminal guidance technologies during cannon-launched Global Positioning System -guided flights characteristic of future Long Range Precision Fires missions.</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding change reflects planned lifecycle of this effort.</p>				
<p><b>Title:</b> Munition Maneuvering Technology in Extreme Environments</p> <p><b>Description:</b> This effort investigates and designs technologies to improve maneuverability (e.g., extended range glide, intercept moving target, course- correct to imperfectly located target, perform evasive terminal maneuver to increase survivability) of munitions subject to extreme environments (set- back, set-forward, and balloting loads encountered during gun launch and thermal loads encountered during high speed/long time flights). These technologies include the maneuvering airframe, control actuation, and flight control algorithms.</p> <p><b>FY 2020 Plans:</b> Will demonstrate technologies for increased range/lateral acceleration in gun firings with open-loop maneuvers; will perform un/ coupled fluid dynamics, heat transfer, structural dynamics, flight dynamics and control computations validated by spark range and onboard sensor flights; Develop flight control algorithms for automating flight conditions and configurations and assess flight performance in simulation; Design control actuation, characterize static and dynamic performance, and validate mechanical/ thermal survivability in lab and verify flight control and control actuation implementation in common software/hardware-in-the-loop environment.</p> <p><b>FY 2021 Plans:</b> Will design munition guidance algorithms and required system characteristics to improve terminal survivability against integrated air defense system targets; will design model-based optimal flight control automation to reduce gain tuning cycle time; will develop aerodynamic control actuation with increased hinge loads, rise time/delay, packaging, and launch survivability; will design airframe flight characterization and design tools to improve accuracy and shorten design cycle time; will validate airframe, control actuation,</p>		-	4.105	4.533

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> AH4 / Precision and Coop Weapons in a Denied Env Tech		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
and flight control technologies during cannon-launched GPS guided flights characteristic of future Long Range Precision Fires missions. <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding change reflects planned lifecycle of this effort.				
<b>Title:</b> FY 2020 SBIR/STTR Transfer <b>Description:</b> Funding transferred in accordance with Title 15 USC ?638 <b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638 <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638		-	0.415	-
<b>Accomplishments/Planned Programs Subtotals</b>		-	9.121	9.628
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army										<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2					<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology				<b>Project (Number/Name)</b> BN5 / Fuze and Power for Munitions			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021 Base</b>	<b>FY 2021 OCO</b>	<b>FY 2021 Total</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
BN5: Fuze and Power for Munitions	-	0.000	0.960	1.065	-	1.065	2.615	2.667	2.696	2.723	0.000	12.726

**Note**

In Fiscal Year (FY) 2020 this Project was realigned from:  
 Program Element (PE) 0602624A Weapons and Munition Technology:  
 \* Project H18 Weapons and Munitions Technologies

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

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating critical component technologies and designs capable to enable advanced lethality and scalable warheads for future munitions as well as exploring new power technologies for extended run time and extended range munitions.

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

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

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

	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<b>Title:</b> Advanced Energetics	-	0.917	1.065
<b>Description:</b> This effort develops advanced fuze and power technologies for future munition applications that enable an increase in range and lethality, of ammunitions.			
<b>FY 2020 Plans:</b> Will advance the capability of state of the art in fuze proximity sensors to track targets in order to improve burst point accuracy and countermeasure robustness; will maximize usage of all real time battlefield targeting data and integrate with fuze setters, fuze sensors, power sources, component protective technologies and unique fuze ignition schemes to design and develop extremely reliable and versatile fuzes; will investigate these new fuze designs to support hypersonics, autonomous fuzing for varied targets including Unmanned Aerial Systems. These technologies will continue to leverage the Office of the Secretary of Defense (OSD) Joint Munitions Program TCG - 5 and TCG-10 and the OSD Joint Fuze Technology Program.			
<b>FY 2021 Plans:</b> Will investigate enabling technologies for improved lethality in munition applications while ensuring operation during extended range flight; will develop algorithms and explore advance capabilities for fuze proximity sensors to track targets and resist countermeasures; will conduct component level experiments for breadboard design architectures of of electronic safe and			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020		
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> BN5 / Fuze and Power for Munitions		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
arm device; will design interfaces for secure wireless data setting in advanced auto-loader systems; will investigate wireless technology protocols to enable high speed data transfer; will investigate novel power approaches for long range munitions and hypersonics technologies. This effort will continue to leverage the OSD Joint Munitions Program TCG-5 and TCG-10 and the OSD Joint Fuze Technology Program.  <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding change reflects planned lifecycle of this effort.				
<b>Title:</b> FY 2020 SBIR/STTR Transfer  <b>Description:</b> Funding transferred in accordance with Title 15 USC ?638  <b>FY 2020 Plans:</b> Funding transferred in accordance with Title 15 USC ?638  <b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Funding transferred in accordance with Title 15 USC ?638		-	0.043	-
<b>Accomplishments/Planned Programs Subtotals</b>		-	0.960	1.065
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A				
<b>Remarks</b>				
<b>D. Acquisition Strategy</b> N/A				

**UNCLASSIFIED**

**Exhibit R-2A, RDT&E Project Justification:** PB 2021 Army **Date:** February 2020

<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / Long Range Precision Fires Technology	<b>Project (Number/Name)</b> BO9 / WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
BO9: WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)	-	0.000	49.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	49.000

**Note**  
Congressional Interest Item funding provided for Weapons and Munitions Tech Program Initiative.

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

Congressional Interest Item funding provided for Weapons and Munitions Tech Program Initiative.

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

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

	FY 2019	FY 2020
<b>Congressional Add:</b> Composite Cannon Tubes and Propulsion Technology <i>FY 2020 Plans:</i> Composite Cannon Tubes and Propulsion Technology	-	10.000
<b>Congressional Add:</b> Hybrid Projectile Technology <i>FY 2020 Plans:</i> Hybrid Projectile Technology	-	6.000
<b>Congressional Add:</b> Additive Manufacturing to Support Optimized Fires <i>FY 2020 Plans:</i> Additive Manufacturing to Support Optimized Fires	-	5.000
<b>Congressional Add:</b> Program Increase <i>FY 2020 Plans:</i> Program Increase	-	20.000
<b>Congressional Add:</b> Novel Printed Armament Components <i>FY 2020 Plans:</i> Novel Printed Armament Components	-	8.000
<b>Congressional Adds Subtotals</b>	-	49.000

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

N/A

**Remarks**

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2021 Army		<b>Date:</b> February 2020
<b>Appropriation/Budget Activity</b> 2040 / 2	<b>R-1 Program Element (Number/Name)</b> PE 0602147A / <i>Long Range Precision Fires Technology</i>	<b>Project (Number/Name)</b> BO9 / <i>WEAPONS &amp; MUNITIONS TECH PROGRAM INITIATIVE (CA)</i>

**D. Acquisition Strategy**

N/A