Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army											Date: May 2021	
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 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
Total Program Element	-	117.395	119.007	64.285	-	64.285	-	-	-	-	-	-
AE7: *Land-Based Anti-Ship Missile (LBASM) Technology*	-	10.951	21.849	14.053	-	14.053	-	-	-	-	-	-
AF1: *Long Range Maneuverable Fires (LRMF) Technology*	-	-	-	5.033	-	5.033	-	-	-	-	-	-
AF3: *Extended Range Propulsion Technology*	-	5.366	6.354	9.886	-	9.886	-	-	-	-	-	-
AF5: *Simulation and Aerostructures Technology*	-	1.319	-	-	-	-	-	-	-	-	-	-
AF6: *Structures Technology*	-	1.146	-	-	-	-	-	-	-	-	-	-
AF7: *Warhead Integration Technology*	-	1.612	-	-	-	-	-	-	-	-	-	-
AF8: *Affordable Extended Range Precision Technology*	-	0.277	8.181	8.684	-	8.684	-	-	-	-	-	-
AF9: *Precision and Accuracy Technology*	-	7.892	-	-	-	-	-	-	-	-	-	-
AG1: *Missile Electronics Technology*	-	2.897	-	-	-	-	-	-	-	-	-	-
AG2: *Information and Signal Processing Technology*	-	1.536	-	-	-	-	-	-	-	-	-	-
AG4: *Extended Range Artillery Munition Suite Technology*	-	6.526	8.351	11.151	-	11.151	-	-	-	-	-	-
AG6: *Energetic Materials and Advanced Processing Techno*	-	6.335	3.430	3.468	-	3.468	-	-	-	-	-	-
AG8: *Advanced Energetics Technology*	-	9.682	-	-	-	-	-	-	-	-	-	-
AG9: *Multiple Simul Engagement Technologies (MSET) Tech*	-	1.978	-	-	-	-	-	-	-	-	-	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army											Date: May 2021		
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602147A *I Long Range Precision Fires Technology*								
AH2: *Single Multi-mission Attack Missile (SMAM) Technol*	-	1.212	-	-	-	-	-	-	-	-	-	-	-
AH4: *Precision and Coop Weapons in a Denied Env Tech*	-	8.746	9.277	9.427	-	9.427	-	-	-	-	-	-	-
BN5: *Fuze and Power for Munitions*	-	0.920	1.065	2.583	-	2.583	-	-	-	-	-	-	-
BO9: *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)*	-	49.000	60.500	-	-	-	-	-	-	-	-	-	-

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).

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

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	120.327	60.553	65.959	-	65.959
Current President's Budget	117.395	119.007	64.285	-	64.285
Total Adjustments	-2.932	58.454	-1.674	-	-1.674
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	60.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.932	-2.046			
• Adjustments to Budget Years	-	-	-1.674	-	-1.674

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Project: BO9: *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)*		
Congressional Add: *Composite Cannon Tubes and Propulsion Technology*	10.000	-
Congressional Add: *Hybrid Projectile Technology*	6.000	-
Congressional Add: *Additive Manufacturing to Support Optimized Fires*	5.000	-
Congressional Add: *Program Increase*	20.000	-
Congressional Add: *Novel Printed Armament Components*	8.000	-
Congressional Add: *Program increase - precision strike munitions*	-	4.000
Congressional Add: *Program increase - extended range hybrid and precision gun launched projectiles*	-	15.000
Congressional Add: *Program increase - novel printed armament components*	-	6.500
Congressional Add: *Program increase: Advanced materials for missile applications*	-	20.000
Congressional Add: *Program increase - phase changing hydrogen fuel program*	-	15.000
Congressional Add Subtotals for Project: BO9	49.000	60.500
Congressional Add Totals for all Projects	49.000	60.500

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*	Project (Number/Name) AE7 / *Land-Based Anti-Ship Missile (LBASM) Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AE7: *Land-Based Anti-Ship Missile (LBASM) Technology*	-	10.951	21.849	14.053	-	14.053	-	-	-	-	-	-

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 developing technologies for Precision Strike Missile (PrSM) modular payloads for the delivery of dedicated Army intelligence, surveillance and reconnaissance (ISR) payloads and attack capabilities via long range missiles.

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)	FY 2020	FY 2021	FY 2022
Title: Land Based Anti-Ship Missile (LBASM) Technology	10.951	9.710	-
Description: 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. ***FY 2021 Plans:*** 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; design payload concept evaluation to determine lethality against both land and maritime targets. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** 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.			
Title: Precision Strike Missile Modular Payload Technology	-	12.139	14.053
Description: 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			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** AE7 / *Land-Based Anti-Ship Missile (LBASM) Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
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. ***FY 2021 Plans:*** 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; identify critical technologies associated with each subsystem, and initiate the development of preliminary designs for each subsystem to support required payload capabilities. ***FY 2022 Plans:*** Will advance the designs for payload subsystems including ISR sensor, signal processing, datalink, propulsion, and deployment mechanization; will initiate hardware fabrication of payload subsystems including ISR sensor, signal processing, datalink, propulsion, and deployment mechanization; and will develop system and subsystem level high fidelity modeling and simulations to assess integrated performance. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increase due to planned lifecycle of the project to enable additional development and fabrication of subsystems.			
Accomplishments/Planned Programs Subtotals	10.951	21.849	14.053

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*	Project (Number/Name) AF1 / *Long Range Maneuverable Fires (LRMF) Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AF1: *Long Range Maneuverable Fires (LRMF) Technology*	-	-	-	5.033	-	5.033	-	-	-	-	-	-

Note

This is a new start in FY 2022.

This is a new start for FY 2022.

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by developing next generation Multi-Domain Operations extended range missile technology for Precision Strike Missile to increase survivability, penetration, and range in A2/AD and denied environments while maintaining compatibility with M142 HIMARS and M270 MLRS launchers.

Work in this Project complements PE 0603464A (Long Range Precision Fires Advanced Technology) / AF2 (Long Range Maneuverable Fires 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 (US) Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Long Range Maneuverable Fires (LRMF) Technology	-	-	5.033
Description: Investigate and develop critical technologies that enable next generation Precision Strike Missile capabilities for extended range lethality up to or greater than 1000 km, increase survivability, and penetration in complex A2/AD and in GPS denied environments. ***FY 2022 Plans:*** Will determine system level technical requirements for next generation Precision Strike Missile capability; will develop system concepts; will identify subsystem functional and technical requirements; will determine critical technology requirements; and will investigate subsystem/component designs. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** This project was programmed in POM19, with efforts beginning in FY22.			
Accomplishments/Planned Programs Subtotals	-	-	5.033

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** AF1 / *Long Range Maneuverable Fires (LRMF) Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army											Date: May 2021	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*				Project (Number/Name) AF3 / *Extended Range Propulsion Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
AF3: *Extended Range Propulsion Technology*	-	5.366	6.354	9.886	-	9.886	-	-	-	-	-	-

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)	FY 2020	FY 2021	FY 2022
Title: Extended Range Propulsion Technology	5.366	6.354	9.886
Description: 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. ***FY 2021 Plans:*** Design air breathing propulsion component technology for cannon and rocket/missile artillery systems range extension; 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. ***FY 2022 Plans:*** Will conduct experiments and ground testing of semi-free jet air-breathing propulsion subsystems alternatives that can dramatically increase the range of rocket/missile artillery systems in the same form factor as traditional solid propellant rocket motor subsystems; will determine the viability of advanced propellant processing techniques via actual composite and minimum			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** AF3 / *Extended Range Propulsion Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
smoke propellant processing and static motor testing; will determine plume signature management technologies through static motor testing. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** FY22 funding increase due to planned lifecycle of the project; additional funding required to develop, design multiple/alternative technology subsystems, and perform ground testing; also will evaluate multiple advanced propellant formulations for increase range capability for missile systems			
Accomplishments/Planned Programs Subtotals	5.366	6.354	9.886

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*	Project (Number/Name) AF5 / *Simulation and Aerostructures Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AF5: *Simulation and Aerostructures Technology*	-	1.319	-	-	-	-	-	-	-	-	-	-

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)	FY 2020	FY 2021	FY 2022
Title: Simulation and Aerostructures Technology ***Description:*** Investigate and develop novel aerodynamic modeling and aerostructures to support extended range and maneuvering missile applications in high aerodynamic and thermal loading environments.	1.319	-	-
Accomplishments/Planned Programs Subtotals	1.319	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*	Project (Number/Name) AF6 / *Structures Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AF6: *Structures Technology*	-	1.146	-	-	-	-	-	-	-	-	-	-

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)	FY 2020	FY 2021	FY 2022
Title: Structures Technology ***Description:*** 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.	1.146	-	-
Accomplishments/Planned Programs Subtotals	1.146	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*	Project (Number/Name) AF7 / *Warhead Integration Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AF7: *Warhead Integration Technology*	-	1.612	-	-	-	-	-	-	-	-	-	-

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)	FY 2020	FY 2021	FY 2022
Title: Warhead Integration Technology ***Description:*** Investigate advanced warhead subsystem integration techniques for future missile systems.	1.612	-	-
Accomplishments/Planned Programs Subtotals	1.612	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army											Date: May 2021	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*				Project (Number/Name) AF8 / *Affordable Extended Range Precision Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
AF8: *Affordable Extended Range Precision Technology*	-	0.277	8.181	8.684	-	8.684	-	-	-	-	-	-

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)	FY 2020	FY 2021	FY 2022
Title: Affordable Extended Range Precision Technology ***Description:*** 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.	0.277	-	-
Title: LRPF High Payoff Missile Technology ***Description:*** 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. ***FY 2021 Plans:*** 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; investigate advanced materials modeling/optimization techniques and emerging high temperature materials to reduce weight and further extend the range of long range missiles; investigate advanced navigation and alternate navigation approaches that greatly reduce or eliminate the need for GPS for	-	8.181	8.684

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** AF8 / *Affordable Extended Range Precision Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
precision guidance of long range missiles in contested environments; and research long range, low altitude datalink technologies and communication architectures. ***FY 2022 Plans:*** Will continue to develop and mature integrated board level sensor-on-a-chip utilizing advanced thermal management techniques; will develop advanced materials modeling/optimization techniques and evaluate emerging high temperature materials to reduce weight and further extend the range of long range missiles; will design and develop advanced navigation and alternate navigation approaches; will refine concepts and evaluate through modeling and simulation long range, low altitude datalink technologies and communication architectures. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding increase due to planned lifecycle of the project; advance critical technologies required for future missile efforts in the Long Range Precision Fires Army Modernization Priority area.			
Accomplishments/Planned Programs Subtotals	0.277	8.181	8.684

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*	Project (Number/Name) AF9 / *Precision and Accuracy Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AF9: *Precision and Accuracy Technology*	-	7.892	-	-	-	-	-	-	-	-	-	-

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 2020	FY 2021	FY 2022
Title: Precision and Accuracy Technology	7.892	-	-
Description: 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.			
Accomplishments/Planned Programs Subtotals	7.892	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*	Project (Number/Name) AG1 / *Missile Electronics Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AG1: *Missile Electronics Technology*	-	2.897	-	-	-	-	-	-	-	-	-	-

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)	FY 2020	FY 2021	FY 2022
Title: Missile Electronics Technology	2.897	-	-
Description: Investigates and develops technologies and techniques to miniaturize guidance electronics for advanced missile			
Accomplishments/Planned Programs Subtotals	2.897	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*	Project (Number/Name) AG2 / *Information and Signal Processing Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AG2: *Information and Signal Processing Technology*	-	1.536	-	-	-	-	-	-	-	-	-	-

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)	FY 2020	FY 2021	FY 2022
Title: Information and Signal Processing Technology	1.536	-	-
Description: 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.			
Accomplishments/Planned Programs Subtotals	1.536	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*	Project (Number/Name) AG4 / *Extended Range Artillery Munition Suite Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AG4: *Extended Range Artillery Munition Suite Technology*	-	6.526	8.351	11.151	-	11.151	-	-	-	-	-	-

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)	FY 2020	FY 2021	FY 2022
Title: Precision At Range Technologies	2.794	3.151	3.204
Description: Investigates technologies that provide affordable precision capabilities for projectiles fired into Global Positioning System (GPS) denied environments. ***FY 2021 Plans:*** 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. ***FY 2022 Plans:*** Will investigate EO/IR Seeker performance including imaging detectors, optics trains, and supporting electronics for processing target recognition software integrated into a 155mm precision guided munition. Will conduct target data collections to inform algorithm development in advanced precision seekers. Will validate seeker sensor and algorithm M&S performance against			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** AG4 / *Extended Range Artillery Munition Suite Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
real world data. Will design and develop component technologies such as tactical grade IMU hardware to ensure gun-launch survivability. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding reflects planned lifecycle for this effort.			
Title: Extended Range Artillery Munition Suite Enabling Technologies ***Description:*** 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. ***FY 2021 Plans:*** 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. ***FY 2022 Plans:*** Will mature component technologies for extended range artillery projectiles through novel and improved algorithms using refined guidance and navigation system design concepts; conduct component level experiments to validate modeled performance to determine SWaP allocations required for future munition systems; will investigate solutions to enable in-flight, intra-munition communications, enhancing performance against targets in highly cluttered environments. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding reflects planned lifecycle for this effort.	3.732	1.997	2.008
Title: Optionally Manned Artillery Platform Technology ***Description:*** 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 ***FY 2021 Plans:*** Investigate cannon artillery automation technologies; Investigate automated fuze/fuze setting technologies to decrease fuze setting times and increase the rate of fire for precision projectiles; Investigate automated prognostics/diagnostics to enable	-	3.203	2.892

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** AG4 / *Extended Range Artillery Munition Suite Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
automated operations; Investigate automated and rapid rearm technologies including automated ammunition inventory to decrease operational down-time and unburden the soldier. ***FY 2022 Plans:*** Will investigate sensing technologies to improve spatial awareness for optionally manned artillery loading operations. Will investigate and design solutions to increase the speed of automated fuze setting for artillery autoloader applications. Will design solutions for prognostic systems to unburden the soldier during artillery loading operations and investigate an open architecture to enable connection to an optionally manned hull. Will design automated resupply component technologies and conduct experiments to define requirements for automated resupply. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding reflects planned lifecycle for this effort.			
Title: Large Caliber Cannon Technologies ***Description:*** This effort will advance the current state of the art in cannon and barrel technology for compatibility with higher velocity and precision munitions, harder rotating bands, high temperature operation, robustness against non-firing loads, and minimized weight and imbalance. This effort will investigate cannon concepts focused on residual stress & dynamic strain reduction, coating metallurgy, and barrel cooling to increase tube life and performance in high demand environments. ***FY 2022 Plans:*** Will investigate technologies to improve the life and performance of large caliber cannons. Will investigate: novel materials and impacts on dynamic strain using multiscale modeling, residual stress through triaxial stress/strain measurements of cannon tubes, novel refractory coating technologies, and barrel cooling techniques to reduce temperature rise at high rates of fire. Will conduct experiments and modeling to mature component technologies for future armament systems. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** In FY22 funding for this project is to investigate new technologies to increase the life and improve performance of large caliber cannons firing higher velocity projectiles.	-	-	3.047
Accomplishments/Planned Programs Subtotals	6.526	8.351	11.151

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** AG4 / *Extended Range Artillery Munition Suite Technology*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army											Date: May 2021	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*				Project (Number/Name) AG6 / *Energetic Materials and Advanced Processing Techno*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
AG6: *Energetic Materials and Advanced Processing Techno*	-	6.335	3.430	3.468	-	3.468	-	-	-	-	-	-

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)	FY 2020	FY 2021	FY 2022
Title: Novel Propulsion ***Description:*** 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.	3.191	-	-
Title: Scale-up of Insensitive Energetic Materials ***Description:*** Conduct research to advance the maturity of disruptive energetic materials. ***FY 2021 Plans:*** Design synthesis processes for the fabrication of energetic materials applicable to a wide range of additive manufacturing technologies; design embedded ignition for additively manufactured gun propulsion charges; conduct experiments of ECEM formulations; investigate next generation post launch propulsion concepts to achieve extended range. ***FY 2022 Plans:*** Will develop synthesis processes and fabrication of energetic materials applicable to a wide range of additive manufacturing technologies, and conduct experiments of additive energetic components; will develop embedded ignition concepts for additively manufactured gun propulsion charges and conduct advanced ignition experiments; will continue to conduct experiments of	3.144	3.430	3.468

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** AG6 / *Energetic Materials and Advanced Processing Techno*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Electrically Controlled Energetic Materials (ECEM) formulations; will design and develop next generation post launch propulsion on gun launched concepts for extended range. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	6.335	3.430	3.468

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*	Project (Number/Name) AG8 / *Advanced Energetics Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AG8: *Advanced Energetics Technology*	-	9.682	-	-	-	-	-	-	-	-	-	-

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)	FY 2020	FY 2021	FY 2022
Title: Advanced Energetics ***Description:*** 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.	9.682	-	-
Accomplishments/Planned Programs Subtotals	9.682	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*	Project (Number/Name) AG9 / *Multiple Simul Engagement Technologies (MSET) Tech*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AG9: *Multiple Simul Engagement Technologies (MSET) Tech*	-	1.978	-	-	-	-	-	-	-	-	-	-

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)	FY 2020	FY 2021	FY 2022
Title: Multiple Simultaneous Engagement Technologies (MSET) Technology	1.978	-	-
Description: 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.			
Accomplishments/Planned Programs Subtotals	1.978	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*	Project (Number/Name) AH2 / *Single Multi-mission Attack Missile (SMAM) Technol*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AH2: *Single Multi-mission Attack Missile (SMAM) Technol*	-	1.212	-	-	-	-	-	-	-	-	-	-

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)	FY 2020	FY 2021	FY 2022
Title: Single Multi-mission Attack Missile (SMAM) Technology	1.212	-	-
Description: 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.			
Accomplishments/Planned Programs Subtotals	1.212	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*	Project (Number/Name) AH4 / *Precision and Coop Weapons in a Denied Env Tech*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
AH4: *Precision and Coop Weapons in a Denied Env Tech*	-	8.746	9.277	9.427	-	9.427	-	-	-	-	-	-

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 research 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 2020	FY 2021	FY 2022
Title: Munition Navigation Technology in Contested Environments	4.641	4.919	4.999
Description: 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).			
FY 2021 Plans: Design collaborative navigation and guidance algorithms with improved realism of collaborative munitions engagement modeling and simulation; 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; validate mid-course and terminal guidance technologies during cannon-launched Global Positioning System -guided flights characteristic of future Long Range Precision Fires missions.			
FY 2022 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** AH4 / *Precision and Coop Weapons in a Denied Env Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Will conduct experiments on collaborative engagements to include multiple unmanned aerial systems equipped with imagers, software-defined radios, inertial measurement units, and embedded processors for validation of unanchored multi-agent localization (UMAL), UMAL-Aided anchored localization, formation control, multi-agent tracking, and weapon-target assignment; will conduct experiments on mid-course navigation technologies and data collection for terminal guidance algorithms. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.			
Title: Munition Maneuvering Technology in Extreme Environments ***Description:*** 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. ***FY 2021 Plans:*** Design munition guidance algorithms and required system characteristics to improve terminal survivability against integrated air defense system targets; design model-based optimal flight control automation to reduce gain tuning cycle time; develop aerodynamic control actuation with increased hinge loads, rise time/delay, packaging, and launch survivability; design airframe flight characterization and design tools to improve accuracy and shorten design cycle time; validate airframe, control actuation, and flight control technologies during cannon-launched GPS guided flights characteristic of future Long Range Precision Fires missions. ***FY 2022 Plans:*** Will conduct experiments to validate spiral technologies for long range precision fires airframe design concepts and characterization, control actuation, guidance and flight control algorithms; will conduct analysis of unique ballistic launch and flight system simulations to characterize hypersonic flight behaviors. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Funding change reflects planned lifecycle of this effort.	4.105	4.358	4.428
Accomplishments/Planned Programs Subtotals	8.746	9.277	9.427

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** AH4 / *Precision and Coop Weapons in a Denied Env Tech*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army										Date: May 2021		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*				Project (Number/Name) BN5 / *Fuze and Power for Munitions*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
BN5: *Fuze and Power for Munitions*	-	0.920	1.065	2.583	-	2.583	-	-	-	-	-	-

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)	FY 2020	FY 2021	FY 2022
Title: Advanced Energetics	0.920	1.065	2.583
Description: This effort develops advanced fuze and power technologies for future munition applications that enable an increase in range and lethality, of ammunitions.			
FY 2021 Plans: Investigates enabling technologies for improved lethality in munition applications while ensuring operation during extended range flight; develops algorithms and explore advance capabilities for fuze proximity sensors to track targets and resist countermeasures; conducts component level experiments for breadboard design architectures of of electronic safe and arm device; designs interfaces for secure wireless data setting in advanced auto-loader systems; investigates wireless technology protocols to enable high speed data transfer; investigates novel power approaches for long range munitions and hypersonics technologies. This effort continues to leverage the OSD Joint Munitions Program TCG-5 and TCG-10 and the OSD Joint Fuze Technology Program.			
FY 2022 Plans: Will conduct experiments to mature components and algorithms for tracking proximity sensors; will design fuze breadboards for wireless setting and advanced multi-point initiation architectures; will conduct power source performance predictions and investigations of experimental materials. This effort will continue to leverage the OSD Joint Munitions Program TCG-3 and the OSD Joint Fuze Technology Program.			
FY 2021 to FY 2022 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** BN5 / *Fuze and Power for Munitions*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Increase to support the increased development of component and sub-component technologies critical to timed munitions.			
Accomplishments/Planned Programs Subtotals	0.920	1.065	2.583

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army												Date: May 2021
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602147A / *Long Range Precision Fires Technology*				Project (Number/Name) BO9 / *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)*			
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
BO9: *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)*	-	49.000	60.500	-	-	-	-	-	-	-	-	-

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 2020	FY 2021
Congressional Add: Composite Cannon Tubes and Propulsion Technology ***FY 2020 Accomplishments:*** Program Increase supported applied research on Composite Cannon Tubes and Propulsion Technology. Work executed under the direction of the Army Futures Command.	10.000	-
Congressional Add: Hybrid Projectile Technology ***FY 2020 Accomplishments:*** Program Increase supported applied research on Hybrid Projectile Technology. Work executed under the direction of the Army Futures Command.	6.000	-
Congressional Add: Additive Manufacturing to Support Optimized Fires ***FY 2020 Accomplishments:*** Program Increase supported applied research on Additive Manufacturing to Support Optimized Fires. Work executed under the direction of the Army Futures Command.	5.000	-
Congressional Add: Program Increase ***FY 2020 Accomplishments:*** Program Increase supported applied research on Long Range Precision Fires Technology.	20.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** BO9 / *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021
Work executed under the direction of the Army Futures Command.		
Congressional Add: Novel Printed Armament Components ***FY 2020 Accomplishments:*** Program Increase supported applied research on Novel Printed Armament Components. Work executed under the direction of the Army Futures Command.	8.000	-
Congressional Add: Program increase - precision strike munitions ***FY 2021 Plans:*** Conduct applied research in Precision Strike Munitions. Work executed by Army Futures Command.	-	4.000
Congressional Add: Program increase - extended range hybrid and precision gun launched projectiles ***FY 2021 Plans:*** Conduct applied research in Extended Range Hybrid and Precision Gun Launched Projectiles. Work executed by Army Futures Command.	-	15.000
Congressional Add: Program increase - novel printed armament components ***FY 2021 Plans:*** Conduct applied research in Novel Printed Armament Components. Work executed by Army Futures Command.	-	6.500
Congressional Add: Program increase: Advanced materials for missile applications ***FY 2021 Plans:*** Conduct applied research in Advanced Materials for Missile Applications. Work executed by Army Futures Command.	-	20.000
Congressional Add: Program increase - phase changing hydrogen fuel program ***FY 2021 Plans:*** Conduct applied research in Phase Changing Hydrogen Fuel Program. Work executed by Army Futures Command.	-	15.000
Congressional Adds Subtotals	49.000	60.500

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** BO9 / *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A