Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army												Date: May 2021
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 5: *System Development & Demonstration (SDD)*					R-1 Program Element (Number/Name) PE 0604854A / *Artillery Systems - EMD*							
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	-	20.290	36.187	-	-	-	-	-	-	-	-	-
509: *LIGHTWEIGHT 155M HOWITZER*	-	7.318	-	-	-	-	-	-	-	-	-	-
HB6: *Mobile 155MM Howitzer*	-	12.972	36.187	-	-	-	-	-	-	-	-	-

Note

Elimination: Project HB6 has no funding request for Fiscal Year (FY) 2022.

A. Mission Description and Budget Item Justification

This program element encompasses engineering and manufacturing development for artillery weapons systems.

Project 509 supports the Lightweight 155mm Howitzer (LW155), also known as the M777A2, which is a Joint Service program between the United States Marine Corps (USMC) and US Army which provides direct, reinforcing, general support fires to maneuver forces and direct support artillery. The LW155 was first introduced into the USMC in April 2005 and the Marines have fielded the howitzer to all active units. The Army fielded the howitzer to its Stryker Brigade Combat teams (SBCT), Fires Brigades, National Guard and Infantry Brigade Combat Teams (IBCT). The LW155 fires unassisted projectiles to a range of 30 kilometers (km) and assisted projectiles to 40km. It is a successful joint service program between the USMC and US Army working together to develop, produce, field, and sustain the howitzer. The howitzer will be going through obsolescent replacement of electronic components in its digital fire control system, since it has been in the field for more than ten years.

Current development efforts are focused on extending the range of the LW155 to reduce the threat of being out ranged by potential adversaries and meeting the range key performance parameter objective distance (greater than 40km) as stated in the Joint US Army, USMC Operational Requirements Document (JORD) for Advanced Towed Cannon System, but deferred during Engineering Manufacturing and Development due to technology maturity, cost and schedule. The USMC and US Army are leveraging technology being developed as part of the Extended Range Cannon Artillery (ERCA) program by the US Army. The ERCA program is a suite of technologies, cannon, ammunition and fire control, to increase the range of cannon artillery to exceed peer competitors range (greater than 70km). An operational demonstration of the M777 Extended Range (M777ER) howitzer will be conducted at the end of FY 2020 to assess the performance of best available projectiles and objective hardware of M777ER howitzer.

Project HB6 supports the mobile howitzer program. The Mobile 155mm Howitzer is a Self-Propelled, 155mm Wheeled Howitzer that provides lethal, proactive counter-fire essential for the survivability of the maneuver formations and other close support fires as required. The Mobile Howitzer improves the Field Artillery Battalion's ability to maintain pace with its supporting maneuver formations and survive against responsive, counter-fire from near-peer threats with rapid displacement and emplacement times. The mobile howitzer will improve tactical mobility and system survivability compared to existing towed howitzer systems. Development efforts, prototyping and evaluations will focus on attributes such as improved emplacement and displacement times, driving speed, and crew protection capabilities, all without sacrificing lethality versus existing towed howitzer systems. Program activities in FY 2021 will be focused on evaluation of multiple vendor mobile howitzer systems at United

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 5: *System Development & Demonstration (SDD)*	**R-1 Program Element (Number/Name)** PE 0604854A *I Artillery Systems - EMD*

States proving grounds against system requirements. Evaluation will include safety testing, US ammunition compatibility testing, and assessment of mobility, survivability and transportability.

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	10.732	11.611	35.263	-	35.263
Current President's Budget	20.290	36.187	0.000	-	0.000
Total Adjustments	9.558	24.576	-35.263	-	-35.263
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	25.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	10.000	-			
• SBIR/STTR Transfer	-0.442	-0.424			
• Adjustments to Budget Years	-	-	-35.263	-	-35.263

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Project: HB6: *Mobile 155MM Howitzer*		
Congressional Add: *105MM Mobile Howitzer Evaluation*	10.000	-
Congressional Add: *Soft Recoil Development*	-	25.000
Congressional Add Subtotals for Project: HB6	10.000	25.000
Congressional Add Totals for all Projects	10.000	25.000

Change Summary Explanation

Decrease of $35,263K from FY21 to FY22 is the result of the completion of the 155mm Mobile Howitzer System Evaluation.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0604854A / *Artillery Systems - EMD*	Project (Number/Name) 509 / *LIGHTWEIGHT 155M HOWITZER*	

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
509: *LIGHTWEIGHT 155M HOWITZER*	-	7.318	-	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Lightweight 155 millimeter (mm) Howitzer (LW155), also known as the M777A2, is a Joint Service program between the United States Marine Corps (USMC) and United States Army which provides direct, reinforcing, general support fires to maneuver forces and direct support artillery. The LW155 was first introduced into the USMC in April 2005 and the Marines have fielded the howitzer to all active units. The Army fielded the howitzer to its Stryker Brigade Combat teams (SBCT), Fires Brigades, National Guard and Infantry Brigade Combat Teams (IBCT). The LW155 saw extensive action in Afghanistan, receiving high marks for its performance. It replaces all howitzers in all USMC missions and replaces the M198 howitzer as the general support artillery for light forces in the Army. The LW155 fires unassisted projectiles to a range of 30 kilometers (km) and assisted projectiles to 40km. The addition of the digital fire control system enables the weapon to program and fire the improved Excalibur precision-guided munitions to ranges in excess of 40km with better than 10-meter Circular Error Probable (CEP) accuracy. The LW155 is the first ground combat system whose major structures are made of high strength titanium alloy and the system makes extensive use of hydraulics to operate the breech, load tray, recoil and wheel arms. It is a successful joint service program between the USMC and United States Army working together to develop, produce, field, and sustain the howitzer. The howitzer will be going through obsolescent replacement of electronic components in its digital fire control system, since it has been in the field for more than ten years.

Production and fielding of the LW155 concluded and entered into the Sustainment Life Cycle Phase. Current development efforts are focused on extending the range of the LW155 to reduce the threat of being out ranged by potential adversaries and meeting the range key performance parameter objective distance (greater than 40km) as stated in the Joint United States Army, USMC Operational Requirements Document (JORD) for Advanced Towed Cannon System, but deferred during Engineering Manufacturing and Development due to technology maturity, cost and schedule. The USMC and United States Army are leveraging technology being developed as part of the Extended Range Cannon Artillery (ERCA) program by the United States Army. The ERCA program is a suite of technologies, cannon, ammunition and fire control, to increase the range of cannon artillery to exceed peer competitors range (greater than 70km). An operational demonstration of the M777 Extended Range (M777ER) howitzer will be conducted at the end of FY 2020 to assess the performance of best available projectiles and objective hardware of M777ER howitzer.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Product Development ***Description:*** Funds engineering support from the Armaments Research Development and Engineering Center	5.491	-	-
Title: Opertional Assessment ***Description:*** Funding will support operational assessment of M777 Extended Range Howitzer in a controlled test environment.	1.827	-	-
Accomplishments/Planned Programs Subtotals	7.318	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 5	**R-1 Program Element (Number/Name)** PE 0604854A / *Artillery Systems - EMD*	**Project (Number/Name)** 509 / *LIGHTWEIGHT 155M HOWITZER*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• GZ1700: *M777 Mods*	2.367	9.783	21.976	-	21.976	-	-	-	-	-	-

Remarks

Procurement funding supports active retrofits and hardware refresh for previously contracted Digital Fire Control System components, addressing obsolescence.

D. Acquisition Strategy

Production and fielding of the M777A2 has concluded and has now entered into the Sustainment Life Cycle Phase. Current Research Development Test & Evaluation (RDTE) efforts are focused on extending the range of the M777A2 to reduce the threat of being out ranged by potential adversaries and meeting the range key performance parameter objective distance (>40 KM) as stated in the Joint US Army, USMC JORD for Advanced Towed Cannon System, but deferred during Engineering Manufacturing and Development due to technology maturity, cost and schedule. The USMC and US Army are leveraging technology being developed as part of the ERCA program by the US Army. The ERCA program is a suite of technologies, cannon, ammunition and fire control, to increase the range of cannon artillery to exceed peer competitors range (>70KM). An operational demonstration of the M777 Extended Range howitzer will be begin at the end of FY 2020 to support the decision point for procurement in support of an Urgent Materiel Release.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0604854A / *Artillery Systems - EMD*	Project (Number/Name) 509 / *LIGHTWEIGHT 155M HOWITZER*

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management	Sub Allot	Program Management Towed Artillery Systems : Picatinny Arsenal, NJ	0.998	-		-		-		-		-	0.000	0.998	Continuing
		Subtotal	0.998	-		-		-		-		-	0.000	0.998	N/A

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering	MIPR	Armaments Research & Developmet Center : Picatinny Arsenal, NJ	8.474	5.491	Nov 2019	-		-		-		-	0.000	13.965	Continuing
Long Lead Prototypes	MIPR	Watervliet Arsenal : Watervliet, NY	1.920	-		-		-		-		-	0.000	1.920	Continuing
		Subtotal	10.394	5.491		-		-		-		-	0.000	15.885	N/A

Remarks

FY 2020 increase funds the operational assessment of the M777 Extended Range (M777ER) howitzer for the Army's modernization Long Range Precision Fires.

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Operational Assessment	MIPR	Army Test & Evaluation Command : Yuma, AZ	-	1.827	Jul 2020	-		-		-		-	0.000	1.827	Continuing
		Subtotal	-	1.827		-		-		-		-	0.000	1.827	N/A

Remarks

FY2020 increase funds test center costs in support of the Operational Assessment at Yuma Test Center.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0604854A / *Artillery Systems - EMD*	Project (Number/Name) 509 / *LIGHTWEIGHT 155M HOWITZER*	

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	11.392	7.318		0.000		-		-		-	0.000	18.710	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 5	**R-1 Program Element (Number/Name)** PE 0604854A / *Artillery Systems - EMD*	**Project (Number/Name)** 509 / *LIGHTWEIGHT 155M HOWITZER*

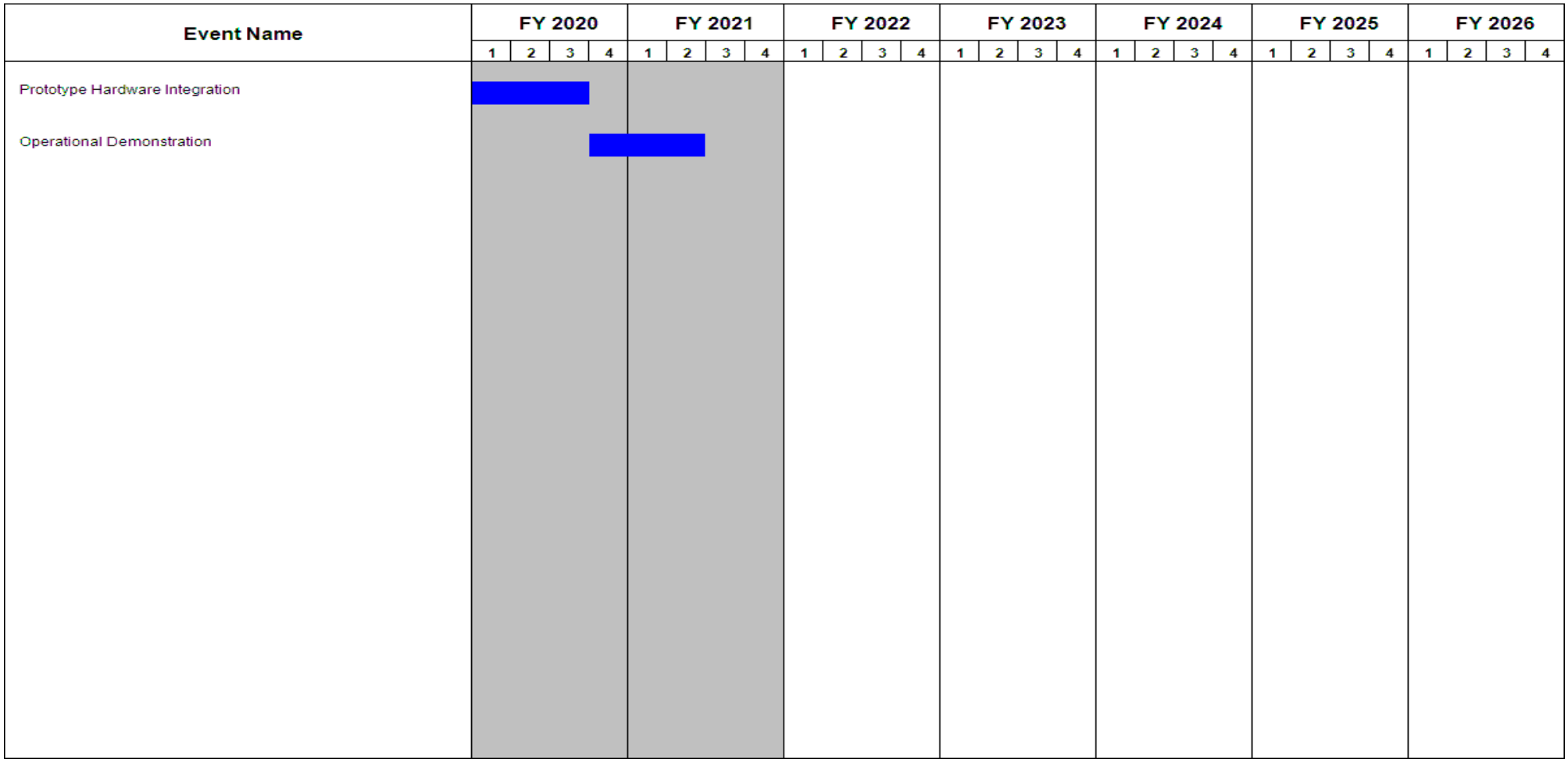

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 5	**R-1 Program Element (Number/Name)** PE 0604854A / *Artillery Systems - EMD*	**Project (Number/Name)** 509 / *LIGHTWEIGHT 155M HOWITZER*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
XM907 Common Cannon Assembly Support	1	2015	2	2019
Objective M777ER Design, Analysis & Drawings	1	2015	1	2019
Objective M777ER Component Fabrication	2	2018	3	2019
Prototype Hardware Integration	1	2019	3	2020
Operational Demonstration	4	2020	2	2021

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0604854A / *Artillery Systems - EMD*	Project (Number/Name) HB6 / *Mobile 155MM Howitzer*	

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
HB6: *Mobile 155MM Howitzer*	-	12.972	36.187	-	-	-	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

Elimination: Project HB6 has no funding request for Fiscal Year (FY) 2022.

A. Mission Description and Budget Item Justification

Project HB6 supports the mobile howitzer program. The Mobile 155 millimeter (mm) Howitzer is a Self-Propelled, 155mm Wheeled Howitzer that provides lethal, proactive counter-fire essential for the survivability of the maneuver formations and other close support fires as required. The Mobile Howitzer improves the Field Artillery Battalion's ability to maintain pace with its supporting maneuver formations and survive against responsive, counter-fire from near-peer threats with rapid displacement and emplacement times. The mobile howitzer will improve tactical mobility and system survivability compared to existing towed howitzer systems. Development efforts, prototyping and evaluations will focus on attributes such as improved emplacement and displacement times, driving speed, and crew protection capabilities, all without sacrificing lethality versus existing and future towed howitzer systems.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Title: Mobile Howitzer Analysis ***Description:*** Conducts analysis of prototype and existing mobile howitzers.	2.972	-	-
Title: Testing and Engineering Support ***Description:*** Live fire testing of Mobile Howitzer and associated engineering support. ***FY 2021 Plans:*** Funding will provide range time for United States (US) ammunition compatibility testing and system safety release to mature systems for operational evaluation. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Decrease from FY 2021 to FY 2022 reflects the completion of testing.	-	8.802	-
Title: Bid Sample Test ***Description:*** Funding will support engineering and operational evaluation of Mobile Howitzer vendor systems against the Operational Needs Statement (ONS). ***FY 2021 Plans:***	-	2.385	-

Exhibit R-2A, RDT&E Project Justification: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 5	**R-1 Program Element (Number/Name)** PE 0604854A / *Artillery Systems - EMD*	**Project (Number/Name)** HB6 / *Mobile 155MM Howitzer*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021	FY 2022
Funding will support engineering and operational evaluation of Mobile Howitzer vendor systems. ***FY 2021 to FY 2022 Increase/Decrease Statement:*** Decrease from FY 2021 to FY 2022 reflects the completion of testing.			
Accomplishments/Planned Programs Subtotals	2.972	11.187	-

	FY 2020	FY 2021
Congressional Add: 105MM Mobile Howitzer Evaluation ***FY 2020 Accomplishments:*** Funds procure test systems from the potential vendor and test system to support safe operational use by soldiers.	10.000	-
Congressional Add: Soft Recoil Development ***FY 2021 Plans:*** Funds support the engineering and development of the soft recoil system.	-	25.000
Congressional Adds Subtotals	10.000	25.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The acquisition strategy for the Mobile Howitzer Program is to evaluate existing industry prototypes and fielded systems and assess capability of mobility and survivability attributes. Evaluation will be conducted by US Army engineers and the Army Test and Evaluation Command.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army			Date: May 2021
Appropriation/Budget Activity 2040 / 5	R-1 Program Element (Number/Name) PE 0604854A / *Artillery Systems - EMD*	Project (Number/Name) HB6 / *Mobile 155MM Howitzer*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Mobile Howitzer Analysis	MIPR	Combat Capability Development Command, Armaments Center : Picatinny Arsenal, NJ	-	2.972	Oct 2019	-		-		-		-	0.000	2.972	-
Soft Recoil Development	TBD	PM Towed Artillery Systems : Picatinny Arsenal, NJ	-	-		25.000	Mar 2021	-		-		-	0.000	25.000	-
		Subtotal	-	2.972		25.000		-		-		-	0.000	27.972	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2020 Cost	FY 2020 Award Date	FY 2021 Cost	FY 2021 Award Date	FY 2022 Base Cost	FY 2022 Base Award Date	FY 2022 OCO Cost	FY 2022 OCO Award Date	FY 2022 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Testing and Engineering Support	MIPR	Yuma Test Center / Combat Capability Development Command, Armaments Center : Yuma, AZ / Picatinny, NJ	-	-		8.802	Oct 2020	-		-		-	Continuing	Continuing	-
Bid Sample Test	MIPR	Yuma Test Center : Yuma, AZ	-	-		2.385	Jul 2021	-		-		-	0.000	2.385	-
105MM Mobile Howitzer Evaluation	SS/FFP	Army Contracting Command New Jersey : Various	-	10.000		-		-		-		-	0.000	10.000	-
		Subtotal	-	10.000		11.187		-		-		-	Continuing	Continuing	N/A

	Prior Years	FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	12.972		36.187		-		-		-	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 5	**R-1 Program Element (Number/Name)** PE 0604854A / *Artillery Systems - EMD*	**Project (Number/Name)** HB6 / *Mobile 155MM Howitzer*

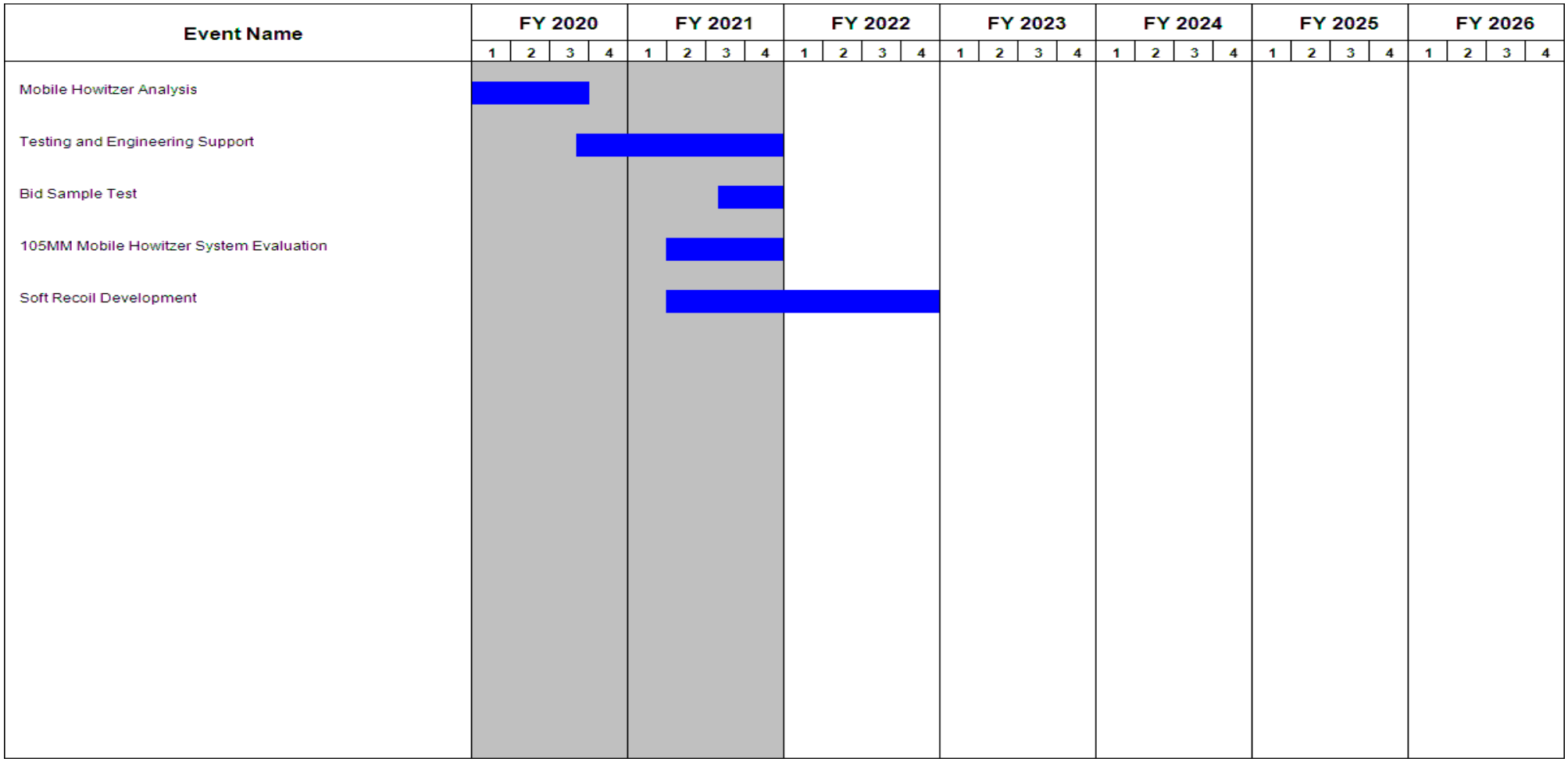

Exhibit R-4A, RDT&E Schedule Details: PB 2022 Army		Date: May 2021
Appropriation/Budget Activity 2040 / 5	**R-1 Program Element (Number/Name)** PE 0604854A / *Artillery Systems - EMD*	**Project (Number/Name)** HB6 / *Mobile 155MM Howitzer*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Mobile Howitzer Analysis	1	2020	3	2020
Testing and Engineering Support	3	2020	4	2021
Bid Sample Test	3	2021	4	2021
105MM Mobile Howitzer System Evaluation	2	2021	4	2021
Soft Recoil Development	2	2021	4	2022