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**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 7: Operational Systems Development</i>					<b>R-1 Program Element (Number/Name)</b> PE 0203743A / <i>155mm Self-Propelled Howitzer Improvements</i>							
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	-	35.681	199.274	427.254	-	427.254	301.244	87.210	33.657	33.997	0.000	1,118.317
FF9: <i>PIM Improvement Program</i>	-	35.681	199.274	427.254	-	427.254	301.244	87.210	33.657	33.997	0.000	1,118.317

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

The current Paladin Integrated Management (PIM) is an Acquisition Category (ACAT) 1C Acquisition program which consists of the Self Propelled Howitzer (SPH) and the Carrier Ammunition Tracked (CAT). The PIM Improvement Program is intended to address the current Howitzer capability gap based on a capability needs assessment performed by the user community to restore indirect fires support overmatch to the United States Army. This effort will evaluate developing technologies to determine which configuration will add optimal value to the Army. This effort will consist of multiple increments to spiral technology as it matures and may include, but is not limited to mobility, survivability, reliability, supportability, and lethality upgrades such as the Extended Range Cannon Artillery (ERCA) modernization effort to integrate a new cannon, gun mount, gun drive systems, fire control systems, autoloader, and optionally-manned capability into a Howitzer platform. Analysis will be required to evaluate the impact of the new cannon technology and modifications required to support ammunition automation, remote firing, and remote movement on the vehicle chassis, cab, suspension, mobility, and electronic architecture. This effort will develop, evaluate, build, and test prototypes.

<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	37.155	214.246	393.712	-	393.712
Current President's Budget	35.681	199.274	427.254	-	427.254
Total Adjustments	-1.474	-14.972	33.542	-	33.542
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-14.972			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.474	-			
• Adjustments to Budget Years	-	-	33.542	-	33.542

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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 / 7					<b>R-1 Program Element (Number/Name)</b> PE 0203743A / 155mm Self-Propelled Howitzer Improvements				<b>Project (Number/Name)</b> FF9 / PIM Improvement Program			
<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>
FF9: PIM Improvement Program	-	35.681	199.274	427.254	-	427.254	301.244	87.210	33.657	33.997	0.000	1,118.317
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

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

The current Paladin Integrated Management (PIM) is an Acquisition Category (ACAT) 1C Acquisition program which consists of the Self Propelled Howitzer (SPH) and the Carrier Ammunition Tracked (CAT). The PIM Improvement Program is intended to address the current Howitzer capability gap based on a capability needs assessment performed by the user community to restore indirect fires support overmatch to the United States Army. This effort will evaluate developing technologies to determine which configuration will add optimal value to the Army. This effort will consist of multiple increments to spiral technology as it matures and may include, but is not limited to mobility, survivability, reliability, supportability, and lethality upgrades such as the Extended Range Cannon Artillery (ERCA) modernization effort to integrate a new cannon, gun mount, gun drive systems, fire control systems, autoloader, and optionally-manned capability into a Howitzer platform. Analysis will be required to evaluate the impact of the new cannon technology and modifications required to support ammunition automation, remote firing, and remote movement on the vehicle chassis, cab, suspension, mobility, and electronic architecture. This effort will develop, evaluate, build, and test prototypes.

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

	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<b>Title:</b> ERCA INC 1 - Product Development	31.220	162.050	129.834
<b>Description:</b> ERCA INC 1C improves lethality through increased range to the SPH. Funds support the ERCA INC 1C developmental engineering costs and build the ERCA INC 1C prototypes.			
<b>FY 2020 Plans:</b> Will purchase long lead materials for the ERCA prototypes to be integrated onto the M109A7 platform. Use Army Combat Capabilities Development Command Armaments Center (ARDEC) Other Transaction Agreement (OTAs) to bring non traditional contractors to burn down risk. System Level Critical Design Review (CDR) in 2nd Quarter (2Q) Fiscal Year (FY) 2020.			
<b>FY 2021 Plans:</b> Conduct developmental engineering efforts, conduct vehicle integration design, build ERCA INC 1C prototypes, support testing, and develop level 3 Thermal Design Power (TDP).			
<b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Decrease from FY 2020 to FY 2021 is due to ERCA INC 1C and ERCA INC 2 detailed breakout in the R Forms.			
<b>Title:</b> ERCA INC 2 - Product Development	-	-	219.784
<b>Description:</b> ERCA INC 2 improves lethality through increased rate of fire. Funds support the ERCA INC 2 development engineering costs to include building the ERCA INC 2 prototypes.			

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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 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0203743A / 155mm Self-Propelled Howitzer Improvements	<b>Project (Number/Name)</b> FF9 / PIM Improvement Program		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
<p><b>FY 2021 Plans:</b> Design and integrate autoloader and cab configurations. Conduct system level integration and engineering efforts to upgrade and design mobility, survivability, reliability and lethality upgrades. As necessary, procure long lead material for ERCA INC 2 prototypes.</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Increase from FY 2020 to FY 2021 is due to ERCA INC 1C and ERCA INC 2 detailed breakout in the R Forms.</p>				
<p><b>Title:</b> Program Management</p> <p><b>Description:</b> Funding is provided for all Program Management efforts on the Extended Range Cannon Artillery effort.</p> <p><b>FY 2020 Plans:</b> Continue the development for all required documents, office staff and engineering Integrated Product Team (IPT) development. Use CCDC-AC OTAs to reduce risk.</p> <p><b>FY 2021 Plans:</b> Continue the development and production for all required documents, office staff and engineering IPT development. Use non traditional contractors OTAs to reduce risk.</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Increase from FY 2020 to FY 2021 is due to ramp up on ERCA INC 1C and ERCA INC 2 development.</p>		3.701	3.896	7.070
<p><b>Title:</b> Test and Evaluation</p> <p><b>Description:</b> This funding supports all Testing and Evaluation on all increments on the Extended Range Cannon Artillery effort.</p> <p><b>FY 2020 Plans:</b> Government Test support to include all test execution, data collection and logistic support. To include tests of Mobility, Reliability and Test Firings. Use CCDC-AC OTAs to reduce risk. TDP Development through 3Q FY 2020.</p> <p><b>FY 2021 Plans:</b> Conduct Developmental Testing and ammunition qualification. These events include all test execution, data collection, contractor and logistic support for mobility, reliability and firings tests.</p> <p><b>FY 2020 to FY 2021 Increase/Decrease Statement:</b> Increase from FY 2020 to FY 2021 is due to the beginning of ERCA INC 1C developmental testing efforts and ammunition qualifications.</p>		0.760	33.328	70.566
<b>Accomplishments/Planned Programs Subtotals</b>		35.681	199.274	427.254

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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 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0203743A / 155mm Self-Propelled Howitzer Improvements	<b>Project (Number/Name)</b> FF9 / PIM Improvement Program

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

<u>Line Item</u>	<u>FY 2019</u>	<u>FY 2020</u>	<u>FY 2021</u> <u>Base</u>	<u>FY 2021</u> <u>OCO</u>	<u>FY 2021</u> <u>Total</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• GA0400: M109 FOV Modifications	26.482	25.756	26.893	-	26.893	80.337	122.886	158.750	253.849	0.000	694.953

**Remarks**

**D. Acquisition Strategy**

Program Manager (PM) Self-Propelled Howitzer Systems (SPHS) will use the approved National Defense Authorization Act (NDAA) Section 804 middle tier acquisition program and subsequent NDAA Section 804 middle tier acquisition programs for development, rapid prototyping, rapid fielding, integration, test, and sustainment actions as the program moves forward and transitions to a program of record to field the ERCA system.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Army												Date: February 2020			
Appropriation/Budget Activity 2040 / 7				R-1 Program Element (Number/Name) PE 0203743A / 155mm Self-Propelled Howitzer Improvements					Project (Number/Name) FF9 / PIM Improvement Program						
Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
PIM Improvement Program	MIPR	Various - OGAs : PEO	22.161	-		-		-		-		-	Continuing	Continuing	Continuing
ERCA INC 1C - Developmental Eng	Various	Various : Various Locations	14.344	21.878	Jan 2019	86.040	Jan 2020	77.715	Jan 2021	-		77.715	Continuing	Continuing	Continuing
ERCA INC 1C - Prototype Build	Various	Various : Various Locations	-	9.342	Jan 2019	-		52.119	Jan 2021	-		52.119	Continuing	Continuing	Continuing
ERCA INC 2 - Developmental Eng	Various	Various : Various Locations	-	-		76.010	Feb 2020	143.712	Feb 2021	-		143.712	Continuing	Continuing	Continuing
ERCA INC 2 - Prototype Build	Various	Various : Various Locations	-	-		-		76.072	Oct 2020	-		76.072	Continuing	Continuing	Continuing
<b>Subtotal</b>			36.505	31.220		162.050		349.618		-		349.618	Continuing	Continuing	N/A
Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
PMO/PEO Support	MIPR	PM/PEO PIM : Various	2.649	3.701	Dec 2018	3.896	Dec 2019	7.070	Oct 2020	-		7.070	Continuing	Continuing	Continuing
<b>Subtotal</b>			2.649	3.701		3.896		7.070		-		7.070	Continuing	Continuing	N/A
Test and Evaluation (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Test and Evaluation	MIPR	Various - OGAs : Various	-	0.760	Dec 2018	33.328	Apr 2020	70.566	Oct 2020	-		70.566	Continuing	Continuing	Continuing
<b>Subtotal</b>			-	0.760		33.328		70.566		-		70.566	Continuing	Continuing	N/A
<b>Project Cost Totals</b>			39.154	35.681		199.274		427.254		-		427.254	Continuing	Continuing	N/A



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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2021 Army</b>		<b>Date:</b> February 2020
<b>Appropriation/Budget Activity</b> 2040 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0203743A / 155mm Self-Propelled Howitzer Improvements	<b>Project (Number/Name)</b> FF9 / PIM Improvement Program

Event Name	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025											
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4								
INC 1 Developmental Engineering	[Blue bar spanning FY 2019 Q1-Q4, FY 2020 Q1-Q4, FY 2021 Q1-Q4, FY 2022 Q1-Q4]																																			
INC 1 Dev Eng	[Blue bar spanning FY 2019 Q1-Q4, FY 2020 Q1-Q4, FY 2021 Q1-Q4, FY 2022 Q1-Q4]																																			
INC 1 Integration OTA Award			1																																	
INC 1 OTA Award			1																																	
INC 1 Prototype Manufacturing	[Blue bar spanning FY 2019 Q1-Q4, FY 2020 Q1-Q4, FY 2021 Q1-Q4, FY 2022 Q1-Q4]																																			
INC 1 Prototypes	[Blue bar spanning FY 2019 Q1-Q4, FY 2020 Q1-Q4, FY 2021 Q1-Q4, FY 2022 Q1-Q4]																																			
INC 1 Developmental Testing and Operational Assessment	[Blue bar spanning FY 2019 Q1-Q4, FY 2020 Q1-Q4, FY 2021 Q1-Q4, FY 2022 Q1-Q4, FY 2023 Q1-Q4]																																			
INC 1 DT/OA	[Blue bar spanning FY 2019 Q1-Q4, FY 2020 Q1-Q4, FY 2021 Q1-Q4, FY 2022 Q1-Q4, FY 2023 Q1-Q4]																																			
INC 2 Developmental Engineering									[Blue bar spanning FY 2021 Q1-Q4, FY 2022 Q1-Q4, FY 2023 Q1-Q4, FY 2024 Q1-Q4, FY 2025 Q1-Q4]																											
INC 2 Dev Eng									[Blue bar spanning FY 2021 Q1-Q4, FY 2022 Q1-Q4, FY 2023 Q1-Q4, FY 2024 Q1-Q4, FY 2025 Q1-Q4]																											
INC 2 Integration OTA Awards											2																									
OTA Awards											2																									
INC 2 Prototype Manufacturing									[Blue bar spanning FY 2021 Q1-Q4, FY 2022 Q1-Q4, FY 2023 Q1-Q4]																											
INC 2 Prototypes									[Blue bar spanning FY 2021 Q1-Q4, FY 2022 Q1-Q4, FY 2023 Q1-Q4]																											
INC 2 Developmental Testing and Operational Assessment									[Blue bar spanning FY 2021 Q1-Q4, FY 2022 Q1-Q4, FY 2023 Q1-Q4, FY 2024 Q1-Q4, FY 2025 Q1-Q4]																											
INC 2 DT/OA									[Blue bar spanning FY 2021 Q1-Q4, FY 2022 Q1-Q4, FY 2023 Q1-Q4, FY 2024 Q1-Q4, FY 2025 Q1-Q4]																											

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2021 Army		<b>Date:</b> February 2020
<b>Appropriation/Budget Activity</b> 2040 / 7	<b>R-1 Program Element (Number/Name)</b> PE 0203743A / 155mm Self-Propelled Howitzer Improvements	<b>Project (Number/Name)</b> FF9 / PIM Improvement Program

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
INC 1 Developmental Engineering	2	2018	3	2023
INC 1 Integration OTA Award	4	2019	4	2019
INC 1 Prototype Manufacturing	4	2018	3	2023
INC 1 Developmental Testing and Operational Assesment	1	2019	4	2024
INC 2 Developmental Engineering	2	2020	2	2025
INC 2 Integration OTA Awards	4	2020	4	2020
INC 2 Prototype Manufacturing	1	2021	3	2023
INC 2 Developmental Testing and Operational Assesment	1	2021	2	2025