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

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0604327F I <i>Hard and Deeply Buried Target Defeat System (HDBTDS) Program</i>
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	41.259	113.121	52.921	0.000	52.921	16.974	0.000	0.000	0.000	0.000	224.275
645341: <i>Direct Strike Penetrator Systems</i>	0.000	41.259	113.121	52.921	0.000	52.921	16.974	0.000	0.000	0.000	0.000	224.275
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-	-	

A. Mission Description and Budget Item Justification

The Direct Strike Penetrator Systems program develops and modifies a family of advanced precision-guided penetrator munitions to include evaluation of integrated technologies for the development/integration of advanced position, navigation, and timing (PNT) capabilities (i.e., Global Positioning System (GPS), non-GPS, optical, passive, active, etc.) and smart fuze systems, and all penetrator components, that will provide the Air Force with improved ability to attack Hard and Deeply Buried Targets (HDBT), such as bunker and tunnel facilities, using air-to-surface conventional munitions. Systems developed include, but are not limited to Massive Ordnance Penetrator (MOP), Advanced 5,000-lb Penetrator Weapon System (A5K), and Section 804 Rapid Prototype/Rapid Fielding activities. Systems developed will be integrated onto current and future platforms to reduce the number of weapons required to hold HDBTs at risk and will result in more targets engaged per mission flown. Direct Strike Penetrators will provide critical global strike capability not met by inventory conventional weapons and will hold at risk the best protected high value assets essential to an enemy's war fighting ability. The project also provides an opportunity to quickly insert emerging technologies into existing and developing aircraft munitions and fuzes.

A Hard Target Munitions (HTM) Analysis-of-Alternatives (AoA) was conducted in 2014 to determine the best weapons and/or development efforts for addressing the HDBT mission area. The HTM AoA determined that it was necessary to develop a family of HTMs in order to apply effects to the entire range of HDBT sets. The Air Force is using the AoA to develop, produce and modify HDBT weapons identified as the most effective and affordable. Modeling and simulation is used to assess and characterize current inventory and, to drive design and explore the utility of new classes of penetrator munitions.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver Direct Strike Penetrator Systems and M-code weapon system capabilities. The use of such program funds would be in addition to the civilian pay expenses budgeted in program element 0605831F.

This requirement supports performance of a full financial audit as required by title 10 U.S.C. Chapter 9A, Sec 240-D.

This effort is in Budget Activity 4, Advanced Component Development and Prototypes (ACD&P), because efforts are necessary to evaluate integrated technologies, representative modes or prototype systems in a high fidelity and realistic operating environment.

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B. Program Change Summary (\$ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	36.701	113.121	0.000	0.000	0.000
Current President's Budget	41.259	113.121	52.921	0.000	52.921
Total Adjustments	4.558	0.000	52.921	0.000	52.921
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	5.700	0.000			
• SBIR/STTR Transfer	-1.142	0.000			
• Other Adjustments	0.000	0.000	52.921	0.000	52.921

Change Summary Explanation

FY 2019 \$1.142M was decreased due to Small Business Innovation Research
 FY 2019 \$5.700M was increased due to BTR for MOP Modification
 FY 2021 increase for MOP Smart Fuze Testing

C. Accomplishments/Planned Programs (\$ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Massive Ordnance Penetrator (MOP) Modification	5.700	77.000	50.771	0.000	50.771
Description: Modify the Massive Ordnance Penetrator (MOP) weapon for enhanced capability to hold additional Hard and Deeply Buried Targets at risk in multiple Combatant Commands (COCOMs). The modification will be primarily software-based and the existing inventory of Guided Bomb Unit (GBU)-57E/B will be retrofitted. Construct relevant hard and deeply buried targets for testing. Execute MOP testing in support of modification efforts to included sub-scale and full-scale ground and flight tests. Analyze MOP weapon effectiveness.					
FY 2020 Plans: Continue testing and evaluating integration of MOP Modification for enhanced capability. Evaluate and analyze designs and prototype concepts for expanded aircraft employment.					
FY 2021 Base Plans: Continue testing and evaluating integration of MOP Modification for enhanced capability. Build long-lead targets and accomplish flight tests for expanded aircraft employment.					
FY 2021 OCO Plans:					

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A						
FY 2020 to FY 2021 Increase/Decrease Statement: Funding decreased in coordination with program test activities.						
Title: Advanced 5,000 lb (A5K) Penetrator		31.010	36.121	0.000	0.000	0.000
Description: Advanced 5,000 lb (A5K) Penetrator is an improved 5,000 lb class penetrator to address capability gaps identified in the HTM AoA. Conduct A5K design, development, integration, modeling and simulation, and testing to improve performance against increasingly hardened targets. This effort utilizes existing and improved technologies to field an integrated penetrator weapon system to include: an improved penetrator warhead, a smart fuze system that can detect layers/voids, and a modified Joint Direct Attack Munition (JDAM) tail kit for all weather, precision guidance, navigation, and control. The program has completed the Preliminary Design Review and has moved into prototype production, integration and testing.						
FY 2020 Plans: Finalize A5K prototype design and complete full scale sled testing. Continue prototype production, integration and qualification testing, and conduct flight testing against operationally representative targets to verify system performance against the prioritized HTM AoA target set.						
FY 2021 Base Plans: N/A						
FY 2021 OCO Plans: N/A						
FY 2020 to FY 2021 Increase/Decrease Statement: Funding decreased in coordination with program activities.						
Title: Military Code (M-Code) and Enhanced Anti-Jam (EAJ)		4.549	0.000	2.150	0.000	2.150
Description: M-Code and EAJ provides the capability to operate in increasing adversarial anti-access/area denial (A2/AD) jamming environments. M-Code and EAJ also provide increased accuracy, better signal acquisition, and advanced security.						
FY 2020 Plans:						

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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A					
FY 2021 Base Plans: Continue developing M-Code integration into MOP weapon system.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: Funding increased due to continuation of development work.					
Accomplishments/Planned Programs Subtotals	41.259	113.121	52.921	0.000	52.921

D. Other Program Funding Summary (\$ in Millions)											
Line Item	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
• PAAF 01 353190: Massive Ordnance Penetrator (MOP)	34.711	-	-	-	-	-	-	-	-	0.000	34.711
• RDTE 05 0604602F: Armament/ Ordnance Development	34.788	28.043	23.076	-	23.076	9.183	6.705	6.825	6.950	Continuing	Continuing
• RDTE 05 0604618F: Joint Direct Attack Munition	-	-	7.926	-	7.926	-	-	-	-	0.000	7.926
• RDTE 04 0604201F: PNT Resiliency	86.445	124.600	-	-	-	-	-	-	-	0.000	211.045

Remarks

E. Acquisition Strategy
MOP uses sole source cost type contracts to complete development, test, and evaluation activities.

M-Code/EAJ effort uses a Family of Systems approach where the three prime weapons contractors develop receivers capable of operating in any of their AF weapons. The receivers are based on a common, internally-developed interface requirements specification, technology requirement document, and threat scenario. This approach uses a combination of contract types based on acquisition phase (Technology Maturation and Risk Reduction, Development, Production) and risk. The Weapons System Program Offices share a common development program element to allow flexibility in funding and planning, switching to individual PEs for receiver integration, operational test, and production. The M-Code/EAJ Weapons Receiver Development effort leverages technology currently under development by the GPS-Directorate Military GPS User Equipment program and will provide the warfighter with unmatched capability to operate in future A2/AD environments.

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The initial A5K design was accomplished through modeling, simulation, and analysis producing potential designs. The designs were developed based on the performance parameters of survivability, lethality, accuracy and penetration. Upon completion of the modeling, simulation, and analysis of the A5K prototype designs a government review will determine the optimum A5K design going forward. That design will be used to fabricate test articles to include warheads, fuzing, and modified JDAM tail kits. These assets will be used to conduct and successfully complete qualification testing.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Air Force **Date:** February 2020

Appropriation/Budget Activity 3600 / 4	R-1 Program Element (Number/Name) PE 0604327F / <i>Hard and Deeply Buried Target Defeat System (HDBTDS) Program</i>	Project (Number/Name) 645341 / <i>Direct Strike Penetrator Systems</i>
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Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
MOP Modification and Integration	SS/ Various	Boeing : St Louis, MO	0.000	-		14.727	Feb 2020	24.266	Feb 2021	-		24.266	3.000	41.993	-
M-Code/EAJ Receiver	SS/CPAF	Various : TBD	0.000	4.549	May 2019	-		2.150	Jan 2021	-		2.150	0.000	6.699	-
A5K Warhead Design/ Components & Cases	MIPR	DOTC/ARA : Albuquerque, NM	0.000	10.642	Jan 2019	2.480	Oct 2019	-		-		-	0.000	13.122	-
A5K Guidance (JDAM)	SS/ Various	Boeing : St Louis, MO	0.000	9.169	Apr 2019	3.840	Dec 2019	-		-		-	0.000	13.009	-
A5K Embedded Fuze	MIPR	DOTC/ARA/NGIS : Albuquerque, NM	0.000	5.857	Jan 2019	6.803	Oct 2019	-		-		-	0.000	12.660	-
Subtotal			0.000	30.217		27.850		26.416		-		26.416	3.000	87.483	N/A

Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
MOP Govt Support	Various	Various : Eglin AFB, FL	0.000	-		3.688	Feb 2020	2.006	Feb 2021	-		2.006	1.250	6.944	-
A5K System T&E Contractor Support	MIPR	DOTC/ARA/NGIS : Albuquerque, NM	0.000	1.800	Jan 2019	4.316	Oct 2019	-		-		-	0.000	6.116	-
A5K System T&E Government Support	MIPR	MCAAP : McAlester, OK	0.000	1.070	Apr 2019	0.622	May 2020	-		-		-	0.000	1.692	-
Subtotal			0.000	2.870		8.626		2.006		-		2.006	1.250	14.752	N/A

Test and Evaluation (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
MOP Test & Evaluation	Various	AFLCMC : Eglin, Holloman, Edw, FL	0.000	5.695	Aug 2019	30.282	Jan 2020	22.536	Jan 2021	-		22.536	3.630	62.143	-
MOP Target Construction and Instrumentation	Various	DTRA : Albuquerque, NM	0.000	-		28.210	Nov 2019	-		-		-	7.485	35.695	-

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Air Force		Date: February 2020
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>Direct Strike Penetrator Systems</i>				
MOP Modification Analysis and Testing	1	2019	3	2022
A5K Design, Development and Testing	1	2019	4	2021
M-Code/EAJ Development/Integration	1	2019	2	2021

Note

Fielding M-code integration will be funded through the Weapons SPOs individual PEs.