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Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Air Force										Date: February 2019		
Appropriation/Budget Activity					R-1 Program Element (Number/Name)							
3600: Research, Development, Test & Evaluation, Air Force I BA 4: Advanced Component Development & Prototypes (ACD&P)					PE 0604327F I Hard and Deeply Buried Target Defeat System (HDBTDS) Program							
COST (\$ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
Total Program Element	0.000	39.682	36.701	113.121	0.000	113.121	0.000	0.000	0.000	0.000	0.000	189.504
645341: Direct Strike Penetrator Systems	0.000	39.682	36.701	113.121	0.000	113.121	0.000	0.000	0.000	0.000	0.000	189.504
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 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 MOP, A2K, 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 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 MOP, A2K, A5K, and M-Code weapon system capability. The use of such program funds would be in addition to the civilian pay expenses budgeted in program elements 0605826F, 0605827F, 0605828F, 0605829F, 0605830F, 0605831F, 0605832F, 0605898F, and 0605833F.

As directed in the FY 2018 NDAA, Sec 825, amendment to PL 114-92 FY 2016 NDAA, Sec 828 Penalty for Cost Overruns, the FY 2018 Air Force penalty total is \$14.373M. The calculated percentage reduction to each research, development, test and evaluation and procurement account will be allocated proportionally from all programs, projects, or activities under such account.

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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	17.365	71.501	4.121	0.000	4.121
Current President's Budget	39.682	36.701	113.121	0.000	113.121
Total Adjustments	22.317	-34.800	109.000	0.000	109.000
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	-3.300	-1.800			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	-33.000			
• Reprogrammings	25.900	0.000			
• SBIR/STTR Transfer	-0.283	0.000			
• Other Adjustments	0.000	0.000	109.000	0.000	109.000
Change Summary Explanation					
FY 2018 funds reduced by \$3.300M for Congressional Directed Reduction of excess to need for Advanced 5000lb Penetrator and \$0.283M for Small Business Innovation Research. FY 2018 funds increased by \$24.900M via Above Threshold Reprogramming for Massive Ordnance Penetrator (MOP) Modification and by \$1.000 via Below Threshold Reprogramming from AMRAAM, PE 0207163F.					
FY 2019 funds reduced by \$33.000M for Congressional Directed Transfer to Integrated Avionics Planning and Development, PE 0604201F and \$1.800 for Congressional Directed Reductions for program excess.					
FY 2020 request increased by \$109.000M to support program requirements for MOP Modification and Advanced 5000lb Penetrator.					
C. Accomplishments/Planned Programs (\$ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: Massive Ordnance Penetrator (MOP) Modification	24.900	0.000	77.000	0.000	77.000
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 2019 Plans: Modification of weapon, target construction, and testing of the MOP Modification for enhanced capability.					
FY 2020 Base Plans:					

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Continue testing and integration of MOP Modification for enhanced capability. Evaluate and analyze designs and prototype concepts for expanded aircraft employment. FY 2020 OCO Plans: N/A FY 2019 to FY 2020 Increase/Decrease Statement: Funding increased due to testing and integration of MOP Modification for enhanced capability.						
Title: Massive Ordnance Penetrator (MOP) Description: Integrate MOP weapon modifications onto the B-2. Design, prototype, modify and test concept penetrator and fuzing systems for expanded aircraft employment. Construct relevant hard and deeply buried targets for testing. Execute MOP testing in support of development efforts. Analyze MOP weapon effectiveness. FY 2019 Plans: N/A FY 2020 Base Plans: N/A FY 2020 OCO Plans: N/A FY 2019 to FY 2020 Increase/Decrease Statement: N/A		0.785	0.000	0.000	0.000	0.000
Title: Advanced 5,000 lb (A5K) Penetrator 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 will utilize 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. FY 2019 Plans:		12.997	32.701	33.970	0.000	33.970

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Continue A5K prototype design and development through modeling and simulation, initiate prototype production, conduct integration, testing and qualification of the A5K weapons system to verify system performance against the prioritized HTM AoA target set. FY 2020 Base 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 2020 OCO Plans: N/A FY 2019 to FY 2020 Increase/Decrease Statement: Funding increased due to A5K test activities.						
Title: Military Code (M-Code) and Enhanced Anti-Jam (EAJ) 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 2019 Plans: Develop and integrate M-Code receivers across the Air Force Program Executive Officer (AFPEO) weapons portfolio. FY 2020 Base Plans: Begin integration of M-Code into MOP weapon system. FY 2020 OCO Plans: N/A FY 2019 to FY 2020 Increase/Decrease Statement: Funding decreased due to integration of M-Code into MOP beginning in FY20.		1.000	4.000	2.151	0.000	2.151
Accomplishments/Planned Programs Subtotals		39.682	36.701	113.121	0.000	113.121

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D. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• PAAF 01 Line Item 353190: WRM-Ammunition (MOP)	38.382	38.111	0.000	-	0.000	0.000	0.000	-	-	Continuing	Continuing
• RDTE 04 PE 0604201F: Integrated Avionics Planning & Development	58.288	81.271	92.600	-	92.600	0.000	0.000	-	-	Continuing	Continuing
Remarks											
In FY 2018, PE 0604602F, Armament/Ordnance Development, Project 653134, BLU-109 and BLU-113 Upgrade efforts were transferred to PE 0604327F, Hard and Deeply Buried Target Defeat System (HDBTDS) Program, Project 645341, Direct Strike Penetrator Systems, in order to consolidate hard target munitions in one program element.											
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 PE 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.											
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.											
F. Performance Metrics											
Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.											

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Air Force												Date: February 2019			
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>					
Product Development (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 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
MOP Modification and Integration	SS/ Various	Boeing : St Louis, MO	0.000	8.000	Mar 2019	-		28.000	Mar 2020	-		28.000	0.000	36.000	-
MOP HTM Weapons Effects/Target Analysis	MIPR	DTRA : Albuquerque, NM	0.000	0.785	Sep 2018	-		-		-		-	0.000	0.785	-
M-Code/EAJ Receiver	SS/CPAF	Various : TBD	0.000	1.000	Feb 2019	4.000	Mar 2019	-		-		-	0.000	5.000	-
MOP M-Code Integration	Various	Boeing : St Louis, MO	0.000	-		-		2.151	Jun 2020	-		2.151	0.000	2.151	-
A5K Warhead Design/ Components & Cases	MIPR	DOTC/ARA : Albuquerque, NM	0.000	3.491	May 2018	5.470	Jan 2019	2.480	Oct 2019	-		2.480	0.000	11.441	-
A5K Guidance (JDAM)	SS/ Various	Boeing Tech Services : St. Louis, MO	0.000	4.014	May 2018	9.710	Apr 2019	3.840	Dec 2019	-		3.840	0.000	17.564	-
A5K Embedded Fuze	MIPR	DOTC/ARA/NGIS : Albuquerque, NM	0.000	0.892	Aug 2018	7.019	Jan 2019	4.652	Oct 2019	-		4.652	0.000	12.563	-
Subtotal			0.000	18.182		26.199		41.123		-		41.123	0.000	85.504	N/A
Support (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 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
MOP Govt Support	Various	Various : Eglin AFB, FL	0.000	0.351	Dec 2018	-		1.000	Feb 2020	-		1.000	0.000	1.351	-
A5K System T&E Contractor Support	MIPR	DOTC/ARA/NGIS : Albuquerque, NM	0.000	-		2.734	Jan 2019	4.316	Oct 2019	-		4.316	0.000	7.050	-
A5K System T&E Government Support	MIPR	MCAAP : McAlister, OK	0.000	0.321	Aug 2018	1.217	Apr 2019	0.622	May 2020	-		0.622	0.000	2.160	-
Subtotal			0.000	0.672		3.951		5.938		-		5.938	0.000	10.561	N/A

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Test and Evaluation (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 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
MOP Test & Evaluation	Various	AFLCMC : Eglin, Holloman, Edw, FL	0.000	6.590	Feb 2019	-		8.000	Jan 2020	-		8.000	0.000	14.590	-
MOP Target Construction and Instrumentation	Various	DTRA : Albuquerque, NM	0.000	8.120	Dec 2018	-		36.000	Nov 2019	-		36.000	0.000	44.120	-
A5K Developmental Test & Evaluation	Various	96 TW, 780 TS : Eglin, Holloman, FL	0.000	3.042	May 2018	4.153	Jul 2019	10.493	Apr 2020	-		10.493	0.000	17.688	-
A5K Operational Test & Evaluation	Various	96 TW, Det 1, DTRA : Eglin,WSMR, FL	0.000	0.407	Jul 2018	2.298	Mar 2019	6.387	Oct 2019	-		6.387	0.000	9.092	-
Subtotal			0.000	18.159		6.451		60.880		-		60.880	0.000	85.490	N/A
Management Services (\$ in Millions)				FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 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
MOP Program Management Administration (PMA)	Various	AFLCMC/EBD : Eglin AFB, FL	0.000	1.839	May 2019	-		4.000	May 2020	-		4.000	0.000	5.839	-
A5K Program Management Administration (PMA)	Various	AFLCMC/EBD : Eglin AFB, FL	0.000	0.830	May 2018	0.100	Jan 2019	1.180	Jan 2020	-		1.180	0.000	2.110	-
Subtotal			0.000	2.669		0.100		5.180		-		5.180	0.000	7.949	N/A
			Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			0.000	39.682		36.701		113.121		-		113.121	0.000	189.504	N/A
Remarks															

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Exhibit R-4, RDT&E Schedule Profile: PB 2020 Air Force												Date: February 2019					
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>			

	FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024			
	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
Direct Strike Penetrator Systems																												
MOP Modification Analysis and Testing																												
MOP M-Code Integration																												
A5K Design, Development and Testing																												
M-Code/EAJ Development/Integration																												

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Exhibit R-4A, RDT&E Schedule Details: PB 2020 Air Force			Date: February 2019
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>	

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	4	2022
MOP M-Code Integration	3	2020	4	2022
A5K Design, Development and Testing	2	2018	4	2021
M-Code/EAJ Development/Integration	1	2018	2	2021