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Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force										Date: May 2017		
Appropriation/Budget Activity					R-1 Program Element (Number/Name)							
3600: Research, Development, Test & Evaluation, Air Force I BA 5: System Development & Demonstration (SDD)					PE 0604933F / ICBM Fuze Modernization							
COST (\$ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
Total Program Element	205.638	138.027	189.751	178.991	0.000	178.991	168.101	157.809	123.628	19.649	0.000	1,181.594
655082: ICBM FUZE SUPPORT	205.638	138.027	189.751	178.991	0.000	178.991	168.101	157.809	123.628	19.649	0.000	1,181.594
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		
Program MDAP/MAIS Code: 0498												
A. Mission Description and Budget Item Justification												
<p>The ICBM Fuze Modernization Program is designing and developing a form, fit and functionally equivalent replacement for the Mk21 fuze. The legacy Mk21 fuze is three times past its design life and ongoing Mk21 fuze refurbishment does not meet Nuclear Weapon Stockpile Plan requirements. The Mk21 Reentry Vehicle and fuze will be deployed on the current Minuteman III (MM III) and future Ground Based Strategic Deterrent (GBSD). Previous plans to integrate and test the Mk21 replacement fuze with the U.S. Department of Energy (DOE) National Nuclear Security Administration (NNSA) W78/88-1 Life Extension Program warhead were deferred.</p> <p>The US Air Force (USAF) will develop the Mk21 fuze utilizing the NNSA complex consisting of Sandia National Labs-California (SNL-CA), Sandia National Labs-New Mexico (SNL-NM), and Kansas City National Security Campus (KCNSC), formerly Kansas City Plant; as well as a USAF weapons system integration contractor. The ICBM Fuze Modernization program will leverage technologies, parts, components and development/production capabilities resulting from extensive fuze work performed by the US Navy (USN) and NNSA on the Mk5 Alt 370 Fuze program. Common USN & USAF fuze components include the Radar Module (RM), Thermal Battery Assembly (TBA) and Path Length Module (PLM). USN & USAF fuze components that are partially common and use common technologies include the Missile Interface and Controller Module (MICM), Launch Safety Device (LSD), Firing Set Integration Module (FSIM) and Terminal Protection Device (TPD).</p> <p>The ICBM Fuze Modernization Program will integrate the replacement fuze into MM III weapon system to include, support equipment, data, flight test hardware, and training materials. The program will also conduct required system testing (including ground and flight tests). The program is coordinating Mk21 fuze replacement development efforts with the DOE to synchronize USAF arming and fuze development activities with DOE warhead requirements. When prudent, the program will conduct trade studies and initiate conceptual designs to address operational system issues and meet future requirements.</p> <p>As a cooperative USAF, USN and NNSA acquisition, the USAF is executing the program using Department of Defense (DoD)-DOE Instruction 5030.55 Joint Nuclear Weapons Life Cycle Activities (Phase 6.X process) while meeting Major Defense Acquisition Program (MDAP) statutory requirements.</p> <p>The FY18 budget request continues cooperative efforts with the USN to leverage common components; continues design efforts for AF unique components; and continues development of lab, ground and flight test assets. This program also includes any needed nuclear surety and certification and system vulnerability assessments.</p>												

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This program is in Budget Activity 5, System Development and Demonstration (SDD), and continues to execute Phase 6.3 "Development Engineering" of the 6.X process. The program is conducting engineering development tasks aimed at meeting validated requirements prior to Phase 6.4 "Production Engineering", scheduled for FY19 (Objective).						
B. Program Change Summary (\$ in Millions)		FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget		142.551	189.751	178.475	0.000	178.475
Current President's Budget		138.027	189.751	178.991	0.000	178.991
Total Adjustments		-4.524	0.000	0.516	0.000	0.516
• 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		0.000	0.000			
• SBIR/STTR Transfer		-4.524	0.000			
• Other Adjustments		0.000	0.000	0.516	0.000	0.516
Change Summary Explanation						
FY 2016 funding reflects a decrease of \$4.524M for SBIR/STTR.						
C. Accomplishments/Planned Programs (\$ in Millions)				FY 2016	FY 2017	FY 2018
Title: Fuze Design and Development				106.385	151.935	139.357
Description: Design and develop the Mk21 fuze required to support the ICBM W87 warhead. Coordinate design and development efforts with the ICBM weapon system integrator and support flight testing.						
FY 2016 Accomplishments:						
- Finalized development of common parts, components, and technology for application to Mk21 replacement fuze						
- Finalized component conceptual design development of common components to include Arming and Fuzing Assembly (AFA) prototype builds						
- Completed conceptual design development of AF unique components						
- Began Reentry Vehicle (RV) integration, systems engineering at SNL-CA, system qualification and flight test planning and flight test vehicle (Joint Test Assembly or JTA) development						
- SNL-NM began testing of common components in conjunction with the group builds supporting production planning for the Radar, Battery, and Path Length Module						

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2016	FY 2017	FY 2018
- SNL continued to analyze the design and perform tests on the remaining four components with AF unique sub-components (MICM, LSD, TPD and FSIM). SNL-CA solidified detailed AFA qualification plans and began the development process for the Flight Test Vehicle to meet the established objectives of Flight Test 1 FY 2017 Plans: - Continue assessing, testing and qualifying the common components (RM, PLM, TBA) with the unique AF environments to ensure compliance to AF requirements - Establish a solid design baseline for the AF unique components (MICM, TPD, LSD, FSIM) and push the design envelope towards meeting the Entrance and Exit criteria of the Baseline Design Review (BDR) scheduled for May 2017 - Finalize the Ground Test Unit (GTU) for ground testing and integration testing with the Integrated Test Bed (ITB) in preparation for Flight Test 1 scheduled for Oct 2018 - Develop surveillance strategy plan in order to finalize the requirements for assessing the aging trends, reliability and service life estimate during fuze operational and sustainment phase - Integrate updated MM Operational Targeting Program (MOTP) software to be utilized in Flight Test 2 - Establish a baseline design for the JTA used on Flight Test 3 and Flight Test 4 FY 2018 Plans: - Continue assessing, testing and qualifying the common components (RM, PLM, TBA) with the unique AF environments to ensure compliance to AF requirements - Accomplish engineering and design work for the AF unique components - Conduct Design Reviews - Prepare and complete all planning and coordination for Flight Test 1 - Continue to mature surveillance strategy plan in order to finalize the requirements for assessing the aging trends, reliability and service life estimate during fuze operational and sustainment phase - Begin preparations for AFA final design review - Begin flight test planning for Flight Test Unit 2				
Title: Weapon System Integration/Systems Engineering Description: Integrate Mk21 fuze into the MMIII weapon system. Validate designs through ground tests on an Integrated Test Bed (ITB). Plan and conduct necessary ground and flight testing. Coordinate design, development and test efforts. FY 2016 Accomplishments: - Developed Systems Engineering, Integration, and Management expertise in support of USAF and SNL development of the Mk21 replacement fuze - Continued to integrate AFA with the MM III weapon system during the development build		31.642	37.816	39.634

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C. Accomplishments/Planned Programs (\$ in Millions)										FY 2016	FY 2017	FY 2018
- Continued test and verification of SNL developed Laboratory Test Units (LTUs) and corresponding GTUs via the MM III ITB. Assessed the program's impact on MM III system-level effectiveness. FY 2017 Plans: - Finalize the results of the LTU to verify the functionality and performance of multiple fuze HW components during the Integration testing with the MM III weapon system which will provide the catalyst for starting the integration testing of the GTU to perform Flight Profiles and environmental unit tests (shock, vibe, temp) FY 2018 Plans: - Perform test and integration on GTU 1 for mechanical environmental, electrical integration, and performance - Perform integration testing on GTU 1B for MICM Fox Application Specific Integrated Circuit (ASIC) - Finalize GTU 1 and GTU 1B test data - Analyze test data for continued design confidence - Provide integration support												
Accomplishments/Planned Programs Subtotals										138.027	189.751	178.991
D. Other Program Funding Summary (\$ in Millions)												
<u>Line Item</u>	<u>FY 2016</u>	<u>FY 2017</u>	<u>FY 2018</u> <u>Base</u>	<u>FY 2018</u> <u>OCO</u>	<u>FY 2018</u> <u>Total</u>	<u>FY 2019</u>	<u>FY 2020</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>	
• MPAF: BA05: Line Item # M30MLG: <i>Minuteman III Modifications</i>	13.700	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	18.400	
• MPAF: BA03: Line Item # M30FLH: <i>ICBM Fuze Mod</i>	0.000	17.095	6.334	0.000	6.334	9.841	12.094	34.145	88.677	643.463	811.649	
Remarks												
Other Program Funding Summary reflects equipment buys in FY15-19 as part of life of program buys, enabling the ICBM Fuze Modernization program to continue leveraging the USN design, development and production activities.												
E. Acquisition Strategy												
The USAF ICBM Fuze Modernization program is executing a full cost reimbursable Work for Others (WFO) agreement with the NNSA complex using SNL as the design agent and KCNSC as the production agent. The program is a collaborative effort with the USN reducing total program cost and development time by leveraging commonality between the ICBM and Submarine Launched Ballistic Missile fuze components. The USN Mk5 Alt 370 fuze is being developed first, with the USAF Mk21 fuze effort following. The USN Mk5 Alt 370 fuze entered Phase 6.3 Development Engineering in October 2012. USAF Mk21 fuze entered Phase 6.3 in August 2013. Both services participate in all design and development efforts to ensure maximum use of common components, subassemblies and technologies. Both services are												

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<p>using NNSA/SNL to perform fuze design and development. The USAF, as lead systems integrator for the Mk21 fuze, competed a separate Weapon System Integration Contract (WSIC) for integration support to assist the government with MM III unique modifications and fuze integration efforts. Both services are using KCNSC to produce fuzes.</p>		
F. Performance Metrics <p>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.</p>		

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Exhibit R-3, RDT&E Project Cost Analysis: FY 2018 Air Force												Date: May 2017			
Appropriation/Budget Activity 3600 / 5						R-1 Program Element (Number/Name) PE 0604933F / ICBM Fuze Modernization				Project (Number/Name) 655082 / ICBM FUZE SUPPORT					
Product Development (\$ in Millions)				FY 2016		FY 2017		FY 2018 Base		FY 2018 OCO		FY 2018 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
Fuze Preliminary Design Development	MIPR	Sandia National Labs : Albuquerque, NM	132.596	90.785	Nov 2015	129.850	Nov 2016	112.447	Nov 2017	0.000		112.447	255.538	721.216	-
Fuze EMD	Various	Various : TBD	0.767	0.660	Dec 2015	0.000		0.000		0.000		0.000	0.000	1.427	-
Fuze Engineering Change Orders	Various	Various : TBD	0.000	0.000		2.785	May 2017	4.175	May 2018	0.000		4.175	16.206	23.166	-
Fuze National Security Campus (formerly Kansas City Plant)	MIPR	National Security Campus : Kansas City, MO	5.750	15.600	Nov 2015	19.300	Nov 2016	22.735	Nov 2017	0.000		22.735	63.270	126.655	-
Fuze Weapon System Integration - ICBM Prime	C/CPAF	Northrop Grumman : Clearfield, UT	25.937	0.000		0.000		0.000		0.000		0.000	0.000	25.937	25.937
Fuze Weapon System Integration - RS/RV Sub-System Contract (SSC)	SS/CPAF	Lockheed Martin : Valley Forge, PA	11.269	24.102	Jan 2016	22.800	Jan 2017	20.885	Jan 2018	0.000		20.885	17.427	96.483	96.210
Fuze Nuclear Safety Cross-Check Analysis (NSCCA)	TBD	TBD : TBD	0.000	0.000		0.000		0.000		0.000		0.000	7.945	7.945	-
Subtotal			176.319	131.147		174.735		160.242		0.000		160.242	360.386	1,002.829	-
Support (\$ in Millions)				FY 2016		FY 2017		FY 2018 Base		FY 2018 OCO		FY 2018 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
Fuze Engineering Support - BAH	C/FP	Booz Allen Hamilton : Clearfield, UT	2.757	0.000		0.000		0.000		0.000		0.000	0.000	2.757	-
Fuze Engineering Support - BAE	C/FFP	BAE : Clearfield, UT	4.380	2.690	Jul 2016	3.216	Jul 2017	4.000	Jul 2018	0.000		4.000	34.004	48.290	47.506
Subtotal			7.137	2.690		3.216		4.000		0.000		4.000	34.004	51.047	-

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Test and Evaluation (\$ in Millions)				FY 2016		FY 2017		FY 2018 Base		FY 2018 OCO		FY 2018 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
Fuze Lead Project Office Support	MIPR	AFNWC : Albuquerque, NM	10.480	0.000		0.000		0.000		0.000		0.000	0.000	10.480	10.480
Fuze Finite Element Model Validation	C/CPFF	LMTF : Little Mountain, UT	1.843	0.000		0.000		0.000		0.000		0.000	0.000	1.843	1.843
Fuze Flight Test Support and Evaluation	TBD	TBD : TBD	0.000	0.000		0.000		8.502	Feb 2018	0.000		8.502	26.186	34.688	-
Subtotal			12.323	0.000		0.000		8.502		0.000		8.502	26.186	47.011	-
Management Services (\$ in Millions)				FY 2016		FY 2017		FY 2018 Base		FY 2018 OCO		FY 2018 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
Fuze Cost and Financial Management	C/FFP	Tecolote : Salt Lake City, UT	2.177	1.125	Dec 2015	1.762	Dec 2016	1.950	Dec 2017	0.000		1.950	0.420	7.434	-
Fuze FFRDC Support	MIPR	Aerospace : Los Angeles, CA	3.117	0.473	Dec 2015	2.284	Dec 2016	2.100	Dec 2017	0.000		2.100	3.836	11.810	-
Fuze Program Support	C/FFP	BAE : Clearfield, UT	0.000	0.918	Feb 2016	2.472	Feb 2017	1.400	Feb 2018	0.000		1.400	27.176	31.966	-
Fuze Program Management Administration	Various	Various : Various, UT	4.565	1.674	Mar 2016	5.282	Mar 2017	0.797	Mar 2018	0.000		0.797	17.179	29.497	-
Subtotal			9.859	4.190		11.800		6.247		0.000		6.247	48.611	80.707	-
			Prior Years	FY 2016		FY 2017		FY 2018 Base		FY 2018 OCO		FY 2018 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			205.638	138.027		189.751		178.991		0.000		178.991	469.187	1,181.594	-
Remarks															

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Exhibit R-4, RDT&E Schedule Profile: FY 2018 Air Force															Date: May 2017				
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	FY 2016				FY 2017				FY 2018				FY 2019				FY 2020				FY 2021				FY 2022									
	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						
Phase 6.3 Developmental Engineering																																		
Phase 6.4 Production Engineering Mk21																																		
Baseline Design Review (BDR) (May 2017)																																		
Final Design Review (FDR) (Dec 2019)																																		
Complete Engineering Release (Jun 2020)																																		
Flight Test 1 (Oct 2018)																																		
Flight Test 2 (Oct 2019)																																		
Flight Test 3 (Jul 2021)																																		
Flight Test 4 (Mar 2022)																																		
Life of Program Buy (LOPB)																																		

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Exhibit R-4A, RDT&E Schedule Details: FY 2018 Air Force			Date: May 2017
Appropriation/Budget Activity 3600 / 5	R-1 Program Element (Number/Name) PE 0604933F / ICBM Fuze Modernization	Project (Number/Name) 655082 / ICBM FUZE SUPPORT	

Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Phase 6.3 Developmental Engineering	1	2016	1	2019
Phase 6.4 Production Engineering Mk21	2	2019	4	2022
Baseline Design Review (BDR) (May 2017)	3	2017	3	2017
Final Design Review (FDR) (Dec 2019)	1	2020	1	2020
Complete Engineering Release (Jun 2020)	3	2020	3	2020
Flight Test 1 (Oct 2018)	1	2019	1	2019
Flight Test 2 (Oct 2019)	1	2020	1	2020
Flight Test 3 (Jul 2021)	4	2021	4	2021
Flight Test 4 (Mar 2022)	2	2022	2	2022
Life of Program Buy (LOPB)	1	2016	4	2019