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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 5: System Development & Demonstration (SDD)</i>	R-1 Program Element (Number/Name) PE 0604933F / ICBM Fuze Modernization
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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	681.902	124.457	161.199	167.099	0.000	167.099	104.657	20.503	2.067	2.105	0.000	1,263.989
655082: <i>ICBM FUZE SUPPORT</i>	681.902	124.457	161.199	167.099	0.000	167.099	104.657	20.503	2.067	2.105	0.000	1,263.989
Quantity of RDT&E Articles	38	8	5	10	-	10	19	8	-	-		

Program MDAP/MAIS Code: 0498

A. Mission Description and Budget Item Justification

The FY2021 funding request was reduced by \$1.735 million to account for the availability of prior year execution balances.

The Intercontinental Ballistic Missile (ICBM) Fuze Modernization Program is designing and developing a form, fit and functionally equivalent replacement for the Mk21 fuze that will provide a 30-year objective design life. 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) Weapons Systems. Plans to integrate and test the Mk21 replacement fuze with the U.S. Department of Energy (DOE) National Nuclear Security Administration (NNSA) W87-1 warhead are currently under evaluation in the Mk21A program.

The US Air Force (USAF) will develop the Mk21 fuze using the NNSA complex, and the USAF weapons system integration contractor. The NNSA complex consists 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. 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/W88 Alt 370 Fuze program. Common USN & USAF fuze components include the Radar Module, Thermal Battery Assembly and Path Length Module. USN & USAF fuze components that are partially common and use common technologies include the Missile Interface and Controller Module, Launch Safety Device, Firing Set Integration Module and Terminal Protection Device.

The ICBM Fuze Modernization Program will integrate the replacement fuze into MM III weapon system, to include support/test 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.

As a cooperative USAF, USN and NNSA acquisition, the USAF is executing the program using Department of Defense (DoD)-DOE Manual 5030.55 Joint Nuclear Weapons Life Cycle Activities (Phase 6.X process) while meeting Major Defense Acquisition Program (MDAP) statutory requirements.

The ICBM Fuze Modernization Program requires a program rebaseline due to capacitor redesign issues and funding limitations in FY19 and FY20. Requirements were deferred until FY21 resulting in a corresponding schedule slip. The funding profile needs for FY22 and beyond will be addressed in future budget submissions.

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The FY21 budget request continues cooperative efforts with the USN to leverage common components; conduct final qualification tests; and continue development of lab, ground, and flight test assets. This program also includes any needed nuclear surety and certification and system vulnerability assessments.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver ICBM Fuze Modernization weapon system capability. The use of such program funds would be in addition to the civilian pay expenses budgeted in program element 0605831F or 0605833F.

This program entered Phase 6.4 "Production Engineering" of the 6.X process Jan 2019. The program will conduct production engineering tasks aimed at meeting validated requirements prior to Phase 6.5.

This program is in Budget Activity 5, System Development and Demonstration (SDD) because it has passed Milestone B approval and is conducting engineering and manufacturing development tasks aimed at meeting validated requirements prior to full rate production.

B. Program Change Summary (\$ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	167.659	161.199	132.926	0.000	132.926
Current President's Budget	124.457	161.199	167.099	0.000	167.099
Total Adjustments	-43.202	0.000	34.173	0.000	34.173
• 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	-37.000	0.000			
• SBIR/STTR Transfer	-6.202	0.000			
• Other Adjustments	0.000	0.000	34.173	0.000	34.173

Change Summary Explanation

FY 2019 funding reflects a Congressionally-approved reprogramming of \$37.000 million and a Small Business Innovation Research transfer of \$6.202 million.
FY 2021 increase to fully fund ICBM Fuze

C. Accomplishments/Planned Programs (\$ in Millions)	FY 2019	FY 2020	FY 2021
Title: Fuze Design and Development	109.388	123.787	151.999
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 2020 Plans:			

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
<ul style="list-style-type: none"> • Continue assessing, testing and qualifying the common components [Radar Module (RM), Path Length Module (PLM), Thermal Battery Assembly (TBA)] with the unique Air Force (AF) environments to ensure compliance to AF requirements • Continue to refine engineering and design work for the AF unique components • Execute and conduct fuze level post test analysis of Flight Test 2 • Assess capacitor failures and implement corrective actions • Re-accomplish Final Design Reviews on base metal electrode components requiring electrical board redesign • Accomplish AFA Final Design Review (FDR) and Complete Engineering Release (CER) • Continue Arming and Fuzing Assembly (AFA) Production Process Prove-In • Continue preparations for Joint Test Assembly 4a (JTA4a) developmental flight test • Conduct Ground Test Unit 3 (GTU-3c test activities) <p>FY 2021 Plans:</p> <ul style="list-style-type: none"> • Finish and release JTA4a drawings • Finish and release AFA drawings • Conduct Ground Test Unit 3 (GTU-3b test activities) • Conduct JTA4a High-Fidelity development test • Conduct Process Prove In (PPI) mechanical environmental tests • Conduct PPI thermal environments, cumulative damage, and radiation tests • Continue AFA large and small core material compatibility testing <p>FY 2020 to FY 2021 Increase/Decrease Statement: Funding increased due to capacitor redesign activities that deferred FY20 PPI activities to FY21.</p>				
<p>Title: Weapon System Integration/Systems Engineering</p> <p>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.</p> <p>FY 2020 Plans:</p> <ul style="list-style-type: none"> • Provide integration support • Perform mass properties analysis to Fuze reentry vehicle integration • Support AFOTEC Flight Test 1 assessment • Support Ground Test Unit 3 (GTU-3c test activities) <p>FY 2021 Plans:</p> <ul style="list-style-type: none"> • Conduct Electrical Compatibility Test 3 • Conduct JTA4a Pathfinder Testing 		15.069	37.412	15.100

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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2019	FY 2020	FY 2021
<ul style="list-style-type: none"> • Continue Basic Nuclear Safety Assessment Report updates • Continue Nuclear Surety Evaluation Report updates • Continue ICBM Compatibility Certification Report updates • Conduct Final Special Safety Study • Validate Technical Order updates • Execute and conduct RV level post test analysis of Flight Test 2 • Support Ground Test Unit 3 (GTU-3b test activities) <p><i>FY 2020 to FY 2021 Increase/Decrease Statement:</i> Funding decreased due to reduced development cost as the program prepares to enter production.</p>			
Accomplishments/Planned Programs Subtotals	124.457	161.199	167.099

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
• MPAF 03 M30FLH: <i>ICBM FUZE MOD</i>	13.941	19.497	46.908	-	46.908	101.652	114.783	120.971	121.290	276.158	815.200

Remarks
Other Program Funding Summary reflects Advance Procurement starting FY19, the use of life-of-type equipment buys in FY19, and full funding starting in FY22. This enables the ICBM Fuze Modernization program to continue leveraging the USN design, development and production activities. Life-of-type equipment buys in FY15-18 totaled \$41.778M.

E. Acquisition Strategy
The ICBM Fuze Modernization program is executing a full cost reimbursable work-for-others 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. Both services participate in all design and development efforts to ensure maximum use of common components, subassemblies and technologies. Both services are 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 for integration support to assist the government with MM III unique modifications and fuze integration efforts. Both services are using KCNSC to produce fuzes.

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

Appropriation/Budget Activity 3600 / 5	R-1 Program Element (Number/Name) PE 0604933F / ICBM Fuze Modernization	Project (Number/Name) 655082 / ICBM FUZE SUPPORT
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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			
Fuze Preliminary Design Development	MIPR	Sandia National Labs : Albuquerque, NM	430.462	59.733	Nov 2018	79.729	Nov 2019	71.510	Nov 2020	-		71.510	48.083	689.517	776.264
Fuze EMD	Various	Various : Various	1.746	1.457	Dec 2018	1.025	Nov 2019	2.740	Nov 2020	-		2.740	3.950	10.918	7.362
Fuze Engineering Change Orders	Various	Various : Various	4.175	3.256	May 2019	2.354	May 2020	4.880	May 2021	-		4.880	5.035	19.700	22.364
Fuze National Security Campus (formerly Kansas City Plant)	MIPR	National Security Campus : Kansas City, MO	94.188	38.460	Nov 2018	40.679	Nov 2019	66.380	Nov 2020	-		66.380	35.265	274.972	205.387
Fuze Weapon System Integration - ICBM Prime	C/CPAF	Northrop Grumman : Clearfield, UT	25.937	-		-		-		-		-	0.000	25.937	25.937
Fuze Weapon System Integration - RS/RV Sub-System Contract (SSC)	SS/CPAF	Lockheed Martin : Valley Forge, PA	69.622	15.069	Jan 2019	-		-		-		-	0.000	84.691	89.264
RS/RV Sub-System Contract (SSC)	C/CPFF	Lockheed Martin : Valley Forge, PA	0.000	-		20.840	Jan 2020	15.100	Jan 2021	-		15.100	15.768	51.708	59.140
Fuze Nuclear Safety Cross-Check Analysis (NSCCA)	TBD	TBD : TBD	0.000	-		-		-		-		-	5.945	5.945	7.945
Subtotal			626.130	117.975		144.627		160.610		-		160.610	114.046	1,163.388	N/A

Remarks
 The current Fuze Weapon System Integration - RS/RV Sub-System Contract (SSC) ends in FY19 requiring a new Fuze Weapon System Integration Contract beginning in FY20.
 As the program finalizes the design and begins developmental test item production, funding for Sandia (Fuze Preliminary Design Development) will decrease and funding for Kansas City National Security Campus (Fuze National Security Campus (formerly Kansas City Plant)) will increase.

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Appropriation/Budget Activity 3600 / 5				R-1 Program Element (Number/Name) PE 0604933F / ICBM Fuze Modernization				Project (Number/Name) 655082 / ICBM FUZE SUPPORT							
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	Cost To Complete	Total Cost	Target Value of Contract
Fuze Engineering Support - BAH	C/FP	Booz Allen Hamilton : Clearfield, UT	2.757	-		-		-		-		-	0.000	2.757	2.757
Fuze Engineering Support - BAE	C/FFP	BAE : Clearfield, UT	12.220	1.521	Jul 2019	1.843	Jul 2020	2.000	Jul 2021	-		2.000	5.384	22.968	46.700
Subtotal			14.977	1.521		1.843		2.000		-		2.000	5.384	25.725	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	Cost To Complete	Total Cost	Target Value of Contract
Fuze Lead Project Office Support	MIPR	AFNWC : Albuquerque, NM	10.480	-		-		-		-		-	0.000	10.480	10.480
Fuze Finite Element Model Validation	C/CPFF	LMTF : Little Mountain, UT	1.843	-		-		-		-		-	0.000	1.843	1.843
Fuze Flight Test Support and Evaluation	Various	Various : Various	4.538	1.112	Feb 2019	9.429	Feb 2020	-		-		-	0.000	15.079	35.876
Subtotal			16.861	1.112		9.429		-		-		-	0.000	27.402	N/A
Management Services (\$ 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	Cost To Complete	Total Cost	Target Value of Contract
Fuze Cost and Financial Management	C/FFP	Tecolote : Salt Lake City, UT	5.157	-		-		-		-		-	0.000	5.157	5.157
Fuze FFRDC Support	MIPR	Aerospace : Los Angeles, CA	4.838	1.385	Feb 2019	1.300	Dec 2019	1.300	Nov 2020	-		1.300	5.305	14.128	11.504
Fuze Program Support	C/FFP	BAE : Clearfield, UT	0.993	0.292	Jul 2019	0.979	Jul 2020	-		-		-	0.000	2.264	5.957
Fuze Program Management Administration	Various	Various : Various	12.946	2.172	Mar 2019	3.021	Jul 2020	3.189	Jul 2021	-		3.189	4.597	25.925	26.802
Subtotal			23.934	3.849		5.300		4.489		-		4.489	9.902	47.474	N/A

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	Prior Years	FY 2019		FY 2020		FY 2021 Base	FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	681.902	124.457		161.199		167.099		-	167.099	129.332	1,263.989	N/A

Remarks

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

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	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

AF ICBM Fuze Modernization Program																												
Phase 6.4 Production Engineering																												
Flight Test 1 (Feb 2019)																												
Flight Test 2 (Feb 2020)																												
Final Design Review [FDR] (Aug 2020)																												
Complete Engineering Release (Oct 2020)																												
Flight Test 3 (Aug 2022)																												
Production Readiness Review (Nov 2022)																												
Flight Test 4 (Feb 2024)																												
Phase 6.5 Low Scale Production																												
First Production Unit (May 2024)																												
Required Assets Available (Nov 2024)																												
Phase 6.6 Full Scale Production																												

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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
AF ICBM Fuze Modernization Program				
Phase 6.4 Production Engineering	2	2019	3	2024
Flight Test 1 (Feb 2019)	2	2019	2	2019
Flight Test 2 (Feb 2020)	2	2020	2	2020
Final Design Review [FDR] (Aug 2020)	4	2020	4	2020
Complete Engineering Release (Oct 2020)	1	2021	1	2021
Flight Test 3 (Aug 2022)	4	2022	4	2022
Production Readiness Review (Nov 2022)	1	2023	1	2023
Flight Test 4 (Feb 2024)	2	2024	2	2024
Phase 6.5 Low Scale Production	3	2024	4	2025
First Production Unit (May 2024)	3	2024	3	2024
Required Assets Available (Nov 2024)	1	2025	1	2025
Phase 6.6 Full Scale Production	4	2025	4	2025