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Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Air Force **Date:** May 2021

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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	846.100	155.476	156.693	129.709	0.000	129.709	-	-	-	-	-	-
655082: <i>ICBM FUZE SUPPORT</i>	846.100	155.476	156.693	129.709	0.000	129.709	-	-	-	-	-	-
Quantity of RDT&E Articles	46	-	-	27	-	27	-	-	-	-	-	-

Program MDAP/MAIS Code: 0498

Note
 • Prior year RDT&E includes \$9.740M in PE 0604222F FY11 and \$39.717M in PE 0604851F FY12

A. Mission Description and Budget Item Justification

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.

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 and the future GBSD weapon systems, 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 was rebaselined and the Arming and Fuzing Assembly completed Final Design Review in Fiscal Year 2020. An updated Service Cost Position was approved in July 2020. The Fiscal Year 2022 budget submission accounts for the rebaselined position.

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The Fiscal Year 2022 budget request continues cooperative efforts with the USN to leverage common components; conduct 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 emergent or unanticipated civilian pay expenses required to manage, execute, and deliver ICBM Fuze Modernization for emergent or unanticipated weapon system capability. The use of such program funds would be in addition to the civilian pay expenses budgeted in program elements 0605833F or 0605831F.

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 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	161.199	167.099	104.657	0.000	104.657
Current President's Budget	155.476	156.693	129.709	0.000	129.709
Total Adjustments	-5.723	-10.406	25.052	0.000	25.052
• Congressional General Reductions	0.000	-0.286			
• Congressional Directed Reductions	0.000	-10.120			
• 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	-5.723	0.000			
• Other Adjustments	0.000	0.000	25.052	0.000	25.052

Change Summary Explanation

FY2020 funding reflects a Small Business Innovation Research (SBIR) adjustment of 5.723 million.

FY2021 funding reflects a Congressional Directed Reduction of 10.120 million for "Forward Financing" and a Congressional General Reduction of 0.286 million for an undistributed mark.

FY2022 funding reflects an increase in accordance with the latest service cost position.

C. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021	FY 2022
Title: Fuze Design and Development	147.826	139.293	110.177

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<p>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.</p> <p>FY 2021 Plans:</p> <ul style="list-style-type: none"> • Finish and release Joint Test Assembly (JTA) 4a drawings • Finish and release Arming and Fuzing Assembly (AFA) drawings • Conduct Ground Test Unit 3 (GTU-3) test activities • Conduct JTA 4a 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 • Conduct Milestone C Review <p>FY 2022 Plans:</p> <ul style="list-style-type: none"> • Conduct Flight Test Unit 3 testing and activities • Conduct Mass Properties Test • Conduct Mechanical Environments qualification • Conduct Hostile Shock qualification • Conduct Susceptibility Test • Conduct Cumulative Effects Test (Radiated Susceptibility and Thermal Cycle plus mechanical & electrical tests) • Conduct Radiation Test Qualification • Conduct Mass Properties testing for Trainers • Conduct Handling Environment testing for Trainers • Conduct Accumulated Damage Testing on the Storage Environment for Trainers • Conduct Shock/Vibe testing in the transportation environment for Trainers • Further develop analytical, information technology, and data management capabilities. <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funding decreased due to ramp down of development efforts in preparation for production.</p>				
<p>Title: Weapon System Integration/Systems Engineering</p> <p>Description: Integrate the Mk21 fuze into the Intercontinental Ballistic Missile 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>		7.650	17.400	19.532

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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021	FY 2022
<p>FY 2021 Plans:</p> <ul style="list-style-type: none"> • Conduct Electrical Compatibility Test 3 • Conduct JTA4a Pathfinder Testing • 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-3) test activities <p>FY 2022 Plans:</p> <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 • Support Flight Test Unit 3 testing and activities • Validate Technical Order updates • Chair Survivability Task Team (STT) • Perform Comparative Analysis • Operate & Maintain ITB Fuze System Tester <p>FY 2021 to FY 2022 Increase/Decrease Statement: Funding increased due to the program entering qualification testing, continued nuclear and compatibility certification efforts, and additional tasks to augment SPO engineering support.</p>			
Accomplishments/Planned Programs Subtotals	155.476	156.693	129.709

D. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• MPAF 03 M30FLH: <i>ICBM FUZE MOD</i>	14.497	43.450	100.770	-	100.770	-	-	-	-	-	-
• RDTE 04 0605230F: <i>Ground Based Strategic Deterrent</i>	538.643	1,447.113	2,553.541	-	2,553.541	-	-	-	-	-	-
• MPAF 01 MGBSD0: <i>GBSD</i>	0.000	0.000	10.895	-	10.895	-	-	-	-	-	-

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D. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2020</u>	<u>FY 2021</u>	<u>FY 2022</u> <u>Base</u>	<u>FY 2022</u> <u>OCO</u>	<u>FY 2022</u> <u>Total</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>FY 2026</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• RDTE 07 0101328F: <i>ICBM Reentry Vehicles</i>	63.484	112.547	96.313	-	96.313	-	-	-	-	-	-

Remarks

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.

Due to the differences between the Department of Energy and the Department of Defense acquisition processes, the program has decoupled Milestone C from Phase 6.5 and Full Rate Production from Phase 6.6. The program is forecasted to complete a Milestone C decision in 4QFY2021 and a Full Rate Production Decision in 2QFY2024.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Air Force **Date:** May 2021

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 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 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	529.936	77.371	Nov 2019	59.452	Nov 2020	50.938	Nov 2021	-		50.938	-	-	782.461
Fuze EMD	Various	Various : Various	3.203	1.020	Nov 2019	7.746	Nov 2020	4.659	Nov 2021	-		4.659	-	-	22.845
Fuze Engineering Change Orders	Various	Various : Various	7.431	1.300	May 2020	3.441	May 2021	2.709	Nov 2021	-		2.709	-	-	18.496
Fuze National Security Campus (formerly Kansas City Plant)	MIPR	National Security Campus : Kansas City, MO	132.648	60.827	Nov 2019	63.191	Nov 2020	47.466	Nov 2021	-		47.466	-	-	365.663
Fuze Weapon System Integration - ICBM Prime	C/CPAF	Northrop Grumman : Clearfield, UT	25.937	-		-		-		-		-	-	-	25.937
Fuze Weapon System Integration - RS/RV Sub-System Contract (SSC)	C/CPAF	Lockheed Martin : Valley Forge, UT	84.691	-		-		-		-		-	-	-	84.691
RS/RV Sub-System Contract (SSC)	C/CPFF	Lockheed Martin : Valley Forge, PA	0.000	7.650	Jan 2020	17.400	Jan 2021	19.532	Jan 2022	-		19.532	-	-	70.645
Subtotal			783.846	148.168		151.230		125.304		-		125.304	-	-	N/A

Support (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 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	-		-		-		-		-	-	-	2.757
Fuze Engineering Support - BAE	C/FFP	BAE : Clearfield, UT	13.741	1.390	Jul 2020	1.675	Jul 2021	1.225	Nov 2021	-		1.225	-	-	23.415
Subtotal			16.498	1.390		1.675		1.225		-		1.225	-	-	N/A

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Test and Evaluation (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 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 Lead Project Office Support	MIPR	AFNWC : Albuquerque, NM	10.480	-		-		-		-		-	-	-	10.480
Fuze Finite Element Model Validation	C/CPFF	LMTF : Little Mountain, UT	1.843	-		-		-		-		-	-	-	1.843
Fuze Flight Test Support and Evaluation	Various	Various : Various	5.650	4.884	Feb 2020	-		-		-		-	-	-	10.534
Subtotal			17.973	4.884		-		-		-		-	-	-	N/A

Management Services (\$ in Millions)				FY 2020		FY 2021		FY 2022 Base		FY 2022 OCO		FY 2022 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 Cost and Financial Management	C/FFP	Tecelote : Salt Lake City, UT	5.157	-		-		-		-		-	-	-	5.157
Fuze FFRDC Support	MIPR	Aerospace : Los Angeles, CA	6.223	0.680	Dec 2019	0.780	Nov 2020	0.780	Nov 2021	-		0.780	-	-	9.997
Fuze Program Support	C/FFP	BAE : Clearfield, UT	1.285	0.000	Jul 2020	-		-		-		-	-	-	1.285
Fuze Program Management Administration	Various	Various : Various	15.118	0.354	Jul 2020	3.008	Jul 2021	2.400	Nov 2021	-		2.400	-	-	23.735
Subtotal			27.783	1.034		3.788		3.180		-		3.180	-	-	N/A

	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals		846.100	155.476	156.693	129.709	-	-	-	N/A

Remarks
 Prior year RDT&E includes \$9.740M in PE 0604222F FY11 and \$39.717M in PE 0604851F FY12

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Exhibit R-4, RDT&E Schedule Profile: PB 2022 Air Force **Date:** May 2021

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	FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025				FY 2026			
	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	
Engineering and Manufacturing Development	
Flight Test 2 (Feb 2020)	
Final Design Review [FDR] (Aug 2020)	
Complete Engineering Release (Oct 2020)	
Milestone C Review (Aug 2021)	
Production and Deployment	
Flight Test 3 (Aug 2022)	
Production Readiness Review (Jan 2023)	
Flight Test 4 (Feb 2024)	
Full Rate Production Decision (Mar 2024)	
DOE Phase 6.5 Milestone Decision (May 2024)	
First Production Unit (May 2024)	
Initial Operating Capability (Feb 2025)	
DOE Phase 6.6 Milestone Decision (May 2025)	

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Exhibit R-4A, RDT&E Schedule Details: PB 2022 Air Force **Date:** May 2021

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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
AF ICBM Fuze Modernization Program				
Engineering and Manufacturing Development	1	2020	2	2023
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
Milestone C Review (Aug 2021)	4	2021	4	2021
Production and Deployment	4	2021	4	2026
Flight Test 3 (Aug 2022)	4	2022	4	2022
Production Readiness Review (Jan 2023)	2	2023	2	2023
Flight Test 4 (Feb 2024)	2	2024	2	2024
Full Rate Production Decision (Mar 2024)	2	2024	2	2024
DOE Phase 6.5 Milestone Decision (May 2024)	3	2024	3	2024
First Production Unit (May 2024)	3	2024	3	2024
Initial Operating Capability (Feb 2025)	2	2025	2	2025
DOE Phase 6.6 Milestone Decision (May 2025)	3	2025	3	2025

Note

The ICBM Fuze Mod Program discovered the need to de-couple Milestone C and Full Rate Production (FRP) from Phase 6.5 and Phase 6.6 respectively. At the time of the initial baseline in 2014, Phase 6.5 and Phase 6.6 were selected as the surrogates for the DoD milestones. Since that time differences between the DOE Phase 6.x process and the DoD 5000, as it relates to funding of Title 10 programs, have drove a de-coupling of these milestones into the Acquisition Program Baseline. This program is still being managed according to the Phase 6.x process but Milestone C and FRP have been added as milestones that will be accomplished to satisfy statutory requirements of a Title 10 funded acquisition.