Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force											Date: March 2023	
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603273F / *Science & Technology for Nuclear Re-entry Systems*							
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
Total Program Element	-	0.000	27.031	70.321	0.000	70.321	88.464	120.090	157.035	162.718	Continuing	Continuing
634094: *Next Gen Platform Dev/ Demo*	-	0.000	27.031	70.321	0.000	70.321	88.464	120.090	157.035	162.718	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

NOTE: Funding in this Project was spread into four separate thrusts in FY 2024 to provide for additional detail and traceability to efforts being executed. The total funding change for this project increased by $43.290 million in FY 2024 as compared to FY 2023, that increase is due to investment in next-generation hardware, software and material technologies for flight representative environments for re-entry systems, as well as component integration into initial flight experimentation.

Future FYs will include a detailed increase/decrease by thrust area described in a more relevant manner.

A. Mission Description and Budget Item Justification

This program supports Department of Defense (DOD) priorities for enduring nuclear science and technology (S&T) for re-entry systems. This effort will provide advanced technology development that will effectively address evolving threats and maintain operational effectiveness while also aligning with the highest-level guidance for nuclear forces identified in the 2022 Nuclear Posture Review, and National Defense Strategy. This effort will contribute to preserving the viability of the nuclear deterrent in a cost-effective manner by reducing technical and programmatic risk associated with execution of the overall nuclear modernization program. This effort will advance materials and manufacturing methods to develop new, manufacturable options to increase capability and reduce cost for re-entry systems. These ends will be reached by developing technologies to inform future system requirements, establishing interagency partnerships for re-entry system platform development and infrastructure modernization, revitalizing nuclear workforce talent, and coordinating with existing programs for next generation strategic system development. This program enhances and enables technology developed under the Next Gen Platform Dev/Demo Effort currently being executed under program element 0603211F, Aerospace Technology Dev/Demo, Project 634094.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this program element would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, and 0602298F.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	0.000	39.431	70.162	0.000	70.162
Current President's Budget	0.000	27.031	70.321	0.000	70.321
Total Adjustments	0.000	-12.400	0.159	0.000	0.159
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	-12.400			
• 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	0.000	0.000			
• Other Adjustments	0.000	0.000	0.159	0.000	0.159

C. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Re-entry System Technologies	0.000	27.031	0.000
Description: Develop next generation hardware, software and material technologies for flight representative testing and environments for re-entry systems. ***FY 2023 Plans:*** Initiate development of advanced aeroshell technologies to maintain a viable deterrent for the foreseeable future through enhanced resiliency and survivability. Initiate development of advanced fuzing solutions that are able to maintain operational effectiveness against emerging targeting challenges and develop alternative safety and surety features required for nuclear systems. Initiate development of strategic-grade, radiation-hardened guidance, navigation and control solutions for advanced systems. Initiate establishment of requisite testing infrastructure to enable nuclear re-entry S&T development activities and to evaluate component technologies in relevant environments. ***FY 2024 Plans:*** Plans are spread between new thrusts in FY 2024 ***FY 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 decreased compared to FY 2023 by $27.031 million. FY 2024 funds were reallocated across the four thrust areas supporting S&T for nuclear re-entry systems: Aeroshell Technologies, Advanced Fuzing Technologies, Advanced Guidance, Navigation and Control Technologies, and Integration, Experimentation and Evaluation Solutions. In FY 2023 the funds breakout was as follows: $5.747 million, $6.784 million, $7.883 million, and $6.617 million.			
Title: Aeroshell Technologies	-	0.000	24.487

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: Develop next-generation material technologies and joint Government Reference Designs (GRD) for flight representative environments and experimentation for re-entry systems. ***FY 2023 Plans:*** New thrust created in FY 2024. Prior plans captured in Re-entry System Technologies thrust, previously described. ***FY 2024 Plans:*** Continue development of advanced aeroshell technologies to maintain a viable deterrent through modeling and simulation (M&S) of re-entry environments (being supported by PE 0602201F). Initiate advanced M&S development to characterizing re-entry environment. Initiate update to M&S integrated solvers for enhanced analysis workflow with inclusion of an advanced physics-based re-entry characterization protocol for decreased computational time. Initiate benchtop experimentation supporting M&S code validation. Continue aeroshell materials trade studies and procurement of material coupons. Initiate iterative material characterization and benchtop experimentation to build materials database. Initiate additional material development for future benchtop experimentation. Initiate trade studies and requirements of material sample experimentation for integration onto platform generating a combined effects environment. Initiate development of a GRD platform through requirements development and with continued design trade studies and optimization. Initiate manufacturing process trade studies and analysis. Initiate model-based systems engineering approach for future GRD development build and risk reduction. Initiate investigations into sourcing options for outer aeroshell materials and high-temperature GRD components. Initiate requirements development supporting component integration onto a future launch platform. Initiate required test-bed design trades and/or modifications, including instrumentation options for future flight characterization and analysis capabilities. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased compared to FY 2023 by $24.487 million due to funding being realigned from Re-entry System Technologies to provide additional detail aligned with established thrust areas as described above. $5.747 million was executed against Aeroshell Technologies in FY 2023 thus the actual increase was $18.740 million for increased emphasis in advanced M&S analysis, aeroshell materials characterization and experimentation, GRD platform development, and requirements development for component integration.			
Title: Advanced Fuzing Technologies	-	0.000	9.341

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Description: Develop next-generation fuzing solutions which maintain operational effectiveness against emerging targeting challenges and develop alternative safety and surety features required for nuclear systems. ***FY 2023 Plans:*** New thrust created in FY 2024. Prior plans captured in Re-entry System Technologies thrust, previously described. ***FY 2024 Plans:*** Continue the development of advanced fuzing solutions which maintain operational effectiveness against emerging targeting challenges and threat environments. Initiate research into integrated guidance/fuzing solutions which are capable of synthesizing positional information with altitude measurement. Initiate advanced fuzing design requirements. Initiate the development of hardware concepts for advanced fuzing architectures. Initiate experimentation on advanced impact fuze technologies. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased compared to FY 2023 by $9.341 million due to funding being realigned from Re-entry System Technologies to provide additional detail aligned with established thrust areas as described above. $6.784 million was executed against Advanced Fuzing Technologies in FY 2023 thus the actual increase was $2.557 million for increased emphasis in integrated guidance/fuzing solutions, and design requirements for fuzing architectures.			
Title: Advanced Guidance, Navigation and Control (GNC) Technologies ***Description:*** Develop next generation, strategic level radiation hardened GNC technologies and solutions, including sensors, systems, aides and control elements to support GNC requirements in relevant environments. ***FY 2023 Plans:*** New thrust created in FY 2024. Prior plans captured in Re-entry System Technologies thrust, previously described. ***FY 2024 Plans:*** Continue strategic-grade, solid-state radiation-hardened guidance solution development and radiation component testing reinforcing nuclear efforts in PE 0603211F. Initiate design of high-gravity (high-g) accelerometer Application Specific Integrated Circuits (ASICs). Initial delivery of solid-state, high-g accelerometer advanced technological development characterization and insertion into inertial measurement unit (IMU) future architecture. Initiate and complete solid-state, low-g accelerometer development unit design/build and initiate integration into IMU.	-	0.000	20.218

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Initiate benchtop experimentation of resonant fiber optic gyroscope (RFOG), including multiple component level design, testing and experimentation, to inform the iterative development of ensuing RFOG design. Initiate final RFOG design trades and develop mechanical flight architectures. Initiate risk reduction activities for resonant fiber optic gyroscope (RFOG) components, including fiber improvement, radiation hardened parts development, and light source performance. Initiate inertial measurement unit (IMU) concept development and maturation through the design, build and environmental testing of inertial sensor components. Initiate purchase of long-lead IMU components. Initiate bench-level characterization for IMU system with early sensor designs. Initiate IMU radiation-hardened electronics design, build and analysis. Initiate risk reduction to meet future follow-on evaluation opportunities. Initiate requirements development in support of inertial sensor component integration for future re-entry testbed flight. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased compared to FY 2023 by $20.218 million due to funding being realigned from Re-entry System Technologies to provide additional detail aligned with established thrust areas as described above. $7.883 million was executed against Advanced guidance, navigation and control (GNC) Technologies in FY 2023 thus the actual increase was $12.335 million for high-g accelerometer design and delivery of the low-g accelerometer, RFOG experimentation and final design, and IMU maturation.			
Title: Integration, Experimentation and Evaluation Solutions ***Description:*** Development of inherent government expertise through integration and experimentation laboratories. This capability enables S&T for current and future nuclear re-entry systems and component Technology Readiness Level (TRL) maturation through Government reference designs (GRDs) in strategic environments. ***FY 2023 Plans:*** New thrust created in FY 2024. Prior plans captured in Re-entry System Technologies thrust, previously described. ***FY 2024 Plans:*** Continue establishing requisite testing infrastructure to enable nuclear re-entry science and technology (S&T) development activities and to evaluate component technologies in relevant environments. Initiate procurement of long-lead time special equipment for installation into government integration facilities. Initiate and complete design of radiographic facility to support imaging for high-fidelity demonstrators and begin procurement of radiographic equipment. Initiate the development of enhanced ground and complementary experimentation capabilities. Initiate and complete high-gravity, high-precision centrifuge designs. Initiate build supporting strategic-grade inertial sensor characterization and validation to meet GNC analytic activities for future flight to achieve IMU TRL 6. Initiate the development of a recoverable re-entry testbed	-	0.000	16.275

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
supporting modeling and simulation (M&S) validation and component technology readiness level (TRL) maturation through interim design review. Initiate integration planning activities for recoverable flight unit. Initiate functional requirements development to establish an integration strategy and proposed test plan in relation to guidance, navigation and control (GNC) technologies and telemetry for future flight. Initiate planning and requirements development activities for enduring government reference design (GRD) flights. Initiate and complete planning and development of integration and radiographic facility operations, roadmaps and procedures. Initiate in-house employee training program, supporting enduring expertise for integration, experimentation and evaluation activities for future flight demonstrators. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased compared to FY 2023 by $16.275 million due to funding being realigned from Re-entry System Technologies to provide additional detail aligned with established thrust areas as described above. $6.617 million was executed against Integration, Experimentation and Evaluation Solutions in FY 2023 thus the actual increase was $9.658 million for development of experimentation capabilities for component TRL maturation, purchase of laboratory equipment and in-house training supporting enduring expertise.			
Accomplishments/Planned Programs Subtotals	0.000	27.031	70.321

D. Other Program Funding Summary ($ in Millions)

N/A

Remarks

E. Acquisition Strategy

Not applicable