Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Air Force	**Date:** March 2024
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 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	22.893	70.321	91.885	0.000	91.885	127.244	164.414	170.367	173.931	Continuing	Continuing
634094: *Next Gen Platform Dev/ Demo*	-	22.893	70.321	91.885	0.000	91.885	127.244	164.414	170.367	173.931	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

NOTE: Funding was realigned into this PE/Project from PE 0603211F / Aerospace Technology Dev/Demo, Project 634094: Next Gen Platform Dev/ Demo.

A. Mission Description and Budget Item Justification

This project demonstrates advanced nuclear-related components and technologies in support of the nuclear enterprise, nuclear deterrence operations missions, and integrated deterrence operations. Next Gen Platform Development/Demonstration efforts are accomplished through development, integration, experimentation, and evaluation of various technologies to include fuzes, aeroshells, inertial guidance, and strategic radiation hardened communications for demonstration in near-realistic operational environments. This program supports Department of Defense (DoD) priorities for enduring nuclear science and technology (S&T) for nuclear delivery 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. Technology that enhanced and enabled this program in Program Element 0603211F Project 634094 was realigned into this PE for clarity and traceability.

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 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	27.031	70.321	88.464	0.000	88.464
Current President's Budget	22.893	70.321	91.885	0.000	91.885
Total Adjustments	-4.138	0.000	3.421	0.000	3.421
• 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	-0.950	0.000			
• Other Adjustments	-3.188	0.000	3.421	0.000	3.421

Change Summary Explanation

The FY 2025 funding request was reduced by $3.500 million to account for the availability of prior year execution balances.

FY 2025 funding increased due to the transfer from PE 0603211F, Aerospace Technology Dev/Demo, efforts to PE 0603273F, Next Generation Platform Dev/Demo.

C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Re-entry System Technologies ***Description:*** Develop next generation hardware, software and material technologies for flight representative testing and environments for re-entry systems. ***FY 2024 Plans:*** Plans are spread between new thrusts in FY 2024 ***FY 2025 Plans:*** Plans are spread between thrusts in FY 2025	22.893	0.000	0.000
Title: Aeroshell Technologies ***Description:*** Develop next-generation material technologies and Government Reference Designs (GRD) for flight representative environments and experimentation for multi-service re-entry systems characterization. ***FY 2024 Plans:***	0.000	24.487	29.734

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
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 GRD platforms 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 2025 Plans:*** -Continue development of advanced aeroshell technologies to maintain a viable deterrent through M&S of re-entry environments (being supported by PE 0602201F) and initiate technology development for enhance GRD testing capabilities. -Continue advanced M&S development to characterizing re-entry environments and 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. Continue benchtop experimentation supporting M&S code validation. -Complete aeroshell materials trade studies, procurement of material coupons, iterative material characterization, and benchtop experimentation to build materials database. Complete additional material development for future benchtop experimentation. -Continue trade studies and requirements of material sample experimentation for integration onto platform generating a combined effects environment. -Initiate test planning for a combined effects environment.			

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
-Continue development of a GRD platform through requirements development with continued design trade studies and optimization. Continue manufacturing process trade studies and analysis as well as model-based systems engineering approach for future GRD development build and risk reduction. Continue investigations into sourcing options for outer aeroshell materials and high-temperature GRD components. -Complete requirements development supporting component integration onto a future launch platform. -Complete required test-bed design trades and/or modifications, including instrumentation options for future flight characterization and analysis capabilities. -Initiate planning for future GRD integration, test, and evaluation activities. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 increased compared to FY 2024 by $5.247 million. FY 2025 increased due to planned purchase of long lead items for the GRD and subsystem integration design work for low level experimentation on the ground and during re-entry.			
Title: Advanced Fuzing Technologies ***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 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 2025 Plans:*** -Continue the development of advanced fuzing solutions to improve reliability with non-ballistic vehicles. -Continue development of integrated guidance/fuzing solutions and complete evaluation of advanced fuzing requirements. -Continue development of experimental impact fuze technologies. -Continue development of MK21A dual-use fuze design. -Complete delivery of advanced impact fuze P0 for testing and integration. -Continue development of prototypes for design, build and preliminary testing. -Initiate integration planning of advanced guidance with fuzing architecture and target optimization algorithms. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	0.000	9.341	9.079

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
FY 2025 decreased compared to FY 2024 by 0.262 million. Funding decreased due to decreased emphasis in advanced fusing technologies.			
Title: Advanced Guidance, Navigation and Control (GNC) Technologies	0.000	20.218	27.828
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 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 (ASIC). 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. 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 RFOG components, including fiber improvement, radiation hardened parts development, and light source performance. Initiate 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 2025 Plans:*** -Continue strategic-grade, solid state radiation-hardened guidance solution development and radiation component testing reinforcing nuclear efforts. -Continue design of high-g accelerometer ASICs and the delivery of solid-state, high-g accelerometer advanced technological development characterization and insertion into IMU future architecture.			

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
-Continue benchtop experimentation of RFOG, including multiple component level design, testing and experimentation, to inform the iterative development of ensuing RFOG design. Continue final RFOG design trades and develop mechanical flight architectures. Continue risk reduction activities for RFOG components, including fiber improvement, radiation hardened parts development, and light source performance. -Continue IMU concept development and maturation through the design, build, and environmental testing of inertial sensor components. Complete purchase of long-lead IMU components and continue bench-level characterization for IMU system with early sensor designs. Continue IMU radiation-hardening electronics design, build and analysis and risk reduction to meet future follow-on evaluation opportunities. Initiate covariance analysis improvement through sensor/system test data inputs to predict IMU performance. Complete requirements development in support of inertial sensor component integration for future re-entry testbed flight. -Initiate and complete delivery of strategic grade rad-hard gyroscope in final form factor for FY 2026 insertion into IMU as well as future inertial sensor designs of quantum IMUs. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 increased compared to FY 2024 by $7.61 million. Funding increased due to the initiation of efforts to develop strategic grade rad-hard gyroscope in final form factor for FY 2026 insertion into Inertial Measurement Unit (IMU) as well as future inertial sensor designs of quantum IMUs.			
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 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 Guidance, Navigation, and Control (GNC) analytic activities for future flight to achieve Inertial Measure Unit (IMU) TRL 6. Initiate	0.000	16.275	25.244

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
the development of a recoverable re-entry testbed supporting modeling and simulation (M&S) validation and component 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 GNC technologies and telemetry for future flight. Initiate planning and requirements development activities for enduring 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 2025 Plans:*** -Continue establishing requisite testing infrastructure to enable nuclear re-entry S&T development activities and to evaluate component technologies in relevant environments. -Continue procurement of long-lead time special equipment for installation into government integration facilities. -Initiate and complete construction of integration facility for integration of strategic technologies and testbeds. Initiate significant manpower increase to support Initial Operating Capability (IOC) of government integration facility. Initiate accreditation and certification process for integration facility infrastructure, personnel, and equipment. -Initiate construction of radiographic facility to support imaging and evaluation for high-fidelity demonstrators. -Initiate procurement of long-lead time radiographic test equipment for installation into government radiographic facility. -Initiate and complete build and installation of high-G, high-precision centrifuge. -Continue the development of enhanced ground and complementary experimentation capabilities as well as the build supporting strategic-grade inertial sensor characterization and validation to meet GNC analytic activities for future flight to achieve IMU TRL 6. -Complete the development of a recoverable re-entry testbed supporting M&S validation and component TRL maturation through interim design review. Transition testbed for enduring experimentation. -Complete integration planning activities for recoverable re-entry testbed and complete flight test for SPARROW IMU. -Continue development of enhanced ground and complementary experimentation capabilities. -Continue functional requirements development to establish an integration strategy and proposed test plan in relation to GNC technologies, aeroshell technologies, fuzing technologies, and telemetry for future flight. -Continue planning and requirements development activities for enduring GRD flights.			

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
-Initiate planning with government reference design (GRD) delivery system developer and launch facility coordinator. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 increased compared to FY 2024 by $8.969 million. FY 2025 increased $1.684 million due to the realignment of funding from Program 0603211F, Aerospace Technology Dev/Demo, Project 634094, Next Gen Platform Dev/Demo. FY 2025 decreased by $.83 million to account for the availability of prior year execution balances. Furthermore, funding increased to account for training and manpower increases required for achieving Initial Operational Capability (IOC) of Re-Entry Vehicle Integration Laboratory (REVIL) and significantly increased experimentation activities in support of GRD testbed development.			
Accomplishments/Planned Programs Subtotals	22.893	70.321	91.885

D. Other Program Funding Summary ($ in Millions)

N/A

Remarks

E. Acquisition Strategy

Not applicable