Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Defense Advanced Research Projects Agency	Date: March 2024
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603286E / *ADVANCED AEROSPACE 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	-	242.369	331.753	269.700	-	269.700	302.244	346.641	366.495	379.542	-	-
AIR-01: *ADVANCED AEROSPACE SYSTEMS*	-	242.369	331.753	269.700	-	269.700	302.244	346.641	366.495	379.542	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) address the Advanced Technology Development associated with the Advanced Aerospace Systems Program that is focused on exploiting high pay-off opportunities to provide revolutionary new system capabilities, as opposed to incremental or evolutionary advancements, in order to achieve undeterrable air presence at dramatically reduced costs. Rapid prototyping and experimentation of integrated system concepts, as well as enabling vehicle subsystems will be conducted. Programs will explore new architectural concepts that employ a mix of weapon technologies that achieve lethality through a combination of overwhelming performance and overwhelming numbers rather than through the use of singular and costly high value assets. Studies conducted under this program element include examination and evaluation of emerging aerospace threats, technologies, concepts, use of autonomy to minimize risk, and applications for missiles, munitions, and vehicle systems.

B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	241.015	331.753	361.051	-	361.051
Current President's Budget	242.369	331.753	269.700	-	269.700
Total Adjustments	1.354	0.000	-91.351	-	-91.351
• 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	9.114	0.000			
• SBIR/STTR Transfer	-7.760	0.000			
• TotalOtherAdjustments	-	-	-91.351	-	-91.351

Change Summary Explanation

FY 2023: Increase reflects SBIR/STTR transfer offset by reprogrammings.

FY 2024: N/A

FY 2025: Decrease reflects completion of the Tactical Boost Glide and MoHAWC programs as well as the shift from aircraft fabrication and ground testing to flight testing in the Control of Revolutionary Aircraft with Novel Effectors (CRANE) program.

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: LongShot	36.000	41.038	36.742
Description: The LongShot program is developing and flight demonstrating an air-launched system capable of engaging multiple adversary targets from standoff ranges using existing air-to-air missiles. LongShot will be deployed either externally from existing fighters or internally from existing bombers. This system will capitalize on a slower speed, fuel-efficient air vehicle for ingress, while retaining highly energetic air-to-air missiles for end-game target engagements, which provides several key benefits that increase weapon effectiveness. This program will address the stability and control challenges of launching air-to-air missiles from a relatively small UAV in an operational environment. Potential transition partners include the Navy and Air Force. ***FY 2024 Plans:*** - Complete detailed design of full vehicle including all subsystems, fabrication of initial flight test vehicles and begin integration onto host aircraft. - Conduct subscale wind-tunnel campaign verifying final design aerodynamic parameters. - Conduct subsystem and safety recovery system verification testing. - Conduct weapon integration and ground testing. - Conduct fabrication, integration, testing, and checkout of final flight test vehicles. ***FY 2025 Plans:*** - Conduct full-scale wind-tunnel test to exercise critical mechanisms and subsystems, gather structural dynamics data, gather unsteady aerodynamic data, and derive scaling corrections for transonic aero data. - Conduct captive carry test of flight vehicles on host aircraft. - Conduct a series of flight demonstrations validating air vehicle stability and controls upon separation from host-aircraft and prior to, during, and after separation of an air-to-air missile payload. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects the shift from fabrication of final test vehicles to flight testing.			
Title: Glide Breaker	18.250	29.100	38.029
Description: Glide Breaker is developing and demonstrating a propulsion technology to support a lightweight vehicle designed for hit-to-kill engagement of hypersonic threats at very long range. Glide Breaker will first demonstrate a divert and attitude control system (DACS) to enable a kill vehicle capable of intercepting hypersonic threats during glide phase. The program will then quantify jet interaction effects between the DACS plumes and the hypersonic cross flow by conducting wind tunnel and flight tests. Results of these tests will culminate into a divert propelled flight test of a vehicle at conditions relevant to glide-phase intercept of a hypersonic threat. ***FY 2024 Plans:***			

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Conduct cold-gas wind tunnel testing of aero bodies with divert jets to develop performance database in a relevant aerodynamic environment. - Conduct hot-gas wind tunnel testing of aero bodies with divert jets to develop a performance database in relevant aerothermal environment. - Complete detailed design of the flight test article. - Initiate procurement of long lead items leading to a demonstration vehicle. ***FY 2025 Plans:*** - Complete wind tunnel testing of aero bodies with divert jets. - Manufacture and instrument a separating aero body to be flown in the flight test. - Integrate ground test data with computational tools for verification and validation of jet interaction effects. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects the shift from ground testing and simulation to flight test vehicle build up and integration.			
Title: Advanced Aerospace System Concepts ***Description:*** Studies conducted under this program examine and evaluate emerging aerospace technologies and system concepts for applicability to military use. This includes the degree and scope of potential impact and improvements to military operations, mission utility, and warfighter capability. Studies are also conducted to analyze emerging aerospace threats along with possible methods and technologies to counter them. The feasibility of achieving potential improvements, in terms of resources, schedule, and technological risk, is also evaluated. The results from these studies are used, in part, to formulate future prototype development programs or refocus ongoing work. Topics include: methods of defeating enemy anti-aircraft attacks; munition technologies to increase precision, range, endurance, and lethality of weapons for a variety of mission sets; novel launch systems; air vehicle control, power, propulsion, materials, and architectures; and payload and cargo handling systems. ***FY 2024 Plans:*** - Examine and refine rocket, airbreathing, and combined air vehicle architectures, concepts of operations, and propulsion and vehicle technology. - Demonstrate integrated cross-domain air dominance solutions. - Develop deeper understanding of hybrid aerodynamics and propulsion concepts to enable future technology demonstrations. ***FY 2025 Plans:*** - Perform laboratory demonstrations of technologies to enable cross-domain air dominance solutions. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	4.554	3.360	3.500

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
The FY 2025 increase reflects minor program repricing.			
Title: Control of Revolutionary Aircraft with Novel Effectors (CRANE) ***Description:*** The Control of Revolutionary Aircraft with Novel Effectors (CRANE) program will develop and demonstrate revolutionary improvements in aircraft controls technology. The program will design, build, and flight test an aircraft able to fly and maneuver at altitude relying on state-of-the-art Active Flow Control (AFC) technology. AFC is a broad term that encompasses a range of technology approaches; it includes a number of control mechanisms which alter the aerodynamic flow field thru ejection or suction of fluid via an orifice on a lifting body. An emphasis of the program is on assessing AFC component technologies, risk reduction and experimentation, integrated testing, fabrication and demonstration of a relevant scale novel and innovative aircraft. Technologies, design tools and models developed and demonstrated under this program will be made available to all Services as well as the civilian aerospace sector for application to future air systems development. ***FY 2024 Plans:*** - Complete the system Critical Design Review (CDR). - Complete fabrication and subsystem integration of a demonstration aircraft. - Complete airworthiness and ground/flight test approvals. - Initiate ground test of the demonstration aircraft. ***FY 2025 Plans:*** - Complete ground testing of the demonstration aircraft. - Initiate and complete flight testing of the demonstration aircraft. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects the shift from aircraft fabrication and ground testing to flight testing.	40.565	42.500	29.715
Title: Liberty Lifter ***Description:*** The Liberty Lifter program will design and demonstrate a runway-independent, large-payload, survivable, dual-flight regime aircraft capable of extended on-water operations and flight both in and out of ground effect. Critical to an effective aircraft of this type is a robust sea plane capability to operate in high sea states as well as an innovative manufacturing approach that dramatically reduces vehicle acquisition costs. The vehicle is anticipated to be survivable against peer threats due to the combination of extremely low altitude operations and speeds significantly higher than ships. The ability to deploy amphibious cargo while on the water will minimize exposure time and enable a wide variety of mission capabilities in the maritime domain including rapid contested logistics support, and search and rescue. The Liberty Lifter program is envisioned to deliver a technology demonstrator with potential to transition to military service partners for continued testing and development activities.	31.000	42.310	38.398

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
The demonstrator is expected to be approximately 80% size and 50% maximum gross takeoff weight of a future Liberty Lifter objective system. ***FY 2024 Plans:*** - Complete design changes reflecting the program refocus on a technology demonstrator, leading to delta CoDR. - Continue extensive risk reduction analysis, modeling and simulation, and test activities to inform demonstrator preliminary design. - Scope and purchase of initial long-lead items for demonstrator production. ***FY 2025 Plans:*** - Complete platform preliminary design review, manufacturing plan review, and test planning review for demonstrator. - Initiate demonstrator detailed design and analysis activities. - Conduct demonstrator subcomponent testing. - Purchase of remaining long-lead items for demonstrator production. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects shift from demonstrator preliminary design and extensive risk reduction activities to detailed design and demonstrator subcomponent testing.			
Title: SPeed and Runway INdependent Technologies (SPRINT) X-Plane Demonstration Project	-	22.663	36.866
Description: The SPeed and Runway INdependent Technologies (SPRINT) X-Plane Demonstration Project will develop and demonstrate the fundamental technologies needed for combined high speed and vertical take-off and landing (VTOL) capabilities in a single aircraft. This program culminates in the fabrication and flight test of a demonstrator that validates the critical technologies in a representative environment and reduces technical, schedule, and cost risk for a follow-on operational system. High speed VTOL aircraft are highly desired in a variety of military missions such as infiltration/exfiltration, contested personnel recovery, troop transport, logistics support, and armed escort; however, the thresholds for speed and range have evolved with military strategy and mission needs. The SPRINT Demonstrator is envisioned to transition to military services for further risk reduction flight testing. ***FY 2024 Plans:*** - Conduct design and analysis activities leading to Conceptual Design Review (CoDR) for multiple concepts. - Initiate preliminary design and analysis activities. - Initiate simulations, component testing, subsystem testing, manufacturing planning, and flight test planning. ***FY 2025 Plans:*** - Continue simulations, component testing, subsystem testing, manufacturing planning, and flight test planning.			

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Conduct design and analysis activities leading to Preliminary Design Review (PDR). - Initiate limited detailed design and critical design activities. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects the shift from simulations, component testing and subsystem testing to initiation of limited detailed design and critical design activities.			
Title: Artificial Intelligence (AI) Reinforcements (AIR) ***Description:*** AI Reinforcements (AIR) will develop and demonstrate dominant tactical autonomy for multi-ship, beyond visual range, real-world air combat missions. This program is focused on developing highly accurate models that are orders of magnitude faster than the present state-of-the-art and then using those models to unlock novel and robust AI-driven autonomy approaches. An operations-centric development approach will be enabled through the use of human-on-the-loop F-16 testbeds. On piloted platforms, AIR's algorithms will automate tactical control tasks transforming junior pilots from low-level tacticians into high-level mission commanders. For unpiloted platforms, AIR will enable vehicles to perform missions with minimal human oversight. The outcome of this program will be an AI air combat capability that works in dynamic, operationally representative environments. The transition partner is the U.S. Air Force. ***FY 2024 Plans:*** - Evaluate current sensor and aircraft models and the ability to use them in high-speed simulation. - Establish pipelines to incorporate feedback from flight test data into underlying Modeling and Simulation (M&S) tools. - Develop AI algorithms that work on testbed aircraft. - Establish framework for M&S and interfaces with testbed aircraft. - Incorporate F-16 testbeds into the AIR integration and testing pipeline and iterate development through live flight testing. ***FY 2025 Plans:*** - Demonstrate modeling approaches that are significantly faster than baseline references. - Verify performance in Offensive Counter Air (OCA) and Defensive Counter Air (DCA) mission sets. - Introduce non-stationary conditions and incorporate Electronic Warfare capabilities. - Scale the AI-driven autonomy to four-ship operations. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects scaling up testing from two to four-ship operations.	-	21.082	41.171
Title: AdvaNced airCraft Infrastructure-Less Launch And RecoverY (ANCILLARY) ***Description:*** The AdvaNced airCraft Infrastructure-Less Launch And RecoverY (ANCILLARY) program will develop and flight demonstrate an X-plane with the critical technologies required for a leap-ahead in long endurance, vertical takeoff and landing	-	13.200	22.886

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
(VTOL) unmanned air system (UAS) performance. The UAS will be able to launch and recover from small ship flight decks and austere land locations in adverse weather without additional infrastructure equipment, thus enabling expeditionary deployments. ***FY 2024 Plans:*** - Conduct design and analysis activities leading to Conceptual Design Review (CoDR) for multiple concepts. - Complete Preliminary Design Reviews (PDRs) for multiple performer X-Plane designs. - Conduct risk reduction activities. ***FY 2025 Plans:*** - Conduct detailed design and analysis activities leading to Critical Design Review (CDR) for multiple concepts. - Conduct manufacturing, assembly, and ground testing of the X-plane vehicle(s). - Conduct VTOL flight testing of the X-plane(s) at Flight Test Event 1. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects a shift from design activities to manufacturing, assembly, and testing of the vehicle(s).			
Title: Rapid Experimental Missionized Autonomy (REMA)	-	5.000	13.893
Description: Commercial-quality drones demonstrate surprising usefulness on the modern battlefield. Rapid Experimental Missionized Autonomy (REMA) will enhance commercially available and stock military drones with a subsystem to enable autonomous operation. The program, building on technologies developed under the Oversight program (PE 0602702E / Project TT-07), will focus on delivering autonomy without being tied to a specific drone design. REMA will look to develop these capabilities through rapid spirals of development. New mission functionality will be delivered through development spirals accelerating from three-month duration at program inception to one-month by program completion. Drones are either remotely piloted via radio frequency (RF) tethers or pre-programmed with relatively simple mission profiles relying on GPS waypoints. Both approaches are vulnerable to RF jamming, especially at the terminal phase of the mission. Research and Development (R&D) programs have demonstrated autonomy capabilities for drones, but these have been bespoke solutions, with software spirals of nine months or longer, too slow of a response in a dynamic battlefield. The REMA program addresses specific challenge problems, during which performers will develop, collaborate, and deliver an autonomy subsystem for drones at a rapid pace. ***FY 2024 Plans:*** - Develop software, integrate with other performers, test, refine, and retest REMA solution in each spiral. ***FY 2025 Plans:*** - Continue to develop software, integrate with other performers, test, refine, and retest REMA solution in each spiral.			

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Increase the rate of spiral events from 2-month durations to 1-month duration. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects a shift from hardware procurement and longer spiral events for software development, testing and integration to 1-month spiral events for software development, testing and integration.			
Title: Making and Maintaining in Advanced Military Systems ***Description:*** Studies conducted under this thrust will examine and evaluate advanced approaches to make military system technologies manufacturable and accessible for the DoD and domestic industry. This includes new methods to design, fabricate, package, and test complex assemblies. Certain DoD applications also need these complex assemblies to be used in extreme environments. The feasibility of achieving potential improvements, in terms of resources, schedule, and technological risk, is also evaluated. Topics include: additive manufacturing at scale, portable methods of manufacturing and maintaining platforms and systems at point-of-need, technological solutions to increase rate of testing while continuing to manage risk, and application of novel materials or processes to reduce cost, time, and infrastructure requirements for production of platforms and systems. ***FY 2025 Plans:*** - Initiate additive manufacturing techniques to mass produce reliable low-cost platforms. - Initiate model-based systems engineering techniques to explore approaches to design that allow rapid scalable production. - Initiate design techniques that increase portability for manufacturing surges at time-of-demand. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 increase reflects program initiation.	-	-	3.500
Title: Kinetic Delivery in Advanced Aerospace Systems ***Description:*** Studies and other initiatives conducted under this thrust examine and evaluate emerging technologies and system concepts that employ physical means to degrade or deny targeted adversary capabilities. The feasibility of achieving potential improvements, in terms of resources, schedule, and technological risk, is also evaluated. The results from these studies and initiatives are used, in part, to formulate future prototype development programs or refocus ongoing work. Topics for this thrust include: methods of defeating enemy anti-aircraft attacks; munition technologies to increase precision, range, endurance, and lethality of weapons for a variety of mission sets; digital design methodologies that are compatible with surged production to deliver large quantities in time of critical need; advanced energetics; and examining novel target defeat mechanisms. ***FY 2025 Plans:*** - Laboratory testing of advanced effector concepts. - Development and testing of novel energetics.	-	-	5.000

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
- Planning for field testing of prototype concepts. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY 2025 increase reflects program initiation.			
Title: Tactical Boost Glide (TBG) ***Description:*** The Tactical Boost Glide (TBG) program is a Joint DARPA / Air Force effort developing and demonstrating technologies to enable air-launched tactical range hypersonic boost glide systems, including flight demonstration of a vehicle that is traceable to an operationally relevant weapon that can be launched from current platforms. The program will also consider traceability, compatibility, and integration with the Navy Vertical Launch System (VLS). The metrics associated with this objective include total range, time of flight, payload, accuracy, and impact velocity. The program will address the system and technology issues required to enable development of a hypersonic boost glide system considering (1) vehicle concepts possessing the required aerodynamic and aero-thermal performance, controllability and robustness for a wide operational envelope, (2) the system attributes and subsystems required to be effective in relevant operational environments, and (3) approaches to reducing cost and improving affordability for both the demonstration system and future operational strike systems. TBG capabilities are planned for transition to the Air Force and the Navy. ***FY 2024 Plans:*** - Complete assembly, integration, and test (AI&T) of fourth flight test vehicle. - Conduct test readiness reviews (TRR), conduct flight tests, and complete post-test analysis. - Conduct Navy variant subsystem demonstration testing. - Conduct technology development studies and ground testing to support ability to separate weapons and stores at speeds above the state of the art and supporting next generation strike capabilities. - Conduct propulsion system technology development to support continuous operations for next generation strike platforms. - Conduct technology development studies and testing in the area of design criteria, material attributes and airframe/subsystem development that supports next generation strike platforms. - Complete initial combined heating and mechanical loads test to calibrate analysis models, quantify structural contact loads and thermal transfer functions through representative joints and materials. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects program completion.	30.000	81.500	-
Title: More Opportunities with HAWC (MoHAWC) ***Description:*** MoHAWC will develop, integrate, and demonstrate technologies to increase effectiveness and producibility of an air-launched hypersonic cruise missile. These technologies include advancing hydrocarbon scramjet-powered propulsion operation,	60.000	30.000	-

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
shrinking navigation components, upgrading aircraft integration algorithms, and improving manufacturing approaches. Flight tests will expand the operational envelope. This program will collaborate with Navy and Air Force science and technologies efforts to meet future technology insertion dates for service programs of record. This program builds off the demonstrator system design, technology advances and lessons learned under the Hypersonic Airbreathing Weapon Concept (HAWC) and supporting technology maturation programs. ***FY 2024 Plans:*** - Complete subsystem technology risk reduction efforts. - Complete assembly, integration, and ground testing of multiple flight test systems. - Complete multiple flight tests. - Complete flight test data analysis and final program review. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The FY 2025 decrease reflects program completion.			
Title: Series Hybrid Electric Propulsion AircRaft Demonstrator (SHEPARD) ***Description:*** The Series Hybrid Electric Propulsion AircRaft Demonstrator (SHEPARD) program designed and developed an efficient Hybrid Electric Propulsion (HEP) system and integrated it into a unique military aircraft application. The innovative aircraft design included essential operational considerations and mission system components. The program employed a rapid development framework that capitalizes on maturing mission-enabling technologies to quickly meet emergent mission needs while overcoming significant system-level technical challenges. The result was a flight-demonstrated system with a minimal viable mission capability that was developed quickly and at relatively low cost.	22.000	-	-
Accomplishments/Planned Programs Subtotals	242.369	331.753	269.700

D. Other Program Funding Summary ($ in Millions)

N/A

Remarks

E. Acquisition Strategy

N/A