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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 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0604004F / <i>Advanced Engine Development</i>
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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	-	696.099	671.442	636.495	0.000	636.495	111.830	208.687	218.644	0.000	0.000	2,543.197
643608: <i>Advanced Engine Dev</i>	-	696.099	671.442	636.495	0.000	636.495	111.830	208.687	218.644	0.000	0.000	2,543.197
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Advanced Engine Development Program enables demonstration of advanced turbine engine prototypes. This program is maturing fuel efficient adaptive engine component technologies and reducing associated risk in preparation for next-generation propulsion system development for combat aircraft applications. Adaptive engine technology enables next generation combat aircraft capabilities by combining the efficiency of high bypass turbofans used by commercial airlines with the performance demanded of military fighter engines. This technology has undergone initial development under the auspices of the Air Force Research Laboratory through the Adaptive Engine Technology and Adaptive Engine Technology Demonstrator programs.

In addition, this program element may include necessary civilian pay expenses required to manage, execute, and deliver advanced engine capabilities. The use of such program funds would be in addition to the civilian pay expenses budgeted in program element 0605831F.

This effort is in Budget Activity 4, Advanced Component Development and Prototypes (ACD&P), because efforts are necessary to evaluate integrated technologies, representative modes or prototype systems in a high fidelity and realistic operating environment.

B. Program Change Summary (\$ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	720.355	878.442	637.657	0.000	637.657
Current President's Budget	696.099	671.442	636.495	0.000	636.495
Total Adjustments	-24.256	-207.000	-1.162	0.000	-1.162
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	-207.000			
• 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	-24.256	0.000			
• Other Adjustments	0.000	0.000	-1.162	0.000	-1.162

Change Summary Explanation

Decrease in FY 2020 of \$207.000 million is due to a Congressional directed reduction in the Department of Defense Appropriations Act 2020 for funding excess to need.

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Decrease in FY 2021 of \$1.162 million is due to Department of Defense inflation adjustments.

C. Accomplishments/Planned Programs (\$ in Millions)

	FY 2019	FY 2020	FY 2021
<p>Title: Adaptive Engine Transition Program</p> <p>Description: The Adaptive Engine Transition Program (AETP) will design and manufacture multiple flight-weight adaptive engine prototypes, complete component rig assessments, characterize materials, and inform manufacturing process improvements. The program will demonstrate adaptive engine technology can be scaled to meet military fighter engine size requirements, while ensuring appropriate manufacturing and technology readiness levels by producing flight-weight prototypes. The prototype engines will demonstrate fuel efficiency increases, thrust increases, and new component technologies by performing sea-level, altitude, and durability assessments across multiple power settings. These assessments will provide data to quantify the capability and reduce risk in areas such as thermal capacity, reliability, and supportability, among others.</p> <p>The FY 2021 Budget Justification Exhibit has been updated to reflect the breakout of the FY2019 through FY 2021 Next Generation Adaptive Engine (NGAP) funds from the AETP effort to increase transparency to Congress. This breakout will be reflected in future Budget Exhibits.</p> <p>FY 2020 Plans: Continue component rig activities. Continue technology, affordability, and sustainability studies. Continue engine fabrication. Begin engine assessments. Continue additional airframe integration/adaptive propulsion design efforts. More details can be provided in an appropriate forum.</p> <p>FY 2021 Plans: Complete component rig activities. Complete technology, affordability, and sustainability studies. Complete engine fabrication and assessments. Complete airframe integration/adaptive propulsion design efforts. More details can be provided in an appropriate forum.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: FY 2021 decreased compared to FY 2020 by \$214.018 million. Funding decreased due to completion of numerous activities leading up to the final prototype ground-run demonstrations in FY 2021.</p>	589.729	447.449	233.431
<p>Title: Next Generation Adaptive Propulsion</p> <p>Description: The Next Generation Adaptive Propulsion (NGAP) effort will design and perform component risk reduction for flight-weight adaptive engine prototypes for next generation fighter applications. NGAP will demonstrate that adaptive engine technology can be scaled to meet next generation military fighter engine size requirements, while ensuring appropriate manufacturing and technology readiness levels.</p>	106.370	223.993	403.064

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
<p>The FY 2021 Budget Justification Exhibit has been updated to reflect the breakout of the FY2019 through FY 2021 Next Generation Adaptive Engine (NGAP) funds from the AETP effort to increase transparency to Congress. This breakout will be reflected in future Budget Exhibits.</p> <p>FY 2020 Plans: Conduct adaptive engine preliminary design activities for next generation fighter applications. More details can be provided in an appropriate forum.</p> <p>FY 2021 Plans: Complete adaptive engine preliminary design activities for next generation fighter applications. More details can be provided in an appropriate forum.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: FY 2021 increased compared to FY 2020 by \$179.071 million. Funding increased due to continuation of preliminary design activities leading up to the initiation of prototyping activities in FY 2022.</p>				
Accomplishments/Planned Programs Subtotals		696.099	671.442	636.495
D. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
E. Acquisition Strategy				
<p>For Adaptive Engine Transition Program, the Air Force has awarded two limited source, cost plus incentive fee contracts to General Electric and Pratt & Whitney due to their unique qualifications to design a high performance, flight-weight adaptive turbine engine in the thrust class for AETP. Incentive categories include engine weight, performance factors, and maintainability and supportability, with specific metrics for each area incentivized. The government agency responsible for managing this program is the Air Force Life Cycle Management Center, Propulsion Directorate, Wright-Patterson Air Force Base, Ohio.</p>				

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

Appropriation/Budget Activity 3600 / 4	R-1 Program Element (Number/Name) PE 0604004F / <i>Advanced Engine Development</i>	Project (Number/Name) 643608 / <i>Advanced Engine Dev</i>
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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			
Adaptive Engine Transition Program - GE	C/CPIF	GE : Evendale, OH	-	336.645	Oct 2018	189.559	Oct 2019	94.607	Oct 2020	-		94.607	0.000	620.811	-
Adaptive Engine Transition Program - PW	C/CPIF	PW : East Hartford, CT	-	251.079	Oct 2018	251.522	Oct 2019	135.194	Oct 2020	-		135.194	0.000	637.795	-
Next Generation Adaptive Propulsion - GE	C/CPIF	GE : Evendale, OH	-	52.655	Oct 2018	109.579	Oct 2019	188.267	Oct 2020	-		188.267	Continuing	Continuing	-
Next Generation Adaptive Propulsion - PW	C/CPIF	PW : East Hartford, CT	-	51.710	Oct 2018	111.048	Oct 2019	211.167	Oct 2020	-		211.167	Continuing	Continuing	-
Subtotal			-	692.089		661.708		629.235		-		629.235	Continuing	Continuing	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			
Adaptive Engine Transition Program - Program Management Support	Various	Various : TBD	-	2.005	Dec 2018	6.367	Dec 2019	3.630	Dec 2020	-		3.630	0.000	12.002	-
Next Generation Adaptive Propulsion - Program Management Support	Various	Various : TBD	-	2.005	Dec 2018	3.367	Dec 2019	3.630	Dec 2020	-		3.630	Continuing	Continuing	-
Subtotal			-	4.010		9.734		7.260		-		7.260	Continuing	Continuing	N/A

	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		-	696.099	671.442	636.495	636.495	-	Continuing	Continuing	N/A

Remarks
 The FY 2021 Budget Justification Exhibit has been updated to reflect the breakout of the FY2019 through FY 2021 Next Generation Adaptive Engine (NGAP) funds from the AETP effort to increase transparency to Congress. This breakout will be reflected in future Budget Exhibits.

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Air Force		Date: February 2020
Appropriation/Budget Activity 3600 / 4	R-1 Program Element (Number/Name) PE 0604004F / <i>Advanced Engine Development</i>	Project (Number/Name) 643608 / <i>Advanced Engine Dev</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>Adaptive Engine Transition Program</i>				
Detailed Design, Engine Fabrication, Engine Assessments	1	2019	2	2022
<i>Next Generation Adaptive Propulsion</i>				
Preliminary Design	1	2019	1	2022
Detailed Design, Engine Fabrication, Engine Assessments	2	2022	2	2025

Note

The FY 2021 Budget Justification Exhibit has been updated to reflect the breakout of the FY2019 through FY 2021 Next Generation Adaptive Engine (NGAP) funds from the AETP effort to increase transparency to Congress. This breakout will be reflected in future Budget Exhibits.

The Adaptive Engine Transition Program consists of three phases: detailed design, engine fabrication, and engine assessments.

Program deliverables include: military adaptive engine detailed design parameters and models, multiple engine sets of hardware (plus spare parts), matured technologies, major rig assessment data (controls, combustor, etc.), program reviews, and technology, affordability and sustainability studies.

The Next Generation Adaptive Propulsion effort consists of four phases: Preliminary design, detailed design, engine fabrication, and engine assessments.

Program deliverables include: military adaptive engine detailed design parameters and models, engine hardware (plus spare parts), matured technologies, major rig assessment data (controls, combustor, etc.), program reviews, and technology, affordability and sustainability studies for next generation fighter aircraft.

Additional details can be provided in the appropriate forum.