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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force **Date:** February 2020

Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0603033F I Next Gen Platform Dev/Demo
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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	-	0.000	0.000	199.556	0.000	199.556	197.210	230.125	257.613	301.799	Continuing	Continuing
633035: Aerospace Power Technology	-	0.000	0.000	22.368	0.000	22.368	18.492	18.855	19.237	19.628	Continuing	Continuing
633834: Integrated Space Technology Demonstrations	-	0.000	0.000	25.526	0.000	25.526	37.346	47.580	56.864	59.572	Continuing	Continuing
634920: Flight Vehicle Tech Integration	-	0.000	0.000	15.115	0.000	15.115	0.000	14.870	35.859	36.529	Continuing	Continuing
634921: Aircraft Propulsion Subsystems Int	-	0.000	0.000	10.826	0.000	10.826	10.096	8.095	18.855	19.236	Continuing	Continuing
634922: Space & Missile Rocket Propulsion	-	0.000	0.000	28.757	0.000	28.757	27.218	30.443	31.159	31.795	Continuing	Continuing
634926: High Speed Systems Integ & Demo	-	0.000	0.000	16.533	0.000	16.533	18.463	15.640	6.291	35.081	Continuing	Continuing
634927: Aerospace Power & Flight Control Integ & Demo	-	0.000	0.000	5.582	0.000	5.582	11.245	25.259	27.745	28.371	Continuing	Continuing
635098: Advanced Aerospace Propulsion	-	0.000	0.000	20.931	0.000	20.931	22.428	11.940	20.441	35.709	Continuing	Continuing
63681B: Advanced Turbine Engine Gas Generator	-	0.000	0.000	22.176	0.000	22.176	22.820	23.403	23.972	24.458	Continuing	Continuing
63682J: Spacecraft Vehicles	-	0.000	0.000	31.742	0.000	31.742	29.102	34.040	17.190	11.420	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops and conducts technology platform demonstrations that provide compelling advantage to the warfighter. The technologies address enabling and enduring Air Force requirements as well as integrated enterprise transformational capabilities intended to reshape the future force. This Program includes space platform technologies, including payloads, protection, vehicles, systems survivability, and in-space propulsion; flight vehicle technologies, including hypersonic flight regime and manned/unmanned systems; propulsion technologies, including turbine-based, high speed/hypersonic, advanced-cycle, space and missile propulsion; and system component technologies, including controls, electrical power, and thermal management. Efforts in this program have been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

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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 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/Demo</i>	
<p>In the FY 2021, the Air Force is consolidating its existing thirteen Advanced Technology Development (ATD), Research Development Test and Evaluation (RDT&E), Budget Activity 03 (BA 03) PEs into five new capability focused RDT&E BA 03 PEs to better align with the Air Force Science and Technology (S&T) Strategy signed by the Secretary of the Air Force in April 2019. This consolidation will improve and accelerate delivery of integrated transformational, multidisciplinary, collaborative technology solutions necessary to enable new Air Force warfighting capabilities that support of the National Defense Strategy. This new structure will provide the Air Force and Congress with a clearer understanding and increased transparency of integrated technology solutions and demonstrations key to enabling the Air Force future force design.</p> <p>In FY 2021, the entirety of 633834, Integrated Space Technology Demonstrations, is transferred from PE 0603401F, Advanced Spacecraft Technology, to PE 0603033F, Next Gen Platform Dev/Demo, with the exception of the work and funding that is associated with the Navigation Technology Satellite-3 Vanguard demonstration which will be realigned to the PE 0603032F, Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard.</p> <p>In FY 2021, the entirety of Project 63682J, Spacecraft Vehicles, is transferred from PE 0603401F, Advanced Spacecraft Technology, to PE 0603033F, Next Gen Platform Dev/Demo.</p> <p>In FY 2021, the entirety of Project 634920, Flight Vehicle Tech Integration, is transferred from PE 0603211F, Aerospace Technology Dev/Demo, to PE 0603033F, Next Gen Platform Dev/Demo, with the exception of the work and funding associated with the Skyborg Vanguard demonstration which will be realigned to the PE 0603032F, Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard.</p> <p>In FY 2021, the entirety of Project 634926, High Speed/Hypersonic Integration & Demonstrations, is transferred from PE 0603211F, Aerospace Technology Dev/Demo, to PE 0603033F, Next Gen Platform Dev/Demo.</p> <p>In FY 2021, the entirety of Project 634927, Flight Systems Control, is transferred from PE 0603211F, Aerospace Technology Dev/Demo, to PE 0603033F, Next Gen Platform Dev/Demo, Project 634927, Flight Systems Control, with the exception of the work and funding associated with the Skyborg Vanguard demonstration which will be realigned to the PE 0603032F, Future AF Integrated Technology Demos.</p> <p>In FY 2021, the entirety of Project 634921, Aircraft Propulsion Subsystems Integration, is transferred from PE 0603216F, Aerospace Propulsion and Power Technology, to PE 0603033F, Next Gen Platform Dev/Demo, with the exception of funding associated with Skyborg Vanguard demonstration which will be realigned to the PE 0603032F, Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard.</p> <p>In FY 2021, the entirety of Project 633035, Aerospace Power Technology; Project 63681B, Advanced Turbine Engine Gas Generator; Project 634922, Space & Missile Rocket Propulsion; and Project 635098, Advanced Aerospace Propulsion, are transferred from PE 0603216F, Aerospace Propulsion and Power Technology, to PE 0603033F, Next Gen Platform Dev/Demo.</p> <p>All these transfers detailed above are part of the Air Force RDT&E BA 03 PE consolidation in order to realign technology areas to better support the National Defense Strategy, Air Force Future Operating Concept, and Air Force S&T Strategy, April 2019. This is an administrative realignment and not a new start.</p>		

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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force	Date: February 2020
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/Demo</i>
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The Air Force Science and Technology portfolio will continued to be managed at the Enterprise level by the Air Force Technology Executive Officer, dual-hatted as the Air Force Research Laboratory (AFRL) Commander, and executed across the various AFRL Technology Directorates and locations.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science and technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 1206601SF, and 0602298F.

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.

B. Program Change Summary (\$ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	0.000	0.000	0.000	0.000	0.000
Current President's Budget	0.000	0.000	199.556	0.000	199.556
Total Adjustments	0.000	0.000	199.556	0.000	199.556
• 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	0.000	0.000			
• Other Adjustments	0.000	0.000	199.556	0.000	199.556

Change Summary Explanation

Increase in FY 2021 of \$199.556 million is due to the following PEs, Projects, and efforts being transferred to PE 0603033F, Next Gen Platform Dev/Demo:

- 1) Entirety of Project 63682J, Spacecraft Vehicles, from PE 0603401F, Advanced Spacecraft Technology
- 2) Project 634920, Flight Vehicle Tech Integration, from PE 0603211F, Aerospace Technology Dev/Demo, to PE 0603033F, Next Gen Platform Dev/Demo, with the exception of the work and funding associated with the Skyborg Vanguard demonstration.
- 3) Entirety of Project 634926, High Speed/Hypersonic Integration & Demonstrations, from PE 0603211F, Aerospace Technology Dev/Demo, to PE 0603033F, Next Gen Platform Dev/Demo.

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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/Demo</i>	
4) Project 634927, Flight Systems Control, from PE 0603211F, Aerospace Technology Dev/Demo with the exception of the work and funding associated with the Skyborg Vanguard demonstration		
5) Project 634921, Aircraft Propulsion Subsystems Integration, from PE 0603216F, Aerospace Propulsion and Power Technology, with the exception of funding associated with Skyborg Vanguard demonstration		
6) Entirety of Project 633035, Aerospace Power Technology; Project 63681B, Advanced Turbine Engine Gas Generator; Project 634922, Space & Missile Rocket Propulsion; and Project 635098, Advanced Aerospace Propulsion, from PE 0603216F, Aerospace Propulsion and Power Technology		
These transfers in FY 2021 are part of the Air Force RDT&E BA 03 PE consolidation in order to realign technology areas to better support the National Defense Strategy, Air Force Future Operating Concept, and Air Force S&T Strategy, April 2019.		

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force										Date: February 2020		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/ Demo</i>				Project (Number/Name) 633035 / <i>Aerospace Power Technology</i>			
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
633035: <i>Aerospace Power Technology</i>	-	0.000	0.000	22.368	0.000	22.368	18.492	18.855	19.237	19.628	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates system and subsystem integration to include adaptive architectures, actuation, electrical power, thermal management, and distribution for aerospace applications. This project develops and demonstrates the components, controls and systems required to satisfy the operational needs of current and future aircraft and enables the use of future high-power payloads. This technology enhances reliability and survivability, and reduces vulnerability, weight, and life cycle costs of air platforms. The electrical power system components developed are projected to provide a two-fold to five-fold improvement in aircraft reliability and maintainability, and a reduction in power system weight. This project is integrated into energy optimized aircraft efforts and power and thermal programs.

In FY 2021, the entirety of Project 633035, Aerospace Power Technology, is transferred from PE 0603216F, Aerospace Propulsion & Power Technology, Project 633035, to PE 0603033F, Next Gen Platform Dev/Demo, Project 633035, Aerospace Power Technology as part of the Air Force RDT&E BA 03 PE consolidation in order to realign technology areas to better support the National Defense Strategy, Air Force Future Operating Concept and Air Force Science and Technology Strategy, April 2019. The Project and associated efforts will continue to be executed by the Air Force Research Laboratory Aerospace Systems Technology Directorate located in Wright Patterson AFB, OH. This is an administrative realignment for consolidation, and not a new start.

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

	FY 2019	FY 2020	FY 2021
Title: High Power Aircraft Subsystem Technologies	0.000	0.000	22.368
Description: Develop and demonstrate integrated architecture, controls and components for power generation, conditioning, and distribution; energy storage components; and thermal management and subsystem technologies for integration into high power aircraft.			
FY 2020 Plans: For FY 2020 and prior years, this work was performed under the High Power Aircraft Subsystem Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 633035, Aerospace Power Technology.			
FY 2021 Plans: Continue development and demonstration of system and component electrical power, electro-mechanical, and thermal technologies for high-power aircraft. Continue the development of hybrid-cycle power and thermal management system. Continue development of advanced power generation and distribution system. Continue development and demonstration of integrated, adaptive megawatt- class tactical aircraft power and thermal capability. Continue development and demonstration of megawatt class architecture, controls and integration. Continue development and demonstration of robust electrical power systems for			

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force		Date: February 2020		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/ Demo</i>	Project (Number/Name) 633035 / <i>Aerospace Power Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
megawatt applications. Continue development and demonstration of thermal management systems for megawatt applications. Complete development and demonstration of solid state electrical distribution technology for megawatt applications. <i>FY 2020 to FY 2021 Increase/Decrease Statement:</i> FY 2021 increased compared to FY 2020 by \$22.368 million. Funding increased due to the transfer and realignment of this work from the High Power Aircraft Subsystem Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 633035, Aerospace Power Technology, as part of the Air Force RDT&E BA 03 PE consolidation.				
Accomplishments/Planned Programs Subtotals		0.000	0.000	22.368
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force **Date:** February 2020

Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/Demo</i>	Project (Number/Name) 633834 / <i>Integrated Space Technology Demonstrations</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
633834: <i>Integrated Space Technology Demonstrations</i>	-	0.000	0.000	25.526	0.000	25.526	37.346	47.580	56.864	59.572	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project is a series of advanced technology demonstrations designed to address mission needs by applying emerging technologies from the Air Force Research Laboratory, other United States government laboratories, and industry. These technologies are integrated into system-level demonstrations that are used to test, evaluate, and validate the technologies in a relevant environment.

In FY 2021, the entirety of Project 633834, Integrated Space Technology Demonstrations, is transferred from PE 0603401F, Advanced Spacecraft Technology, Project 633834, to PE 0603033F, Next Gen Platform Dev/Demo, Project 633834, Integrated Space Technology Demonstrations as part of the Air Force RDT&E BA 03 PE consolidation in order to realign technology areas to better support the National Defense Strategy, Air Force Future Operating Concept, and Air Force Science and Technology Strategy, April 2019. The Project and associated efforts will continue to be managed by the Air Force Research Laboratory Space Vehicles Technology Directorate located in Kirtland AFB, New Mexico. This is an administrative realignment for consolidation, and not a new start.

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

	FY 2019	FY 2020	FY 2021
<p>Title: Integrated Satellite Demonstrations</p> <p>Description: Develop satellite technologies for integrated, robust, and flexible satellite demonstrations building on previous work and leveraging investments by other organizations.</p> <p>FY 2020 Plans: For FY 2020 and prior years, this work was performed under the Integrated Satellite Demonstration effort in PE 0603401F, Advanced Spacecraft Technology, Project 633834, Integrated Space Technology.</p> <p>FY 2021 Plans: Continue on-orbit demonstrations of multiple formation flying satellites for near autonomous formation control leveraging opportunities to fly demonstrations and prototypes, where successes can identify quick transition to next generation technology needs. Continue coordination of a manifest timeline for critical space projects prioritizing Air Force Space Command technical, security, and operational development requirements. Continue to utilize the Long Duration Propulsive Evolved Expendable Launch Vehicle Secondary Payload Adaptor launch schedule and other prospects to quickly fly demonstrations and prototypes. Continue payloads maturation tasks from concept proposal to leveraging commercial Low Earth orbit constellations.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement:</p>	0.000	0.000	25.526

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Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/ Demo</i>	Project (Number/Name) 633834 / <i>Integrated Space Technology Demonstrations</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
FY 2021 increased compared to FY 2020 by \$25.526 million. Funding increased due to the transfer and realignment of this work from the Integrated Satellite Demonstrations effort in PE 0603401F, Advanced Spacecraft Technology, Project 633834, Integrated Space Technology, as part of the Air Force RDT&E BA 03 PE consolidation.				
Accomplishments/Planned Programs Subtotals		0.000	0.000	25.526
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force										Date: February 2020		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603033F / Next Gen Platform Dev/ Demo				Project (Number/Name) 634920 / Flight Vehicle Tech Integration			
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
634920: <i>Flight Vehicle Tech Integration</i>	-	0.000	0.000	15.115	0.000	15.115	0.000	14.870	35.859	36.529	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project demonstrates advanced aerospace vehicle technologies. Aerospace Vehicle Technology Integration efforts are accomplished through integration of various technologies to include avionics, advanced propulsion, and weapon systems for demonstration in near-realistic operational environments. Advanced Aerospace Structures Technologies are demonstrated to enhance the capability of current and future aerospace vehicles.

In FY 2021, Project 634920, Flight Vehicle Tech Integration, non-Vanguard efforts and activities are transferred from PE 0603211F, Aerospace Technology Dev/Demo, to PE 0603033F, Next Gen Platform Dev/Demo, Project 634920, Flight Vehicle Tech Integration, as part of the Air Force RDT&E BA 03 PE consolidation in order to realign technology areas to better support the National Defense Strategy, Air Force Future Operating Concept and Air Force S&T Strategy, April 2019. The Project and associated Non-Vanguard efforts and activities will continue to be executed by the Air Force Research Laboratory Aerospace Systems Technology Directorate located in Wright Patterson Air Force Base, Ohio. This is an administrative realignment for consolidation, and not a new start.

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

	FY 2019	FY 2020	FY 2021
Title: Aerospace Vehicle Technology Integration	0.000	0.000	7.117
Description: Develop, simulate, and demonstrate integrated technologies to improve the performance of aerospace platform capabilities.			
FY 2020 Plans: For FY 2020 and prior years, this work is performed under Aerospace Vehicle Technology Integration effort in PE 0603211F, Aerospace Technology Dev/Demo, Project 634920, Flight Vehicle Tech Integration.			
FY 2021 Plans: Continue integrated full flow path demonstration of a medium bypass embedded engine for next generation mobility. Continue the flight demonstration of a low cost unmanned aerospace systems capable of interoperations with different unmanned aerospace systems assets; completing the next sensor extension variant in FY 2021 and initiate an off-board weapons station variant. Initiate next variant of a low cost unmanned aerospace system. Complete propulsion integration component validation tests for Air Superiority 2030 requirements. Complete flight demonstrations of practical laminar flow for swept wing aircraft designs.			
FY 2020 to FY 2021 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force		Date: February 2020		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/Demo</i>	Project (Number/Name) 634920 / <i>Flight Vehicle Tech Integration</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
FY 2021 increased compared to FY 2020 by \$7.117 million. Funding increased due to the transfer and realignment of this work from the Aerospace Vehicle Technology Integration effort in PE 0603211F, Aerospace Technology Dev/Demo, Project 634920, Flight Vehicle Tech Integration, as part of the Air Force RDT&E BA 03 PE consolidation.				
<p>Title: Advanced Aerospace Structure Technologies</p> <p>Description: Develop and demonstrate affordable, lightweight, adaptive, and multifunctional structural concepts integrated into aerospace systems.</p> <p>FY 2020 Plans: For FY 2020 and prior years, this work is performed under the Advanced Aerospace Structure Technologies effort in PE 0603211F, Aerospace Technology Dev/Demo, Project 634920, Flight Vehicle Tech Integration.</p> <p>FY 2021 Plans: Complete low cost airframe design and manufacturing demonstrations. Continue fully automated manufacturing demonstrations of large airframe structures. Complete structural life extension demonstration of legacy fleet metallic structures. Continue validation tests of life extension and durability methods for legacy fleet composite structures in support of aircraft Service Life Extension programs.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: FY 2021 increased compared to FY 2020 by \$7.998 million. Funding increased due to the transfer and realignment of this work from Advanced Aerospace Structure Technologies effort in PE 0603211F, Aerospace Technology Dev/Demo, Project 634920, Flight Vehicle Tech Integration, as part of the Air Force RDT&E BA 03 PE consolidation.</p>		0.000	0.000	7.998
Accomplishments/Planned Programs Subtotals		0.000	0.000	15.115
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force										Date: February 2020		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603033F / Next Gen Platform Dev/ Demo				Project (Number/Name) 634921 / Aircraft Propulsion Subsystems Int			
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
634921: Aircraft Propulsion Subsystems Int	-	0.000	0.000	10.826	0.000	10.826	10.096	8.095	18.855	19.236	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates technology to increase turbine engine operational reliability, durability, mission flexibility, and performance while reducing weight, fuel consumption, and cost of ownership. The Aircraft Propulsion Subsystems Integration (APSI) project includes demonstrator engines for manned systems and efficient small-scale propulsion for remotely piloted aircraft and cruise missile applications. The demonstrator engines integrate the core (high- pressure spool) technology developed under the Versatile Affordable Advanced Turbine Engines (VAATE) project with the engine (low-pressure spool) technology such as fans, turbines, engine controls, mechanical systems, exhaust nozzles, and augmentors. Additionally, this project includes activities to improve propulsion safety and readiness. This project also focuses on integration of inlets, nozzles, engine-to-airframe compatibility, and power and thermal management subsystems technologies. The APSI project provides aircraft with potential for longer range and higher cruise speeds with lower specific fuel consumption, surge power for successful engagements, high sortie rates with reduced maintenance, reduced life cycle cost, and improved survivability, resulting in increased mission effectiveness. Technologies developed are applicable to sustained high-speed vehicles and responsive space launch. The Aircraft Propulsion Subsystems Integration project is focused on improving propulsion capabilities while at the same time reducing the cost of ownership. Anticipated technology advances include turbine engine improvements providing approximately twice the range for a sustained supersonic combat aircraft, doubling the time on station with ten times the power output for surveillance aircraft and propulsion for a high speed supersonic missile with double the range for time sensitive targets. A portion of this project supports the demonstration of adaptive cycle technologies, which develop component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, high power extraction, integrated thermal management, and durability for widely varying mission needs.

In FY 2021, Project 634921, Aircraft Propulsion Subsystems Int, Non-Vanguard efforts and activities are transferred from PE 0603216F, Aerospace Propulsion and Power Technology, to PE 0603033F, Next Gen Platform Dev/Demo, Project 634921, Aircraft Propulsion Subsystems Int, as part of the Air Force RDT&E BA 03 PE consolidation in order to realign technology areas to better support the National Defense Strategy, Air Force Future Operating Concept and Air Force S&T Strategy, April 2019. The Project and associated Non-Vanguard efforts and activities will continue to be managed by the Air Force Research Laboratory Aerospace Systems Technology Directorate located in Wright Patterson, OH. This is an administrative realignment for consolidation, and not a new start.

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

	FY 2019	FY 2020	FY 2021
Title: Missile/Remotely Piloted Aircraft Engine Performance	0.000	0.000	6.414
Description: Design, fabricate, and test component technologies for limited-life engines to improve the performance, durability, and affordability of missile and remotely piloted aircraft engines.			
FY 2020 Plans:			

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Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/ Demo</i>	Project (Number/Name) 634921 / <i>Aircraft Propulsion Subsystems Int</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
<p>For FY 2020 and prior years, this work is performed under the Missile/remotely Piloted Aircraft Engine Performance effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 634921, Aircraft Propulsion Subsystems Int.</p> <p>FY 2021 Plans: Complete several key risk reduction testing of components for small engines. Finalize conceptual and preliminary design of small engine technology. Identify next innovative architecture, critical technologies and component designs for efficient small engines. Finalize the assembly of advanced concept additive manufacturing heat exchanger for small core engines. Finalize fabrication of recuperator for demonstration of increased core efficiency in small core engines. Initiate operational benefits analysis for missile and UAV systems.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: FY 2021 increased compared to FY 2020 by \$6.414 million. Funding increased due to the transfer and realignment of this work from the Missile/Remotely Piloted Aircraft Engine Performance effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 634921, Aircraft Propulsion Subsystems Int, as part of the Air Force RDT&E BA 03 PE consolidation.</p>				
<p>Title: Adaptive Turbine Engine Technologies</p> <p>Description: Design, fabricate, and demonstrate performance, durability, and operability technologies to mature adaptive turbine engine technologies.</p> <p>FY 2020 Plans: For FY 2020 and prior years, this work is performed under the Adaptive Turbine Engine Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 634921, Aircraft Propulsion Subsystems Int.</p> <p>FY 2021 Plans: Analyze and evaluate conceptual design of adaptive engine technology and continue technology rig tests to decrease risk in core technology testing. Complete component tests of advanced variable turbine and innovative compression rear block designed to accept flow variations caused by variable turbine operation.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: FY 2021 increased compared to FY 2020 by \$4.412 million. Funding increased due to the transfer and realignment of this work from the Adaptive Turbine Engine Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 634921, Aircraft Propulsion Subsystems Int, as part of the Air Force RDT&E BA 03 PE consolidation.</p>		0.000	0.000	4.412
Accomplishments/Planned Programs Subtotals		0.000	0.000	10.826
C. Other Program Funding Summary (\$ in Millions)				
N/A				

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Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/ Demo</i>	Project (Number/Name) 634921 / <i>Aircraft Propulsion Subsystems Int</i>

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

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force										Date: February 2020		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/ Demo</i>				Project (Number/Name) 634922 / <i>Space & Missile Rocket Propulsion</i>			
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
634922: <i>Space & Missile Rocket Propulsion</i>	-	0.000	0.000	28.757	0.000	28.757	27.218	30.443	31.159	31.795	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced and innovative low-cost rocket turbo-machinery and components, and low-cost space launch propulsion technologies. Additionally, this project develops technologies for the sustainment of strategic systems (including solid rocket motor boosters and missile propulsion, post boost control, and aging and surveillance efforts) and tactical rockets. Characteristics such as environmental acceptability, affordability, reliability, responsiveness, reduced weight, and reduced operation and launch costs are emphasized. Increased life and performance of propulsion systems are key goals. Technology areas investigated include ground demonstrations of compact, lightweight, advanced propulsion technologies, higher efficiency energy conversion systems (derived from an improved understanding of combustion fundamentals), and high-energy propellants. Technological advances in this project could improve the performance of expendable payload capabilities by approximately twenty to fifty percent and reduce launch, operations, and support costs by approximately thirty percent. Responsiveness and operability of propulsion systems will be enhanced for reusable launch systems. Aging and surveillance thrusts for solid rocket motors could reduce lifetime prediction uncertainties for individual motors by fifty percent, enabling motor replacement for cause. The efforts in this project contribute to the sustainment of the rocket propulsion industry, providing rocket propulsion technology for the entire Department of Defense (DoD) and National Aeronautics and Space Administration (NASA). The efforts in this project are part of the Rocket Propulsion 21 (RP21) program. The efforts in this project are reviewed by a DoD level steering committee annually for relevance to DoD missions and achievement of technical goals defined by the RP21 program.

In FY 2021, the entirety of Project 634922, Space & Missile Rocket Propulsion, is transferred from PE 0603216F, Aerospace Propulsion & Power Technology, to PE 0603033F, Next Gen Platform Demo, Project 634922, Space & Missile Rocket Propulsion as part of the Air Force RDT&E BA 03 PE consolidation in order to realign technology areas to better support the National Defense Strategy, Air Force Future Operating Concept, and Air Force Science and Technology Strategy, April 2019. The Project and associated efforts will continue to be managed by the Air Force Research Laboratory Aerospace Systems Technology Directorate located in Edwards AFB, CA. This is an administrative realignment for consolidation, and not a new start.

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

	FY 2019	FY 2020	FY 2021
Title: Liquid Rocket Propulsion Technologies	0.000	0.000	14.842
Description: Develop liquid rocket propulsion technology for current and future space launch vehicles.			
FY 2020 Plans: For FY 2020 and prior years, this work is performed under the Liquid Rocket Propulsion Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 634922, Space & Missile Rocket Propulsion.			
FY 2021 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force		Date: February 2020		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/Demo</i>	Project (Number/Name) 634922 / <i>Space & Missile Rocket Propulsion</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
Continue modular engine feasibility demonstration and flight experiment. FY 2020 to FY 2021 Increase/Decrease Statement: FY 2021 increased compared to FY 2020 by \$14.842 million. Funding increased due to the transfer and realignment of this work from the Liquid Rocket Propulsion Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 634922, Space & Missile Rocket Propulsion, as part of the Air Force RDT&E BA 03 PE consolidation.				
Title: On-Orbit Propulsion Technologies Description: Develop solar electric, electric, and monopropellant propulsion technologies for existing and future satellites, upper stages, orbit transfer vehicles, and satellite maneuvering. FY 2020 Plans: For FY 2020 and prior years, this work is performed under the On-Orbit Propulsion Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 634922, Space & Missile Rocket Propulsion. FY 2021 Plans: Continue to develop and transition experimental, modeling and simulation, and theoretical efforts geared towards advanced thruster development with emphasis on understanding thrust scale-up. Continue to advance capabilities to study next generation of hypergolic fuels, including propellant characterization, drop-in testing, and lab-scale thruster demonstration. Continue analysis and development of multi-mode propulsion opportunities to combine high efficiency and high thrust capabilities on a common propellant. Continue thrust scale-up effort for advanced non-toxic monopropellant thrusters. Continue electric propulsion thruster effort utilizing advanced non-toxic monopropellant. FY 2020 to FY 2021 Increase/Decrease Statement: FY 2021 increased compared to FY 2020 by \$11.181 million. Funding increased due to the transfer and realignment of this work from the On-Orbit Propulsion Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 634922, Space & Missile Rocket Propulsion, as part of the Air Force RDT&E BA 03 PE consolidation.		0.000	0.000	11.181
Title: Ballistic Missile Technologies Description: Develop and demonstrate missile propulsion and post-boost control systems technologies for ballistic missiles. FY 2020 Plans: For FY 2020 and prior years, this work is performed under the Ballistic Missile Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 634922, Space & Missile Rocket Propulsion. FY 2021 Plans:		0.000	0.000	2.734

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force		Date: February 2020		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/ Demo</i>	Project (Number/Name) 634922 / <i>Space & Missile Rocket Propulsion</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
<p>Complete current technology maturation and demonstration efforts for post-boost technologies. Continue technology maturation and demonstration efforts for tactical missile technologies. Continue motor component modeling & simulation tool development, assessment, verification, and validations efforts geared towards reducing cost and schedule of new developments in an agile development landscape.</p> <p><i>FY 2020 to FY 2021 Increase/Decrease Statement:</i> FY 2021 increased compared to FY 2020 by \$2.734 million. Funding increased due to the transfer and realignment of this work from the Ballistic Missile Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 634922, Space & Missile Rocket Propulsion, as part of the Air Force RDT&E BA 03 PE consolidation.</p>				
Accomplishments/Planned Programs Subtotals		0.000	0.000	28.757
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
Not Applicable				

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force										Date: February 2020		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603033F / Next Gen Platform Dev/ Demo				Project (Number/Name) 634926 / High Speed Systems Integ & Demo			
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
634926: High Speed Systems Integ & Demo	-	0.000	0.000	16.533	0.000	16.533	18.463	15.640	6.291	35.081	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, integrates and demonstrates, via simulations, ground, and flight tests, advanced flight vehicle technologies that improve the performance and supportability of future high speed/hypersonic vehicles. System level integration brings together air vehicle technologies with avionics, propulsion, and warheads and other aerospace subsystems for demonstration in a near-realistic operational environment. Integration and technology demonstrations reduce the risk and time required to transition technologies into operational systems.

In FY 2021, the entirety of Project 634926, High Speed Systems Integ & Demo, is transferred from PE 0603211F, Aerospace Technology Dev/Demo, to PE 0603033F, Next Gen Platform Dev/Demo, Project 634926, High Speed Systems Integ & Demo, as part of the Air Force RDT&E BA 03 PE consolidation in order to realign technology areas to better support the National Defense Strategy, Air Force Future Operating Concept, and Air Force Science and Technology Strategy, April 2019. The Project and associated efforts will continue to be managed by the Air Force Research Laboratory Aerospace Systems Technology Directorate located in Wright Patterson Air Force Base, Ohio. This is an administrative realignment for consolidation, and not a new start.

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

	FY 2019	FY 2020	FY 2021
Title: High Speed/Hypersonic Vehicle Technologies	0.000	0.000	16.533
Description: Develop, simulate, and demonstrate integrated vehicle technologies to enable and improve the performance of future high-speed and hypersonic systems.			
FY 2020 Plans: For FY 2020 and prior years, this work is performed under the High Speed/Hypersonic Vehicle Technologies effort in PE 0603211F, Aerospace Technology Dev/Demo, Project 634926, High Speed/Hypersonic Integration & Demo.			
FY 2021 Plans: Complete development and demonstration of tactically-relevant long-range high-speed strike technologies including ground and flight demonstrations needed. Complete some flight test activities for both Hypersonic Air-breathing Weapon Concept and Tactical Boost Glide. Initiate Advanced Airbreathing technology maturation activities to expand performance capabilities of high speed systems.			
FY 2020 to FY 2021 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force		Date: February 2020
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/ Demo</i>	Project (Number/Name) 634926 / <i>High Speed Systems Integ & Demo</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2019	FY 2020	FY 2021
FY 2021 increased compared to FY 2020 by \$16.553 million. Funding increased due to the transfer and realignment of this work from the High Speed/Hypersonic Vehicle Technologies effort in PE 0603211F, Aerospace Technology Dev/Demo, Project 634926, High Speed/Hypersonic Integration & Demo, as part of the Air Force RDT&E BA 03 PE consolidation.			
Accomplishments/Planned Programs Subtotals	0.000	0.000	16.533

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

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force										Date: February 2020		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603033F / Next Gen Platform Dev/ Demo				Project (Number/Name) 634927 / Aerospace Power & Flight Control Integ & Demo			
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
634927: Aerospace Power & Flight Control Integ & Demo	-	0.000	0.000	5.582	0.000	5.582	11.245	25.259	27.745	28.371	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program integrates and demonstrates advanced control technologies that improve the performance, reliability, safety, and survivability of existing and future, manned and unmanned, aerospace systems. Enhanced capabilities are enabled by control, automation, and system level integration of subsystems and systems such as propulsion, airframes, avionics, power & thermal management, weapons, communications, and operator interfaces. Modeling and simulation, integration, and technology demonstrations in a near-operational environment reduce the risk and time required to transition technologies into existing and future aerospace systems.

In FY 2021, Project 634927, Aerospace Power & Flight Control Integ & Demo, Non-Vanguard efforts and activities are transferred from PE 0603211F, Aerospace Technology Dev/Demo, to PE 0603033F, Next Gen Platform Dev/Demo, Project 634927, Aerospace Power & Flight Control Integ & Demo, as part of the Air Force RDT&E BA 03 PE consolidation in order to realign technology areas to better support the National Defense Strategy, Air Force Future Operating Concept and Air Force S&T Strategy, April 2019. The Project and associated Non-Vanguard efforts and activities will continue to be managed by the Air Force Research Laboratory Aerospace Systems Technology Directorate located in Wright Patterson Air Force Base, Ohio. This is an administrative realignment for consolidation, and not a new start.

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

	FY 2019	FY 2020	FY 2021
Title: Autonomous Systems Control	0.000	0.000	5.582
Description: Develop, simulate, and demonstrate advanced automation and control-enabled capabilities for manned or unmanned aerospace platforms. Develop, simulate, and demonstrate autonomous flight controls for safe flight and cooperative operations between manned and remotely piloted air platforms.			
FY 2020 Plans: For FY 2020 and prior years, this work is performed under the Autonomous Systems Control effort in PE 0603211F, Aerospace Technology Dev/Demo, Project 634927, Flight Systems Control.			
FY 2021 Plans: Continue development and demonstration of technologies for situational awareness, autonomous control, and survivability for unmanned systems and manned platforms. Continue to incorporate autonomous and safe airspace interoperability for manned and remotely piloted aircraft systems, airborne control of teams of unmanned aircraft, and unmanned sense-and-avoid technologies for ground and air operations to the autonomy spiral demonstrations. Continue development of technologies to reduce risk for transition of collision avoidance technologies to 4th and 5th-gen aircraft. Continue development of foundational autonomy for unmanned systems and spiral demonstrations of capability, including safe airspace interoperability and sense			

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force		Date: February 2020		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/Demo</i>	Project (Number/Name) 634927 / <i>Aerospace Power & Flight Control Integ & Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
and avoid for air and ground operations. Continue spiral autonomy demonstration of manned-unmanned teaming capability incorporating the above technology transitions, including pilot-directed autonomous control.				
FY 2020 to FY 2021 Increase/Decrease Statement: FY 2021 increased compared to FY 2020 by \$5.582 million. Funding increased due to the transfer and realignment of this work from the Autonomous Systems Control effort in PE 0603211F, Aerospace Technology Dev/Demo, Project 634927, Flight Systems Control, as part of the Air Force RDT&E BA 03 PE consolidation.				
Accomplishments/Planned Programs Subtotals		0.000	0.000	5.582
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force										Date: February 2020		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603033F / Next Gen Platform Dev/ Demo				Project (Number/Name) 635098 / Advanced Aerospace Propulsion			
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
635098: <i>Advanced Aerospace Propulsion</i>	-	0.000	0.000	20.931	0.000	20.931	22.428	11.940	20.441	35.709	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates, via ground and flight tests, the scramjet propulsion cycle to a technology readiness level appropriate for full integration with other engine cycles (including turbine and rocket-based) to provide the Air Force with transformational military capabilities. The primary focus is on the hydrocarbon-fueled, scramjet engine. Multi-cycle engines will provide the propulsion systems for possible application to support aircraft and weapon platforms operating up to Mach 7. Efforts include: scramjet flow-path optimization to enable operation over the widest possible range of Mach numbers; active combustion control to assure continuous positive thrust (even during mode transition); robust flame-holding to maintain stability through flow distortions; and maximized volume-to-surface area to minimize the thermal load imposed by the high-speed engine. Thermal management plays a vital role in scramjet and combined cycle engines, including considerations for protecting low speed propulsion systems (e.g., turbine engines) during hypersonic flight.

In FY 2021, the entirety of Project 635098, Advanced Aerospace Propulsion, is transferred from PE 0603216F, Aerospace Propulsion & Power Technology, to PE 0603033F, Next Gen Platform Demo, Project 635098, Advanced Aerospace Propulsion, as part of the Air Force RDT&E BA 03 PE consolidation in order to realign technology areas to better support the National Defense Strategy, Air Force Future Operating Concept, and Air Force Science and Technology Strategy, April 2019. The Project and associated efforts will continue to be managed by the Air Force Research Laboratory Aerospace Systems Technology Directorate located in Wright Patterson Air Force Base, Ohio. This is an administrative realignment for consolidation, and not a new start.

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

	FY 2019	FY 2020	FY 2021
Title: Scramjet Technologies	0.000	0.000	20.931
Description: Develop and demonstrate technologies for a hydrocarbon-fueled scramjet with robust operation up to Mach 7.			
FY 2020 Plans: For FY 2020 and prior years, this work is performed under the Scramjet Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 635098, Advanced Aerospace Propulsion.			
FY 2021 Plans: Continue development of scramjet technologies to enhance operability including robust operation during maneuvers. Continue accelerated development and demonstration of tactically- relevant, long range, high speed strike scramjet engine designs, technologies, and components including ground and flight demonstrations needed for potential follow-on acquisition program. Initiate propulsion technology maturation activities for Multi-Mission Cruiser concept to expand performance capabilities of high speed systems.			
FY 2020 to FY 2021 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force		Date: February 2020
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/ Demo</i>	Project (Number/Name) 635098 / <i>Advanced Aerospace Propulsion</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2019	FY 2020	FY 2021
FY 2021 increased compared to FY 2020 by \$20.931 million. Funding increased due to the transfer and realignment of this work from the Scramjet Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 635098, Advanced Aerospace Propulsion, as part of the Air Force RDT&E BA 03 PE consolidation.			
Accomplishments/Planned Programs Subtotals	0.000	0.000	20.931

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

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force										Date: February 2020		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603033F / Next Gen Platform Dev/ Demo				Project (Number/Name) 63681B / Advanced Turbine Engine Gas Generator			
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
63681B: <i>Advanced Turbine Engine Gas Generator</i>	-	0.000	0.000	22.176	0.000	22.176	22.820	23.403	23.972	24.458	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates technology to increase turbine engine operational reliability, durability, mission flexibility, and performance while reducing weight, fuel consumption, and cost of ownership. The objective is to provide continuous evolution of technologies into an advanced gas generator in which the performance, cost, durability, repairability, and maintainability can be assessed in a realistic engine environment. The gas generator, or core, is the basic building block of the engine and nominally consists of a compressor, a combustor, a high-pressure turbine, mechanical systems, and core subsystems. Experimental core engine demonstration validates engineering design tools and enhances rapid, low-risk transition of key engine technologies into engineering development, where they can be applied to derivative and/or new systems. These technologies are applicable to a wide range of military and commercial systems including aircraft, missiles, land combat vehicles, ships, and responsive space launch. Component technologies are demonstrated in a core (sub-engine). This project also assesses the impact of low spool components such as; inlet systems, fans, low pressure turbines, exhaust systems, and system level technologies such as; integrated power generators and thermal management systems on core engine performance, and durability in ground demonstrations of engine cores. The core performances of this project are validated on demonstrator engines in the Aircraft Propulsion Subsystem Integration Project of this program. A portion of this project supports the demonstration of adaptive cycle technologies, which develop component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, and durability for widely varying mission needs.

In FY 2021, the entirety of Project 63681B, Advanced Turbine Engine Gas Generator, is transferred from PE 0603216F, Aerospace Propulsion & Power Technology, to PE 0603033F, Next Gen Platform Dev/Demo, Project 63681B, Advanced Turbine Engine Gas Generator, as part of the Air Force RDT&E, BA 03 PE consolidation in order to realign technology areas to better support the National Defense Strategy, Air Force Future Operating Concept, and Air Force Science and Technology Strategy, April 2019. The Project and associated efforts will continue to be executed by the Air Force Research Laboratory Aerospace Systems Technology Directorate located in Wright Patterson Air Force Base, Ohio. This is an administrative realignment for consolidation, and not a new start.

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

	FY 2019	FY 2020	FY 2021
Title: Core Engine Technologies	0.000	0.000	9.333
Description: Design, fabricate, and demonstrate performance predictions in core engines, using innovative engine cycles and advanced materials for turbofan and for turbojet engines.			
FY 2020 Plans: For FY 2020 and prior years, this work is performed under the Core Engine Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 63681B, Advanced Turbine Engine Gas Generator.			
FY 2021 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force		Date: February 2020		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/ Demo</i>	Project (Number/Name) 63681B / <i>Advanced Turbine Engine Gas Generator</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
<p>Complete detailed design of medium-scale efficient core demonstrator. Complete rig testing. Continue risk reduction component tests for medium-scale engine advanced fan and core. Complete conceptual design of large-scale adaptive core concepts. Complete design of bladed disks and bearing systems components for small cruise missile size engine. Complete development of small cruise missile engine demonstrator test plans to improve life prediction capability for bladed disks and bearing systems. Initiate core tests for medium scale engines.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: FY 2021 increased compared to FY 2020 by \$9.333 million. Funding increased due to the transfer and realignment of this work from the Core Engine Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 63681B, Advanced Turbine Engine Gas Generator, as part of the Air Force RDT&E BA 03 PE consolidation.</p>				
<p>Title: High Pressure Ratio Core Engine Technologies</p> <p>Description: Design, fabricate, and demonstrate high overall pressure ratio engine cores to provide increased durability and affordability with lower fuel consumption for turbofan and for turboshaft engines.</p> <p>FY 2020 Plans: For FY 2020 and prior years, this work is performed under the High Pressure Ratio Core Engine Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 63681B, Advanced Turbine Engine Gas Generator.</p> <p>FY 2021 Plans: Complete several key risk reduction testing of components for small engines (200-800 lbs class). Complete conceptual and preliminary design of small engine technology. Identify and assess innovative architecture, critical technologies and component designs for efficient, small engines. Continue assembly of advanced concept additive manufacturing heat exchanger for small core engines. Continue fabrication of recuperator for demonstration of increased core efficiency in small core engines. Continue to work medium scale core technologies.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: FY 2021 increased compared to FY 2020 by \$3.511 million. Funding increased due to the transfer and realignment of this work from the High Pressure Ratio Core Engine Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 63681B, Advanced Turbine Engine Gas Generator, as part of the Air Force RDT&E BA 03 PE consolidation.</p>		0.000	0.000	3.511
<p>Title: Adaptive Turbine Engine Core Technologies</p> <p>Description: Design, fabricate, and demonstrate adaptive turbine engine cores to provide increased durability and affordability with lower fuel consumption for turbofan and for turboshaft engines.</p> <p>FY 2020 Plans:</p>		0.000	0.000	9.332

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force		Date: February 2020		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/ Demo</i>	Project (Number/Name) 63681B / <i>Advanced Turbine Engine Gas Generator</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
<p>For FY 2020 and prior years, this work is performed under the Adaptive Turbine Engine Core Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 63681B, Advanced Turbine Engine Gas Generator.</p> <p>FY 2021 Plans: Complete conceptual design of adaptive engine technology and initiate technology rig tests to decrease risk in core technology testing. Complete and evaluate compressor core test for large engines. Continue component tests of advanced variable turbine and innovative compression rear block designed to accept flow variations caused by variable turbine operation.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: FY 2021 increased compared to FY 2020 by \$9.332 million. Funding increased due to the transfer and realignment of this work from the Adaptive Turbine Engine Core Technologies effort in PE 0603216F, Aerospace Propulsion & Power Technology, Project 63681B, Advanced Turbine Engine Gas Generator, as part of the Air Force RDT&E BA 03 PE consolidation.</p>				
Accomplishments/Planned Programs Subtotals		0.000	0.000	22.176
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force										Date: February 2020		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603033F / Next Gen Platform Dev/ Demo				Project (Number/Name) 63682J / Spacecraft Vehicles			
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
63682J: <i>Spacecraft Vehicles</i>	-	0.000	0.000	31.742	0.000	31.742	29.102	34.040	17.190	11.420	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates compact, low-cost, spacecraft power generation, storage, distribution, and thermal management technologies, including cryogenic cooling technologies. This project also develops composites for spacecraft structures and technologies for spacecraft control and mechanisms.

In FY 2021, the entirety of Project 63682J, Spacecraft Vehicles, is be transferred from PE 0603401F, Advanced Spacecraft Technology, to PE 0603033F, Next Gen Platform Dev/Demo, Project 63682J, Spacecraft Vehicles, as part of the Air Force RDT&E BA 03 PE consolidation in order to realign technology areas to better support the National Defense Strategy, Air Force Future Operating Concept, and Air Force Science and Technology Strategy, April 2019. The Project and associated efforts will continue to be managed by the Air Force Research Laboratory Space Vehicles Technology Directorate located in Kirtland Air Force Base, New Mexico. This is an administrative realignment for consolidation, and not a new start.

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

	FY 2019	FY 2020	FY 2021
Title: Space Communication Technologies	0.000	0.000	13.106
Description: Develop technologies critical to addressing documented MILSATCOM capability gaps and top-ranked Air Force Space Command, Space Force, and/or Space Missile Control technology needs.			
FY 2020 Plans: For FY 2020 and prior years, this work is performed under the Space Communication and Control Technologies effort in PE 0603401F, Advanced Spacecraft Technologies, Project 63682J, Spacecraft Vehicles.			
FY 2021 Plans: Continue support of planned five-year W/V-band propagation experiment. Support ground terminal operations, maintenance, and re-deployments. Collect and analyze data to statistically characterize atmospheric propagation effects and correlate to meteorological parameters. Continue research and development to address future military satellite communications capability and technology needs. Continue development of space-qualified V-band high power amplifier technology. Initiate development of W/V-band satellite transponder for on-orbit experiment and demonstration coupled with crosslinks. Continue systems engineering and technology risk-reduction for W/V-band ground terminals.			
FY 2020 to FY 2021 Increase/Decrease Statement: FY 2021 increased compared to FY 2020 by \$9.106 million. Funding increased due to the transfer and realignment of this work from the Space Communication and Control Technologies effort in PE 0603401F, Advanced Spacecraft Technologies, Project 63682J, Spacecraft Vehicles, as part of the Air Force RDT&E BA 03 PE consolidation.			
Title: Inertial Sensor Navigation Technologies	0.000	0.000	18.636

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Air Force		Date: February 2020
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603033F / <i>Next Gen Platform Dev/ Demo</i>	Project (Number/Name) 63682J / <i>Spacecraft Vehicles</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2019	FY 2020	FY 2021
<p>Description: Develop next-generation solid state, radiation-hardened strategic advance inertial system components for hostile environment.</p> <p>FY 2020 Plans: For FY 2020 and prior years, this work is performed under the Inertial Sensor Navigation Technologies effort in PE 0603401F, Advanced Spacecraft Technology, Project 63682J, Spacecraft Vehicles.</p> <p>FY 2021 Plans: Continue design of gravity gradiometer test bed. Continue design, development and testing of inertial sensor prototypes and radiation hardened electronics and initiate conceptual designs for inertial measurement systems. Continue to mature modeling, simulation and test/validation procedures for inertial sensor systems in relevant strategic environments.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: FY 2021 increased compared to FY 2020 by \$15.866 million. Funding increased due to the transfer and realignment of this work from Inertial Sensor Navigation Technologies effort in PE 0603401F, Advanced Spacecraft Technology, Project 63682J, Spacecraft Vehicles, as part of the Air Force RDT&E BA 03 PE consolidation.</p>			
Accomplishments/Planned Programs Subtotals	0.000	0.000	31.742

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

N/A

Remarks

D. Acquisition Strategy

N/A