Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force											Date: May 2017	
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602201F / *Aerospace Vehicle Technologies*							
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	118.263	122.831	124.678	0.000	124.678	128.303	131.790	134.761	143.189	Continuing	Continuing
622401: *Structures*	-	48.988	41.103	42.925	0.000	42.925	43.644	43.918	46.870	48.796	Continuing	Continuing
622403: *Flight Controls and Pilot-Vehicle Interface*	-	26.564	28.516	30.130	0.000	30.130	30.089	30.339	31.130	36.248	Continuing	Continuing
622404: *Aeromechanics and Integration*	-	27.854	34.470	29.557	0.000	29.557	30.080	29.118	30.452	31.318	Continuing	Continuing
622405: *High Speed Systems Technology*	-	14.857	18.742	22.066	0.000	22.066	24.490	28.415	26.309	26.827	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program investigates, develops, and analyzes aerospace vehicle technologies in the three primary areas of structures, controls, and aerodynamics for legacy and future aerospace vehicles. Advanced structures concepts are explored and developed to exploit new materials, fabrication processes, and design techniques. Vehicle, inter-vehicle, and intra-vehicle control technologies are developed and simulated for aerospace vehicles. Advanced aerodynamic vehicle configurations are developed and analyzed through simulations, experiments, and multi-disciplinary analyses. Resulting technologies improve performance of existing and future manned and remotely piloted air vehicles, sustained high speed, and space access vehicles. Improvements include, but are not limited to, reduced energy use by efficient air platform designs, use of lightweight composite structures, and improved sustainment methods based on the condition of the platform and sub-systems. Efforts in this program have been coordinated through the Department of Defense (DoD) Science and Technology (S&T) Executive Committee process to harmonize efforts and eliminate duplication.

This program is in Budget Activity 2, Applied Research, because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force					Date: May 2017
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 2: *Applied Research*			R-1 Program Element (Number/Name) PE 0602201F / *Aerospace Vehicle Technologies*		
B. Program Change Summary ($ in Millions)	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**
Previous President's Budget	122.969	122.831	125.042	0.000	125.042
Current President's Budget	118.263	122.831	124.678	0.000	124.678
Total Adjustments	-4.706	0.000	-0.364	0.000	-0.364
• 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	-2.990	0.000			
• SBIR/STTR Transfer	-1.716	0.000			
• Other Adjustments	0.000	0.000	-0.364	0.000	-0.364

Change Summary Explanation

Decreases in FY 2016 reflects reprogramming to support Research and Development Projects, 10 U.S.C. Section 2358.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force			Date: May 2017
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / *Aerospace Vehicle Technologies*	Project (Number/Name) 622401 / *Structures*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
622401: *Structures*	-	48.988	41.103	42.925	0.000	42.925	43.644	43.918	46.870	48.796	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops advanced structures concepts to exploit new materials and fabrication processes and investigates new concepts and design techniques. New structural concepts include incorporating subsystem hardware items and adaptive mechanisms into the aerospace structures and/or skin of the platform.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Aircraft Service Life Technologies	22.234	21.431	22.381
Description: Develop an economic service life analysis capability comprised of analysis tools, methodologies, and structural health monitoring technologies. ***FY 2016 Accomplishments:*** Continued development of engineered residual stress methods for airframe life extension. Continued the technology development of failure criteria methods and tools for advanced aircraft composite and metallic components. Continued efforts in certification of advanced composite for aircraft structures. Continued efforts in Airframe Digital Twin to develop an integrated system of data, models, and analysis tools that enable better decisions regarding fleet lifecycle management and sustainment. ***FY 2017 Plans:*** Continue development of engineered residual stress methods for airframe life extension. Continue efforts in certification of advanced composite for aircraft structures. Complete the technology development of failure criteria methods and tools for advanced aircraft composite and metallic components. Continue efforts in Airframe Digital Twin to develop an integrated system of data, models, and analysis tools that enable better decisions regarding fleet lifecycle management and sustainment. ***FY 2018 Plans:*** Complete development of engineered residual stress methods for airframe life extension. Initiate methods for achieving lifing credit in advanced & enhanced metallic airframe components to extend structural life. Complete efforts in certification of advanced composite for aircraft structures. Complete efforts in Airframe Digital Twin to develop an integrated system of data, models, and analysis tools that enable better decisions regarding fleet lifecycle management and sustainment. Initiate demonstration of Aircraft Digital Twin models and tools on legacy fleet aircraft.			
Title: Vehicle Design Technologies	14.726	12.047	12.581
Description: Develop methodologies to reduce the cost and time involved from design to full-scale testing of structural concepts and aircraft systems.			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602201F / *Aerospace Vehicle Technologies*	**Project (Number/Name)** 622401 / *Structures*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
FY 2016 Accomplishments: Continued the development of advanced high fidelity aircraft design analysis tools. Continued design methods for innovative control of supersonic tailless aircraft. Continued parametric modeling methods for integrated multidiscipline collaborative design. Continued high-fidelity technology assessment and design of next generation mobility concepts. Initiated the development of design methods for low cost attritable aircraft concepts. ***FY 2017 Plans:*** Continue the development of advanced high fidelity aircraft design analysis tools. Complete design methods for innovative control of supersonic tailless aircraft. Continue parametric modeling methods for integrated multidiscipline collaborative design. Complete high-fidelity technology assessment and design of next generation mobility concepts. Continue the development of design methods for low cost attritable aircraft concepts. Initiate evaluation of control effector concepts for supersonic tailless aircraft. ***FY 2018 Plans:*** Continue the development of advanced high fidelity aircraft design analysis tools. Continue parametric modeling methods for integrated multidiscipline collaborative design. Continue the development of design methods for low cost attritable aircraft concepts. Continue evaluation of control effector concepts for supersonic tailless aircraft. Initiate the development of integrating cost, mission effectiveness, and affordable manufacturing methods into the aircraft design analysis tools.			
Title: Structural Concepts ***Description:*** Develop design methods, processes, and lightweight, adaptive, and multifunctional structural concepts to capitalize on new materials, multi-role considerations, and technology integration into aircraft systems. ***FY 2016 Accomplishments:*** Continued innovative energy efficient conformal load bearing antenna structural concepts. Continued development of lightweight, adaptive, and efficient structural concepts for mobility and special operations. Continued low cost airframe design and manufacturing methods. ***FY 2017 Plans:*** Continue innovative energy efficient conformal load bearing antenna structural concepts. Continue development of lightweight, adaptive, and efficient structural concepts for mobility and special operations. Complete low cost airframe design and manufacturing methods. Initiate development and verification of low cost attritable airframe concepts and manufacturing methods. Initiate development of lightweight aircraft structural concepts to support Air Superiority 2030 requirements. ***FY 2018 Plans:***	12.028	7.625	7.963

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602201F / *Aerospace Vehicle Technologies*	**Project (Number/Name)** 622401 / *Structures*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Continue development and verification of low cost attritable airframe concepts and manufacturing methods. Continue development of lightweight aircraft structural concepts to support Air Superiority 2030 requirements.			
Accomplishments/Planned Programs Subtotals	48.988	41.103	42.925

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force			Date: May 2017
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / *Aerospace Vehicle Technologies*	Project (Number/Name) 622403 / *Flight Controls and Pilot-Vehicle Interface*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
622403: *Flight Controls and Pilot-Vehicle Interface*	-	26.564	28.516	30.130	0.000	30.130	30.089	30.339	31.130	36.248	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops technologies that enable maximum affordable capability from manned, remotely-piloted and autonomous aerospace vehicles. Advanced control technologies are developed for maximum vehicle performance throughout the flight envelope and simulated in virtual environments. Resulting technologies contribute significantly towards the development of reliable autonomous remotely piloted air vehicles, hypersonic aircraft, and extended-life legacy aircraft.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Advanced Flight Controls Technologies	6.615	11.658	6.905
Description: Develop technologies for advanced control-enabled capabilities, including flight controls, components, integrated vehicle management systems and software and system certification techniques for both manned and remotely piloted aircraft. ***FY 2016 Accomplishments:*** Continued the development, demonstration, and assessment of advanced flight control mechanization technologies for trusted and certifiable operations under adverse and contested environments. Continued the development of survivable and health-adaptive control system architecture and created a new line of research on adaptive power and thermal systems. Initiated development of advanced automation capabilities for mobility aircraft. Initiated study on implementation of collision avoidance technology on 6th-gen aircraft. Completed the development of adaptive guidance and control technologies for small-scale hypersonic air vehicles. ***FY 2017 Plans:*** Continue the development, demonstration, and assessment of advanced flight control mechanization technologies for trusted and certifiable operations under adverse and contested environments. Continue the development of survivable and health-adaptive control system architecture; developing new methods and expanding to include more aircraft systems. Continue the development of advanced automation capabilities for large aircraft. ***FY 2018 Plans:*** Continue the development, demonstration, and assessment of advanced flight control mechanization technologies for trusted and certifiable operations under adverse and contested environments. Continue the development of survivable and health-adaptive control system architecture. Continue the development of advanced automation capabilities for mobility aircraft, including air drop and air refueling automation technologies. Initiate development of trusted autonomy approach, integrating certification processes and autonomy development.			
Title: Manned and Unmanned Teaming Technologies	6.754	10.026	17.941

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602201F / *Aerospace Vehicle Technologies*	**Project (Number/Name)** 622403 / *Flight Controls and Pilot-Vehicle Interface*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Description: Develop technology for flight control systems that will permit safe interoperability between manned and remotely piloted aircraft and effective teaming in adverse and contested environments.. ***FY 2016 Accomplishments:*** Continued development, demonstration, and assessment of advanced control automation techniques. Continued the development of mixed initiative control techniques for teams of remotely piloted aircraft and/or manned-unmanned teams in contested, dynamic mission environments, as well as for the integration of unmanned systems into controlled airspace and airbase operations. Initiated development of robust, affordable Unmanned Air Systems (UAS) operations in a terminal airspace environment. Completed development of airborne control of UAS in preparation for flight test activities. Initiated development of autonomy architecture development for unmanned tactical wingman. ***FY 2017 Plans:*** Continue development, demonstration, and assessment of advanced control automation techniques. Continue the development of mixed initiative control techniques for teams of remotely piloted aircraft and/or manned-unmanned teams in contested, dynamic mission environments, as well as for the integration of unmanned systems into controlled airspace and airbase operations. Continue the development of robust, affordable UAS operations in a terminal airspace environment. Continue development of autonomy architecture for unmanned tactical wingman. ***FY 2018 Plans:*** Continue development, demonstration, and assessment of advanced control automation techniques. Continue the development of mixed initiative control techniques for teams of remotely piloted aircraft and/or manned-unmanned teams in contested, dynamic mission environments, as well as for the integration of unmanned systems into controlled airspace and airbase operations. Continue the development of robust, affordable UAS operations in a terminal airspace environment. Initiate development of autonomous behaviors for safe, loyal wingman.			
Title: Flight Controls Technologies Modeling and Simulation ***Description:*** Develop tools and methods for capitalizing on simulation-based research and development of future aerospace vehicles. ***FY 2016 Accomplishments:*** Continued modeling and simulation efforts to evaluate emerging autonomous and robust flight control technologies and concepts, as well as assess mission-level performance of integrated aerospace systems. Continued analyses of automated unmanned air systems and manned-unmanned teams in controlled airspace and airbase operations, as well as in adversarial	13.195	6.832	5.284

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602201F / *Aerospace Vehicle Technologies*	**Project (Number/Name)** 622403 / *Flight Controls and Pilot-Vehicle Interface*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
mission environments. Continued trade studies of vehicle concepts for strike, mobility and reconnaissance. Completed mobility evaluations. Initiated manned-unmanned teaming testbed evaluations. ***FY 2017 Plans:*** Continue modeling and simulation efforts to evaluate emerging autonomous and robust flight control technologies and concepts, as well as assess mission-level performance of integrated aerospace systems. Continue analyses of automated unmanned air systems and manned-unmanned teams in controlled airspace and airbase operations, as well as in adversarial mission environments. Continue trade studies of vehicle concepts for strike, mobility and reconnaissance. Continue manned-unmanned teaming evaluations. ***FY 2018 Plans:*** Continue modeling and simulation efforts to evaluate emerging autonomous and robust flight control technologies and concepts, as well as assess mission-level performance of integrated aerospace systems. Continue analyses of automated unmanned air systems and manned-unmanned teams in controlled airspace and airbase operations, as well as in adversarial mission environments. Continue trade studies of vehicle concepts for strike, mobility and reconnaissance. Continue manned-unmanned teaming evaluations. Continue development of autonomy for tactical aircraft operations.			
Accomplishments/Planned Programs Subtotals	26.564	28.516	30.130

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force			Date: May 2017
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / *Aerospace Vehicle Technologies*	Project (Number/Name) 622404 / *Aeromechanics and Integration*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
622404: *Aeromechanics and Integration*	-	27.854	34.470	29.557	0.000	29.557	30.080	29.118	30.452	31.318	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops aerodynamic configurations of a broad range of revolutionary, affordable aerospace vehicles. It matures and applies modeling and numerical simulation methods for fast and affordable aerodynamics prediction and integrates and demonstrates multi-disciplinary advances in airframe, propulsion, weapon and air vehicle control integration.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Aerodynamic Systems Technologies	8.440	9.117	7.818
Description: Develop aerodynamic assessment prediction methods centered on expanding the design capabilities of future air vehicles. ***FY 2016 Accomplishments:*** Continued to develop and assess aerodynamic technologies that enable future revolutionary manned and unmanned air vehicles. Completed development and assessment of advanced aircraft configurations for mobility. Continued to develop and assess advanced aircraft configurations for future air superiority. Continued technology assessments on next generation tanker systems. Initiated development and assessment of low cost attritable unmanned air systems concepts. ***FY 2017 Plans:*** Continue to develop and assess aerodynamic technologies that enable future revolutionary manned and unmanned air vehicles. Complete development and assessment of advanced aircraft configurations for future Air Superiority 2030 requirements. Complete technology assessments on next generation tanker systems. Continue development and assessment of low cost attritable Unmanned Aerial Vehicle (UAV) concepts. ***FY 2018 Plans:*** Complete development and assessment of aerodynamic technologies that enable future revolutionary manned and unmanned air vehicles. Continue development and assessment of low cost attritable UAV concepts. Continue assessment of efficient airfoil flow control and distributed propulsion concepts. Initiate design assessments of distributed propulsion concepts for next generation Mobility.			
Title: Next Generation Aerodynamic Technologies	11.089	10.988	9.422
Description: Develop and assess technologies for the next generation of multi-role large aircraft.			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602201F / *Aerospace Vehicle Technologies*	**Project (Number/Name)** 622404 / *Aeromechanics and Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
FY 2016 Accomplishments: Continued development of high fidelity aerodynamic analysis and method development for Mobility and future Air Superiority 2030. Continued development of practical laminar flow technologies for highly swept wings. Continued development of aerodynamics technologies to enable control of supersonic tailless aircraft. Initiated development of flow control techniques to increase the efficiency of practical laminar flow technologies for highly swept wings. ***FY 2017 Plans:*** Continue development of high fidelity aerodynamic analysis and method development for future Air Superiority 2030. Continue development of practical laminar flow technologies for highly swept wings. Complete development of aerodynamics technologies to enable control of supersonic tailless aircraft. Initiate aerodynamic technology maturation for next generation tanker. Continue development of flow control techniques to increase the efficiency of practical laminar flow technologies for highly swept wings. ***FY 2018 Plans:*** Continue development of practical laminar flow technologies for highly swept wings. Continue next generation tanker maturation and assess promising configurations in high and low speed wind tunnels. Complete wind tunnel test of natural laminar flow for Mobility hybrid wing body configuration. Initiate distributed embedded propulsion wind tunnel test.			
Title: Aircraft Integration Technologies ***Description:*** Develop enabling technologies to allow efficient and effective integration of propulsion, weapons, and subsystems into current and future air vehicles. ***FY 2016 Accomplishments:*** Continued to develop aerodynamic and propulsion integration technologies that enable future mobility and fighter aircraft. Completed analyses and experiments to investigate propulsion integration flow control to enhance mobility and future air superiority vehicle performance. Initiated advanced inlet and exhaust systems subscale tests for air superiority. Continued development of advanced kinetic and directed energy weapons integration technologies for future air superiority requirements. Completed innovative aerodynamic design methods for integrating high bypass propulsion for future mobility aircraft. ***FY 2017 Plans:*** Continue to develop aerodynamic and propulsion integration technologies that enable future mobility and fighter aircraft. Continue advanced inlet and exhaust systems subscale tests for future air superiority. Continue development of advanced kinetic and directed energy weapons integration technologies for future air superiority. Initiate analysis of innovative propulsion integration technologies that enable low cost attritable aircraft. ***FY 2018 Plans:***	8.325	14.365	12.317

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602201F / *Aerospace Vehicle Technologies*	**Project (Number/Name)** 622404 / *Aeromechanics and Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Complete the development of aerodynamic and propulsion integration technologies that enable future mobility and fighter aircraft. Complete advanced inlet and exhaust systems subscale tests for future air superiority. Continue development of advanced kinetic and directed energy weapons integration technologies for future air superiority. Continue the design of an integrated full flow path demonstration of a medium bypass embedded engine for next generation mobility.			
Accomplishments/Planned Programs Subtotals	27.854	34.470	29.557

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force			Date: May 2017
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / *Aerospace Vehicle Technologies*	Project (Number/Name) 622405 / *High Speed Systems Technology*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
622405: *High Speed Systems Technology*	-	14.857	18.742	22.066	0.000	22.066	24.490	28.415	26.309	26.827	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program investigates, analyzes, and develops high speed/hypersonic aerospace vehicle technologies. Advanced high temperature structures concepts are explored and developed to exploit new materials, fabrication processes, and design techniques. Advanced aerodynamic vehicle configurations are developed and analyzed through simulations, experiments, and multi-disciplinary analyses. Advanced flight control technologies are developed and simulated for hypersonic vehicles. These technologies will enable future high speed; weapons, intelligence, surveillance, and reconnaissance systems; and space access vehicles.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: High Speed/Hypersonics Structures	8.315	10.896	12.828

Description: Develop high speed, high temperature structural analysis methods and technologies for extreme operating conditions in current and future air vehicles.

FY 2016 Accomplishments:

Completed fabrication and instrumentation representative oxide-oxide hypersonic hot structure and a metallic hot structure. Continued development of innovative structural concepts for high speed/hypersonic air vehicles. Continued development of analytical methods for predicting structural response needed for design and evaluation of hot primary structure for hypersonic vehicles. Continued to assess the impact of path dependent structural behavior on the service life prediction for hot structures encountering extreme environments. Continued to develop and integrate model uncertainty methods into multi-disciplinary simulations and quantify its impact on the structural margin. Continued development of structural analysis methods and technology for hot structure concepts under extreme environment loading conditions. Continued the assessment of the aerospace community to quantify the structural margins for extreme environment hot structure through experimental validation of ground test articles. Prepared for testing of representative vehicle structures for combined aero, thermal, and acoustic loads. Began validation of combined loads methodology to predict structural response. Initiated study to characterize attachment techniques for hot structures.

FY 2017 Plans:

Complete thermal/mechanical/acoustic testing of a representative oxide-oxide hypersonic hot structure and a metallic hot structure. Continue development of innovative structural concepts for high speed/hypersonic air vehicles. Continue development of analytical methods for predicting structural response needed for design and evaluation of hot primary structure for hypersonic vehicles. Continue to assess the impact of path dependent structural behavior on the service life prediction for hot structures encountering extreme environments. Continue to develop and integrate model uncertainty methods into multi-disciplinary

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602201F / *Aerospace Vehicle Technologies*	**Project (Number/Name)** 622405 / *High Speed Systems Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
simulations and quantify its impact on the structural margin. Continue development of structural analysis methods and technology for hot structure concepts under extreme environment loading conditions. Continue the assessment of the aerospace community to quantify the structural margins for extreme environment hot structure through experimental validation of ground test articles. Initiate development of structural life prediction methodology for extreme environment structures and thermal protection systems. ***FY 2018 Plans:*** Continue development of innovative structural concepts for high speed/hypersonic air vehicles. Continue development of analytical methods for predicting structural response needed for design and evaluation of hot primary structure for hypersonic vehicles. Continue to assess the impact of path dependent structural behavior on the service life prediction for hot structures encountering extreme environments. Continue to develop and integrate model uncertainty methods into multi-disciplinary simulations and quantify its impact on the structural margin. Continue development of structural analysis methods and technology for hot structure concepts under extreme environment loading conditions. Continue the assessment of the aerospace community to quantify the structural margins for extreme environment hot structure through experimental validation of ground test articles. Continue development of structural life prediction methodology for extreme environment structures and thermal protection systems.			
Title: High Speed Vehicle Aeromechanics and Integration	6.542	7.846	9.238
Description: Develop new and improved components, concepts, and designs for sustained flight of high-speed/hypersonic expendable and re-useable vehicles. Conduct analyses of high speed/hypersonic vehicles to enable revolutionary capabilities. ***FY 2016 Accomplishments:*** Completed first ever time-accurate computational fluid dynamics (CFD) modeling of a full hypersonic vehicle. Successfully flew Hypersonic International Flight Research Experimentation flight 5b (HIFiRE-5b) collecting data on boundary-layer dynamics. Continued maturation of critical technologies for high speed/hypersonic flight. Continued development of design/analysis techniques/ tools and experimental approaches to enable enhanced high-speed air induction system starting, operability, and performance for propulsion integration concepts over a wide range of flight conditions. Completed performance and operability ground testing of advanced high contraction ratio inlets. Continued development of high speed system concepts that provide revolutionary capabilities. Investigated aeromechanic technologies to reduced drag and enable robust stability and control at low dynamic pressure flight conditions. Continued efforts to characterize high-speed phenomena and develop and validate fundamental high-speed technologies through experimental testing. As part of an international collaborative effort, continued flight tests of Mach 6 adaptive guidance and control flight experiment. Continued assessment of mission-level effectiveness and refinement of definition of preferred high speed weapon alternatives and limited life hypersonic intelligence, surveillance, and reconnaissance vehicles. Continued assessment of campaign-level benefits of preferred high speed weapon alternatives. ***FY 2017 Plans:***			

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602201F / *Aerospace Vehicle Technologies*	**Project (Number/Name)** 622405 / *High Speed Systems Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Continue to mature critical technologies for high speed/hypersonic flight. Continue development of design/analysis techniques/ tools and experimental approaches to enable enhanced high-speed air induction system starting, operability, and performance for propulsion integration concepts over a wide range of flight conditions. Continue development of high speed system concepts that provide revolutionary capabilities. Continue investigation of aeromechanic technologies to reduced drag and enable robust stability and control at low dynamic pressure flight conditions. Continue efforts to characterize high-speed phenomena and develop and validate fundamental high-speed technologies through experimental testing. As part of international collaborative effort, complete flight testing of Mach 6 adaptive guidance and control flight experiment and initiate boundary layer transition flight experiment program. Continue assessment of mission-level effectiveness and refinement of definition of preferred high speed weapon alternatives and limited life hypersonic intelligence, surveillance, and reconnaissance vehicles. Continue assessment of campaign-level benefits of preferred high speed weapon alternatives.. ***FY 2018 Plans:*** Complete Critical Design Review (CDR) for HIFiRE 5c, begin manufacturing of flight vehicle hardware. Evaluate interactions between air flow and structural deformations for a complex built-up hypersonic inlet. Continue to mature critical technologies for high speed/hypersonic flight. Continue development of design/analysis techniques/ tools and experimental approaches to enable enhanced high-speed air induction system starting, operability, and performance for propulsion integration concepts over a wide range of flight conditions. Continue development of high speed system concepts that provide revolutionary capabilities. Continue investigation of aeromechanic technologies to reduced drag and enable robust stability and control at low dynamic pressure flight conditions. Continue efforts to characterize high-speed phenomena and develop and validate fundamental high- speed technologies through experimental testing. As part of international collaborative effort, complete flight testing of Mach 6 adaptive guidance and control flight experiment and initiate boundary layer transition flight experiment program. Continue assessment of mission-level effectiveness and refinement of definition of preferred high speed weapon alternatives and limited life hypersonic intelligence, surveillance, and reconnaissance vehicles. Continue assessment of campaign-level benefits of preferred high speed weapon alternatives.			
Accomplishments/Planned Programs Subtotals	14.857	18.742	22.066

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

N/A

D. Acquisition Strategy

Not Applicable.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602201F / *Aerospace Vehicle Technologies*	**Project (Number/Name)** 622405 / *High Speed Systems Technology*

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.