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Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force	Date: May 2017
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 1: Basic Research</i>					R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>							
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	-	365.276	340.812	342.919	0.000	342.919	348.323	357.213	364.271	371.549	Continuing	Continuing
613001: <i>Physics and Electronics</i>	-	108.850	100.067	100.693	0.000	100.693	102.281	104.890	106.962	109.100	Continuing	Continuing
613002: <i>Aerospace, Chemical and Material Sciences</i>	-	115.911	105.484	106.172	0.000	106.172	107.845	110.597	112.784	115.036	Continuing	Continuing
613003: <i>Mathematics, Information and Life Sciences</i>	-	110.161	101.258	101.920	0.000	101.920	103.526	106.168	108.265	110.428	Continuing	Continuing
613004: <i>Education and Outreach</i>	-	30.354	34.003	34.134	0.000	34.134	34.671	35.558	36.260	36.985	Continuing	Continuing

A. Mission Description and Budget Item Justification

Defense Research Sciences consists of extramural research activities in academia and industry along with in-house investigations performed in the Air Force Research Laboratory (AFRL). This program supports fundamental broad-based scientific and engineering research in areas critical to Air Force weapon, sensor, and support systems. All research areas are subject to long-range planning and technical review by both Air Force and tri-Service scientific planning groups. 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.

In FY 2018, a portion of HQ AFRL S&T civilian manpower in PE 0601102F, Defense Research Sciences, was transferred to PE 0602298F, Science and Technology Management - Major Headquarters Activities, to provide increased transparency to Congress on personnel in Major Headquarters Activities (MHA).

This program is in Budget Activity 1, Basic Research, because this budget activity includes scientific study and experimentation directed toward increasing fundamental knowledge and understanding in those fields of the physical, engineering, environmental, and life sciences related to long-term national security needs.

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Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force				Date: May 2017			
Appropriation/Budget Activity		R-1 Program Element (Number/Name)					
3600: Research, Development, Test & Evaluation, Air Force I BA 1: Basic Research		PE 0601102F I Defense Research Sciences					
B. Program Change Summary (\$ in Millions)		FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	
Previous President's Budget		374.721	340.812	344.609	0.000	344.609	
Current President's Budget		365.276	340.812	342.919	0.000	342.919	
Total Adjustments		-9.445	0.000	-1.690	0.000	-1.690	
• 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		-9.445	0.000				
• Other Adjustments		0.000	0.000	-1.690	0.000	-1.690	
Congressional Add Details (\$ in Millions, and Includes General Reductions)							
Project: 613001: Physics and Electronics							
Congressional Add: Program Increase							
						FY 2016	FY 2017
						15.666	0.000
Congressional Add Subtotals for Project: 613001						15.666	0.000
Project: 613002: Aerospace, Chemical and Material Sciences							
Congressional Add: Program Increase							
						11.167	0.000
Congressional Add Subtotals for Project: 613002						11.167	0.000
Project: 613003: Mathematics, Information and Life Sciences							
Congressional Add: Program Increase							
						11.167	0.000
Congressional Add Subtotals for Project: 613003						11.167	0.000
Project: 613004: Education and Outreach							
Congressional Add: Program Increase							
						7.000	0.000
Congressional Add Subtotals for Project: 613004						7.000	0.000
Congressional Add Totals for all Projects						45.000	0.000

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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 1: Basic Research</i>	R-1 Program Element (Number/Name) PE 0601102F <i>I Defense Research Sciences</i>	
<u>Change Summary Explanation</u> Decrease in FY 2018 due to realignment of some HQ AFRL civilian personnel to PE 0602298F, Science and Technology Management - Major Headquarters Activities.		

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Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force										Date: May 2017		
Appropriation/Budget Activity 3600 / 1					R-1 Program Element (Number/Name) PE 0601102F / Defense Research Sciences				Project (Number/Name) 613001 / Physics and Electronics			
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
613001: Physics and Electronics	-	108.850	100.067	100.693	0.000	100.693	102.281	104.890	106.962	109.100	Continuing	Continuing
A. Mission Description and Budget Item Justification												
Basic research in the Physics and Electronics Project seeks to enable revolutionary advances and expand the fundamental knowledge supporting technologies critical to the future of the Air Force. Research stresses high-risk, far-term, game-changing capability breakthroughs essential for future leaps in warfighter system performance, functionality, reliability, and survivability while simultaneously reducing component and system power, size, mass, and life cycle costs. Major areas being investigated in this project are complex electronics and fundamental quantum processes; plasma physics and high energy density non-equilibrium processes; and lasers and optics, electromagnetics, communication, and signal processing. While the following specific sub-areas are the focus of the project, there is interest in exploring novel ideas that may bridge these major efforts as well as those in the other projects within this program.												
B. Accomplishments/Planned Programs (\$ in Millions)										FY 2016	FY 2017	FY 2018
Title: Complex Electronics and Fundamental Quantum Processes										42.781	40.491	40.756
Description: Scientific focus areas are atomic and molecular physics, photonics, quantum electronic solids, adaptive multi-mode sensing and ultra-high speed electronics, semiconductor and electromagnetic materials, and optoelectronics.												
FY 2016 Accomplishments: Supported the development of a new type of ultra-thin semiconductor laser that can be integrated with mainstream electronics for increased capacity and energy efficiency. Explored a wide range of complex materials and devices, including non-linear optical materials, photonics, optoelectronics, meta-materials, cathodes, dielectric and magnetic materials, semiconductor lasers, memristive systems, new classes of high-temperature superconductors, quantum dots, quantum wells and graphene. Included generating and controlling quantum states, such as superposition and entanglement, in photons and ultracold atoms and molecules.												
FY 2017 Plans: Explore a wide range of complex materials and devices, including non-linear optical materials, photonics, optoelectronics, meta-materials, cathodes, dielectric and magnetic materials, semiconductor lasers, memristive systems, new classes of high-temperature superconductors, quantum dots, quantum wells and graphene. Includes generating and controlling quantum states, such as superposition and entanglement, in photons and ultracold atoms and molecules.												
FY 2018 Plans: Continue to explore a wide range of complex materials and devices, including non-linear optical materials, photonics, optoelectronics, meta-materials, cathodes, dielectric and magnetic materials, memristive systems, new classes of high-temperature superconductors, quantum dots, quantum wells and graphene. Includes generating and controlling quantum states, such as superposition and entanglement, in photons and ultracold atoms and molecules.												
Title: Plasma Physics and High Energy Density Non-Equilibrium Processes										18.768	20.856	20.993

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Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017	
Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613001 / <i>Physics and Electronics</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2016	FY 2017
<p>Description: Scientific focus areas are plasma, electro-energetic physics and space sciences.</p> <p>FY 2016 Accomplishments: Supported research analyzing the energy entering the upper atmosphere following space weather events like solar flares to help refine the models used to forecast and track satellite trajectories. Explored a wide range of activities characterized by processes sufficiently energetic to require the understanding and managing of plasma phenomenology and the non-linear response of materials to high electric and magnetic fields. Included space weather, plasma control of boundary layers in turbulent flow, plasma discharges, Radio Frequency (RF) propagation, RF-plasma interaction, and high-power, beam-driven microwave devices.</p> <p>FY 2017 Plans: Explore a wide range of activities characterized by processes sufficiently energetic to require understanding and managing plasma phenomenology and the non-linear response of materials to high electric and magnetic fields. Includes space weather, plasma discharges, RF propagation, RF-plasma interaction, and high-power, beam-driven microwave devices.</p> <p>FY 2018 Plans: Continue to explore a wide range of activities characterized by processes sufficiently energetic to require understanding and managing plasma phenomenology and the non-linear response of materials to high electric and magnetic fields. Includes space weather, plasma discharges, RF propagation, RF-plasma interaction, and high-power, beam-driven microwave devices.</p>			
<p>Title: Lasers and Optics, Electromagnetics, Communication and Signal Processing</p> <p>Description: Scientific focus areas are physical mathematics and applied analysis, novel computational methods, dynamics sensing capability, electromagnetics, remote sensing and imaging physics, and surveillance and navigation.</p> <p>FY 2016 Accomplishments: Supported the development of a newly patented class of lasers that offer the potential for improved Laser Detection and Ranging (LADAR) capabilities and advanced remote sensing of chemical and biological agents. Explored all aspects of producing and receiving electromagnetic and electro-optical signals, as well as their propagation through complex media, including adaptive optics and optical imaging. Investigated aspects of the phenomenology of lasers including high energy lasers, non-linear optics, and ultra-short pulse laser science. Included the development of sophisticated mathematics and algorithm development for extracting information from complex and/or sparse signals.</p> <p>FY 2017 Plans: Explore all aspects of producing and receiving electromagnetic and electro-optical signals, as well as their propagation through complex media, including adaptive optics and optical imaging. Continue to investigate aspects of the phenomenology of lasers</p>		31.635	38.720
			38.944

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Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613001 / <i>Physics and Electronics</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2016	FY 2017
including high energy lasers, non-linear optics, and ultra-short pulse laser science. Includes the development of sophisticated mathematics and algorithm development for extracting information from complex and/or sparse signals.			
FY 2018 Plans: Continue to explore all aspects of producing and receiving electromagnetic and electro-optical signals, as well as their propagation through complex media, including adaptive optics and optical imaging. Continue to investigate aspects of the phenomenology of lasers including high energy lasers, non-linear optics, and ultra-short pulse laser science. Includes the development of sophisticated mathematics and algorithm development for extracting information from complex and/or sparse signals.			
Accomplishments/Planned Programs Subtotals		93.184	100.067
	FY 2016	FY 2017	
Congressional Add: Program Increase	15.666	0.000	
FY 2016 Accomplishments: Conducted Congressionally directed effort.			
FY 2017 Plans: N/A			
Congressional Adds Subtotals	15.666	0.000	
C. Other Program Funding Summary (\$ in Millions)			
N/A			
Remarks			
D. Acquisition Strategy			
N/A			
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.			

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Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force										Date: May 2017		
Appropriation/Budget Activity 3600 / 1					R-1 Program Element (Number/Name) PE 0601102F / Defense Research Sciences				Project (Number/Name) 613002 / Aerospace, Chemical and Material Sciences			
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
613002: Aerospace, Chemical and Material Sciences	-	115.911	105.484	106.172	0.000	106.172	107.845	110.597	112.784	115.036	Continuing	Continuing

A. Mission Description and Budget Item Justification

Basic research in the Aerospace, Chemical, and Materials Sciences Project seeks to enable revolutionary advances and expand the fundamental knowledge supporting technologies critical to the future of the Air Force. Research stresses high-risk, far-term, game-changing capability breakthroughs essential for future leaps in warfighter system performance, functionality, reliability, and survivability while simultaneously reducing component and system power, size, mass, and life cycle costs. Major thrust areas being investigated in this project are aero-structure interactions and control; energy, power, and propulsion; and complex materials and structures. Although the major thrust descriptions that follow are specific sub-areas of focus within this project, there is interest in exploring novel ideas that may bridge these major thrusts as well as those in the other projects within this program.

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

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2016	FY 2017	FY 2018
<p>Title: Aero Structure Interactions and Control</p> <p>Description: Scientific focus areas are high temperature aerospace materials, hypersonics, aerothermodynamics and turbulence, and flow interactions and control.</p> <p>FY 2016 Accomplishments: Supported experimental and computational research on nonlinear interactions and energy transfer that arise from Turbulent Boundary Layers and Shock-Boundary Layer Interactions on various surfaces. The research will improve understanding of phenomena critical to the development of predictive models for high-speed air vehicles. Investigated the characterization, modeling, and exploitation of interactions between the unsteady aerodynamic flow field and the dynamic air vehicle structure to enable enhanced performance in next generation Air Force systems. Explored the synergy gained from an interdisciplinary look at multiple technologies and the integration of core disciplines of fluid mechanics, material properties, high-performance structures, and thermodynamics.</p> <p>FY 2017 Plans: Investigate the characterization, modeling, and exploitation of interactions between the unsteady aerodynamic flow field and the dynamic air vehicle structure to enable enhanced performance in next generation Air Force systems. Explore the synergy gained from an interdisciplinary look at multiple technologies and the integration of core disciplines of fluid mechanics, material properties, high-performance structures, and thermodynamics.</p> <p>FY 2018 Plans: Continue to investigate the characterization, modeling, and exploitation of interactions between the unsteady aerodynamic flow field and the dynamic air vehicle structure to enable enhanced performance in next generation Air Force systems. Explore the</p>	30.152	31.105	31.295

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2016	FY 2017
synergy gained from an interdisciplinary look at multiple technologies and the integration of core disciplines of fluid mechanics, high-performance structures, and thermodynamics.			
Title: Energy, Power, and Propulsion Description: Scientific focus areas are thermal control, theoretical chemistry, molecular dynamics, space power and propulsion, and combustion and diagnostics. FY 2016 Accomplishments: Funded the synthesis, characterization, and theoretical prediction of properties and processes of energetic ionic liquids. Exploited technological innovations and developed potentially revolutionary technologies by integrating core disciplines of combustion, plasma dynamics, chemistry, hybrid simulation, structures, and materials. Investigated processes associated with the generation, storage, and utilization of energy, specifically for Air Force systems. Included developing novel energetic materials as well as understanding and optimizing combustion processes. FY 2017 Plans: Exploit technological innovations and develop potentially revolutionary technologies by integrating core disciplines of combustion, plasma dynamics, chemistry, hybrid simulation, structures, and materials. Investigate processes associated with the generation, storage, and utilization of energy, specifically for Air Force systems. This includes developing novel energetic materials as well as understanding and optimizing combustion processes. FY 2018 Plans: Continue to exploit technological innovations and develop potentially revolutionary technologies by integrating core disciplines of combustion, plasma dynamics, chemistry, hybrid simulation, and structures. Investigate processes associated with the generation, storage, and utilization of energy, specifically for Air Force systems. This includes developing novel energetic materials as well as understanding and optimizing combustion processes.		36.830	33.513
Title: Complex Materials and Structures Description: Scientific focus areas are mechanics of multifunctional materials and microsystems, multi-scale mechanics and prognosis, low density materials, and polymer chemistry. FY 2016 Accomplishments: Supported the development of a graphene-based de-icing material that melts ice from wings and resists the formation of ice when temperatures are above seven degrees Fahrenheit. The material is intended for use in extreme environments. Investigated multifunctional materials and structures composed of different classes of materials that may be able to change functionality or performance characteristics to enhance the mission versatility of future air and space systems, with a key goal of increasing functionality while decreasing weight and volume. Explored complex materials, microsystems, and structures that incorporate		37.762	40.866
			41.114

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2016	FY 2017
<p>hierarchical design and functionality from the nano-scale through the meso-scale, ultimately leading to controlled, well-understood material or structural behavior capable of dynamic functionality and/or performance characteristics to enhance mission versatility.</p> <p>FY 2017 Plans: Investigate multifunctional materials and structures composed of different classes of materials, both organic and inorganic, that may be able to change functionality or performance characteristics to enhance the mission versatility of future air and space systems, with a key goal of increasing functionality while decreasing weight and volume. Explore complex materials, microsystems, and structures that incorporate hierarchical design and functionality from the nano-scale through the meso-scale, ultimately leading to controlled, well-understood material or structural behavior capable of dynamic functionality and/or performance characteristics to enhance mission versatility.</p> <p>FY 2018 Plans: Continue to investigate multifunctional materials and structures composed of inorganic materials that may be able to change functionality or performance characteristics to enhance the mission versatility of future air and space systems, with a key goal of increasing functionality while decreasing weight and volume. Explore materials, microsystems, and structures that incorporate hierarchical design and functionality from the nano-scale through the meso-scale, ultimately leading to controlled, well-understood material or structural behavior capable of dynamic functionality and/or performance characteristics to enhance mission versatility.</p>			
Accomplishments/Planned Programs Subtotals		104.744	105.484
		FY 2016	FY 2017
Congressional Add: Program Increase		11.167	0.000
FY 2016 Accomplishments: Conducted Congressionally directed effort.			
FY 2017 Plans: N/A			
Congressional Adds Subtotals		11.167	0.000
C. Other Program Funding Summary (\$ in Millions)			
N/A			
Remarks			
D. Acquisition Strategy			
N/A			

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Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613002 / <i>Aerospace, Chemical and Material Sciences</i>

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.

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Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force										Date: May 2017		
Appropriation/Budget Activity 3600 / 1					R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>				Project (Number/Name) 613003 / <i>Mathematics, Information and Life Sciences</i>			
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
613003: <i>Mathematics, Information and Life Sciences</i>	-	110.161	101.258	101.920	0.000	101.920	103.526	106.168	108.265	110.428	Continuing	Continuing

A. Mission Description and Budget Item Justification

Basic research in the Mathematics, Information, and Life Sciences Project seeks to enable revolutionary advances and expand the fundamental knowledge supporting technologies critical to the future of the Air Force. Research stresses high-risk, far-term, game-changing capability breakthroughs essential for future leaps in warfighter system performance, functionality, reliability, and survivability while simultaneously reducing component and system power, size, mass, and life cycle costs. Major areas being investigated in this project are information and complex networks, decision making, dynamical systems, optimization and control, and natural materials and systems. While the following are specific sub-areas within this project, there is a continuing interest to explore novel ideas to bridge projects within this program.

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

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2016	FY 2017	FY 2018
<p>Title: Information and Complex Networks</p> <p>Description: Scientific focus areas are systems and software, information operations and security, information fusion, and complex networks.</p> <p>FY 2016 Accomplishments: Supported the development of formal methods to automate the identification of cyber-physical system specification mismatches to enable safe upgrades of systems consisting of old and new subsystems. Designed and analyzed techniques to enable reliable and secure exchange of information and predictable operation of networks and systems. Included traditional aspects of information assurance, software engineering, and reliable systems, but the emphasis was on the underlying mathematics of secure-by-design architectures of networked communications and neural information processing. Sub-areas included system and network performance prediction, design and analysis, and modeling of human-machine systems.</p> <p>FY 2017 Plans: Design and analyze techniques to enable reliable and secure exchange of information and predictable operation of networks and systems, including hardware and software interactions. This includes traditional aspects of information assurance, software engineering, and reliable systems, but the emphasis is on the underlying mathematics of secure-by-design architectures of networked communications and neural information processing. Sub-areas include system and network performance prediction, design and analysis, and modeling of human-machine systems.</p> <p>FY 2018 Plans: Continue to design and analyze techniques to enable reliable and secure exchange of information and predictable operation of networks and systems. This includes traditional aspects of information assurance, software engineering, and reliable systems, but the emphasis is on the underlying mathematics of secure-by-design architectures of networked communications and neural</p>	26.921	25.825	25.982

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2016	FY 2017	FY 2018
information processing. Sub-areas include system and network performance prediction, design and analysis, and modeling of human-machine systems.				
<p>Title: Decision Making</p> <p>Description: Scientific focus areas are mathematical modeling of cognition and decision making, trust between humans and autonomous agents, and mixed human-machine decision making.</p> <p>FY 2016 Accomplishments: Funded the development of a computational model that captures irrational aspects of human reasoning . The research will improve the reasoning of fully autonomous systems that interact with humans. Investigated new mathematical laws, scientific principles, and robust algorithms that underlie intelligent, mixed human-machine decision making to achieve accurate real-time projection of expertise and knowledge into and out of the battlespace. Included efforts to advance the critical knowledge base in information sciences and information fusion, and to model individual and group cognitive processing and decision making.</p> <p>FY 2017 Plans: Investigate new mathematical laws, scientific principles, and robust algorithms that underlie intelligent, mixed human-machine decision making to achieve accurate real-time projection of expertise and knowledge into and out of the battlespace. This includes efforts to advance the critical knowledge base in information sciences and information fusion, and to model individual and group cognitive processing and decision making.</p> <p>FY 2018 Plans: Continue to investigate new mathematical laws, scientific principles, and robust algorithms that underlie intelligent, mixed human-machine decision making to achieve accurate real-time projection of expertise and knowledge into and out of the battlespace. This includes efforts to advance the critical knowledge base in information sciences, and to model individual and group cognitive processing and decision making.</p>		19.347	20.140	20.263
<p>Title: Dynamical Systems, Optimization, and Control</p> <p>Description: Scientific focus areas are computational mathematics, dynamics and control, and optimization and discrete mathematics.</p> <p>FY 2016 Accomplishments: Supported the investigation and formalization of a Bayesian inference approach to machine learning and concept formation that will provide measureable results and a significant reduction in costs for a system to learn and formulate new concepts. Developed new scientific concepts supported by rigorous analysis for advancing the science of autonomy and promoting the understanding necessary to analyze and design complex multi-scale systems as well as provide guaranteed levels of performance. Included</p>		28.112	26.575	26.782

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2016	FY 2017
study of novel adaptive control strategies for coordinating heterogeneous, autonomous, or semi-autonomous aerospace vehicles in uncertain, information rich, dynamically changing, adversarial, and networked environments.			
FY 2017 Plans: Develop new scientific concepts supported by rigorous analysis for advancing the science of autonomy and promoting the understanding necessary to analyze and design complex multi-scale systems as well as provide guaranteed levels of performance. Develop novel adaptive control strategies for coordinating heterogeneous, autonomous, or semi-autonomous aerospace vehicles in uncertain, information rich, dynamically changing, adversarial, and networked environments.			
FY 2018 Plans: Continue to develop new scientific concepts supported by rigorous analysis for advancing the science of autonomy and promoting the understanding necessary to analyze and design complex multi-scale systems as well as provide guaranteed levels of performance. This includes developing novel adaptive control strategies for coordinating heterogeneous, autonomous, or semi-autonomous aerospace vehicles in uncertain, information rich, dynamically changing, adversarial, and networked environments.			
Title: Natural Materials and Systems Description: Scientific focus areas are renewable energy, natural materials and nature inspired systems.		24.614	28.718
FY 2016 Accomplishments: Supported the development of a "liquid wire" material inspired by spider silk that extends like a solid and compresses like a liquid. The bio-inspired threads have potential applications in a broad range of areas including robotics and stretchable electronics. Investigated multi-disciplinary approaches for studying, using, mimicking, synthesizing and adapting to the ways natural systems accomplish their required tasks. Studied how to adapt and mimic existing natural sensory systems and add existing capabilities to these organisms with the intent to gain more precise control over their material production.			
FY 2017 Plans: Investigate multi-disciplinary approaches for studying, using, mimicking, synthesizing and adapting to the ways natural systems accomplish their required tasks. Study how to adapt and mimic existing natural sensory systems and add existing capabilities to these organisms with the intent to gain more precise control over their material production.			
FY 2018 Plans: Continue to investigate multi-disciplinary approaches for studying the ways natural systems accomplish their required tasks. Study how to adapt and mimic existing natural sensory systems and add existing capabilities to these organisms with the intent to gain more precise control over their material production.			
Accomplishments/Planned Programs Subtotals		98.994	101.258

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Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613003 / <i>Mathematics, Information and Life Sciences</i>	
		FY 2016	FY 2017
Congressional Add: Program Increase		11.167	0.000
FY 2016 Accomplishments: Conducted Congressionally directed effort.			
FY 2017 Plans: N/A			
Congressional Adds Subtotals		11.167	0.000
C. Other Program Funding Summary (\$ in Millions)			
N/A			
Remarks			
D. Acquisition Strategy			
N/A			
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.			

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Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force										Date: May 2017		
Appropriation/Budget Activity 3600 / 1					R-1 Program Element (Number/Name) PE 0601102F / Defense Research Sciences				Project (Number/Name) 613004 / Education and Outreach			
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
613004: Education and Outreach	-	30.354	34.003	34.134	0.000	34.134	34.671	35.558	36.260	36.985	Continuing	Continuing

A. Mission Description and Budget Item Justification

The major efforts in the Science and Technology (S&T) Education and Outreach Project are to facilitate interactions between the international and domestic research communities and Air Force researchers, and to support and develop scientists and engineers with an awareness of Air Force basic research priorities. These professional interactions and collaborations benefit the Air Force by increasing awareness of Air Force basic research priorities in the research community as a whole, and attracting talented scientists and engineers to address Air Force needs. International interactions facilitate future interoperability of coalition systems and foster relationships with future coalition partners. This project also seeks to enhance interactions with Historically Black Colleges and Universities, Hispanic serving institutions, and other minority institutions.

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

	FY 2016	FY 2017	FY 2018
Title: Outreach to International S&T Community	10.141	11.978	12.019
Description: Foster international S&T cooperation by supporting direct interchanges with a broad range of key international researchers and communities. Identify and leverage international scientific advances when appropriate.			
FY 2016 Accomplishments: Hosted the International Basic Research Infrastructure Meeting in collaboration with the Embassy of Italy in Washington, D.C. and the National Research Council of Italy. Participants from the U.S., Italy, Australia and South Africa explored building basic science partnerships by leveraging international investments in global research infrastructure. Leveraged international expertise and supported international technology liaison missions to identify and maintain awareness of foreign science and technology developments. Explored current foreign investments and influenced world-class scientific research on specific topics of Air Force interest. Pursued access to technical information on foreign research capabilities within our interests. Supported international visits by scientists and high-level Department of Defense (DoD) S&T delegations, and provided primary interface to coordinate international S&T participation among DoD organizations.			
FY 2017 Plans: Leverage international expertise and support international technology liaison missions to identify and maintain awareness of foreign science and technology developments. Explore current foreign investments and influence world-class scientific research on specific topics of Air Force interest. Pursue access to technical information on foreign research capabilities within our interests. Support international visits by scientists and high-level DoD S&T delegations, and provide primary interface to coordinate international S&T participation among DoD organizations.			
FY 2018 Plans: Continue to leverage international expertise and support international technology liaison missions to identify and maintain awareness of foreign science and technology developments. Explore current foreign investments and influence world-class			

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Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force			Date: May 2017		
Appropriation/Budget Activity 3600 / 1		R-1 Program Element (Number/Name) PE 0601102F / Defense Research Sciences	Project (Number/Name) 613004 / Education and Outreach		
B. Accomplishments/Planned Programs (\$ in Millions)			FY 2016	FY 2017	FY 2018
scientific research on specific topics of Air Force interest. Pursue access to technical information on foreign research capabilities within our interests. Support international visits by scientists and high-level DoD S&T delegations.					
Title: Outreach to U.S. S&T Workforce			13.213	22.025	22.115
Description: Strengthen science, mathematics, and engineering research and infrastructure in the U.S., thereby strengthening current and future Air Force S&T capabilities.					
FY 2016 Accomplishments: Awarded grants to 56 scientists and engineers from 41 research institutions and small businesses under the Air Force's Young Investigator Research Program. Increased awareness of Air Force research needs and opportunities throughout the civilian scientific community, while simultaneously identifying, recruiting, and increasing opportunities for new young investigators to participate in critical Air Force research. Supported science, mathematics, and engineering research, and educational outreach programs at U.S. colleges and universities, including Historically Black Colleges and Universities, Hispanic serving institutions, and other minority institutions.					
FY 2017 Plans: Increase awareness of Air Force research needs and opportunities throughout the civilian scientific community, while simultaneously identifying, recruiting, and increasing opportunities for new young investigators to participate in critical Air Force research. Support science, mathematics, and engineering research, and educational outreach programs including Historically Black Colleges and Universities, Hispanic serving institutions, and other minority institutions.					
FY 2018 Plans: Continue identifying, recruiting, and increasing opportunities for new young investigators to participate in critical Air Force research. Support science, mathematics, and engineering research including Historically Black Colleges and Universities, Hispanic serving institutions, and other minority institutions. Support science activities that encourage elementary/middle/ high school youths to develop an interest in and pursue higher education and employment in the science, mathematics, and engineering (STEM) fields.					
Accomplishments/Planned Programs Subtotals			23.354	34.003	34.134
			FY 2016	FY 2017	
Congressional Add: Program Increase			7.000	0.000	
FY 2016 Accomplishments: Conducted Congressionally directed effort.					
FY 2017 Plans: N/A					
Congressional Adds Subtotals			7.000	0.000	

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Exhibit R-2A, RDT&E Project Justification: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613004 / <i>Education and Outreach</i>
C. Other Program Funding Summary (\$ in Millions) N/A		
Remarks		
D. Acquisition Strategy N/A		
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.		