Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Air Force											Date: February 2015	
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603112F / *Advanced Materials for Weapon Systems*							
COST ($ in Millions)	**Prior Years**	**FY 2014**	**FY 2015**	**FY 2016 Base**	**FY 2016 OCO**	**FY 2016 Total**	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**	**Cost To Complete**	**Total Cost**
Total Program Element	-	53.593	40.177	37.665	-	37.665	36.284	37.012	38.251	39.545	Continuing	Continuing
632100: *Laser Hardened Materials*	-	22.330	17.285	15.629	-	15.629	17.145	16.986	17.349	17.693	Continuing	Continuing
633153: *Non-Destructive Inspection Development*	-	5.450	5.275	5.029	-	5.029	6.350	6.331	6.423	6.550	Continuing	Continuing
633946: *Materials Transition*	-	25.813	17.617	17.007	-	17.007	12.789	13.695	14.479	15.302	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops and demonstrates materials technology for transition into Air Force systems. The program has four projects which develop: hardened materials technologies for the protection of aircrews and sensors; non-destructive inspection and evaluation technologies; transition data on structural and non-structural materials for aerospace applications; and airbase operations technologies including deployable base infrastructure, force protection, and fire fighting capabilities. Efforts in the program have been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

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 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	54.572	32.177	39.975	-	39.975
Current President's Budget	53.593	40.177	37.665	-	37.665
Total Adjustments	-0.979	8.000	-2.310	-	-2.310
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	8.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.897	-			
• Other Adjustments	-0.082	-	-2.310	-	-2.310

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2014	FY 2015
Project: 633946: *Materials Transition*		

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Air Force	Date: February 2015
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603112F / *Advanced Materials for Weapon Systems*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2014	FY 2015
Congressional Add: *Materials Research and Technology*	10.000	-
Congressional Add: *Metals Affordability Research*	5.000	8.000
Congressional Add Subtotals for Project: 633946	15.000	8.000
Congressional Add Totals for all Projects	15.000	8.000

Change Summary Explanation

Decrease in FY16 due to higher DoD priorities.

Exhibit R-2A, RDT&E Project Justification: PB 2016 Air Force			Date: February 2015
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603112F / *Advanced Materials for Weapon Systems*	Project (Number/Name) 632100 / *Laser Hardened Materials*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
632100: *Laser Hardened Materials*	-	22.330	17.285	15.629	-	15.629	17.145	16.986	17.349	17.693	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced materials technologies that enhance protection for Air Force aircrews to ensure safety and to enable aircrews to perform required missions in threat environments. Advanced materials technologies are also developed and demonstrated to enhance protection for Air Force sensors and systems to ensure safety, survivability, and operability in threat environments.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Aerospace Systems Protection	10.800	8.161	7.379

Description: Develop and demonstrate materials technologies that enhance hardening for sensors, avionics, and components to increase survivability and mission effectiveness of aerospace systems.

FY 2014 Accomplishments:
Demonstrated strategies to mitigate directed energy damage for visual/near-infrared (NIR), short wave infrared (SWIR), and mid wave infrared (MWIR) detectors critical to Intelligence, Surveillance, and Reconnaissance (ISR) sensors. Demonstrated damage-limiting semiconductor materials in a test bed configuration representing protection of both visual/NIR and SWIR sensors. Employed computation materials science to model material characteristics to increase accuracy and shorten design cycle time of coatings and dyes for use in sensor hardening. Conducted an air systems airframe and anti-access munitions hardening assessment.

FY 2015 Plans:
Continue to advance development of protection materials for visual/NIR ISR Sensors. Validate and demonstrate use of protection technologies for future ISR sensor designs and strategies to mitigate directed energy damage for visual/NIR, SWIR, and MWIR detectors. Continue to develop survivable electro-optic sensors that provide full spectrum protection for missile warning. Continue evaluating the performance impact of damage-limiting semiconductor materials designed to harden electro-optic imaging sensors. Continue to develop laser countermeasures for survivability of dynamic electro-optional and infrared (EO/IR) imagers. Validate and continue to employ computation materials science to model materials characteristics to increase accuracy and shorten design cycle time of coatings for use in sensor hardening. Initiate air systems airframe and anti-access munitions hardening assessment.

FY 2016 Plans:
Continue development of protection materials for visual/NIR ISR Sensors. Demonstrate use of protection technologies for future ISR sensor designs and strategies to mitigate directed energy damage for visual/NIR, SWIR, and MWIR detectors. Develop survivable electro-optic sensors that provide full spectrum protection for missile warning. Continue evaluating the

Exhibit R-2A, RDT&E Project Justification: PB 2016 Air Force		Date: February 2015
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603112F / *Advanced Materials for Weapon Systems*	**Project (Number/Name)** 632100 / *Laser Hardened Materials*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
performance impact of damage-limiting semiconductor materials designed to harden electro-optic imaging sensors. Develop laser countermeasures for survivability of dynamic electro-optional and infrared (EO/IR) imagers. Continue to employ computation materials science to model materials characteristics to increase accuracy and shorten design cycle time of coatings for use in sensor hardening. Initiate air systems airframe and anti-access munitions hardening assessment.			
Title: Aircrew Protection ***Description:*** Develop and demonstrate materials technologies that enhance protection for Air Force aircrews to ensure safety and to enable aircrews to perform required missions in a threat environment. ***FY 2014 Accomplishments:*** Developed and demonstrated personnel protection technologies for night-time operation across the visible/NIR and SWIR spectral bands. Fabricated and demonstrated performance of agile optical coatings and dyes for use in night-time applications. Characterized eye protection technologies using computational materials science tools. Insured process repeatability and performed demonstrations of personnel protection technologies in realistic operation environments. ***FY 2015 Plans:*** Develop and demonstrate laser protection materials and technologies for personnel protection. Continue development of helmet mounted sensor hardening materials. Continue development of visor based aircrew protection materials. Characterize eye protection technologies using computational materials science tools. Continue to improve functionality and performance of personnel protection technologies in expected operational conditions. ***FY 2016 Plans:*** Continue to develop and demonstrate laser protection materials and technologies for personnel protection. Validate and continue development of helmet mounted sensor hardening materials. Continue to advance development of visor based aircrew protection materials. Characterize and demonstrate eye protection technologies using computational materials science tools. Demonstrate and continue to improve functionality and performance of personnel protection technologies in expected operational conditions.	11.530	9.124	8.250
Accomplishments/Planned Programs Subtotals	22.330	17.285	15.629

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not Applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2016 Air Force		Date: February 2015
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603112F / *Advanced Materials for Weapon Systems*	**Project (Number/Name)** 632100 / *Laser Hardened Materials*

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: PB 2016 Air Force			Date: February 2015
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603112F / *Advanced Materials for Weapon Systems*	Project (Number/Name) 633153 / *Non-Destructive Inspection Development*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
633153: *Non-Destructive Inspection Development*	-	5.450	5.275	5.029	-	5.029	6.350	6.331	6.423	6.550	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced nondestructive inspection/evaluation technologies to monitor performance integrity and to detect failure causing conditions in weapon systems components and materials. Nondestructive inspection/evaluation capabilities greatly influence and/or limit many design, manufacturing, and maintenance practices. This project provides technology to satisfy Air Force requirements to extend the lifetime of current systems through increased reliability and cost-effectiveness at field and depot maintenance levels. Equally important is assuring manufacturing quality, integrity, and safety requirements.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Advanced Engine Inspection Technologies	1.036	1.298	1.237
Description: Develop and demonstrate advanced technologies to improve capabilities to inspect for cracks and other damage to extend the total safe life of turbine engines.			
FY 2014 Accomplishments: Continued development of novel, whole-field nondestructive inspection/evaluation approaches to nondestructively assess material and damage state of critical turbine engine components for the purpose of extending the useful life without increasing risk of in-flight failure of fracture to critical gas turbine engine components.			
FY 2015 Plans: Continue development of nondestructive inspection/evaluation approaches to nondestructively assess material and damage state of critical turbine engine components for the purpose of extending the useful life without increasing risk of in-flight failure of fracture critical to gas turbine engine components.			
FY 2016 Plans: Demonstrate nondestructive inspection/evaluation approaches to nondestructively assess material and damage state of critical turbine engine components for the purpose of extending the useful life without increasing risk of in-flight failure of fracture critical to gas turbine engine components.			
Title: Low-Observable Inspection Technologies	0.927	0.985	0.939
Description: Develop and demonstrate advanced inspection technologies supporting low-observable (LO) systems to enhance affordability and ensure full performance and survivability.			
FY 2014 Accomplishments:			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Air Force		Date: February 2015
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603112F / *Advanced Materials for Weapon Systems*	**Project (Number/Name)** 633153 / *Non-Destructive Inspection Development*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Validated handheld inspection method and sensor system for signature and material integrity assessment of existing and next generation LO material systems. Validated that the handheld nondestructive inspection tool can identify damage and register position relative to an aircraft, enabling more affordable signature assessment. ***FY 2015 Plans:*** Initiate development of improved methods to acquire and analyze data to facilitate improved characterization, registration, and tracking of degradation and damage of LO materials that enables/ensures more affordable signature assessment. ***FY 2016 Plans:*** Continue development of improved methods to acquire and analyze data to facilitate improved characterization, registration, and tracking of degradation and damage of LO materials that enables/ensures more affordable signature assessment.			
Title: Advanced System Monitoring Technologies ***Description:*** Develop and demonstrate advanced systems status monitoring technologies to provide on-board and embedded sensing to gain continuous awareness of the state of key subsystems. ***FY 2014 Accomplishments:*** Transitioned augmented field and depot-level inspection technologies for assessing the structural integrity of airframes. Integrated computational materials science tools with life prediction methods to increase accuracy of life prediction. Continued to demonstrate and transition advanced turbine engine process/status monitoring technologies to enable adaptive functions. ***FY 2015 Plans:*** Validate improved field and depot-level nondestructive inspection/evaluation technologies and methodologies for assessing the structural integrity of airframes. Validate improved nondestructive inspection/evaluation methods to minimize maintenance burden to access critical, hard to reach locations on aircraft structures. Initiate enhanced methods for collecting and analyzing digital nondestructive inspection/evaluation data necessary for improved damage detection and characterization. Validate the integration of computational materials science tools with life prediction methods to enable risk-based life management. Validate technologies to analyze materials state awareness and prevent corrosion. Initiate development of digitally enhanced nondestructive inspection/evaluation techniques. ***FY 2016 Plans:*** Transition improved field and depot-level nondestructive inspection/evaluation technologies and methodologies for assessing the structural integrity of airframes. Transition improved nondestructive inspection/evaluation methods to minimize maintenance burden to access critical, hard to reach locations on aircraft structures. Continue enhanced methods for collecting and analyzing digital nondestructive inspection/evaluation data necessary for improved damage detection and characterization. Demonstrate the integration of computational materials science tools with life prediction methods to enable risk-based life management.	3.487	2.992	2.853

Exhibit R-2A, RDT&E Project Justification: PB 2016 Air Force		Date: February 2015
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603112F / *Advanced Materials for Weapon Systems*	**Project (Number/Name)** 633153 / *Non-Destructive Inspection Development*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Demonstrate technologies to analyze materials state awareness and prevent corrosion. Continue development of digitally enhanced nondestructive inspection/evaluation techniques.			
Accomplishments/Planned Programs Subtotals	5.450	5.275	5.029

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: PB 2016 Air Force			Date: February 2015
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603112F / *Advanced Materials for Weapon Systems*	Project (Number/Name) 633946 / *Materials Transition*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
633946: *Materials Transition*	-	25.813	17.617	17.007	-	17.007	12.789	13.695	14.479	15.302	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced materials and processing technologies for fielded and planned Air Force weapon, airframe, and propulsion applications. Advanced materials and processes that have matured beyond applied research are characterized, critical data are collected, and critical evaluations in the proposed operating environment are performed. This design and scale-up data improves the overall affordability of promising materials and processing technologies, providing needed initial incentives for their industrial development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Air Vehicle Materials Technologies	7.178	8.213	14.524
Description: Develop and demonstrate materials and processes technologies for air vehicle and subsystems to enhance lift, propulsion, LO performance, power generation management, and affordability of air vehicles. ***FY 2014 Accomplishments:*** Continued to advance validation of processing methods and lifing tools for ceramic matrix composites and graded microstructure turbine engine disk concepts. Continued validation and initiated transition of next generation nondestructive inspection/evaluation sensor systems for advanced LO material systems. Continued to advance development of magnetoresistive sensing technologies. Initiated integration of damage characterization with risk-based life management strategies for turbine engines. Initiated development of materials and processes to increase LO materials affordability. ***FY 2015 Plans:*** Validate processing methods and lifing tools for ceramic matrix composites and graded microstructure turbine engine disk concepts. Demonstrate repeatability of magnetoresistive sensing technologies. Continue integration of damage with risk-based life management strategies for turbine engines. Continue development of materials and processes to increase LO materials affordability. ***FY 2016 Plans:*** Demonstrate processing methods and lifing tools for ceramic matrix composites and graded microstructure turbine engine disk concepts. Continue demonstration of repeatability of magnetoresistive sensing technologies. Integrate damage with risk-based life management strategies for turbine engines. Continue development of materials and processes to increase LO materials affordability.			
Title: High Temperature Material Technologies	1.635	1.404	2.483

Exhibit R-2A, RDT&E Project Justification: PB 2016 Air Force		Date: February 2015
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603112F / *Advanced Materials for Weapon Systems*	**Project (Number/Name)** 633946 / *Materials Transition*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Description: Develop and demonstrate affordable, novel high temperature materials/structures and thermal management concepts to enable future defense capabilities for prompt global strike concepts. ***FY 2014 Accomplishments:*** Developed and demonstrated multimaterial structures to optimally address operational temperature zones for hot structure and expendable thermal protection systems made out of advanced ceramics, ceramic matrix composites, hybrids, advanced metals, and intermetallics. Continued development of 2700F ceramic matrix composites for turbine hot section components. ***FY 2015 Plans:*** Initiate validation of repeatability of multimaterial structures to optimally address operational temperature zones for hot structure and expendable thermal protection systems made out of advanced ceramics, ceramic matrix composites, hybrids, advanced metals, and intermetallics. Validate 2700F ceramic matrix composites for turbine hot section components. ***FY 2016 Plans:*** Validate repeatability of multimaterial structures to optimally address operational temperature zones for hot structure and expendable thermal protection systems made out of advanced ceramics, ceramic matrix composites, hybrids, advanced metals, and intermetallics. Demonstrate 2700F ceramic matrix composites for turbine hot section components.			
Title: Adapative Turbine Engine Technologies ***Description:*** Develop and demonstrate material and process technologies to increase power and efficiency for adaptive turbine engine propulsion and subsystem integration. ***FY 2014 Accomplishments:*** Completed materials and production process assessments for an adaptive turbine engine prototype. ***FY 2015 Plans:*** Work completed in FY14. ***FY 2016 Plans:*** Work completed in FY14.	2.000	-	-
Accomplishments/Planned Programs Subtotals	10.813	9.617	17.007

	FY 2014	FY 2015
Congressional Add: Materials Research and Technology	10.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2016 Air Force		Date: February 2015
Appropriation/Budget Activity 3600 / 3	**R-1 Program Element (Number/Name)** PE 0603112F / *Advanced Materials for Weapon Systems*	**Project (Number/Name)** 633946 / *Materials Transition*

	FY 2014	FY 2015
FY 2014 Accomplishments: Conduct Congressionally-directed effort.		
Congressional Add: Metals Affordability Research	5.000	8.000
FY 2014 Accomplishments: Conduct Congressionally-directed effort.		
FY 2015 Plans: Conduct Congressionally directed effort.		
Congressional Adds Subtotals	15.000	8.000

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.