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 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602602F / *Conventional Munitions*							
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	-	80.804	87.387	99.851	-	99.851	101.043	103.921	104.261	106.387	Continuing	Continuing
622068: *Advanced Guidance Technology*	-	32.513	40.757	46.822	-	46.822	47.549	47.713	47.046	47.998	Continuing	Continuing
622502: *Ordnance Technology*	-	48.291	46.630	53.029	-	53.029	53.494	56.208	57.215	58.389	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program investigates, develops, and establishes the technical feasibility and military utility of guidance and ordnance technologies for conventional air-launched munitions. Program supports core technical competencies of fuze technology; energetic materials; damage mechanisms; munitions aerodynamics, guidance, navigation, and control; terminal seeker sciences; and munition systems effects. Technologies to be developed include blast, fragmentation, penetrating and low-collateral damage warheads, hard target fuzing, precise terminal guidance, and high performance and insensitive explosives. 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.

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	81.521	87.387	97.399	-	97.399
Current President's Budget	80.804	87.387	99.851	-	99.851
Total Adjustments	-0.717	-	2.452	-	2.452
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.717	-			
• Other Adjustments	-	-	2.452	-	2.452

Change Summary Explanation

Increase in FY 2016 due to a higher priority for seeker, guidance and control, and ordnance technologies for air superiority.

Exhibit R-2A, RDT&E Project Justification: PB 2016 Air Force			Date: February 2015
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602602F / *Conventional Munitions*	Project (Number/Name) 622068 / *Advanced Guidance Technology*	

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
622068: *Advanced Guidance Technology*	-	32.513	40.757	46.822	-	46.822	47.549	47.713	47.046	47.998	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project investigates, develops, and evaluates conventional munitions guidance technologies to establish technical feasibility and military utility of innovative munition seekers, weapon aerodynamics, navigation and control, and guidance subsystem integration/simulation. Project payoffs include adverse-weather, GPS-degraded and GPS-denied, networked, and autonomous precision munition guidance capability; increased number of kills per sortie; increased aerospace vehicle survivability; improved weapon reliability and affordability; and improved weapon survivability and effectiveness.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Seeker Technologies	6.780	9.000	11.500

Description: Develop seeker technologies for air-delivered munitions to provide high confidence target discrimination and classification, precise target location, and robust terminal tracking.

FY 2014 Accomplishments:
Developed technologies that simplify, increase the flexibility, and reduce the cost of passive and active electro-optical, infrared, and radar munition seekers, with focus on combat operations in adverse weather and in high-speed engagements. Continued developing seeker technologies that provide enhanced mission capability for fifth generation aircraft, specifically as it applies to success in denied or anti-access environments. Developed algorithms and processing technologies to acquire and track targets with and without an operator in the loop. Increased emphasis on revolutionary bio-inspired seeker technologies to increase immunity to countermeasures, to exploit multi-discriminant signatures, and to reduce the size and cost of detectors; and also increased emphasis on high-resolution wide field of view (WFOV) sensors, particularly with bio-inspired and high-rate processing characteristics.

FY 2015 Plans:
Develop technologies that simplify, increase the flexibility, and reduce the cost of passive and active electro-optical, infrared, and radar munition seekers, with focus on combat operations in adverse weather and in high-speed engagements. Continue to emphasize high-resolution WFOV sensors, particularly with bio-inspired and high rate processing characteristics to allow precise munition terminal guidance in degraded, contested environments.

FY 2016 Plans:
Continue to develop technologies that simplify, increase the flexibility, and reduce the cost of passive and active electro-optical, infrared, and radar munition seekers, with focus on combat operations in adverse weather and in high-speed engagements. Continue to emphasize technology development for high-resolution WFOV sensors, particularly with bio-inspired and high rate

Exhibit R-2A, RDT&E Project Justification: PB 2016 Air Force		Date: February 2015
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602602F / *Conventional Munitions*	**Project (Number/Name)** 622068 / *Advanced Guidance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
processing characteristics to allow precise munition terminal guidance in degraded, contested environments. Explore terminal seeker technologies that enable innovative air-to-air engagements.			
Title: Aerodynamics, Navigation and Control Technologies ***Description:*** Develop weapon aerodynamic, control, navigation, and networking technologies for air-delivered munitions to provide precise, agile flight, networked effects, and immunity to countermeasures. ***FY 2014 Accomplishments:*** Developed technologies for precision navigation under GPS-degraded and GPS-denied conditions. Developed weapon navigation and control networking technologies that provide enhanced mission capability in denied or anti-access environments; facilitate agile and maneuverable weapons; foster autonomy, trust, and networking; and enable precise munition control and actuation, especially for munitions during high-speed engagements. Investigated multi-functional, multi-strategy weapon swarms to defeat enemy defenses. ***FY 2015 Plans:*** Increase emphasis in developing technologies that achieve precision navigation under GPS-degraded and GPS-denied conditions. Develop weapon navigation and control networking technologies that provide enhanced mission capability in denied or anti-access environments, facilitate agile and maneuverable weapons, foster autonomy, trust, and networking, and enable precise munition control and actuation. Continue to investigate multi-functional, multi-strategy weapon swarms to defeat enemy defenses. Develop technologies for weapon-platform interfaces that enable flexible, reprogrammable load-outs and achieve hardware and software modularity. ***FY 2016 Plans:*** Continue developing technologies that achieve precision navigation under GPS-degraded and GPS-denied conditions. Continue to develop weapon navigation and control networking technologies that provide enhanced mission capability in denied or anti-access environments, facilitate agile and maneuverable weapons, foster autonomy, trust, and networking, and enable precise munition control and actuation. Continue to investigate multi-functional, multi-strategy weapon swarms to defeat enemy defenses. Continue developing technologies for weapon-platform interfaces that enable flexible, reprogrammable load-outs and achieve hardware and software modularity. Develop airframe and control technologies that enable innovative air-to-air engagements.	18.800	24.000	26.212
Title: Guidance Technologies ***Description:*** Develop guidance subsystem integration and evaluation technologies to provide open and closed loop ground testing, flight test risk reduction, and digital simulation of novel concepts. ***FY 2014 Accomplishments:*** Developed precision guided munition integration technology and functionality. Focused on capabilities to simulate, test, and refine seeker concepts and navigation and control approaches in a realistic operational environment. Continued to emphasize guidance	6.933	7.757	9.110

Exhibit R-2A, RDT&E Project Justification: PB 2016 Air Force		Date: February 2015
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602602F / *Conventional Munitions*	**Project (Number/Name)** 622068 / *Advanced Guidance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
integration and evaluation technologies that provide enhanced mission capability for fifth-generation aircraft. Developed modeling techniques and tools to evaluate integrated, multi-weapon, and swarming search and attack. Improved test technologies for evaluating higher speed weapon guidance subsystems. ***FY 2015 Plans:*** Continue to develop a modular radio-frequency hardware-in-the-loop capability to support munitions concepts with high speed target engagement. Continue developing new infrared projection capabilities to evaluate a new class of multi-aperture sensor systems. Continue to develop a real-time radar/millimeter wave signature generation capability for testing algorithms in real-time software and hardware in-the-loop environments. ***FY 2016 Plans:*** Continue to develop a modular radio-frequency hardware-in-the-loop capability to support munitions concepts with high speed target engagement. Continue developing new infrared projection capabilities to evaluate a new class of multi-aperture sensor systems. Continue to develop a real-time radar/millimeter wave signature generation capability for testing algorithms in real-time software and hardware in-the-loop environments. Continue to develop simulation technologies that evaluate cooperative, flexible munition target engagements. Continue to develop improved simulation technologies that evaluate innovative air-to-air engagements.			
Accomplishments/Planned Programs Subtotals	32.513	40.757	46.822

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 / 2	R-1 Program Element (Number/Name) PE 0602602F / *Conventional Munitions*	Project (Number/Name) 622502 / *Ordnance Technology*	

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
622502: *Ordnance Technology*	-	48.291	46.630	53.029	-	53.029	53.494	56.208	57.215	58.389	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project investigates, develops, and evaluates conventional ordnance technologies to establish technical feasibility and military utility for advanced explosives, fuzes, warheads, submunitions, and weapon airframes, carriage, and dispensing. The project also assesses the lethality and effectiveness of current and planned conventional weapons technology programs and assesses target vulnerability. The payoffs include improved storage capability and transportation safety of fully assembled weapons, improved warhead and fuze effectiveness, improved submunition dispensing, low-cost airframe/subsystem components and structures, and reduced aerospace vehicle and weapon drag.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Energetic Materials Technology	10.000	10.000	10.300
Description: Investigate and develop energetic materials technology that can maximize weapon lethality, while applying appropriate safety and security features. ***FY 2014 Accomplishments:*** Developed, modeled, and tested explosive fills that reduce pre-detonation during warhead penetration. Further developed low density energetic materials for small munition applications. Exploited new nanoenergetic materials to enhance and tailor explosive effects. Emphasized development of energetic materials that improve performance and reduce bomb and missile size to increase loadout. ***FY 2015 Plans:*** Continue to emphasize development of energetic materials, including reactive cases, that improve performance and reduce bomb and missile size so as to increase loadout and increase safety. Continue to investigate energetic formulations that increase thermal and vibration tolerance required for very long range, high speed munitions. Continue to develop a virtual design tool for use in material design activities. ***FY 2016 Plans:*** Continue to emphasize development of energetic materials, including reactive cases, that improve performance and reduce bomb and missile size so as to increase loadout and increase safety. Continue to investigate energetic formulations that increase thermal and vibration tolerance required for very long range, high speed munitions. Continue to develop a virtual design tool for use in material design activities			
Title: Fuze Technologies	13.580	13.000	14.729
Description: Investigate and develop fuzes for air-delivered weapon applications to develop novel energetic initiation concepts, penetration fuzing, point burst fuzes, and develop predictive models.			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Air Force		Date: February 2015
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602602F / *Conventional Munitions*	**Project (Number/Name)** 622502 / *Ordnance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
FY 2014 Accomplishments: Improved modeling and testing techniques to investigate novel methods to initiate explosives, to include distributed and embedded fuzing concepts. Emphasized development of fuze technologies that enable increased capacity and capability of fifth-generation aircraft, specifically as it facilitates success in denied or anti-access environments. Continued to investigate and characterize the mechanical environment that a fuze must survive during hard target penetration, and explore ground profiling imaging fuze technology. ***FY 2015 Plans:*** Continue developing a fuzing system employing ground profiling radar for miniature ordnance packages to enable more lethal forward-firing as well as low collateral damage. Investigate the capability to predict and measure fuze performance during munition penetration at high impact speeds. ***FY 2016 Plans:*** Continue developing fuzing system technologies to employ ground profiling radar for miniature ordnance packages to enable more lethal forward-firing effects with low collateral damage. Investigate the capability to predict and measure fuze performance during munition penetration at high impact speeds. Investigate alternative fuzing technologies that facilitate tailored lethal effects.			
Title: Warhead Technologies ***Description:*** Investigate and develop innovative warhead kill mechanisms, such as adaptable warheads, directional-control fragmenting warheads, and reactive metals. ***FY 2014 Accomplishments:*** Increased emphasis in developing warhead technologies, especially those that enable munition agility, variable effects, and improved energy coupling. Continued investigating directional warhead concepts to improve standoff kills for non-direct hit encounters by employing reactive fragments or by utilizing a forward focusing fragment capability. Developed tools to better predict material-to-material interface dynamics, loading, and vibration during high-speed penetration. ***FY 2015 Plans:*** Develop penetrator technologies that address penetrator stability through novel nose shapes and increased survivability through internal structures for high-speed impacts into hard and deeply buried targets. Continue to develop small, multi-output warhead technologies primarily for soft surface targets, but with limited penetration capability for hardened, shallow structures. ***FY 2016 Plans:*** Develop penetrator technologies that address penetrator stability through novel nose shapes and increased survivability through internal structures for high-speed impacts into hard and deeply buried targets. Continue to develop small, multi-output warhead	13.700	13.000	15.000

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Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602602F / *Conventional Munitions*	**Project (Number/Name)** 622502 / *Ordnance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
technologies primarily for soft surface targets, but with limited penetration capability for hardened, shallow structures. Explore novel warhead technologies that increase lethality in innovative air-to-air engagements.			
Title: Ordnance Technologies	11.011	10.630	13.000
Description: Using a system approach, investigate and develop ordnance concepts by making technology trades between fuzes, warheads, and explosives and by improving weapon carriage, release, and dispensing. ***FY 2014 Accomplishments:*** Continued to investigate precision guided munition integration issues and functionality in various flight environments, and continue building and using interoperable simulations to evaluate emerging technologies. Continued developing technologies to improve models for small munitions, penetrators, and counter chemical, biological, radiological, and nuclear effects. Developed ordnance concepts that increase the capacity and capability of fifth-generation aircraft. ***FY 2015 Plans:*** Continue to develop mission-level simulation architecture capability to enable weapon system and weapon technology assessments. Continue development of multiphase physics models analyzing the detonation of a warhead and the dispersal of either a neutralizer or fuel. Continue to develop inventive ordnance concepts that increase the capacity and capability of fifth-generation aircraft. ***FY 2016 Plans:*** Continue to develop mission-level simulation architecture capability to enable weapon system and weapon technology assessments. Continue development of multiphase physics models analyzing the detonation of a warhead and the dispersal of either a neutralizer or fuel. Continue to develop inventive ordnance concepts that increase the capacity and capability of fifth generation aircraft. Explore general purpose warhead concepts that allow technology refresh matching the pace of technology discovery in an affordable, sustainable design. Develop technologies for low-cost, long-range munition concepts.			
Accomplishments/Planned Programs Subtotals	48.291	46.630	53.029

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 / 2	**R-1 Program Element (Number/Name)** PE 0602602F / *Conventional Munitions*	**Project (Number/Name)** 622502 / *Ordnance 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.