Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force										DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602602F: *Conventional Munitions*							
COST ($ in Millions)	**FY 2009 Actual**	**FY 2010 Estimate**	**FY 2011 Base Estimate**	**FY 2011 OCO Estimate**	**FY 2011 Total Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	56.596	58.044	61.330	0.000	61.330	60.765	64.988	66.974	64.813	Continuing	Continuing
622068: *Advanced Guidance Technology*	17.473	17.758	20.039	0.000	20.039	21.133	22.472	23.035	22.540	Continuing	Continuing
622502: *Ordnance Technology*	39.123	40.286	41.291	0.000	41.291	39.632	42.516	43.939	42.273	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program investigates, develops, and establishes the technical feasibility and military utility of advanced guidance and ordnance technologies for conventional air-launched munitions. Programs support core technical competencies of target identification and tracking, guidance navigation and control, munition systems, explosives, fuzes, and warheads/damage mechanisms. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	57.407	58.289	0.000	0.000	0.000
Current President's Budget	56.596	58.044	61.330	0.000	61.330
Total Adjustments	-0.811	-0.245	61.330	0.000	61.330
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.245			
• Congressional Adds		0.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-0.811	0.000	61.330	0.000	61.330

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2009	FY 2010
Project: 622502: *Ordnance Technology*		

Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force	DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	**R-1 ITEM NOMENCLATURE** PE 0602602F: *Conventional Munitions*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2009	FY 2010
Congressional Add: *Advanced Nanotube Micro-Munition Weapon Technology Initiative.*	1.596	0.000
Congressional Add Subtotals for Project: 622502	1.596	0.000
Congressional Add Totals for all Projects	1.596	0.000

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

C. Performance Metrics
(U) Under Development.

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602602F: *Conventional Munitions*	PROJECT 622068: *Advanced Guidance Technology*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
622068: *Advanced Guidance Technology*	17.473	17.758	20.039	0.000	20.039	21.133	22.472	23.035	22.540	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project investigates, develops, and evaluates conventional munitions advanced guidance technologies to establish technical feasibility and military utility. This project includes development of advanced guidance including terminal seekers, navigation and control, signal and processing algorithms, and guidance and control simulations. Project payoffs include: adverse-weather and autonomous precision guidance capability; increased number of kills per sortie; increased aerospace vehicle survivability; improved reliability and affordability; and improved survivability and effectiveness of conventional weapons.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Investigate and develop advanced guidance component technologies for seekers to increase air-delivered weapon kill probability, reduce pilot workload, and enhance sortie effectiveness.	4.950	9.825	11.504	0.000	11.504
FY 2009 Accomplishments: In FY 2009: Continued laboratory demonstration of test components for laser ranging seeker to profile "single shot" images of targets. Tested and demonstrated an optical seeker that used multi-discriminate signatures to improve targeting obscured targets. Refined Synthetic Aperture Radar system simulation. Began developing a multimode seeker that provided improved performance in two wavelength bands.					
FY 2010 Plans: In FY 2010: Continue laboratory demonstration of test components for laser ranging seeker to profile "single shot" images of targets. Complete demonstration of optical seeker that uses multi-discriminate signatures to improve targeting obscure targets. Continue development of multimode seeker that provides improved performance using two complimentary wavelength bands. Develop algorithms to use wide field of view optical imager data to augment map-matching techniques, enabling navigation					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602602F: *Conventional Munitions*	PROJECT 622068: *Advanced Guidance Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
under Global Positioning System (GPS)-denied conditions. Verify polarization theory models through simulation. Conduct tests on optical flow enhanced seeker. *FY 2011 Base Plans:* In FY 2011: Continue laboratory demonstration of test components for laser ranging seeker to profile "single shot" images of targets. Complete demonstration of optical seeker that uses multi-discriminate signatures to improve targeting obscure targets. Continue development of multimode seeker that provides improved performance in two wavelength bands. Continue development of algorithms to use wide field of view optical imager data to augment map-matching techniques, enabling navigation under GPS-denied conditions. Complete verification of polarization theory models through simulation. Conduct tests on optical flow enhanced seeker. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Investigate and develop advanced navigation and control technologies for air-delivered munitions to improve stand off ranges, resistance to GPS jamming, and aircraft survivability. *FY 2009 Accomplishments:* In FY 2009: Continued applying the neuro-physiology of insects to guide small vehicles to moving targets in urban-like environments. Continued evaluating navigation systems within GPS jamming environments. Evaluated utility data links to provide target location updates for precision strike against time sensitive targets. Investigated guidance navigation and control algorithms for engaging high agility, reduced signature targets. Investigated technologies applicable to indoor navigation within facilities. *FY 2010 Plans:* In FY 2010: Continue applying the neuro-physiology of insects to guide small vehicles to moving targets in urban-like environments. Continue evaluating navigation systems within GPS jamming	3.366	3.900	4.566	0.000	4.566

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APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602602F: *Conventional Munitions*	PROJECT 622068: *Advanced Guidance Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
environments. Continue maturing technologies allowing weapons to communicate in a secure, low probability of detection mode with launch platforms, submunitions, and/or ground elements. Begin integrated multi-UAV search and attack demonstration on a time critical moving target. *FY 2011 Base Plans:* In FY 2011: Continue applying the neuro-physiology of insects to guide small vehicles to moving targets in urban-like environments. Continue evaluating navigation systems within GPS jamming environments. Continue maturing technologies allowing weapons to communicate in a secure, low probability of detection mode with launch platforms, submunitions, and/or ground elements. Continue integrated multi-UAV search and attack demonstration on a time critical moving target. Investigate guidance technologies that optimize delivery of selectable effects munitions. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Investigate and develop advanced optical and digital processors and target detection, classification, and identification algorithms for improved seeker performance. *FY 2009 Accomplishments:* In FY 2009: Continued verifying biomimetic models through simulation and field testing. Verified polarization theory models through simulation. Conducted tests on an optical flow enhanced seeker. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable.	3.752	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602602F: *Conventional Munitions*	PROJECT 622068: *Advanced Guidance Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 OCO Plans: In FY 2011 OCO: N/A.					
MAJOR THRUST: Using a system approach, investigate and develop weapons by making trades between guidance, navigation and control, and seekers. *FY 2009 Accomplishments:* In FY 2009: Continued refining the set of interoperable simulations to evaluate emerging munitions technologies. Integrated and tested updates for multi-spectral phenomenology models and evaluated updated results via synthetic scene simulation. Continued the investigation of a LADAR scene generation capability for hardware-in-the-loop testing. *FY 2010 Plans:* In FY 2010: Continue refining the set of interoperable simulations to evaluate emerging munitions technologies. Simulate different highly innovative concepts and approaches in guidance and control technology. *FY 2011 Base Plans:* In FY 2011: Continue refining the set of interoperable simulations to evaluate emerging munitions technologies. Simulate highly innovative concepts and approaches in guidance and control technology. Develop capability to test and refine development programs and future weapon concepts in a realistic operational environment. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.	5.405	4.033	3.969	0.000	3.969
Accomplishments/Planned Programs Subtotals	17.473	17.758	20.039	0.000	20.039

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602602F: *Conventional Munitions*	PROJECT 622068: *Advanced Guidance Technology*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0603601F: *Conventional Weapons Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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 2011 Air Force			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602602F: *Conventional Munitions*	PROJECT 622502: *Ordnance Technology*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
622502: *Ordnance Technology*	39.123	40.286	41.291	0.000	41.291	39.632	42.516	43.939	42.273	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 to include technologies for advanced conventional weapon dispensers, submunitions, safe and arm devices, fuzes, explosives, warheads, and weapon airframe and carriage technology. 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 Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Investigate and develop high fidelity analytical tools for predicting weapons' effects and assessing target vulnerability to reduce development costs and provide maximum lethality.	8.400	0.000	0.000	0.000	0.000
FY 2009 Accomplishments: In FY 2009: Modeled damage to buildings caused by direct weapon effects. Continued developing capability to apply first principles computational tools to design and evaluation of new munitions concepts. Continued to identify high payoff technologies for defeating mobile targets. Applied system level analysis tools to identify promising high payoff technologies for defeating mobile targets.					
FY 2010 Plans: In FY 2010: Not Applicable.					
FY 2011 Base Plans: In FY 2011: Not Applicable.					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602602F: *Conventional Munitions*	PROJECT 622502: *Ordnance Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 OCO Plans: In FY 2011 OCO: N/A.					
MAJOR THRUST: Investigate and develop energetic materials technology that can maximize weapon lethality, while applying appropriate safety and security features. *FY 2009 Accomplishments:* In FY 2009: Continued developing highly energetic material with twice the power density of conventional explosives by characterizing advanced conventional explosive formulations. Evaluated the sensitivity and detonation performance and developed processes of new energetic materials. Continued developing a materials properties database characterizing chemical reaction kinetics. *FY 2010 Plans:* In FY 2010: Continue developing the materials properties database to develop system-level models for predicting initiation. Develop explosive fills that reduce pre-detonation during high "G" loading. Investigate low-density energetic materials for use in micro-munitions. Investigate high-density case materials capable of enhancing warhead performance. *FY 2011 Base Plans:* In FY 2011: Complete the materials properties data base to develop system level models for predicting initiation. Test and model explosive fills that reduce pre-detonation during high "G" loading. Develop low-density energetic materials for micro-munitions applications. Investigate high-density case materials to tailor or improve warhead performance. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.	6.638	9.617	9.364	0.000	9.364
MAJOR THRUST: Investigate and develop fuzes for air-delivered weapon applications to develop novel energetic initiation concepts, penetration fuzing, point burst fuzes, and develop predictive models.	5.944	6.016	7.237	0.000	7.237

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602602F: *Conventional Munitions*	PROJECT 622502: *Ordnance Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Demonstrated a miniature fuze that provides safe and arm, burst point sensor, and low power initiator in a four cubic inch package. Continued investigating novel methods to initiate explosives. Began investigating miniature components to transmit bomb damage information. *FY 2010 Plans:* In FY 2010: Continue investigating novel methods to initiate explosives, including new modeling and testing techniques. Investigate the mechanical environment that a fuze must survive during hard target penetration events. Explore ground profiling imaging fuze technology. Begin investigating a hardened chip fuze that uses integrated logic. *FY 2011 Base Plans:* In FY 2011: Continue investigating novel methods to initiate explosives, including new modeling and testing techniques. Continue to investigate and characterize the mechanical environment that a fuze must survive during hard target penetration events. Explore ground profiling imaging fuze technology. Continue development of a hardened chip fuze that uses integrated logic. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Using a system approach, investigate and develop weapons by making technology trades between fuzes, warheads, and explosives. *FY 2009 Accomplishments:* In FY 2009: Completed development of third spiral of covert video distribution capability and transmitted data to coordinate attacks of enemy targets. Continued investigating reaction jet control for dual role area dominance missile technology. Continued investigating the design of precision guided munitions by performing subsystem design trade studies. Conducted research on dispensing technologies for aerospace applications.	8.718	12.283	12.450	0.000	12.450

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602602F: *Conventional Munitions*	PROJECT 622502: *Ordnance Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2010 Plans: In FY 2010: Complete investigation of reaction jet control for dual role missile technology. For precision guided munitions, investigate issues of integrating miniaturized components and functionality in various flight environments. Develop and use a set of interoperable simulations to evaluate emerging munition technologies. Develop and enhance models for micromunitions, penetrators, and counter-chemical, biological, radiological, and nuclear effects. *FY 2011 Base Plans:* In FY 2011: Continue investigation of precision guided munition integration issues and functionality in various flight environments. Continue building and using interoperable simulations to evaluate emerging technologies. Continue developing and enhancing new models and improvements for micromunitions, penetrators, and counter-chemical, biological, radiological, and nuclear effects. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
MAJOR THRUST: Investigate and develop advanced warhead kill mechanisms, such as adaptable warheads, directional control, fragmenting warheads, and application of reactive metals. *FY 2009 Accomplishments:* In FY 2009: Completed evaluation of selected materials for high-speed penetrating weapons and the hard nose-caps against hard and combination targets. Continued investigating high strength next generation warhead cases with the eventual goal of terradynamic steering. Continued evaluation of shaped charges to defeat medium and heavy armor. Continued investigating micro-damage technologies to neutralize electronics with small robotic weapons. Continued developing a small high velocity UAV deliverable with strength to defeat hardened targets. Continued investigating submunition technology that provides agent defeat mechanisms against hardened targets. Began investigations into new mechanisms for defeating agent defeat targets.	7.827	12.370	12.240	0.000	12.240

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2010 Plans: In FY 2010: Complete investigation of high strength next generation warhead cases with the eventual goal of terradynamic steering. Complete evaluation of shaped charges to defeat medium and heavy armor. Complete investigation of micro-damage technologies to neutralize electronics with air delivered small robotic weapons. Explore compact lethality warhead technologies for use in urban terrain. Begin investigating directional warhead concepts employing reactive fragments to improve standoff kills for non-direct hit encounters. Develop numerical algorithms for material-to-material interface dynamics, loading, and vibration during high speed penetration. Investigate techniques to control, direct, and focus the energy release from explosives in real-time by means of applying small amounts of electromagnetic energy. *FY 2011 Base Plans:* In FY 2011: Develop compact lethality warhead technologies for use in urban terrain. Continue investigating directional warhead concepts employing reactive fragments to improve standoff kills for non-direct hit encounters. Continue developing numerical algorithms for material-to-material interface dynamics, loading, and vibration during high speed penetration. Continue investigating techniques to control, direct, and focus the energy release from explosives in real-time by means of applying small amounts of electromagnetic energy. Investigate novel warhead designs that provide warfighting capability to deliver selectable effects on targets. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A.					
Accomplishments/Planned Programs Subtotals	37.527	40.286	41.291	0.000	41.291

	FY 2009	FY 2010
Congressional Add: Advanced Nanotube Micro-Munition Weapon Technology Initiative.	1.596	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602602F: *Conventional Munitions*	PROJECT 622502: *Ordnance Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010
FY 2009 Accomplishments: In FY 2009: Conducted Congressionally-directed effort for the Advanced Nanotube Micro-Munitions Technology Initiative. *FY 2010 Plans:* In FY 2010: Not Applicable.		
Congressional Adds Subtotals	1.596	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0603601F: *Conventional Weapons Technology.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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.