

**UNCLASSIFIED**

PE NUMBER: 0602602F  
 PE TITLE: Conventional Munitions

<b>Exhibit R-2, RDT&amp;E Budget Item Justification</b>	DATE <b>February 2008</b>
---	------------------------------

<b>BUDGET ACTIVITY</b> <b>02 Applied Research</b>	<b>PE NUMBER AND TITLE</b> <b>0602602F Conventional Munitions</b>
--	--

Cost (\$ in Millions)	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
Total Program Element (PE) Cost	60.150	58.632	55.963	60.781	58.725	56.638	59.159	Continuing	TBD
2068 Advanced Guidance Technology	18.493	17.778	17.982	19.171	19.206	18.354	19.299	Continuing	TBD
2502 Ordnance Technology	41.657	40.854	37.981	41.610	39.519	38.284	39.860	Continuing	TBD

**(U) 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. The program includes two projects: (1) development of advanced guidance technologies, including seekers, navigation and control, target detection and identification algorithms, and simulation assessments; and (2) development of conventional ordnance technologies, including warheads, fuzes, explosives, munitions integration, and weapon lethality and vulnerability assessments. Note: In FY 2008, Congress added \$1.2 million for Advanced Nanotube Micro-Munition Weapon Technology Initiative. 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.

**(U) B. Program Change Summary (\$ in Millions)**

	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Previous President's Budget	61.868	57.804	56.081
(U) Current PBR/President's Budget	60.150	58.632	55.963
(U) Total Adjustments	-1.718	0.828	
(U) Congressional Program Reductions			
Congressional Rescissions		-0.372	
Congressional Increases		1.200	
Reprogrammings	-0.814		
SBIR/STTR Transfer	-0.904		

**(U) Significant Program Changes:**

Not Applicable.

**C. Performance Metrics**

(U) Under Development.

**Exhibit R-2a, RDT&E Project Justification**

DATE

**February 2008**

BUDGET ACTIVITY <b>02 Applied Research</b>				PE NUMBER AND TITLE <b>0602602F Conventional Munitions</b>			PROJECT NUMBER AND TITLE <b>2068 Advanced Guidance Technology</b>		
Cost (\$ in Millions)	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
2068 Advanced Guidance Technology	18.493	17.778	17.982	19.171	19.206	18.354	19.299	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

**(U) 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.

**(U) B. Accomplishments/Planned Program (\$ in Millions)**

	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST: Investigate and develop advanced guidance component technologies for adverse weather and autonomous seekers for air-delivered munitions, such as detectors and detector arrays, receiver electronics, signal pre-processing, target recognition, spatial target characteristics, optics, and low-cost beam scanning and shaping technologies. These technologies will enable the development of next generation seekers that will increase a weapon's kill probability, reduce pilot workload, and enhance sortie effectiveness.	6.712	5.621	5.080
(U) In FY 2007: Further improved and tested components in laser ranging seeker to provide "single-shot" imaging. Conducted further fabrication of an optical seeker that uses multi-discriminate signatures to improve targeting obscured targets. Used ground test data to further augment the shape signatures in the automatic target acquisition algorithms to add laser multi-discriminate signatures.			
(U) In FY 2008: Test and demonstrate in a lab environment test components for laser ranging seeker to provide "single shot" imaging at useful ranges. Lab test an optical seeker that uses multi-discriminate signatures to improve targeting of obscured targets. Develop Synthetic Aperture Radar (SAR) system simulation for designing Radar Frequency (RF) seeker technologies analysis.			
(U) In FY 2009: Laboratory demonstration of test components for laser ranging seeker to profile "single shot" images of useful targets. Test and demonstrate an optical seeker that uses multi-discriminate signatures to improve targeting obscure targets. Refine SAR System simulation. Begin developing a multi mode seeker that provides improved performance in two wavelength bands.			
(U) MAJOR THRUST: Investigate and develop advanced navigation and control technologies for air-delivered munitions to include nonlinear controllers, biomimetic guidance, clutter rejection modules, detection and segmentation modules, and micro-electromechanical gyros. These technologies will allow a more efficient flight path to target, increase stand off ranges, improve resistance to Global Positioning System (GPS) jamming, and enhance strike aircraft effectiveness and survivability.	3.800	3.300	3.455

## Exhibit R-2a, RDT&amp;E Project Justification

DATE

February 2008

BUDGET ACTIVITY

02 Applied Research

PE NUMBER AND TITLE

0602602F Conventional Munitions

PROJECT NUMBER AND TITLE

2068 Advanced Guidance Technology

(U) <b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) In FY 2007: Further developed navigation and guidance techniques to autonomously guide cooperative robotic weapons without location information from GPS. Further developed small agile vehicle guidance to avoid obstacles. Applied neuro-physiology of insects to guide small vehicles to moving targets in an urban-like environment. Further evaluated navigation systems within GPS jamming environments.			
(U) In FY 2008: Test navigation and guidance techniques to autonomously guide cooperative robotic weapons without location information from GPS. Continue applying neuro-physiology of insects to guide small vehicles for moving targets in urban like environments. Continue novel evaluating navigation system within GPS jamming environments. Investigate using data links to provide target location updates for precision strike against mobile, time sensitive targets.			
(U) In FY 2009: 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. Evaluate utility data links to provide target location updates for precision strike against time sensitive targets. Investigate guidance navigation and control algorithms for engaging high agility, reduced signature targets. Investigate technologies applicable to indoor navigation within facilities.			
(U) MAJOR THRUST: Investigate and develop advanced optical and digital processors and target detection, classification, and identification algorithms for improved seeker performance to allow greater air-delivered weapon autonomy. Continue developing highly innovative concepts and approaches in guidance and control. These seekers will deny an enemy the ability to hide or camouflage a target, while also decreasing aircrew workload.	3.109	3.570	3.851
(U) In FY 2007: Investigated particular target attributes using biomimetic principles. Developed polarization behavior theory models. Further evaluated contractor developed optic-flow algorithms.			
(U) In FY 2008: Verify biomimetic models through simulation. Continue developing polarization behavior theory models. Develop an optical flow enhanced seeker.			
(U) In FY 2009: Continue verifying biomimetic models through simulation and field testing. Verify polarization theory models through simulation. Conduct tests on an optical flow enhanced seeker.			
(U) MAJOR THRUST: Investigate and develop detailed six-degree-of-freedom and hardware-in-the-loop simulations including synthetic aperture radar, automatic target recognition, and biomimetic processing. Technologies also include trajectory optimization algorithm and polarization sensing and models to analyze guided munitions and their components that will enable requirement studies, design iteration and evaluation, and experiment risk reduction. These simulations will shorten development time, reduce development costs, and provide more effective munitions.	4.872	5.287	5.596
(U) In FY 2007: Further refined the set of interoperable simulations, validating the reusable aspect, to evaluate emerging			

<b>Exhibit R-2a, RDT&amp;E Project Justification</b>	DATE <b>February 2008</b>
--	------------------------------

BUDGET ACTIVITY <b>02 Applied Research</b>	PE NUMBER AND TITLE <b>0602602F Conventional Munitions</b>	PROJECT NUMBER AND TITLE <b>2068 Advanced Guidance Technology</b>
---	---	--

<b>(U) B. Accomplishments/Planned Program (\$ in Millions)</b>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
munitions technologies. Improved existing multi-spectral phenomenology models and evaluate in a synthetic scene environment. Developed a set of reusable modeling tools to allow munition simulations to be built from standardized components using standard commercial products.			
<b>(U)</b> In FY 2008: Continue refining the set of interoperable simulations, validating the reusable aspects, to evaluate emerging munitions technologies. Update and test multi-spectral phenomenology models and evaluate via synthetic scene simulation. Investigate laser radar (LADAR) scene generation to demonstrate a feasible projection system for hardware-in-the-loop testing.			
<b>(U)</b> In FY 2009: Continue refining the set of interoperable simulations to evaluate emerging munitions technologies. Integrate and test updates for multi-spectral phenomenology models and evaluate updated results via synthetic scene simulation. Continue the investigation of a LADAR scene generation capability for hardware-in-the-loop testing.			
<b>(U)</b> Total Cost	18.493	17.778	17.982

<b>(U) C. Other Program Funding Summary (\$ in Millions)</b>		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
		<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Complete</u>	
<b>(U)</b> Related Activities:										
<b>(U)</b> PE 0603601F, Conventional Weapons Technology.										
<b>(U)</b> This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.										
<b>(U) D. Acquisition Strategy</b>										
Not Applicable.										

**Exhibit R-2a, RDT&E Project Justification**

DATE  
**February 2008**

BUDGET ACTIVITY <b>02 Applied Research</b>				PE NUMBER AND TITLE <b>0602602F Conventional Munitions</b>			PROJECT NUMBER AND TITLE <b>2502 Ordnance Technology</b>		
Cost (\$ in Millions)	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
2502 Ordnance Technology	41.657	40.854	37.981	41.610	39.519	38.284	39.860	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

**(U) 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.

**(U) B. Accomplishments/Planned Program (\$ in Millions)**

	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST: Investigate and develop high fidelity analytical tools, such as computational mechanics models for predicting weapons' effects and assessing target vulnerability. These analysis tools will reduce air-delivered munitions development costs and provide weapons that can generate maximum lethality against a given target class.	6.700	7.810	8.582
(U) In FY 2007: Modeled damage to buildings caused by direct weapon effects. Improved methods for predicting damage caused by detonation of penetrating warheads in a variety of materials. Developed a model to predict the vulnerability of protected assets in deep underground facilities.			
(U) In FY 2008: Continue modeling damage to buildings caused by direct weapon effects. Develop capability to apply first principles computational tools to the design and evaluation of new munitions concepts. Identify high payoff technologies for defeating mobile targets.			
(U) In FY 2009: Continue modeling damage to buildings caused by direct weapon effects. Continue developing capability to apply first principles computational tools to design and evaluation of new munitions concepts. Continue to identify high payoff technologies for defeating mobile targets. Apply system level analysis tools to identify promising high payoff technologies for defeating mobile targets.			
(U) MAJOR THRUST: Investigate and develop more efficient, affordable explosives including multi-phase blast explosives, cast and cure high energy composite explosives, and nano-scale metal fuels that provide both higher blast performance and lower ignition sensitivity for air-delivered munitions. These technologies will enable safer, more insensitive to unplanned stimuli, and less expensive explosive fills for inventory and future weapons.	6.600	6.000	6.700
(U) In FY 2007: Further developed highly energetic material with twice the power density of conventional explosives by delivering a modeling and simulation capability for enhanced blast materials. Developed energetic liner technology to enhance blast output yet improve the insensitive munition attributes of the weapon system. Demonstrated performance of cast/cure PBX using advanced materials, plasticizers, and formulation techniques.			

Exhibit R-2a, RDT&E Project Justification		DATE February 2008		
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions	PROJECT NUMBER AND TITLE 2502 Ordnance Technology		
<b>(U) B. Accomplishments/Planned Program (\$ in Millions)</b>		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) In FY 2008: Continue developing highly energetic material with twice the power density of conventional explosives by formulating advanced energetic materials. Evaluate the sensitivity and detonation performance and develop design processes for new energetic formulations. Characterize the chemical reaction kinetics of new energetic materials to develop a materials properties database.				
(U) In FY 2009: Continue developing highly energetic material with twice the power density of conventional explosives by characterizing advanced explosive formulations. Evaluate the sensitivity and detonation performance and develop process of new energetic materials. Continue developing a materials properties database characterizing chemical reaction kinetics.				
(U)				
(U)	MAJOR THRUST: Investigate and develop advanced fuze technologies for air-delivered munitions, such as commercially available micro-mechanical systems, shock-hardened fuzes, low energy detonators, light activated and modular firing systems for advanced single-point initiation, switches, capacitors, power sources, and safe-arming components. These advanced fuze technologies will enhance lethality through precise selection of burst-height at, above, or below the surface to increase weapon safety and tactical performance, while simultaneously decreasing procurement costs and system supportability requirements.	7.050	5.600	6.000
(U)	In FY 2007: Further developed a miniaturized fuze to provide safe and arm, burst point sensor and low power initiator in a four cubic inch package. Further developed a wireless communication system to fuze a hard target munition. Continued to develop a waveform agile fuze to defeat smart jamming devices.			
(U)	In FY 2008: Test a miniaturized fuze to provide safe and arm, burst point sensor and low power initiator in a four cubic inch package. Complete static and sled testing of a wireless communication system to fuze a hard target munitions. Complete development of a waveform agile fuze to defeat smart jamming. Begin investigating novel warheads to initiate explosives.			
(U)	In FY 2009: Demonstrate a miniature fuze that provides safe and arm, burst point sensor and low power initiator in a four cubic inch package. Continue investigating novel methods to initiate explosives. Begin investigating miniature components to transmit bomb damage information.			
(U)				
(U)	MAJOR THRUST: Investigate and develop control and carriage technologies for ordnance packages for advanced air-delivered munitions in order to enhance weapon lethality. Examples of these technologies include high-energy formulations, mass-focus fragmentation, and multi-sensor fuzing. These technologies will increase weapon systems effectiveness by contributing to increased weapon load-out on strike aircraft and enhanced sortie effectiveness. Note: In FY 2007, funds are increased to support Battlefield Air Operations efforts.	13.859	12.152	8.800
(U)	In FY 2007: Completed precision time-of-arrival investigation to defeat tunnel blast doors. Further investigated			

## Exhibit R-2a, RDT&amp;E Project Justification

DATE

February 2008

BUDGET ACTIVITY

02 Applied Research

PE NUMBER AND TITLE

0602602F Conventional Munitions

PROJECT NUMBER AND TITLE

2502 Ordnance Technology

(U) <b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
<p>technologies for miniature cruise missile development. Completed the design studies for loitering, persistent, low-cost multiple-shot munitions. Completed the initial investigation of nanotube reinforced composites to reduce structural weight of weapons. Further miniaturized the attack system to communicate target aim point position from behind enemy lines. Further developed a covert video capability to collect and transmit data to coordinate attack of enemy targets.</p>			
<p>(U) In FY 2008: Finish investigating technologies for miniature cruise missile development. Finish miniaturizing the attack system to communicate target aim point position from behind enemy lines. Field test a covert video distribution capability to collect and transmit data to coordinate attack of enemy targets. Investigate reaction jet control technology to enable dual role air dominance missile technology. Begin to investigate the design of precision guided munitions.</p>			
<p>(U) In FY 2009: Complete development of third spiral of covert video distribution capability and transmit data to coordinate attacks of enemy targets. Continue investigating reaction jet control for dual role area dominance missile technology. Continue investigating the design of precision guided munitions by performing subsystem design trade studies. Conduct research on dispensing technologies for aerospace applications.</p>			
<p>(U) MAJOR THRUST: Investigate and develop advanced warhead kill mechanisms, such as adaptable warhead, directional control and fragmenting ordnance, and application of reactive metals. The investigation includes characterization of the dynamic response of metals and geologic materials, adjustable yield ordnance packages, and distributed multi-point fire set to enhance air-delivered munition lethality. This enhanced lethality supports the development of smaller munitions with effectiveness similar to current inventory weapons with a corresponding increase in aircraft load-out and sortie effectiveness.</p>	7.448	8.100	7.899
<p>(U) In FY 2007: Evaluated selected materials for high-speed penetrating weapons. Further developed focusing kill mechanisms for dual role, dual range missiles. Investigated micro damage technologies to neutralize electronics with small robotic weapons.</p>			
<p>(U) In FY 2008: Continue evaluating selected materials for high-speed penetrating weapons and the hard nose-caps against hard and combination targets. Begin investigating high strength next generation warhead cases with the eventual goal of terradynamic steering. Evaluate shaped charges to defeat medium and heavy armor. Continue investigating micro-damage technologies to neutralize electronics with small robotic weapons. Develop a small high velocity unmanned aerial vehicle (UAV) deliverable with strength to defeat hardened targets. Develop a submunition concept that can penetrate hardened target for agent defeat.</p>			
<p>(U) In FY 2009: Complete evaluation of selected materials for high-speed penetrating weapons and the hard nose-caps against hard and combination targets. Continue investigating high strength next generation warhead cases with the</p>			

<b>Exhibit R-2a, RDT&amp;E Project Justification</b>	DATE <b>February 2008</b>
--	------------------------------

BUDGET ACTIVITY <b>02 Applied Research</b>	PE NUMBER AND TITLE <b>0602602F Conventional Munitions</b>	PROJECT NUMBER AND TITLE <b>2502 Ordnance Technology</b>
---	---	---

<u>(U) B. Accomplishments/Planned Program (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
eventual goal of terradynamic steering. Continue evaluation of shaped charges to defeat medium and heavy armor. Continue investigating micro-damage technologies to neutralize electronics with small robotic weapons. Continue developing a small high velocity UAV deliverable with strength to defeat hardened targets. Continue investigating submunition technology that provide agent defeat mechanisms against hardened targets. Begin investigations into new mechanisms for defeating agent defeat targets.			
<u>(U) CONGRESSIONAL ADD: Advanced Nanotube Micro-Munition Weapon Technology Initiative.</u>	0.000	1.192	0.000
<u>(U) In FY 2007: Not Applicable.</u>			
<u>(U) In FY 2008: Conduct Congressionally-directed research for the Advanced Nanotube Micro-Munition Technology Initiative.</u>			
<u>(U) In FY 2009: Not Applicable.</u>			
<u>(U) Total Cost</u>	41.657	40.854	37.981

<u>(U) C. Other Program Funding Summary (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Complete</u>	
<u>(U) Related Activities:</u>									
<u>(U) PE 0603601F, Conventional Weapons Technology.</u>									
<u>(U) This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.</u>									
<u>(U) D. Acquisition Strategy</u>									
Not Applicable.									