RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602602F Conventional Munitions

	COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	51,474	49,029	60,343	52,709	54,210	55,489	56,767	Continuing	TBD
2068	Advanced Guidance Technology	0	16,667	18,048	18,156	18,716	19,155	19,795	Continuing	TBD
2502	Ordnance Technology	51,474	32,362	42,295	34,553	35,494	36,334	36,972	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0

Note: In FY 2001, Project 2068 was combined with Project 2502. In FY 2002, Project 2068 was separated from Project 2502 for clarity of describing the different technologies.

(U) A. Mission Description

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.

(U) B. Budget Activity Justification

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) C. Program Change Summary ($ in Thousands)

		FY 2001	FY 2002	FY 2003	Total Cost
(U)	Previous President's Budget	52,734	49,270	49,798	
(U)	Appropriated Value	53,223	49,270		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions		-241		

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(U) C. Program Change Summary ($ in Thousands) Continued

		FY 2001	FY 2002	FY 2003	Total Cost
	b. Small Business Innovative Research	-1,260			
	c. Omnibus or Other Above Threshold Reprogram				
	d. Below Threshold Reprogram				
	e. Rescissions	-489			
(U)	Adjustments to Budget Years Since FY 2002 PBR			10,545	
(U)	Current Budget Submit/FY 2003 PBR	51,474	49,029	60,343	TBD

(U) Significant Program Changes:

FY 2003 increases are due to increased emphasis in Project 2502 for Advanced Penetrator Technology, Tunnel Defeat Weapons Concepts, and Advanced Energetics.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602602F Conventional Munitions

PROJECT: 2068

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
2068 Advanced Guidance Technology	0	16,667	18,048	18,156	18,716	19,155	19,795	Continuing	

Note: In FY 2001, Project 2068 was combined with 2502. In FY 2002, Project 2068 was separated from 2502 for clarity of describing the different technologies.

(U) A. Mission Description

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) FY 2001 ($ in Thousands)

(U) $0 This work was performed in Project 2502.

(U) $0 Total

(U) FY 2002 ($ in Thousands)

(U) $5,733 Investigate and develop advanced guidance component technologies such as laser sources, detectors and detector arrays, receiver electronics, signal pre-processing, target recognition, spatial target characteristics, optics, and beam scanning and shaping technology for lower cost, enhanced precision, adverse weather, and autonomous seekers for air-delivered munitions. 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. Develop software tools for the development of laser radar algorithms and create a database for both measured and synthetic laser radar information. Initiate development and ground test of a scanner-less laser radar system with simultaneous, multi-wavelength capabilities. In conjunction with DARPA, investigate and develop focal plane array architecture capable of flash (one shot) range imaging for application in laser radar seekers.

(U) $4,782 Investigate and develop advanced navigation and control technologies, for example nonlinear controllers, biomimetic guidance, clutter rejection modules, detection and segmentation modules, and micro-electromechanical gyros for air-delivered munitions. These technologies will allow a more efficient flight path to the target, increase standoff ranges, and enhance strike aircraft effectiveness and survivability. Design and fabricate a reliable, accurate, miniaturized, and low-cost anti-jam weapon guidance system capable of operating in highly dynamic flight environments in the presence of Global Positioning System (GPS) jamming systems. Complete applied research of a miniature navigation device, based on micro-electromechanical system technology, which couples the GPS signal with an inertial navigation system to provide

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BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602602F Conventional Munitions
	PROJECT: 2068

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

ultra-high GPS jamming resistance and accuracy without the need for an anti-jam antenna.

(U) $3,095 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. These seekers will deny an enemy the ability to hide or camouflage a target while also decreasing the pilot's workload. Develop an in-house, state-of-the-art signal and imaging processing capability used to assess current and future, single-mode, ultra-spectral, and multi-mode seeker concepts. Investigate and transition biomimetic principles and concepts, including foveal vision and neuromorphic imaging systems, into advanced seeker components for moving target scenarios. Continue in-house activities including algorithms and simulation development and validation, statistical analysis of fixed, mobile targets, and background data, independent evaluation of target classification software, pattern recognition concepts, and seeker processing techniques to support design of autonomous munitions.

(U) $3,057 Investigate and develop detailed six-degree-of-freedom and hardware-in-the-loop simulations including synthetic aperture radar, automatic target recognition, and biomimetic processing. Simulations 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 cost, and provide more effective munitions. Continue analysis efforts and multi-sensor modeling to improve target signature prediction models, expedite development, and reduce the acquisition cycle expense for state-of-the-art seekers. Develop hardware-in-the-loop, laser radar, scene projector instrumentation. The instrumentation will combine optical signals to produce a complex laser radar return signal capable of providing real-time scene generation capabilities to test seeker components. Develop six-degree-of-freedom simulations to provide detailed performance estimates of guidance related component technology for guided weapon systems. Develop modular system level analysis tools to provide comprehensive comparisons among inventory, planned, and conceptual munitions to identify high payoff technologies and weapon attributes.

(U) $16,667 Total

(U) FY 2003 ($ in Thousands)

(U) $6,774 Investigate and develop advanced guidance component technologies for adverse weather, and autonomous seekers for air-delivered munitions, such as laser sources, 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. Demonstrate in-house, high-throughput, parallel processing target acquisition algorithms. Evaluate laser radar components to quantify operational range, target detection and

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BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602602F Conventional Munitions	PROJECT: 2068

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

identification, aim-point selection, and weather penetration effectiveness. Develop a low-cost, synthetic aperture radar seeker to assess future advanced guidance applications.

(U) $4,803 Investigate and develop advanced navigation and control technologies for air-delivered munitions, for instance 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 the target, increase standoff ranges, and enhance strike aircraft effectiveness and survivability. Complete laboratory field testing of a reliable, accurate, miniaturized, and low-cost anti-jam weapon guidance system. This guidance system will be capable of operating in highly dynamic flight environments in the presence of Global Positioning System jamming devices. Develop new design technologies for tactical munitions flight control systems. Develop novel ways to enhance weapon system effectiveness through higher levels of integration of guidance, navigation, control, and estimation algorithms. Investigate the neuro-physiology of insects for applications to guidance. Investigate clutter and mult-discriminate rejection to defeat camouflage, concealment, and deception.

(U) $3,308 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. These seekers will deny an enemy the ability to hide or camouflage a target while also decreasing the pilot's workload. Develop highly innovative concepts and approaches in guidance and control. Continue investigating biomimetic principles and concepts, including foveal vision and neuromorphic imaging systems, for use in advanced seekers for moving target scenarios. Investigate algorithms to perform flight trajectory shaping that reduce manning effects.

(U) $3,163 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 cost, and provide more effective munitions. Continue analysis efforts and multi-sensor modeling to improve target signature prediction models, expedite development, and reduce the acquisition cycle expense for state-of-the-art seekers. Investigate the long-term technology and strategy for developing an advanced laser radar scene projector. Develop two-dimensional laser arrays for laser radar scene projectors. Provide detailed performance estimates of guidance-related component technology, using six-degree-of-freedom simulations, for guided weapon systems. Continue to develop modular, system-level, analysis tools to provide comprehensive comparisons among inventory, planned, and conceptual munitions to identify high pay-off technologies and weapon attributes.

(U) $18,048 Total

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
02 - Applied Research	0602602F Conventional Munitions	2068

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) PE 0603601F, Conventional Weapons Technology.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602602F Conventional Munitions

PROJECT: 2502

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
2502 Ordnance Technology	51,474	32,362	42,295	34,553	35,494	36,334	36,972	Continuing	

Note: In FY 2001, Project 2068 was combined with 2502. In FY 2002, Project 2068 was separated from 2502 for clarity of describing the different technologies.

(U) A. Mission Description

This project investigates, develops, and evaluates conventional ordnance technologies to establish technical feasibility and military utility. Included in this project are 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/weapon's drag.

(U) FY 2001 ($ in Thousands)

(U) $6,736 Investigated and developed high fidelity analytical tools such as computational mechanics models for predicting weapons effects and assessing target vulnerability. These analysis tools reduced warhead development time and cost, thereby providing more effective munitions to the Air Force. Investigated demilitarization concepts for the 1000-pound unitary, general-purpose bomb. Developed a high-level model, including models of geological structures, involved in predicting penetrator performance against hard targets. Investigated innovative kill mechanisms for defeating weapons of mass destruction. Transitioned selected high fidelity analytical tools to weapon designers, DoD, and industry.

(U) $3,316 Investigated and developed more efficient affordable explosives including inert dense metal additives, tungsten-laden 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 enabled the development of safer, less expensive explosive fills for inventory and future weapons. Completed warhead testing and evaluation of the reformulated MNX-221 explosive to verify improved density and reduced ignition sensitivity. Continued development of a new class of energetic materials based on nano-scale and micro-scale particles, with initial emphasis on improving handling safety. Initiated development of innovative explosive technologies that allowed concentration of the explosive effects on the target, thereby reducing potential collateral damage.

(U) $5,343 Investigated and developed advanced fuze technologies, such as commercially available micro-mechanical systems, shock-hardened components, low energy detonators, light activated and modular firing systems for advanced single point initiation, switches, capacitors, power sources, and safe arming concepts for air-delivered munitions. The advanced fuze technologies enhanced lethality through precise selection of burst-height either at, above, or below the surface to increase weapon safety and tactical performance while simultaneously decreasing

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	PROJECT: 2502

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

procurement costs and system supportability requirements. Investigated micro-electromechanical system technology concepts for safe and arm components and fuze accelerometers. Developed and initiated testing of a low-threshold energy, shock-hardened detector for multi-event, hard target fuze capable of 4000 feet per second impacts.

(U) $5,317 Investigated and developed control and carriage technologies for ordnance packages for advanced air-delivered munitions in order to enhance weapon lethality. Examples of these technologies included high-energy explosives, mass focus fragmentation, and multi-sensor fuzing. These technologies contributed to increasing weapon load-out on strike aircraft and increased sortie effectiveness. Designed, fabricated, and tested submunitions for survivability during high mach number dispensing. Began ground testing of technologies that enabled the development of a fast reaction weapon to engage and destroy time-critical targets. Investigated the communication architectures to determine if they could be utilized to improve munitions planning, performance, and deployment.

(U) $7,118 Investigated and developed advanced warhead kill mechanisms, for instance adaptable warhead, directional control and fragmenting ordnance, application of reactive metals and processing explosive forming, and adjustable-yield ordnance packages. These technologies enhanced air-delivered munition lethality and enabled the development of smaller munitions with effectiveness similar to current inventory weapons, which resulted in a corresponding increase in strike aircraft load-out and sortie effectiveness. Performed sub-scale and full-scale experiments of several candidate payload technologies to determine their effectiveness to neutralize, deny, or destroy specially formulated chemical and biological targets. Continued testing and characterizing the effectiveness of tantalum warheads against targets that simulate the full spectrum of ground mobile threats. Completed in-house research on the effects of explosives on chemical and biological containers to determine residual collateral damage effects to areas surrounding the target area. Completed research on explosive compressor generators as novel, non-lethal kill mechanisms.

(U) $5,020 Investigated and developed advanced component technologies, including laser sources, detectors and detector arrays, receiver electronics, signal pre-processing, target recognition, spatial target characteristics, optics, and beam scanning and shaping technology for lower cost, enhanced precision, adverse weather, and autonomous seekers for air-delivered munitions. These technologies enabled the development of next generation seekers that increased a weapon's kill probability, reduced pilot workload, and enhanced sortie effectiveness. Designed and fabricated the subsystems for a gimbal-less, laser radar sensor with total electronic scanning. Developed and validated advanced algorithms that identified mobile targets using their unique external components, such as guns or antenna.

(U) $5,071 Investigated and developed advanced navigation and control technologies for air-delivered munitions, for example nonlinear controllers, biomimetic guidance, clutter rejection modules, detection and segmentation modules, and micro-electromechanical gyros. These technologies allowed an optimal flight path to the target and increased standoff ranges, enhanced strike aircraft effectiveness and survivability. Investigated

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(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

guidance and control technologies that could provide significantly enhanced capability to locate and engage a moving or partially hidden target. Developed a low-cost, multi-sensor navigation device using micro-electromechanical system technology that could meet tactical grade performance in a low-cost package. Fabricated components and began integration of the component intended for field testing for the multi-sensor navigation device. Combined components of advanced Global Positioning System and began laboratory bench tests for the multi-sensor navigation device.

(U) $2,992 Investigated and developed advanced optical and digital processors and target detection, classification, and identification algorithms for improved seeker performance to allow greater air-delivered weapon autonomy. The advanced seekers would further deny an enemy's ability to hide or camouflage a target while decreasing the pilot's workload. Completed the phenomenology studies required validating the performance enhancements to be realized with a dual-mode, millimeter wave and infrared seeker. Developed the analytical tools required that enhanced the development, test, and analysis of advanced seekers and target detection and identification processors. Investigated optical processing and components technologies that increased sensor field-of-view, tracking rates, and target resolution for the dual-mode seeker.

(U) $2,561 Investigated and developed detailed six-degree-of-freedom and hardware-in-the-loop simulations, including synthetic aperture radar, automatic target recognition, and biomimetic processing. Simulations also included trajectory optimization algorithm and polarization sensing and models to analyze guided munitions or their components to enable requirements studies, design iteration and evaluation, and experiment risk reduction. These advanced simulations reduced development cost and time, and provided more effective munitions. Developed tactical scene generation capability to produce re-useable, government-owned acquisition and targeting software algorithms for guided munition seekers. Completed the analysis of air-to-surface terminal fuzing. Developed in-house personal computer-based simulations for analysis of advanced weapon concepts.

(U) $8,000 Developed microsatellite (10-100 kg) technologies, combined sub-system technologies, and launched first microsatellite in the XSS series to evaluate autonomous space operations. (Note: In FY 2001, Congress added $8.0 million for MicroSat Technology (XSS-10). However, this was not the correct Program Element for this effort, so these funds were transferred to PE 0603401F, Advanced Spacecraft Technology, for execution).

(U) $51,474 Total

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U) $6,206 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 providing weapons that can generate maximum lethality against a given target class. Develop new hydro-code to improve predictive warhead performance capabilities by adding metal cutting, detonation waves, shear banding, and phase transitions. Develop a high fidelity model that predicts the dispersion of chemical and biological neutralizing agents from warheads. Upgrade and refine basic models describing fragmentation effects against various target facilities, including weapons of mass destruction (WMD). Perform phenomenology tests to provide data for the development of lethality and vulnerability codes for ground-fixed WMD targets.

(U) $3,318 Investigate and develop more efficient, affordable explosives, including inert dense metal additives, tungsten-laden 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 enable safer, less expensive explosive fills for inventory and future weapons. Continue developing micro-scale and nano-scale fuel and oxidizer particles to create new, intermolecular energetic materials. In collaboration with Department of Energy labs, complete efforts to develop a new class of materials for use in fragments, shaped charges and explosively formed projectiles. Develop insensitive explosive formulations for use in penetrator warheads capable of mach four impact velocities. Initiate development of a highly energetic material with twice the power density of conventional explosives, but exhibiting insensitive munition attributes. Evaluate intermolecular energetic material to measure mixing and fabrication techniques, material properties, and performance augmentations for specific applications. Initiate dense reactive metal explosive research to investigate cost effective methods to improve current explosives.

(U) $6,258 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 concepts. The advanced fuze techniques 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. Develop test methodology to analyze hardened-influence-fuze components, and bench-level and field-shock testing of fuze components. Initiate critical component design and fabrication of the next generation burst-height fuze with discrimination against foliage, rain, chaff, electronic countermeasures, and electromagnetic interference. Develop technologies that communicate battle damage assessment through hardened mediums.

(U) $7,394 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 explosives, mass focus fragmentation, and multi-sensor fuzing. These

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

technologies will increase weapon system effectiveness by contributing to increased weapon load-out on strike aircraft and enhanced sortie effectiveness. Develop advanced munition dispenser electronics and software and investigate reduction of platform integration cost for the advanced carriage technology. Investigate alternate technologies, such as microbots, nano-encapsulation, to disrupt, deny, destroy, or damage facilities involved with chemical and biological weapons. Continue investigating technologies for defeating hard and deeply buried targets.

(U) $9,186 Investigate and develop advanced warhead kill mechanisms, like 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 and with a corresponding increase in strike aircraft load-out and sortie effectiveness. Design, fabricate, and evaluate initiation-based, adaptable, and multi-mode warheads using enhanced lethality materials and miniaturization technologies for the advanced warhead kill mechanism. Fabricate and test a chemical and biological agent defeat warhead design to determine its ability to deny an adversary access to storage and production facilities containing chemical or biological weapons. Analyze improvements to multi-mode warheads using heavy metal liners to enhance lethality. Perform in-house experiments to characterize the interaction of munitions with chemical and biological containers.

(U) $32,362 Total

(U) FY 2003 ($ in Thousands)

(U) $6,507 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 providing weapons that can generate maximum lethality against a given target class. Develop new hydro-code to improve predictive warhead performance capabilities by adding metal cutting, detonation waves, shear banding, and phase transitions. Upgrade and refine basic models describing fragmentation effects against various target facilities, including weapons of mass destruction (WMD). Perform phenomenology tests to provide data for the development of lethality and vulnerability codes for ground-fixed WMD targets. Apply campaign analysis tools to compare inventory, budgeted, and conceptual munitions to identify high pay-off technologies.

(U) $5,206 Investigate and develop more efficient, affordable explosives including inert dense metal additives, tungsten-laden 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, less expensive explosive fills for inventory and future weapons. Utilize micro-scale and nano-scale fuel and oxidizer particles to create new, advanced, intermolecular energetic materials. Complete efforts to develop

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

a new class of materials for use in fragments, shaped charges, and explosively formed projectiles. Continue development of a highly energetic material with twice the power density of conventional explosives, but exhibiting insensitive munition attributes. Develop an explosive capable of surviving Mach eight impacts that still functions as desired when initiated by the fuze. Continue research of dense reactive metal explosives and investigate cost-effective methods to improve current explosives.

(U) $7,103 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 concepts. The 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. Develop a high resolution, electromagnetic countermeasure-hardened, active imaging fuze that calculates warhead burst direction and detonation time. Determine the benefits of developing a high speed, hard target fuze using sensors such as micro-electromechanical system gyroscopes. Investigate technologies that can communicate battle damage assessment information through hardened mediums.

(U) $10,657 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 explosives, 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. Investigate and compare the subsystem technologies necessary to develop an optimum kill missile against low-observable, air targets. Investigate technologies, such as microbots and nano-encapsulation, to disrupt, deny, destroy, or damage facilities containing chemical and biological weapons. Investigate technologies that can defeat hard and deeply buried targets by simultaneously placing multiple, precise, time-of-arrival guided munitions on target.

(U) $12,822 Investigate and develop advanced warhead kill mechanisms, like 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 and with a corresponding increase in strike aircraft load-out and sortie effectiveness. Continue to evaluate initiation-based, adaptable, and multi-mode warheads using enhanced lethality materials and miniaturization technologies for the advanced warhead kill mechanism. Begin evaluation of an ordnance package designed for low collateral damage with high near-field and minimum far-field lethality. Complete assessment of multi-mode warheads using heavy metal liners to enhance lethality. Complete in-house experiments to characterize the interaction of munitions with chemical and biological weapon and

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
02 - Applied Research	0602602F Conventional Munitions	2502

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

storage containers. Begin an effort to improve the attributes of penetrating munitions by focusing on improving warhead case survivability, control of depth of burial, trajectory control methodologies while penetrating hardened material, and decreasing case thickness to allow a greater amount of energetic material to be carried to required depth of target.

(U) $42,295 Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) PE 0603601F, Conventional Weapons Technology.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.