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

DATE: February 2003

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602602F Conventional Munitions

	COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	48,051	58,802	46,455	50,351	51,310	55,768	53,718	54,991	Continuing	TBD
2068	Advanced Guidance Technology	14,534	17,175	16,731	17,305	17,633	18,199	18,651	19,094	Continuing	TBD
2502	Ordnance Technology	33,517	41,627	29,724	33,046	33,677	37,569	35,067	35,897	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

(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. Note: In FY 2003, Congress added $1.1 million for the Defense Against Weapons of Mass Destruction (WMD).

(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 2002	FY 2003	FY 2004	Total Cost
(U)	Previous President's Budget	49,029	60,343	52,709	
(U)	Appropriated Value	49,270	61,443		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions	-241	-2,283		
	b. Small Business Innovative Research	-743			
	c. Omnibus or Other Above Threshold Reprogram		-358		
	d. Below Threshold Reprogram				

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

		FY 2002	FY 2003	FY 2004	Total Cost
	e. Rescissions	-235			
(U)	Adjustments to Budget Years Since FY 2003 PBR			-6,254	
(U)	Current Budget Submit/FY 2004 PBR	48,051	58,802	46,455	TBD

(U) Significant Program Changes:

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: February 2003
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602602F Conventional Munitions / PROJECT: 2068

COST ($ in Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
2068	Advanced Guidance Technology	14,534	17,175	16,731	17,305	17,633	18,199	18,651	19,094	Continuing	

(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 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $5,133 Investigated and developed 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 enabled the development of next generation seekers that will increase a weapon's kill probability, reduce pilot workload, and enhance sortie effectiveness. Developed software tools for the development of laser radar algorithms and created a database for both measured and synthetic laser radar information. Initiated development and ground test of a scanner-less laser radar system with simultaneous, multi-wavelength capabilities. In conjunction with the Defense Advance Research Project Agency, investigated and developed focal plane array architecture that is capable of flash (one shot) range imaging for application in laser radar seekers.

(U) $4,282 Investigated and developed advanced navigation and control technologies, including nonlinear controllers, biomimetic guidance, clutter rejection modules, detection and segmentation modules, and micro-electromechanical gyros for air-delivered munitions. These technologies allowed a more efficient flight path to the target, increased stand off ranges, and enhanced strike aircraft effectiveness and survivability. Designed and fabricated 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. Completed 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 ultra-high GPS jamming resistance and accuracy without the need for an anti-jam antenna.

(U) $2,484 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. These seekers deny an enemy the ability to hide or camouflage a target while also decreasing the pilot's workload. Developed an in-house, state-of-the-art signal and imaging processing capability used to assess

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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

current and future, single-mode, ultra-spectral, and multi-mode seeker concepts. Investigated and transitioned biomimetic principles of variable resolution sensors, which emulate biological or human characteristics, into advanced seeker components for moving target scenarios. Continued in-house activities including algorithms and simulation development and validation, statistical analysis of fixed, mobile targets and background data, and independent evaluation of target classification software, pattern recognition concepts, and seeker processing techniques to support design of autonomous munitions.

(U) $2,635 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 and their components that enabled requirement studies, design iteration and evaluation, and experiment risk reduction. These simulations shortened development time, reduced development cost, and provided more effective munitions. Continued 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. Developed hardware-in-the-loop, laser radar, and scene projector instrumentation. The instrumentation combined optical signals to produce a complex laser radar return signal capable of providing real-time scene generation capabilities to test seeker components. Developed six-degree-of-freedom simulations to provide detailed performance estimates of guidance-related component technology for guided weapon systems. Developed modular system level analysis tools to provide comprehensive comparisons amongst inventory, and conceptualized munitions to identify high payoff technologies and weapon attributes.

(U) $14,534 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $6,779 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 identification, aim-point selection, and weather penetration effectiveness. Develop a low-cost, synthetic aperture radar seeker to assess future advanced guidance applications.

(U) $4,921 Investigate and develop 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

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

will allow a more efficient flight path to the target, increase stand off 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 multi-discriminate rejection to defeat camouflage, concealment, and deception.

(U) $2,112 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 and transitioning biomimetic principles of variable resolution sensors, which emulate biological or human characteristics, into advanced seeker components for moving target scenarios. Investigate algorithms to perform flight trajectory shaping that reduces manning effects.

(U) $3,363 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 payoff technologies and weapon attributes.

(U) $17,175 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $6,471 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

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(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

will increase a weapon's kill probability, reduce the pilot's workload, and enhance sortie effectiveness. Demonstrate a laser ranging and detection seeker with the capability to perform 'single-shot' imaging technology. Begin design of a dual-mode seeker that uses both long and short-range electromagnetic wave energy to improve adverse weather performance with clearer resolution. Develop a low-cost, synthetic aperture radar seeker to assess future advanced guidance applications.

(U) $4,787 Investigate and develop advanced navigation and control technologies for air-delivered munitions. Example technologies 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, and enhance strike aircraft effectiveness and survivability. Investigate concepts for penetrator guidance below the surface. Develop new design technologies for tactical munitions flight control systems using the results of basic research. Develop novel ways to enhance weapon system effectiveness through higher levels of integration of guidance, navigation, control, and estimation algorithms. Continue to investigate the neuro-physiology of insects for applications to guidance.

(U) $1,747 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 for use in advanced seekers for moving target scenarios. Continue investigating and transitioning biomimetic principles of variable resolution sensors, which emulate biological or human characteristics, into advanced seeker components for moving target scenarios. Investigate algorithms to perform flight trajectory shaping that reduces human error design effects. Investigate polarization measurement to differentiate the properties of manmade materials from natural backgrounds.

(U) $3,726 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. 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 ranging and detection scene projector capability. Develop two-dimensional laser arrays for laser ranging and detection scene projectors. Provide detailed performance estimates of guidance-related component technology, using six-degree-of-freedom simulations, for guided weapon systems. To identify high payoff technologies and weapon attributes, continue to develop modular, system-level, analysis tools to provide comprehensive comparisons among inventory, planned, and conceptual munitions.

(U) $16,731 Total

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(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 2003
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602602F Conventional Munitions / PROJECT: 2502

COST ($ in Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
2502	Ordnance Technology	33,517	41,627	29,724	33,046	33,677	37,569	35,067	35,897	Continuing	

(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 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $6,006 Investigated and developed 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 by providing weapons that can generate maximum lethality against a given target class. Developed new hydro-code to improve predictive warhead performance capabilities by adding metal cutting, detonation waves, shear banding, and phase transitions. Developed a high fidelity model that predicts the dispersion of chemical and biological neutralizing agents from warheads. Upgraded and refined basic models describing fragmentation effects against various target facilities, including weapons of mass destruction (WMD). Performed phenomenology tests to provide data for the development of lethality and vulnerability codes for ground-fixed WMD targets.

(U) $3,155 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 enable safer, less expensive explosive fills for inventory and future weapons. Continued developing micro-scale and nano-scale fuel and oxidizer particles to create new, intermolecular energetic materials. In collaboration with the Department of Energy labs, completed efforts to develop a new class of materials for use in fragments, shaped charges, and explosively formed projectiles. Developed insensitive explosive formulations for use in penetrator warheads capable of Mach 4 impact velocities. Initiated development of a highly energetic material with twice the power density of conventional explosives, but exhibiting insensitive munition attributes. Evaluated intermolecular energetic material to measure mixing and fabrication techniques, material properties, and performance augmentations for specific applications. Initiated dense reactive metal explosive research to investigate cost-effective methods to improve current explosives.

(U) $6,258 Investigated and developed advanced fuze technologies for air-delivered munitions, such as commercially available micro-mechanical systems,

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

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. Developed test methodology to analyze hardened-influence-fuze components, and bench-level and field-shock testing of fuze components. Initiated critical component design and fabrication of the next generation burst-height fuze with discrimination against foliage, rain, chaff, electronic countermeasures, and electromagnetic interference. Developed technologies that communicate battle damage assessment through hardened mediums.

(U) $8,912 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 include high energy explosives, mass focus fragmentation, and multi-sensor fuzing. These technologies will increase weapon system effectiveness by contributing to increased weapon load-out on strike aircraft and enhanced sortie effectiveness. Developed advanced munition dispenser electronics and software, and investigated reduction of platform integration cost for the advanced carriage technology. Investigated alternate technologies, such as microbots and nano-encapsulation, to disrupt, deny, destroy, or damage facilities involved with chemical and biological weapons. Continued investigating technologies for defeating hard and deeply buried targets.

(U) $9,186 Investigated and developed advanced warhead kill mechanisms, such as the adaptable warhead, directional control and fragmenting ordnance, and application of reactive metals. The investigation included 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. Designed, fabricated, and evaluated initiation-based, adaptable, and multi-mode warheads using enhanced lethality materials and miniaturization technologies for the advanced warhead kill mechanism. Fabricated and tested 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. Analyzed improvements to multi-mode warheads using heavy metal liners to enhance lethality. Performed in-house experiments to characterize the interaction of munitions with chemical and biological containers.

(U) $33,517 Total

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(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 payoff 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 a new class of materials for use in fragments, shaped charges, and explosively formed projectiles. Continue development of a highly energetic material that has twice the power density of conventional explosives, while exhibiting insensitive munition attributes. Develop an explosive capable of surviving Mach 4 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)	$7,116	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)	$9,976	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, aerial

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

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, such as the 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 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 the required depth of target.

(U) $41,627 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $6,321 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. Upgrade and refine basic models describing fragmentation effects against various target facilities, including weapons of mass destruction. Apply campaign analysis tools to compare inventory, budgeted, and conceptual munitions to identify high payoff technologies. Complete development of improved engineering level predictive methods for blast effects, combined effects environment, and target structural response. Improve methodologies for predicting the penetration performance of unitary penetrating materials into complex target structures.

(U) $3,028 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. Continue

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(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

development of a highly energetic material that has twice the power density of conventional explosives, while still exhibiting insensitive munition attributes. Continue developing an explosive capable of surviving Mach 4 impacts that still functions as desired when initiated by the fuze. Develop characterization and evaluation methodologies to test the munition application performance of high energy density materials developed in other laboratories. Increase the energy output while maintaining the producible capability of cast and cure composite explosives by using advanced energetic materials, plasticizers techniques, and formulation techniques.

(U) $6,592 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. Develop a high resolution, electromagnetic countermeasure-hardened, active imaging fuze that calculates warhead burst direction and detonation time. Investigate technologies that can communicate battle damage assessment information through hardened mediums. Develop miniaturized fuze to effectively control the release of anti-agent and submunition for defeating weapons of mass destruction.

(U) $6,267 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. Continue investigating the subsystem technologies necessary to develop an optimum kill missile against low-observable, aerial targets. Investigate technologies that can defeat hard and deeply buried targets by simultaneously placing multiple, precise, time-of-arrival guided munitions on target. Perform concept trade studies to determine the technologies necessary to deny adversary operations over long, stand off ranges.

(U) $7,516 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 and with a corresponding increase in 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. Continue evaluation of an ordnance package designed for low collateral damage with high near-field and minimum far-field lethality. Develop the design constraints to provide adaptable warhead technologies to better attack mobile ground targets. Begin evaluating tungsten to be used for high-speed, penetrating-warhead case material. Continue an effort to

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(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

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 the required depth of target. Complete an effort to develop experimental data analysis techniques to characterize the dynamic response of metals used for warhead cases. Investigate effectiveness of large blast explosive mechanisms.

(U) $29,724 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.