

UNCLASSIFIED

PE NUMBER: 0602602F
PE TITLE: Conventional Munitions

Exhibit R-2, RDT&E Budget Item Justification

DATE

February 2005

BUDGET ACTIVITY

02 Applied Research

PE NUMBER AND TITLE

0602602F Conventional Munitions

| Cost (\$ in Millions) | FY 2004 Actual | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate | Cost to Complete | Total |
|-----------------------------------|-------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|-------|
| Total Program Element (PE) Cost | 45.312 | 51.790 | 58.058 | 60.210 | 58.011 | 58.262 | 58.164 | 58.145 | Continuing | TBD |
| 2068 Advanced Guidance Technology | 15.997 | 16.215 | 17.612 | 17.418 | 17.965 | 18.679 | 18.752 | 18.803 | Continuing | TBD |
| 2502 Ordnance Technology | 29.315 | 35.575 | 40.446 | 42.792 | 40.046 | 39.583 | 39.412 | 39.342 | Continuing | TBD |

Note: In FY 2006, funding increased to support added emphasis on Battlefield Air Operations efforts.

(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. 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 2004</u> | <u>FY 2005</u> | <u>FY 2006</u> | <u>FY 2007</u> |
|--------------------------------------|----------------|----------------|----------------|----------------|
| (U) Previous President's Budget | 46.061 | 52.251 | 50.260 | 54.704 |
| (U) Current PBR/President's Budget | 45.312 | 51.790 | 58.058 | 60.210 |
| (U) Total Adjustments | -0.749 | -0.461 | | |
| (U) Congressional Program Reductions | | | | |
| Congressional Rescissions | | -0.461 | | |
| Congressional Increases | | | | |
| Reprogrammings | | | | |
| SBIR/STTR Transfer | -0.749 | | | |

(U) **Significant Program Changes:**

Not Applicable.

C. Performance Metrics

(U) Under Development.

Exhibit R-2a, RDT&E Project Justification

DATE

February 2005

| BUDGET ACTIVITY | | | | | PE NUMBER AND TITLE | | | PROJECT NUMBER AND TITLE | | |
|-----------------------------------|-------------------|---------------------|---------------------|---------------------|--|---------------------|---------------------|--|---------------------|-------|
| 02 Applied Research | | | | | 0602602F Conventional Munitions | | | 2068 Advanced Guidance Technology | | |
| Cost (\$ in Millions) | FY 2004 Actual | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate | Cost to Complete | Total |
| 2068 Advanced Guidance Technology | 15.997 | 16.215 | 17.612 | 17.418 | 17.965 | 18.679 | 18.752 | 18.803 | Continuing | TBD |
| Quantity of RDT&E Articles | 0 | 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 2004</u> | <u>FY 2005</u> | <u>FY 2006</u> | <u>FY 2007</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. | 6.371 | 6.100 | 5.241 | 5.256 |
| (U) In FY 2004: Developed a low-cost, synthetic aperture radar seeker to assess future advanced guidance applications. Completed initial efforts to support demonstration of a laser ranging and detection seeker with the capability to perform 'single-shot' imaging technology. | | | | |
| (U) In FY 2005: Continue testing laser ranging and detection seeker with the capability to perform 'single-shot' imaging technology. Begin ground testing a low-cost, synthetic aperture radar seeker to assess future advanced guidance applications. Design of an optical seeker using multiple discriminates to improve performance against obscured or hidden targets. | | | | |
| (U) In FY 2006: Incorporate and test improved components in laser ranging and detection seekers with goal to provide "single-shot" imaging at useful ranges. Complete testing of a low-cost synthetic aperture radar seeker. Begin fabrication of an optical seeker that uses multi-discriminate signatures to improve targeting against obscured targets. Using ground test data, augment the shape signatures in the automatic target acquisition algorithms to add laser multi-discriminate signatures. | | | | |
| (U) In FY 2007: Continue improving and testing components in laser ranging seeker to provide "single-shot" imaging. Continue fabrication of an optical seeker that uses multi-discriminate signatures to improve targeting obscured targets. Using ground test data, continue augmenting the shape signatures in the automatic target acquisition algorithms to add laser multi-discriminate signatures. | | | | |
| (U) MAJOR THRUST: Investigate and develop advanced navigation and control technologies for | 4.008 | 4.060 | 4.971 | 5.100 |

Project 2068

R-1 Shopping List - Item No. 11-3 of 11-11

Exhibit R-2a (PE 0602602F)

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification

DATE

February 2005

BUDGET ACTIVITY

02 Applied Research

PE NUMBER AND TITLE

0602602F Conventional Munitions

PROJECT NUMBER AND TITLE

2068 Advanced Guidance Technology

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.

- (U) In FY 2004: Evaluated new design technologies for tactical munitions flight control systems. Developed novel ways to enhance weapon system effectiveness through higher levels of integration of guidance, navigation, control, and estimation algorithms. Further investigated the neuro-physiology of insects for applications to guidance. Investigated concepts for penetrator guidance below the ground surface.
- (U) In FY 2005: Complete developing new design technologies for tactical munitions flight control systems. Complete a modeling and simulation testbed for developing novel ways to enhance weapon system effectiveness through higher levels of integration of guidance, navigation, control, and estimation algorithms. Continue investigating the neuro-physiology of insects for applications to guidance. Complete investigating concepts for penetrator guidance below the ground surface.
- (U) In FY 2006: Initiate development of navigation and guidance techniques to autonomously guide cooperative robotic weapons without location information from GPS. Begin developing guidance techniques for small agile vehicles in close proximity to cluttered terrain. Continue investigating the neuro-physiology of insects for application to guidance, particularly engaging moving ground targets. Begin evaluating advanced navigation systems within GPS jamming environments.
- (U) In FY 2007: Continue developing navigation and guidance techniques to autonomously guide cooperative robotic weapons without location information from GPS. Continue developing small agile vehicle guidance to avoid obstacles. Continue applying the neuro-physiology of insects to guide small vehicles to moving targets in an urban-like environment. Continue evaluating navigation systems within GPS jamming environments.
- (U)
- (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.
- (U) In FY 2004: Enhanced development of highly innovative concepts and approaches in guidance and control to include advanced seekers for moving target scenarios. Using digital simulation and hardware-in-the-loop testing, transitioned biomimetic principles developed in basic research for variable resolution sensors that will emulate biological or human characteristics for use in advanced seeker components for moving target scenarios. Completed investigation of algorithms to perform flight trajectory shaping that reduces human error design effects. Initiated investigating polarization

1.892

2.250

2.900

2.762

Project 2068

R-1 Shopping List - Item No. 11-4 of 11-11

Exhibit R-2a (PE 0602602F)

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification

DATE

February 2005

BUDGET ACTIVITY

02 Applied Research

PE NUMBER AND TITLE

0602602F Conventional Munitions

PROJECT NUMBER AND TITLE

2068 Advanced Guidance Technology

measurement to differentiate the properties of manmade materials from natural backgrounds.

(U) In FY 2005: Continue transitioning biomimetic principles developed in basic research for variable resolution sensors that will emulate biological or human characteristics for use in advanced seeker components for moving target scenarios. Continue investigating polarization measurement to differentiate the properties of manmade materials from natural backgrounds. Develop an in-house capability to evaluate contractor-developed optic-flow algorithms.

(U) In FY 2006: Continue work in biomimetic principles by developing modular models to investigate particular target attributes. Continue investigating polarization techniques to develop model behavior theory. Continue in-house capability to evaluate contractor developed optic-flow algorithms.

(U) In FY 2007: Continue developing innovative approaches in guidance and control. Continue investigating particular target attributes using biomimetic principles. Continue developing polarization behavior theory models. Continue to evaluate contractor developed optic-flow algorithms.

(U)

| | | | | |
|--|-------|-------|-------|-------|
| (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. | 3.726 | 3.805 | 4.500 | 4.300 |
|--|-------|-------|-------|-------|

(U) In FY 2004: Furthered analysis efforts and multi-sensor modeling to improve target signature prediction models, expedite development, and reduced the acquisition cycle expense for state-of-the-art seekers. Investigated the long-term technology and strategy for developing an advanced laser ranging and detection scene projector capability. Developed two-dimensional laser arrays for laser ranging and detection scene projectors. Provided detailed performance estimates of guidance-related component technology, using six-degree-of-freedom simulations, for guided weapon systems. Enhanced modular, system-level, analysis tools to provide comprehensive comparisons among inventory, planned, and conceptual munitions to identify high payoff technologies and weapon attributes.

(U) In FY 2005: Complete 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. Continue development of simulation models and reusable end-system simulation tools. Develop a prototype waveform generator, meeting DoD simulator requirements, using a commercial synthesizer chip.

(U) In FY 2006: Complete development and establish a reusable, simulation architecture consisting of a set of reusable interoperable simulations to evaluate emerging munitions technologies. Complete developing an arbitrary waveform simulation using a commercial synthesizer chip. Improve existing

Project 2068

R-1 Shopping List - Item No. 11-5 of 11-11

Exhibit R-2a (PE 0602602F)

Exhibit R-2a, RDT&E Project Justification

DATE

February 2005

BUDGET ACTIVITY

02 Applied Research

PE NUMBER AND TITLE

0602602F Conventional Munitions

PROJECT NUMBER AND TITLE

2068 Advanced Guidance Technology

multi-spectral phenomenology models for synthetic scene generation.

- (U) In FY 2007: Continue refining the set of interoperable simulations, validating the reusable aspect, to evaluate emerging munitions technologies. Improve existing multi-spectral phenomenology models and evaluate in a synthetic scene environment. Develop a set of reusable modeling tools to allow munition simulations to be built from standardized components using standard commercial products.

(U) Total Cost 15.997 16.215 17.612 17.418

(U) **C. Other Program Funding Summary (\$ in Millions)**

| | <u>FY 2004</u> | <u>FY 2005</u> | <u>FY 2006</u> | <u>FY 2007</u> | <u>FY 2008</u> | <u>FY 2009</u> | <u>FY 2010</u> | <u>FY 2011</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>Estimate</u> | <u>Complete</u> | |

(U) Related Activities:

(U) PE 0603601F, Conventional Weapons Technology.

This project has been coordinated through the

(U) Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Acquisition Strategy**

Not Applicable.

Exhibit R-2a, RDT&E Project Justification

DATE

February 2005

| BUDGET ACTIVITY | | | | | PE NUMBER AND TITLE | | | PROJECT NUMBER AND TITLE | | |
|----------------------------|-------------------|---------------------|---------------------|---------------------|--|---------------------|---------------------|---------------------------------|---------------------|-------|
| 02 Applied Research | | | | | 0602602F Conventional Munitions | | | 2502 Ordnance Technology | | |
| Cost (\$ in Millions) | FY 2004 Actual | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate | Cost to Complete | Total |
| 2502 Ordnance Technology | 29.315 | 35.575 | 40.446 | 42.792 | 40.046 | 39.583 | 39.412 | 39.342 | Continuing | TBD |
| Quantity of RDT&E Articles | 0 | 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 2004</u> | <u>FY 2005</u> | <u>FY 2006</u> | <u>FY 2007</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. | 6.200 | 7.125 | 7.600 | 7.650 |
| (U) In FY 2004: Upgraded and refined basic models describing fragmentation effects against various target facilities, including weapons of mass destruction (WMD). Used campaign analysis tools to compare inventory, budgeted, and conceptual munitions to identify high payoff technologies. Developed improved engineering level predictive methods for blast effects, combined effects environment, and target structural response. Improved methodologies for predicting the penetration performance of unitary penetrating materials into complex target structures. | | | | |
| (U) In FY 2005: Complete upgrading and refining basic models illustrating fragmentation effects against various target facilities, including hardened facilities and WMD. Finish using campaign analysis tools to compare inventory, budgeted, and conceptual munitions to identify high payoff technologies. Continue developing improved engineering level predictive methods with a simplified finite element model that estimates the damage from collapse and instability caused by direct weapon strikes. Develop models to assess the failure of blast doors and other hardened assets in deep underground facilities. | | | | |
| (U) In FY 2006: Develop code enhancements to computer model for dynamic submunition dispensing of new weapon concepts. Continue developing a simplified finite element model to estimate damage to buildings caused by direct weapon effects. Improve methods for predicting the effects of munition detonations in embedded soil, concrete or rock. | | | | |
| (U) In FY 2007: Continue modeling damage to buildings caused by direct weapon effects. Continue improving methods for predicting damage caused by detonation of penetrating warheads in a variety of materials. Develop a model to predict the vulnerability of protected assets in deep underground facilities. | | | | |

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification

DATE

February 2005

| BUDGET ACTIVITY | | PE NUMBER AND TITLE | | PROJECT NUMBER AND TITLE | |
|----------------------------|---|--|-------|---------------------------------|-------|
| 02 Applied Research | | 0602602F Conventional Munitions | | 2502 Ordnance Technology | |
| (U) | | | | | |
| (U) | MAJOR THRUST: 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, more insensitive to unplanned stimuli, and less expensive explosive fills for inventory and future weapons. | 4.372 | 5.119 | 5.803 | 5.800 |
| (U) | In FY 2004: Developed a highly energetic material that has twice the power density of conventional explosives, while still exhibiting insensitive munition attributes. Developed an explosive capable of surviving Mach 4 impacts that still functions as desired when initiated by the fuze. Developed characterization and evaluation methodologies to test the munition application performance of high energy density materials developed in other laboratories. Initiated increasing the energy output, while maintaining the producible capability of cast and cure composite explosives by using advanced energetic materials, plasticizers, and formulation techniques. | | | | |
| (U) | In FY 2005: Continue developing a highly energetic material with twice the power density of conventional explosives by establishing experimental fragment threshold on-set velocities for a variety of new energetic candidates. Continue increasing the energy output, while maintaining the producibility of cast/cure Plastic Bonded Explosives (PBX), by using advanced energetic materials, plasticizers, and formulation techniques. Complete an effort to add dense metal powders to PBX to enhance near-field lethality when low collateral damage attributes are required. | | | | |
| (U) | In FY 2006: Continue developing highly energetic material with twice the power density of conventional by developing and validating new energetics ignition parameters. Demonstrate use of multi-functional material or nano energetic fills. Fabricate cast/cure PBX using advanced materials, plasticizers, and formulation techniques. | | | | |
| (U) | In FY 2007: Continue developing highly energetic material with twice the power density of conventional explosives by delivering a modeling and simulation capability for enhanced blast materials. Develop energetic liner technology to enhance blast output yet improve the insensitive munition attributes of the weapon system. Demonstrate performance of cast/cure PBX using advanced materials, plasticizers, and formulation techniques. | | | | |
| (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 | 6.240 | 6.705 | 7.300 | 7.300 |
| Project 2502 | | R-1 Shopping List - Item No. 11-8 of 11-11 | | Exhibit R-2a (PE 0602602F) | |

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification

DATE

February 2005

BUDGET ACTIVITY

02 Applied Research

PE NUMBER AND TITLE

0602602F Conventional Munitions

PROJECT NUMBER AND TITLE

2502 Ordnance Technology

requirements.

- (U) In FY 2004: Furthered development of a high resolution, electromagnetic countermeasure-hardened, active imaging fuze that calculates warhead burst direction and detonation time. Investigated technologies that communicate battle damage assessment information through hardened mediums. Developed miniaturized fuze to effectively control the release of submunition for defeating weapons of mass destruction.
- (U) In FY 2005: Continue developing a high resolution, electromagnetic countermeasure-hardened, active imaging fuze that calculates warhead burst direction and detonation time. Complete initial design of a miniaturized fuze to effectively control the release of anti-agent for defeating weapons of mass destruction. Begin developing a miniaturized fuze to provide safe and arm, burst point sensor and low power initiator in a four cubic inch package. Begin developing a wireless communication system to fuze a hard target munition.
- (U) In FY 2006: Demonstrate a high resolution, electromagnetic countermeasure-hardened, active imaging fuze that calculates warhead burst direction and detonation time. Continue developing a miniaturized fuze to provide safe and arm, burst point sensor and low power initiator in a four cubic inch package. Continue developing a wireless communication system to fuze a hard target munition. Begin to develop waveform agile fuze to defeat smart jamming devices.
- (U) In FY 2007: Continue developing a miniaturized fuze to provide safe and arm, burst point sensor and low power initiator in a four cubic inch package. Continue developing a wireless communication system to fuze a hard target munition. Continue to develop a waveform agile fuze to defeat smart jamming devices.
- (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 2006, funds are increased to support Battlefield Air Operations efforts.
- (U) In FY 2004: Expanded investigations of subsystem technologies necessary to develop an optimum kill missile against low-observable air targets. Performed concept trade studies to determine the technologies necessary to deny adversary operations over long, stand off ranges.
- (U) In FY 2005: Finish investigating specific missile subsystem technologies to counter low-observable air targets. Begin an effort to design and ground test precise time-of-arrival munitions. Begin to identify the critical technologies needed for an advanced next generation, low-cost miniature cruise missile. Begin developing technologies to deny enemy operations through loitering, persistent, low-cost multiple-shot

| | | | |
|-------|-------|--------|--------|
| 5.567 | 8.745 | 11.067 | 13.242 |
|-------|-------|--------|--------|

Project 2502

R-1 Shopping List - Item No. 11-9 of 11-11

Exhibit R-2a (PE 0602602F)

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification

DATE

February 2005

BUDGET ACTIVITY

02 Applied Research

PE NUMBER AND TITLE

0602602F Conventional Munitions

PROJECT NUMBER AND TITLE

2502 Ordnance Technology

munitions.

- (U) In FY 2006: Continue research to develop precise time-of-arrival munitions. Continue to identify critical technologies needed for an advanced next generation, low-cost miniature cruise missile. Continue investigating technologies to deny enemy operations through loitering, persistent, low-cost, multiple-shot munitions. Begin investigating application of nanotube-reinforced composites to reduce structural weight of weapons. Develop a miniaturized attack system to communicate target aim point position from behind enemy lines. Develop a covert video capability to collect and transmit data to coordinate attack of enemy targets.
- (U) In FY 2007: Complete precision time-of-arrival investigation to defeat tunnel blast doors. Continue investigating technologies for miniature cruise missile development. Finish the design studies for loitering, persistent, low-cost multiple-shot munitions. Finish the initial investigation of nanotube reinforced composites to reduce structural weight of weapons. Continue miniaturizing the attack system to communicate target aim point position from behind enemy lines. Continue to develop a covert video capability to collect and transmit data to coordinate attack of enemy targets.
- (U)
- (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.
- (U) In FY 2004: Evaluated initiation-based, adaptable, and multi-mode warheads using enhanced lethality materials and miniaturization technologies for the advanced warhead kill mechanism. Advanced evaluations of an ordnance package designed for low collateral damage with high near-field and minimum far-field lethality. Improved 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. Completed preliminary evaluation of tungsten to be used for high-speed, penetrating-warhead case material. Developed the design constraints to provide adaptable warhead technologies to better attack mobile ground targets. Developed experimental data analysis techniques to characterize the dynamic response of metals used for warhead cases. Investigated effectiveness of large blast explosive mechanisms.
- (U) In FY 2005: Continue evaluating an ordnance package designed for low collateral damage with high near-field and minimum far-field lethality. Complete evaluation of low collateral damage, multi-mode

| | | | |
|-------|-------|-------|-------|
| 6.936 | 7.881 | 8.676 | 8.800 |
|-------|-------|-------|-------|

Project 2502

R-1 Shopping List - Item No. 11-10 of 11-11

Exhibit R-2a (PE 0602602F)

Exhibit R-2a, RDT&E Project Justification

DATE

February 2005

BUDGET ACTIVITY

02 Applied Research

PE NUMBER AND TITLE

0602602F Conventional Munitions

PROJECT NUMBER AND TITLE

2502 Ordnance Technology

warheads. Continue in-house effort to improve penetrating warhead case survivability, depth of burial, and trajectory control, with lower case thickness. Continue evaluating tungsten for high-speed penetrating weapons. Evaluate high energetic materials for adaptable warheads to attack mobile ground targets.

- (U) In FY 2006: Demonstrate an ordnance package designed for low collateral damage and minimum far-field lethality. Complete in-house effort to improve penetrating warhead case survivability, depth of burial, and trajectory control with lower case thickness. Continue evaluating tungsten for high-speed penetrating weapons. Begin an effort to develop focusing kill mechanisms for dual role, dual range missiles. Begin to investigate micro damage technologies to neutralize electronics with small robotic weapons.
- (U) In FY 2007: Continue evaluating tungsten for high-speed penetrating weapons. Continue an effort to develop focusing kill mechanisms for dual role, dual range missiles. Continue investigating micro damage technologies to neutralize electronics with small robotic weapons.

(U) Total Cost 29.315 35.575 40.446 42.792

(U) **C. Other Program Funding Summary (\$ in Millions)**

| | <u>FY 2004</u> | <u>FY 2005</u> | <u>FY 2006</u> | <u>FY 2007</u> | <u>FY 2008</u> | <u>FY 2009</u> | <u>FY 2010</u> | <u>FY 2011</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>Estimate</u> | <u>Complete</u> | |

- (U) Related Activities:
PE 0603601F, Conventional
(U) Weapons Technology.
This project has been
coordinated through the
(U) Reliance process to
harmonize efforts and
eliminate duplication.

(U) **D. Acquisition Strategy**

Not Applicable.

UNCLASSIFIED

PE NUMBER: 0602605F

PE TITLE: DIRECTED ENERGY TECHNOLOGY

Exhibit R-2, RDT&E Budget Item Justification

DATE

February 2005

BUDGET ACTIVITY

02 Applied Research

PE NUMBER AND TITLE

0602605F DIRECTED ENERGY TECHNOLOGY

| Cost (\$ in Millions) | FY 2004 Actual | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate | Cost to Complete | Total |
|---|-------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|-------|
| Total Program Element (PE) Cost | 40.827 | 43.594 | 37.709 | 42.602 | 40.830 | 41.252 | 41.591 | 41.934 | Continuing | TBD |
| 4866 Lasers & Imaging Technology | 26.725 | 28.215 | 22.737 | 25.642 | 24.701 | 24.857 | 25.061 | 25.272 | Continuing | TBD |
| 4867 Advanced Weapons & Survivability Technology | 14.102 | 15.379 | 14.972 | 16.960 | 16.129 | 16.395 | 16.530 | 16.662 | Continuing | TBD |

(U) **A. Mission Description and Budget Item Justification**

This program covers research in directed energy technologies, primarily lasers and high power microwaves, that are not space unique. In lasers, this includes moderate to high power lasers (solid state and chemical) and associated optical components and techniques. In advanced weapons, this program examines technologies such as narrowband and wideband high power microwave devices and antennas. Both areas also provide vulnerability/lethality assessments of representative systems. Note: In FY 2005 Congress added \$2.5 million for Adaptive Optics Lasercom, and \$5.0 million for Ultra Short Pulse Laser Technology Development.

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 2004</u> | <u>FY 2005</u> | <u>FY 2006</u> | <u>FY 2007</u> |
|--------------------------------------|----------------|----------------|----------------|----------------|
| (U) Previous President's Budget | 42.077 | 36.532 | 38.540 | 44.413 |
| (U) Current PBR/President's Budget | 40.827 | 43.594 | 37.709 | 42.602 |
| (U) Total Adjustments | -1.250 | 7.062 | | |
| (U) Congressional Program Reductions | | | | |
| Congressional Rescissions | | -0.438 | | |
| Congressional Increases | | 7.500 | | |
| Reprogrammings | | | | |
| SBIR/STTR Transfer | -1.250 | | | |

(U) **Significant Program Changes:**

Not Applicable.

C. Performance Metrics

Under Development.