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

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602602F Conventional Munitions

	COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	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	36,466	52,734	49,270	49,798	50,900	51,142	52,532	53,964	Continuing	TBD
2068	Advanced Guidance Technology	12,764	0	16,749	17,566	17,778	18,374	18,837	19,526	Continuing	TBD
2502	Ordnance Technology	23,702	52,734	32,521	32,232	33,122	32,768	33,695	34,438	Continuing	TBD
	Quantity of RDT&E Articles	0	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. FY 2003 - FY 2007 budget numbers do not reflect the DoD strategy review results.

(U) A. Mission Description

The Conventional Munitions 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, munition integration, and weapon lethality and vulnerability assessments. Note: In FY 2001, Congress added $8.0 million for MicroSat Technology (XSS-10). Program Element 0603401F, Advanced Spacecraft Technology was the more appropriate Program Element for this effort.

(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 2000	FY 2001	FY 2002	Total Cost
(U)	Previous President's Budget (FY 2001 PBR)	37,892	45,223	45,350	
(U)	Appropriated Value	38,205	53,223		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions	-61			
	b. Small Business Innovative Research	-901			

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

		FY 2000	FY 2001	FY 2002	Total Cost
	c. Omnibus or Other Above Threshold Reprogram				
	d. Below Threshold Reprogram	-502			
	e. Rescissions	-275	-489		
(U)	Adjustments to Budget Years Since FY 2001 PBR			3,920	
(U)	Current Budget Submit/FY 2002 PBR	36,466	52,734	49,270	TBD

(U) Significant Program Changes:

Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

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

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602602F Conventional Munitions

PROJECT: 2068

COST ($ in Thousands)		FY 2000 Actual	FY 2001 Estimate	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	12,764	0	16,749	17,566	17,778	18,374	18,837	19,526	Continuing	TBD

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

The Advanced Guidance Technology project investigates, develops, and evaluates conventional munition 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 2000 ($ in Thousands)

(U) $4,067 Investigated and developed advanced component technology for low-cost precision adverse-weather autonomous seekers that will allow increased standoff launch ranges, reduced pilot workload, and improved aerospace vehicle survivability.

(U) $4,611 Investigated and developed advanced navigation and control technologies for current and future munitions that will decrease pilot workload and increase survivability.

(U) $2,076 Investigated and developed advanced optical and digital processors and advanced target detection, classification, and identification algorithms for autonomous seekers. These seekers will provide the basis for smart autonomous weapons that will decrease pilot workload and increase survivability.

(U) $2,010 Investigated and developed detailed six-degree-of-freedom and hardware-in-the-loop simulations and models for the analysis of guided munitions and their components to enable requirement studies, design iteration/evaluation, and experiment risk reduction. These advanced simulations will shorten development time, reduce development cost, and, provide more effective munitions that will reduce cost per kill.

(U) $12,764 Total

(U) FY 2001 ($ in Thousands)

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

(U) $0 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE June 2001
BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions
PROJECT 2068	

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U) $5,733 Investigate and develop advanced guidance component technologies 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 (LADAR) algorithms and create a database for both measured and synthetic LADAR information. Initiate development and ground test of a scanner-less LADAR 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 LADAR seekers.

(U) $4,782 Investigate and develop advanced navigation and control technologies 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 development of a miniature navigation system, based on micro-electro mechanical system technology, that 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) $3,177 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/validation, statistical analysis of fixed/mobile targets/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 and models to analyze guided munitions and their components that will enable requirements 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 LADAR scene projector instrumentation. The instrumentation will combine optical signals to produce a complex LADAR 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.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE June 2001
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
(U) $16,749 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.

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

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602602F Conventional Munitions

PROJECT: 2502

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	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	23,702	52,734	32,521	32,232	33,122	32,768	33,695	34,438	Continuing	TBD

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

The Ordnance Technology 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. Note: In FY 2001, Congress added $8.0 million for MicroSat Technology (XSS-10). Program Element 0603401F, Advanced Spacecraft Technology was the more appropriate Program Element for this effort.

(U) FY 2000 ($ in Thousands)

(U)	$5,625	Investigated and developed high fidelity analytical tools such as computational mechanics models for predicting weapon's 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.
(U)	$2,452	Investigated and developed more affordable explosives that provide both higher blast performance and lower ignition sensitivity for air-delivered munitions. This technology will allow the Air Force and Navy to develop safer and less expensive explosive fills for inventory and future weapons.
(U)	$5,417	Investigated and developed advanced fuze and safe/arm technologies for air-delivered munitions to enhance lethality through precise selection of burst-height either at, above, or below the surface. These technologies will increase weapon safety and tactical performance while simultaneously decreasing procurement costs and system supportability requirements.
(U)	$4,603	Investigated and developed advanced air-delivered munition control and carriage technologies for ordnance packages in order to enhance weapon lethality. These technologies will contribute to increased weapon load-out on strike aircraft and increased sortie effectiveness.
(U)	$5,605	Investigated and developed advanced warhead kill mechanisms to enhance air-delivered munition lethality. These advanced kill mechanisms allow a smaller warhead to have the effectiveness of a larger one, thereby enabling the development of smaller munitions with corresponding increases in strike aircraft load-out and sortie effectiveness.
(U)	$23,702	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: June 2001
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602602F Conventional Munitions	PROJECT: 2502

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands)

(U) $6,736 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 warhead development time and cost, thereby providing more effective munitions to the Air Force. Investigate demilitarization concepts for the 1000-pound unitary, general-purpose bomb. Develop a high-level model, including models of geological structures, involved in predicting penetrator performance against hard targets. Investigate innovative kill mechanisms for defeating weapons of mass destruction. Transition selected high fidelity analytical tools to weapon designers in the DoD and industry.

(U) $3,316 Investigate and develop more efficient affordable explosives that provide both higher blast performance and lower ignition sensitivity for air-delivered munitions. This technology will enable the Air Force and Navy to develop safer, less expensive explosive fills for inventory and future weapons. Complete warhead testing and evaluation of the reformulated MNX-221 explosive to verify improved density and reduced ignition sensitivity. Continue development of a new class of energetic materials based on nano-scale and microscale particles, with initial emphasis on improving handling safety. Initiate development of innovative explosives technologies that allow concentration of the explosive effects on the target, thereby reducing potential collateral damage.

(U) $5,343 Investigate and develop advanced fuze, including safe and arm, technologies for air-delivered munitions. The advanced fuze technologies enhance lethality through precise selection of burst-height either at, above, or below the surface to increase weapon safety and tactical performance while simultaneously decreasing procurement costs and system supportability requirements. Investigate micro-electro mechanical system technology concepts for safe and arm components and fuze accelerometers. Develop a low-threshold energy, shock-hardened detector for multi-event, hard target fuze capable of 4000 feet per second impacts. Initiate testing of the multi-event hard target fuze.

(U) $5,317 Investigate and develop advanced air-delivered munition control and carriage technologies for ordnance packages in order to enhance weapon lethality. These technologies will contribute to increased weapon load-out on strike aircraft and increased sortie effectiveness. Design, fabricate, and test submunitions for survivability during high mach number dispensing. Begin ground testing of technologies that will enable the development of a fast reaction weapon to engage and destroy time-critical targets. Investigate the communication architectures to determine if they can be utilized to improve munitions planning, performance, and deployment.

(U) $7,118 Investigate and develop advanced warhead kill mechanisms to enhance air-delivered munition lethality and enable the development of smaller munitions, with effectiveness similar to current inventory weapons, which would result in a corresponding increase in strike aircraft load-out and sortie effectiveness. Perform 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. Continue testing and characterizing the effectiveness of tantalum warheads against targets that simulate the full spectrum of ground mobile threats. Complete 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. Complete research on explosive compressor generators as novel, non-lethal kill mechanisms.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE June 2001
BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions
PROJECT 2502	

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

(U)	$5,020	Investigate and develop advanced component technologies 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. Design and fabricate the subsystems for a gimbal-less laser radar sensor with total electronic scanning. Develop and validate advanced algorithms that identify mobile targets using their unique external components, such as guns or antenna.
(U)	$6,331	Investigate and develop advanced navigation and control technologies for air-delivered munitions. These technologies will allow a more efficient flight path to the target and increase standoff ranges, enhancing strike aircraft effectiveness and survivability. Investigate guidance and control technologies that may provide significantly enhanced capability to locate and engage a moving or partially hidden target. Develop a low-cost, multi-sensor navigation device using micro-electro mechanical system technology that can meet tactical grade performance in a low cost package. Fabricate brassboard components and begin integration of the brassboard intended for field testing for the multi-sensor navigation device. Combine brassboard components of advanced Global Positioning System to begin laboratory bench tests for the multi-sensor navigation device.
(U)	$2,992	Investigate and develop advanced optical and digital processors and target detection/classification/identification algorithms for improved seeker performance to allow greater air-delivered weapon autonomy. The advanced seekers will further deny an enemy's ability to hide or camouflage a target while decreasing the pilot's workload. Complete the phenomenology studies required validating the performance enhancements to be realized with a dual-mode, millimeter wave and infrared seeker. Develop the analytical tools required to enhance the development, test, and analysis of advanced seekers and target detection and identification processors. Investigate optical processing and components technologies that increase sensor field-of-view, tracking rates, and target resolution for the dual-mode seeker.
(U)	$2,561	Investigate and develop detailed six-degree-of-freedom and hardware-in-the-loop simulations and models to analyze guided munitions or their components to enable requirements studies, design iteration and evaluation, and experiment risk reduction. These advanced simulations will reduce development cost and time, and provide more effective munitions. Develop tactical scene generation capability to produce re-useable, government-owned acquisition and targeting software algorithms for guided munition seekers. Complete the analysis of air-to-surface terminal fuzing. Develop in-house personal computer-based simulations for analysis of advanced weapon concepts.
(U)	$8,000	Develop microsatellite (10-100 kg) technologies, combine sub-system technologies, and launch 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 is not the correct Program Element for this effort and current plans are to transfer these funds to PE 0603401F, Advanced Spacecraft Technology, for execution).
(U)	$52,734	Total

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

(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) $3,477 Investigate and develop more efficient, affordable explosives that provide both higher blast performance and lower ignition sensitivity for air-delivered munitions. This technology will enable the Air Force and Navy to develop safer, less expensive explosive fills for inventory and future weapons. Utilize 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. Complete development of 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's research to investigate cost effective methods to improve current explosives.

(U) $6,258 Investigate and develop advanced fuze, including safe and arm, technologies for air-delivered munitions. 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, field-shock testing of fuze components. Initiate critical component design and brassboard fabrication for the next generation burst-height fuze with discrimination against foliage, rain, chaff, electronic countermeasures, and electromagnetic interference. Investigate technologies with potential for allowing the reporting of battle damage assessment through hardened mediums.

(U) $7,394 Investigate and develop advanced air-delivered munition control and carriage technologies for ordnance packages to enhance weapon lethality. These 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. Increase emphasis on defeating hard and deeply buried targets.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE June 2001

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

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U) $9,186 Investigate and develop advanced warhead kill mechanisms 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 working agent defeat warhead design to determine its ability to deny an adversary access to a facility 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) $32,521 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.