PE NUMBER: 0602602F PE TITLE: Conventional Munitions

	Exhil	bit R-2, RDT	&E Budge	t Item Just	ification			DATE	February	2004
BUDG 02 A	GET ACTIVITY pplied Research			PI 0	E NUMBER AND 602602F Con	TITLE	initions			
	Cost (\$ in Millions)	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Cost to	Total
	Cost (\$ III WIIIIolis)	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Complete	
	Total Program Element (PE) Cost	62.802	46.061	52.251	50.260	54.704	52.684	53.998	0.000	0.000
2068	Advanced Guidance Technology	16.905	16.589	16.359	16.454	16.960	17.366	17.717	0.000	0.000
2502	2 Ordnance Technology	45.897	29.472	35.892	33.806	37.744	35.318	36.281	0.000	0.000
(U)	A. Mission Description and Budget Iter This program investigates, develops, and air-launched munitions. The program inc detection and identification algorithms, an munitions integration, and weapon lethali	n Justification establishes the t cludes two project and simulation as ty and vulnerabl	echnical feasib cts: (1) develop sessments; and ility assessmen	ility and milita oment of advand (2) developme ts.	ry utility of adv ced guidance to ent of conventio	vanced guidanc echnologies, inc onal ordnance to	e and ordnance cluding seekers echnologies, in	technologies f , navigation an cluding warhea	or conventiona d control, targe ids, fuzes, expl	l t osives,
(U)	B. Program Change Summary (\$ in Mi	<u>llions)</u>					EV 2002		2004	EV 2005
	Duravious Durasidant's Dudgat						<u>FY 2003</u>	<u>FY</u>	<u>2004</u>	<u>FY 2005</u> 50 251
(\mathbf{U})	Current DPD/Dresident's Pudget						50.002	40	.433	52 251
(0)	Total Adjustments						4 000	40	30/	52.251
	Congressional Program Reductions						4.000	-0		
(0)	Congressional Rescissions							-0	394	
	Congressional Increases							-		
	Reprogrammings						4.000			
	SBIR/STTR Transfer									
(U)	Significant Program Changes:									
	Not Applicable.									
			R-1 Sh	opping List - Item	n No. 11-1 of 11-	9			Exhibit R-2 (I	PE 0602602F)

	ExI	hibit R-2a, F	RDT&E Pro	ject Justifi	cation			DATE	February	2004
BUDG 02 A	BET ACTIVITY pplied Research			PI 0	E NUMBER AND	TITLE	unitions	PROJECT NUM 2068 Advanc	BER AND TITLE	Technology
	Cost (\$ in Millions)	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Cost to	Total
20.69		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Complete	0.000
2068	Ouantity of RDT&E Articles	16.905	16.589	16.359	16.454	16.960	17.300	17.717	0.000	0.000
(U)	<u>A. Mission Description and Budget Iter</u> This project investigates, develops, and en project includes development of advanced simulations. Project payoffs include: adv survivability; improved reliability and aff	n Justification valuates conven l guidance inclu erse-weather an ordability; and i	tional munitior iding terminal s d autonomous improved survi	ns advanced gui seekers, navigat precision guida vability and eff	idance technolo tion and contro ance capability; fectiveness of c	ogies to establis l, signal and pr increased num onventional we	sh technical fe ocessing algor iber of kills pe eapons.	asibility and mi ithms, and guic r sortie; increas	litary utility. T lance and contr ed aerospace vo	his ol ehicle
(U) (U)	B. Accomplishments/Planned Program (MAJOR THRUST: Investigate and develo autonomous seekers for air-delivered muni pre-processing, target recognition, spatial t technologies. These technologies will enal weapon's kill probability, reduce pilot wor	\$ in Millions) op advanced gui tions, such as d arget characteri ble the developi kload, and enha	dance compon- etectors and de stics, optics, ar nent of next ge nce sortie effec	ent technologie stector arrays, re ad low-cost bea eneration seeker ctiveness.	s for adverse w eceiver electror m scanning and rs that will incr	reather, and hics, signal d shaping ease a	FY	<u>7 2003</u> 6.779	<u>FY 2004</u> 6.471	<u>FY 2005</u> 6.100
(U)	In FY 2003: Tested in-house, high-through ranging and detection seeker components the selection, and weather penetration effective advanced guidance applications.	hput, parallel pr o quantify opera eness. Designed	ocessing target ational range, t d a low-cost, sy	t acquisition alg arget detection ynthetic apertur	gorithms. Evalu and identification e radar seeker t	uated laser ion, aim-point to assess future				
(U)	In FY 2004: Develop a low-cost, synthetic Initiate demonstration of a laser ranging an technology.	c aperture radar ad detection seel	seeker to asses ker with the caj	s future advanc pability to perfo	ed guidance ap orm 'single-sho	plications. t' imaging				
(U)	In FY 2005: Continue testing laser ranging technology. Begin ground testing a low-co applications. Initiate design of an optical s obscured or hidden targets.	g and detection ost, synthetic ap seeker using mu	seeker with the erture radar see ltiple discrimin	e capability to p eker to assess fu nates to improve	erform 'single- uture advanced e performance a	shot' imaging guidance against				
(U)	C									
(U)	MAJOR THRUST: Investigate and develor to include nonlinear controllers, biomimeti and micro-electromechanical gyros. These stand off ranges, and enhance strike aircraft	op advanced nav c guidance, clut e technologies w ft effectiveness	vigation and co tter rejection m vill allow a mor and survivabili	ntrol technolog odules, detection re efficient flight ty.	ies for air-deliv on and segment nt path to target	vered munitions ation modules, t, increase	5	4.758	4.500	4.204
(U)	In FY 2003: Completed laboratory field-te	esting of a reliab	ole, accurate, m	iniaturized, and	d low-cost anti-	jam weapon				
Proi	ect 2068	giny dynamic n	R-1 St	nopping List - Iten	n No. 11-2 of 11-	9			Exhibit R-2a (PE 0602602F)
				222)					/

	Exhibit R-2a, RDT&E Project Justif	ication	DATE	February	2004
BUD 02	OGET ACTIVITY F Applied Research (PE NUMBER AND TITLE D602602F Conventional Munitions	PROJECT NUM 2068 Advan	BER AND TITLE ced Guidance	Technology
(U)	System jamming devices. Designed new technologies for tactical munitions flight cont development of novel ways to enhance weapon system effectiveness through higher lev navigation, control, and estimation algorithms. Investigated neuro-physiology of insect Investigated clutter and multi-discriminate rejection to defeat camouflage, concealment In FY 2004: Continue evaluating new design technologies for tactical munitions flight developing novel ways to enhance weapon system effectiveness through higher levels of navigation, control, and estimation algorithms. Continue investigating the neuro-physic applications to guidance. Investigate concepts for penetrator guidance below the groun	rol systems. Advanced rels of integration of guidance, as for applications to guidance. , and deception. control systems. Continue of integration of guidance, blogy of insects for d.			
(U)	In FY 2005: Continue developing new design technologies for tactical munitions flight modeling and simulation testbed for developing novel ways to enhance weapon system levels of integration of guidance, navigation, control, and estimation algorithms. Conti- neuro-physiology of insects for applications to guidance. Continue investigating conce- below the ground.	control systems. Complete a effectiveness through higher nue investigating the pts for penetrator guidance			
(U) (U)	MAJOR THRUST: Investigate and develop advanced optical and digital processors an classification, and identification algorithms for improved seeker performance to allow g autonomy. These seekers will deny an enemy the ability to hide or camouflage a target pilot's workload.	d target detection, greater air-delivered weapon while also decreasing the	2.005	1.892	2.250
(U)	In FY 2003: Evaluated highly innovative concepts and approaches in guidance and cor principles and concepts, including foveal vision and neuromorphic imaging systems, fo moving target scenarios. Investigated algorithms to perform flight trajectory shaping th	trol. Investigated biomimetic r use in advanced seekers for at reduce human workload.			
(U) (U)	In FY 2004: Enhance development of highly innovative concepts and approaches in guadvanced seekers for moving target scenarios. Using digital simulation and hardware in biomimetic principles developed by the Air Force Office for Scientific Research for van These sensors will emulate biological or human characteristics for use in advanced seek target scenarios. Complete investigation of algorithms to perform flight trajectory shap design effects. Initiate investigating polarization measurement to differentiate the properties and approaches in guidant transitioning biomimetic principles developed by the Air Force Office for Scientific Research for van These sensors. These sensors will emulate biological or human characteristics for use in advanced seek target scenarios. Continue developing highly innovative concepts and approaches in guidant transitioning biomimetic principles developed by the Air Force Office for Scientific Research for use in advanced seeks sensors. These sensors will emulate biological or human characteristics for use in advanced moving target scenarios. Continue investigating polarization measurement to different manmade materials from natural backgrounds. Develop an in-house capability to evaluate biological or human characteristics for use in advanced moving target scenarios.	idance and control to include in the loop testing, transition riable resolution sensors. ter components for moving ing that reduces human error erties of manmade materials nee and control. Continue search for variable resolution nced seeker components for tiate the properties of ate contractor-developed			
(U)	optic-flow algorithms.				
Pr	oject 2068 R-1 Shopping List - Ite	m No. 11-3 of 11-9		Exhibit R-2a (P	PE 0602602F)

BUDGET ACTIVITY PE NUMBER AND TITLE PROJECT NUMBER AND TITLE 022 Applied Research 0602602F Conventional Munitions 3.363 3.726 3.805 including synthetic aperture radar, automatic target recognition, and biomimetic processing. Technologies also include rejectory optimization algorithm and polarization sensing and models to analyze guided munitions. 3.363 3.726 3.805 (1) MATOR THRUST: Investigate and develop detailed six-degree-of-freedom and hardware-in-the-loop simulations include trajectory optimization algorithm and polarization sensing and models to analyze guided munitions. 3.363 3.726 3.805 (1) In FY 2003: Analyzed efforts and multi-sensor modeling to improve target signature reflection models, expedite development, and reduce the acquisition cycle expense for state-of-the-ant seekers. Investigated the long-term technology and strategy for developing an advanced laser radar scene projector. Provide de child evelopment to provide comprehensive comparisons among inventory, planned, and conceptual munitions to identify high pay-off technologies and weapon attributes. (1) In FY 2003: Continue analysis forts and multi-sensor modeling to improve target signature prediction models, expedite development, and reduce the acquisition cycle expense for state-of-the-ant seekers. Complete investigating the long-term technology and strategy for developing and advanced laser ranging and detection scene projectors. Complete providing detailed performance estimates of guidance-related component technology, using six-degree-of-freedom simulations, for guidade weapon systems. Continue developing motal tark, system-ievel, analysis to lot provide c			Exhibit R-	2a, RDT&E	Project Jus	stification			DATE	February	2004
(1) MAOR THRUST: Investigate and develop detailed six-degree-of-freedom and hardware-in-the-loop simulations 3.63 3.726 3.805 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 its, refauce development cores, and provide more effective munitions. 3.63 3.726 3.805 (1) In FY 2003: Analyzed efforts and multi-sensor modeling to improve target signature prediction models, expedite development, and reduce to acquisition cycle expense for state-off-near texckers. Investigated the long-term technology and strategy for developing an advanced laser radar scene projector. Provide detailed performance estimates of guidance-related component technologies and weapon attributes. 10 In FY 2004: Continue analysis efforts and multi-sensor modeling to improve target signature prediction models, expedite development, and reduce the acquisition cycle expense for state-off-near target provide competensive comparisons among inventory, planned, and conceptual munitions to identify high pay-off technologies and warkened laser ranging and detection scene projector. Complete providing detailed performance estimates of guidance-related component technology, using six-degree-of-freedom signific development to edveloping and advanced laser ranging and detection scene projectors. Complete providing detailed performance estimates of guidance-related component technology, using six-degree-of-freedom signific development to edveloping methalic, system -level, analysis tools to provide competensive comparisons among inventory, planned, and conceptual munitions to identify high pay-off technologies and ways and forms gr	BUD 02 A	GET ACTIVITY Applied Research				PE NUMBER A 0602602F C	AND TITLE	unitions	PROJECT NUM 2068 Advand	BER AND TITLE	e Technology
(U) In FY 2003: Analyzed 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. Investigated the long-term technology and strategy for developing an advanced laser radar scene projector. 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 development to provide comprehensive comparisons among investigated development, and reduce the acquisition cycle expense for state-of-the-art seekers. Complete investigating the long-term technology and strategy for developing an advanced laser ranging and detection scene projector. capability. Complete developing two-dimensional laser arrays for laser ranging and detection scene projectors. Complete providing detailed performance estimates of guidance-related component technology, using six-degree-of-freedom simulations, for guided weapon systems. Continue developing modular, system-level, analysis tools to provide comprehensive comparisons among inventory, planned, and conceptual munitions to identify high pay-off technologies and weapon attributes. (U) In FY 2005: 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. Continue development of simulation model, reusable end system simulation tools. Develop a protype waveform generator, meeting DoD simulation model, reusable and vegine approtapte seare seekers. Continue development of si	(U)	MAJOR THRUST: Investigate and including synthetic aperture radar, a include trajectory optimization algo components that will enable require These simulations will shorten deve	d develop detailed automatic target r prithm and polariz ement studies, des elopment time, re	l six-degree-of- ecognition, and zation sensing a sign iteration ar duce developm	freedom and har l biomimetic pro and models to an ad evaluation, an ent costs, and pr	dware-in-the-lo cessing. Techno alyze guided mu d experiment ris ovide more effe	op simulations ologies also initions and their sk reduction. ctive munitions.		3.363	3.726	3.805
 (U) In FY 2004: 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. Complete investigating the long-term technology and strategy for developing an advanced laser ranging and detection scene projector capability. Complete developing two-dimensional laser arrays for laser ranging and detection scene projector. Complete providing detailed performance estimates of guidance-related component technology, using six-degree-of-freedom simulations, for guided weapon systems. Continue developing modular, system-level, analysis tools to provide comprehensive comparisons among inventory, planned, and conceptual munitions to identify high pay-off technologies and weapon attributes. (U) In FY 2005: 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. Continue development of simulation model, reusable end system simulation tools. Develop a prototype waveform generator, meeting DoD simulator requirements, using a commercial synthesizer chip. (U) Total Cost 16.589 16.589 16.589 16.359 (U) Related Activities: <u>FY 2003</u> <u>FY 2004</u> <u>FY 2005</u> <u>FY 2008</u> <u>FY 2009</u> <u>Cost to Complete</u> Total Cost <u>16.905</u> <u>16.589</u> <u>16.589</u> <u>16.589</u> <u>16.589</u> <u>16.359</u> <u>16.3</u>	(U)	In FY 2003: Analyzed efforts and r development, and reduce the acquis technology and strategy for develop estimates of guidance-related comp systems. Enhanced modular, syster inventory, planned, and conceptual	multi-sensor mod sition cycle exper- bing an advanced onent technology n-level, analysis munitions to iden	leling to improv use for state-of- laser radar scent v, using six-deg tools developm ntify high pay-o	ve target signatur the-art seekers. ne projector. Pro ree-of-freedom s tent to provide co off technologies	e prediction mo Investigated the ovided detailed p imulations, for omprehensive co and weapon attr	dels, expedite long-term performance guided weapon omparisons among ibutes.	9 5			
 (U) In FY 2005: 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. Continue development of simulation model, reusable end system simulation tools. Develop a prototype waveform generator, meeting DoD simulator requirements, using a commercial synthesizer chip. (U) Total Cost (U) Total Cost (I) C.Other Program Funding Summary (\$ in Millions) (I) EY 2003 FY 2004 FY 2005 FY 2006 FY 2007 FY 2008 FY 2009 Cost to Actual Estimate Estimate Estimate Estimate Estimate Estimate Estimate Estimate Complete Total Cost (U) Related Activities: (U) PE 0603601F, Conventional Weapons Technology. This project has been coordinated through the Reliance process to harmonize efforts and eliminate 	(U)	In FY 2004: Continue analysis effore expedite development, and reduce to the long-term technology and strate capability. Complete developing tw Complete providing detailed perform six-degree-of-freedom simulations, tools to provide comprehensive com- pay-off technologies and weapon at	orts and multi-sen the acquisition cy gy for developing vo-dimensional la mance estimates for guided weap nparisons among trributes.	asor modeling to cle expense for g an advanced l aser arrays for l of guidance-rel on systems. Co inventory, plan	o improve target state-of-the-art aser ranging and aser ranging and ated component ontinue developin aned, and concep	signature predic seekers. Compl detection scene detection scene technology, using modular, syst tual munitions t	ction models, ete investigating projector projectors. ng tem-level, analysi o identify high	s			
(U) Total Cost 16.905 16.589 16.359 (U) C. Other Program Funding Summary (\$ in Millions) Image: Control of the structure of the structur	(U)	In FY 2005: Continue analysis effect expedite development, and reduce t simulation model, reusable end syst simulator requirements, using a con-	orts and multi-sen he acquisition cy tem simulation to nmercial synthesi	sor modeling to cle expense for ols. Develop a izer chip.	o improve target state-of-the-art prototype wave	signature predic seekers. Contin form generator,	ction models, ue development o meeting DoD	f			
C. Other Program Funding Summary (\$ in Millions) FY 2003 FY 2004 FY 2005 FY 2007 FY 2008 FY 2009 Cost to Actual Total Cost Actual Estimate Estimate Estimate Estimate Estimate Complete Total Cost (U) Related Activities: PE 0603601F, Conventional Veapons Technology. This project has been This project has been Figure Process to harmonize	(U)	Total Cost	, and the second se	I					16.905	16.589	16.359
 (U) Related Activities: (U) PE 0603601F, Conventional Weapons Technology. This project has been (U) coordinated through the Reliance process to harmonize efforts and eliminate 	(U)	C. Other Program Funding Sum	mary (\$ in Millie FY 2003 <u>Actual</u>	ons) FY 2004 Estimate	<u>FY 2005</u> Estimate	<u>FY 2006</u> <u>Estimate</u>	<u>FY 2007</u> <u>Estimate</u>	<u>FY 2008</u> <u>Estimate</u>	<u>FY 2009</u> <u>Estimate</u>	<u>Cost to</u> <u>Complete</u>	Total Cost
	(U) (U) (U)	Related Activities: PE 0603601F, Conventional Weapons Technology. This project has been coordinated through the Reliance process to harmonize efforts and eliminate									
Project 2068 R-1 Shopping List - Item No. 11-4 of 11-9 Exhibit R-2a (PE 0602602F)	Pro	ject 2068			R-1 Shopping List	- Item No. 11-4 of	11-9			Exhibit R-2a ((PE 0602602F)

	Exhibit R-2a, RDT&E	E Project Justification		DATE February 2004		
BUD 02 /	GET ACTIVITY Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions	PROJEC ⁻ 2068 Ac	T NUMBER AND TITLE		
(U)	<u>C. Other Program Funding Summary (\$ in Millions)</u> duplication.					
(U)	D. Acquisition Strategy Not Applicable.					
Pro	oject 2068	R-1 Shopping List - Item No. 11-5 of 11-9		Exhibit R-2a (PE 0602602F)		

	Exhibit R-2a, RDT&E Project Justification Date Period Research Peabuage AND TITLE 0602602F Conventional Munitions PEAUET NUMBER AND TITLE 2020 Ordnance Technology <u>Cost</u> (s in Millions) <u>FY 2003</u> <u>A chall</u> <u>Estimate</u> <u>Estimate</u> <u>Estimate</u> <u>Estimate</u> <u>Cost</u> (s in Millions) <u>FY 2003</u> <u>A chall</u> <u>Estimate</u> <u>Estimate</u> <u>Estimate</u> <u>Cost</u> (s in Millions) <u>FY 2003</u> <u>A chall</u> <u>Estimate</u> <u>Estimate</u> <u>Estimate</u> <u>Estimate</u> <u>Estimate</u> <u>Cost</u> (s in Millions) <u>Cost</u> (s in Millions) <u>FY 2003</u> (S 23) <u>Cost</u> (s in Millions) <u>FY 2004</u> (S 507) <u>G 507</u> (S 32) <u>FY 2004</u> (S 507) <u>G 531</u> (S 607) <u>G 531</u> (S 607) <u>G 531</u> (S 607) <u>G 531</u> (S 607) <u>G 531</u> (S	2004								
BUDG 02 A	BET ACTIVITY pplied Research			P 0	E NUMBER AND	TITLE	unitions	PROJECT NUME 2502 Ordnan	BER AND TITLE	gy
	Exhibit R-2a, RDT&E Project Justification Pr TACTIVITY PE NUMBER AND TITLE PC020C1 NL Digit Research Cost (\$ in Millions) FY 2003 FY 2004 FY 2006 FY 2007 FY 2008 V2009 Cost (\$ in Millions) Actual Estimate Estimat	FY 2009	Cost to	Total						
2502	Ordnonge Technology	Actual	Estimate 20,472	Estimate	Estimate	Estimate	Estimate 25 219	Estimate 26 281	Complete	0.000
2502	Quantity of RDT&E Articles	45.897	29.472	35.892	33.800	37.744	35.318	30.281	0.000	0.000
(U)	A. Mission Description and Budget Iter This project investigates, develops, and e advanced conventional weapon dispenser also assesses the lethality and effectivene improved storage capability and transport airframe/subsystem components and struct	m Justification valuates conven s, submunitions ss of current and tation safety of t ctures; and redu	tional ordnance , safe and arm d planned conv fully assembled ced aerospace	e technologies devices, fuzes, rentional weapo l weapons; imp vehicle/weapor	to establish tecl explosives, wa ons technology oroved warhead i's drag.	nnical feasibilit rheads, and we programs and a and fuze effect	y and military apon airframe ssesses target tiveness; impro	utility to includ and carriage ted vulnerability. To oved submunition	le technologies chnology. The The payoffs incl on dispensing; l	for project lude: low-cost
(U) (U)	B. Accomplishments/Planned Program (MAJOR THRUST: Investigate and developed for predicting weapons' effects and assessimunitions development costs and provide In FY 2003: Developed new hydro-code t cutting, detonation waves, shear banding, a fragmentation effects against various targe phenomenology tests to provide data for th targets. Applied campaign analysis tools t	(<u>\$ in Millions</u>) op high fidelity ng target vulner weapons that ca o improve predi and phase transi t facilities, inclu- ne development o compare inve	analytical tools ability. These n generate max active warhead tions. Upgrade uding weapons of lethality and ntory, budgeted	s such as compu- analysis tools w kimum lethality performance ca ed and refined b of mass destru- l vulnerability of and conceptu	utational mecha will reduce air-o against a given apabilities by ac pasic models de ction (WMD). codes for groun al munitions to	nics models delivered n target class. lding metal escribing Performed d-fixed WMD identify high	<u>FY</u>	<u>7 2003</u> 6.507	<u>FY 2004</u> 6.321	<u>FY 2005</u> 7.125
(U) (U)	payoff technologies. In FY 2004: Continue upgrading and refir facilities, including WMD. Continue appl conceptual munitions to identify high payo for blast effects, combined effects environ the penetration performance of unitary per In FY 2005: Continue upgrading and refir facilities, including hardened facilities and	ning basic mode ying campaign a off technologies ment, and target tetrating materia ning basic mode WMD. Contin	ls describing fr analysis tools to . Develop imp t structural resp als into complet ls illustrating fr ue using campa	ragmentation ef o compare inve roved engineer oonse. Improve x target structu ragmentation e aign analysis to	fects against va ntory, budgetec ing level predic e methodologies res. ffects against va pols to compare	arious target l, and tive methods s for predicting arious target inventory,				
(U) (U)	budgeted, and conceptual munitions to ide level predictive methods with a simplified instability caused by direct weapon hits. I in deep underground facilities. MAJOR THRUST: Investigate and develo	ntify high payof finite element r Develop models op more efficier	tt technologies. nodel that estin to assess the fa nt, affordable es	Continue dev nates the damag ailure of blast d xplosives inclue	eloping improv ge from collaps oors and other l ding inert dense	ed engineering e and hardened assets e metal	;	5.206	4.050	5.119
Proj	ect 2502		R-1 Sł	hopping List - Iter	n No. 11-6 of 11-	9			Exhibit R-2a (I	PE 0602602F)
				226)					

Exhibit R-2a, RDT&E Project Justification	DAT	February 2	2004
BUDGET ACTIVITY PE NUMBER AND TITLE 02 Applied Research 0602602F Conventional Munitions	PROJECT NU 2502 Ordna	MBER AND TITLE Ance Technolog	у
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.			
(U) In FY 2003: Completed creation of new, advanced, intermolecular energetic materials using micro-scale and nano-scale fuel and oxidizer particles. Completed efforts to develop a new class of materials for use in fragments, shaped charges, and explosively formed projectiles. Enhanced a highly energetic material development with twice the power density of conventional explosives, but exhibiting insensitive munition attributes. Evaluated materials for explosive capable of surviving Mach 4 impacts that will still functions as desired when initiated by the fuze. Completed research of dense reactive metal explosives and investigated cost-effective methods to improve current explosives.			
(U) In FY 2004: Continue developing a highly energetic material that has twice the power density of conventional explosives, while still exhibiting insensitive munition attributes. Complete development of 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. Initiate increasing 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) In FY 2005: Continue developing a highly energetic material with twice the power density of conventional explosives, while still exhibiting insensitive munition attributes. Continue increasing the energy output while maintaining the producibility of cast/cure Plastic Bonded Explosives (PBX) composite explosives, 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 is required.			
(U)			
(U) MAJOR THRUST: Investigate and develop advanced fuze technologies for air-delivered munitions, such as commercially available micro-mechanical systems, shock-hardened fuzes, low energy detonators, light activated and modular firing systems for advanced single-point initiation, switches, capacitors, power sources, and safe-arming components. These advanced fuze technologies will enhance lethality through precise selection of burst-height at, above, or below the surface to increase weapon safety and tactical performance while simultaneously decreasing procurement costs and system supportability requirements.	7.116	6.340	6.705
(U) In FY 2003: Designed a high resolution, electromagnetic countermeasure-hardened, active imaging fuze that calculates warhead burst direction and detonation time. Determined the benefits of developing a high-speed, hard target fuze using sensors such as micro-electromechanical system gyroscopes. Investigated technologies that communicate battle damage assessment information through hardened mediums.			
(U) In FY 2004: Continue developing a high resolution, electromagnetic countermeasure-hardened, active imaging fuze that calculates warhead burst direction and detonation time. Complete investigating technologies that communicate battle damage assessment information through bardened mediums. Develop miniaturized fuze to effectively control			
Project 2502 R-1 Shopping List - Item No. 11-7 of 11-9		Exhibit R-2a (F	PE 0602602F)

	Exhibit R-2a, RDT&E Project Ju	stification	DAT	[™] February 2	2004
BUDO 02 A	ET ACTIVITY pplied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions	PROJECT NU 2502 Ordna	MBER AND TITLE	у
(U)	the release of anti-agent and submunition for defeating weapons of mass destruction In FY 2005: Continue developing a high resolution, electromagnetic countermeasu that calculates warhead burst direction and detonation time. Continue developing a control the release of anti-agent for defeating weapons of mass destruction. Begin provide safe and arm, burst point sensor and low power initiator in a 4 cubic inch p communication system to fuze a hard target munition.	n. re-hardened, active imaging fuze miniaturized fuze to effectively developing a miniaturized fuze to ackage. Develop a wireless			
(U)	MAJOR THRUST/CONGRESSIONAL ADD: Investigate and develop control and ordnance packages for advanced air-delivered munitions in order to enhance weapon technologies include high-energy explosives, mass-focus fragmentation, and multi- will increase weapon systems effectiveness by contributing to increased weapon los enhanced sortie effectiveness. Note: This effort includes \$1.1 million in FY2003 (defense against Weapons of Mass Destruction.	l carriage technologies for n lethality. Examples of these sensor fuzing. These technologies ad-out on strike aircraft and Congressional Add funding for	13.146	5.567	8.745
(U)	In FY 2003: Investigated and compared subsystem technologies necessary to devel low-observable, air targets. Investigated technologies, such as microbots and nano- destroy, or damage facilities containing chemical and biological weapons. Investig hard and deeply buried targets by simultaneously placing multiple, precise, time-of	op an optimum kill missile against encapsulation, to disrupt, deny, ated technologies that can defeat arrival guided munitions on target.			
(U)	In FY 2004: Continue investigating subsystem technologies necessary to develop a low-observable, air targets. Perform concept trade studies to determine the technol operations over long, stand off ranges.	n optimum kill missile against ogies necessary to deny adversary			
(U)	In FY 2005: Finish investigating specific missile subsystem technologies to counte Begin an effort to design and ground test precise time-of-arrival munitions. Begin needed for an advanced next generation, low cost mini-cruise missile. Begin devel operations through loitering low-cost multi-shot munitions.	r low-observable, air targets. to identify the critical technologies oping technologies to deny enemy			
(U) (U)	MAJOR THRUST: Investigate and develop advanced warhead kill mechanisms, s	ich as adaptable warhead,	13.922	7.194	8.198
	directional control and fragmenting ordnance, and application of reactive metals. T characterization of the dynamic response of metals and geologic materials, adjustab distributed multi-point fire set to enhance air-delivered munition lethality. This enl development of smaller munitions with effectiveness similar to current inventory w increase in aircraft load-out and sortie effectiveness.	The investigation includes le yield ordnance packages, and nanced lethality supports the eapons and with a corresponding			
(U)	In FY 2003: Evaluated initiation-based, adaptable, and multi-mode warheads using miniaturization technologies for the advanced warhead kill mechanism. Evaluated fratricide in urban warfare scenarios. Completed assessment of multi-mode warhea enhance lethality. Completed in-house experiments to characterize the interaction	enhanced lethality materials and ordnance technology to reduce ds using heavy metal liners to of munitions with chemical and			
Proj	ect 2502 R-1 Shopping List	- Item No. 11-8 of 11-9		Exhibit R-2a (F	PE 0602602F)

	Exhibit R-	2a, RDT&E	Project Jus	stification			DATE	February	2004
BUDGET ACTIVITY 02 Applied Research				PE NUMBER A 0602602F C	ND TITLE	lunitions	PROJECT NUM	BER AND TITLE	gy
biological weapon and storage contain by focusing on improving warhead ca while penetrating hardened material a be carried to required depth of target.	ners. Conduct use survivabilit and decreasing	ed design trades y, control of dep case thickness t	to improve the a oth of burial, traj o allow a greater	attributes of pen- ectory control n r amount of ener	etrating munition nethodologies rgetic material to	ns			
 (U) In FY 2004: Complete evaluating inimaterials and miniaturization technol ordnance package designed for low cd an effort to improve the attributes of p control of depth of burial, trajectory cd thickness to allow a greater amount o evaluating tungsten to be used for hig provide adaptable warhead technolog techniques to characterize the dynamic blast explosive mechanisms. (U) In FY 2005: Continue avaluating an antipation of the set of the se	tation-based, a ogies for the ac ollateral damag penetrating mu ontrol method f energetic ma h-speed, penet ies to better att c response of p	adaptable, and n lvanced warhea ge with high nea nitions by focus ologies while pe terial to be carrie rating-warhead ack mobile grou netals used for	d kill mechanisn ar-field and minin sing on improvin enetrating harder ed to the require case material. E und targets. Dev warhead cases.	and using enna- n. Continue eva mum far-field le g warhead case ned material and d depth of target Develop the desig relop experiment Investigate effect	nced lethality luating an ethality. Continu survivability, decreasing case t. Begin gn constraints to tal data analysis etiveness of large	e			
(U) In FY 2005: Continue evaluating an minimum far-field lethality. Complet in-house effort to improve penetrating case thickness. Continue evaluating for adaptable warheads to attack mob	ordnance pack te evaluation o g warhead case tungsten for hi ile ground targ	age designed for f low collateral survivability, d gh-speed penetr ets.	r low collateral c damage, multi-n lepth of burial, a rating weapons.	lamage with hig node warheads. nd trajectory con Evaluate high es	h near-field and Continue ntrol, with lower nergetic materia	ls			
(U) Total Cost							45.897	29.472	35.892
(U) <u>C. Other Program Funding Summ</u>	<mark>ary (\$ in Milli</mark> <u>FY 2003</u> Actual	<u>ons)</u> FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	<u>FY 2007</u> Estimate	<u>FY 2008</u> Estimate	<u>FY 2009</u> Estimate	<u>Cost to</u> Complete	<u>Total Cost</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.									
Project 2502		F	R-1 Shopping List	- Item No. 11-9 of	11-9			Exhibit R-2a ((PE 0602602F)