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

February 2003

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602624A - Weapons and Munitions Technology

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Total Program Element (PE) Cost		62914	72504	39485	45598	44192	41846	42580	42596
H18	ARTY & CBT SPT TECH	15796	16183	12256	14745	14225	15379	15642	16020
H19	CLOSE COMBAT WEAPONRY	9975	9729	6846	6729	11527	12339	12558	6486
H1A	WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE	0	2382	0	0	0	0	0	0
H28	MUNITIONS TECHNOLOGY	24766	23574	20383	24124	18440	14128	14380	20090
WA2	GREEN ARMAMENTS TECHNOLOGY	4989	5337	0	0	0	0	0	0
WA3	CORROSION MEASUREMENT AND CONTROL	4125	3241	0	0	0	0	0	0
WA4	ARMAMENT SYSTEMS NETWORK IA CENTER	3263	3336	0	0	0	0	0	0
WA5	HOMELAND DEFENSE TECHNOLOGIES	0	4670	0	0	0	0	0	0
WA6	NANOTECHNOLOGY CONSORTIUM	0	953	0	0	0	0	0	0
WA7	PUBLIC-PRIVATE PARTNERSHIP, NON-MUNITIONS	0	1668	0	0	0	0	0	0
WA8	SEAMLESS DATA DISPLAY	0	1431	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Program Element (PE) researches improved weapon and munitions technologies to enable combat overmatch for the Objective Force. Efforts are focused on meeting requirements of the Future Combat Systems (FCS). The program funds research that will result in increased system lethality and survivability with the potential for better affordability, lower weight and reduced size. The FCS Multi-Role Armament and Ammunition System (MRAAS) Advanced Technology Demonstration (ATD) will provide the basis for a direct and indirect fire system for FCS designed to exceed the lethality of the Abrams main battle tank. At lower turret elevation positions the weapon system will provide direct capabilities, while at higher elevation positions, up to 55 degrees (based on chassis configuration), it will achieve indirect fire capabilities. It uses advanced materials, advanced recoil techniques, and Electrothermal-Chemical (ETC) propulsion to overcome the challenges of creating a smaller, lighter armament system with lethality equaling or exceeding that of current systems. The current government baseline for FCS Multi-Role Ammunition is a three-cartridge suite that provides overwhelming lethality at ranges up to 50 km (based on chassis configuration), with increased weapon delivery accuracy. Specific efforts in explosives, propellants, fuzing, composite structures, miniaturized seekers and warhead technology are the pacing technologies in support of the ammunition suite. Multiple Effects Warhead Technology researches new warhead technologies for smaller, more lethal chemical energy warheads. Advanced Sensors for Smart Munitions will enhance current smart sensors for use in the ammunition suite.

Responsive Accurate Mission Module (RAMM) provides technologies for an advanced mortar for FCS manned or tele-operated ground vehicles. The PE also funds the development of modeling and analytic codes for thermal analysis and high impetus, low flame temperature propellants to reduce wear on gun tubes (which degrades accuracy and increases the system cost); advanced armament fire control; advanced laser radar/infrared (LADAR/IR) sensor technology to enhance performance of smart munitions; technology advances in acoustic sensors; advanced wear and erosion resistant barrel coatings to increase service life and provide an environmentally friendly barrel coating process; thermal management of high performance, high rate of fire, large caliber guns; ways to make artillery systems more flexible and deployable through range extension and weight reduction technologies; and smart materials to improve accuracy and reduce operational and support (O&S) costs. Beginning in FY 06, this PE will research multi-mode sensor and Automatic Target Recognition technologies for future smart munitions as well as microelectronic fuzing technology. The work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. The program element contains no duplication with any effort within the Military Departments. The U.S. Army Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, New Jersey primarily manages this program. No Defense Emergency Response Funds have been provided to this program.

Work in this PE is related to, and fully coordinated with, efforts in PE 0602618A (Ballistics Technology) and PE 0602623A (Joint Service Small Arms Program (JSSAP)), and its technologies typically transition to PE 0603004A (Weapons and Munitions Advanced Technology) and PE 0603802A (Weapons and Munitions Advanced Development). This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

B. Program Change Summary	FY 2002	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2003)	65197	38090	37961	42422
Current Budget (FY 2004/2005 PB)	62914	72504	39485	45598
Total Adjustments	-2283	34414	1524	3176
Congressional program reductions				
Congressional rescissions		-2876		
Congressional increases		39350		
Reprogrammings	-930	-417		
SBIR/STTR Transfer	-1353	-1643		
Adjustments to Budget Years			1524	3176

Change Summary Explanation:

Significant Changes:
FY04 - ($3813) Funds increased to support the Multiple Effects Warhead Technology effort.

FY03 Congressional Adds:
Phyto-Extraction Technology, Project H1A ($2500); Public Private Partnership, Non-Munitions, Project WA7 ($1750); Applied Research Integration, Project H18 ($1400); Homeland Defense Technologies, Project WA5 ($4900); Green Armaments Technology, Project WA2 ($5600); Nano Technology in SmartCoatings Partnership, Project H18 ($1750); Nano Technology for Smart Munitions, Project H18 ($1400); Generation-2 Warhead Development (X-caliber) Explosively Formed Penetrators, Project H28 ($1400); Seamless Data Display, Project WA8 ($1500); Single Crystal Tungsten Alloy Penetrators, Project H28 ($3000); Alloy Tungsten (LA-T) Armor Piercing Ammunition, Project H28 ($4250); Armament Systems Network IA Center, Project WA4 ($3500); Corrosion Measurement & Control Project, Project WA3 ($3400); M795 extended range, high explosive baseburner projectile, Project H28 ($2000); Nanotechnology Consortium, Project WA6 ($1000)

Projects with no R-2A:
($2465) Phyto-Extraction Technology, Project H1A: The objective of this one year Congressional Add is to conduct applied research to develop phyto-extraction decontamination technology. No additional funds are required to complete this project.
($1726)Public Private Partnership, Non-Munitions, Project WA7: The objective of this one year Congressional Add is to fund applied research in partnership with industry and non-governmental public organizations to develop non-munitions technologies. No additional funds are required to complete this project.
($4832) Homeland Defense Technologies, Project WA5: The objective of this one year Congressional Add is to conduct applied research supporting the development of technologies supporting Homeland Defense. No additional funds are required to complete this project.
($5522) Green Armaments Technology, Project WA2: The objective of this one year Congressional Add is to research and develop environmentally friendly armaments technologies. No additional funds are required to complete this project.
($1480) Seamless Data Display, Project WA8: The objective of this one year Congressional Add is to research data display technologies for weapons systems. No additional funds are required to complete this project.
($3451) Armament Systems Network IA Center, Project WA4: The objective of this one year Congressional Add is to research integration and analysis technologies to support armament systems networks. No additional funds are required to complete this project.
($3353) Corrosion Measurement & Control Project, Project WA3:The objective of this one year Congressional Add is to research corrosion measurement technologies that control and mitigate sources of corrosion. No additional funds are required to complete this project.
($986) Nanotechnology Consortium, Project WA6: The objective of this one year Congressional Add is to conduct applied research to identify nanotechnology solutions for the warfighter. No additional funds are required to complete this project.

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602624A - Weapons and Munitions Technology**	**H18**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H18	ARTY & CBT SPT TECH	15796	16183	12256	14745	14225	15379	15642	16020

A. Mission Description and Budget Item Justification: This project focuses on applied research of technologies for multi-role cannon, mortar weapon, smart cargo projectile, fire control and combat support systems in support of FCS and the Objective Force. Specific efforts include FCS MRAAS; RAMM; QuickLook; Advanced Sensors for Smart Munitions; and Advanced Acoustic/Seismic Systems. Recoil management and lightweight materials technologies are being investigated to create a more lethal, lightweight FCS Multi-Role Armament, utilizing ETC propulsion. Also being pursued is the corresponding FCS Multi-Role Ammunition suite, which includes technologies for achieving both revolutionary fire support lethality and precision point target defeat at extended ranges in lighter and smaller configurations. The RAMM lightweight mortar concept will be developed to a maturity level suitable for insertion into FCS. QuickLook will provide the brigade commander with real time target imagery, target coordinates, and battle damage assessment (BDA). This system will utilize an artillery launched loitering munition that flies out to a maximum range of 50 km, acquires the target and transmits targeting information, such as video and/or Global Positioning System (GPS) coordinates, back to the tactical operations center via a wireless link. Advanced acoustic sensors will be investigated for providing non-line of sight target cueing for a variety of weapons platforms. Technologies for reducing artillery target location error and for providing to fire direction centers real time targeting and battle damage assessment data are being matured to support information dominance strategies for FCS. This program supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds have been provided to this project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
-RAAM: In FY02, finalized the hardware design of the mortar system and autoloader/magazine. In FY03, complete generation of system simulation models; establish a virtual battlefield model and conduct a performance analysis of the RAMM mortar system.At the end of FY 03, designs and models develped will be transitioned to support the maturation and demonstration of RAMM under PE0603004A.	802	3977	984	0
- Advanced Sensors for Smart Munitions: In FY02, concluded system trade-off studies and compiled baseline algorithm code; finalized design and began fabrication of tactical sensor hardware for captive flight test. In FY03, fabricate smart sensor component hardware and perform captive flight test; conclude sensor suite packaging analysis for smart munitions. This effort will transition to the MRAAS Program for use in the ATD described in PE0603004A	1576	1790	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- Advanced Acoustic/Seismic Sensors: In FY02, incorporated advanced detection, classification and tracking algorithms/software into acoustic sensor testbeds, then validated the modeling predictions with empirical sensor performance improvements. In FY03, evaluate integrated acoustic cuers on Strikers for AN/TPQ-36/37 (Fire Finder Radar) and transmit location messages to the fire director center; integrate acoustic and seismic modeling capabilities; implement advanced acoustic sensor networks. In FY04, integrate the acoustic & seismic propagation and sensor system model on a developmental platform; conduct an initial evaluation of a sensor emplacement tactical decision aid for optimum system performance.	962	1989	1341	0
-Quicklook: In FY02, conducted an evaluation demonstration of the QuickLook system, detecting and locating targets in real-time, using battlefield imagery and GPS coordinates.	1800	0	0	0
- MRAAS: In FY02, completed detailed design of ETC propulsion and turreted armament system; conducted limited gun testing of cartridge case and seals with ETC ignition and kinetic energy (KE) composite sabot; continued Smart Suite design tradeoffs and laboratory demos of shaped charge (SC) and explosively formed penetetor (EFP) warheads. In FY03, fabricate smart cargo projectile test hardware for high-G testing and full-scale wind tunnel testing; conduct maneuverability analysis and preliminary guidance and control design for laboratory testing; complete fabrication of hardware and conduct breadboard demonstration of a Multi-Purpose Extended Range Munition (MP-ERM) air frame projectile; fabricate hardware for maneuver mechanism and guidance and control airgun tests. In FY04, complete system integration laboratory demo of fire control functionality; complete functional demo's of launcher and autoloader prototypes; initiate turret manufacturing/integration. In FY05, conduct form and fit testing on hardstand followed by turret system checkout (turret slew, gun elevation, and autoloader feed rate).	6287	4045	9931	14745
- This one year Congressional add for Smart Coatings, will complete development of coatings for Army materiel that are self-healing and have advanced attributes such as providing camouflage. No additional funding is required to complete this project.	971	1686	0	0
- This one year Congressional add for Army Center of Excellence in Acoustics will complete development of acoustic sensor systems for FCS applications. No additional funding is required to complete this project.	3398	0	0	0
-This one year Congressional add for Applied Research Integration will investigate new armament and fire control technologies for future Army systems. Lethality will be increased with lighter, more effective systems. Technologies to be explored include warheads, fire control, fuzing, smart munitions/algorithms, directed energy, etc	0	1348	0	0
-This one year Congressional add for Nanotechnology for Smart Munitions develop nanoparticle and devices for integration into smart munitions. This includes materials and transducer devices.	0	1348	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Totals	15796	16183	12256	14745

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602624A - Weapons and Munitions Technology**	**H19**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H19	CLOSE COMBAT WEAPONRY	9975	9729	6846	6729	11527	12339	12558	6486

A. Mission Description and Budget Item Justification: This project focuses on applied research of technology for maneuver and fire support cannon armament systems in support of FCS and the Objective Force. The project funds research in technologies that will result in significantly greater lethality with more accurate delivery, significantly reducing logistics footprint while reducing life cycle costs for ground and air combat platforms. This project provides opportunities for longer range, more accurate and more lethal cannon systems for armored vehicles, to include enabling technologies to support FCS. Principal efforts support the ammunition suite for the FCS MRAAS and MP-ERM for rapid extended range defeat of high value targets out to 8km+, expanding the maneuver commander's battle area 7-fold. This project funds modeling and simulation of advanced armament systems leading to application for FCS. Cannon design technologies include: recoil mitigation techniques for use of large caliber cannons on lightweight (less than 20 ton) vehicles and a novel chamber configuration, leading to overall compact armament system configurations. Advanced barrel coating technology, utilizing cylindrical magnetron sputtering (CMS) of refractory alloys, is being pursued to provide extended barrel life for tanks, artillery and FCS cannon systems, with potential to provide an environmentally friendly process as a future replacement for chrome plating. This PE will develop advanced multi-mode fuzing technologies including some lower cost, self-destruct technologies for submunitions that could reduce unexploded ordnance on the battlefield and provide low cost electronic safe and arm devices for single and future multi-mode warheads. The project also develops extended range munitions and alternative mechanisms to defeat advanced armor systems. Both hardware and analytical tools will be developed and used to assess system performance, identify problem areas and develop solutions. This program supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds have been provided to this project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
-MRAAS: In FY02, completed base design of lightweight, low impulse Multi-Role Cannon for FCS; validated FCS Kinetic Energy (KE) Munition launch package (novel penetrator with composite sabot) function from FCS ammo configuration; conducted electronic safe and arm fuzing initiation accuracy for multi-point detonations. In FY03, conduct initial fabrication of lightweight cannon, autoloader, fire control, ETC propulsion and turreted armament system; conduct initial system component demonstration; conduct high-G tests of beyond line of sight (BLOS) projectile sensor components; initiate optimization of multimode warheads in prototype projectile designs. In FY04, conduct beyond line of sight (BLOS) projectile airframe structural integrity demonstration; demo composite sabot with integration of novel penetrator against armor; complete non line of sight (NLOS) projectile design; conduct BLOS projectile warhead demo vs. armor targets; continue seeker high-G tests . In FY05, conduct firing demonstration of ETC) propulsion for KE round ; demo composite sabot with integration of novel penetrator agaisnt armor; conduct BLOS projectile flight test; conduct BLOS projectile warhead demo vs. multiple target types. Also in FY05, begin conceptualization of next generation direct fire projectiles to defeat future threat targets.	4000	6048	3211	5000
MRM: Reduced size of critical sensor/seeker and electronic subsystem components; conduct sub-system high-g testing.	3730	0	0	0
Advanced Light Armament for Combat Vehicles: Completed medium caliber novel KE penetrator target effects evaluation; down select to best technical approach.	500	0	0	0
-Agile Target Effects: In FY02, demonstrated synergy of directed energy effects in laboratory; established baseline effects of an acoustic/light direct energy (dazzler) munition. In FY03, identify Agile Target Effects laser and microwave sources and demonstrate reduction of input power to defeat selected targets; enhance dazzler energetic material with nano-particles. In FY04, integrate laser and microwave sources into brassboard Agile Target Effects weapon system and demonstrate effectiveness and benefit of synergy against representative target(s). In FY05, complete detailed concept design of ATE system, conduct feasibility demonstrations of major ATE components with reduced size/weight/power , and continue ATE effects investigations on selected targets to refine/enhance system design requirements. Program will be jointly executed by ARDEC and ARL.	1745	3681	3635	1729
Totals	9975	9729	6846	6729

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February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602624A - Weapons and Munitions Technology**	**H28**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H28	MUNITIONS TECHNOLOGY	24766	23574	20383	24124	18440	14128	14380	20090

A. Mission Description and Budget Item Justification: This program advances the state of the art for enabling technologies supporting the FCS and the Objective Force. The project focuses on achieving increased lethality using smaller and lighter weapon systems with smaller and lighter armaments. The project funds development of: warheads, both shaped charge (SC) and explosively formed penetrators (EFP); high energy explosives; large-caliber gun propellants with barrel wear reducing additives; insensitive munitions (IM); energetics; advanced materials/processes for warheads; and techniques/processes to address material corrosion. Novel warhead architectures, new initiation techniques and advanced material technologies are being applied to produce smaller, lighter, more effective, multi-role warheads having advanced warhead liners to defeat existing and projected targets more efficiently. Aerostable EFP designs will be investigated to enable target defeat from greater standoff range. High-energy, high-density explosives are being developed to increase lethality and optimize design performance. New improved energetic materials developed provide numerous transition opportunities for weapon system upgrades and FCS. Developmental high-impetus propellant formulations, optimized for ETC initiation, offer increased muzzle kinetic energy, precision ignition and unmatched repeatability. The integrated propellant and explosive insensitive munitions program will will increase the battlefield survivability of land combat systems and enhance overall safety at manufacturing plants, storage depots, and during air and sea transport. Efforts under this project support the MRAAS ATD, which develops and demonstrates a lightweight, multi-role armament and ammunitions system. Analysis and development of Multiple-EFP warheads also supports the Army's Full Spectrum Active Protection System (APS) research and development, performed by the Tank Automotive and Armaments Command's Tank Automotive Research Development and Engineering Center (TACOM-TARDEC) under Program Element (PE) 0603005A. This program supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds have been provided to this project

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
MRAAS: In FY02, selected, fabricated and delivered high-energy and high-blast insensitive explosive formulations for FCS multi-purpose warhead concept testing; continued explosive formulation insensitivity improvements and testing; conducted laboratory demonstration of the multi-purpose SC warhead and the maturing Collinear EFP warhead concepts; conducted laboratory demonstrations of revolutionary Generation II EFP and Compact SC warhead designs for FCS multi-role ammo suite and common missile; showed greater than 3 times penetration increase in reduced size warhead; showed compact SC size reduction by 1/2 while maintaining penetration capability. In FY03, prove feasibility of an environmentally friendly, pilot-scale process for selected explosive formulation. Deliver 200 pounds of the candidate high-energy and high blast insensitive explosive formulations for testing in FCS warheads; tailor selected multi-purpose SC and EFP warhead designs for fabrication in the optimum FCS munition configuration; fabricate, characterize and assemble developmental FCS propellant charges for full-up firing demo of ETC propulsion capability in FY04. In FY04, complete optimization of multimode warheads ; demonstrate high energy sensitive explosive. In FY05, conduct beyond line of site (BLOS) flight projectile tests; conduct BLOS projectile warhead demo vs. multiple target types .	10980	9000	11795	10992
Full Spectrum Active Protection: In FY02, proved feasibility of an enhanced multiple EFP warhead forAPS applications against both chemical energy (CE) and kinetic energy (KE) threats, with the goal of producing zero residual penetration (i.e., penetration potential remaining after active protection system intercept penetration on target). In FY03, conduct dynamic tests of APS warhead design to validate warhead effectiveness against both CE and the more challenging KE threats. In FY04, integrate APS warhead into counter munition; optimize warhead design with system fuzing. In FY05, conduct dynamic testing of optimized APS warhead integrated into counter munition. This task is complementary to and fully coordinated with work accomplished in PE0602601A and supports demonstration of APS , conducted under PE0603005A.	1600	1500	1825	2136
- Advanced Energetic Materials: Perform critical evaluation and selection of novel/nano energetic materials concepts.	0	2871	3000	3946
-Shaped Charge Warheads: In FY05, determine bash thru loads of targets on warhead and begin hardened SC design. Incorporate new high blast explosive/frag designs.	0	0	0	3733
- Multiple Effects Warhead Technology: In FY04, develop and demonstrate a revolutionary Gen II EFP warhead concept for FCS smart munitions. A greater than 3 calibers long EFP will be designed and demonstrated. In FY 05, optimize Gen II design with aerostable tail configuration to demonstrate enhanced penetration capability at standoff greater than 50 meters.	0	0	3763	3317

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
- This one year Congressional add in Future Combat System Propellant and Survivability develops (and completes development of) advanced propellants to meet the propulsion and survivability requirements of the MRAAS; it will prove feasibility of Generation II ETC gun propellent for FCS cartridge applications providing a 25% increase in performance. No additional funding is required to complete this project.	2687	0	0	0
- This one year Congressional add (Liquidmetal Alloy-Tungsten Alloy Penetrator) demonstrates (and completes demonstration of) a potential alternative material for depleted uranium (DU) for use in medium caliber KE penetrator munitions for the Army, Navy and Air Force. No additional funding is required to complete this effort.	3262	0	0	0
- This one year Congressional add (Multiple Explosively-Formed Penetrators) develops (and completes development of) a unique EFP warhead capable of breaching obstacles, concrete walls and other targets from a man-portable system. No additional funding is required to complete this project.	960	0	0	0
- This one year Congressional add (Single Crystal Tungsten Alloy Penetrator) evaluates (and completes evaluation of) the viability and affordability of single crystal tungsten alloy material as a KE penetrator and validates ballistic performance compared to that of DU; explores viability of a manufacturing process. No additional funding is required to complete this project.	1919	0	0	0
- This one year Congressional add (Cooperative Energetics Initiative) allows the Army to leverage applicable ARDEC technologies with mining, construction and drilling industries research and development for Dual-Use Science and Technology applications. No additional funding is required to complete this project.	3358	0	0	0
The objective of this Congressional add is to support the design and development of a Gen-2 warhead (x-caliber) EFP. No additional funds are required to complete this project.	0	1341	0	0
The objective of this Congressional add is to support the development of a M795 extended range high explosive projectile. No additional funds are required to complete this project.	0	1916	0	0
The object of this Congressional add is to investigate the properties and performance of liquidmetal tungsten alloy penetrators. No additional funds are required to complete this project.	0	4072	0	0
The object of this Congressional add is to investigate the properties and performance of single crystal tungsten alloy penetrators. No additional funds are required to complete this project.	0	2874	0	0
Totals	24766	23574	20383	24124