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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE
6 - Management support	**0605805A - Munitions Standardization, Effectiveness and Safet**

	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	29443	30029	19855	19627	20032	22168	21621	21623
296	PYROTECHNIC RELIABILITY & SAFETY	867	862	894	911	918	931	957	979
297	MUN SURVIVABILITY & LOG	4101	3820	7949	7576	7770	7876	8060	8224
857	DOD EXPLOSIVES SAFETY STANDARDS	744	751	788	802	860	1674	1714	1730
858	ARMY EXPLOSIVES SAFETY MANAGEMENT PROGRAM	480	473	490	486	482	487	736	487
859	LIFE CYCLE PILOT PROCESS	12472	16064	2474	2494	2528	2550	2570	2585
862	FUZE TECHNOLOGY INTEGRATION	1928	1916	1981	1991	2057	2077	2099	2124
F21	NATO SMALL ARMS EVAL	472	466	481	475	486	491	503	515
F24	CONVENTION AMMO DEMIL	8379	5677	4798	4892	4931	6082	4982	4979

A. Mission Description and Budget Item Justification: This Program Element supports continuing technology investigations. It provides a coordinated tri-service mechanism for the collection and free exchange of technical data on the performance and effectiveness of all non-nuclear munitions and weapons systems in a realistic operational environment. It provides for NATO interchangeability testing (F21); joint munition effectiveness manuals used by all services; development of standardization agreements (STANAGS) and associated Manuals of Proof and Inspection (MOPI); operation of the North American Regional Test Center (NARTC); evaluation of demilitarization methods for existing conventional ammunition (F24); evaluation of useful shelf life, safety, reliability and producibility of pyrotechnic munitions; and improvement of explosives safety criteria for DOD munitions via the DOD Explosives Safety Board (857). Pyrotechnic Reliability and Safety (M296) supports pyrotechnic research, development and testing to identify, characterize and resolve reliability, safety, storage and manufacturing issues that impact production availability and field use of pyrotechnics. It will result in the development and demonstration of new, safe, reliable and environmentally acceptable munitions. Munitions Survivability and Logistics (D297) will make Army units more survivable by testing and demonstrating munitions logis tics system solutions that prevent or minimize catastrophic explosive events and accelerate ammunition resupply. The Army Explosives Safety Management Program (M858) was established in FY01. The U.S. Army Technical Center for Explosives Safety use the funds in this project to evaluate current explosives safety standards and develop new, scientific and risk-based standards to meet U. S. Army explosives requirements. The Life Cycle Pilot Program (LCPP) (M859) will assess production base capabilities and needs over the acquisition life cycle of various ammunitions, address the producibility of ammunition, transition to type classification and production, and address the ability of the production base to cost effectively produce quality products on schedule. The Fuze Technology Integration program (D862) will improve performance and lower the cost for existing proximity fuzes and enable new applications in submunitions and medium caliber fuzes, addressing advanced proximity fuze sensor technology, Micro-electromechanical Systems (MEMS), Safe and Arms (S&A) technology, and Electronic S&A (ESA)technology for smart munitions. These systems support the Legacy 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)	30437	16014	11447	11611
Current Budget (FY 2004/2005 PB)	29443	30029	19855	19627
Total Adjustments	-994	14015	8408	8016
Congressional program reductions				
Congressional rescissions		-480		
Congressional increases		15500		
Reprogrammings	-176	-173		
SBIR/STTR Transfer	-818	-832		
Adjustments to Budget Years			8408	8016

FY 03:
Congressional increases were provided for the following programs:
$6.3M Public Private Partnership.
$4.2M Life Cycle Pilot Process.
$1.4M Manufacturing RDE Center, Nanotechnologies.
$1.4M Micro Electrical Mechanical Systems Technology Applications.
$1.0M CVT Detection for Automated Munitions Inspection and Surveillance.
$1.2M Plasma Ordnance Demilitarization Systems (PODS).

FY04:
$0.9M realigned to project D296 to continue the program beyond FY 2003.
$3.1M realigned to project D297- Munitions Survivability & Logistics.
$2.5M realigned to project M859-Life Cycle Pilot Process to continue program beyond FY 2003.
$1.9M realigned to project D862-Fuze Technology Integration to continue program beyond FY 2003.

FY05:
$0.9M realigned to project D296 to continue the program beyond FY 2003.
$2.7M realigned to project D297- Munitions Survivability & Logistics.
$2.4M realigned to project M859-Life Cycle Pilot Process to continue program beyond FY 2003.
$2.0M realigned to project D862-Fuze Technology Integration to continue program beyond FY 2003.

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
6 - Management support	**0605805A - Munitions Standardization, Effectiveness and Safet**	**297**

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
297	MUN SURVIVABILITY & LOG	4101	3820	7949	7576	7770	7876	8060	8224

A. Mission Description and Budget Item Justification: This project supports the Army Transformation by making Army units more survivable through the investigation, testing and demonstration of munitions logistics system improvements that prevent or minimize catastrophic explosive events and accelerate ammunition resupply. Key thrusts are munitions storage area survivability, insensitive munitions technology integration and compliance, weapon system rearm, munitions configured load enablers and advanced packaging and distribution system enhancements. Within each thrust, a broad array of solutions will be identified, tested, and evaluated against developed system measures of effectiveness. Optimum, cost effective solutions that enable the rapid projection of lethal and survivable forces will be demonstrated. The early stages of force deployment are especially critical. Theater ammunition storage areas are vulnerable and present the enemy with lucrative targets. These areas and distribution nodes contain the only available munitions stocks in theater. Loss of these munitions could cripple the force, jeopardize the mission, and result in high loss of life. This project mitigates vulnerabilities and ensures a survivable fighting force.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Develop less sensitive propellants for M915 and XM916 DPICM projectiles to reduce adverse reaction to unplanned stimuli such as fires, bullet and fire impact, etc. FY02- Refined and manufactured alternative less sensitive propellants, conducted Insensitive Munitions (IM) tests, and completed comparative analysis.	64	0	0	0
Develop advanced materials for munitions packaging or ballistic blankets/barriers to minimize the impact of bullets and fragments and therefore reduce reaction to unplanned stimuli. FY02-Identified candidate IM barrier materials for a Line Of Sight Anti-Tank Missile ballistic blanket, conducted bullet/fragment impact tests, completed evaluation, and transitioned. FY03-Conduct market survey and evaluate advanced materials for ballistic barriers. FY04-Design, fabricate, and test bullet impact mitigating barrier. FY05- Design, fabricate, and test sympathetic detonation mitigating barrier.	111	146	500	450
Develop IM technology solutions for the 2.75” Rockets/Advanced Precision Kill Weapon System (APKWS) family of munitions to reduce reaction to unplanned stimuli. FY02-Loaded warheads with a less sensitive explosive replacement and conducted pit tests to evaluate fragment distribution. FY03-Design an IM venting system for 2.75”/APKWS packaging. FY04-Fabricate prototype vented containers and conduct engineering tests. FY05-Finalize vented container design, conduct IM tests, and transition.	149	200	200	200

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Develop scoring patterns and techniques for munitions packaging that will create a venting system during unplanned propellant burning to reduce internal pressures and minimize explosive reactions. FY02-Developed and tested a full-scale prototype scored container for the Modular Ammo Charge System (MACS) which allows the MACS charge to significantly improve it's IM performance and pass 5 out of 6 IM tests . FY03- Improve design to achieve success in the final 6th IM test and conduct final IM and rough handling tests.	267	200	0	0
Develop an active venting sensor system for the 2.75" Rocket/Advanced Precision Kill Weapon System (APKWS) family of munitions that will help minimize the munitions' reaction in cook-off environments. FY02-Completed prot otype sensor system design and evaluation.	121	0	0	0
Develop a Guided Multiple Launch Rocket System (GMLRS) Grenade High Explosive Replacement by substituting PAX2A IM explosive (a less sensitive HE replacement for Comp-A in the M85 Grenade) and optimizing the shaped charge liner to enable munitions to burn rather than detonate in cook-off environments. FY02-Refined warhead liner design, complete manufacturing process development, and load warhead IM test units. FY03-Conduct IM tests, complete HE down selection. FY04-Conduct final performance, safety, full-scale IM, and arena tests and transition.	604	400	500	0
Develop a less sensitive high performance melt castable explosive to replace Composition B explosive in mortars, 2.75" rockets/APKWS, and other warheads for reduced sensitivity to unplanned stimuli. FY02-Conducted producibility and binder mix analysis. FY03-Complete explosive development and conduct small scale IM tests. FY04-Conduct large scale IM testing, refine formulation. FY05-Complete large scale IM testing and performance and safety testing, transition.	392	265	500	450
Develop alternate low temperature gas generating mixtures that are added to explosives to reduce reaction to unplanned stimuli. As temperature rises during cook-off, this additive produces pressure to rupture the projectile resulting in a controlled burning rather than detonation. FY02-Continue additive development, conduct safety, characterization, stability, and long term tests. FY03- Refine additive formulation, conduct small scale performance, IM, compatibility, safety, and long term tests. FY04-Produce explosives and additives, test to determine percentage of additive in selected high explosive warhead. FY05-Conduct bursting warhead demonstration and IM tests on selected warhead, transition.	344	377	480	0
Conduct reviews of munitions in development and production to determine if they meet DoD 5000.2-R requirement to withstand unplanned stimuli, recommend technical approaches to meet the requirement, update and maintain IM compliance status database. Manage the IM waiver process for the Army. FY02-Conducted quarterly IM reviews, updated database. FY03-Conduct quarterly IM reviews, update IM database. FY04-Conduct quarterly IM reviews, update IM database. FY05- Conduct quarterly IM reviews, update IM database.	159	248	250	250

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
The objective of this effort is to insert IM explosive PAX-2A into M864 RECAP projectiles for a dramatic increase in survivability, penetration performance and service life. FY04-Optimize expulsion charge explosive formulation and conduct IM tests. FY05-Complete IM tests and cartridge level qualification and safety tests, transition.	0	0	375	300
Identify successful IM technologies that were developed for specific munitions and apply them to other types of munitions to reduce reactions to unplanned stimuli such as fires, bullet and fragment impact, etc. FY04-Down select initial candidate munitions and apply technologies, conduct engineering tests. FY05-Manufacture munitions and conduct final IM qualification tests.	0	0	1548	2279
The objective of this effort will be to develop a material that will neutralize/disable expulsion propellant in Dual Purpose Improved Conventional Munitions (DPICM) in fire or high temperature environments before the expulsion propellant reaches its auto ignition temperature. This will minimize the dangerous possibility of expelling and exploding grenades during unplanned fires and cook-offs. FY04-Conduct failure analysis on DPICMs, develop propellant neutralization formulations, conduct engineering evaluation. FY05-Down select neutralization technologies and conduct further development to meet IM cook-off requirements.	0	0	375	300
This program will develop thermal management materials that when exposed to heat will form an insulating barrier on the inside of the munition or container to reduce the heat transfer rate during a fire. This will allow more time for firefighters to put out the fire and reduce the possibility of violent reactions. FY04-Conduct failure analysis on candidate munitions, evaluate and select insulating materials. FY05-Produce test munitions using insulating materials and conduct IM tests.	0	0	400	400
Develop IM explosives using new IRDX ingredients that maximize performance and minimize reaction to unplanned stimuli. FY04-Conduct evaluation of foreign IRDX ingredients and compare characteristics with US developed IRDX. FY05-Formulate new IRDX and develop new explosive.	0	145	400	514
This program will evaluate Volatile Corrosion Inhibitor (VCI)-free barrier packaging material for application to Army munitions and spare parts. This material will provide corrosion protection where VCI cannot be used to extend the useful life of munitions and spare parts items. While eliminating the current VCI cleaning process & associated hazardous waste. FY02-Tested and evaluated sealing concepts, identified candidate munitions, prepared final report.	98	0	0	0
The objective of this program is to develop an improved M2A1 container design that is 10-30% lighter, provides a 20% reduction in cubic space required, and is lower in cost than current containers. This design will benefit Brigade Combat Teams by allowing them to reduce their logistics footprint and facilitate handling and transportation. FY02- Completed container design and modifications. FY03-Complete prototype fabrication and conduct qualification testing, transition.	204	286	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
This program will develop a collapsible pallet for consolidating and securing small ammo items such as fuzes, primers, and ammo containers for shipment as Brigade Combat Team SCLs and in-theater Combat Configured Loads. FY02-Conducted market survey, acquired commercial prototypes, conducted testing.	102	0	0	0
The objective of this program is to develop an advanced materials container that will hold 6 M67 Fragment Grenades and reduce hazard classification. This will enable Brigade Combat Teams to meet their requirement to ship and store these grenades in Strategic Configured Loads (SCL) with nearly all other ammunition. FY02-Completed container concept and design, selected materials. FY03-Fabricate prototype containers, conduct rough handling tests. FY04-Conduct hazard testing, prepare exemption documentation and transition.	74	180	200	0
Develop a procedure for return, refurbishment, and reuse of 120mm mortar containers and conduct economic analysis versus purchasing new containers. FY04-Conduct analysis.	0	0	73	0
Develop environmental barriers/coatings for packaging that will reduce heat transfer to munitions and thereby enhance shelf-life and reduce life-cycle costs due to deterioration/degradation from heat exposure. FY04-Conduct market survey of materials and develop preliminary packaging designs. FY05-Complete design, fabricate prototypes and conduct engineering testing.	0	0	290	270
Develop lightweight, low cost, high performance immiscible polymer blend material based munitions packaging and pallets to replace conventional wood materials. FY04-Conduct material evaluation, select candidates, and develop packaging designs. FY05-Fabricate prototype containers/pallets, test and transition.	0	0	180	180
Develop low cost mechanism that will secure 120mm tank munitions in PA116 containers. This will eliminate the need for packaging spacers and ensure the munition is protected form vibration and shock environments. It will also eliminate the potential for foreign object damage. FY04-Develop, test, transition.	0	0	107	0
Develop nanocoating materials for packaging that will facilitate cleaning and Nuclear, Biological, and Chemical (NBC) decontamination of munitions and equipment on the battlefield. FY05-Conduct market survey and evaluation of materials.	0	0	150	250
Develop a container for 2.75" and 120mm tank munitions that uses hybrid materials (both metal and composite) and provides a lightweight, high strength, low cost replacement alternative to existing packaging. FY05-Evaluate and select materials, develop design concepts.	0	0	0	300
Develop a lightweight universal cargo platform and transfer system designs for seamless intermodal (air/ground/ship/rail) ammo movement and rapid deployment. FY02-Developed and evaluated design concepts.	216	0	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Develop a munitions storage area planning software tool that enables soldiers to quickly design a survivable and efficient in-theater storage area given known quantities and types of munitions and terrain features. FY02-Completed system field testing of version I of a Munitions Survivability Software (MSS) tool and transitioned to PM Standard Army Ammo System (SAAS)/PM Global Combat Support System-Army (GCSS-A). Completed design architecture for version 2 that adds an interactive planning/asset management capability. FY03-Complete software design of interactivity enhancements. FY04-Conduct field tests and modify software. FY05-Complete modifications, conduct final test and transition.	855	839	872	525
Develop robotic capability for forklifts and truck mounted cranes to enable the rapid in-theater building of mission configured munition loads for improved distribution velocity and mission transition agility. FY02-Upgraded crane software/hardware for “in the cab” operational capability FY03-Develop and integrate laser vision software and hardware, implement performance, safety, and stability logic enhancements into controller, complete end effector development. FY04-Complete development of software based controller.	341	349	200	0
Develop and demonstrate a pallet/individual munition level environmental sensor suite (shock, temperature, humidity, etc.) and reader system that will monitor and predict munitions reliability to ensure that only fully ready munitions move forward through the logistics system to the warfighter. Benefits include reduced logistics footprint, improved surveillance methodology and reduce surveillance operations and support costs. FY03-Develop data reader and complete Ammo Surveillance Information System integration, conduct field prototype demonstrations . FY04-Develop data analysis/presentation software module. FY05-Develop single chip multiple sensor design	0	100	189	450
Develop a lightweight, load conforming tie down system for cargo platforms that will enable the rapid securing of configured supply loads. FY03-Acquire and test pre-prototypes and complete evaluation. FY04-Select concept and complete system design. FY05-Fabricate prototypes and conduct engineering tests.	0	85	160	458
Totals	4101	3820	7949	7576

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
6 - Management support	**0605805A - Munitions Standardization, Effectiveness and Safet**	**859**

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
859	LIFE CYCLE PILOT PROCESS	12472	16064	2474	2494	2528	2550	2570	2585

A. Mission Description and Budget Item Justification: This project supports the implementation of the Ammunition Industrial Base Strategic Plan through technology investigations, model based process controls, pilot prototyping, and industrial assessments. It will assess life cycle production capabilities required for all ammunition families, address design for manufacturabililty to facilitate economical production, identify industrial and technology requirements, and address the ability of the production base to rapidly and cost effectively produce quality products. Total Ownership Cost Reduction is an important part of the Life Cycle Pilot Process (LCPP). LCPP provides the resources to prototype critical technologies and develop the knowledge base to establish cost effective, environmentally safe and modern production processes.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Continue technology investigations and industrial assessments started in FY 2002. Develop concept designs and plans to transfer life cycle pilot process technology into the supplier base.	300	2764	1000	1000
Perform production base readiness assessments to analyze present capabilities and identify trends in munitions and industrial technology.	455	500	0	0
Develop "pilot" prototype processes for critical ammunition end items and components necessary to establish a quality, affordable, and environmentally safe production.	517	3700	0	0
Establish framework and operations for NJ Nanotechnology and Micro-Electromechanical Systems (MEMS) consortium in support of ammunition production modernization.	0	1400	1474	1494
Establish framework and operations for Nanotechnology Manufacturing RDE Center in support of ammunition production modernization.	700	1400	0	0
Under the Public Private Partnership program, establish and enhance prototype manufacturing utilizing commercially available off-the-shelf equipment.	10500	6300	0	0
Totals	12472	16064	2474	2494

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February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
6 - Management support	**0605805A - Munitions Standardization, Effectiveness and Safet**	**862**

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
862	FUZE TECHNOLOGY INTEGRATION	1928	1916	1981	1991	2057	2077	2099	2124

A. Mission Description and Budget Item Justification: This program supports technology investigations in the areas of munition fuzing and safe and arming (S&A). The program addresses four major areas: Second source development, including a battery separator material source development, a second source Monolithic Microwave Integrated Circuit (MMIC) for artillery and mortar fuzes and a second source signal processor for mortars; Block upgrades for artillery ammunition; Block upgrades for mortar ammunition, including a second environmental safety for non-spinning projectiles and a gun hardened electronic S&A for mortars; and Legacy fuze risk reduction, including battery aging studies, increased reliability of ammunition and an alternative self destruct design. Development and demonstration of second sources for fuzing systems will reduce cost by providing competition, update components with the latest technology advances and maintain production when sources or parts are no longer available. Block upgrades for artillery and mortar fuzes will enable the introduction of the latest technologies into fuzing, keep the fuzing design current to avoid obsolescence issues and add capabilities. Legacy fuze risk reduction will allow for the performance enhancement of current ammunition items by conducting aging studies of major fuze components to detect and identify latent defects and weak designs. This project supports the Legacy transition path on the Transformation campaign Plan (TCP).

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Legacy Fuze Risk Reduction: Predict/evaluate fuze stockpile, conduct fuze dud reduction effort, develop self destruct fuze alternatives. Evaluate storage reliability of current artillery batteries/determine possible solutions to battery electrolyte storage instabilities. Develop improvements to stockpiled training and war reserve fuzes to enhance capabilities and/or address deficiencies.	698	500	350	450
Second Source Development: Develop new sources for battery separator material, tuning fork crystal for artileery time fuzes, new source for Monolithic Microwave Integrated Circuits (MMICs) used in artillery and mortar fuzes, develop new battery and electronics sources for legacy fuzes. Purchased Non-Developmental Item (NDI) batteries for testing and battery aging study.	200	1016	831	841
Block Upgrades for Artillery: Develop drop in proximity upgrades for current artillery fuzing. Complete breadboard design of new artillery processor. Translate medium caliber Microelectromechanical (MEMS) Safety and Arming device to artillery. Develop MEMS environmental impact sensors. Evaluate proximity sensor technologies inclusive of ultrawideband (UWB), all digital and clutter resistant air target sensors. Task order contract awarded to University of Florida to conduct designs and experiments on UWB and clutter resistant air target sensors.	500	0	500	700

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Block Upgrades for Mortars: Develop second safety sensors for non-spinning projectiles. RF sensors fabricated and tested on mortars. Contract awarded for testing of new magnetic sensor, additional magnetic sensor contract to be awarded in FY03. Develop proximity sensor upgrades for M734A1 and gun hardened Electronic Safety and Arming Devices (ESADs) for mortars. ESAD parts being purchased and assembled for FY03 firing tests. MEMS impact sensor development, PD/DLY fuze upgrades and insertion of inductive setting capability into mortars.	530	400	300	0
Totals	1928	1916	1981	1991

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6 - Management support	**0605805A - Munitions Standardization, Effectiveness and Safet**	**F24**

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
F24	CONVENTION AMMO DEMIL	8379	5677	4798	4892	4931	6082	4982	4979

A. Mission Description and Budget Item Justification: This project supports a continuing technology evaluation of demilitarization methods for existing conventional ammunition and conventional ammunition recovered from formerly used defense sites (FUDS). It will complete the development and demonstration of new, safe, and environmentally acceptable alternatives to open burning/open detonation (OB/OD) of recovery/recycle/reclamation equipment, and processes to reduce the extremely large stockpile of munitions in the resource recovery disposition account and munitions from FUDS.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Prove out prototype plasma arc technology for conventional ammunition and resource recovery potential.	2000	3205	1400	0
Cryofracture development for demilitarization of Anti-Personnel Landmines and other munitions.	3000	1346	800	0
Prove-out of prototype Super-Critical Water Oxidation technology.	447	0	0	0
Development of recycle/reuse technology for magnesium/aluminum	650	326	0	2000
Development of enhanced flexible energetic material handling automation upgrade capabilities sized to real time requirements	0	0	500	1000
Development of transportable alternative materials recovery capabilities for various energetic components	2282	800	2098	0
Multi-based propellant recovery	0	0	0	950
Development of advanced resource recovery/reuse technology for explosives	0	0	0	942
Totals	8379	5677	4798	4892