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

February 2003

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602601A - Combat Vehicle and Automotive 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		109394	79952	80910	71108	72733	72206	59977	51183
C05	ARMOR APPLIED RESEARCH	15362	18153	19972	15514	10738	10946	11194	11452
C84	AC84	906	933	0	0	0	0	0	0
H77	ADV AUTOMOTIVE TECH	40711	22509	24999	21760	16620	16564	16870	17274
H91	TANK & AUTOMOTIVE TECH	19698	20534	35939	33834	45375	44696	31913	22457
HH7	FUTURE COMBAT SYSTEMS - APPLIED RESEARCH	18984	0	0	0	0	0	0	0
HH8	VOICE INTERACTIVE DEVICE	1630	1620	0	0	0	0	0	0
HH9	UNIVERSITY PROGRAM IN MOBILE ROBOTICS	0	1431	0	0	0	0	0	0
T21	21ST CENTURY TRUCK (T21)	9225	11343	0	0	0	0	0	0
T26	HYBRID ELECTRIC HMMWV	2878	0	0	0	0	0	0	0
T27	ADVANCED COATINGS RESEARCH	0	1048	0	0	0	0	0	0
T28	FASTENING AND JOINING RESEARCH	0	1239	0	0	0	0	0	0
T29	NBC AGENT WATER CONTAMINATION MONITORING	0	1142	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program researches, investigates and applies combat vehicle and automotive technologies that will improve survivability, mobility, sustainability, and maintainability of Army ground vehicles. As combat vehicle systems become smaller and lighter to provide the necessary strategic deployability and tactical mobility, one of the greatest technological and operational challenges is providing adequate protection without reliance on heavy passive armor. This challenge will be met using a layered approach, substituting long-range situational awareness, multi-spectral signature reduction, Active Protection (AP) systems and advanced lightweight armor for conventional armor. Project C05 focuses on this later survivability effort, designing a suite of protection components that, when installed and integrated, will give lightweight vehicles superior protection against Chemical Energy (CE) and Kinetic Energy (KE) threats with only one fourth the weight burden of the only conventional option - heavy armor. Goals are to provide lightweight structural armor at 20 lb/sq.ft. to defeat heavy machine gun threats and 60 lb/sq.ft. frontal armor to protect against more severe threats. In conjunction, Project H91 is developing unique CE & KE active protection countermeasures and vehicle-mounted sensor systems, required for AP cueing, targeting and intercepting threats, which are being characterized and tested. Project H91 also develops Hybrid electric and electric vehicle technologies, which are key enablers for achieving Future Combat Systems

(FCS) and Objective Force capabilities. In the near term, FCS vehicles will be designed with hybrid electric architectures, providing power for propulsion, communications and control systems, life support systems, electrothermal chemical (ETC) guns and electromagnetic (EM) armor. In the far term, vehicle energy and power levels will be increased to accommodate advanced electric weapons (e.g., lasers, high power microwave and electric guns)and advanced electric-based protection systems. This program also advances technologies for critical power, propulsion and electric components, including energy storage, power distribution and pulse forming networks (PFNs). Components that will improve vehicle performance (e.g., active suspensions, wheel motors, regenerative brakes, vehicle electronics (VETRONICS), and track will be developed and matured. Project H91 provides components for improved mobility, including active suspensions, motors, generators, controllers, hybrid electric architectures, inverters and lightweight track. It also investigates and develops high temperature/power electronics, high energy density energy storage devices, and PFN elements (batteries, switches, inductors and capacitors), required for electric vehicle mobility and survivability. In addition, Project H91 addresses sustainability and maintainability, with efforts in advanced military fuels and lubricants; vehicle diagnostics; and on-vehicle water generation and water purification. Project H77 funds the National Automotive Center (NAC). The goal of the NAC is to leverage large commercial investments in automotive technology research and development, pursuing automotive-oriented technology programs that have potential benefit to military ground vehicles. This PE adheres to Tri-Service Reliance Agreements on advanced materials, fuels and lubricants, and ground vehicles, with oversight and coordination provided by the Joint Directors of Laboratories. The project is coordinated with the Marine Corps through the Naval Surface Warfare Center and with other ground vehicle developers within the Departments of Energy, Commerce, Transportation, and DARPA. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication of any similar effort within the Military Departments. Products of this program transition primarily to PE 0603005A for maturation and incorporation into platforms/vehicles. No Defense Emergency Response Funds were provided to this program. This program supports the Objective Force transition path of the Transformation Campaign Plan.

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B. Program Change Summary	FY 2002	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2003)	112957	55763	60728	59452
Current Budget (FY 2004/2005 PB)	109394	79952	80910	71108
Total Adjustments	-3563	24189	20182	11656
Congressional program reductions				
Congressional rescissions		-4455		
Congressional increases		30700		
Reprogrammings	-988	-458		
SBIR/STTR Transfer	-2575	-1598		
Adjustments to Budget Years			20182	11656

Change Summary Explanation:
Significant Changes:
FY04 ($16262) & FY05 ($11528) Funds increased to support Pulse Power for Electric Weapons and Hybrid Electric Vehicle efforts.

FY03 ($30700) Congressional adds:
COMBATT, Project H77 ($3500)
Next Generation Smart Truck, Project H77 ($3400)
Combat Vehicle Mobility System, Project H91 ($3400)
Military Wheeled Vehicle Electronic Architecture Integration (EAI), Project H91 ($1700)
Voice Interactive Device, Project HH8 ($1700)
University Program in mobile Robotics, Project HH9 ($1500)
21st Century Truck, Project T21 ($11900)
Advanced Coatings Research, Project T27 ($1100)
Fastening & Joining Research, Project T28 ($1300)
NBC Agent Water Contamination Monitoring/Remediation Technology, Project T29

($1200)

Projects with no R-2As:
($1700), Voice Interactive Device, Project HH8: The objective of this one-year Congressional Add is for enhancements to a voice-interactive software capability and interfaces that requires less individualized voice training and to embed this capability into a vehicle. No additional funding is required to complete this project.

($1500), University Program in mobile Robotics, HH9: The objective of this one-year Congressional Add is to integrate imaging and sensors into the ODIS robotic platform for security applications and the intelligent mobility programs. Demonstrate sensor and algorithm integration with platform and user including communications and data management. No additional funding is required to complete this project.

($11900), 21st Century Truck, T21: The objective of this one-year Congressional Add is to investigate and evaluate high power density engines, lightweight engine/components, high temperature engine materials, engine coatings, coolants and cooling systems computer controlled energy management systems, electric traction motors, electric generators, high power motor controllers, and advanced energy storage systems; integrated and test vehicle intelligence technologies that involve both information and control technology to improve fuel efficiency, driving efficiency, safety and quality of driving trucks. No additional funding is required to complete this project.

($1100), Advanced Coatings Research, T27: The objective of this one-year Congressional Add is to focus on identifying and proving out improved coatings and coating technologies for ground vehicles. The goal is to identify coatings that provide improved corrosion resistance and offer the potential for reduced operations and support costs. No additional funding is required to complete this project.

($1300), Fastening & Joining Research, T28: The objective of this one-year Congressional Add is to establish the Fastening and Joining Research Institute at Oakland University that will work towards making advances in joining components together. Emphasis will initially be placed on improving mechanical fastening methods to increase joint reliability, reduce costs and associated maintenance burdens that currently exist. No additional funding is required to complete this project.

($1200), NBC Agent Water Contamination Monitoring/Remediation Technology, T29: The objective of this one-year Congressional Add is to develop technologies that can detect and treat Nuclear, Chemical, and Biological (NBC) contamination in water. No additional funding is required to complete this project.

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February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602601A - Combat Vehicle and Automotive Technology**	**C05**

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
C05	ARMOR APPLIED RESEARCH	15362	18153	19972	15514	10738	10946	11194	11452

A. Mission Description and Budget Item Justification: This project investigates, designs and tests armor component technologies and armor packaging to achieve lightweight, ballistically-superior integrated structures that will provide the last line of defense for Future Combat Systems (FCS) and Objective Force vehicles. The effort provides the analytical basis for understanding and predicting the effectiveness of various armor systems and examines the vehicle armor systems required to protect against collateral damage from debris from the AP system (debris protection). A major focus is on providing armor component technologies with reduced weight, reduced space claim and lower cost for protection against KE Projectiles, CE Warheads, Explosively Formed Penetrators (EFP) and blast fragments from mines. Goals are to provide base armor to defeat heavy machine guns and residual fragments from AP events at 20 lbs/sq.ft.; armor packages to defeat limited rocket propelled grenade (RPG) and medium caliber KE at 40 lbs/sq.ft.; and novel frontal armors to defeat heavier threats at 80 lb/sq.ft. for initial (block I) FCS. The latter will be reduced to 60 lb/sq.ft. for FCS block II. The armor technologies designed and fabricated in this project complement innovative non-armor survivability component techniques that are funded in project AH91. In addition, this project investigates low-burden solutions for the protection of tactical vehicles in war and operations-other-than-war, focusing on appliqué armor for small arms and land mine protection. International cooperative research in mine blast characterization and vehicle response is also conducted. The project is executed by TARDEC in collaboration with the ARL. Efforts are fully coordinated and complementary to work performed under PE 0602618A (Ballistic Technology) and PE 0602105A (Materials). No Defense Emergency Response Funds were provided to the project. This program supports the Objective Force transition path of the Transformation Campaign Plan.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Advanced Armor - In FY 02, completed quarter scale Smart Armor KE threat AP debris analysis. Completed trade study and evaluation of 2nd generation electromagnetic (EM) armor. In FY 03-04, provide Smart Armor solutions and model data for defeat of AP residual KE debris. Evaluate Smart Armor solutions that address medium caliber KE and CE threats that meet the intermediate weight efficiency goal of 80lbs/sq ft. Provide EM armor solutions for defeat of Chemical Energy (CE) weapons. Evaluate EM armor solutions that address large CE threats that meet the intermediate weight efficiency goal of 80lbs/sq ft. In FY04, complete 2nd generation EM armor component development.	15362	15379	2118	0
Countermine - In FY 03, evaluate lightweight ballistic solutions for mine blast protection and apply modeling and simulation tools. In FY04, demonstrate armor configurations, obtain improved mine blast data, and validate M&S. In FY05, complete testing and evaluation of FCS armor solutions for mine blast protection.	0	2774	2832	891
Structural Armors - In FY04, build vehicle quarter section ballistic targets and range test these fully integrated 3rd generation armor/structure designs against FCS Block II threats and demonstrate: armor/structural capability at FCS weights; integration of critical components; armor/structural reliability; and evaluation EM armor components for structural armor applications. Improve physics and engineering based models and design tools. In FY05, conduct ballistic range tests to optimize and validate the best achievable integrated armor packages for lightweight platforms.	0	0	15022	14623
Totals	15362	18153	19972	15514

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602601A - Combat Vehicle and Automotive Technology**	**H77**

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
H77	ADV AUTOMOTIVE TECH	40711	22509	24999	21760	16620	16564	16870	17274

A. Mission Description and Budget Item Justification: This project funds the National Automotive Center (NAC), which leverages large commercial investments in automotive technology research and development. NAC initiates shared technology programs that focus on benefiting military ground vehicle systems. The component technologies being developed support the Army's current and future combat and tactical wheeled vehicle fleet. Improvements in the legacy force are expected to rely heavily on leveraging commercial technologies for advances in operational performance and cost. The NAC, a part of TARDEC, serves as a catalyst, linking industry, academia and government agencies for the development and exchange of automotive design and component technologies. The NAC executes collaborative research and development contracts and Cooperative Research and Development Agreements for two-way industry/government technology transfer that leverages commercial industry investment to support key Army automotive technology thrust areas. These areas include fuel efficiency, vehicle modernization, crew safety, maintenance, logistics improvement and manufacturing innovation. Efforts focus on improving the performance and endurance of ground vehicle fleets and reducing vehicle design, manufacturing, production, operating and support costs. Some activities of the NAC are supported by other government agencies via a Memorandum of Agreement (MOA). These linkages permit the NAC to consolidate the collective expertise of federal government departments such as Energy, Transportation, Commerce and other DoD agencies. The NAC also performs basic research in PE 0601104A, project H73 (National Automotive Center). A new initiative at the NAC is the Future Tactical Truck System (FTTS) program. The objective of this program is to incorporate a number of advanced technologies the Army, the NAC and commercial sector have been maturing in recent years into tactical support vehicles for the FCS and Objective Force, providing a number of FTTS Demonstrators that will be evaluated in a military unit field environment. Technical testing and User unit field demonstrations will determine their feasibility for transition to tactical vehicle development programs.
No Defense Emergency Response Funds were provided to the project. This system supports the Objective Force transition path of the Transformation Campaign Plan.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Advanced Automotive Technology: In FY 02, evaluated Hybrid Electric (HE) M113 performance at Aberdeen Test Center (ATC); continued development and completed initial testing of hybrid electric HEMTT; completed testing the HE Light Armored Vehicle and Parallel HE drive; completed powertrain configuration study, which included modeling and simulation of 9 different solutions for the FMTV and initiated studies for the HMMWV and HEMTT; completed diagnostic solution for Family of Medium Tactical Vehicles (FMTV) with embedded Interactive Electronic Technical Manual and prognostics link. In FY 03, baseline COMBATT and Hybrid Electric COMBATT testing will be completed; updated Hybrid Electric design configuration and associated testing for the HEMTT will be completed; advanced development of the 8X8 to enhance power converter will proceed; will complete instrumentation of HEMTT ESP hydraulics with diagnostic sensors; demonstrate concept to HTV PM; test concept at ATC or equal; work with PM community to commonize A-kit and B-kit installations for embedded diagnostics on Brigade Combat Team vehicle fleet. In FY04, conduct extensive demonstrations and evaluations of subsystems and components which comprise hybrid electric propulsion systems in medium ground vehicles. FY05 demonstrate their synergistic effects when integrated with mission specific hardware/electronics, and offer these technologies/systems as candidates for inclusion in the Future Combat System.	15941	15242	16091	15884
Future Tactical Truck System (FTTS): In FY04, design Medium Support Vehicle variant and Utility variant, integrating selected advanced technologies such as high power density engines; hybrid electric propulsion; electric traction motors; advanced power distribution and control; advanced battery storage; independent and variable height suspension; semi-active/selectable damping suspension; advanced digital driver displays and controls; vehicle structure and cab designed for survivability and mine protection; and new methods and techniques for material handling. In FY05, fabricate prototype vehicles and conduct tests to verify performance characteristics.	0	0	7918	4897
Mobility: Vehicle Design - In FY03, complete requirements analysis and design for use of emerging commercially developed systems at 42VDC, 120 VAC. In FY04, develop baseline 42V power generation, energy storage devices, and smart power architecture components. In FY05, develop power distribution, power modules, and smart switching technologies.	0	669	990	979
COMBATT - In FY 02, this one-year Congressional Add performed performance/endurance testing of commercial vehicles converted to hybrid electric propulsion. In FY03, the objective of this one-year Congressional Add is to evaluate and mature technologies on commercial light truck platforms that enhance vehicle's performance while demonstrating the benefits of hybrid propulsion. No additional funds are required to complete this project.	13441	3347	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Smart Truck - In FY02, this one-year Congressional Add completed adaptation of commercially available digital technology for improved operation and safety of Army trucks. In FY03, the objective of this one-year Congressional Add is to demonstrate emerging automotive/military technologies on commercially based platforms that can be used for homeland defense. No additional funds are required to complete this project.	3264	3251	0	0
Hydrogen PEM Fuel Cell Heavy Duty Vehicle - In FY 02, this one-year Congressional Add completed development of a hydrogen PEM fuel cell powered heavy duty vehicle for demonstration in California to quantify the overall reduction of emissions. No additional funds are required to complete this project.	4801	0	0	0
Advanced Virtual Environments - In FY 02, this one-year Congressional Add completed development of a suite of 3D graphic simulation tools and displays that will allow users to operate within a computer generated collaborative virtual environment on a real-time basis. No additional funds are required to complete this project.	1344	0	0	0
National Auto Center - In FY02, this one-year Congressional Add formulated advanced modeling and simulation strategies for the Army's vehicle fleet; validated advanced propulsion and mobility simulation models. No additional funds are required to complete this project.	1920	0	0	0
Totals	40711	22509	24999	21760

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February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602601A - Combat Vehicle and Automotive Technology**	**H91**

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
H91	TANK & AUTOMOTIVE TECH	19698	20534	35939	33834	45375	44696	31913	22457

A. Mission Description and Budget Item Justification: This project investigates, develops and tests innovative vehicle concepts, survivability and critical power, propulsion, and electronic component technologies for future combat vehicles. The project addresses: vehicle concepts; mobility; integrated survivability; mechanical (non-electronic) countermine technology; vehicle electronics (VETRONICS) and intra-vehicle digitization; military fuels and lubricants and; water recovery/purification. The vehicle concepts effort investigates novel vehicles, develops virtual prototypes, conducts trade studies, and makes performance predictions and analyses. Virtual prototyping provides early and frequent evaluation of vehicle systems and subsystems in a simulated environment, allowing more rapid and efficient integration, assessment and transfer of component technology. Virtual prototyping will also be used to evaluate lightweight advanced bridging technologies, which meets load and mobility requirements. The goal of the mobility effort is to advance technologies for prime power generation (engines), running gear (tracks and suspensions), hybrid electric systems (including intelligent power and energy management) and pulse power for all on-board electric powered systems, including Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), electro-magnetic armor, electro-thermo-chemical gun, environmental systems, soldier power recharging, and vehicle accessories. The Active Protection effort provides component technologies that contribute to an integrated vehicle survivability approach that also includes signature reduction, countermeasures, damage reduction, laser protection, and advanced lightweight structure and base armor improvements using revolutionary materials and process technology. Defeat of Kinetic Energy (KE) threats offers a substantial challenge due to size and speed of the threat. The goal of the AP against KE effort is to detect, track and defeat KE with a multi-purpose hard kill warhead. This work complements, but does not duplicate, work performed under the armor exploratory development project (C05). This project also assesses mechanical countermine technology components for lightweight, energy absorbing, mechanical systems to meet the Objective Force's Countermine Mobility requirement to breach obstacles in-stride. The goal of the VETRONICS effort is to investigate vehicle electronics based on adapting commercial electronic standards, architectures and components for combat vehicle battlefield unique requirements. Water recovery and purification are sustainability technologies focusing on reducing the logistics footprint by leveraging emerging technologies and the basic research being conducted by DARPA. One goal is to reduce water distribution requirements (estimated at 106 tons/day for UOA and projected to be 40% of the total daily sustainment requirement of the Objective Force) through the development of a distributed water production capability leveraging developments in two areas: 1) innovative purification of traditional water sources and 2) water recovery from non-traditional sources including exhaust and atmospheric humidity. Activities are closely coordinated with TRADOC's Mounted and Dismounted Battlespace Battle Labs, the Directorate of Combat Developments for Transportation, Quartermaster, Program Executive Office for Ground Combat and Support Systems, ARL; DARPA and the Red River Army Depot. This program supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds were provided to the project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Advanced Distributed Simulation: In FY02, matured engineering level chassis models to evaluate mobility and dynamic stability of mobile manned and robotic vehicles. Developed FCS concepts and analyses and completed evaluation of the FCS industry team concepts through the IPT process. In FY03, mature physics based platform and terrain models for advanced manned and robotic ground vehicle subsystems. Complete baseline and validation experiments for moving vehicle operations. Provide FCS concepts, trade studies and performance predictions/input to performance predictions. In FY04, mature physics based mobility and durability models for advanced manned and robotic ground vehicle platforms and their associated complex urban, all-season terrain environment; make tire, snow and 3-D soil models run in real-time; develop models for ground contact with vehicle chassis and other implements. In FY05, mature the understanding of adverse effects of moving vehicle operations and promising passive and active mitigation strategies. Generate FCS Block II technology insertion concepts.	3000	1905	1586	1973
Hybrid/Electric Power: In FY03, develop and test high-power semi-conductor motor controllers for FCS. In FY04-05, develop advance silicon carbide for high voltage rectifier, converters, and motor drives for a more compact FCS Block II hybrid power management system for FCS. Evaluate advanced silicon and emerging wide bandgap power control for FCS block II and assess Li-Ion battery with improved performance (fire retarding and high retention) with power density of 2 kW/Kg.	0	500	1500	9600
Propulsion/Prime Power: In FY02, completed final 100 hour durability and performance demonstration of high output, low heat rejection compact 4-stroke diesel engine. In FY03, design/analysis/fabrication of running FCS test stand engines will be completed at 4.5 Net HP/cu-ft power density - Army will downselect to one engine. In FY04, full performance characteristics and 50 hour NATO durability testing will be demonstrated at 6 Net HP/cu-ft system power density. In FY05 selected engine will be performance and durability enhanced to achieve a 6 power density potential for integration into a complete propulsion package.	2750	3000	2000	1500

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Mobility/Drive - In FY02, completed fuel economy lab bench test evaluations of novel military fuels and lubricants; Petroleum Oil and Lubricants (POL) Quality Analyzer and Sensors device integration tested as a hand held unit; and performance analysis of heavy tactical vehicle concepts for mobility, survivability, transportability. In FY03, conduct fleet testing of novel fuels and lubricants; develop software to download POL Analyzer sensor data into AOAP database; and develop virtual prototypes of future light tactical vehicle configurations. In FY04, develop: improved Li-Ion battery with flame retardant electrolyte; high temperature, high frequency SiC switching devices; and in-hub and chassis high torque density motor concepts. In FY05, Investigate New Li-Ion battery electrode materials for higher power density; demonstrat e and test high torque density chassis and in-hub motors; develop Cascade type SiC motor inverter and battery charger; and develop and test hybrid Si/SiC motor inverter.	2822	1614	10962	8924
Active Protection/Survivability - In FY 02, designed, tested and demonstrated radar sensor technology for Kinetic Energy threat detection and tracking. Integrated KE defeat capability algorithms in the Systems Integration Lab for trade studies. Designed man/machine interfaces and formats with soldiers to control active protection. In FY03, conduct dynamic CM range tests of potential CE & KE countermeasure configurations against multiple dynamic horizontal and overhead threats. In FY04, for countermine survivability technology, determine optimum ground pressure to trigger age affected legacy mines. In FY05, investigate lightweight material solutions capable of withstanding the local blast effect of legacy mines, using modeling and simulation.	6236	1431	746	892
Pulse Power Hybrid Electric - In FY04-05, investigate and develop high-energy film capacitors, switches and chargers for electro-thermo gun and electro-magnetic armor system power source. In FY04, develop: 1.2 J/cc capacitors; high voltage, di/dt Si, and SiC semiconductor switches; and 2.5 j/cc capacitor prototype at 1kV. In FY05, demonstrate: 13 kJ (1.2 j/cc) capacitors at 10 kV; SiC Thyristor at 10 kV; 2.5 J/cc capacitor at 10 kV; and hybrid Si/SiC PFN charger.	0	0	12645	8971
Crew Integration & Automation Testbed (CAT) - In FY02, evaluated cognitive decision aids to reduce crew workload on multi-mission capable vehicle systems such as FCS. The increase in FY03 covers evaluation of intra-vehicle networking using wireless technologies, hardware dynamic reconfiguration technology, adaptable software technology, and system health & usage monitoring technologies. Evaluate the usage of 3D audio systems for the control and situational awareness of robotic and dismounted unmanned system assets. In FY04, evaluate speech recognition technology for speaker independence, natural language and expanded control to unmanned systems while working high noise environment.	1985	4084	1500	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Water recovery/purification - In FY02, demonstrated on-board water recovery from engine exhaust with HMMWV mounted water collection system achieving equivalent performance (0.5 to 0.6 gallons water/gallon fuel) with a 35% smaller heat exchanger than previously used. Transitioned MIOX (mix oxidant) electrolytic disinfection technology to PM Soldier and PM PAWS. In FY03, field demonstration of water recovery from exhaust prototype, with collection and purification system (of water from any source) integrated and mounted on a HMMWV. In FY04, demonstrate a water production prototype in a relevant environment that meets all the above requirements while reducing the operating (or price per gallon) costs by 20% and field assessment of purification of water from any source. In FY05, demonstrate feasibility of water recovery from atmospheric humidity with laboratory breadboard systems.	1925	3000	5000	1974
Calstart/Westart - This one-year Congressional Add demonstrated the hybrid electric component technologies in various vehicles used for public transportation and/or military purposes. No additional funding is required to complete this project.	980	0	0	0
Combat Vehicle Mobility System - The objective of this one-year Congressional Add is to develop component technology to improve mobility and survivability of the Army's ground vehicle systems. Making advances in the off-road mobility characteristics of wheeled vehicles to approach those of tracked vehicles is a major goal of the program. No additional funding is required to complete this project.	0	3334	0	0
Military Wheeled Vehicle Electronic Architecture Integration (EAI) - The objective of this one-year Congressional Add is to design and create an interface to serial databus architecture, such as J1939 and J1708, for legacy vehicles such as HMMWV, which will enable the vehicle platform to be equipped with critical capability like embedded diagnostics/prognostics. No additional funding is required to complete this project.	0	1666	0	0
Totals	19698	20534	35939	33834