# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

**February 2008**

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

| | COST (In Thousands) | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate | FY 2012 Estimate | FY 2013 Estimate |
|---|---|---|---|---|---|---|---|---|
| | Total Program Element (PE) Cost | 88749 | 93622 | 55234 | 59496 | 64024 | 65210 | 64449 |
| C05 | ARMOR APPLIED RESEARCH | 9155 | 9387 | 15489 | 18883 | 21940 | 22168 | 20416 |
| H77 | ADV AUTOMOTIVE TECH | 13922 | 13902 | 14226 | 14400 | 14517 | 14862 | 15219 |
| H91 | TANK & AUTOMOTIVE TECH | 30142 | 29709 | 25519 | 26213 | 27567 | 28180 | 28814 |
| T26 | Ground Vehicle Technologies (CA) | 11030 | 21255 | | | | | |
| T31 | NAT'L AUTO CENTER APP RES INIT (CA) | 24500 | 19369 | | | | | |

**A. Mission Description and Budget Item Justification:** This program element (PE) researches develops, and applies combat vehicle and automotive component technologies that enhance survivability, mobility, sustainability, and maintainability of Army ground combat and tactical vehicles. As combat vehicle systems become smaller and lighter, and tactical vehicles are more often exposed to combat conditions, one of the greatest technological and operational challenges is providing adequate crew protection without reliance on heavy passive armor. This challenge will be met using a layered approach that includes long-range situational awareness, advanced lightweight opaque and transparent armors, active protection, and multi-spectral signature reduction. Project C05 focuses on designing, fabricating, and evaluating performance of add-on lightweight armor packages as well as improving heavy integrated armor on current force platforms (i.e. Abrams). Lightweight armor is designed as (A-kits and B-kits) where the A-kits provide structural support to carry the minimum automotive loads and B-kits are added to the A-kit as an armor system to provide appropriate ballistic protection and can be upgraded over life time of vehicle. Lightweight armors and improved integrated armors are needed to provide both tactical wheeled and combat vehicles protection against Chemical Energy (CE) , Kinetic Energy (KE), and landmine threats with less than one fourth the weight of current heavy armor. Armor components are developed and demonstrated for application to the Future Force combat and tactical wheeled vehicles and offer transition opportunities for the Current Force platforms as described in PE 0603005A (Project 221). 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 by pursuing automotive-oriented technology programs that have potential benefit to military ground vehicles. Project H91 assesses a variety of enabling technologies in the areas of hybrid electric propulsion, mobility, thermal management, intelligent systems, vehicle diagnostics, fuels/lubricants, and water purification. Future Force combat and tactical wheel vehicles are being designed with hybrid electric architectures, advanced high power density engines, and auxiliary power units that provide power for propulsion, control systems, communications, life support systems, electromagnetic (EM) armor, Soldier battery charging, as well as exportable power for other systems. Project H91 also develops and evaluates hybrid electric propulsion and electronic vehicle component technologies, which are key enablers for achieving Future Force and enhanced Current Force capabilities. In the near term, Project H91 designs and fabricates components and conducts experiments to determine/validate performance of these devices and various subsystems used in Future Force vehicles and, where possible, as improvements in current combat and tactical vehicles. Project H91 conducts modeling and simulation (M&S) of Hybrid Electric Vehicle (HEV) performance on tactical wheel vehicles during realistic military missions (duty cycles); designs and evaluates components for improved vehicle performance and mobility including active suspensions, motors, regenerative brakes, vehicle electronics, generators, controllers, hybrid electric architectures, inverters, and lightweight metallic and segmented track. Project H91 performs design and fabrication of components for high temperature/power electronics, high energy density energy storage devices, JP-8 reformation and desulphurization as a fuel source for fuel cells, and Pulse Forming Networks (PFNs) (batteries, switches, inductors, and capacitors) required for electric vehicle mobility and survivability. Over the far term, this effort focuses on components that increase vehicle energy and power levels to accommodate advanced electric weapons (such as lasers, high power microwaves, and electro-magnetic guns) and advanced electric-based protection systems. Project H91 designs and develops ground vehicle diagnostics and

prognostics systems to improve vehicle reliability and maintenance (condition based maintenance). Project H91 also assesses the use of augmented and virtual reality technologies for incorporating data available from local unmanned system assets to enhance the Soldier's local situational awareness and vehicle control in dynamic environments. It assesses the effects of vehicle motion on the Soldier during combat or tactical vehicle operations and how these effects can be mitigated. Project T26 funds congressional special interest items. The PE is coordinated with PE 0602618 (Project H80), the U.S. Marine Corps through the Naval Surface Warfare Center for work on future tactical wheeled vehicles and with other ground vehicle developers within Defense Advanced Research Projects Agency (DARPA) and the Departments of Energy, Commerce, and Transportation. Products of this program primarily transition to PE 0603005A (Combat Vehicle and Automotive Advanced Technology) for maturation and incorporation into demonstration platforms/vehicles. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this PE is performed by Tank-Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI, in collaboration with the Army Research Laboratory (ARL), Adelphi and Aberdeen Proving Ground, MD.

| **B. Program Change Summary** | FY 2007 | FY 2008 | FY 2009 |
|---|---|---|---|
| Previous President's Budget (FY 2008/2009) | 91483 | 53342 | 49321 |
| Current BES/President's Budget (FY 2009) | 88749 | 93622 | 55234 |
| Total Adjustments | -2734 | 40280 | 5913 |
| Congressional Program Reductions | | -620 | |
| Congressional Rescissions | | | |
| Congressional Increases | | 40900 | |
| Reprogrammings | -942 | | |
| SBIR/STTR Transfer | -1792 | | |
| Adjustments to Budget Years | | | 5913 |

FY09 increased to develop and demonstrate armor components for ground combat and tactical vehicle against advanced emerging threats.

Twenty FY08 congressional adds totaling $40900 were added to this PE.

($800) Digital Engine/Hydraulic Valve Actuation Technology
($800) Nano-Engineered Multi-Functional Transparent Armor
($1000) Extreme-Condition Vehicle Tribology for Military Vehicle Technology at Northwestern University
($1200) Secure Mobile MANET System (HAC); Teamline Secure Mobile MANET System (HASC)
($1600) Automotive Research Equipment Purchase
($1600) Center for Advanced Vehicle Design and Simulations
($1600) Rapid Up-Armor Synthesis and Crashworthiness Design for Improved Soldier Survivability
($1600) SkyPure-Water from Air
($2400) Institute for Advanced Materials and Manufacturing Strategies (IAMMS)
($2800) Development of Logistical Fuel Processors to Meet Army/TARDEC/TACOM Needs
($2800) Quick Reaction Advanced Tactical Vehicle Technology
($3200) DoD Hydrogen PEM Fuel Cell Medium/Heavy Duty Vehicle Demonstration Program
($1000) Light Utility Vehicle
($1600) Advanced Manufacture of Lightweight Materials and Components
($1600) Military Fuels Research
($2000) Advanced Digital Hydraulic Hybrid Drive System
($2400) Globally Accessible Manufacturing and Maintenance Activity (GAMMA)
($2400) Tactical Metal Fabrication System (TacFab)
($4000) Hydraulic Hybrids, Advanced Materials, and Multi-fuel Engine Research (HAMMER) program

($4500) Spring-Suspended Airless Tires for Convoy Protection

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2008**

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

| COST (In Thousands) | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate | FY 2012 Estimate | FY 2013 Estimate |
|---|---|---|---|---|---|---|---|
| C05 ARMOR APPLIED RESEARCH | 9155 | 9387 | 15489 | 18883 | 21940 | 22168 | 20416 |

**A. Mission Description and Budget Item Justification:** This project investigates, designs, and evaluates advanced armor materials, advanced structural armors, ballistic defeat mechanisms, and armor packaging concepts to achieve lightweight, ballistically-superior armors/structures that provide the last line of defense for the Future Force vehicles and Current Force combat and tactical vehicles. The effort also provides analysis, modeling, and characterization of advanced armor solutions designed to protect against existing and emerging threats, including collateral damage from residual debris generated by Active Protection Systems (APS) threat defeat mechanisms. The Vehicle Armor Protection for Lightweight Combat Systems effort designs, fabricates, and evaluates performance of integrated and add-on lightweight armor packages (A-kits and B-kits) or vehicle protection treatments that reduce weight, reduce space claims, and lower the cost for protection against medium Kinetic Energy (KE) projectiles, Chemical Energy (CE) warheads, Explosively Formed Penetrators (EFPs), and blast fragments from mines. These will be used in Future Force vehicles as well as spun out to Current Force vehicles. Goals are to provide base armor to defeat heavy machine guns and residual fragments from APS intercept events at 20 lbs/sq.ft. (or less); armor packages to defeat limited rocket propelled grenades (RPGs) and medium caliber KE at 40 lbs/sq.ft. (or less); and novel frontal armors to defeat heavier threats at 80 lb/sq.ft. for Future Force Vehicles (reducing this to 60 lb/sq.ft. for future insertion/upgrades). The Armor for Tactical Wheeled Vehicle (TWV) Survivability effort designs, fabricates, and evaluates structural and add-on armors for tactical vehicles and investigates and characterizes effects of mine blasts on lightweight vehicles. Work conducted in this project provides armor components that are matured and demonstrated in the TWV Survivability effort described in PE 0603005A (Project 221), focusing on armor for protection from small arms and countermine applications, where possible, as add-on enhancements/upgrades. International cooperative research in mine blast characterization and vehicle response is also conducted. The armor technologies designed and fabricated in this project complement innovative non-armor survivability capabilities funded in Project H91. Efforts are fully coordinated with and complementary to work performed under program element (PE) 0602618A (Ballistic Technology) and PE 0602105A (Materials Technology). Products from this project generally transition to PE 0603005 for advanced demonstration. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI, in collaboration with the Army Research Laboratory (ARL), Adelphi, MD.

| **Accomplishments/Planned Program:** | FY 2007 | FY 2008 | FY 2009 |
|---|---|---|---|
| Vehicle Armor Protection for Lightweight Combat Systems: In FY07, evaluated performance of future armor concepts for ballistic protection; demonstrated candidate armors against FCS objective threats to include small arms, medium caliber KE, and fragment defeat; applied and validated modeling and simulation tools; continued electromagnetic armor evaluations; and conducted experiments to determine the best solutions for integrating ballistic, signature management, and related survivability technologies. In FY08, demonstrate optimized third generation add-on armor (upgraded performance B-Kit armor package for objective projectile, fragment, and mine threats at reduced weights) and structure configurations for Future Force combat vehicles; conduct ballistic tests to verify final armor designs and integrate into second generation full sized concept vehicle structure (spaceframe demonstrator). In FY09, will develop enhancements to ground vehicle armor and mine kits to reduce weight and meet objective and emerging threats. Conduct and report armor space and weight trade studies to support next generation add-on armor solutions. Assess blast modeling and simulation tool(s) capability for full platform level simulation with a human response component. | 8542 | 8522 | 8876 |

| | | | |
|---|---|---|---|
| Armor for Tactical Vehicle Survivability: In FY07, evaluated advanced armor materials for tactical vehicles; evaluated performance of a lightweight blast/fragmentation add-on armor under live-fire conditions. In FY08, continue assessment of new armor solutions for implementation in the associated PE 0603005A TWV Survivability effort. In FY09, will conduct final armor assessments of potential candidates for spiral insertion. | 613 | 642 | 647 |
| Armor Materials: In FY09, will assess Reactive Armor and Electromagnetic Armor designs developed by ARL under PE 0602618 (Project H80) for defeat of emerging KE and CE threats. Demonstrate tools and techniques for Non Destructive Evaluation (NDE)/Non Destructive Inspection (NDI) tools for dissimilar material joints. Assess M&S tools for vehicle level analysis to harden combat vehicles to collisions and blast threats. | | | 5966 |
| Small Business Innovative Research/Small Business Technology Transfer Programs. | | 223 | |
| Total | 9155 | 9387 | 15489 |

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2008**

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

| COST (In Thousands) | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate | FY 2012 Estimate | FY 2013 Estimate |
|---|---|---|---|---|---|---|---|
| H77 ADV AUTOMOTIVE TECH | 13922 | 13902 | 14226 | 14400 | 14517 | 14862 | 15219 |

**A. Mission Description and Budget Item Justification:** This project funds the National Automotive Center (NAC), which leverages commercial investments in automotive technology research and development. NAC conducts shared government and industry technology programs that focus on benefiting military ground vehicle systems. Component technologies being developed in this project support the combat and tactical vehicles in the Army's Current and Future Modular Force. Improvements in the Current Force are expected to rely heavily on leveraging commercial technologies for advances in operational capabilities and reduced cost. The NAC serves as a catalyst, linking industry, academia, and government agencies in the development and exchange of automotive design and component technologies. The NAC core program is focused in two primary areas: Advanced Automotive Technology (AAT), and the Future Tactical Truck System (FTTS) Advanced Concept Technology Demonstrator (ACTD). A major effort in AAT is the application of Hybrid Electric Drive (HED) for tactical and light combat vehicles to improve fuel economy and mobility. Another major effort in AAT is fuel cell research, addressing fuel cell design and the equipment required to convert battlefield hydrocarbon fuels into hydrogen that is needed for fuel cell operation. AAT also includes efforts that address fuel efficiency, vehicle modernization (suspension and structures), crew safety, maintenance, reliability, diagnostics and prognostics, network centricity, wireless communications, logistics improvement and manufacturing innovation with an overall goal of improving performance and endurance of ground vehicle fleets and reducing vehicle design, manufacturing, production, operating, and support costs. The FTTS ACTD, completed in FY07, implemented and evaluated a number of advanced automotive technologies, which the Army and commercial sector have matured over the last decade, into tactical support vehicles. The FTTS ACTD test results validated performance models, refined user requirements for tactical trucks, and reduced risk of insertion of certain advanced technologies into current and future tactical vehicle platforms such as the Joint Light Tactical Vehicle (JLTV). Some activities of the NAC are supported by other government agencies via Memoranda of Agreement (MOA) and Memoranda of Understanding (MOU). The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI.

| **Accomplishments/Planned Program:** | FY 2007 | FY 2008 | FY 2009 |
|---|---|---|---|
| Advanced Automotive Technology: In FY07, implemented embedded diagnostics on current tactical vehicle platforms; integrated wireless sensor capabilities to provide oil analysis, tire pressure, and battery analysis; initiated integration of hybrid-hydraulic technology on TWV; developed inline oil sensing technology to provide condition data including viscosity, oxidation, lubricant contaminants; initiated vehicle integration efforts for fuel cell Auxiliary Power Unit (APU). In FY08, develop thermoelectric power modules using waste exhaust heat to power low current sensing devices on relevant TWV platforms; develop inline oil sensing technology to provide condition data including viscosity, oxidation, and lubricant contaminants; expand hybrid-hydraulic hybrid technology effort to include demonstration on a light tactical vehicle platform; expand fuel cell Auxiliary Power Unit (APU) development to include on-vehicle demonstration. In FY09, will evaluate the FY08 thermoelectric power modules on relevant TWV platforms; conduct technology evaluation of fuel cell APU; expand mobile micro-grid technology development program with large scale technology demonstration; continue crash modeling and safety design for TWV's. Conduct qualification experiments for alternative fuels program for ground vehicle systems. Assess available automotive industry suspension technologies for axels and structural support improvements for ground combat and tactical wheeled vehciles. | 12922 | 13709 | 14226 |

| | | | |
|---|---|---|---|
| Future Tactical Truck System (FTTS) ACTD: In FY07, finalized safety certification testing for the Utility Variant (UV); completed the Military User Assessment (MUA) with both the Maneuver Sustainment Variant and UV vehicles; supported the MSV and UV vehicles during a residual phase during which further user evaluation was conducted. Results of the FTTS ACTD fed requirements for development of the JLTV. | 1000 | | |
| Small Business Innovative Research/Small Business Technology Transfer Programs. | | 193 | |
| Total | 13922 | 13902 | 14226 |

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

**February 2008**

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

| COST (In Thousands) | | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate | FY 2012 Estimate | FY 2013 Estimate |
|---|---|---|---|---|---|---|---|---|
| H91 | TANK & AUTOMOTIVE TECH | 30142 | 29709 | 25519 | 26213 | 27567 | 28180 | 28814 |

**A. Mission Description and Budget Item Justification:** This project designs, develops and evaluates a variety of innovative and enabling technologies in the areas of vehicle concepts, virtual prototyping, power, thermal management, propulsion, mobility, survivability, vehicle diagnostics, fuels, lubricants, water purification, intelligent systems, and other component technologies for application to current and future combat and tactical vehicles. Future Force vehicles and new tactical vehicle designs include hybrid electric architectures, advanced high power density engines, and non-primary power systems that provide power for propulsion, control systems, communications, life support systems, electric-based weapons and protection systems, Soldier battery charging, and exportable power. The Hybrid Electric Vehicle (HEV) Components effort designs, fabricates, and evaluates critical components for energy storage (batteries), power distribution and power management, and conducts experiments to determine/validate performance of the components and various subsystems for potential use in FCS, future tactical vehicles, and, where possible, as improvements in current combat and tactical vehicles. Components developed under this effort are often incorporated into the Power & Energy Systems Integration Laboratory (P&E SIL), funded in PE 0603005A, Project 441, for system maturation. The HEV Experimentation and Assessment effort develops a technical approach to quantify battery state of charge within 5 percent error and the evaluation of the impacts of various power management strategies on fuel economy. The Pulse Power efforts focus, in the near to mid-term, on providing compact, high frequency/high energy/high power density components and devices for Pulse Forming Networks (PFNs) and Pulse Power Supplies (PPS), which are enablers for several advanced electric-based weapon systems, including electro-magnetic gun. The JP-8 Reformation for Military Fuel Cells effort focuses on JP-8 reformation and desulphurization to provide hydrogen on which fuel cells can operate. The goal of the Propulsion-Prime Power/Non-primary Power System (NPS) effort is to design engines and generators and their components with significantly improved performance characteristics, efficiencies, and power densities. The Mobility effort for manned and unmanned vehicles focuses on improving drive component performance and reliability (e.g., running gear, tracks, and suspensions), fuels and lubricants, minefield clearance, counter obstacle bridging, and gap-crossing technologies to reduce logistics burdens associated with sustainment of manned and unmanned combat and tactical vehicles. The Vehicle Survivability effort provides advanced component technologies that contribute to a layered vehicle survivability approach to address emerging threats. This effort includes design and evaluation of active protection and hit-avoidance components, signature reduction materials, tracking/detection components for unmanned systems, and laser protection materials. The Water Generation, Recovery, and Purification effort focuses on reducing the logistics footprint by leveraging emerging technologies. The program designs enhanced water production technology, which can be embedded in combat and tactical platforms to support the individual Soldier and/or create distributed modular water production units. The Intelligent Systems Technology Research effort assesses improved operations of manned platforms through the application of sensing and autonomy technologies developed for unmanned systems. It performs applied research in control technologies incorporating drive-by-wire and autonomous mobility in combat and tactical vehicles; use of augmented and virtual reality to help the Soldier better control vehicles in highly dynamic environments; innovative approaches for extreme mobility of small to medium Unmanned Ground Vehicle (UGV) systems to include legged locomotion; minimizing vehicle motion effects for combat and tactical vehicle crews. The Diagnostics/Prognostics for Condition Based Maintenance effort will focus on developing the tools to gather data from ground vehicles that would allow maintainers to diagnose problems more accurately and lead to being able to predict failures before they occur. Efforts in this project are closely coordinated the Army Research Laboratory (ARL), the Defense Advanced Research Projects Agency (DARPA), the U.S. Army Engineer Research, Development, and Engineering Center, Edgewood Chemical biological Center, and the Army Medical Department. The cited work is consistent with the Department of Defense Research and Engineering Strategic Plan, the Army Science and Technology Master Plan, the Army Modernization Strategy, and the Army Posture Statement. Work in this project is performed by Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI.

| **Accomplishments/Planned Program:** | FY 2007 | FY 2008 | FY 2009 |
|---|---|---|---|
| Hybrid Electric Vehicle Components: In FY07, validated significant performance and capability enhancements to SiC components (20 percent increase for inverters and a 100 percent increase for DC-DC conversion in power density) and special high-power/high-energy Li-ion batteries (20 percent increase in power density), allowing for integration into a complete, compact hybrid power management system; designed and fabricated SiC Metal Oxide Semiconductor Field Effect Transistor (MOSFET) motor drive and conducted experiments determining whether components, sub-systems, and systems can operate successfully at the required 110 degrees C without degradation in vehicle performance. This was a collaborative TARDEC and ARL effort. In FY08, design and fabricate high power density DC-DC converter (8kW/l) using SiC MOSFET; demonstrate innovative thermal management technique achieving heat rejection rates of 300 W/cm2 and high inlet coolant temperatures (1100 C) compatible with SiC technologies; conduct computational fluid dynamics analysis on cooling systems to optimize their integration in vehicle platforms. | 8995 | 4684 | |
| Hybrid Electric Vehicle Experimentation and Assessment: In FY07, investigated impacts of various power management strategies on fuel economy including variations to the battery management system. Using battery management system, optimized battery charge state to maximize the recapturing of energy during recharge cycles; exercised the test methodology to provide data for the TWV program; developed and validated M&S tools that predict hybrid electric drive cycle performance with analysis of data on relevant performance characteristics to supports potential TWV HEVs and the TWV Fleet Modernization Strategy. M&S also supported test operating procedure development with simulation excursions and provided data to quantify duty cycles. Additionally M&S was used to analyze the Joint Light Tactical Vehicle variants and determined the optimal set of advanced propulsion system architectures to meet variant Mission Profile requirements in support of the Army/Marine Corps next generation tactical vehicle. | 4997 | | |
| Pulse Power: In FY07, refined component designs, integrated, and tested to validate performance enhancement and size reduction goals for SiC solid-state switches, pulse charger inverter/rectifier circuits, fast-discharge, high-voltage capacitors, and advanced thermal management technologies. In FY08, increase pulse width of Si and SiC switches by 10X, increase power density of converters by 3X, and increase power density for batteries and capacitors by 2X to provide compact power conditioning and energy/power storage for applications such as EM gun, laser, and other directed energy weapons. In FY09, will evaluate first generation pulse switches, power converters, and power, and energy storage. Will evaluate Si-based Super Gate Turn-Off (SGTO) versus SiC-based thyristors for capability to meet power density and switching speeds required for High Energy Laser application. | 5206 | 2177 | 3294 |
| JP-8 Reformation for Alternative Power Sources: In FY07, integrated system components into a functional brass board and tested fuel cell power modules, Proton Exchange Membrane (PEM), High Temperature PEMs (HTPEM), and Solid Oxide Fuel Cells, as well as identified technology gaps in thermal management, load following capabilities, power management, system integration, and overall system requirements. In FY08, optimize and integrate JP8 reformer to transportable system and interface with fuel cell toward meeting the size and signature requirements of the Army. In FY09, will complete integration of JP8 reformer; begin test plan and preliminary fuel cell/reformer system integration for endurance test; begin 1000 hour endurance test on JP8 reformer connected to fuel cell to produce power. Complete addition 250 hour test to include military environmental requirements. Follow on programs will integrate the JP-8 reformers developed with fuel cells to meet auxiliary power and light robotic platform propulsion requirements. | 1627 | 5806 | 3921 |
| Propulsion-Prime Power/Non-primary Power System (NPS): In FY07, began fabrication of an Opposed Piston Opposed Cylinder (OPOC) engine. In FY08, complete fabrication of the OPOC engine and perform optimization, performance testing and 50 hour NATO durability test demonstration. Initiate concept analyses and designs for low heat rejection, oil cooled, high speed, and high power density engine design. Initiate concept analyses and design of a closed loop controlled fuel injection system for heavy fuel operation to achieve constant power. In FY09, will perform hybrid electric power component test and evaluation for tactical wheeled vehicle; optimize control | 2381 | 7594 | 9978 |

| | | | |
|---|---|---|---|
| strategy for high power density engine design. Will develop, verify, and validate power and thermal management models and simulations; design and begin development of intelligent power and thermal components; generate test and evaluations of intelligent power and thermal management; develop optimal hybridization strategy combining energy storage and power generation components into a non-primary power system. | | | |
| Mobility: In FY07, worked with industry to assess the technical and economic barriers to develop a single lubricant; identified key test and evaluation requirements to understand and verify technical barriers; collected relevant economic information; and conducted initial cost analysis. In FY08, complete technical investigations, conduct final cost analysis; complete technical and economic feasibility report for single lubricant technology, develop additives, and identify synthetic base stocks for making a single lubricant that can meet multi-functionality requirement. In FY09 will reformulate, model, redesign, and fabricate high performance bushings using improved materials; install the improved bushings onto standard Abrams track for relative evaluation and conduct vehicle test of the augmented Abrams track to validate track system durability improvements. | 1366 | 1374 | 1000 |
| Vehicle Survivability (Active Protection/Ballistic Protection /Laser Protection /Minefield Clearance): In FY07, matured countermine mission module prototypes, developed interface/platform baseline requirements, and conducted advanced trials; performed simulation and modeling of advanced survivability technologies for tactical vehicles. In FY08, purchase long lead materials and begin fabrication of advanced survivability technologies, to include active, passive, and laser protection, to address emerging threats. | 3584 | 3142 | |
| Force Projection: In FY07, conducted field experimentation and modeling and system analysis of water from air device. In FY08, develop and test alternative disinfection technology and analyze rate and transformation of water contaminants in order to reduce health risks and improve water quality. In FY09, will integrate water from air system on a mobile platform and demonstrate water production on the move; will assess in-line and hand held water monitoring technology | 1730 | 2070 | 2870 |
| Intelligent Systems Technology Research: In FY07, conducted M&S to assess improvements to the mobility and local situational awareness tasks of manned ground vehicles resulting from the application of sensing and autonomy technologies; began an analysis based on user requirements for a small robot incorporating legged locomotion to support dismounted operations in complex terrain. In FY08, determine design approaches for displays involving a mix of live video and computer generated graphics, and solutions for the transfer of mobility control between manned driving and autonomous driving modes for manned vehicles, complete the analysis of a small-legged robotic system, and conduct modeling and simulation to explore design approaches; develop and evaluate embedded real-time dynamic mobility models to predict manned and unmanned vehicle responses to prevent unsafe mobility situations while under robotic control. | 256 | 2619 | |
| Diagnostics/Prognostics for Condition Based Maintenance: In FY09, will develop diagnostic and prognostics systems capabilities to monitor/anticipate incipient failures, isolate faults, and identify root-cause of failures for critical power train components on current force ground combat vehicles (i.e. Abrams and Bradley engine and transmission). Will evaluate and identify commercially available monitoring sensor capabilities wired to existing databus technologies. Investigate capability to integrate additional sensors to provide higher resolution as well as architecture to integrate into wireless networks to enable remote monitoring capability. | | | 4456 |
| Small Business Innovative Research/Small Business Technology Transfer Programs. | | 243 | |
| Total | 30142 | 29709 | 25519 |