

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army	DATE: February 2012
---	----------------------------

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
2040: <i>Research, Development, Test & Evaluation, Army</i> BA 2: <i>Applied Research</i>				PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>							
COST (\$ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
Total Program Element	61.893	64.205	69.062	-	69.062	67.789	71.809	70.503	64.873	Continuing	Continuing
C05: <i>ARMOR APPLIED RESEARCH</i>	24.776	25.798	28.440	-	28.440	27.037	28.407	28.547	25.414	Continuing	Continuing
H77: <i>National Automotive Center</i>	16.016	15.120	16.250	-	16.250	15.939	16.606	16.813	17.010	Continuing	Continuing
H91: <i>Ground Vehicle Technology</i>	21.101	23.287	24.372	-	24.372	24.813	26.796	25.143	22.449	Continuing	Continuing

Note

FY13 funding increased for vehicle blast research and alternative fuels research.

A. Mission Description and Budget Item Justification

This program element (PE) researches, designs, and evaluates combat and tactical vehicle automotive technologies that enable the Army to have a lighter, more survivable, more mobile and more deployable force. Project C05 investigates, researches, and evaluates advanced ground vehicle design and occupant protection technologies in such areas as armor concepts, ballistic defeat mechanisms, blast mitigation, survivability modeling and simulation (M&S), hit avoidance, kill avoidance, safety, sensors, instrumentation and survivability packaging concepts to achieve superior survivability/protection for soldiers and military ground vehicles. Project H77 funds the National Automotive Center (NAC), which was chartered by the Secretary of the Army to conduct shared government and industry, or "dual use", technology programs to leverage commercial investments in automotive technology research and development for Army ground combat and tactical vehicle applications. Project H91 designs, matures, and evaluates a variety of innovative and enabling technologies in the areas of electrical power, thermal management, propulsion, mobility, power for advanced survivability, vehicle diagnostics, fuels, lubricants, water purification, intelligent systems, and other component technologies to enhance the mobility, power and energy and reduce the logistic chain of combat and tactical vehicles.

Work in this PE is related to, and fully coordinated with, PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology, Robotics Technology, PE 0602705A (Electronics and Electronic Devices), PE 0602716A (Human Factors Engineering Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), and PE 0708045A (Manufacturing Technology), PE 0603734 (Military Engineering Advanced Technology).

Work in this PE is coordinated with the U.S. Marine Corps, the Naval Surface Warfare Center, and other ground vehicle developers within the Defense Advanced Research Projects Agency (DARPA) and the Departments of Energy, Commerce, and Transportation.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, MI.

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army				DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY		R-1 ITEM NOMENCLATURE			
2040: Research, Development, Test & Evaluation, Army		PE 0602601A: Combat Vehicle and Automotive Technology			
BA 2: Applied Research					
B. Program Change Summary (\$ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total
Previous President's Budget	64.740	64.306	62.264	-	62.264
Current President's Budget	61.893	64.205	69.062	-	69.062
Total Adjustments	-2.847	-0.101	6.798	-	6.798
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.006	-			
• Adjustments to Budget Years	-	-	6.798	-	6.798
• Other Adjustments 1	-1.841	-0.101	-	-	-

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army									DATE: February 2012		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research				R-1 ITEM NOMENCLATURE PE 0602601A: Combat Vehicle and Automotive Technology				PROJECT C05: ARMOR APPLIED RESEARCH			
COST (\$ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
C05: ARMOR APPLIED RESEARCH	24.776	25.798	28.440	-	28.440	27.037	28.407	28.547	25.414	Continuing	Continuing
Note Not applicable for this item.											
A. Mission Description and Budget Item Justification This project investigates, researches, and evaluates advanced ground vehicle design and occupant protection technologies in such areas as armor concepts, ballistic defeat mechanisms, blast mitigation, survivability M&S, hit avoidance, kill avoidance, safety, sensors, instrumentation and survivability packaging concepts to achieve superior survivability/protection for soldiers and ground combat and tactical vehicles. Survivability/protection technologies are being investigated to meet anticipated ground combat and tactical vehicle survivability objectives. Additionally, this project focuses on analysis, modeling, and characterization of potential survivability solutions that could protect against existing and emerging threats. This analysis is used to aid in the identification of technologies to enter maturation and development in PE 0603005A/project 221. This project supports Army science and technology efforts in the Ground portfolio. The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy. Work in this project is performed by the Tank Automotive Research, Development, and Engineering Center (TARDEC) Warren, MI and is fully coordinated with work at the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD.											
B. Accomplishments/Planned Programs (\$ in Millions)								FY 2011	FY 2012	FY 2013	
Title: Vehicle Armor Protection for Lightweight Combat Systems:								10.505	9.966	-	
Description: This effort designs, fabricates, and investigates add-on lightweight armor packages to protect combat systems against projectiles, warheads, penetrators and blast fragments.											
FY 2011 Accomplishments: Performed armor recipe optimization to establish armor efficiency; completed ballistic testing of selected armor systems to validate the armor design; downselected materials/armor systems for entire vehicle protection and procured long lead items for future demonstration builds; and matured and validated performance of multifunctional armor.											
FY 2012 Plans:											

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602601A: Combat Vehicle and Automotive Technology	PROJECT C05: ARMOR APPLIED RESEARCH		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2011	FY 2012	FY 2013
Complete armor design and fabrication; perform shaker and ballistic assessment to validate and improve armor design, armor attachment durability, and ballistic performance for combat vehicles. This work is done in conjunction with program elements 0602105A, 0602618A, and 0603005A.				
Title: Advanced Armor Development: Description: The objective of this effort is to design, integrate and validate performance of advanced armor systems to defeat single and multiple chemical and kinetic energy (CE and KE) emerging threats for combat and tactical vehicles. These systems include base armor (small arms / medium caliber opaque B-kits and transparent), applique armor (passive / reactive / active multi-threat C-kits) and multifunctional armor (embedded antennas & health monitoring devices). FY 2011 Accomplishments: Validated advanced armor designs at the panel level while reducing armor weight by 10,000 pounds; improved armor recipe to meet threshold areal density while defeating threshold threat for the Ground Combat Vehicle platform. FY 2012 Plans: Develop advanced armor designs at the panel level that will reduce areal density from the threshold level while still defeating threshold threat. Investigate integration of communication antennas and health monitoring equipment into armor recipe and design. This work is done in conjunction with program elements 0602105A, 0602618A and 0603005A. FY 2013 Plans: Will mature high-performance lightweight armor recipes by conducting risk mitigation and system level multi-hit ballistic validation evaluation; examine novel integration methods for transparent armor; mature and evaluate the integration of communication antennas and health monitoring into armor recipe and design; create techniques and procedures for integration of advanced armors.		8.470	7.160	10.950
Title: Blast Mitigation: Description: This effort designs, fabricates and evaluates advanced survivability and protection capabilities, tools and technologies to improve protection against vehicle mines, improvised explosive devices (IEDs) and other underbody threats, and crash events. This effort also designs and evaluates technologies purposed for protecting the occupant such as seats and restraints. This effort creates the laboratory capability needed to enable expeditious research and development of blast-mitigating technologies. Blast and crash mitigation technologies are further investigated and matured in such areas as active and passive exterior/hull/cab/kits, interior energy absorbing capabilities for seats, floors, restraints, sensors for active technologies and performance evaluation, M&S, experimentation and instrumentation. FY 2011 Accomplishments:		5.801	8.672	12.490

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army			DATE: February 2012		
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test & Evaluation, Army</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>		PROJECT C05: <i>ARMOR APPLIED RESEARCH</i>	
B. Accomplishments/Planned Programs (\$ in Millions)			FY 2011	FY 2012	FY 2013
Developed techniques for complete vehicle structure design and crew protection methods for landmine/explosive events; investigated performance and integration of extinguishing mechanisms; enhanced fire M&S tools to incorporate new extinguishing agents, delivery systems, and predictive capabilities for ballistic events; increased cook-off resistance of small arms ammunition via improved stowage without compromising accessibility. FY 2012 Plans: Increase fidelity in end-to-end M&S tools for occupant protection and vehicle underbody and Soldier blast protection. Validate live fire test and evaluation events with M&S to reduce program risk and expense, and use high fidelity models to identify quick reaction solutions to the Warfighter. Mature techniques to reduce flammability of vehicle tires, track, and composite materials and protect lithium-ion batteries against fire events. FY 2013 Plans: Will leverage defense, automotive and medical communities to research innovative occupant protection technologies such as restraints, hull structure designs, seats, and crash event simulation tools; refine finite-element M&S tools for quicker assessment of occupant protection technologies; develop a Multi-Axis Blast Simulator (MABS) for rapid component-level testing; mature and evaluate occupant protection technologies in such areas as exterior protection technologies, interior protection technologies, sensor technologies and instrumentation technologies; Create 3D CAD models of the Occupant Centric System Demonstrator to further refine and validate the design through M&S; create standards for occupant protection against underbody blasts and crashes to capture and document the best practices of occupant protection.					
Title: Synergistic Vehicle Protection Technologies Description: This effort investigates and integrates advanced synergistic survivability technologies and simulation tools to provide enhanced protection for ground vehicles while minimizing overall system burdens. Synergistic survivability technologies such as, armor and active protection, offer the potential of non-linear survivability improvements. The modular approach facilitates trade-offs between protection, payload, performance, cost drivers and performance of vulnerability assessments throughout the life cycle of a system. Provides quantifiable metrics for development of requirements and evaluation of concept feasibility in the development of survivable combat systems. FY 2013 Plans: Will synergize vehicle survivability technologies to optimize protection during multi-threat, multi-aspect engagements; design and evaluate assessment methodologies for quantifying and mitigating post-engagement damage and crew casualties from effects such as fire and blast; provide enhanced capabilities to support combat modeling such as COMBAT XXI by providing rapid vehicle/weapon interaction modeling.			-	-	5.000
Accomplishments/Planned Programs Subtotals			24.776	25.798	28.440

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test & Evaluation, Army</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>	PROJECT C05: <i>ARMOR APPLIED RESEARCH</i>
C. Other Program Funding Summary (\$ in Millions) N/A		
D. Acquisition Strategy N/A		
E. Performance Metrics Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army									DATE: February 2012		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research				R-1 ITEM NOMENCLATURE PE 0602601A: Combat Vehicle and Automotive Technology				PROJECT H77: National Automotive Center			
COST (\$ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H77: National Automotive Center	16.016	15.120	16.250	-	16.250	15.939	16.606	16.813	17.010	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project funds the National Automotive Center (NAC), which was chartered by the Secretary of the Army to conduct shared government and industry (dual use)technology programs to leverage commercial investments in automotive technology research and development for Army ground combat and tactical vehicle applications. Primary thrusts for this activity include advanced power and energy technologies for tactical and non-tactical ground vehicles, electric infrastructure and alternative energy for installations and bases, vehicle networking and connectivity to maximize overlap between commercial and military requirements. Active outreach to industry, academia and other government agencies develops new thrust areas for this project to maximize shared commercial and government investment.

This project supports Army science and technology efforts in the Ground portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, Michigan and is coordinated with PE 0602705A (Electronics and Electronic Devices).

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2011	FY 2012	FY 2013
Title: Alternative Energy:	8.573	9.062	-
Description: This effort leverages opportunities from industry to develop alternative energy technologies for Army applications.			
FY 2011 Accomplishments: Continued development of waste to energy technologies to reduce fuel consumption in power generation; continued to conduct experiments with synthetic and renewable fuel blends for alternative fuels qualification program for ground vehicle systems; expanded development and commercialization of dual-use Modeling and Simulation (M&S) tools by conducting high-density hybrid engine modeling and vehicle thermal management modeling.			
FY 2012 Plans: Conclude development of dual-use M&S tools for advanced high-density hybrid engine powered non-tactical vehicle business case analysis; begin planning for large scale investigation of vehicle-to-grid and grid-to-vehicle capabilities integrated into a power			

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602601A: Combat Vehicle and Automotive Technology	PROJECT H77: National Automotive Center		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2011	FY 2012	FY 2013
grid with a high proportion of renewable generation; continue to pursue qualification of alternative fuels for use in ground vehicle systems; conduct system level assessments of synthetic and renewable fuel blends supporting their implementation into military fleets. This work is being done in conjunction with program element 0602705A.				
Title: Conditioned Based Maintenance (CBM) and Intelligent Systems: Description: This effort advances condition based maintenance and intelligent systems technologies for dual use applications, including the investigation of commercial hybrid electric non-tactical vehicles on military bases to gather performance, reliability and maintainability data. FY 2011 Accomplishments: Expanded development and investigation of dual-use CBM tools by developing battery prognostics and diagnostics M&S tools, as well as investigating on-board vehicle health awareness tools. FY 2012 Plans: Pursue fleet level evaluation of dual-use CBM tools for battery prognostics and diagnostics and begin development and investigation of dual-use CBM tools for additional vehicle subsystem prognostics and diagnostics.		2.152	2.272	-
Title: Power, Energy and Mobility: Description: This effort investigates dual use power, energy, and mobility technologies leveraging commercial and academic investment to military application focusing on technologies such as light weight composite materials, electrification of engine accessories, alternative fuels, hybrid vehicle architectures, and compact electrical power generation in order to maximize common investment to meet Army ground vehicle requirements. This work is done in conjunction with program element 0603005A. FY 2011 Accomplishments: Developed dual-use automotive subsystems and components that can be modified for application to military platforms and alternative chassis structures; pursued power and energy component development; designed high-yield renewable energy generation technology architecture and prepared distributed generation transition criteria for PM Mobile Electric Power; and expanded development of methodologies to validate and explore true potential of proposed advanced engine technologies. FY 2012 Plans: Continue the pursuit of dual-use power and energy component development and integrate initial products into non-tactical vehicles for assessment on military installations. Continue to support transition of distributed generation hardware to PM Mobile Electric Power or other materiel developers. FY 2013 Plans:		3.103	3.786	5.933

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012		
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test & Evaluation, Army</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>	PROJECT H77: <i>National Automotive Center</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2011	FY 2012	FY 2013
Will continue the development and integration of dual use power, energy and weight reducing components such as lightweight composites, electrification of engine accessories and compact electrical power generation into non-tactical vehicles for fuel consumption and mobility improvement; conduct operational assessments of advanced propulsion vehicles on military installations; pursue dual use automotive technology collaborations with other government agencies, industry and university partners.				
Title: Joint Recovery and Distribution System (JRaDS): Description: Provides a Family of Systems (FoS) which enables execution of multiple mission profiles via a small number of trailer variants vs. the current large inventory of distinct service type trailer systems. Will offer high reliability and parts commonality, reducing service logistics and maintenance requirements associated costs of ownership, and requirements for supplementary Materiel Handling Equipment and supporting personnel. FY 2011 Accomplishments: Reduced risk for DoD Joint Recovery and Distribution System (JRaDS) JCTD by enabling the purchase of additional prototype trailer systems and supported the broader scoped Operational Military Utility Assessment. Fielded JRaDs trailers in Afghanistan for a successful operational assessment.		2.188	-	-
Title: Dual Use Technologies Description: This effort investigates, researches and evaluates ground vehicle technologies with both military and commercial applications such as renewable energy technologies, electrical power management between vehicles and the grid, alternative fuels, and advanced vehicle networking and communication (telematics). This effort maximizes commercial technology investment for military applications in line with the National Automotive Center's Charter. Collaborations with industry, universities and other government agencies on standards writing for joint applications will facilitate this activity. This work is done in conjunction with program element 0603005A. FY 2013 Plans: Will actively pursue, identify and leverage dual use technology opportunities to benefit both commercial industry and military application through active partnering and outreach; mature vehicle-to-grid and grid-to-vehicle technology and standards; emphasize the use of renewable energy sources to solve military energy problems for base applications; continue to support the transition of distributed power generation hardware to PM Mobile Electric Power or other materiel developers; pursue vehicle based telematics (vehicle networking and communication) solutions in support of Homeland Defense.		-	-	10.317
Accomplishments/Planned Programs Subtotals		16.016	15.120	16.250

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test & Evaluation, Army</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>	PROJECT H77: <i>National Automotive Center</i>
C. Other Program Funding Summary (\$ in Millions) N/A		
D. Acquisition Strategy N/A		
E. Performance Metrics Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.		

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army									DATE: February 2012		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research				R-1 ITEM NOMENCLATURE PE 0602601A: Combat Vehicle and Automotive Technology				PROJECT H91: Ground Vehicle Technology			
COST (\$ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
H91: Ground Vehicle Technology	21.101	23.287	24.372	-	24.372	24.813	26.796	25.143	22.449	Continuing	Continuing

Note

Not applicable for this item.

A. Mission Description and Budget Item Justification

This project designs, develops, and evaluates a variety of innovative enabling technologies in the areas of vehicle concepts, virtual prototyping, electrical power, thermal management, propulsion, mobility, survivability, vehicle diagnostics, fuels, lubricants, water purification, intelligent systems, and other component technologies for application to combat and tactical vehicles.

This project supports Army science and technology efforts in the Ground portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering science and technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the Tank Automotive Research, Development, and Engineering Center (TARDEC), Warren, Michigan. Efforts in this project are closely coordinated with 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.

B. Accomplishments/Planned Programs (\$ in Millions)

Title: Pulse Power:	FY 2011	FY 2012	FY 2013
	5.997	3.784	1.002
Description: This effort focuses on growing compact, high frequency/high energy/high power density components and devices for several advanced electric-based survivability and lethality weapon systems. Technologies include direct current (DC) to DC chargers, high energy batteries, pulse chargers, high density capacitors, and solid state switches. This effort is coordinated with PEs 0603005A (Combat Vehicle and Automotive Advanced Technology) and 0602705A (Electronics and Electronic Devices).			
FY 2011 Accomplishments: Investigated solid state Silicon (Si) and Silicon Carbide (SiC) based Super Gate Turn Off (SGTO) applications such as high power microwaves, electrified armors, and directed energy weapons applications.			
FY 2012 Plans:			

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012		
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test & Evaluation, Army</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>	PROJECT H91: <i>Ground Vehicle Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2011	FY 2012	FY 2013
Investigate silicon carbide (SiC) based super gate turn off (SGTO) switches for electro-mechanical armor applications; investigate SiC components in high power electrical conversion components, and pulse chargers; investigate improvements in fast high energy density capacitors with improved clearing agents using newly developed films for directed energy weapons (DEW). FY 2013 Plans: Will investigate SiC and fast discharge high energy density capacitors based components for electro-mechanical armor to protect ground vehicles from the next generation threats at reduced platform weight.				
Title: JP-8 Reformation for Military Fuel Cells: Description: This effort investigates JP-8 reformer and desulfurization technologies so that JP-8 may be utilized as a fuel source for fuel cells in future military vehicle power applications. FY 2011 Accomplishments: Further matured major JP-8 reforming fuel cell system components performance and interoperability; designed and developed balance of components for the JP-8 reforming fuel cell system and ensured program specifications met user capability requirements. This effort was done in coordination with efforts in PE 0603005A, project 441. This effort continues in FY1`2 under the Advanced Non-Primary Power Systems effort.		2.061	-	-
Title: Propulsion and Thermal Systems: Description: This effort researches, designs and evaluates high power density engines and transmission systems needed to offset increasing combat vehicle weights (armor), increased electrical power generation needs (onboard communications, surveillance and exportable power), improved fuel economy (fuel cost & range), enhanced mobility (survivability), and reduced cooling system burden (size, heat rejection). Currently, less than 1/3 of the total available energy from the fuel is converted into usable mechanical work (propulsion). This effort also researches and matures thermal management technologies and systems including heat energy recovery, propulsion and cabin thermal management sub-systems to utilize waste heat energy and meet objective power and mobility requirements on all ground vehicles. Lastly, this effort maximizes efficiencies within propulsion and thermal systems to reduce burden on the vehicle while providing the same or greater performance capability. This effort is coordinated with PE 063005A (Combat Vehicle and Automotive Advanced Technology). FY 2011 Accomplishments: Completed common rail fuel pump development and conducted durability experiments with JP-8; completed the design and fabrication of closed-loop fuel injection system; conducted initial fuel injection system performance tests; began advanced drivetrain efficiency design and development; and advanced powertrain noise abatement technology development. FY 2012 Plans:		1.797	5.201	4.334

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test & Evaluation, Army</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>	PROJECT H91: <i>Ground Vehicle Technology</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2011	FY 2012
Investigate the durability and reliability of advanced fuel systems operating on JP-8 fuel at high temperatures; examine engine performance when using military grade fuels; complete powertrain analysis for efficiency and thermal heat rejection; examine designs to improve the mechanical efficiency of advanced transmissions while increasing ratio spread and electronic controls; investigate and develop components to reduce engine cooling burden. FY 2013 Plans: Will conduct combat and tactical powertrain simulation and component designs; investigate novel high power density low heat rejection, fuel efficient engine technologies to address increasing combat vehicle weights and thermal burden issues; assess waste heat recovery feasibility from the engine compartment and innovative thermoelectric generator designs to achieve greater conversion to onboard electricity.			
Title: Power & Thermal Management: Description: This effort investigates power and thermal management components, including traction motors, inverters, DC-DC converters, new motor and generator concepts and control strategies to meet objective power requirements. FY 2011 Accomplishments: Developed advanced intelligent (learning and adaptive) control architecture to control multiple vehicular power sources and loads; initiated development of reliable, cost effective, high temperature power electronic components to reduce system cooling burden. This effort was done in coordination with efforts in 0603005A. For FY12, this effort is continued under titles Power Management Technologies and Power Electronics, Hybrid Electric and On-Board Vehicle Power Components.		5.863	-
Title: Power Management Technologies: Description: This effort investigates power management technologies, software, and implementation approaches. Technologies include A/C-DC inverters, DC-DC converters, solid state circuit protection, power distribution, and automated control of complete power systems. Special emphasis has been placed on developing high temperature capable power electronics, leading to the use of Silicon Carbide (SiC) in the above technologies. This effort coordinates with 0603005A, Project 497 for electrical power architectural needs and interface design standards. This effort also coordinates with 0603005A, Project 441 for interoperability with power generation and non-primary power sources. FY 2012 Plans: Enhanced advanced intelligent (learning and adaptive) control architecture to control multiple vehicular power sources and loads. FY 2013 Plans: This effort will continue to mature a common vehicle power management control architecture as well as write and evaluate power control software. Additionally, this effort will design high voltage power electronics with high operating temperatures to be further		-	1.016
			3.916

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012		
APPROPRIATION/BUDGET ACTIVITY 2040: Research, Development, Test & Evaluation, Army BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602601A: Combat Vehicle and Automotive Technology	PROJECT H91: Ground Vehicle Technology		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2011	FY 2012	FY 2013
matured in 0603005A, project 497. These technologies will optimize power distribution and minimize thermal burdens on the vehicle as demands for greater electrical power continue to increase.				
Title: Power Electronics, Hybrid Electric and On-Board Vehicle Power (OBVP) Components: Description: Advanced computing, sensors, survivability and communications systems have driven electrical power demands on ground vehicle platforms beyond current generation capability, requiring some platforms in theater turn off critical mission systems in order to power other components. Advancing technologies for greater platform capabilities will further exacerbate the problem. To provide the electrical power required by the Warfighter, new efficient power generation systems for platforms must be created. As power increases, waste heat increases and must be removed from the platform. With increased efficiency of the power generation system, less energy will be expended on cooling and can be redistributed to other needs. This effort will design and evaluate high temperature and efficient power generation components using high operating temperature switching devices and advanced electrical generation components such as integrated starter generators and integrated starter alternators as well as advanced control techniques to make these systems more efficient. FY 2012 Plans: Investigate the feasibility of increasing the operating temperature of the power electronics components to reduce the thermal management burden of the total vehicle system that incorporates power generation for internal and external use; Investigate Integrated Starter Generator controls to provide on-board and export power; investigate and evaluate thermal systems to increase Heating Ventilation Air Conditioning (HVAC) efficiency; Evaluate electronics cooling technologies to reduce the system cooling burden. FY 2013 Plans: Will mature OBVP generation components; model and validate electric machines and power electronics hardware that will meet performance requirements for military ground vehicle electrical power needs.		-	6.446	1.968
Title: Advanced Non-Primary Power Systems Description: A significant portion of operating time for stationary military ground vehicles is spent with their main engines idling to generate electrical power which consumes considerable fuel and creates greater vulnerability for signature detection. Auxiliary power units (APUs) can produce the required power more efficiently than the main engines at reduced acoustic and thermal signatures. This effort will research, investigate, conduct experiments and validate APU technologies such as modular/scalable engine based APUs, fuel cell reformer systems to convert JP8 to hydrogen, sulfur tolerant JP8 fuel cell APUs and novel engine based APUs for military ground vehicle and unmanned ground systems. This effort will also determine inputs for APU interface control documents, as well as investigate solutions for reducing APU acoustic signature for silent operation during mounted		-	2.119	2.998

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012		
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test & Evaluation, Army</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>	PROJECT H91: <i>Ground Vehicle Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2011	FY 2012	FY 2013
surveillance missions. Finally, this effort investigates the use of small engines and JP8 fuel cell systems for use as prime power solutions for unmanned ground systems.				
FY 2012 Plans: Investigate JP-8 reformer/fuel cell system models and component level evaluation data; finalize JP-8 reformer/fuel cell system design; investigate small engine technologies for use on small unmanned ground vehicles.				
FY 2013 Plans: In order to reduce fuel consumption and meet the increasing power demands of military vehicles, this effort will investigate modular/scalable small engine technologies, mature fuel injection strategies and validate their application for use as auxiliary power units for military ground vehicles and unmanned ground systems.				
Title: Elastomer Improvement Program Description: Track systems are one of the highest Operations & Sustainment (O&S) cost drivers for combat vehicle platforms. The typical failure mechanism for these systems is associated with the elastomeric (rubber) components. As vehicle platforms operate across a variety of terrain conditions, energy and heat from the environment causes premature fatiguing that can limit the overall life of these track systems. The Elastomer Improvement Program (EIP) uses a state-of-the-art laboratory to research, formulate and laboratory test new elastomer compounds to increase track system durability and reduce O&S costs. FY 2013 Plans: This effort will integrate advanced nano-composites into elastomer designs and formulations to increase durability and reduce flammability of materials. In addition, novel running gear elastomers designs will be fabricated and tested in order to reduce maintenance and increase system durability. Finally, this effort will perform laboratory testing of new compounds to validate the new materials/properties are exceeding the properties of existing materials.		-	-	1.000
Title: Intelligent Systems Technology Research: Description: This effort investigates improved operations of manned platforms through the application of sensing and autonomy technologies developed for unmanned systems such as maneuver and tactical behavior algorithms, driver assist techniques, autonomy kits, advanced navigation and planning, vehicle self-protection, local situational awareness, advanced perception, vehicle and pedestrian safety, and robotic command and control. FY 2011 Accomplishments: Analyzed the integration of robotic sensor data into a network communication model to validate accurate vehicle operations; developed algorithms from the fused sensor data that allow more accurate and precise vehicle manipulation within various virtual environments and predicted vehicle payload effects; developed and evaluated approaches to enhance the capabilities		4.030	4.721	7.909

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012		
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test & Evaluation, Army</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>	PROJECT H91: <i>Ground Vehicle Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2011	FY 2012	FY 2013
for unmanned systems to work in a dynamic environment; and developed interoperability profiles and architectures to facilitate command and control of the unmanned systems from a common Warfighter machine interface. FY 2012 Plans: Conduct initial trade studies in the areas of intelligence, perception, communications, robotic control and payload integration for a weaponized robotic system; advance technologies for manned/unmanned collaboration and teaming, unmanned tactical behaviors, command and control of the unmanned systems from a common Warfighter machine interfaces, intelligence agents, and develop intelligent architectures for systems level weaponized robotic control. FY 2013 Plans: Will expand development of tactical behaviors utilizing common frameworks and control interfaces to provide drive-by-wire capability to the tactical wheeled fleet; extend this capability to the tracked and wheeled combat fleet, emphasizing combat-unique mission sets and payloads; investigate advanced sensors and control software; continue to advance autonomy and cognition to enable manned/unmanned collaboration and teaming; mature command and control software to enable single-operator control of multiple unmanned vehicles.				
Title: Diagnostics/Prognostics for Condition Based Maintenance: Description: This effort focuses on reduction of maintenance time and cost by developing the tools to gather data from ground vehicles to allow more accurate diagnoses of problems, leading to prediction of failures before they occur. FY 2011 Accomplishments: Leveraged past algorithm development to create diagnostics and prognostics on power and energy components (batteries, power converters, alternators). This included failure mode effects and analysis development, model development, root cause analysis, and algorithm updates.		1.353	-	-
Title: Petroleum, Oil, and Lubricant (POL) Products: Description: This project focuses on creating and evaluating innovative petroleum, oil and lubricant (POL) products that reduce logistic burdens, maintenance requirements, and fuel consumption. Products will be developed in areas such as alternative fuels, fuel additives, lubricants, power train fluids, coolants, and petroleum, oil, and lubricant products to support new military technology requirements (i.e. anti-lock brakes, semi-active suspension, etc.). FY 2013 Plans: Will initiate design and evaluation of POL products to meet new military technology requirements (i.e. anti-lock brakes, semi-active suspension, etc.) while exceeding future and legacy equipment performance and technical requirements; begin research and design of lubricants and fluids which promote improved energy efficiencies, improved performance and are longer lasting; characterize alternative fuels and fuel additives that improve performance and diversify energy sources; initiate research and		-	-	1.245

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012		
APPROPRIATION/BUDGET ACTIVITY 2040: <i>Research, Development, Test & Evaluation, Army</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602601A: <i>Combat Vehicle and Automotive Technology</i>		PROJECT H91: <i>Ground Vehicle Technology</i>
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2011	FY 2012	FY 2013
evaluation of nanofluid technology that suspends nanoparticles in coolants and lubricants to improve thermal, friction, and wear properties.				
Accomplishments/Planned Programs Subtotals		21.101	23.287	24.372
C. Other Program Funding Summary (\$ in Millions) N/A				
D. Acquisition Strategy N/A				
E. Performance Metrics Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.				