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

February 2002

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

	COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
	Total Program Element (PE) Cost	87009	112957	55763	60728	59452	56005	56910
C05	ARMOR APPLIED RESEARCH	12972	15839	19169	20315	15972	11126	11358
C84	AC84	0	974	978	1946	2907	3078	3165
H77	ADV AUTOMOTIVE TECH	29990	42012	16986	17575	17543	17275	17255
H91	TANK & AUTOMOTIVE TECH	15643	20084	18630	20892	23030	24526	25132
HH7	FUTURE COMBAT SYSTEMS - APPLIED RESEARCH	7681	19475	0	0	0	0	0
HH8	VOICE INTERACTIVE DEVICE	1923	1687	0	0	0	0	0
T21	21ST CENTURY TRUCK (T21)	12071	9909	0	0	0	0	0
T26	HYBRID ELECTRIC HMMWV	6729	2977	0	0	0	0	0

A. Mission Description and Budget Item Justification: The goal of this Program Element (PE) is to develop component technology to improve mobility and survivability capabilities of Army ground vehicle systems for the Objective Force. To achieve the Army's transformation vision, Army systems must be more strategically deployable and agile, with a smaller logistical footprint. The lighter ground vehicle systems required to achieve this vision must be more lethal, tactically mobile and survivable. The focus of the program element is to identify and develop the suite of protection technologies that can be matured and integrated with those developed under this and other PEs to provide protection from a variety of threats for Future Combat Systems (FCS). Technologies matured in this PE usually transition to PE 0603005A to demonstrate their technical feasibility and operational potential. Project HH7 provides a portion of the Army's share of the Army/Defense Advanced Research Projects Agency (DARPA) collaborative FCS program. Other major projects within this PE include: Tank and Automotive Technologies (H91) which provides critical automotive enabling component technologies, such as active protection defeat mechanisms; Armor Applied Research (C05) which investigates and develops advanced, lighter armor technology; and Advanced Automotive Technologies (H77) which funds the National Automotive Center (NAC). The NAC pursues shared automotive-oriented technology programs that have potential to benefit military ground vehicles, leveraging the large commercial investments in automotive technology research and development. 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 office through the Naval Surface Warfare Center; and with other ground vehicle developers within the Departments of Energy, Commerce and Transportation and the 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 with any effort within the Military Departments. Work is performed by the U.S. Army Tank-Automotive and Armaments Command (TACOM) Tank-Automotive Research, Development and Engineering Center (TARDEC), DARPA, contractors and universities. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

B. Program Change Summary	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	88274	82441	52762
Appropriated Value	89089	113941	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-984	0
b. SBIR / STTR	-1915	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	650	0	0
e. Rescissions	-815	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	3001
Current Budget Submit (FY 2003 PB)	87009	112957	55763

Change Summary Explanation:

Significant Change: FY02 Congressional Adds totaling $31.5M (as noted below) were added to this Program Element.

FY02 - The following Congressional adds were made: Combat Vehicle Transportation Technologies Program: Calstar/Westar Electric Hybrid Tech, Project H91 ($1000); Integration of Army Voice Interactive Device with onboard CPU, Project HH8, ($1700); Hybrid HMMWV Field Evaluation, Project T26, ($3000); Hydrogen PEM Fuel Cell Heavy Duty Vehicle Demonstration, Project H77 ($5000); Smart Truck, Project H77 ($3400); Advanced Virtual Environments, Project H77 ($1400); Combat Truck Initative (COMBATT), Project H77 ($14000); and National Automotive Research Center, Project H77 ($2000).

Projects with no R-2A:
Project HH8 (FY02 Funding=$1700) Integration of Army Voice Iteractive Device with Onboard CPU supports and completes enhancements to voice-interactive software capability and interfaces that require less individualized voice training; embeds this capability into a vehicle and/or bench-top demonstrator. No additional funding is required to complete this effort. COMPLETE 4Q02

Project T26 (FY02 Funding=$3000) Hybrid HMMWV Field Evaluation supports and completes assembly and testing of prototype hybrid electric HMMWVs

which will be subjected to performance testing in accordance with conventional HMMWV requirements duty cycle including extreme temperature ranges and limited endurance testing. No additional funding is required to complete this effort. COMPLETE 4Q02

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

February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
C05	ARMOR APPLIED RESEARCH	12972	15839	19169	20315	15972	11126	11358

A. Mission Description and Budget Item Justification: This project investigates potential solutions to critical armor deficiencies for survivability of light weight vehicles for FCS. Emphasis is on development of advanced armor technologies and other means of protection. The armor technologies designed and developed in this project complement innovative non-armor survivability techniques (such as laser and active protection) that are funded in project AH91. In addition, this project (C05) 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 also is conducted. Efforts focus on the weight, space, performance and cost for protection of combat and tactical vehicles against such threats as Kinetic Energy (KE) projectiles, explosively formed penetrators, Chemical Energy (CE) warheads, as well as blast and fragments from land mines. This project draws upon products from Army Research Laboratory programs in PE 0602618A (Ballistic Technology) and PE 0602105 (Materials), as well as innovative armors from industry. This project also includes supporting work in armor materials, bringing together the collective expertise of the Department of Defense, the Department of Energy, industry and academic sources. Supporting work includes researching and maturing armor performance models to assess armor configurations against different threats, with sufficiently high fidelity to make their implementation in vehicles feasible and affordable. Major contractors include: SAIC, Albuquerque, NM; Southwest Research Institute, San Antonio, TX; TPL, Inc., Albuquerque, NM; University of Hawaii, Honolulu, HI; University of Connecticut, Storrs, CT. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 5311 - Tested the capability of armor systems with 30% greater weight efficiency than the 1996 state of the art, against horizontal KE and CE threats, and determined the capability of these armors to withstand the threat debris from a successful Active Protection System (APS) countermeasure intercept.

  - Investigated and tested top attack armor systems to complement future APS with 30% greater weight efficiency than the 1996 state of the art.

- 4421 - Completed investigation of a series of integrated multifunctional armor/structure systems against the heavy machine gun threat that will offer 25% improved weight efficiency over the Composite Armored Vehicle (CAV), at a projected production cost less that 1.5 times that of the CAV.

  - Investigated armor/structure systems with 30% improved weight efficiency against medium caliber KE and CE threats for validation in FY02.

FY 2001 Accomplishments: (Continued)

- 3240 - Integrated existing physics-based and engineering-based models and design tools to provide industry the capability to design and validate FCS armors without extensive and costly testing.

  - Supported and provided U.S. national leadership to an international cooperative research program for mine blast characterization under The Technical Cooperation Program (TTCP).

  - Conducted safety and user assessments.

  - In partnership with UK, developed a set of design tools to investigate unique electrodynamic defeats.

Total 12972

FY 2002 Planned Program

- 6540 - Research second generation armor systems that will be available for FCS Blocks I and II to defeat medium caliber cannon, hand held infantry weapons, and residual KE behind APS debris to approach meeting a weight efficiency goal of 80 lbs/sq ft; these armor systems will provide light combat vehicles with the survivability required on the future battlefield.

  - Investigate and test top attack armor systems to complement future APS with 30% greater weight efficiency than the 1996 state of the art.

- 4819 - Research second generation of integrated multifunctional armor/structure systems against the heavy machine gun threat, making progress toward meeting a weight efficiency goal of less than 20 lbs/sq ft.

  - Provide armor and model data for defeat of APS residual KE, medium caliber KE and CE threats which meet APS demo weight efficiency goal of 160 lbs/sq ft.

- 4480 - Integrate improved physics-based and engineering-based models and design tools to provide industry the capability to design and validate FCS armors without extensive and costly testing.

  - Acquire experimental data for use in existing mine survivability design codes; provide U.S. national leadership to an international cooperative research program for mine blast characterization under the TTCP.

Total 15839

FY 2003 Planned Program

- 8408 - Test and evaluate second generation armor systems at Technology Readiness Level (TRL) 5 that will be available to transition to FCS which will defeat medium caliber cannon, Hand Held Infantry Weapon, and APS residual KE debris that will be available for FCS, which approach a weight efficiency goal of 80 lbs/sq ft.

  - Extend top attack armor systems to ensure compatibility with armor/structure systems used for flank attack.

- 5166 - Research and test integrated multifunctional armor/structure systems against the heavy machine gun and artillery threats that approach a weight efficiency goal of less than 20 lbs/sq ft at TRL 5 for transition to FCS.

  - Provide armor and model data for defeat of residual KE, medium caliber KE and CE threats that meet APS demo weight efficiency goal of 80 lbs/sq ft.

- 5595 - Integrate improved physics-based and engineering-based models and design tools to provide the capability to design and validate FCS armors without extensive and costly testing.

  - Collect experimental data for use in existing design codes; conduct verification experiments to validate improved design code accuracy. Provide U.S. national leadership to an international cooperative research program for mine blast characterization under TTCP.

Total 19169

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

February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H77	ADV AUTOMOTIVE TECH	29990	42012	16986	17575	17543	17275	17255

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 and initiates shared technology programs that focus on benefiting military ground vehicle systems. The dual use technologies being developed support the Army's wheeled vehicles fleet that may comprise a substantial segment of the FCS and the Objective Force. Improvements in the legacy force are expected to rely heavily on dual-use technologies for advances in operational, performance and cost characteristics. The NAC, located at TACOM, is part of TARDEC. The NAC serves as the catalyst linking industry, academia and government agencies for the development and exchange of automotive technologies. The NAC executes collaborative research and development (R&D) contracts, cooperative agreements, and other initiatives to leverage commercial industry's investment in well-defined, high return-on-investment areas tied to key Army science and technology objectives for advanced land combat. The NAC focuses collaborative R&D contracts on key military automotive technology thrust areas to include: fuel efficiency, vehicle modernization, crew safety, maintenance, and logistics improvement and manufacturing innovation with the goal of (a) improving the performance and endurance of ground vehicle fleets, and (b) reducing ground vehicle design, manufacturing, production, and operating and support costs. Two-way industry/government technology transfer is pursued under Cooperative Research and Development Agreements (CRADAs). The activities of the NAC are supported by other government agencies via a linkage created under Memoranda of Agreement. These linkages permit the NAC to consolidate the collective expertise of federal government departments such as Energy, Transportation and Commerce and other DoD agencies. The NAC performs basic research in PE 0601104A, project BH73 (National Automotive Center). The following Congressional FY02 adds have been placed in this project for implementation: Hydrogen PEM Fuel Cell Heavy Vehicle Demo ($6000); Combat Truck Initiative ($14000); National Automotive Research Center ($2000); Advanced Virtual Environments ($1400);Smart Truck ($3400). Major contractors include: FOCUS: Hope, Detroit, MI; Oshkosh Truck Corporation, Oshkosh, WI; Lockheed Martin Inc., Lexington, MA; Cummins Engine Company, Columbus, IN; ICRC Energy Inc., Oakton, VA; Radian, Inc., Alexandria, VA; Baum, Romstedt Technology Research Corp. (BRTRC Inc.), Fairfax, VA; Southwest Research Institute, San Antonio, TX; Electronic Data Systems, Troy, MI; University of Wisconsin, Madison, WI; University of Iowa, Iowa City, IA; Evans and Southerland Inc., Salt Lake City, UT; IITRI, Chicago, IL; Lockheed Martin Control Systems, Johnson City, N.Y; Ford Motor Company, Dearborn, MI; Sunline Services Group, Thousand Palms, CA; Mobile Medical International, St. Johnsburg, VT; Oakland University, Rochester, MI, General Dynamics Land Systems (GDLS), Muskegon, MI; Electricore, Indianapolis, IN; Engineered Machine Products, Inc, Escanaba, MI; Ovonic Battery Company, Troy, MI; United Defense LP, Santa Clara, CA; Univ of MI, Ann Arbor, MI; XCELLSIS Corp, Poway, CA,; and Parametric Technologies Corp, Waltham, MA.

FY 2001 Accomplishments:

- 5765 - Investigated and tested automotive technologies in the areas of fuel efficiency, vehicle modernization, manufacturing, automotive logistics and maintenance improvement.
- 5581 - Integrated key commercial automotive technologies (engine, brakes, air conditioning, diagnostics, crash protection) into the light and heavy wheeled demonstrators and engine, air conditioning, diagnostics technologies into the tracked vehicle demonstrator.
- 4682 - Completed integration plan for hardware, software, informational, and human interfaces for the selected technologies.
- 3369 - Executed the one-year congressional special interest program to demonstrate various advanced automotive technologies pertaining to Smart Truck.

  - Produced initial and final designs for the electronic architecture and vehicle integration.
- 2888 - Executed the one-year congressional special interest program to develop Solid Oxide Fuel Cell technology.
- 7705 - Executed the one-year congressional special interest program to research and develop improved techniques for reforming JP-8 and related fuels to make hydrogen for vehicle fuel cell propulsion systems.

  - Addressed areas on sulfur tolerance, startup and transient response times, efficiency, and operation in hot, dry climates.

  - Initiated the development and operation of fuel cell power heavy vehicle power systems.

  - Built two additional fuel cell powered trucks for in-service evaluations, one in military environment, and one in a commercial environment.

Total 29990

FY 2002 Planned Program

- 10210 - Investigate and test automo tive technologies in the areas of fuel efficiency, vehicle modernization, manufacturing, automotive logistics and maintenance improvement.
- 4002 - Integrate key commercial automotive technologies (engine, brakes, air conditioning, diagnostics, crash pro tection) into the light and heavy wheeled demonstrators and engine, air conditioning, diagnostics technologies into the tracked vehicle demonstrator.
- 2000 - Perform simulation based modeling and analysis in support of all areas of technology under investigation.
- 5000 - This one year Congressional add for Hydrogen PEM Fuel Cell Heavy Duty Vehicle Transportation supports and completes development of a hydrogen PEM fuel cell powered heavy duty vehicle for demonstration in California. Demonstrates and quantifies reduction of emmisions. No additional funds are required to complete this project.

FY 2002 Planned Program (Continued)

- 14000 - This one year Congressional add supports and completes the Combat Truck Initiative (COMBATT) to develop, design and perform performance/endurance testing of commercial vehicles converted to hybrid electric propulsion. No additional funds are required to complete this project.

  - Commercial trucks will be procured and converted to hybrid propulsion testbeds.

- 2000 - This one year Congressional add for the National Automotive Research Center formulates and matures advanced modelling and simulation strategies for the Army's vehicle fleet; experimentally validates advanced propulsion and mobility simulation models. No additional funds are required to complete this effort.

- 1400 - This one year Congressional add for Advanced Virtual Environments supports and completes development of a suite of 3D graphic simulation tools and displays which 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.

  - Provide simulation tools and displays to experience life-like systems/systems-of-systems that appear real but only exist in a computer-based environment.

- 3400 - This one year Congressional add for Smart Truck supports and completes adaptation of commercially available digital technology for improved operation and safety of Army trucks. No additional funds are required to complete this project.

  - Evaluate current, advanced, and emerging automotive technologies installed on commercial long bed pickup truck testbed.

Total 42012

FY 2003 Planned Program

- 12850 - Investigate and test automotive technologies in the areas of fuel efficiency, automotive vehicle modernization, automotive crew safety enhancement, automotive maintenance and logistics improvement, and automotive manufacturing innovation.
- 4136 - Research collaborative research and development efforts to include fuel efficiency, antilock braking system, safety, engines, and modeling and simulation.

Total 16986

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

February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H91	TANK & AUTOMOTIVE TECH	15643	20084	18630	20892	23030	24526	25132

A. Mission Description and Budget Item Justification: This project provides innovative vehicle concepts and enabling technologies for the FCS and the Objective Force needed to achieve the critical mobility, survivability and sustainability enhancements required to meet the Army Vision. Project funds conceptual designs, virtual prototyping, performance analyses and battlefield wargaming of ground vehicle systems and uses the results to quantify benefits, burdens and trade-offs related to applying the ground vehicle technologies in operational scenarios. The project includes ten areas: vehicle concepts; mobility; integrated survivability (including active protection); vehicle electronics (VETRONICS) and intra-vehicle digitization; advanced vehicle structures; simulation/analysis; military fuels and lubricants; water purification technology; mechanical (as opposed to electronic) countermine technology and gap/obstacle crossing technology. Technologies are being pursued to address advanced mobility, survivability, advanced structures, and lethality requirements of lighter, digitized, more deployable vehicles requiring less Petroleum, Oil and Lubricants (POL). Activities are closely coordinated with TRADOC's Mounted and Dismounted Battlespace Battle Labs and the Directorate of Combat Developments for Transportation and Quartermaster; Program Executive Office for Ground Combat and Support Systems; Army Research Laboratory (ARL); and the Defense Advanced Research Projects Agency (DARPA). Virtual prototyping provides seamless sharing of databases and engineering models, allowing more rapid and efficient integration, assessment and transfer of Department of Defense and commercial vehicle technologies. Vehicle electronics are based on adapting commercial electronic standards and architectures for combat vehicle battlefield unique requirements. The survivability technologies, which include non-armor approaches such as signature reduction, countermeasures, active protection, damage reduction, and laser protection, complement, but do not duplicate, work performed under the armor exploratory development project (DC05) in this PE. The sustainability technologies focus on reducing the logistics footprint, enhancing unit agility and leverage basic research being conducted by DARPA. Other government agencies include: DARPA, Arlington, VA; Army Research Laboratory, Aberdeen, MD; Red River Army Depot, Texarkana, TX. Major contractors include: Detroit Diesel Corp., Redford, MI; Cadillac Gage Textron, New Orleans, LA; Soucy International, Drummondville, Quebec; Pentastar, Huntsville, AL; Michigan Technological University, Houghton, MI; United Defense Limited Partnership, San Jose, CA; University of Texas, Arlington, TX; Oakland University, Rochester Hills, MI; Gonzales Engineering, Troy, MI; Boeing Corporation, St. Louis, MO; Monterey Technologies Inc., Monterey, CA; DCS Corp, Alexandria, VA; Texas Instruments, Dallas, TX; Southwest Research Institute, San Antonio, TX;, , Mesosytems Technology Inc .Albuquerque, NM, MIOX Corp, Albuquerque, NM; Scientific Systems, Boston, MA; University of California, Berkley, CA; General Dynamics Land Systems Division, Sterling Heights, MI; Chang Ind., Salt Lake City, UT, & Laverne, CA; TRW, Redondo Beach, CA, Sanders Lockheed Martin, Nashua, NH; Raytheon, Danbury, Conn., New Mexico Tech., Socorro, NM, Talking Lights Company, Cambridge, MA. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 5570 - Jointly with DARPA, performed effectiveness, performance, cost and tradeoff analysis of innovative FCS system concepts to support the evaluation of the FCS contractor alternative concepts.

  - Matured system concepts validating the performance of manned and robotic vehicles in multiple roles that are available for FCS which supported a major user FCS experimentation program; developed concepts for potential insertion to the Objective Force.

  - Established and addressed emerging combat support requirements for tactical vehicles necessary to support the Objective Force; conducted trade-off studies and supporting performance and supportability analysis of heavy tactical vehicle concepts supporting the Objective Force and User Integrated Concept Team; conducted simulation experiments using Army Materiel Command Research and Development Engineering Center Federation Architecture in conjunction with FCS and Objective Force efforts.

- 4468 - Completed electromechanical active suspension testing showing an 80% improvement in cross-country mobility with potential for over 100%; completed final 4-stroke demonstrator diesel engine design and initiated build; conducted performance and durability optimization on screening engine to achieve the high power density, low heat rejection and improved fuel economy goals established in the memorandum of understanding. (Cooperative Research Program with Japan.)

  - Demonstrated in laboratory increased vehicle range through fuel additives.

  - Conducted materials comparison studies of composites versus metallics and their applicability towards military bridging technologies and began Virtual Prototyping simulations and studies of new and unique bridge launching techniques that will be available for the Objective Force.

  - Investigated, tested and characterized obstacle marking and vehicle guidance systems based on FY2000 analysis; performed detailed assessments in vehicle interoperability, system deployability and cost to prepare for FY2002 test bed demonstration.

- 3795 - Integrated and evaluated Natick Research and Development Engineering Center laser protection materials into retrofittable wide-angle optical viewing system incorporating laser-limiting materials.

  - Developed Full Spectrum Active Protection (FSAP) system engineering model and initiated system simulations against tube launched tube launched KE and HEAT.

  - Designed improved FSAP countermeasure proximity fusing system for notional delivery system.

  - Assessed armor/structure concepts developed under project DC05 to deal with adaptive threats.

  - Designed and fabricated miniaturized FSAP proximity fuse for installation into delivery system.

  - Conducted laboratory tests to determine proximity fuse effectiveness.

FY 2001 Accomplishments: (Continued)

- 1810 - Completed workload modeling & analysis to investigate embedded unmanned system control from manned platforms to provide required capability for FCS.

  - Reduced the size of the water production subsystem of the drinking water recovery from engine exhaust system by 40%.

Total 15643

FY 2002 Planned Program

- 5121 - Assess emerging requirements of FCS, including the role of robotics and tactical vehicles; refine Government concepts and perform analysis in support of FY03 technology readiness decision and User experimentation; complete independent evaluation of FCS industry team concepts through the Integrated Product Team process.

  - Mature engineering-level of detail ground vehicle models and terrain databases to evaluate mobility and dynamic stability of highly mobile manned and robotic vehicles operating in complex terrain; perform validation studies of motion effects on soldier performance.

- 4683 - Complete final 100 hour high output, low heat rejection compact 4-stroke diesel engine durability and performance demonstration to achieve the high power density, low heat rejection and improved fuel economy goals. (Cooperative Research Program with Japan.)

  - Complete laboratory demonstration of enhanced lubricants for fuel economy and with increased oil sump temperature; evaluate candidates on second series of multi-cylinders engine tests; determine formulations that can be evaluated in field tests.

  - Conclude materials studies of composites versus metallics; refine virtual prototype simulations of launching techniques; conduct Finite Element Modeling of weight reduction and enhancement studies.

  - Finalize design based on FY01 detailed assessments of obstacle marking and vehicle guidance systems in the areas of vehicle interoperability, system deployability and cost; participate in Joint Area Clearance Advanced Concepts Technology Demonstrator.

- 1035 - Evaluate/validate performance levels via component structural and ballistic tests; perform structural and weight analysis of candidate FCS vehicle designs.

- 3245 - Evaluate cognitive decision aids to reduce workload on multi-mission capable systems such as FCS; mature approach/architecture for implementation of cognitive decision aids in ground systems.

  - Construct FSAP subsystem models based on successful countermeasure demonstrations.

FY 2002 Planned Program (Continued)

- Complete HMMWV system level design for a mounted, integrated water-from-exhaust system, fabricate and validate components in a relevant environment; investigate materials/components to illustrate humidity concentrator concepts to reduce the size and energy requirements of a water from air generator.

• 5000 - Fabricate and conduct field tests of robust active protection kill mechanisms (e.g., multi-explosively formed penetrators) to protect light-medium weight ground vehicles (i.e., FCS) against anti-armor threats, including kinetic energy penetrators and high explosive anti-tank rounds.

• 1000 This one year Congressional add for Combat Vehicle Transportation Technologies Program: CalStart/WestStart Electric Hybrid Technologies demonstrates hybrid electric component technologies in various vehicles used for public transportation and/or military purposes. No additional funds are required to complete this program. COMPLETE 4QFY02

Total 20084

FY 2003 Planned Program

• 5646 - Provide technical input, concepts, characteristics, performance predictions and trade-off analysis in support of the Army Milestone B for FCS.

- Conduct initial advanced technology and subsystem studies to assess potential product improvements to the base FCS family to attain Objective Force capabilities.

- Perform trade-off analysis in support of Future Tactical Truck Systems acquisition milestone; perform innovative lightweight and robotic tactical vehicle concept studies.

- Mature physics-based mobility models for design evaluation of small, lightweight ground vehicle platforms; perform studies to determine the most effective soldier interfaces for control of robotic vehicles while on the move; evaluate passive and active motion-effect mitigation techniques.

• 5020 - Fabricate advanced ceramic in-cylinder components for high output, low heat rejection, diesel engine dynamometer. Test high temperature lubricants and coolants.

- Conduct field evaluation of enhanced Petroleum, Oil & Lubricants (POL) products; prepare report on POL field tests; revise/develop specification for implementation of the enhanced POL products.

- Implement obstacle marking hardware and vehicle guidance software improvements and participate in the Joint Area Clearance Advanced Concepts Technology Demonstrator; conclude virtual prototype simulations of launching techniques and Finite Element Modeling for weight reduction and enhancement studies.

FY 2003 Planned Program (Continued)

- 2731 - Determine optimal active protection (AP) sensor/ countermeasure performance matches based on simulations and field test data.
- 1733 - Evaluate alternative (helmet mounted, projection, curved) display technologies and input mechanisms to reduce the size of multi-mission crewstations to meet FCS transportability requirements; mature approach for mu lti-modal crew stations for FCS.
- 3000 - Reduce water distribution requirements (~106 stons/day), projected to be 40% of the total daily sustainment requirement of the Interim Brigade Combat Team, through the development of new water production capabilities in two thrust areas: 1) purification of traditional water sources and 2) water recovery generation from non-traditional sources
- 500 - Fabricate silicon carbide switching devices for high efficiency inverters and converters for FCS hybrid electric power system.

Total 18630

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

February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602601A - Combat Vehicle and Automotive Technology**	**HH7**

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
HH7	FUTURE COMBAT SYSTEMS - APPLIED RESEARCH	7681	19475	0	0	0	0	0

A. Mission Description and Budget Item Justification: This project provides a part of the Army's share of the Army/DARPA collaborative FCS Program. (See PE 0603005A, Projects 440 and 53G for a description of the FCS Program and for information on other Army funding provided for the collaborative FCS Program in FY03.) Funds in this project support contractual and government concept design efforts in accordance with the FCS Memorandum of Agreement (MOA) signed February 2000. Competing designs will be evaluated for their ability to perform combat missions across the full spectrum of operations. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 7681 - Provided funds in support of DARPA to research and define initial force concepts as a result of tradeoff assessment process.
  - Matured and evaluated innovative system concepts that reflect the force in a system of systems context; developed operational and technical models to represent the best system of systems concepts for FCS.
  - Performed effectiveness, performance, cost and technology tradeoff analyses on innovative system concepts developed in support of a strategically deployable, agile, survivable and tactically mobile force for the Army. Provided information to support the development of requirements and enabling technology for FCS.
  - Identified key enabling technologies to support FCS based Objective Force concept architectures.
  - Performed technical and operational experimentation in support of system of systems design.

Total 7681

FY 2002 Planned Program

- 3000 - Provide funds for Army share of DARPA's FCS Concept Development efforts in accordance with the MOA.
- 16475 - Provide funds toward the Army share of the Army/DARPA development of FCS Enabling Technologies ($62436 in PE 0603005A, Project 53G , also supports this effort) in accordance with the MOA.

  - Mature new and novel modeling and simulation techniques to support network-centric force architectures for a FCS equipped Objective Force.

  - Evaluate novel cooperative engagement, cooperative survivability, and command and control strategies for FCS-based tactics, techniques and procedures.

Total 19475

FY 2003 Planned Program

This effort transitions to PE 0603005A projects 440 and 53G starting in FY 03.

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

February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602601A - Combat Vehicle and Automotive Technology**	**T21**

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T21	21ST CENTURY TRUCK (T21)	12071	9909	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this project is to provide a collaborative government and commercial truck manufacturing industry research and development initiative to investigate automotive component technologies for trucks that will be much more fuel efficient, less polluting, and safer to operate. These most promising components from this research will be incorporated into test vehicles and evaluated in commercial and military operational environments.

FY 2001 Accomplishments:

- 7291 - Researched and investigated 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, integrated gate bipolar transistors, and advanced energy storage systems.
- 1748 - Integrated and tested vehicle intelligence technologies that involve both information and control technology to improve fuel efficiency, driving efficiency, safety and quality of driving trucks.
- 1767 - Evaluated the use of alternative fuels to meet military requirements for fuels with high stored energy density, reduced emissions and that will facilitate the use of Solid Oxide Fuel Cell propulsion systems.
- 779 - Tested and evaluated the application of current and new commercial materials technologies that result in increase payload, corrosion resistance, vehicle life cycle, durability and mobility
- 486 - Conducted research in fuel cell technologies to include alternatives to diesel reformers and improvements in propulsion density, weight and cube of present generation fuel cells.

Total 12071

FY 2002 Planned Program

- 8000 - Integrate and test high power fuel efficient engines, lightweight engine/components, high temperature engine materials, engine coatings, coolants and cooling systems, computer controlled energy management systems, electric traction motors, electric generators, highpower motor controllers, integrated gate bipolar transistors, and advanced energy storage systems.
- 954 - Integrate and test vehicle intelligence technologies involving information and control technology to improve fuel efficiency, driving efficiency, safety and quality of driving trucks.
- 955 - Integrate and test the use of alternative fuels to meet military requirements for fuels with high stored energy density, reduced emissions and that will facilitate the use of Solid Oxide Fuel Cell propulsion systems. This supports more stringent emissions protocols.

Total 9909

FY 2003 Planned Program

Project not funded in FY 2003