RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)							DATE February 2007	
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development			R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E					
COST (In Millions)	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Total Program Element (PE) Cost	107.171	44.805	24.711	32.612	56.890	57.097	57.097	57.097
Rapid Strike Force Technology LNW-01	16.371	36.755	24.711	32.612	56.890	57.097	57.097	57.097
Future Combat Systems LNW-03	90.800	8.050	0.000	0.000	0.000	0.000	0.000	0.000

(U) Mission Description:

(U) This program element is budgeted in the Advanced Technology Development Budget Activity because it is developing and demonstrating the concepts and technologies that will address the mission requirements of the 21st Century land warrior.

(U) The emerging U.S. vision of future land warfare places strong emphasis on technology supporting early entry of light, efficient land forces, particularly in urban areas where both combatants and civilians are present. This project is developing technologies that serve as force multipliers, enabling safe and effective operations in hostile environments. Revival of this project stems from the need to support the development of effective and adaptive weaponry, both lethal and non-lethal, for a variety of target suppression effects. Other technologies to be explored will include tele-operated systems, novel targeting and firing techniques, and advanced situational awareness and response systems.

(U) The U.S. Army's Future Combat Systems (FCS) is envisioned to be a System of Systems (SoS), which will provide capabilities that strike an optimum balance between critical performance factors (e.g., operational and tactical mobility, lethality, survivability, and sustainability) and strategic responsiveness. The FCS program embraces an evolutionary acquisition, spiral development process. This Joint DARPA/Army activity supports the FCS spiral process through the development of critical technology improvements for FCS platform variants and the Network. The resulting network-centric SoS will continue to provide the Unit of Action overwhelming lethality, strategic deployability, self-sustainment, and high survivability over other conventional ground forces.

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(U) **Program Change Summary:** *(In Millions)*	**FY 2006**	**FY 2007**	**FY 2008**	**FY 2009**
Previous President's Budget	125.384	48.975	51.480	71.092
Current Budget	107.171	44.805	24.711	32.612
Total Adjustments	-18.213	-4.170	-26.769	-38.480
Congressional program reductions	-15.000	-4.170		
Congressional increases	0.000			
Reprogrammings	0.000			
SBIR/STTR transfer	-3.213			

(U) Change Summary Explanation:

FY 2006	The decrease reflects the SBIR/STTR transfer and the Section 8040 rescission.
FY 2007	The decrease reflects congressional cuts to HYFORM and FCS Supporting Technologies and a decrease for Section 8106 Economic Assumptions.
FY 2008/2009	The decrease reflects re-prioritization and completion of Urban Warfare efforts in Project LNW-01, Rapid Strike Force Technology and completion of the Future Combat Systems project.

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COST (In Millions)	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Rapid Strike Force Technology LNW-01	16.371	36.755	24.711	32.612	56.890	57.097	57.097	57.097

(U) Mission Description:

(U) The emerging U.S. vision of future land warfare places strong emphasis on technology supporting early entry of light, efficient land forces, particularly in urban areas where both combatants and civilians are present. This project is developing technologies that serve as force multipliers, enabling safe and effective operations in hostile environments. Revival of this project stems from the need to support the development of effective and adaptive weaponry, both lethal and non-lethal, for a variety of target suppression effects. Other technologies to be explored will include teleoperated systems, novel targeting and firing techniques, and advanced situational awareness and response systems.

(U) Program Accomplishments/Planned Programs:

	FY 2006	FY 2007	FY 2008	FY 2009
Multi-Modal Missile (M3)	3.000	9.500	7.000	6.500

(U) The Multi Modal Missile (M3) program will explore the development of an integrated, man-portable weapon system capable of performing surface-to-surface, anti-armor, and surface-to-air anti-aircraft missions with an emphasis on extreme precision. The program will focus on delivering precision targeting accuracy to 1) enable light-weight munitions and thus deeper magazine and/or longer engagement ranges, 2) tailor categories of kill through subsystem targeting, and 3) provide lethal effects against targets otherwise beyond the reach of man-portable weapons. The objective M3 capability will integrate a variety of existing weapons-systems functions and provide the dismounted soldier with a compact system to engage vehicles, rotorcraft, and close air support aircraft. The effort will also explore additional mission concepts to include anti-personnel and breaching applications, beyond-line-of-sight functionality, air-to-ground capability, and ground vehicle mounting options. Critical characteristics of this weapon system concept include light weight, simple operation, and affordability. Technologies under consideration will include advanced imaging seekers and/or operator terminal guidance; low-cost, high-performance, solid-rocket engines; sensor-based fusing;

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and novel warhead concepts to support a wide range of engagement geometries with desired lethality effects against a range of targets. This program is planned to transition to the U.S. Army.

(U) Program Plans:
- Perform initial system design analyses and trade off studies.
- Initiate critical technology, maturation efforts for seeker, propulsion, guidance and warhead.
- Develop, analyze and assess initial multi-modal missile system preliminary designs.

	FY 2006	FY 2007	FY 2008	FY 2009
Non-Lethal Alternatives for Urban Operations	1.500	5.500	3.211	3.500

(U) The Non-Lethal Alternatives for Urban Operations effort will explore system concepts and enabling technologies for non-lethal weapons in challenging urban and semi-urban environments. This effort will assess effects, targeting systems, delivery systems, and countermeasures, and will develop integrated less-lethal system options for application to urban warfighting. Effects to be investigated will include less-lethal projectiles, malodorants, entanglers, and marking agents. The effort will consider direct and indirect fire systems to counter personnel and to provide area effects against vehicles, crowds and groups of combatants. Operating scenarios to be explored will include force protection for fixed sites, force protection for mobile forces, situational control (including traction control), individual soldier weapons, border protection, and protection of extended infrastructure. The effort will pay particular attention to technologies that support application on autonomous and teleoperated unmanned ground robotic vehicles in urban environments at a sustained operational tempo. Transition organizations will be the United States Air Force and the National Reconnaissance Office, Special Operations Command, the Army Corp of Engineers' Engineering Research and Development Center, and others may be identified as efforts and systems are developed.

(U) Program Plans:
- Perform initial concept development and effects assessments.
- Develop initial urban less-than-lethal system designs.
- Conduct less-than-lethal technology maturation efforts to address and reduce system risk.

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– Develop non-lethal, asymmetric systems that deny vehicle and pedestrian traction.

	FY 2006	FY 2007	FY 2008	FY 2009
Tactical Urban Operations (TURBO) program	2.469	3.425	0.000	0.000

(U) The Tactical Urban Operations (TURBO) program sought to provide dismounts with integrated information from low-level airborne assets, such as the Micro Air Vehicle (MAV) or the Organic Air Vehicle (OAV), local intelligence sources, and responsive and improved fires / effects capable of acting on this information. Technologies explored included: aggregation of information from multiple MAVs and OAVs with other sources into an easy-to-use interface; improved techniques for detecting dismounted targets and distinguishing friend from foe; and improved methods for displaying information to dismounts and allowing them to direct operations without impeding their mission.

(U) Program Plans:

– Defined system architecture and constraints based on MAV ACTD experience.

	FY 2006	FY 2007	FY 2008	FY 2009
PEO-Soldier/Exoskeleton Transition	9.402	7.000	0.000	0.000

(U) The PEO-Soldier Exoskeleton Transition program will employ novel mechanisms, information systems, and power management hardware and software to ultimately produce a wearable machine that will serve as an intuitively operated load carriage system for individuals. The goal of the program is to enable an individual soldier to lift and carry 150 pounds while feeling only a small part of the load, work for long periods of time, and to travel in difficult conditions. This ability for a single soldier to carry heavy loads could be leveraged in applications ranging from moving boxes of ammunition or supplies to enabling the carriage of significantly greater body armor than is presently possible. The Army envisions the Personal Combat Vehicle (PCV) to be a highly armored anthropomorphic vehicle for the individual soldier that can move through rough and urban terrain without difficultly while providing the individual soldier with an unprecedented amount of ballistic protection. This program has transitioned from PE 0602715E, MBT-01, where the underlying smart materials and mechanism development was funded. Transition is planned to the Army in FY 2008.

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(U) Program Plans:
- Develop the enabling components and improve the overall system performance of the exoskeleton device against threshold requirements developed in an MOA with the Army (May 2005).

	FY 2006	FY 2007	FY 2008	FY 2009
Concealed Weapons Detection	0.000	6.330	3.500	2.000

(U) The Concealed Weapons Detection program will explore various phenomenologies that will permit concealed weapons detection. Imaging based approaches will be developed utilizing an integrated silicon-based antenna array receiver device to produce whole radar arrays on a single die. Advanced front-end lens/reflector subsystems composed of lightweight, low cost materials must be developed in conjunction with highly sensitive receiver subsystems to extend the standoff range. Alternative sensor approaches are also being explored to provide a multi-mode, multi-sensor solution targeted at improved discrimination. These approaches will incorporate x-ray, THz, and millimeter wave radar to provide multispectral tomographic capability. Specific dielectric properties at various electromagnetic frequencies will also provide measurable fingerprints for material classification. High-performance, real-time image processing algorithms must be executed in real-time and would require the development of a lightweight, low-power processor. This novel concealed weapons detection system could result in a significant reduction in military and civilian casualties. Transition is planned to the operational forces.

(U) Program Plans:
- Conduct conceptual verification to determine qualitative performance achievable of stand-off imaging detection.
- Develop candidate conceptual designs meeting objective system performance.
- Perform laboratory prototype demonstration.
- Perform brassboard demo of basic penetration performance.
- Conduct experimental field trials.

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	FY 2006	FY 2007	FY 2008	FY 2009
Asymmetric Materials for the Urban Battlespace (formerly Urban Obscurants)	0.000	5.000	5.000	5.000

(U) The Asymmetric Materials for the Urban Battlespace program will investigate a novel class of materials that, either by themselves or as part of a system, provide asymmetric capabilities in visible signatures, ballistic/fragment/blast protection, and personnel transport. Friendly forces will be able to see through it and shoot through it, but hostile forces will not. Asymmetric, or "one-way," materials will support basic unit operations such as raids, cordon and search activities, snap checkpoints, and fire fights. Significant technical obstacles include the design and fabrication of composite or meta-materials with true one-way capabilities, including the ability to "self-heal" if necessary. The materials must be lightweight, respond instantly, and be easy to deploy and retract in confined spaces. Potential transition partners include SOCOM, Army, and Marines.

(U) Program Plans:
- Explore material architectures that are appropriate to the design concept.
- Develop material components and architectures and integrate into Asymmetric Materials platform.
- Perform laboratory and field tests to demonstrate capabilities.

	FY 2006	FY 2007	FY 2008	FY 2009
Deep Speak	0.000	0.000	2.000	3.520

(U) The Deep Speak program is developing new networking, coding, and waveform techniques that enable communications signals to penetrate the surrounding buildings and underground facilities. This will maintain the warfighters' links to each other and the global network thus magnifying our striking power.

(U) Predictive networking techniques that use current position and velocity information to predict future network topologies will reduce the number of broken links by 90%. Also, by breaking the communications waveform into multiple layers, each encoded at a different quality and energy per bit of information (E_b/N_0), it is possible to reduce the sensitivity of the communications system to the unpredictable shadowing and

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fading that occurs in urban environments. For voice transmissions multi-layer waveforms will reduce the transmit energy required by 5 dB, and for video by 7 dB while still ensuring that the transmission is comprehensible. Finally, synthetic speech encoding techniques will vastly reduce the data rate required for transmitting speech, and thus has the potential to increase the signal level at the receiver tenfold. Transition is planned to the Army in FY 2009.

(U) Program Plans:
- Develop predictive network techniques.
- Develop multi-layer waveforms for both speech and video transmissions.
- Develop a very low bit rate synthetic speech encoder that maintains a high level of comprehension.
- Demonstrate predictive networking, multi-layer waveforms and synthetic speech encoding in typical urban environments.

	FY 2006	FY 2007	FY 2008	FY 2009
Laser Guided Bullet	0.000	0.000	1.500	6.092

(U) The Laser Guided Bullet (LGB) initiative will develop the capability to provide precision long-range, laser-based guidance updates to percussively driven or rocket propelled projectiles with the objective to develop a laser guided bullet. This capability will provide overmatching fire power to ground and vehicle-borne forces and significantly improve first shot effectiveness in engaging distant enemy forces. The development will focus on both the technologies required to enable low-cost, high performance guided projectiles or bullets along with the guidance and targeting systems. This will include new guidance technologies, such as compact MEMs-based thrusters and high-stress tolerant electronics in the guided bullet and new compact targeting systems robust to field operations under a variety of conditions. The technology is planned to be transitioned to the Special Forces and Army Sniper Team.

(U) Programs Plans:
- Develop and demonstrate initial side-thrust technologies with sufficient authority to move a projectile in flight.
- Demonstrate closed-loop communications with the projectile in flight.
- Demonstrate closed-loop control with sufficient timing precision to significantly improve accuracy of projectiles at extended ranges.
- Demonstrate bistatic guidance operations and incorporate detailed user feedback into system design.

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- Develop fieldable prototype for evaluation in the field and transition to ground forces.
- Develop, analyze and assess initial multi-modal missile system preliminary designs.

	FY 2006	FY 2007	FY 2008	FY 2009
Robot Human Teams (RigHT)	0.000	0.000	2.500	6.000

(U) The RigHT (Robot Human Teams) program will develop software that enables warfighters (humans) and robots to work effectively together as teams. The technologies will enable humans to form teams with robots so the combined team is able to leverage the strengths of each to create a unit whose whole is greater than the sum of its parts. The program will design new cognitive algorithms that enable the robots to reason about joint goals or missions, reason about role and task assignment, and engage in distributed collaborative planning with their other teammates. This technology is planned to transition to the Army in the future.

(U) Program Plans:
- Design distributed collaborative planning algorithms that enable robots to plan with each other and with the warfighters.
- Create multi-modal interfaces for human-to-robot interaction that support distributed planning and distributed plan execution.

(U) Other Program Funding Summary Cost:

- Not Applicable.

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COST (In Millions)	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Future Combat Systems LNW-03	90.800	8.050	0.000	0.000	0.000	0.000	0.000	0.000

(U) Mission Description:

(U) The Army's Future Combat Systems Brigade Combat Team (FCS BCT) is envisioned to be a System of Systems (SoS), which will provide capabilities that strike an optimum balance between critical performance factors (e.g., operational and tactical mobility, lethality, survivability, and sustainability) and strategic responsiveness. The FCS program embraces an evolutionary acquisition, spiral development process. The program allows for continuous capability upgrades through the introduction of new, enabling technologies throughout the development phase. This Joint DARPA/Army activity supports the FCS spiral process through the development of critical technology improvements for FCS BCT platform variants and the Network. The resulting network-centric SoS will continue to provide the Unit of Action overwhelming lethality, strategic deployability, self-sustainment, and high survivability over other conventional ground forces.

(U) Program Accomplishments/Planned Programs:

	FY 2006	FY 2007	FY 2008	FY 2009
FCS Supporting Technologies	90.800	8.050	0.000	0.000

(U) DARPA and the Army identified key areas where technology development is needed for potential pre-planned product improvements via the planned FCS BCT Spirals: Class I, II, and III unmanned air vehicles, robotic unmanned ground vehicles, Unit of Action (UA) and above command, control and communications, advanced radar sensor and EW systems, and advanced armament and missile systems.

(U) The Unmanned Ground Combat Vehicle (UGCV) – Perception for Off-Road Robotics (PerceptOR) Integration (UPI) program is integrating and testing autonomous navigation algorithms with the Crusher platform to yield an unmanned ground vehicle (UGV) that operates reliably in obstacle-rich terrain. Two Crusher platforms are being used to port and test methods for perception techniques to optimize autonomous performance. Autonomous mobility is being further enhanced by the use of terrain data for path planning. The program's technologies will

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transfer to the FCS UGV Integrated Product Team activities to include System Development and Demonstration (SDD) efforts and potential early spirals into FCS BCT anticipated to occur in FY 2008.

(U) The Future Combat Systems MultiCell and Dismounted Command and Control program enabled experimentation with advanced command and control information technology. MultiCell emulates the functionality of an entire tactical combined arms force. The program incorporates both unmanned air and ground robotic platforms, headquarters working at the operational level, and human dismounts. MultiCell also provides commanders with recommended interface functions and workload allocations. MultiCell validates the understanding of the dynamics of complex warfighting organizations thus defining commander interface layouts, functions and displays for maximum flexibility and effectiveness. This program recommends capability enhancements supporting technology for the nomination of information sources and supports visualization of current and future operational states. MultiCell enables commanders to successfully prosecute future command and control operations with significantly reduced staff. DARPA established an MOA with the Army for this program in August 2003. The MultiCell Command and Control technology transitioned to the Army at the conclusion of Phase II, completed in FY 2006.

(U) The Maneuver C^3 program will develop robust, assured and potentially high data rate connectivity for the Future Combat Systems Brigade Combat Team (FCS BCT) elements along with a command and control architecture to reduce the number of forward deployed Command and Control (C^2) operators. The communications component will develop an integrated architecture that provides for a seamless transition from line-of-sight to non-line-of-sight communications. To enable this functionality, development of new secure waveforms, directional antennas and mobile ad hoc networks will be initiated. The C^2 component will directly leverage the Army's investment in the automation of the Battlefield Functional Areas within the Army Battle Command System (ABCS). Because of the multitude of single aspect systems that feed information in ABCS, large amounts of data are made available to the commander, thus requiring a much larger staff of operators and workstation analysts to complete the fusion function of battlefield data into information for the commander to make decisions. Future operations involving FCS technologies and operational capabilities cannot be restricted by a less responsive C^2 architecture and large support staffs.

(U) Two autonomous air vehicle programs were developed to provide reconnaissance and surveillance, and targeting information for small unit FCS direct and indirect fire weapons. A company level vertical take off and landing unmanned air vehicle (VTOL UAV) program developed a vehicle for carrying out airborne surveillance and targeting against ground targets, and a platoon level VTOL UAV was developed for providing small units with an organic reconnaissance and surveillance capability. The company level UAV was developed under the OAV-II program and the platoon level UAV was developed under the Micro Air Vehicle (MAV) program.

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(U) The Organic Air Vehicle – II program developed lift augmented ducted fan vertical flight vehicles together with associated flight controls, collision avoidance capability, non-line-of-sight communications capability and heavy fuel engine technology. The OAV-II program leveraged several programs in DARPA and the services including advanced communications, sensor developments, the Micro Air Vehicle (MAV) Advanced Concept Technology Demonstration (ACTD), and UAV command and control programs. The dry system weight (no fuel) of the OAV II was 112 lbs. While efforts under the current phase have been successful, the Army has notified OAV contractors that it does not plan to pursue further development of this vehicle.

(U) The MAV ACTD program developed and integrated MAV technologies into militarily useful and affordable backpackable systems suitable for dismounted soldier, Marine, and Special Forces missions. The ACTD focused on the development of lift augmented ducted fan MAVs to accomplish unique military missions, particularly the hover and stare capability in restricted environments. The system provides the small unit with militarily useful real-time combat information of difficult to observe and/or distant areas or objects. The system will also be employable in a variety of war fighting environments (for example: in complex topologies such as mountainous terrain, urban areas, and confined spaces). The MAV ACTD program sought to get DARPA-developed small, Vertical Take – Off and Landing (VTOL) UAVs rapidly into the hands of the users for evaluation and evolution of the technologies; to develop tactics, techniques and procedures; and to provide a residual operational capability to active duty forces. The FCS MAV technology will transfer to the Army during FY 2007, at the conclusion of the ACTD user experimentation.

(U) The FCS laser radar (LADAR) Support (JIGSAW Phase III) program is developing advanced LADAR sensor systems and technologies for foliage penetration. Jigsaw will enable warfighters to accomplish day/night target identification and verification in the most stressing environments at short range (<1km). Environments of interest include targets hidden by foliage and camouflage, and targets in urban settings, such as alleyways. Jigsaw technologies are designed to provide warfighters with reliable combat identification based on a LADAR sensor that will deliver a visual picture of the target scene. The JIGSAW technology is planned for transition to the Army, which is to be completed by FY 2007.

(U) The Foliage Penetration (FOPEN) Reconnaissance, Surveillance, Tracking and Engagement Radar (FORESTER) initiative supports the Future Combat Systems (FCS) and the U.S. Army Objective Force. The program is developing FOPEN Ground Moving Target Indication (GMTI) radar. This radar promises persistent, long-term detection and tracking of dismounted troops and vehicles moving under foliage and in the open. The technology allows Objective Force commanders to operate with confidence in forested areas. The FORESTER radar will also be able

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to detect low-flying aircraft such as helicopters and ultra-lights at ranges out to 75km. FORESTER is a UHF-band FOPEN GMTI radar designed to operate on rotary wing platforms such as the A-160 unmanned helicopter. For GMTI operation, the helicopter flies into the wind to maintain near-zero ground speed. The goal is to detect dismounted troops under foliage at 30 km range under calm to low surface wind speeds. The program employs adaptive processing and innovative radar waveforms to overcome radio frequency interference and electronic countermeasures in hostile electromagnetic environments. The FORESTER technology is planned for transition to the Army at the conclusion of Phase III anticipated to be completed by FY 2008.

(U) The goal of the Affordable Adaptive Conformal ESA Radar (AACER) Program is to develop a high performance radar and communication system for Class IV unmanned helicopters such as the A-160. The Ka-band radar will provide airborne, all-weather, day-night Synthetic Aperture Radar reconnaissance, wide area Ground Moving Target Indication (GMTI) surveillance, dismount detection, and target acquisition and designation for precision fires. It will provide this information directly to the Unit of Action commander via an interleaved data link through the same antenna. The program will develop Electronically Scanned Array (ESA) technology in a small Ka-band antenna. The combination of platform and radar characteristics will provide for persistent surveillance including that in urban areas, with a minimum discernable velocity of 1 mph. The technologies being developed include: (1) affordable radar devices such as phase shifting elements and power amplifiers/combiners which operate at Ka band; (2) miniature receiver/exciter modules generating very broadband waveforms; (3) signal processing algorithms to support multiple functions simultaneously and detect and track dismounts. Use of existing signal and data processing hardware and software will allow an early flight demonstration of the entire system on an A-160 or surrogate aircraft. If successful, this program will provide a vastly improved intelligence and targeting capability for local commanders by providing a dedicated, rapidly taskable asset with surveillance of most of their battlespace, including areas inaccessible or obscured to larger airborne assets. DARPA negotiated an MOA with the Army for this program in August 2005, and the AACER technology is planned for transition to the Program Executive Office – Intelligence Electronic Warfare and Sensors (PEO-IEW&S) at the conclusion of Phase III in FY 2008.

(U) The Electromagnetic (EM) Mortar program will design and demonstrate EM guns (coilgun and railgun) capable of firing modified 120 mm mortar rounds at velocities up to 420 m/s. In addition, this program will also evaluate significant system “trade space issues” for implementation including: 1) ammunition integration and compatibility; 2) vehicle integration concerns; 3) system reliability metrics (barrel life, EM interference); 4) lethality change due to modification; and 5) system supportability metrics. Transition of developed capabilities will be accomplished through the Army FCS BCT program, and is anticipated to occur in FY 2007.

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(U) The Future Combat Systems Studies, Analysis and Experimentation Program enabled the continued Joint analysis and integration of enabling future land warfare concepts and technologies into the U.S. Army Future Combat System Brigade Combat Team (FCS BCT) program. It enabled the rapid analysis of opportunistic concepts and technologies, and provided support for Joint Force effectiveness modeling of DARPA enabling technologies by the Army Capabilities Integration Center (ARCIC). The program had two initial focus areas: United States Military Academy (USMA) Systems Engineering and Directed Studies.

(U) The objective of the FCS International Cooperation program is to establish and execute Science and Technology Project Agreements with the Republic of Singapore (SN) and the United Kingdom (UK) to identify new S&T initiatives. The program is in collaboration with the U.S. Army. The Singapore Project Agreement initially supported projects to investigate tactical command and control interoperability, explore the use of computer-based technology to mitigate differences between coalition partner planning processes and tools; investigate and assess the utility of various sensor packages on UAV/UGV platforms in dense jungle environments, urbanized terrain and littoral/maritime environments; and determine the applicability of quantum dot technology for developing multi-spectral optic systems. DARPA established an MOA with the Army for this program in April 2004. The agreement with the United Kingdom supports projects to: survey and assess international technologies applicable to the FCS BCT program; compare and assess the coalition effects-based operations planning technologies available from the U.S. and U.K., and conduct an analysis of U.S./U.K. coalition interoperability. The FCS International Cooperation technology program completes in FY 2007, with results being provided to ARCIC and the FCS BCT Program.

(U) The WolfPack program will further develop the initial capability for close approach, networked electronic warfare. The overall effectiveness and efficiency of FCS will be improved by this effort through the development of an advanced, collaborative electronic warfare sensing and attack system. This will provide improved situational awareness in the battlespace for other FCS platforms, thereby improving their survivability in a wide range of scenarios. The improved WolfPack system will be able to detect, locate and jam RF communications as well as providing targeting information to other FCS platforms for kinetic fires or collaborative electronic countermeasures. The WolfPack technology is planned for transition to the Army in FY 2008.

(U) Program Plans:

- UGCV – PerceptOR Integration (UPI)
  - -- Integrate vehicle payloads.
  - -- Commence testing of ported Learning Applied Ground Robots (LAGR) hardware.

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-- Conduct operational UPI testing of vehicle, perception and prior data.
-- Provides program planning support for the DARPA Urban Challenge.

– MultiCell and Dismounted Command and Control
-- Developed prototype command and control interfaces for higher commanders, cell commanders and dismount commanders.
-- Developed supporting operational and systems architectural framework products.
-- Developed a supporting C^4ISR simulation test-bed to assess the performance of the C^2 prototype.

– Maneuver C^3
-- Validated organic, self-contained approaches versus approaches that "reachback" to other systems for C^2.
-- Selected wireless communications network architecture(s) for implementation.
-- Demonstrated sub-system components for assured communications in a hostile environment using novel waveforms and beam steering antennas for low probability of detection and anti-jam.
-- Refined Commander's Support Environment (CSE); expanded CSE knowledge base and collective intelligence module.
-- Continued to refine and expand supporting simulation.
-- Collected and assessed the insights of human-machine interface requirements for training prototypes with the assistance of Army Research Institute.
-- Conducted experiments in support of selected command and control functions for operations with manned/unmanned systems.
-- Completed the development of an initial C^2 experimental demonstrator.
-- Continue experiments of Unit Cell C^2 incorporating limited activities of the dismounted soldier.
-- Extended C^2 architecture to handle inter-unit cell operations, and operations between unit cell and next higher level.
-- Demonstrated an integrated architecture that provides seamless transition from line-of-sight to non-line-of-sight communications via unmanned aerial vehicles and satellite communications.
-- Demonstrate new gateway-based mobile ad hoc networks facilitating radio interoperability among future, current, and legacy military and civilian radios.
-- Perform Technology Maturity Assessment and training with users and National Assessment Group.

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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-03

- Organic Air Vehicle - II
  - -- Completed Phase II of competitive contracts for system detailed design.
  - -- Conducted critical design review confirming ability to develop capable air vehicle systems.
  - -- Completed risk reduction testing on critical vehicle subsystems.
  - -- Initiated Phase IIIA to build and fly a ~ 112 lb (dry weight) flight vehicle and demonstrate robust flight stability.
  - -- Demonstrated collision avoidance system performance.

- Micro Air Vehicle
  - -- Demonstrated an enhanced g-MAV (gasoline engine) in military operations in urban terrain exercises and conducted experiments with troops in field trials.
  - -- Provide Army unit from 25th Infantry Division, 25 MAV systems (50 air Vehicles) as a residual operational capability.

- Jigsaw Phase III
  - -- Developed a form, fit, and function Jigsaw Sensor for integration onto the DP-5X.
  - -- Developed real-time on-board registration and processing capability.
  - -- Performed initial flight tests and data collections to demonstrate the utility of the Jigsaw system using a UH-1.
  - -- Perform flight tests and data collections using a DP-5X UAV.
  - -- Advance the technologies to a Technical Readiness Level 6.

- Foliage Penetration (FOPEN) Reconnaissance, Surveillance, Tracking and Engagement Radar (FORESTER)
  - -- Demonstrated detection of slowly moving ground targets in foliage by rotorcraft-mounted Ground Moving Target Indication (GMTI) radars through measurements, simulations and analyses.
  - -- Designed, assessed, and evaluated a brassboard FORESTER hardware system.
  - -- Design, assess, and evaluate a form-fit-and-function FORESTER hardware system for rotorcraft installation.
  - -- Design, and fabricate a FORESTER radar and integrate it first on a Black Hawk helicopter and then on an A-160 helicopter.
  - -- Conduct airborne flight-testing of the FORESTER first on a Black Hawk and then on an A-160 and demonstrate ability to do real-time detection of moving troops under foliage and in the open.

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– Affordable Adaptive Conformal Electronically Steerable Array Radar (AACER)
  -- Demonstrated sub-array antennas, with a waveform generator suitable for 3-inch resolution.
  -- Fabricated full antenna array (6" x 24") with ~ 50 W average power.
  -- Integrate full array and radar system with existing processor and receiver hardware for lab testing.
  -- Develop software and demonstrate functionality in A-160 or surrogate flight platform.
  -- Train military operators and perform simulated military mission tests and evaluation.

– EM Mortar
  -- Demonstrated integration compatibility for existing 120mm ammunition.
  -- Completed missions and military utility analysis.
  -- Demonstrated 3 j/cc capacitor capability in lab.
  -- Fabricated coilgun and railgun launchers.
  -- Conducted laboratory testing of the launchers with capacitor-based power systems.
  -- Complete projectile test round design and fabrication.
  -- Assess large-scale manufacturing issues for capacitors and demonstrate operation in a full-size module.
  -- Conduct ammunition and weapon system testing.

– Studies/Analysis/Experiments
  -- Complete systems engineering studies.
  -- Complete FCS related directed studies and analysis.

– International Cooperation
  -- Complete data analysis and force impact of innovative mechanized air assault force concept of operations in command and control jointly developed and evaluated in a wargame environment. Assess Human Factors effects from Coalition operations of U.S. and Singaporean forces.
  -- Evaluated the operational performance of DARPA Organic and Micro Air Vehicles and Unmanned Ground Vehicles in complex terrain environments, e.g. jungle and urban.

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-- Complete the data analysis of the operational performance of DARPA advanced sensors and advanced sensor exploitation technologies against tactical targets in complex terrain environments, e.g. urban and jungle, performed in Singapore in early FY 2007.
-- Evaluated U.S., U.K. and Singapore Command Post of the Future (CPoF) like technologies for facilitating the exchange of information, investigated concepts for command and control, and explored interoperable architectures demonstrating plug and operate capabilities.
-- Conducted interoperability wargaming.
-- Initiated development of novel quantum dot detector technology for new design concepts for micro-sensors.
-- Surveyed and assessed the applicability of international technologies to the FCS program.
-- Compared and assessed the coalition effects-based operations planning technologies available from the U.S. and U.K.
-- Analyzed U.S./U.K. coalition interoperability of tactical command, control and communications systems.

– WolfPack
-- Reduce form factor size of initial WolfPack capability hardware to suit multiple delivery options under the FCS architecture.
-- Refine target set and mission roles to complement existing EW systems with unique WolfPack capabilities.
-- Optimize initial WolfPack power generation and management systems for longer endurance.
-- Demonstrate capability during field experiments.

(U) Other Program Funding Summary Cost:

	FY 2006	FY 2007	FY 2008	FY 2009
PE 0603005A Army	25.687	26.490	28.000	29.000