RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 2008
APPROPRIATION/BUDGET ACTIVITY: RDT&E, Defense-wide; BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE: Land Warfare Technology; PE 0603764E

COST (In Millions)	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Total Program Element (PE) Cost	36.658	19.642	0.000	0.000	0.000	0.000	0.000
Rapid Strike Force Technology LNW-01	17.304	19.642	0.000	0.000	0.000	0.000	0.000
Future Combat Systems LNW-03	19.354	0.000	0.000	0.000	0.000	0.000	0.000

(U) Mission Description:

(U) The Land Warfare Technology 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. This program will complete with FY 2008 funding and on-going efforts will continue in other program elements that fund technologies to support urban area operations.

(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. The Rapid Strike Force Technology project developed technologies that serve as force multipliers, enabling safe and effective operations in hostile environments.

(U) The U.S Army's Future Combat Systems (FCS) is 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 Joint DARPA/Army activity supported the FCS spiral process through the development of critical technology improvements for FCS platform variants and the Network.

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(U) Program Change Summary: *(In Millions)*

	FY 2007	FY 2008	FY 2009
Previous President's Budget	44.805	24.711	32.612
Current Budget	36.658	19.642	0.000
Total Adjustments	-8.147	-5.069	-32.612
Congressional program reductions	-7.000	-5.069	
Congressional increases	0.000		
Reprogrammings	0.000		
SBIR/STTR transfer	-1.147		

(U) Change Summary Explanation:

FY 2007	Decrease reflects the SBIR/STTR transfer and the Section 8043 rescission.
FY 2008	Decrease reflects a PE execution adjustment and reductions for Section 8097 Contractor Efficiencies and Section 8104 Economic Assumptions.
FY 2009	Decrease reflects re-prioritization, completion of several Urban Warfare efforts in Project LNW-01, Rapid Strike Force Technology, transfer of the balance of the urban warfare efforts to other, more suitable Program Elements, and completion of the Future Combat Systems project.

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COST (In Millions)	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Rapid Strike Force Technology LNW-01	17.304	19.642	0.000	0.000	0.000	0.000	0.000

(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. 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. This project will complete with FY 2008 funding and on-going efforts will continue in other Program Elements that fund technologies to support urban area operations.

(U) Program Accomplishments/Planned Programs:

	FY 2007	FY 2008	FY 2009
Multi-Modal Missile	3.400	7.000	0.000

(U) The Multi-Modal Missile program will explore the development of an integrated, networked man-portable weapon system capable of performing surface-to-surface, and surface-to-air missions with an emphasis on extreme precision. The program will focus on delivering precision targeting accuracy in both direct and indirect fire modes against multiple targets, and beyond line-of-sight functionality including: armored and soft ground vehicles, bunkers, personnel and helicopters, and UAVs. The Multi-Modal Missile is being developed to replace both the Javelin and TOW missiles with a single missile and be compatible with existing Javelin and TOW launch infrastructures. The objective capability will integrate a variety of existing weapons systems functions and provide both mounted and dismounted soldiers with an affordable compact system. Critical characteristics of this weapon system concept include lightweight, simple operation, and affordable. Technologies under consideration will include advanced imaging seekers precision terminal guidance, propulsion, power storage, vertical launch with lock-on-after-launch

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capability, and novel warhead concepts to support a wide range of engagement geometries with desired lethality effects against a range of targets. Beginning in FY 2009, this program will be funded in PE 0603286E, Project AIR-01.

(U) Program Plans:
FY 2007 Accomplishments:
- Performed initial system design analyses and trade off studies.

FY 2008 Plans:
- Initiate critical technology, maturation efforts for seeker, propulsion, guidance and warhead.

	FY 2007	FY 2008	FY 2009
Non-Lethal Alternatives for Urban Operations	2.200	2.268	0.000

(U) The Non-Lethal Alternatives for Urban Operations effort is exploring 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 being investigated include less-lethal projectiles, malodorants, entanglers, and marking agents. The effort is considering direct and indirect fire systems to counter personnel and to provide area effects against vehicles, crowds and groups of combatants. Operating scenarios being explored 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:
FY 2007 Accomplishments:
- Performed initial concept development and effects assessments.
- Developed initial urban less-than-lethal system designs.

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- Developed initial reversible chemical formulations for significant traction reduction on rough surfaces.
- Identified and modeled means for asymmetric mobility.

FY 2008 Plans:

- Conduct less-than-lethal technology maturation efforts to address and reduce system risk.
- Research and develop prototype chemical system that reversibly denies adversary mobility (people and vehicles) by modifying ground traction, with simultaneous retention of friendly force mobility.
- Refine mobility control formulations and develop delivery systems.

	FY 2007	FY 2008	FY 2009
Tactical Urban Operations (TURBO)	0.425	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:

FY 2007 Accomplishments:

- Identified system architecture and constraints based on MAV Advanced Concept Technology Demonstration experience.

	FY 2007	FY 2008	FY 2009
PEO-Soldier/Exoskeleton Transition	6.000	0.000	0.000

(U) The PEO-Soldier Exoskeleton Transition program employed 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

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the program was 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. This program transitioned to the Army.

(U) Program Plans:
FY 2007 Accomplishments:
- Developed the enabling components and improved the overall system performance of the exoskeleton device against threshold requirements.
- Transitioned program to Army for continued development and solider evaluations.

	FY 2007	FY 2008	FY 2009
Concealed Weapons Detection	2.330	3.500	0.000

(U) The Concealed Weapons Detection program will explore various phenomenologies for 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 stand-off 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 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. The concepts and technology will continue in PE 0603767E, Project SEN-01.

(U) Program Plans:
FY 2007 Accomplishments:
- Demonstrated dielectric spectroscopy techniques in very near field applications.
- Developed sensor fusion algorithms for registering disparate sensor outputs and integrating their results.

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FY 2008 Plans:
- Conduct conceptual verification to determine qualitative performance achievable of stand-off imaging detection.
- Develop candidate conceptual designs meeting objective system performance.

	FY 2007	FY 2008	FY 2009
Asymmetric Materials for the Urban Battlespace	2.149	4.874	0.000

(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:

FY 2007 Accomplishments:
- Explored material architectures appropriate to the design concept.

FY 2008 Plans:
- Develop and integrate material components and architectures for laboratory testing.

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	FY 2007	FY 2008	FY 2009
Deep Speak	0.800	2.000	0.000

(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, 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 98%. 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 fading that occurs in urban environments. For voice transmissions multi-layer waveforms will reduce the transmit energy required by 5 decibel (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. The program is planned to transition to the Army in FY 2009.

(U) Program Plans:

FY 2007 Accomplishments:

- Developed multi-layer waveforms and demonstrated (through simulation) that they are much more efficient than conventional waveforms for video transmission and at 5 dB more efficient for speech transmission.
- Developed a phoneme based synthetic speech encoder/decoder and demonstrated that cooperative tasks can be accomplished using the synthetic speech encoder/decoder.

FY 2008 Plans:

- Develop predictive network techniques and demonstrate (through simulation) a significant reduction in the number of broken links in an urban networking environment.
- Demonstrate predictive networking, multi-layer waveforms and synthetic speech encoding technologies in typical urban environments.

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(U) Other Program Funding Summary Cost:

- Not Applicable.

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