RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, R-1 #48

COST (In Millions)	FY 2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009
Total Program Element (PE) Cost	153.017	165.963	82.387	15.433	0.000	0.000	0.000	0.000
Rapid Strike Force Technology LNW-01	14.444	9.261	0.819	0.721	0.000	0.000	0.000	0.000
Small Unit Operations LNW-02	25.023	31.841	18.578	0.000	0.000	0.000	0.000	0.000
Future Combat Systems LNW-03	113.550	124.861	62.990	14.712	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. Three broad efforts are being pursued in support of this objective: Rapid Strike Force Technology, Small Unit Operations and Future Combat Systems.

(U) The emerging U.S. vision of future land warfare places strong emphasis on technology supporting early entry of light, efficient land forces. This project is developing technologies that enable mobile and survivable systems for efficient command and control, mobility, surveillance, targeting and reconnaissance as well as effective and adaptive weaponry, which are important aspects of an early-entry capability. The project consists of: the Reconnaissance, Surveillance and Targeting Vehicle (RST-V); Tactical Mobile Robotics (TMR); Metal Storm (MS), Mach 5/50 Technology Development, and the Micro Air Vehicle (MAV) Advanced Concept Technology Demonstration program. These programs are closely coordinated with the U.S. Army, Navy and Marine Corps, and with DARPA's Small Unit Operations (LNW-02) project.

(U) The Services are pursuing new tactical concepts for employing small, easily deployed units as an early entry force to address future contingencies. Their objective is to enable these forces to quickly control a large battlespace with dispersed forces, control the operational tempo, engage enemy targets with remote fire and operate effectively across the spectrum of conflict in severe communications environments. These dismounted forces must be self-sufficient, capable of operating for several days and be sufficiently lean to be quickly inserted anywhere in the world.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, R-1 #48

(U) The U.S. Military requires flexible, effective and efficient multi-mission forces capable of projecting overwhelming military power worldwide. This force must ultimately provide our national leaders with increased options when responding to potential crises and conflicts. To satisfy this requirement, the joint Army/DARPA Future Combat Systems (FCS) program was developed to provide enhancements in land force lethality, protection, mobility, deployability, sustainability, and command and control capabilities.

(U)	**Program Change Summary:** *(In Millions)*	**FY 2002**	**FY 2003**	**FY 2004**	**FY2005**
	Previous President's Budget	153.067	162.100	121.407	73.561
	Current President's Budget	153.017	165.963	82.387	15.433
	Total Adjustments	-0.050	3.863	-39.020	-58.128
	Congressional program reductions	0.000	-4.137		
	Congressional increases	0.000	8.000		
	Reprogrammings	-0.050	0.000		
	SBIR/STTR transfer	0.000	0.000		

(U) Change Summary Explanation:

FY 2002	Decrease reflects a below threshold reprogramming.
FY 2003	Increase reflects $8 million transfer from DERF for the Wolfpack program offset by congressional undistributed reductions.
FY 2004 - 2005	Decreases reflect realignment of Projects LNW-01 and LNW-02 funding to PE 0603766E, Project NET-01.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-01

COST (In Millions)	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Rapid Strike Force Technology, LNW-01	14.444	9.261	0.819	0.721	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. This project is developing technologies that enable mobile and survivable systems for efficient command and control, mobility, surveillance, targeting and reconnaissance as well as effective and adaptive weaponry, which are important aspects of an early-entry capability. The project consists of: the Reconnaissance, Surveillance and Targeting Vehicle (RST-V); Tactical Mobile Robotics (TMR); Metal Storm (MS), Mach 5/50 Technology Development, and the Micro Air Vehicle (MAV) Advanced Concept Technology Demonstration program. These programs are closely coordinated with the U.S. Army, Navy and Marine Corps, and with DARPA's Small Unit Operations (LNW-02) project. This project draws to an end in FY 2005. Programs traditionally budgeted in this project will be reflected in a new program element 0603766E, project NET-01, to better reflect today's emphasis on network centric warfare.

(U) Program Accomplishments/Planned Programs:

	FY 2002	FY 2003	FY 2004	FY 2005
Reconnaissance, Surveillance and Targeting Vehicle (RST-V)	5.274	3.049	0.000	0.000

(U) The Reconnaissance, Surveillance and Targeting Vehicle (RST-V) program is designing, developing, testing/demonstrating and transitioning to the Services four hybrid electric drive, lightweight, highly maneuverable advanced technology demonstrator vehicles capable of V-22 internal transport. The vehicle incorporates technological advancements in the areas of integrated survivability techniques and advanced suspension. The vehicle also hosts integrated precision geolocation, communication and Reconnaissance, Surveillance and Targeting sensor subsystems. The RST-V platform provides a mobile quick deployment and deep insertion capable, multi-sensor, battlespace awareness asset for small unit tactical reconnaissance teams, fire support coordinators and special reconnaissance forces. Hardware and lessons learned from this program directly support the Marine Corps-Navy Extending the Littoral Battlespace (ELB) Advanced Concept Technology Demonstration

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-01

(ACTD) as well as address joint U.S. Marine Corps – Special Operations Command (USMC-SOCOM) requirements for the Internally Transportable Vehicle/Light Strike Vehicle (ITV/LSV), Tactical Vehicle, Reconnaissance, Surveillance, Targeting and Acquisition (TV-RSTA) program and High Mobility Multi-purpose Wheeled Vehicle (HMMWV) upgrades. The Marine Corps will develop vehicle concepts and chassis, integrate the DARPA developed components and conduct vehicle performance tests (PE 0603640M) through participation in scheduled Advanced Warfighting Experiments (AWEs) and ACTDs (e.g., Capable Warrior).

(U) Program Plans:

- Continue enhancing high voltage battery power conversion, refurbishing battery packs and upgrading system control equipment.
- Rollout vehicles 3 and 4.
- Conduct Technical Performance Measure Verification.
- Conduct users' evaluation and assessment with potential USSOCOM/USMC/US Army customers.
- Deliver vehicles 1, 2, 3 and 4.
- Deliver final report.

	FY 2002	FY 2003	FY 2004	FY 2005
Tactical Mobile Robotics (TMR)	3.392	0.993	0.000	0.000

(U) The Tactical Mobile Robotics (TMR) program developed mobile robotic technologies to enable land forces to dominate the battlespace through employment of mobile semi-autonomous robot teams performing challenging missions in complex environments (dynamic urban areas, rugged terrain with high obstacle clutter, etc.). TMR has provided DoD organizations with a team of semi-intelligent, cooperating robot prototype platforms carrying a variety of integrated mission payloads required to conduct activities in risk intensive or inaccessible areas. Operational emphasis was on urban environments and denied areas. Specific robot technologies that were advanced include: machine perception, autonomous operation and advanced locomotion for complex obstacle negotiation. Perception capabilities included: (a) an on-board multi-sensor perception system capable of detecting at least 80 percent of decimeter-scale terrain hazards and at least 95 percent of meter-scale terrain hazards, both at 20Hz; and (b) multi-source mapping algorithms capable of creating topological maps of urban structures with 90 percent accuracy. Autonomous operation capabilities included: (a) coordination of the tactical behavior of a multi-robot team with significant command cycle reduction; and (b) traversal of rugged/complex terrain using one command per 100 meters of travel. TMR prototypes were used during Operation Enduring Freedom

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-01

for cave clearing and on numerous other activities including explosive ordinance disposal and recovery operations at the World Trade Center immediately following the September 11th attacks. TMR prototypes and research artifacts have been transitioned to the DoD Joint Robotic Program where they are being utilized to support additional research on robots.

(U) Program Plans:
- Completed final prototype modifications.
- Transitioned to military departments.

	FY 2002	FY 2003	FY 2004	FY 2005
Metal Storm (MS)	2.801	0.000	0.000	0.000

(U) The Metal Storm program demonstrated a revolutionary technique for firing tactically relevant projectiles at very high rates without the need for internal moving parts. The elimination of moving parts from the system significantly reduced production, operation and support costs, and decreased the level of maintenance required in the field. This effort demonstrated : 1) electronic sequential firing of three or more projectiles from a *single* barrel with the shortest possible time interval between rounds; 2) projectile penetration 25.4 mm of rolled homogenous armor at 1,000 meters; and 3) maximum vertical spread of 1 1/2 minute of angle at 300 and 600 meters. Studies were conducted to explore the feasibility and applicability of Metal Strom technology to other weapon systems, including vehicle self-defense, anti-personnel landmine replacement, and a naval self-defense system. As a result of data gathered under this program, a more promising endeavor has been undertaken in the Mach 5/50 Technology Development. Therefore, this program ends in FY 2002 and transitions to the Mach 5/50 Technology Development program.

(U) Program Plans:
- Conducted vented bomb tests.
- Conducted preliminary smooth bore test firings with U.S. contractor and Australian government partner.
- Performed a series of rifled bore proof-of-principle test firings with performance increasing to the minimum time interval between rounds and 1200 m/s muzzle velocity.
- Demonstrated a preliminary reloading concept.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-01

- Designed and simulated high performance, multi-barrel systems for launching 40-50 millimeter supersonic projectiles.
- Conducted testing and assessment of critical system components.

	FY 2002	FY 2003	FY 2004	FY 2005
Mach 5/50 Technology Development	2.977	1.323	0.819	0.721

(U) Early Metal Storm tasks demonstrated revolutionary weapon concepts for firing small caliber projectiles at very high rates without the need for internal moving parts. The continuing Mach 5/50 tasks extend the concepts and technologies for leap-ahead performance in tactically relevant, lightweight, medium caliber direct fire weapons. The medium caliber projectiles (50 millimeter bore) will have a minimum muzzle velocity of 1,600 meters per second (~ Mach 5) at 600 rounds per minute or greater. Mach 5/50 technology development will provide multiple services with a low-cost, reliable enabling technology to support a wide range of current/future applications including extended range combat vehicle firepower and lethality, full-spectrum future combat vehicle lethality for active protection systems, high engagement rate naval air defense, critical fixed site defense and improved aircraft self-defense. Portions of the technology development will be conducted under an agreement with the Australian Defence Science and Technology Office.

(U) Program Plans:

- Develop medium caliber concepts, detailed performance simulations and technical analyses.
- Fabricate and test critical technology subsystems.
- Complete integration of pre-prototype components and evaluate against simulation-based interim performance parameters.
- Critical design review and complete fabrication of full-function prototype.
- Complete system test and evaluation of full function prototype and validate simulations.
- Conduct firing demonstration and deliver final report.
- Transition hardware and data packages to DoD laboratories for Service-specific engineering and platform integration.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-01

	FY 2002	FY 2003	FY 2004	FY 2005
Micro Air Vehicle (MAV) Advanced Concept Technology Demonstration (ACTD)	0.000	3.896	0.000	0.000

(U) The primary goal of the MAV ACTD program is to further develop and integrate MAV technologies into militarily useful and affordable backpackable systems suitable for dismounted soldier, marine, and special forces missions. It will focus on the development of MAVs to accomplish unique military missions, particularly with regard to flight operations in restricted environments. The objective of the MAV ACTD is to demonstrate a backpackable, affordable, easy-to-operate, and responsive reconnaissance and surveillance system. The system will provide 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 warfighting environments. For example, it will be beneficial in complex topologies (i.e., mountainous terrain with caves), heavily forested areas/dense foliage/triple canopy jungle, confined spaces (often internal to buildings) and high concentrations of civilians (where it may be critical to determine the neutral or hostile intent of a crowd). The initial MAV technology development program focused on the technologies and components required to enable flight at small scales, including flight control, power and propulsion, navigation and communications. The MAV ACTD program will also leverage other DARPA technology development efforts, including advanced communications and information systems, high performance computer technology, Microelectromechanical Systems (MEMS), advanced sensors, advanced electronic packaging technologies, and lightweight, efficient high-density power sources. This program will be funded from PE 0603766E, Project NET-01 in FY 2004 and FY 2005.

(U) Program Plans:

- Demonstrate electric MAV in military operations in urban terrain exercises and conduct experiments with troops in field trials.
- Evaluate lessons learned and design of diesel MAV.
- Conduct further experiments with troops in the field to complete detailed design of hybrid MAV.
- Conduct experimentation of hybrid MAV; evaluate lessons learned; provide optimum MAV for evaluation.
- Conduct experimentation of optimum MAV and complete final military evaluation.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-01

(U) Other Program Funding Summary Cost:

Reconnaissance, Surveillance and Targeting Vehicle (RST-V)	FY 2002	FY 2003	FY 2004	FY 2005
PE 0603640M, Marine Corps Advanced Technology Demonstration	1.982	0.000	0.000	0.000
PE 0602131M, Marine Corps Future Naval Capabilities	1.000	0.000	0.000	0.000

Micro Air Vehicle (MAV) Advanced Concept Technology Demonstration (ACTD)	FY 2002	FY 2003	FY 2004	FY 2005
PE 0603001A, Army	10.000	0.000	0.000	0.000
PE 0603750D, OSD	1.000	4.400	*	*

*funded in concert with the MAV ACTD effort in NET-01.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-02

COST (In Millions)	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Small Unit Operations LNW-02	25.023	31.841	18.578	0.000	0.000	0.000	0.000	0.000

(U) Mission Description:

(U) The Services are pursuing new tactical concepts for employing small, easily deployed units as an early entry force to address future contingencies. Their objective is to enable these forces to quickly control a large battlespace with dispersed forces, control the operational tempo, engage enemy targets with remote fire and operate effectively across the spectrum of conflict in severe communications environments. These dismounted forces must be self-sufficient, capable of operating for several days and be sufficiently lean to be quickly inserted anywhere in the world.

(U) The objective of the Small Unit Operations Project is to develop critical technologies that will enable small dismounted forces to effectively fight anywhere, anytime. The technology needs are: semi-automated maneuver and strike/fire planning and re-planning that can be employed by commanders who are physically separated but need to be virtually collocated; automated aggregation and mining of information sources to provide a “bubble” of awareness over each warrior and team describing the relevant situation; accurate geographic position estimation, other than GPS, which works in all environments; and radio links and self-forming ad hoc networked communications that “glue” the components together, operate in any environment, are covert and resistant to interference. In addition, these technologies must not significantly increase the dismounted force’s mass and power burden. The programs that make up this project include Wolfpack, the Situational Awareness System (SAS), Tactical Sensors, Optical Tags, and Advanced Sensing Technologies. This project draws to an end in FY 2005 and programs traditionally budgeted in this project will instead be located in Program Element 0603766E, Project NET-01, to better reflect today’s emphasis on network centric warfare.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-02

(U) Program Accomplishments/Planned Programs:

	FY 2002	FY 2003	FY 2004	FY 2005
Wolfpack	11.195	25.541	16.097	0.000

(U) The Wolfpack program will develop technologies that would enable the U.S. to deny the enemy use of radio communications and radars throughout the battlespace. The networked system will be comprised of autonomous, ground-based monitors/jammers that are cooperatively linked to avoid disruption of friendly military and protected commercial radio communications and radars. The specific technologies to be developed include: (1) high efficiency sub-resonant antennas, (2) networking algorithms to allow coordinated access to the spectrum by communicators, jammers and SIGINT systems, (3) methods to easily deploy the systems in RF advantaged sites, and (4) algorithms to rapidly and autonomously detect, classify, identify and jam target signals with low power electronics.

(U) In FY 2003, additional funding was added from the Defense Emergency Response Fund for the development of an accelerated Wolfpack capability. These funds will be used to enable early development of technologies that could lead to a rudimentary Wolfpack-like system. Potentially used as a Distributive Suppression of Enemy Air Defense (DSEAD) asset, these rudimentary, close proximity WolfPack systems could permit non-lethal disruption of enemy radar systems, including possible terrorist reuse of civilian platforms.

(U) Program Plans:

- Wolfpack:
  - Develop enabling technologies.
  - Complete system design and performance analysis.
  - Verify low duty cycle, low power jamming techniques with benchtop experiments.
  - Construct and lab test brassboard-jamming subsystems.
  - Conduct limited lab tests using brassboard equipment to attack several legacy type communication systems.
  - Design, develop, and demonstrate via simulation and field tests the specific technologies developed.

- Wolfpack Accelerated Program
  - Mature enabling technologies for potential development of rudimentary Wolfpack-capable system.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology 0603764E, Project LNW-02

	FY 2002	FY 2003	FY 2004	FY 2005
Situational Awareness System (SAS)	6.867	1.500	0.000	0.000

(U) The Situational Awareness System (SAS) will integrate a variety of communications, navigation and data processing technologies into an eventual 1 kg module (plus 0.5 kg per day for the power source) worn by the individual warrior. The radio frequency module will be interoperable with the Army Land Warrior equipment and provide much greater functionality. The warrior module will provide the communications and computing power to fully interconnect the dismounted force and enable situation awareness information to be distributed, as well as support continuous planning and combat execution. This program will investigate the critical SAS performance parameters with in-depth experiments. It will provide user-centered design input for developers and provide an independent assessment of the SAS design. The experiments will be focused to evaluate the sensor employment, validate network robustness and reliability, and conduct a scenario-focused evaluation of geolocation and navigation requirements in urban, forested and mountainous terrain. Specialized tools will be developed to generate scenario-synchronized data for development and evaluation of the SAS functions. The program will coordinate the use of testing infrastructure to conduct evaluations and assessment and will employ a combination of military and technical subject matter experts, computer modeling and simulation tools, and laboratory and field exercises to provide independent validation of the SAS functionality.

(U) Program Plans:

- Completed prototypes.
- Developed training materials and conducted soldier training for field demonstration.
- Conducted field demonstration to verify communications performance in urban, forested, and mountainous terrain when operated by warfighters.
- Demonstrated the use of multiple organic sensors being operated by battalion and below warfighters.
- Transitioned to the Army, Marine Corps and U.S. Special Operations Command (USSOCOM).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology 0603764E, Project LNW-02

	FY 2002	FY 2003	FY 2004	FY 2005
Tactical Sensors	3.646	1.800	0.000	0.000

(U) The Tactical Sensors program is developing a new generation of unattended ground sensors, planning tools, deployment mechanisms, and command and control components that will provide the warfighter a capability to remotely and cost effectively detect, track, classify and identify mobile tactical targets. This lightweight, long-life system provides the warfighter with unmanned, high confidence reconnaissance, targeting, and surveillance, for integrated force protection and non-line of sight remote sensing in denied or life-threatening areas of interest. An open system architecture reduces logistic costs and anticipates future integration of advanced sensor modalities by service materiel developers via preplanned product improvements. Through integration with current and developmental C2 systems, information provided by these systems can be fused with other assets to enhance the aggregate situational awareness of U.S. forces. The emphasis in the final year will be to identify transition opportunities within the Air Force, Marine Corp, and Army whose employment requirements span fixed wing, rotary wing, ground vehicle, weapon-based or hand emplacement methods.

(U) Program Plans:

- Complete development and field-test unattended sensor and gateway nodes for detection, classification and tracking of mobile tactical targets such as missile launchers, armored personnel carriers, logistics vehicles, mobile cruise missile launchers, tanks and light vehicles.
- Develop planning and monitoring tools for the warfighters, including emplacement decision aids using 3D topography, foliage, weather, trafficability and target information. Provide for early warfighter input, test, evaluation and redesign.
- Integrate and demonstrate a fielded deep deployment system followed by node self-erection and autonomous cluster organization, reporting and geo-location.
- Interface to operational command and control networks.
- Demonstrate 70 percent probability of detection at 3,000 meters, 20 meters RMS tracking errors at 500 meters and greater than 90 percent probability of correct target identification at 500 meters against heavy tactical vehicles under reasonably demanding environmental conditions.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology 0603764E, Project LNW-02

	FY 2002	FY 2003	FY 2004	FY 2005
Optical Tags	0.655	0.000	0.000	0.000

(U) The Optical Tags program investigated optical technologies and innovative design and fabrication techniques for kilometer-range optical tag systems, which provide a quantum leap in tactics and operations in a wide variety of applications. The Optical Tags program validated models to predict system performance in support of a selected set of applications for technology demonstration. The applications were selected based on their operational significance and user input. The Optical Tags program developed systems performance requirements for the applications and demonstrated the systems in meaningful warfighter experiments. The technical successes and operational relevance demonstrated under this program has resulted in continuation of investigation of more robust optical tagging technologies in PE0602702E Project TT-04.

(U) Program Plans:

- Designed and tested portable interrogator and detector system to support testing of the tags at ranges in operationally representative field environments.
- Developed and tested remote tag emplacement method.
- Developed an eye safe tagging and interrogator system.
- Improved the response efficiency of the tags.
- Demonstrated system operation at operationally relevant ranges.

	FY 2002	FY 2003	FY 2004	FY 2005
Advanced Sensing Technologies	2.660	3.000	2.481	0.000

(U) The Advanced Sensing Technologies program will develop a new class of sensors for military surveillance and targeting applications. These sensors will provide surveillance, target detection, tracking, and classification, in day or night and in near all-weather conditions, of time critical mobile targets at distances greater than ten times current capabilities. Such capabilities are required to maintain battlespace dominance in challenging environments where sensor shadow zones may exist, such as around man-made and natural terrain obstacles, under forest canopies and within dense foliage.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-02

(U) Program Plans:
- Develop enabling technologies.
- Develop and field test stationary sensor system to detect, localize and characterize targets.
- Complete preliminary assessment of mobile sensor system to detect, localize and characterize targets in challenging environments.

(U) <u>Other Program Funding Summary Cost:</u>

- Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-03

COST (In Millions)	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009
Future Combat Systems LNW-03	113.550	124.861	62.990	14.712	0.000	0.000	0.000	0.000

(U) Mission Description:

(U) The U.S. Military requires flexible, effective and efficient multi-mission forces capable of projecting overwhelming military power worldwide. This force must ultimately provide our national leaders with increased options when responding to potential crises and conflicts. To satisfy this requirement, the joint Army/DARPA Future Combat Systems (FCS) program was developed to provide enhancements in land force lethality, protection, mobility, deployability, sustainability, and command and control capabilities.

(U) Program Accomplishments/Planned Programs:

	FY 2002	FY 2003	FY 2004	FY 2005
FCS Concept Development	30.000	48.000	0.000	0.000

(U) The FCS program will develop network centric concepts for a multi-mission combat system that will be overwhelmingly lethal, strategically deployable, self-sustaining and highly survivable in combat through the use of an ensemble of manned and unmanned ground and air platforms. The goal of the FCS program is to design such an ensemble that strikes an optimum balance between critical performance factors, including ground platform strategic, operational and tactical mobility; lethality; survivability; and sustainability. This system of systems design will be accomplished by using modeling, simulation and experimentation. The FCS unit will be capable of adjusting to a changing set of missions, ranging from warfighting to peacekeeping, as the deployment unfolds. An FCS-equipped force will be capable of providing mobile-networked command, control, communication and computer (C^4) functionalities; autonomous robotic systems; precision direct and indirect fires; airborne and ground organic sensor platforms; and adverse-weather reconnaissance, surveillance, targeting and acquisition.

(U) Program Plans:

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-03

- Conducting concept and technology demonstration (CTD) to support decision for transition to System Development and Demonstration.
- Selected single Lead Systems Integrator to carry out CTD program in partnership with the Government.
- Conducted Technology Investment Decision Review.
- Completing Technology Maturity Assessment.
- Transition program from concept and technology development to system design and demonstration.
- Initiate Force Development Testing and Evaluation activities including limited man-in-the-loop testing.
- Initiate concept and technology demonstration (CTD) for follow-on block improvements.

	FY 2002	FY 2003	FY 2004	FY 2005
FCS Supporting Technologies	83.550	76.861	62.990	14.712

(U) DARPA identified six key areas where technology development is needed to support the overall FCS system of systems design: robotic perception, unmanned ground combat vehicles, maneuver command control and communication (C^3), beyond line of sight fires, organic adverse weather unmanned air vehicles and advanced laser radar sensors.

(U) The Perception for Off-road Robotics (PerceptOR) program will identify and develop revolutionary unmanned vehicle perception prototypes. These perception systems will be flexible enough to operate in off-road environments and will be backed by extensive experimental test data in a variety of operationally relevant terrain and weather conditions. The resulting technology will be applicable to a variety of combat roles and will enable greater confidence in postulating the conditions under which unmanned off-road robotics should be used. The use of advanced remote imagery and small numbers of collective robots will be included in the approaches taken.

(U) The Unmanned Ground Combat Vehicle program will develop vehicle prototypes exhibiting advanced performance in endurance, obstacle

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-03

negotiation, and transportability (small size) based on novel designs unrestrained by the need to accommodate human crews. These prototypes may include unique mobility configurations (traditional wheeled/tracked to organic-mimicking, i.e. walking/crawling), exceptional drivetrains, advanced structures/composites, terrain/soil analysis, sensory exploitation and interaction with robotic control architectures.

(U) The Maneuver C^3 program will develop robust, assured and potentially high data rate connectivity for the Future Combat Systems (FCS) 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) The FCS C^2 program integrates and compresses selected Battlefield Functional Area functions in a scaled architecture to support the FCS Unit Cell operations. Through emulation of advanced information technologies and knowledge base engineering, this program will develop an advanced method of command and control, to integrate the previous stove-piped Battlefield Functional Areas into a single integrated information environment (Commander's Support Environment, CSE) that will support the command and control of manned and unmanned systems. The technical approach is to regulate the flow of information presented to an FCS Commander by moving much of the information/data integration to a hardware/software environment thus allowing the Commander and Battle Managers to leverage existing operational opportunities by focusing on fewer unknowns, clearly visualize current and future operational end states and dictate the tempo of operations within a variety of environments, while being supported by a significantly reduced staff. The true compression and integration of these functions would provide the FCS commander with information for rapid decision making vice numerous data streams requiring analysis by a large battle staff. The compression of these selected functions would enable a reduction of personnel in the Unit Cell C^2 element, and facilitate anticipatory planning and adaptive execution by the FCS Commander. A top level C^2 architecture (systems and operational) will be developed and validation of the architecture and assessment of performance (e.g., command latencies) will be achieved by conducting a series of four experiments within a simulated environment.

(U) The Netfires (formerly Advanced Fire Support System) program will develop and test a containerized, platform-independent multi-

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-03

mission weapon concept as an enabling technology element for FCS. NetFires will provide rapid response and lethality in packages requiring significantly fewer personnel, decreased logistical support and lower life-cycle costs, while increasing survivability compared to current direct fire gun and missile artillery. NetFires will allow FCS to defeat all known threats, will be air deployable in C-130 (and smaller) aircraft, and will enhance the situation awareness and survivability of FCS by providing standoff target acquisition and extended-range, non-line-of-sight engagements. The program will develop and demonstrate a highly flexible modular, multimission precision missile and a loitering attack missile that can be remotely commanded. Both missile types will have a self-locating launcher and a command and control system compatible with FCS.

(U) The Organic Adverse Weather Air Vehicle program provides FCS direct and indirect weapons system targeting under all operating conditions at the small unit level. The approach is to develop adverse weather vehicles for operation at two tiers; an upper tier for wide area coverage and a lower tier that allows a close-up view for positive target identification. For the higher tier, the A160 Vertical Take Off and Landing Unmanned Air Vehicle program will develop a vehicle for carrying out airborne surveillance and targeting against ground targets. The A160 vehicle will further provide an airborne communications/data link relay between the various ground components and the command nodes and satellite communications. In addition, the A160 will deploy unmanned ground sensors, unmanned ground vehicles, and Micro Air Vehicles (MAVs) and provide a data link between them and the C^2 components. For the lower tier, the Organic Air Vehicle program will develop 2 different sizes: 1) very small backpack-able (less then 10 1bs) and 2) small (less than 75 lbs) air vehicles that can fly autonomously in adverse weather. It will leverage DARPA Micro Air Vehicle program technologies and design a ducted fan vehicle that is scalable between 9 and 29 inch outside diameter to accommodate varying missions and payloads.

(U) The Jigsaw program will develop advanced laser radar (LADAR) sensor systems and technologies for day/night target identification and verification in stressing environments. Stressing environments include targets hidden by foliage and camouflage, and targets in urban settings, such as alleyways and alcoves. The sensor systems and technologies developed under this project will support the needs of FCS and will enable human observers to perform combat identification reliably and confidently through a visualization of the target scene by the LADAR sensor(s).

(U) Program Plans:

- PerceptOR.
  - -- Conduct perception system prototype development testing in both laboratory and field.
  - -- Conduct evaluation experiments on early perception system prototypes in variety of terrain and environmental conditions.
  - -- Conduct algorithm development for advanced perception behavior.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-03

- -- Continue algorithm and supporting technology developments for unmanned maneuver.
- -- Update prototype algorithms and hardware based on supporting experimentation.
- -- Explore system implications of degraded component performance (communications constraints, sensor and other faults).

– Unmanned Ground Combat Vehicle (UGCV).
- -- Complete critical subsystem testing and detailed prototype designs.
- -- Select two designs for full prototype fabrication.
- -- Initiate prototype fabrication.
- -- Conduct UGCV surrogate tests.
- -- Conduct testing of prototypes against mobility, endurance, and payload fraction metrics.
- -- Conduct resilience testing on prototypes and make reliability measurements.
- -- Update prototype hardware with late development technology and prepare for extreme testing conditions.

– Maneuver $C^{3.}$
- -- Validate organic, self-contained approaches versus approaches that “reachback” to other systems for C^2.
- -- Select wireless communications network architecture(s) for implementation.
- -- Demonstrate 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.
- -- Refine Commander’s Support Environment (CSE); expand CSE knowledge base and collective intelligence module.
- -- Continue to refine and expand supporting simulation.
- -- Collect and assess the insights of human-machine interface requirements for training prototypes with the assistance of Army Research Institute.
- -- Conduct experiments #2 and #3 in support of selected command and control functions for operations with manned/unmanned systems.
- -- Complete the development of an initial C^2 experimental demonstrator.
- -- Continue experiments of Unit Cell C^2 incorporating limited activities of the dismounted soldier.
- -- Extend C^2 architecture to handle inter-unit cell operations, and operations between unit cell and next higher level.
- -- Demonstrate an integrated architecture that provides seamless transition from line-of-sight to non-line-of-sight communications

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-03

via unmanned aerial vehicles and satellite communications.
-- Demonstrate new secure communication waveforms and mobile ad hoc networks using directional antennas.

– Netfires.
-- Complete controlled test vehicle demonstrations and initiate guided test vehicle demonstrations.
-- Conduct critical design reviews.
-- Investigate coordination of multiple Netfires missiles.

– Organic Adverse - Weather Targeting Vehicles.
-- Select platform and sensory payload for detailed design and prototyping efforts.
-- Complete flight testing of initial sizes for OAVs.
-- Initiate detailed design efforts for different size Organic Air Vehicles to flight demonstrate the design code and scalability of the technology.
-- Ground test A160 anti-icing systems, sand/dust/salt protection systems, and precision flight systems.
-- Demonstrate initial OAV gust stability and inner loop control.
-- Demonstrate second-generation OAV autonomous navigation and auto-landing capabilities.
-- Continue prototype platform development and sensory payload.
-- Complete A160 satellite communications, survivability and resupply studies.
-- Demonstrate third-generation OAV flight in rain, icing and adverse weather.
-- Demonstrate OAV waypoint flight with collision avoidance in stressing environments.

– Jigsaw: LADAR Sensing for Combat ID.
-- Conduct critical design reviews for prototype LADAR sensors.
-- Build prototype LADAR sensors for airborne captive carry operation.
-- Conduct data collection using prototype LADAR sensors.
-- Quantify Combat ID performance of LADAR sensor against stressing targets.

(U) <u>Other Program Funding Summary Cost:</u>

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2003
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development	R-1 ITEM NOMENCLATURE Land Warfare Technology PE 0603764E, Project LNW-03

	FY 2002	FY 2003	FY 2004	FY 2005
PE 622601 Army	9.346	0.000	0.000	0.000
PE 633005 Army	103.417	114.351	114.051	111.102