RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)								DATE February 2000	
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 1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	Cost To Complete	Total Cost
Total Program Element (PE) Cost	85.287	96.320	134.249	157.667	161.100	136.000	87.000	Continuing	Continuing
Rapid Strike Force Technology LNW-01	43.870	52.955	38.129	19.992	6.500	32.500	27.000	Continuing	Continuing
Small Unit Operations LNW-02	41.417	43.365	35.120	47.675	32.600	41.500	45.000	Continuing	Continuing
Future Combat Systems LNW-03	0.000	0.000	61.000	90.000	122.000	62.000	15.000	Continuing	Continuing

(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 Rapid Strike Force Technology project is developing the technologies necessary for highly mobile, covert transportation and information gathering systems to enhance U.S. early-entry capabilities. The primary thrusts of this project include: 1) the Reconnaissance, Surveillance and Targeting Vehicle (RST-V) program that will design, develop, test and transition a minimum of four hybrid electric drive, lightweight, highly maneuverable advanced technology demonstrator vehicles to the Services; 2) the Solar Blind Detectors program that will develop technologies to enhance the survivability of mobile ground vehicles against the threat of advanced tactical guided missiles; 3) the Tactical Mobile Robotics (TMR) program that will develop mobile robotic technologies that will enable land forces to dominate battlespace using individual, or teams, of mobile robots in complex terrain; 4) the Mobile Tactical Operation Center/Future Ground Combat System program that will explore and develop technologies to be used by tactical commanders in situational awareness, communications and control; and 5) the Metal Storm program that will develop a system to pack, transport and fire at variable sequence rates.

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(U) The goal of the Small Unit Operations project is to develop critical technologies that will enable dispersed units to effectively perform warfighting operations traditionally requiring massed forces. Technology development efforts will focus on a comprehensive awareness capability that provides real-time, essential information for small units and individual warfighters; wireless communication technologies to permit exchange of voice, digital and video data with other systems; geolocation technologies that provide navigation information in built-up, forested and mountainous environments; internetted tactical surveillance and targeting sensors to complement information requirements not satisfied by national, theater and component sensor programs; and automated ultra-miniature imaging and non-imaging sensors.

(U) The Future Combat Systems project goal is to develop the optimal balance among critical performance factors, including ground platform strategic, operational and tactical mobility, lethality, survivability and sustainability. Efforts will focus on creating a multi-functional, multi-mission, re-configurable group of systems that maximize joint interoperability, strategic transportability and commonality of mission roles. Support programs will develop rapid response and lethality packages requiring fewer personnel, decreased logistical support and lower life-cycle costs while increasing survivability.

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

	FY1999	FY 2000	FY 2001
Previous President's Budget	88.613	97.825	101.376
Current Budget	85.287	96.320	134.249

(U) Change Summary Explanation:

FY 1999	Decrease reflects SBIR and other minor below threshold reprogrammings.
FY 2000	Decrease reflects congressional reduction to Mobile Theater Operations Center and government-wide rescission, partially offset by below threshold reprogramming for Tatical Sensors.
FY 2001	Increase reflects establishment of the new Future Combat Systems project. This add is partially offset by a reduction in scope of the Situational Awareness System program in the Small Unit Operations project.

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COST *(In Millions)*	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	Cost to Complete	Total Cost
Rapid Strike Force Technology LNW-01	43.870	52.955	38.129	19.992	6.500	32.500	27.000	Continuing	Continuing

(U) Mission Description:

(U) The emerging US 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, which are important aspects of an early-entry capability. The project consists of: Combat Hybrid Power Systems (CHPS); Reconnaissance, Surveillance and Targeting Vehicle (RST-V); Tactical Mobile Robotics (TMR); Solar Blind Detectors; Metal Storm (MS); and a Future Ground Combat System that will include a Mobile Tactical Operations Center (M-TOC). The CHPS, RST-V, M-TOC and TMR programs are closely coordinated with the US Army, Navy and Marine Corps, and with DARPA's Small Unit Operations (LNW-02) project.

(U) The Combat Hybrid Power System program will develop enabling technologies and conduct demonstrations of an integrated hybrid electric power system that provides power and energy management for all of the electric subsystems throughout future combat vehicles. Hybrid electric power is an essential enabling technology for future combat vehicles given the number of electrically powered subsystems planned for implementation. The hybrid electric power system will consist of an engine/alternator, sized for average power demand, energy storage and power averaging components that provide both continuous and pulsed power, distribution networks, subsystem controls and power conditioning devices. Vehicles of various configurations and for a variety of missions will be simulated to evaluate subsystem requirements, topologies and military utility. The simulated vehicle concepts will demonstrate greatly reduced noise and thermal signatures; improved mobility, survivability, lethality and fuel economy; optimized interior layouts; significantly reduced volume and weight. These advantages will result in deployable, affordable combat vehicles that meet mission requirements.

(U) The Reconnaissance, Surveillance and Targeting Vehicle (RST-V) program will design, develop, test/demonstrate and transition to the Services four hybrid electric drive, lightweight, highly maneuverable advanced technology demonstrator vehicles capable of V-22 internal transport. The vehicle will incorporate technological advancements in the areas of integrated survivability techniques and advanced suspension, including both active and passive approaches. The vehicle will also host integrated precision geolocation, communication and Reconnaissance, Surveillance and Targeting (RST) sensor subsystems. The RST-V platform will provide 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. Critical

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components and technologies include a high efficiency, reduced signature hybrid electric propulsion system with increased fuel economy; an advanced suspension to increase cross-country speed and provide platform stabilization; an advanced integrated survivability suite; and the capability to operate in either a silent watch/silent movement or mechanical mode. The vehicle will incorporate modularized design components to allow for signature management and rapid reconfiguration for mission tailoring and multiple purpose utility. Hardware and lessons learned from this program directly support the Marine Corps-Navy Extending the Littoral Battlespace (ELB) ATD as well as address joint US Marine Corps – Special Operations Command (USMC-SOCOM) requirements for the Internally Transportable Vehicle/Light Strike Vehicle (ITV/LSV) and 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 Advanced Concept Technology Demonstrations (ACTDs) (e.g. Capable Warrior).

(U) The Tactical Mobile Robotics (TMR) program will develop mobile robotic technologies that will 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 will provide DoD organizations with semi-intelligent, cooperating platforms carrying a variety of integrated mission payloads required to conduct activities in risk intensive or inaccessible areas. Operational emphasis is on urban environments and denied areas. Specific robot technologies that will be advanced include: perception, autonomous operation and advanced locomotion for complex obstacle negotiation. Perception capabilities will include: (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 20 Hz and (b) multi-source mapping algorithms capable of creating topological maps of urban structures with 90 percent accuracy. Autonomous operation capabilities will include: (a) coordination of the tactical behavior of a multi-robot team with significant command cycle reduction and (b) traversal of rugged/complex terrain using 1 command per 100m of travel. Locomotion capabilities will feature portable (sub-meter-scale) vehicles traveling up to 1 m/s over 25 cm steps and decimeter-scale rubble.

(U) The Solar Blind Detectors program (formerly titled "Vehicle Self-Protection") will develop an ultraviolet (UV) solar blind solid state focal plane array to significantly enhance the survivability of mobile ground vehicles against the threat of advanced tactical guided missiles at greatly reduced cost.

(U) The Future Combat Systems (FCS) program, an out-growth of the Mobile Tactical Operations Center, will develop network centric concepts for a multi-mission combat system (MMCS) that will be overwhelmingly lethal, strategically deployable, self-sustaining and highly

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survivable in combat through the use of integrated command and control capabilities with unsurpassed situational understanding for all levels of commanders. This system will be transitioned to the U.S. Army for full development and ultimate deployment in the 2012 timeframe. The Future Combat Systems (FCS) will be a multi-functional, multi-mission re-configurable system of systems to maximize joint inter-operability, strategic transportability and commonality of mission roles including direct and indirect fire, air defense, reconnaissance, troop transport, counter mobility, non-lethal and C2 on the move. The goal of this effort is to develop a network centric advanced force structure, quantify its benefits and identify materiel solutions and technologies within the context of that force. It will also identify Doctrine, Operational, Training, Leader and Material (DOTLM) specific changes necessary as a result of the development of this network centric advanced force structure. In FY 2001, the FCS program will be funded from a new Project, LNW-03, entitled Future Combat Systems, still within Program Element 0603764E.

(U) The Metal Storm (MS) program will develop a unique 100 percent solid state system for tightly packing, storing, transporting and firing projectiles in multiple tubes with high or low pressures, in an electronically infinitely variable sequence rate with applications to small arms and crew served weapons. The program facilitates current US force reduction and restructuring policies while increasing firepower. The program will demonstrate revolutionary in weapon designs and applications that will far exceed the effectiveness and versatility of existing small arms and large munitions weaponry and will primarily focus on developing, fabricating and testing two 7.62 mm sniper rifle prototypes for Special Operations Forces use. The design will incorporate a multi-barrel configuration allowing instant access to a variety of projectiles. Studies will be conducted to optimize propellants and projectiles; to examine electronic keying, silencing and underwater operations; and to investigate the physics of scaling from a small caliber, low pressure design to a large caliber (40 and 81mm), modest barrel pressure (~60,000 psi) design. Through a Project Arrangement under the Deutsch Ayers Agreement between the US and Australia, the Defence Science & Technology Office (DSTO) will perform work in the areas of scaling, modeling and simulation, and small arms live fire testing.

(U) Program Accomplishments and Plans:

(U) FY 1999 Accomplishments:

- Combat Hybrid Power Systems (CHPS). ($ 16.285 Million)
  - Installed and integrated hybrid electric power components in the Systems Integration Laboratory (SIL).
  - Conducted tests that demonstrated simultaneous operation of pulsed and continuous loads in the laboratory and verified virtual prototype models for selected components.

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- Completed design and initiated fabrication of advanced, high-risk power system components (critical enabling technologies) in particular, Lithium Ion batteries and Silicon Carbide based power electronics module.
- Demonstrated hardware-in-the-loop virtual prototype.

- Reconnaissance, Surveillance and Targeting Vehicle (RST-V). ($ 6.068 Million)
  - Completed Critical Design and conducted Critical Design Review of both RST-V team designs.
  - Down selected to one contractor.
  - Finalized design and conducted Fabrication Readiness Review.
  - Refined development of automotive subsystems.
  - Evaluated emerging technologies for high data rate covert communications.

- Tactical Mobile Robotics (TMR). ($ 16.254 Million)
  - Refined advanced employment concepts to exploit portable robot potential and accommodate expanded user interest.
  - Demonstrated breadboard robot perception, autonomy and obstacle negotiation (stair climbing) in challenging mission scenarios.
  - Completed and evaluated competing designs for integrated robotic system.
  - Refined system design and employment plans to exploit progress made with enabling technologies and accommodated multiple collaborating platform employment where practical.
  - Evaluated advanced communication and control techniques.

- Solar Blind Detectors Program. ($ 4.263 Million)
  - Initiated development of an Ultraviolet (UV) solar blind solid state focal plane array to significantly enhance the survivability of mobile ground vehicles against the threat of advanced tactical guided missiles at greatly reduced cost.

- Advanced Concepts Evaluation. ($ 1.000 Million)
  - Conducted technology assessment and feasibility testing of advanced rapid strike force concepts in the areas of battlefield communications and asset control, autonomous systems, fire support and situational awareness.

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(U) **FY 2000 Plans:**

- Combat Hybrid Power Systems (CHPS). ($ 10.222 Million) [Future Combat Systems – related = $10.222 Million]
  - Install the completed, advanced, high-risk hybrid electric power system components in the Systems Integration Laboratory (SIL).
  - Continue test and evaluation of integrated hybrid electric power system and subsystems.
  - Investigate and quantify benefits of hybrid electric power for future combat vehicles using SIL and virtual prototype.
  - Continue development of and exercising the vehicle virtual prototype.
  - Investigate alternative critical power system component technologies.
  - Develop coordinated plan for continued effective utilization of CHPS SIL and virtual prototypes.
  - Transition CHPS program to U.S. Army Tank-Automotive and Armaments Command (TACOM).

- Reconnaissance, Surveillance and Targeting Vehicle (RST-V). ($ 11.237 Million)
  - Perform wheelmotor qualification tests.
  - Roll out vehicles 1 and 2.

- Tactical Mobile Robotics (TMR). ($ 15.633 Million)
  - Initiate development of fully functional tactical robotic platforms.
  - Integrate enabling technologies into functional platforms.
  - Refine demonstration and transition plans commensurate with success in system design and multi-platform collaboration.

- Solar Blind Detectors Program. ($ 5.895 Million)
  - Demonstrate low defect epitaxial material compatible for photodetectors with high sensitivity operating in the solar-blind region of the spectrum (240-300 nm).

- Future Combat Systems (FCS). (Formerly Mobile Tactical Operations Center (M-TOC). ($ 6.984 Million)
  - Initiate concept design development.
  - Begin formulation of force level concepts.
  - Initiate development standard threat scenarios and Integrated Development Environment (IDE).

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- Perform independent validation, verification and accreditation effort.

- Advanced Concepts Evaluation. ($ 2.984 Million)
  - Conduct technology assessment and feasibility testing of advanced rapid strike force concepts including precision guided munitions, force-on-force modeling, counter situational awareness, covert autonomous sensors and future unmanned vehicle systems.
  - Conduct studies to optimize the Metal Storm concept, research propellants and projectiles, and develop approaches to enhance accuracy. Establish international agreement between the United States and Australia.

(U) FY 2001 Plans:

- Reconnaissance, Surveillance and Targeting Vehicle (RST-V). ($ 8.796 Million)
  - Deliver vehicles 1 and 2 for participation in US Marine Corps (USMC) Advanced Warfighting Experiment.
  - Integrate and demonstrate Survivability Suite.
  - Deliver vehicles 3 and 4.
  - Evaluate active suspension enhancement of RST-V.

- Tactical Mobile Robotics (TMR). ($ 12.217 Million)
  - Complete integrated robotic system development and testing.
  - Conduct operational demonstrations with integrated systems.
  - Initiate transition to military departments.

- Solar Blind Detectors Program. ($ 5.338 Million)
  - Demonstrate solar-blind detector array with 128 x 128 pixels.

- Metal Storm (MS). ($ 10.778 Million)
  - Finalize designs for main sniper rifle and targeting and electronic subsystems.
  - Demonstrate a single barrel, high rate of fire, electronic sniper rifle.
  - Perform modeling studies of lethality and penetration requirements.

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– Perform scaling analysis of Metal Storm technology to larger calibers.

- Advanced Concept Evaluation. ($ 1.000 Million)
  – Continue technology assessment and feasibility testing of advanced rapid strike force concepts including all electric and ceramic engine systems, thin film batteries and future unmanned vehicle systems.

(U) Other Program Funding Summary Cost: *(In Millions)*

	FY1999	FY2000	FY2001
PE 0603640M Marine Corps Advanced Technology Demonstration	3.300	0.700	0.500
PE 0602601A Combat Vehicle and Automotive Technology	0.000	6.586	0.000
PE 0603005A Combat Vehicle and Automotive Advanced Technology	0.500	10.012	4.700

(U) Schedule Profile :

Plan	Milestones
Jan 00	TMR: Conduct preliminary design reviews and begin fabrication of selected TMR platforms.
Feb 00	RST-V: Vehicle 1 rollout.
Mar 00	FCS: Initiate Integrated Development Environment (IDE) effort.
Mar 00	FCS: Initiate technology investment activities.
May 00	FCS: Initiate concept design development.
Jul 00	CHPS: Integrate advanced components and demonstrate fully integrated combat hybrid power system laboratory.
Jul 00	TMR: Conduct final technology demonstration and critical design review for selected TMR platforms.
Sep 00	FCS: Technology investment review.
Sep 00	CHPS: Configure system for Service transition.
Oct 00	RST-V: Deliver vehicles 1 and 2.
Mar 01	Demonstrate RST-V system capabilities in Advanced Warfighting Experiment (AWE).
Mar 01	Solar Blind Detectors: Demonstrate Avalanche Photo Detector (APD) array with 100 amps/watt responsity and low dark current.

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Apr 01	MS: Complete physics of scaling study.
Jun 01	RST-V: Integrated Survivability demonstration of Reconnaissance, Surveillance, and Targeting Vehicle (RST-V).
Jul 01	TMR: Complete operational demonstrations of Tactical Mobile Robotic systems. Initiate transition and technology transfer plans.
Dec 01	MS: Firing demonstration of single barrel, high rate of fire, electronic sniper rifle.

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COST *(In Millions)*	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	Cost to Complete	Total Cost
Small Unit Operations LNW-02	41.417	43.365	35.120	47.675	32.600	41.500	45.000	Continuing	Continuing

(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) Superb situational awareness is critical to the combat effectiveness and survivability of such forces. Each small team must constantly know where it is, where the other teams are and where the enemy and any other threats are located. The Services are developing lightweight radio communications and Global Positioning System (GPS) dependent geo-positioning systems packaged into fielded capabilities such as the Land Warrior System. In addition, advanced standoff sensor systems such as Predator, Global Hawk and Discoverer II are being developed to monitor the enemy's movements and characterize the battlespace. These capabilities will greatly improve the combat effectiveness of small dismounted forces, but will be limited to operations in open areas under benign conditions. Current communications, navigation and sensor technologies are poorly configured to operate in urban areas (outside or inside buildings), in jungles, forests or mountainous terrain. Communications technology is susceptible to enemy jamming or unintentional radio interference and are not covert to intelligence operations. Extant sensors and exploitation capabilities are limited to broad area surveillance of vehicles and facilities; data is not mined and distributed to forces at the lowest echelon.

(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 fusion 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 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 the Situational Awareness System (SAS), Tactical Sensors, Advanced Sensing Technologies, Optical Tags and Wolfpack.

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(U) The Situational Awareness System (SAS) will integrate these technologies into a 1 kg module (plus 0.5 kg per day for the power source) worn by the individual warrior. The Agency module will be interoperable with the Army Land Warrior equipment and provide much greater functionality at significantly less weight. 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. It will also acquire and codify knowledge of dispersed land force tactics to develop decision aids and evaluate the utility of the aids for small units. 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) The Tactical Sensors program will develop new sensor system technologies that will provide the warfighter with a capability to detect, track and classify mobile tactical targets, and to characterize fixed, man-made structures. These sensor systems provide a local, in-situ sensing capability near high value targets or at choke points in denied areas. Information provided by these sensors can be fused with other longer-range space, airborne and ground sensor systems to enhance the aggregate surveillance and tracking capabilities of US forces. Applications include surveillance, cueing, precision targeting, intelligence and battle damage assessment with respect to time critical, mobile targets (vehicles and humans) and to fixed man-made structures (surface and underground facilities).

(U) The Advanced Sensing Technologies program will develop a completely new class of sensors for military surveillance and targeting applications. These sensors will provide surveillance, target detection, tracking, classification, cueing and bomb damage assessments at distances much greater than current capabilities. The sensors will use recent technical breakthroughs to permit vulnerability and access to the target signatures.

(U) The Optical Tags Program will investigate nonlinear 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 will develop validated models to predict system performance in support of a selected set of applications for technology demonstration. The program will select a relatively mature application, such as marking or tagging, and a relatively immature application, such as precision strike. The applications

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will be selected based on their operational significance and user input. The Optical Tags Program will perform system engineering to develop systems performance requirements for the applications and will demonstrate the systems in meaningful warfighter experiments.

(U) The Wolfpack Program will develop technologies that would enable the U.S. to deny the enemy use of radio communications throughout the battlespace. This will culminate in a networked system of air emplaced, autonomous, ground-based monitors/jammers linked together to cooperate and avoid disruption of friendly military and protected commercial radio communications. 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 high terrain high points, and (4) algorithms to rapidly and autonomously detect, classify, identify and jam target signals with low power electronics.

(U) Program Accomplishments and Plans:

(U) FY 1999 Accomplishments:

- Situational Awareness System (SAS). ($ 27.235 Million)
  - Assessed advanced concepts and technologies for dispersed land forces applications.
  - Completed developments for the situation awareness and real time tasking and control technologies.
  - Completed technology development for tactical communications capability.
  - Completed evaluation of enabling technologies associated with SAS design and conducted breadboard demonstration of critical communications and geolocation technologies.
  - Completed detailed design of SAS and began development of situational awareness brassboard system.

- Tactical Sensors. ($ 13.124 Million)
  - Continued development of internetted remote control sensors to detect, localize and characterize targets.
  - Continued development of surveillance and targeting sensors systems for dispersed operations.

- Advanced Sensing Technologies. ($ 1.058 Million)
  - Established feasibility of concept.
  - Initiated development of a breadboard sensor.

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(U) FY 2000 Plans:

- Situational Awareness System. ($ 31.880 Million) [Future Combat Systems – related = $17.900 Million]
  - Complete development of the Individual Warfighter Situational Awareness System (IWSAS), Warfighter Tactical Associate (WTA)-Base, WTA Mobile and Relay/Router/Beacon detailed hardware design, software modules and network protocols.
  - Complete Individual Warfighter/WTA software coding.
  - Complete IWSAS, WTA-Base, WTA-Mobile, Relays and network code development and testing.
  - Complete situation awareness (planning, tasking, sensor control, navigation and alerts) application software coding and testing.
  - Complete brassboard fabrication of the major SAS elements (IWSAS, WTA and Relays).
  - Conduct performance assessment of Phase 3 brassboard design.
  - Verify that Individual Warfighting Situational Awareness System (IWSAS), Warfighter Tactical Associate (WTA) and Relay Radio Frequency (RF) propagation in multipath, jamming and open environments meets 99 percent service availability objective.
  - Verify geolocation accuracy and navigation performance in urban and field environments.
  - Develop Wolfpack system architecture and conduct system level trades to develop sub-system requirements.
  - Determine the optimum use of legacy systems for IPB and cueing and potential modifications required for coordinated spectrum access.

- Tactical Sensors. ($ 8.561 Million)
  - Continue development of internetted remote control sensors to detect, localize and characterize targets.
  - Continue development of surveillance and targeting sensors systems for dispersed operations.
  - Conduct technology development for a kilometer-range optical tag system.
  - Select a relatively mature application and develop optical tag requirements.
  - Select a relatively immature application and develop contractor team.

- Advanced Sensing Technologies. ($ 2.924 Million)
  - Complete and test breadboard sensor and initiate brassboard development.

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(U) FY 2001 Plans:

- Situational Awareness System. ($ 13.344 Million)
  - Complete fabrication of Individual Warfighting System Situational Awareness System (IWSAS), Warfighter Tactical Associate (WTA) Mobile and Base, tactical sensors and tactical relays for test.
  - Integrate IWSAS, WTA-Mobile and Base with external legacy communications, data and sensor equipment.
  - Test integrated system and conduct performance assessment of final Phase 3 design; measure IWSAS, WTA and Relay Radio Frequency (RF) propagation in multipath, jamming and open environments meets 99 percent service availability objective.
  - Complete development of detailed demonstration scenarios to test and evaluate performance under operational conditions.
  - Perform setup of field demonstration.
  - Develop training materials and conduct soldier training for field demonstration.

- Tactical Sensors. ($ 7.944 Million)
  - Continue development of internetted remote control sensors to detect, localize and characterize targets.
  - Continue development of surveillance and targeting sensors systems for dispersed operations.

- Optical Tags. ($ 4.944 Million)
  - Demonstrate a kilometer-range optical tag system.
  - Predict tag performance for relatively mature application.
  - Develop requirements and predict tag performance for relatively immature applications.

- Advanced Sensing Technologies. ($ 2.944 Million)
  - Complete brassboard and initiate fieldable sensor development.

- Wolfpack. ($ 5.944 Million)
  - Complete system design and performance analysis.
  - Conduct proof-of-concept demonstrations of high-speed signal detection and identification algorithms.
  - Verify low duty cycle, low power jamming techniques with benchtop experiments.

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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-02

(U) Other Program Funding Summary Cost:

- Not Applicable.

(U) Schedule Profile :

Plan	Milestones
Situational Awareness System:	
Feb 00	Complete SAS critical design review.
May 00	Complete SAS software coding.
Jun 00	Complete SAS sensor and weapon simulation.
Jul 00	Complete brassboard SAS integration and test.
Mar 01	SAS components fabricated.
Tactical Sensors:	
May 00	Demonstrate Miniature Infrared Camera (MIRC).
Aug 00	Demonstrate brassboard integrated micro-(UGS) system.
Sep 01	Complete micro-UGS field demonstration tests.
Optical Tags:	
Mar 01	Mature application performance predicted.
Jun 01	Less mature application requirements developed and performance predicted.
Advanced Sensing Technologies:	
Sep 00	Demonstrate final breadboard.
Sep 01	Demonstrate final brassboard.

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Wolfpack:

Mar 01	Initial enabling technology demonstrations.
Jun 01	Single sensor performance verified in laboratory.

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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					
COST *(In Millions)*	FY 1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	Cost to Complete	Total Cost
Future Combat Systems LNW-03	0.000	0.000	61.000	90.000	122.000	62.000	15.000	Continuing	Continuing

(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 System (FCS) program has been developed to provide enhancements in land force lethality, protection, mobility, deployability, sustainability, and command and control capabilities.

(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 integrated command and control capabilities with unsurpassed situational understanding for all levels of commanders. The goal of the FCS project is to strike an optimum balance between critical performance factors, including ground platform strategic, operational and tactical mobility; lethality; survivability; and sustainability. The Defense Advanced Research Projects Agency (DARPA) has worked to develop technologies to counter adversaries' modern tank forces with man carried missiles and unmanned indirect fire missile systems. The success of these efforts enables consideration of a modern, light force that does not rely solely on a heavy armor based force structure. The DARPA studies have identified key areas for technology development to enhance these capabilities in a future force as: networked Command, Control, and Communications, Computers, Intelligence, Surveillance, and Targeting (C4IST); robotics; precision indirect fires; and beyond line of sight (BLOS) organic sensing and precision all-weather surveillance and targeting system.

(U) The FCS system will transition to the U.S. Army for full development and ultimate deployment in the 2012 timeframe. The Future Combat System will be a multi-functional, multi-mission re-configurable group of systems to maximize joint inter-operability, strategic transportability and commonality of mission roles including direct and indirect fire, air defense, reconnaissance, troop transport, counter mobility, non-lethal, and C2 on the move. As a result, this effort will develop a network centric advanced force structure, quantify its benefits and identify material solutions and technologies within the context of that force. It will also identify Doctrine, Operational, Training, Leader and Material (DOTLM) specific changes necessary as a result of the development of this network centric advanced force structure. This program was funded in FY 2000 from Project LNW-01, Rapid Strike Force Technology, within this same Program Element.

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(U) The Advanced Fire Support Systems (AFSS) program will develop and test a containerized, platform-independent multi-mission weapon concept. These systems 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 gun and missile artillery. AFSS will allow the military to capitalize on recent advances in military doctrine and infrastructure, such as the ongoing digitization of the Army. It will also allow the Army to streamline its missile acquisition plan around future common missiles. The program will develop and demonstrate highly flexible systems including a modular, multi-mission precision missile, a remotely commanded self-locating launcher, and a command and control system compatible military doctrine. The Advanced Fire Support System will be a key element supporting beyond line of sight engagements for Future Combat Systems. The AFSS program was funded in FY 2000 from Project TT-04, Advanced Land Systems Technology, in Program Element 0602702E.

(U) Program Accomplishments and Plans:

(U) FY 1999 Accomplishments:

- Not Applicable.

(U) FY 2000 Plans:

- Not Applicable.

(U) FY 2001 Plans:

- Future Combat Systems (FCS). ($ 49.000 Million)
  - Complete concept designs.
  - Conduct experiments to validate modeling and simulation tool set and confirm analytic results of designs and studies.
  - Technology assessments of robotics, unmanned ground vehicles, maneuver C3, organic all-weather targeting vehicle and all-weather surveillance and targeting sensor.
  - Maneuver Beyond Line of Sight (BLOS)/Networked Fires Weapon. Complete system hardware and software developments and limited objective flight tests. Plan and initiate preparations for full scale demonstration.

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- Advanced Fire Support Systems (AFSS). ($ 11.000 Million)
  - Continue system hardware and software development.
  - Complete limited objective flight tests.
  - Plan and initiate preparations for full system demonstrations.

- Advanced Concepts. ($ 1.000 Million)
  - Explore new enabling technologies for unmanned systems and sensor technologies required for unmanned systems.

(U) **Other Program Funding Summary Cost:** *(In Millions)*

		FY1999	FY2000	FY2001
PE 0602601A	Combat Vehicle and Automotive Technology	0.000	0.000	7.752
PE 0603005A	Combat Vehicle and Automotive Advanced Technology	0.000	0.000	35.789

(U) **Schedule Profile:**

Plan	Milestones
Oct 00	Advanced Fire Support Systems AFSS critical design review.
Feb 01	AFSS first limited objective tests.
May 01	FCS risk reduction independent design review (IDR).
Oct 01	AFSS first guided test.
Jan 02	FCS risk reduction IDR 2.
Mar 02	AFSS first terminally guided test.