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FY 2005 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
Exhibit R-2

DATE: Feb 2004

BA: 02

PROGRAM ELEMENT: 0602131M

PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

COST: (Dollars in Thousands)

Project Number & Title	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Marine Corps Landing Force Technology	28,247	32,375	35,398	38,707	38,022	39,205	40,014

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Marine Corps is tasked to develop, in conjunction with the Navy, Army, and Air Force, those phases of amphibious operations that pertain to tactics, techniques, and equipment used by the landing force. This Program Element (PE) is organized into six amphibious expeditionary warfighting capability areas. These are: Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR); Maneuver; Logistics; Human Performance, Training and Education; Firepower; and Mine Countermeasures (MCM). The primary objective of this PE is to develop and demonstrate the technologies needed to meet the Marine Corps' unique responsibility of training and equipping the Marine Air/Ground Task Force (MAGTF) for amphibious warfare and subsequent operations ashore. This PE provides the knowledge base to support Advanced Development Technology (6.3) and is the technology base for future amphibious/expeditionary warfare capabilities. This PE supports the Expeditionary Force Development System of the Marine Corps Combat Development Command and responds directly to the Marine Corps Science and Technology (S&T) process. The Future Naval Capabilities (FNC) process is supported and funds are programmed accordingly. The core program also supports Discovery and Invention (D&I) and Innovation and Transformation (I&T). Within the Naval Transformation Roadmap, this investment will achieve key transformational capabilities required by Sea Shield as well as enable the Ship to Objective Maneuver (STOM) and Persistent Intelligence, Surveillance and Reconnaissance (ISR) key transformational capabilities within Sea Strike and the enhanced Sea-borne Positioning of Joint Assets within Sea Basing.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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PROGRAM CHANGE SUMMARY:

	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>
FY 2004-2005 President's Budget Submission	29,568	31,778	35,562
Cong. Rescissions/Adjustments/Undist.Reductions	0	-403	0
Congressional Actions	0	1,000	0
Execution Adjustments	-553	0	0
Inflation Savings	0	0	-114
Rate Adjustments	0	0	-50
SBIR Assessment	-768	0	0
FY 2005 President's Budget Submission	28,247	32,375	35,398

PROGRAM CHANGE SUMMARY EXPLANATION:

Technical: Not Applicable.

Schedule: Not Applicable.

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Project & Title	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Marine Corps Landing Force Technology	28,247	32,375	35,398	38,707	38,022	39,205	40,014

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project is organized into seven activities which are represented as six Expeditionary Warfighting Capability Areas and the Littoral Combat Future Naval Capability (FNC). The six Amphibious Expeditionary Warfighting Areas support the Discovery and Inventions (D&I) and the Innovation and Transformation (I&T) investment. The Littoral Combat FNC supports the Exploitation and Deployment (E&D) investment.

B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 2003	FY 2004	FY 2005
Littoral Combat/Power Projection	15,797	15,000	17,038

This activity provides the capability for the demonstration and transition of technologies developed through the Marine Corps Science and Technology program directly to an acquisition program of record.

FY 2003 Accomplishments:

- Awarded contract for development of Advanced Amphibious Assault Vehicle (AAAV), now referred to as Expeditionary Fighting Vehicle (EFV), collision avoidance system development using Streak Tube Imaging Light Detection and Ranging (LIDAR) technology.
- Developed and demonstrated a proof-of-concept advanced Over-the-Horizon (OTH)/Beyond Line of Sight (BLOS)/On-the-Move (OTM) tactical data network for use by maneuver forces using secure wireless technology.
- Integrated laser range-finding technologies with service radios for achieving interoperability among US/Joint/Coalition close air support platforms.
- Developed, evolved and demonstrated technology solutions that provide tools for Marine ground forces that support the conduct of military decision-making process in the planning, evaluation, and execution of Expeditionary Maneuver Warfare.

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- Developed, and demonstrated a proof-of-concept advanced Position Location Information (PLI) system for use at Twenty-Nine Palms, CA. Transitioned to higher funding category for further development and demonstration.
- Completed Ship To Objective Maneuver (STOM) study and architecture development.
- Completed development and demonstration of diver operated tactical hydrographic survey system. Transitioned to United States Marine Corps (USMC) Underwater Reconnaissance Capability program.
- Completed lethality effectiveness study for mortar ammunition and provided results to USMC Expeditionary Fire Support System (EFSS) program.

FY 2004 Plans:

- Continue development of EFV collision avoidance system.
- Continue development of OTH/BLOS/OTM tactical data network system for use by maneuver forces.
- Continue development of advanced target acquisition technologies for achieving interoperability among US/Joint/Coalition close air support platforms.
- Continue development of planning and decision-making tools for Marine ground forces. Test the software and evaluate during training exercises. Feedback from operational units will be incorporated into succeeding software versions.
- Continue development and integration of advanced PLI system with range instrumentation enhancements.
- Initiate development of algorithms to derive maps of water depths, current speed and direction, terrain elevation, and sandbar and obstacle location using digital imagery from airborne Intelligence, Surveillance, and Reconnaissance (ISR) assets to support expeditionary maneuver planning.
- Develop algorithms for use in discriminating between individual Radio Frequency (RF) emitters on the battlefield and determining their locations.
- Develop a software tool to allow Marine Corps Radio Battalions to quickly characterize an RF environment.

FY 2005 Plans:

- Demonstrate EFV collision avoidance system and transition to acquisition.
- Demonstrate OTH/BLOS/OTM tactical data network system during a scheduled training exercise and transition to acquisition.
- Demonstrate target acquisition technologies for achieving interoperability among US/Joint/Coalition close air support platforms and transition to acquisition.
- Continue development of planning and decision-making tools for Marine ground forces. Test the software and evaluate during training exercises.
- Continue development of algorithms to derive maps of water depths, current speed and direction, terrain elevation, and sandbar and obstacle location using digital imagery from airborne ISR assets to support

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expeditionary maneuver planning.

- Complete development of algorithms for use in discriminating between individual RF emitters on the battlefield and determining their locations.

- Enhance and refine an automated emitter mapping tool for Radio Battalions.

- Initiate investigation of ammunition packaging techniques to lower weight and have the packaging provide additional use on the battlefield.

- Initiate development of an architecture to network existing expeditionary fires systems.

	FY 2003	FY 2004	FY 2005
Maneuver	1,774	4,086	5,000

This activity supports and enhances the overall maneuver of forces ashore through the development of mobility, survivability, and unmanned ground vehicle technologies.

FY 2003 Accomplishments:

- Initiated Marine Corps Air Ground Task Force (MAGTF) Expeditionary Family of Fighting Vehicles (MEFFV) Technology Investment Strategy study.

- Fabricated prototype Expeditionary Fighting Vehicle (EFV) band tracks and initiated performance and durability testing on an Amphibious Assault Vehicle (AAV).

- Continued lightweight Expeditionary Systems Materials (ESM) development program, conducted down-selection process and awarded Phase 2 contracts.

- Completed MEFFV Lethality and Rate-of-Fire Study.

FY 2004 Plans:

- Continue MEFFV Technology Investment Strategy.

- Conduct EFV band track redesign based on lessons learned and results from Phase I AAV testing. Upon approval, fabricate new tracks and test on higher weight AAV or EFV prototype.

- Continue lightweight ESM efforts to determine feasibility of scaling and producing candidate structural armor.

- Initiated Tactical Unmanned Ground Vehicle (TUGV) technology development and insertion to improve propulsion, sensors, and data fusion capabilities.

- Develop simulation based acquisition tool for conducting future combat vehicle design tradeoffs.

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FY 2005 Plans:

- Initiate concepts and designs of the integrated MEFFV System utilizing the simulation based design tool previously developed and results of subsystem developments.
- Initiate S&T efforts addressing MEFFV and USMC future combat system technology investment plan.
- Continue Phase II ESM efforts and prepare for Phase III down selection process.
- Conduct modeling and simulation (M&S) and analysis of detailed MEFFV concepts in accredited USMC and Joint Service scenarios.
- Continue TUGV technology development and insertion to improve propulsion, sensors, and data fusion capabilities.

	FY 2003	FY 2004	FY 2005
HUMAN PERFORMANCE, TRAINING & EDUCATION (HPT&E)	2,610	2,600	3,500

This activity develops advanced training technology and technologies that enhance neural and cognitive aspects of human performance including cognitive task analysis, tactical decision-making, modeling, simulation, range instrumentation and synthetic environment generation.

FY 2003 Accomplishments:

- Evaluated technologies available for the development of an Anti-Terrorism Force Protection (ATFP) Tactical Decision-making Simulation (TDS).
- Developed technologies required to produce a prototype of a Combat Engineering TDS to supplement the program of instruction for the Engineer Officer's Course.
- Developed technologies required to produce a prototype of a Combat Service Support Element (CSSE) TDS to supplement the program of instruction for the Logistics Officer's Course.
- Developed technologies for the development of a Rapid Portable Synthetic Environment Generation capability.
- Developed technologies for Radio Frequency (RF) tracking and video tracking fusion for enhanced situational awareness in a Military Operations in Urban Terrain (MOUT) training environment.

FY 2004 Plans:

- Evaluate technologies available for the development of an Aviation Combat Element (ACE) TDS.
- Develop technologies for an ATFP TDS to include performing a Cognitive Task Analysis (CTA).
- Develop technologies for producing a common three dimensional database format and toolset suitable for use with rapid portable synthetic environment generation technology and tactical decision-making simulation

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technology.

- Evaluate suitability of augmented cognition technology to improve human cognition via multiple sensory modalities. This will identify opportunities for integration of augmented cognition technology with the: C4ISR, Maneuver, Firepower, Organic Mine Countermeasure, Logistics, HPT&E and Littoral Combat efforts.
- Develop technologies for ad hoc wireless networks for enhanced situational awareness in a Military Operations in Urban Terrain (MOUT) training environment.
- Develop technologies for Radio Frequency (RF) tracking and video tracking fusion for enhanced situational awareness in a Military Operations in Urban Terrain (MOUT) training environment.

FY 2005 Plans:

- Evaluate technologies available for the development of a Command Element (CE) TDS.
- Develop technologies for an ACE TDS to include performing a CTA.
- Develop technologies for an ATFP TDS.
- Evaluate technologies for integration of live and virtual simulation technologies for a MOUT training environment.
- Evaluate technologies available for instrumentation and enhanced situational awareness in a MOUT training environment.
- Develop augmented cognition technology to improve human cognition via multiple sensory modalities. This will include integration of augmented cognition technology with the: C4ISR, Maneuver, Firepower, Organic Mine Countermeasure, Logistics, HPT&E and Littoral Combat efforts.

	FY 2003	FY 2004	FY 2005
Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR)	2,219	4,100	3,500

This activity provides technologies for secure, robust, self-forming, mobile communications networks (FORCENet); distributed computing to support information dissemination to all echelons; and sensors, software and data processing to support formation of appropriate common picture. Emphasis for Marine Corps efforts includes power management, low detect ability, size and weight constraints, and interoperability within the joint environment.

FY 2003 Accomplishments:

- Began development of conformal, broadband, Ultra High Frequency-Very High Frequency (UHF-VHF) antennas to be completed FY06.

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- Began development of network mobility capabilities for the low-bandwidth, heterogeneous comms environment to be completed FY05.
- Began development of network security technologies for low-bandwidth distributed environments to be completed FY05.
- Continued development of high-density, solid-state data storage devices to be completed FY04.
- Completed Joint Tactical Radio System Standards (JTRS) and Architecture development and JTRS network modeling and methods of employment.

FY 2004 Plans:

- Initiate development of network management capabilities for the low-bandwidth, heterogeneous comms environment to be completed FY06.
- Initiate development of information technologies for management of sensor and intelligence data to be completed FY06.
- Continue development of conformal, broadband, UHF-VHF antennas to be completed FY06.
- Continue development of network mobility capabilities for the low-bandwidth, heterogeneous comms environment to be completed FY05.
- Continue development of network security technologies for low-bandwidth distributed environments to be completed FY05.
- Complete development of high-density, solid-state data storage devices.

FY 2005 Plans:

- Initiate sensor networking technologies for the tactical environment to be completed FY07.
- Continue development of network management capabilities for the low-bandwidth, heterogeneous comms environment to be completed FY06.
- Continue development of information technologies for management of sensor and intelligence data to be completed FY06.
- Continue development of conformal, broadband, UHF-VHF antennas to be completed FY06.
- Complete development of network mobility capabilities for the low-bandwidth, heterogeneous comms environment.
- Complete development of network security technologies for low-bandwidth distributed environments.

	FY 2003	FY 2004	FY 2005
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	FY 2003	FY 2004	FY 2005
Firepower	1,693	3,000	3,453

This activity develops technologies that enhance effectiveness and expand spectrum of lethality of Marines including non-lethals, and supporting fire control technologies.

FY 2003 Accomplishments:

- Conducted Tactical Weapons Control Station/Dragon Warrior Unmanned Aerial Vehicle software risk reduction assessment and provided results to Naval Air Systems Command.
- Completed Phase 1 of neuromuscular disruption non-lethal weapons technology development involving waveform bio-effects, launcher and projectile concepts, and concepts for multiple target engagement with a single untethered round.
- Commenced Phase 2 development of neuromuscular disruption non-lethal weapons efforts.
- Completed improved signal processing effort involving thermal imaging system in support of M1A1 Firepower Enhancement Program. Technology development included two dimensional interpolation algorithms for improved smoothness of electronic zoom.
- Completed improvements to high performance Forward Looking Infrared Radar sensor in support of M1A1 Firepower Enhancement Program. Technology included advances in pixel density for range performance.

FY 2004 Plans:

- Complete Phase 2 of neuromuscular disruption efforts.
- Improve far target location and extended range performance and detection of camouflaged/hidden targets in support of M1A1 Firepower Enhancement Program.
- Develop concepts for the small arms sensor fusion to enhance the effectiveness of the individual warfighter in conjunction with the Joint Service Small Arms Program.
- Conduct investigation of in-service mortar barrel wear and materials and related processes to enhance the durability of future mortar systems.
- Conduct an assessment of existing and evolving fuze technologies to enhance the reliability and safety of submunitions.
- Complete concept development effort for a mortar reconnaissance round to support warfighter situational awareness.

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FY 2005 Plans:

- Develop sensor technologies to improve firepower effectiveness while increasing affordability and decreasing logistical burden in support of Expeditionary Maneuver Warfare.
- Study explosives technologies to improve firepower effectiveness while increasing affordability and decreasing logistical burden in support of Expeditionary Maneuver Warfare.

	FY 2003	FY 2004	FY 2005
Logistics	1,760	2,600	1,500

This activity develops technologies to enhance distribution of material and reduce footprint to end users ashore with emphasis on expeditionary water and bridging.

FY 2003 Accomplishments:

- Leveraged Defense Advanced Research Projects Agency (DARPA's) Water Harvesting program to evaluate the military utility of Water Disinfection Pen that provides the capability for individuals to purify water from fresh water sources.
- Explored development of a Tactical (High Mobility Multi-purpose Wheeled Vehicle (HMMWV) sized) water purification/generation and distribution program.
- Assessed the feasibility of taking composite raw materials (resins) and manufacturing them into interchangeable bridging (assault, tactical, line of communication) components in a field environment.
- Assessed advanced surface coatings and materials technologies to be utilized in Depot level Reliability, Availability, and Maintainability (RAM), and Service Life Improvement Programs.

FY 2004 Plans:

- Continue exploring the feasibility of developing an individual warfighter handheld water purification/desalination device that can purify any source of water (fresh, brackish, salt).
- Continue exploring the feasibility of a lightweight expeditionary bridging capability by assessing alternative bridging techniques, bridge design, and material and manufacturing solutions to include composite, extrusion, casting and forging techniques.

FY 2005 Plans:

- Continue exploring the development and demonstration of water purification and generation technologies to

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demonstrate the feasibility of performance improvement.

- Continue exploring a lightweight expeditionary bridging capability.

	FY 2003	FY 2004	FY 2005
Mine Countermeasures (MCM)	2,394	0	1,407

This activity develops technologies to enable land-mine detection, neutralization, breaching, and clearing from beach exit zone to inland objectives. Current Naval MCM efforts address MCM capabilities through the Beach Exit Zone, but do not address a seamless, end-to-end MCM capability. Marine Air-Ground Task Force (MAGTF) MCM must be a functional component of Naval Expeditionary Maneuver Warfare (EMW); to include Ship to Objective Maneuver, Expeditionary Operations from a Sea Base, Sustained Operations Ashore, and Operations Other Than War. In 2001 the Institute for Defense Analyses (IDA)/Office of Naval Research (ONR) "Mine Countermeasures (MCM) for Beach Exit Zone to Objectives Study" comprehensively looked at all on-going MCM programs and technologies, particularly U.S. Army MCM plans. The IDA/ONR MCM Study identified major MAGTF deficiencies (inadequately addressed in current Army, Navy, and Marine Corps programs). The IDA/ONR MCM Study's execution strategy was endorsed by senior Marine Corps leadership.

FY 2003 Accomplishments:

Three S&T MCM initiatives were commenced:

- Lightweight Mechanical Breaching Systems for Marine Corps vehicles against all buried mines regardless of fusing type.
- Advanced Signature Duplication Systems, for land and airborne platforms, to neutralize top-attack, side-attack, anti-helicopter, and bottom-attack landmines.
- Family of Tailored Explosive Systems that can attack specific mine belts or individual mines at standoff distances.

FY 2004 Plans:

- Discovery and Invention (D&I) initiatives initiated in FY 2003 have been deferred one year because of affordability constraints due to high priorities in other activity areas.
- A priority MCM initiative, the congressionally mandated Advanced Mine Detector project, is significantly enhanced this year, in the Marine Advanced Technology Demonstration (ATD) line (PE 0603640M).

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FY 2005 Plans:

-Re-institute the three FY 2003 D&I initiatives: (1) Lightweight Mechanical Breaching Systems for Marine Corps vehicles against all buried mines regardless of fusing type; (2) Advanced Signature Duplication (ASD) Systems, for land and airborne platforms, to neutralize top-attack, side-attack, anti-helicopter, and bottom-attack landmines; and (3) Family of Tailored Explosive Systems that can attack specific mine belts or individual mines at standoff distances.

CONGRESSIONAL PLUS-UPS:

	FY 2003	FY 2004
ADVANCED LEAD ACID BATTERY DEVELOPMENT FOR MILITARY VEHICLES	0	989

This effort will develop lead acid battery technology to increase the life, energy and power output of lead acid batteries used by the Marine Corps and Navy. Novel approaches will be explored including the use of a horizontal plate design, and conductive additives to the electrodes. High performance batteries will have improved performance to their cycle life and energy density, while maintaining high power capabilities which will translate directly into cost reductions, increased efficiency and improved sea basing of naval expeditionary forces.

C. OTHER PROGRAM FUNDING SUMMARY:

NAVY RELATED RDT&E: This program adheres to Tri-Service Reliance Agreements in Chemical/Biological Defense; Command, Control and Communications; Conventional Air/Surface Weaponry; Electronic Devices; Ground Vehicles; Ships and Watercraft; Manpower and Personnel; and Training Systems.

PE 0601152N (In-House Laboratory Independent Research)
PE 0601153N (Defense Research Sciences)
PE 0204163N (Fleet Telecommunications (Tactical))
PE 0602235N (Common Picture Applied Research)
PE 0602782N (Mine and Expeditionary Warfare Applied Research)
PE 0603782N (Mine and Expeditionary Warfare Advanced Technology)
PE 0603235N (Common Picture Advanced Technology)
PE 0206623M (Marine Corps Ground/Supporting Arms Systems)
PE 0603640M (Marine Corps Advanced Technology Demonstrations)

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PE 0603612M (Marine Corps Mine Countermeasures)
PE 0603635M (Marine Corps Ground Combat/Support System)
PE 0206313M (Marine Corps Communications Systems)
PE 0603236N (Warfighter Sustainment Advanced Technology)

NON NAVY RELATED RDT&E:

PE 0603004A (Weapons and Munitions Advanced Technology)
PE 0603005A (Combat Vehicle and Automotive Advanced Technology)
PE 0603606A (Landmine Warfare and Barrier Advanced Technology)
PE 0603607A (Joint Service Small Arms Programs)
PE 0603619A (Landmine Warfare and Barrier Advanced Development)
PE 0603772A (Advanced Tactical Computer Science and Sensor Technology)
PE 0604710A (Night Vision Systems-Engineering Development)
PE 0604808A (Landmine Warfare/Barrier Engineering Development)
PE 0602301E (Computing Systems and Communications Technology)
PE 0602702E (Tactical Technology)

D. ACQUISITION STRATEGY:

Not Applicable

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