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Land Warrior - Archived 3/2011

Outlook

- Long-term funding for Land Warrior has been terminated; procurement, fielding, and evaluation, however, are being handled through supplemental funding
- While U.S. Army leadership is officially planning to back a future version of the system called Ground Soldier Ensemble, Army personnel in the field are strongly advocating additional, immediate Land Warrior fielding
- General Dynamics C4 Systems awarded a \$19.4 million cost-plus-fixed-fee contract from the U.S. Army for the procurement of logistics and engineering support service and sparing for existing Land Warrior systems

Orientation

Description. The U.S. Land Warrior Soldier System is composed of a:

Computer/Radio Subsystem
Software Subsystem
Integrated Helmet Assembly Subsystem
Weapon Subsystem
Protective Clothing/Equipment Subsystem

Other nations are developing similar systems, some of which are covered in separate reports.

Sponsor

U.S. Army
Natick Research
Development and Engineering Center
Natick, MA
USA
(Lead sponsor)

Status. In spiral development and production.

Application. The objective of the Land Warrior program is to maximize the effectiveness of the soldier in concert with his materiel in order to survive and prevail on the battlefield.

Price Range. According to the U.S. Army, the total complement of Land Warrior systems have a target cost of \$50,000 (2009 dollars).

Contractors

Prime

Computer Sciences Corp (CSC)	http://www.csc.com , 2100 E Grand Ave, El Segundo, CA 90245-5098 United States, Tel: + 1 (310) 615-0311, Fax: + 1 (310) 322-9768, Email: generalinformation@csc.com , Co-producer
General Dynamics C4 Systems	http://www.gdc4s.com , 8201 E McDowell Rd, Scottsdale, AZ 85252-3812 United States, Tel: + 1 (877) 449-0600, Fax: + 1 (877) 449-0599, Email: info@gdc4s.com , Prime

Land Warrior

Raytheon Co	http://www.raytheon.com , 870 Winter St, Waltham, MA 02451-1449 United States, Tel: + 1 (781) 522-3000, Fax: + 1 (781) 860-2520, Co-producer
Rockwell Collins Inc	http://www.rockwellcollins.com , 400 Collins Rd NE, Cedar Rapids, IA 52498-0001 United States, Tel: + 1 (319) 295-1000, Fax: + 1 (319) 295-5429, Co-producer

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Technical Data

Characteristics. The Land Warrior program was designed to produce the first fully integrated fighting system for combat soldiers. The many programs and projects involved in the Land Warrior soldier system support research efforts in the engineering, manufacturing, development, and non-developmental items phases of the acquisition strategy.

At present, the Land Warrior system comprises five major subsystems: the Computer/Radio, Software, Helmet Assembly, Weapon, and Protective Clothing components. Additional components will likely be incorporated into Land Warrior, though this report focuses on the five major original subsystems.

Computer/Radio Subsystem. The Computer/Radio Subsystem (CRS), mounted in the backpack frame, is divided into two sections. The upper portion contains two radios: the squad radio and the soldier radio. The two radios give the soldier the ability to communicate with others in his or her squad, greatly improving situational awareness and survivability.

Beneath the squad/soldier radios, the pack contains the computer and Global Positioning System (GPS) modules. Integration of the GPS and radio into the CRS eliminates separate displays, controls, and cases, thereby saving weight and reducing power requirements. Menu-driven displays are controlled by the soldier from the Remote Input Pointing Device. This device is located on the chest strap and is operated by the touch of a finger. Some functions are controlled with two buttons located near the trigger finger, allowing the soldier to maintain a firing position. Embedded into the load-carrying frame are the antennas for the GPS and soldier radio.

Software Subsystem. The Software Subsystem is designed with a modular architecture to allow flexibility. Mission-specific software ties the individual

soldier into the larger digital battlefield picture and minimizes data clutter. In 2003, the U.S. Army decided to go with a Linux-based system for Land Warrior's software component.

Integrated Helmet Assembly Subsystem. The Integrated Helmet Assembly Subsystem (IHAS) is designed to provide improved ballistic protection at a reduced weight, while offering advanced command and control capabilities. The IHAS' helmet-mounted computer and sensor display serves as the soldier's interface to the other subsystems and to the digital battlefield. Through the helmet-mounted display, the soldier can view computer-generated data, digital maps, intelligence information, troop locations, and imagery from his weapon-mounted Thermal Weapon Sight (TWS) and video camera. This capability allows the soldier to view around a corner, acquire a target, and then fire the weapon without exposing more than his arms and hands to the enemy.

Weapon Subsystem. Initial weapon modifications involve replacing the hand guards along the upper receiver of the M-16 and M-4 rifle with rails, upon which mission-specific components may be mounted.

Development continues, with the Individual Objective Combat Weapon scheduled for integration around 2010.

Protective Clothing/Equipment Subsystem. The Protective Clothing and Individual Equipment Subsystem consists of a redesigned, flexible backpack frame with integrated cables. The new Land Warrior body armor, like the helmet, provides improved ballistic protection at a reduced weight, and includes a modular upgrade plate to protect the soldier against a small-arms threat. Future considerations include improved nuclear/biological/chemical (NBC) protective gear and detection equipment.

Variants/Upgrades

Situational Awareness System (SAS). The SAS will incorporate a number of sensors into the Land Warrior system that will, in theory, enable individual soldiers to detect enemy forces 5 to 15 minutes prior to contact. This advanced warning would provide valuable time to prepare for the attack, blunting it via air and artillery strikes, or even evading the oncoming force.

The SAS would be composed of the following subcomponents:

- Individual Warfighter System – A small, watch-sized computer that would display the reporting and receiving of data from the sensors.
- Warfighter's Tactical Associate – Manpack, vehicular, and airborne versions of the Individual Warfighter System that would display more

information, as well as have increased communications capability.

- Relays, Routers, and Servers – These will be in several forms, including disposable and wearable versions. The primary means of sorting and shifting communications will be through the use of fiber optics.

A single SAS node would be able to support up to 70 teams (560 to 840 men) over a 40,000-square-kilometer area.

Mounted Warrior. The Mounted Warrior, the vehicular version of the Land Warrior, is being developed for U.S. Army M1 Abrams tanks and Bradley fighting vehicles.

Program Review

Background. In January 1995, Hughes Aerospace and Electronics (now Raytheon) announced that it would be the lead company in a team composed of Motorola, Honeywell, Arthur D. Little, Battelle, and Gentex in the pursuit of an engineering development and manufacturing contract for Land Warrior.

Raytheon assumed responsibility for systems integration, weapons components, and software. Motorola began development of software and miniature communications components and computer hardware. Honeywell took on the Integrated Helmet Assembly Subsystem (IHAS), and Arthur D. Little tackled handwear, footwear, and load-bearing components. Battelle was assigned responsibility for the lightweight integrated protective-suit technology and protective-respirator systems, with Gentex providing overall subsystems for the individual, as well as the ballistic helmet shell and components.

Trouble Out of the Starting Gate

1997. In February, the Land Warrior system underwent a Critical Design Review (CDR). Of the five subsystems, four – the IHAS, Computer/Radio, Weapon, and Software subsystems – received an "amber" rating. The protective clothing received a "red" rating because of numerous complaints from soldiers regarding the clothing's flexibility and load carrying capacity, and the awkwardness of the armor.

The U.S. Army stated in November that it had reduced the weight and increased the power of the Land Warrior system in the engineering and manufacturing development (EMD) phase. Raytheon trimmed the

weapon system's weight, going from 20 pounds over requirement to less than 3.5 pounds over requirement, via several design changes. In addition, the power of the system was increased with the use of an erbium-glass laser emitter.

1998. In January, the sunny picture painted earlier by the U.S. Army and its contractors regarding Land Warrior began to cloud. While power consumption had been reduced, the system was still intensively power hungry, according to a National Research Council (NRC) paper titled "Energy Efficient Technologies for the Dismounted Soldier." The report noted that the power demands of the computer and radio system would limit the effectiveness of the system as a whole.

The NRC made several recommendations to rectify these deficiencies. Wireless power transmission could be used to power the suites, the Army's procurement strategy could be modified to keep pace with commercial technology, and long-term, high-energy-fueled batteries could be used.

By June, the U.S. Army admitted that the Land Warrior program had slipped behind schedule, not due to any single problem, but rather to "problems related to the integration of the subsystems with each other." These problems halted the Initial Operational Test & Evaluation (IOT&E), originally slated to run through June 1999, and culminated in a low-rate initial production (LRIP) contract in December 1999. U.S. Army officials requested an additional \$51.4 million to begin procurement of at least some components of the Land Warrior system, such as the body armor.

Land Warrior

In May 1998, the Land Warrior system once again failed a water-immersion, or "dunk," test. The system needed to pass this test to receive the final safety certificate prior to IOT&E. The dunk test failure further increased program slippage, but senior U.S. Army officials apparently accepted this setback as part of a high-risk, fast-track program.

A few months later, in August 1998, DARPA (Defense Advanced Research Projects Agency) issued two \$10 million contracts to ITT and Raytheon to begin development on the Small Unit Operations-Situational Awareness System (SUO-SAS), which was both a follow-on and an add-on to the Land Warrior system. These two competitors would develop a system that combined a complete mobile communications, computing, navigation, sensor fusion, situational awareness, and visualization suite.

A More Realistic Approach

1999. In December 1999, the Government Accountability Office (GAO) submitted a report to the House Appropriations Subcommittee chairman recommending that the Land Warrior program be moved back into the program definition and risk-reduction phase. The report blasted the manner in which Land Warrior was being handled by the Department of the Army, pointing specifically to the failure to address integration issues with the Force XXI Battle Command Brigade and Below (BCB2) system. Program managers had originally been granted a waiver to continue system development, with BCB2 compatibility to be addressed after Land Warrior fielding. The report also pointed to numerous other deficiencies, including overweight equipment, inadequate battery power, inadequate load-carrying design and comfort, and electromagnetic interference.

2000. In September 2000, the latest version of Land Warrior was successfully demonstrated during combat experiments. During the trials, 52 U.S. Army airborne infantrymen experimented with the system in an extensive, urban terrain live-fire exercise.

The new version included a commercial Pentium II computer, the PC/104, as an illustration of how costs for Land Warrior could be cut. According to U.S. Army officials in response to the demonstration, purchasing commercial off-the-shelf (COTS) components and using pragmatic, businesslike operations solved many of Land Warrior's development problems. The U.S. Army would continue to develop different lightweight versions, each a little more capable than the previous one.

By the end of the year, Raytheon had been phased out as the lead contractor because the program sponsors felt

there was not enough utilization of affordable commercial technology. The U.S. Army then set about putting together a new development team, finally settling on a group consisting of Computer Sciences Corp (CSC) (program leader), Exponent, Pemstar, the Wexford Group, Omega Training Group, and Pacific Consultants.

A Big Step Toward Production

2001. Signaling that program development was on track, in March 2001 there were reports that the U.S. Army would be requesting funding in the FY02 defense budget for Land Warrior's follow-on system, the Objective Force Warrior (OFW). Planners of the new system envisioned that it would bring even more enhancements, including lighter weight and increased carriage capacity.

In May 2001, Land Warrior was trotted out before members of Congress in yet another demonstration of the system's benefits. By this time, the system appeared on target for a planned fielding date of 2004. At this time, the total quantity to be ordered by the U.S. Army was identified as 34,000, at a cost of \$2 billion.

The U.S. Army reorganized the Land Warrior team in July 2001, changing its original contract with CSC to a reportedly more flexible "Other Transactions Agreement," thereby reducing the administrative burden of the program. The scientific consulting firm Exponent was declared the new program manager in this arrangement, although CSC continued to be identified as the lead contractor in some news stories. While CSC would continue to be responsible for software and logistics, the California company Pemstar was chosen to manufacture the system's components.

The follow-on version of Land Warrior came back into the spotlight in July 2001, when the U.S. Army officially requested \$28 million in FY02 for development of the OFW. In the amended FY02 defense budget request, the White House subsequently funded the new program, and development efforts reportedly began soon after, in November 2001.

Development of a new application for Land Warrior was moved forward in October 2001 when the system's production team was awarded a contract (the amount of which was not specified) to supply the prototype Mounted Warrior to the U.S. Army. Mounted Warrior was developed as a Land Warrior extension to provide a wireless voice and data interface among operators of U.S. Army M1 Abrams tanks and Bradley fighting vehicles.

2002. Reflecting the nature of the post-September 11 defense environment, the DoD in the summer of 2002 transferred \$165 million from the 2002 counterterrorism

Land Warrior

budget for enhancements to the chemical and biological defense effort. This included Land Warrior-based technology for the Joint Service Lightweight Integrated Suit Technology (JSLIST) program. The DoD planned to spend \$28 million on acquisition of these protective suits.

In 2002, \$42.5 million of the total Land Warrior RDT&E budget was spent on fabricating the remaining systems that would be used for development and operational testing. Contractors' acceptance testing was also conducted to validate system functionality and integration. By 2002, the total initial number of Land Warrior systems the U.S. Army was expected to procure reached 48,800.

In late 2002, it was announced that the U.S. Army had decided to push back the date for the Block II Land Warrior award. Originally scheduled for January 31, 2003, the award was still expected to be valued at \$500 million for 60,000 units. Testing and fielding of Block II were expected to run from 2005 through 2014.

Major Contract Award Brings Prospect of Fielding Closer

2003. Progress toward Land Warrior fielding received a significant boost with the January 2003 award of a contract with a potential value of \$791 million to a General Dynamics-led team to reduce the weight of the system and make it better able to interact with digital communications systems. Work would also focus on making Land Warrior interoperable with Army Stryker Brigade Combat Teams. An initial \$59.9 million contract was awarded to cover work through 2006.

By the spring of 2003, it had become clear that the Army deemed the system unreliable in its present state and far too complex. In fact, the Army would opt to cancel Block I altogether in favor of simply moving directly to the Block II phase and the development of a somewhat simpler, more reliable version. This would mean that initial fielding of a system to be called LW-Stryker Interoperable (SI) would be delayed.

Rockwell Collins, in March 2003, was chosen to provide Land Warrior's helmet-mounted display.

It was announced in August 2003 that the U.S.-based Thales Communications had been chosen as a subcontractor on the Land Warrior program. The company would supply the Leader Radio Subsystem for the soldier system, providing connectivity with the Tactical Internet.

Based on the Army's decision to move ahead with the SI Block II version of Land Warrior, the decision was also made to change the operating systems from the Microsoft Windows of Block I to a Linux-based system.

This move was also designed to improve interoperability with other service systems.

By October 2003, the U.S. Army Systems Acquisition Review Council had approved the new acquisition strategy for the program. The start of principal production would formally be pushed out until the 2006/2007 timeframe.

2004. Use of Land Warrior elements in Iraq began to yield some areas of needed improvement. Soldiers using evaluation units found out that a blue-force tracking capability was needed for Land Warrior's computer component. When developed and installed, this capability, called the Commander's Digital Assistant (CDA), would help maintain better situational awareness of troops in the battle environment.

According to a Pentagon review released in April 2004, the total anticipated cost of the Land Warrior program had risen to \$12.3 billion, from early estimates of around \$3 billion. Also, the total number of units planned to be fielded had risen to nearly 60,000.

In late 2004, the program became the object of funding cuts. After an initial \$15 million was dropped from the FY05 budget, the Army signed on to additional cuts from FY06 through FY10.

Spiral Development Pushes Program Closer to Reality

2005. Land Warrior officials announced that they were merging the program with its next-generation offshoot, the Future Force Warrior science and technology development program. This, too, was designed as a cost-savings measure. Under this new plan, elements of the Land Warrior would be fielded in increments as individual components were deemed ready to meet the rigors of the battlefield.

It was announced in June 2005 that 500 Land Warrior units in the most viable incarnation would be fielded to the Army starting in 2006. A \$30 million contract for this work was awarded to General Dynamics, which would entail the integration of the Land Warrior units into an experimental Stryker battalion.

Raytheon, in July 2005, reported that it had delivered the first increment of its MicroLight radio for Land Warrior. This increment was to consist of 26 radios and related equipment. The MicroLight is described by Raytheon as a next-generation EPLRS (Enhanced Position Location Reporting System) radio.

The End of Land Warrior?

The U.S. Army, in December 2006, announced that it had finalized a new budget for FY07 and beyond with much-needed savings of some \$3.3 billion. The savings

Land Warrior

would be realized by drastically reducing the budget for the Future Combat Systems (FCS) family of tactical vehicles and killing the Land Warrior program, among other expensive efforts.

The FY08/FY09 budget request issued in early 2007 included no funding for Land Warrior systems development or production.

The U.S. Senate Armed Services Committee (SASC), in June 2007, called for a review of the decision to terminate Land Warrior. The committee also decided to earmark \$80 million to keep the program running through at least FY08 to field the last of the previously planned elements to Army battalions in the field.

The U.S. Army, in July 2007, reported that soldiers using Land Warrior elements in Iraq found them to be great tools that even surpassed their expectations. Soldiers of the 2nd Infantry Division's 4th Battalion, 9th Infantry Regiment were the first to take Land Warrior and Mounted Warrior into combat. Soldiers were reported as stating that Land Warrior performed even better in actual combat than it did in testing.

The FY08 defense supplemental appropriations request included funds for fielding Land Warrior to a Stryker Brigade combat team. The request would provide \$102 million for procurement.

By June 2008, developers brought about a critical weight reduction for Land Warrior from a previous 10 pounds to "just under 7 pounds," according to Mark Showah, business director for General Dynamics. This was done by combining the functions previously contained within five boxes into two boxes.

The Army in November 2008 announced that it was sending Land Warrior to an experimental task force to test its compatibility with the Future Combat Systems program. This came at a time when Army leadership appeared to be reconsidering the termination of Land Warrior after Stryker soldiers from the 4th Battalion, 9th Infantry Regiment praised the system's performance and value in actual combat situations. One of the systems to be tested along with Land Warrior is the Rifleman Radio. This radio, which is in development, emits a signal that conveys the locations of Land Warrior operators to other Land Warrior operators.

Related News

U.S. Army Secures Support Work for Land Warrior Systems – General Dynamics C4 Systems was awarded a \$27,939,130 firm-fixed-price, cost-plus-fixed-fee contract from the United States Army for the Land Warrior systems and engineering support. Work is to be performed in Scottsdale, with an estimated completion date of January 31, 2011. One bid was solicited with one bid received. The U.S. Army Research, Development and Engineering Command, Acquisition Center, Aberdeen Proving Ground, Maryland, is the contracting activity. (DefenseLink, 12/09)

U.S. Army Experiments to Bring Increased Network Connectivity to the Soldier – The U.S. Army recently completed networked operational tests of the first pairing of its developmental Common Controller device with equipment presently used by soldiers in theater from the Land Warrior effort. This mobile capability of integrated and networked systems could offer an increased level of soldier situational awareness in near real-time. This network capability will prove critical in rural areas where vehicles cannot traverse and during the period of time when the brigade network is being established. Termed the Common Controller & Manpackable Network Interoperability and Network Evaluation Experiment, the effort represents the first connection of the Army's Common Controller with equipment from the Land Warrior effort.

Individual Soldier battlefield awareness was enhanced as sensor data was successfully passed from sensor assets like the small unmanned ground vehicle to small Land Warrior equipped units. From there, because of the Land Warrior gear, the information was able to pass from one small Land Warrior unit to another. Further, the critical information passed in real time from the small unit to the battalion and above level, as well as the reverse. (DefenseLink, 12/09)

QinetiQ North America's Sniper Detection Systems Going to Afghanistan – QinetiQ North America will deliver 235 more of its Ears/SWATS (shoulder-wearable acoustic targeting systems) sniper detection systems to the U.S. Army for use in Afghanistan and Iraq. The order is the final increment on a \$10 million contract received last year by QinetiQ North America's Technology Solutions Group and will represent the broadest integration and deployment of the Ears/SWATS capability with the Land Warrior program to date. (QinetiQ-NA, 10/09)

Support Ordered for Existing U.S. Army Land Warrior Systems – General Dynamics C4 Systems was awarded a \$19,419,170 cost-plus-fixed-fee contract from the U.S. Army for the procurement of logistics and engineering support service and sparing for existing Land Warrior systems. (DefenseLink, 9/09)

Land Warrior

5th Stryker BCT First in Afghanistan and First with Land Warrior – The Army is preparing to send a Stryker Brigade Combat Team (SBCT) to Afghanistan this summer for the first time. The 2nd Infantry Division's 5th SBCT, based in Ft. Lewis, Washington, was originally scheduled to deploy to Iraq, though the Pentagon announced in February that the brigade would be diverted to Afghanistan along with 8,000 Marines and 5,000 combat support troops. The 5th SBCT will bring more than 330 Stryker vehicles into southern Afghanistan, where the environmental conditions are similar to Iraq, where SBCTs have been serving.

The 5th SBCT will also be the first full combat brigade to deploy with the Land Warrior combat system, a wearable, command-and-control kit. Portions of the 4th SBCT recently returned from Iraq after a year of putting Land Warrior through its paces. Soldiers deploying to Afghanistan will be receiving 1,000 newer and lighter Land Warrior units (8 pounds, compared to the 11-pound system used in Iraq). (*Army Times*, 4/09)

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Funding

U.S. funding for development, production, and procurement has been discontinued.

Contracts/Orders & Options

Contractor	Award (\$ millions)	Date/Description
General Dynamics	59.9	Jan 2003 – \$7 million increment as part of a \$59.9 million cost-plus-fixed-fee contract for the next phase of the Land Warrior program. Work completed Feb 2006. Contract funds will not expire at the end of the current fiscal year. The U.S. Army Communications-Electronics Command, Fort Monmouth, NJ, is the contracting agency. (DAAB07-03-C-N001)
General Dynamics	30.0	Jun 2005 – U.S. Army contract to integrate 500 Land Warrior units into an experimental Stryker battalion. Delivery was scheduled from Mar to May 2006. The contract's total program value is \$258 million.
General Dynamics	70.0	Sep 2008 – Contract to equip the 5th Brigade, 2nd Infantry Division Stryker Brigade Combat Team (5/2 SBCT) with a new, lighter-weight version of the Land Warrior system. This order funds a Brigade set of Land Warrior ensembles and vehicle integration kits.

Timetable

Month	Year	Major Development
Mar	1997	Critical Design Review
Nov	1997	Development testing of prototypes
2Q	2000	Revised Land Warrior funding identified in Army Objective Memorandum
	2000	Raytheon removed as Land Warrior prime contractor; new development team selected with Computer Sciences Corp as program manager
Dec	2000	67 systems successfully tested
Mar	2001	U.S. Army requests funding for follow-on version of Land Warrior, the Objective Force Warrior
Oct	2001	Contract awarded for Land Warrior vehicular version, Mounted Warrior
	2002	U.S. Army scheduled to receive 500 systems for initial fielding
Summer	2002	Land Warrior used for JSLIST program
Dec	2002	First contract pushed back for Land Warrior Block II
Jan	2003	General Dynamics awarded \$59.9 million contract (with potential value of \$791 million) for Land Warrior work
	2003	Army restructures Land Warrior schedule after testing failures prove system is still not ready

Land Warrior

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Aug	2003	Use and evaluation of Land Warrior in Iraq
Mid-	2005	Developers merge Land Warrior and Future Force Warrior programs and begin spiral development of Land Warrior
Dec	2006	Army states desire to kill Land Warrior
	2007	Senate Armed Services Committee earmarks \$80 million for fielding of Land Warrior elements for one last year – FY08
Mar	2008	\$102 million for Land Warrior procurement
	2009	Ongoing evaluation
	2011	Possible fielding of Ground Soldier Ensemble

Worldwide Distribution/Inventories

This is a **U.S. Department of Defense** program. The U.S. Army had an initial requirement for 48,800 systems by 2015. With the fielding of Block II systems, this would have reached 60,000.

Forecast Rationale

Enough support contracts for Land Warrior were awarded through 2009 to demonstrate that while the program is technically terminated from a long-term RDT&E standpoint, the program is still being used and evaluated in the field. Perhaps the most significant of these awards was made to prime contractor General Dynamics, a nearly \$20 million contract for procurement and systems support.

Long-term funding for Land Warrior has been terminated. Procurement, fielding, and evaluation, however, are being handled through supplemental funding. The Army's FY08 defense supplemental appropriations request included funds for fielding Land

Warrior to the very combat team that had such high praise for the system. The request provided \$102 million for procurement. It is very likely that 2010 will see a similar successful request.

As of early 2010, when this report was prepared, the defense budget stood at zero funding for Land Warrior. However, considering the strong support for the program's resurrection, there is a very good chance that elements will continue to be procured and fielded through supplemental funding. For now, though, the **Ten-Year Outlook** chart has been removed from this report.

Ten-Year Outlook

The **Ten-Year Outlook** chart for Land Warrior has been removed due to possible, permanent termination of the program.

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