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Report to the Chairman,
Subcommittee on Defense,
Committee on Appropriations
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BATTLEFIELD AUTOMATION

Performance Uncertainties Are Likely When Army Fields Its First Digitized Division

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The Honorable Jerry Lewis
Chairman, Subcommittee on Defense
Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

Over the next decade, the Army plans to field dozens of new and improved battlefield systems through its "digitization" initiative. Digitization involves the application of information technologies to acquire, exchange, and employ timely information throughout the battlespace. Use of digitization on the battlefield is expected to increase the Army's survivability, lethality, and tempo of operations.[1] The Army plans to equip its first digitized division with high-priority equipment by December 2000 and its first digitized corps by the end of fiscal year 2004.

This report responds to the former Subcommittee Chairman's request that we review the Army's progress toward its goal of fielding a digitized division by the end of 2000. Specifically, the Chairman asked us to (1) identify the high-priority systems needed to accomplish the digitization fielding goal, (2) determine the acquisition status of these high-priority systems, and (3) identify any performance uncertainties that could confront the Army after its first digitized division is fielded.

Results in Brief

The Army's first digitized division will be the 4th Infantry Division. While the Army's overall digitization initiative involves over 100 systems, its December 2000 digitization goal is to field 16 high-priority systems to 3 of the division's 4 brigades. In general, these 16 systems can be described as command, control, and communications systems, the majority of which will support decision-making by commanders located in tactical

[1]Tempo of operations generally refers to a commander's ability to conduct operations at a time and place of the commander's choosing.

operations centers[2] at battalion, brigade, division, and corps levels. Examples include the Maneuver Control System (MCS), upgrades to Mobile Subscriber Equipment, and satellite communication systems. One system, however, represents an entirely new capability that is intended to accomplish an important digitization objective of sharing battlefield information with the thousands of soldiers operating outside tactical operations centers. This system is the Force XXI Battle Command, Brigade and Below (FBCB2) system and is the critical component of the digitization initiative.

The acquisition status of each of the 16 high-priority systems varies. For example, fielding of the Forward Area Air Defense Command, Control, and Intelligence (FAADC2I) system, with the first digitized division objective software and upgraded hardware, was completed in fiscal year 1998. On the other hand, the delivery of the Global Broadcast Service (GBS) Transportable Ground Receive Suite terminals was delayed because the contractor's initial design required too many terminal transit cases. While there will be a delay in the delivery of the terminals, the Army expects fielding to the first digitized division to be completed during 2000. Although the high-priority systems are being acquired independently of each other, the Army is coordinating and synchronizing individual fielding schedules to enable it to meet its goal of fielding the first digitized division by December 2000.

There are four key performance uncertainties that the Army will confront when the division is fielded at the end of 2000. First, and most importantly, the operational effectiveness and suitability of FBCB2 will be unknown. Because the Army has recently restructured the system's test and evaluation program, a determination of the operational effectiveness and suitability of the FBCB2 system has been postponed until at least fiscal year 2002. Second, the operational performance of other fielded systems may be unknown because the results of scheduled operational tests will not be complete by December 2000. For example, these tests include the follow-on operational test and evaluation of the MCS and the follow-on operational test and evaluation of the Milstar satellite system's tactical communications. Third, the capability of automated sharing of Army Tactical Command and Control System data within tactical operations

[2]Tactical operations centers generally refer to fixed and relocatable command posts throughout the battlespace where commanders and their staffs prepare, monitor, and alter the execution of battle plans.

centers will not have been conclusively demonstrated. Insight into the resolution of this issue is not likely to occur before April 2001 when a digitized brigade participates in an exercise at the National Training Center, Fort Irwin, California. Fourth, it will be uncertain whether digitization, with the expected interoperability of related information systems, has achieved the expected increases in lethality, survivability, and tempo of operations. This uncertainty is not likely to be resolved any earlier than fiscal year 2002—after the FBCB2 initial operational test and evaluation.

This report contains recommendations to the Secretary of Defense to minimize the risks associated with fielding FBCB2 without the benefits of operational testing and to develop a plan for determining that digitization objectives have been achieved before fielding high-priority systems to units beyond the first digitized division.

Background

Throughout the next decade and beyond, the Army plans to modernize its forces through an overarching initiative called Force XXI. The components of this initiative are Army XXI, which extends to about the year 2010, and the Army After Next, which is looking beyond the year 2010. Included within the modernization objectives of Army XXI is the integration of information technologies to acquire, exchange, and employ timely information throughout the battlespace. The integration of information technologies objective of Army XXI is called digitization and will be implemented throughout the Army by the development, production, and fielding of over 100 individual systems. The Army's digitization effort includes a mix of high-priority systems, lower-priority systems, and other modernization systems. For example, FBCB2 is a high-priority system, whereas the Battlefield Combat Identification System is a lower-priority system. The Javelin anti-tank weapon system and the Gun Laying Positioning System are examples of modernization systems not designated as priority systems. According to the President's fiscal year 2000 budget request, the Army plans to invest $20.8 billion for digitization for the period of fiscal year 2000 through fiscal year 2005.

In general, integrated situational awareness and command and control information technologies available to Army commanders currently extend to tactical operations centers at the brigade and battalion levels. By extending information technologies to the thousands of soldiers operating outside the tactical operations centers, the Army expects to increase the

lethality, survivability, and operational tempo of its forces.[3]

The Army plans to digitize its first division by December 2000 and field its first digitized corps by September 2004. The first digitized corps will be III Corps, consisting of the 4th Infantry Division, the 1st Cavalry Division, and the 3rd Armored Cavalry Regiment. The Army intends to digitize its remaining divisions by the 2010-2012 time frame.

First Digitized Division Requires Fielding of 16 High-Priority Systems

In August 1997, the Deputy Chief of Staff for Operations and Plans announced that the 4th Infantry Division would be the first digitized division and that, at a minimum, fielded equipment would include the Army Training and Doctrine Command's list of priority one systems and associated equipment. The Training and Doctrine Command has identified 16 priority one systems. They consist of command, control, and communications systems. Each is considered a critical element within the Army's digitization effort because of the expected contribution it makes to achieve the required capabilities for the digitized battlefield. Approved by the Joint Requirements Oversight Council of the Joint Chiefs of Staff in January 1995, these capabilities are

- integrated battle command from platoon to corps,
- relevant common picture of the battlespace at each level,
- smaller units that are more lethal and survivable,
- more responsive logistics within and between theaters, and
- joint interoperability at appropriate levels.

Fielding of the high-priority systems will contribute to improving the Army Battle Command System, which currently includes the (1) Global Command and Control System-Army located at strategic and theater levels, which interoperates with other theater, joint, and multinational command and control systems, and with Army systems at the corps and levels below and (2) Army Tactical Command and Control System, which meets the command and control needs from corps to battalion. FBCB2 will be the principal digital command and control system for the Army at the brigade level and below and will constitute the third major component of the Army Battle Command System. While FBCB2 is only 1 of the 16 high-priority

[3]The Army has framed its digitization expectations in the form of a hypothesis: if within a digitized force different technologies and doctrine are properly integrated across the force, then increases in lethality, survivability, and tempo will be gained across the force.

systems, it is the centerpiece of digitization because of its potential to contribute significantly to achieving the capabilities articulated by the Joint Chiefs of Staff in 1995.[4] Nearly all of the other high-priority systems are dedicated to enhancing the Army Tactical Command and Control System.

Collectively, the 16 high-priority systems represent a mix of systems that have been in development or production for many years as well as systems that began development more recently. Each of these systems is in one of three general categories: a component system of the Army Tactical Command and Control System, a communications or support system for the Army Tactical Command and Control System, or FBCB2 and its supporting communications system.

Army Tactical Command and Control System Includes Five High-Priority Systems

Components of the Army Tactical Command and Control System are found in tactical operations centers and are expected to provide commanders from corps through battalion with an automated capability to perform maneuver, intelligence, fire support, air defense, and logistics functions across the battlefield. The specific component subsystems are MCS, All Source Analysis System (ASAS), Advanced Field Artillery Tactical Data System (AFATDS), FAADC2I, and Combat Service Support Control System (CSSCS). Each of these component systems is considered a high-priority system for the first digitized division and corps. Each component system uses computers, software, and communications interfaces to support the commander's decision-making. The functionality of each system is expected to increase as new software is developed.

When the first digitized division is fielded, there will be 27 tactical operations centers with varying configurations of the Army Tactical Command and Control System components. There are also plans to add other component systems to some tactical operations centers in the future. For example, the Digital Topographic Support System, when fielded at the corps and division tactical operations centers, is expected to allow commanders to perform terrain analysis and produce topographic products in support of the mobility/survivability battlefield function area.

[4]For background information on the FBCB2 program, please see Battlefield Automation: Acquisition Issues Facing the Army Battle Command, Brigade and Below Program (GAO/NSIAD-98-140, June 30, 1998).

Eight High-Priority Systems Are Intended to Improve Communications and Management of Tactical Operations Centers

Tactical operations centers require communication and support systems to acquire, exchange, and employ timely information throughout the battlespace. The first digitized division requires the fielding of six communication systems and two support systems for its tactical operations centers.

The main communication system between tactical operations centers is the Army's Mobile Subscriber Equipment. This line-of-sight radio communication system provides secure voice, data, and facsimile communications services, as well as a packet switch network[5] for rapid data communications. Two high-priority programs are expected to enhance the Mobile Subscriber Equipment: (1) the Asynchronous Transfer Mode (ATM), a new, commercial switch that will replace the packet switch and improve the rates of data communications and (2) the High-Capacity Line-of-Sight (HCLOS) radio, which will replace the existing radios and provide increased transmission capacity between switches. The first digitized division requires 21 ATM switches and 72 HCLOS radios.

The Army will also enhance its land-based communication system by fielding a Near-Term Data Radio (NTDR). This radio will operate at tactical operations centers and will also provide a data communications capability while tactical operations centers are moving and Mobile Subscriber Equipment is being put in place. The first digitized division requires the fielding of 94 NTDRs. Since this radio is viewed as an interim radio, no additional procurement is planned beyond the first digitized division. It is expected that data radios needed after the first digitized division will be provided through the Department of Defense's Joint Tactical Radio System program. However, the Joint Tactical Radio System architecture development and validation is not expected until late this year and a decision on whether that program will proceed as a major defense acquisition program is not expected until fiscal year 2001.

To overcome the inherent limitations of land-based, line-of-sight communication systems, the Army will be fielding three satellite communication systems to the first digitized division. The first system is the GBS. It is a joint Air Force-Army program intended to provide all

[5]Packet switching is distinguished from message switching. Message switching involves the transmission of entire lengthy messages through the nodes of a network; packet switching involves the transmission of smaller message parts through the network. Packet switching has become the dominant technique for transmitting messages through a network. Please see Gary Dickson and Alan Lloyd, Open Systems Interconnection, Prentice Hall, 1992.

service users with a one-way, high-speed information flow of high-volume multi-media information such as imagery, maps, weather data, logistics, air tasking orders, and operational orders. The Air Force is the executive service for this program and has designated the Army responsible for the terminal portion of the program. The first digitized division requires one transmit terminal, called a Theater Injection Point terminal, and 27 Transportable Ground Receive Suite terminals.

The second satellite communication system is the Secure, Mobile, Antijam, Reliable Tactical Terminal (SMART-T). This system uses the evolving Milstar satellite constellation. Thus far, the system has achieved a low data rate capability. The next step is to achieve a medium data rate capability.[6] This medium data rate capability is considered critical for tactical users like the Army. The first medium data rate satellite is scheduled to be tested with an on-position satellite in March 2000. The Army requires 12 SMART-Ts for the first digitized division.

The third satellite communication system scheduled for fielding is an enhanced manpack terminal called Spitfire. These terminals provide communications through ultra-high frequency satellites and are also capable of line-of-sight terrestrial communications. While Spitfire is a mature system, enhancements are currently being made to make it more efficient. The first digitized division will require 67 Spitfire terminals.

The two systems that will support the management of tactical operations centers are the Integrated Systems Control (ISYSCON) and the Tactical Operations Center (TOC) systems. ISYSCON is a new system that is expected to provide signal operators an automated capability to manage the communications network. The first digitized division requires the fielding of one system with 8 to 10 remote terminals or workstations. The TOC program is intended to provide common operational and system architectures that can be tailored to meet the specific needs of commanders at different levels. The first digitized division requires 27 of the new “digitized” TOCs.

[6]Milstar's low data rate transmissions are at speeds of 75 to 2,400 bits per second. Milstar's medium data rate transmissions are at speeds ranging from 4,800 to 1,544,000 bits per second, thus significantly increasing the volume of data processed through the satellites.

FBCB2 and Its Two Supporting Communications Systems Extend Information Technology Beyond Tactical Operations Centers

When fielded, FBCB2 is expected to provide enhanced situational awareness to the lowest tactical level—the individual soldier—and a seamless flow of command and control information across the battlespace. As the principal command and control system for the Army at the brigade level and below, it is the linchpin of the future digital battlefield. FBCB2 will be composed of:

- a computer that can display a variety of information,[7] including a common picture of the battlefield overlaid with graphical depictions (icons) of friendly and enemy forces;
- software that automatically integrates Global Positioning System data, military intelligence data, combat identification data, and platform data (such as the status of fuel and ammunition); and
- interfaces to communications systems.

Battlefield data will be communicated to and received from users of FBCB2 through a "Tactical Internet." This is a radio network comprising the Enhanced Position Location Reporting System (EPLRS) and the Single Channel Ground and Airborne Radio System (SINCGARS). By connecting platforms through this Tactical Internet, data needed for battlefield situational awareness and command and control decisions can be made available to commanders at all levels of the Army Battle Command System.

Both EPLRS and SINCGARS have undergone recent improvements in support of the first digitized division. EPLRS has incorporated very high-speed integrated circuitry and an engineering change that has increased its data transmission rate. The SINCGARS system improvement program radio has provided enhanced data and voice communications, and allows SINCGARS to interface with EPLRS. An advanced SINCGARS system improvement radio enhances the synchronization capability in a package that is one-half the size and weight of the current SINCGARS system improvement radio. The first digitized division will require an estimated 1,300-1,400 EPLRS radios, an estimated 5,000 SINCGARS radios, and about 2,000 FBCB2 systems.

[7]Platforms such as the M1A2 Abrams tank with system enhancements and the M2A3 Bradley fighting vehicle, which already have an on-board data processing capability, will not require another computer. Instead, the FBCB2 "embedded battle command" software will be used to interface with existing software. Other platforms will require FBCB2 computers. In November 1997, the Army's acquisition objective was 2,604 embedded FBCB2 systems and 59,522 systems requiring computer installations.

Acquisition Status of High-Priority Systems Vary

Each of the high-priority systems is being acquired independently of each other. As a result, the acquisition status of each system varies. For example:

- The Army fielded MCS to III Corps test units in fiscal year 1996 with an earlier version of the software than will be used by the first digitized division. However, based on a recent initial operational test and evaluation, the Department of Defense (DOD) Director of Operational Test and Evaluation characterized the earlier software version as not being operationally effective or operationally suitable. As a result, a full-rate production decision was not authorized and limited production of MCS, sufficient to field the first digitized division and corps, is now being sought.
- Fielding of the FAADC2I with its first digitized division objective software and upgraded hardware was completed in fiscal year 1998.
- The contract for the first digitized division ATM switches was awarded in June 1998. Fielding is scheduled for March through June of 2000.

Although the high-priority systems are being acquired independently of each other, the Army is coordinating and synchronizing individual fielding schedules to enable it to meet its goal of fielding the first digitized division by December 2000. Appendix I describes the acquisition status of all 16 high-priority systems.

Performance Uncertainties Will Exist on Planned Fielding Date

There are four key performance uncertainties that the Army will confront when the first digitized division is fielded at the end of 2000. First, the operational effectiveness and suitability of FBCB2 will be unknown. This uncertainty will persist until the system's initial operational test and evaluation in November 2001. Second, between now and November 2001, nearly every other high-priority digitization system will be undergoing some type of operational evaluation. Since fielding of the first digitized division is scheduled to be completed by December 2000, individual system performance uncertainties will exist when the first digitized division is fielded. Third, the capability of automated sharing of Army Tactical Command and Control System data within tactical operations centers will not be conclusively demonstrated. Insight into the resolution of this issue is not likely to occur before April 2001 when a digitized brigade participates in an exercise at the National Training Center, Fort Irwin, California. Fourth, it will be uncertain whether digitization has achieved the expected

increases in lethality, survivability, and tempo of operations. This uncertainty is not likely to be resolved any earlier than fiscal year 2002.

Operational Test and Evaluation of FBCB2 Is the Most Critical Individual System Performance Event Scheduled

Given its importance to achieving the objectives of digitization, the initial operational test and evaluation of FBCB2 in November 2001 is the most critical operational event scheduled. This test will occur nearly a year after the first digitized division is fielded because of the Army's goal to equip the first digitized division by December 2000. The FBCB2 test event is also significant because the previous initial operational test and evaluation date of October 1999 was to have been the first opportunity to evaluate the performance of the NTDR, TOCs, and new versions of the EPLRS and SINCGARS radios. There may now be opportunities to evaluate the performance of these other systems during the FBCB2 force development test and evaluation in April 2000 as well as FBCB2 limited user tests and the division capstone exercises[8] conducted prior to November 2001. However, we believe these systems will not be exposed to the full rigor of operational testing until the FBCB2 initial operational test and evaluation itself. We believe the acquisition strategy of fielding FBCB2 before completing operational testing exposes the overall digitization initiative to greater risk. If the risk materializes into performance problems, costly fixes to FBCB2 may be required.[9] In addition, FBCB2 performance problems could result in continued uncertainties about expected increases in the lethality, survivability, and operational tempo of a digitized force.

The Army's digitization initiative has been driven by the expectation that information dominance and enhanced battle command capabilities will result in increases in lethality, survivability, and operational tempo across the force. The Army has tried to evaluate force effectiveness at several different times; however, the results have been inconclusive. The FBCB2 system evaluation plan acknowledged the need to evaluate force effectiveness, but proposed employing force-on-force modeling and simulation as a primary tool for the force effectiveness evaluation. After reviewing the FBCB2 system evaluation plan, the Director, Operational Test and Evaluation, expressed concerns about this approach as well as

[8]Division capstone exercises are training events for maneuver units. Under the restructured FBCB2 test program, there will be two division capstone exercises: the first at the National Training Center in April 2001 and the second at Fort Hood in October 2001.

[9]For examples of such systems, please see Weapons Acquisition: Low-Rate Initial Production Used to Buy Weapon Systems Prematurely (GAO/NSIAD-95-18, Nov. 21, 1994).

other aspects of the plan. His concerns were sufficiently serious to cause the Army to reevaluate its FBCB2 test and evaluation strategy, resulting in the revised strategy that postpones the initial operational test and evaluation event for 2 years.

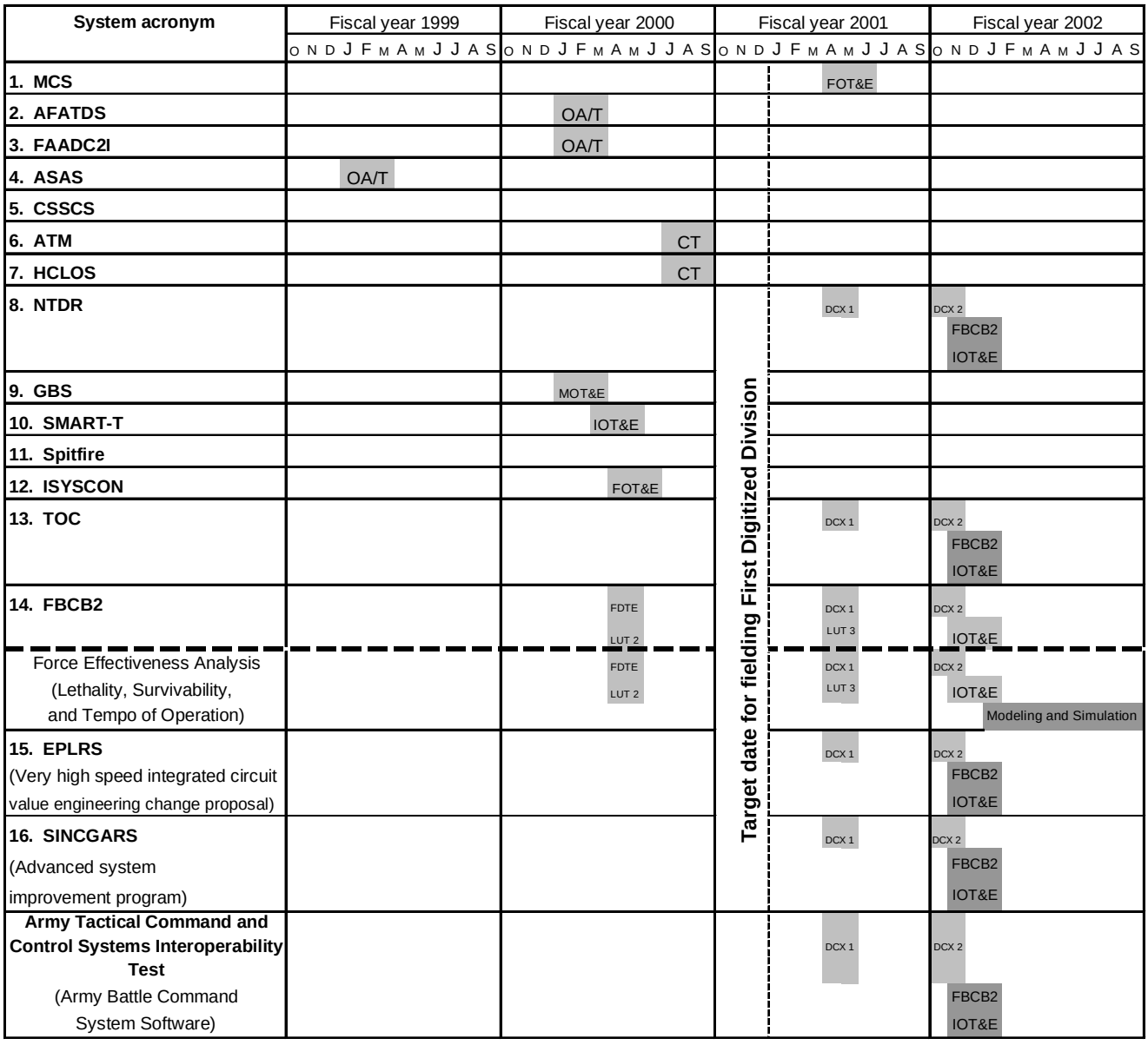
The Army considers increasing the functionality of its units as expeditiously as possible a top priority. However, as illustrated by its FBCB2 acquisition strategy, this high priority has translated into significant quantities of equipment being acquired and fielded before conclusive testing has been completed. The fiscal year 2000 budget submission requests $66.4 million to procure 1,640 FBCB2 units. The budget justification documentation also projects a request in fiscal year 2001 of $62.1 million to procure an additional 1,458 units. The total of the fiscal year 2000 budget request and the projected fiscal year 2001 budget request is $128.5 million for 3,098 units. While the 3,098 units account for only about 5 percent of the projected total Army buy of about 60,000 units, the justification[10] for the low-rate initial production is unclear at this time. Conditional approval for FBCB2 engineering and manufacturing occurred in July 1997 and included an approval for 3,000 low-rate initial production units, then identified as 10 percent of the total production quantity. However, the acquisition decision memorandum did not state the justification for the low-rate initial production approval. The justification should be clarified later this summer when an Army or Defense System Acquisition Review Council makes a decision on the revised FBCB2 acquisition strategy.

Other Individual High-Priority Systems Will Undergo Operational Testing During or After Fiscal Year 2000

In addition to the FBCB2 initial operational test and evaluation, other critical operational evaluations include the follow-on operational test and evaluation of MCS, the multi-service operational test and evaluation of GBS, the follow-on operational test and evaluation of the SMART-T, and the follow-on operational test and evaluation of ISYSCON. Figure 1 shows the planned evaluations of each of the 16 high-priority systems, as well as evaluations of Army Tactical Command and Control System interoperability and digitization force effectiveness.

[10]DOD Regulation 5000.2R states that low-rate initial production quantities shall be minimized. The regulation states that the objective of this activity is to produce the minimum quantity necessary to (1) provide production configured or representative articles for operational tests, (2) establish an initial production base for the system, and (3) permit an orderly increase in the production rate for the system. The regulation also notes that the low-rate initial production quantity shall be determined as part of the program's engineering and manufacturing development approval.

Figure 1: Testing Schedules of High Priority Systems



IOT&E	Initial Operational Test and Evaluation	CT	Customer Test
FOT&E	Follow-on Operational Test and Evaluation	LUT	Limited User Test
MOT&E	Multi-service Operational Test and Evaluation	DCX	Division Capstone Exercise
OA/T	Operational Assessment/Test		
FDT&E	Force Development Test and Evaluation		

In addition to the operational testing that will conclude after December 2000, the complete fielding of priority equipment to the 4th Infantry Division as well as new equipment training will remain unfinished in December 2000. Even if the FBCB2 low-rate initial production acquisition strategy is approved, not all 4th Infantry Division units will be fielded with high-priority systems by December 2000. The 4th infantry Division has three maneuver brigades and an aviation brigade; the 1st and 2nd maneuver brigades are located at Fort Hood, Texas, and the 3rd brigade is located at Fort Carson, Colorado. The digitization schedule calls for the 1st and 2nd brigades and the aviation brigade to be fielded by December 2000; the 3rd maneuver brigade will not be fielded until 2003 when the III Corps' 3rd Armored Cavalry Regiment, also located at Fort Carson, is fielded.

Officials from the 4th Infantry Division told us that the 1st and 2nd brigades would probably be "equipped" rather than "fielded" by December 2000, the distinction being that fielding includes new equipment training. Although it is not certain when FBCB2 new equipment training will be completed for the 1st and 2nd brigades, it will probably be some time after December 2000.

Army Tactical Command and Control System Interoperability Test Has Been Rescheduled to Fiscal Year 2001

Thus far, even with the introduction of new software versions for individual systems, the Army has been unable to exploit the full potential of the Army Tactical Command and Control System because component systems cannot be automatically updated when a change is made to an individual component system's database. The component systems have achieved some degree of success by sharing the same functional data "vertically" at different command levels, but the long sought-after capability to share data "horizontally" across functional areas within the same command level has not yet been achieved. The updates are accomplished either through manual inputs to other related databases or through an electronic message to those databases. For example, if the MCS database is changed to show a new position location of friendly forces, that change would have to be manually entered or changed through a message to the AFATDS or FAADC2I databases. In addition, it presently takes 12 to 15 weeks and requires the assistance of civilian engineers to establish each component system's original database. The Army intends to resolve these database issues with the development and fielding of a software package called Army Battle Command System software.

The Army planned to test the Army Battle Command System software at the FBCB2 initial operational test and evaluation event. The ability of FBCB2 data to be integrated into the Army Tactical Command and Control

System component systems was also to have been tested. As a result of the restructuring of the FBCB2 testing program, version 6.2 of the Army Battle Command System software will undergo an operational evaluation during the division capstone exercise scheduled for April 2001 at the National Training Center. Additional operational evaluations will probably be conducted during another division capstone exercise scheduled for Fort Hood, Texas, in October 2001 and the rescheduled FBCB2 initial operational test and evaluation, also scheduled for Fort Hood, in November 2001.

Force Effectiveness Determination May Not Be Known Before Fiscal Year 2002

After the Task Force XXI Advanced Warfighting Experiment in March 1997, which culminated in a brigade-size experimental force engaging an opposing force at the National Training Center,[11] officials at the Army Operational Test and Evaluation Command concluded that they could not identify any significant increase in force effectiveness over baseline units that had also engaged the opposing force at the National Training Center. The Training and Doctrine Command's Analysis Center at White Sands Missile Range, New Mexico, used the data collected during the Advanced Warfighting Experiment to model the performance of the experimental force assuming that the experimental force had relied more heavily on the data and information available to it through digitized systems. The Training and Doctrine Command analysts concluded that the modeling showed increased force effectiveness. The Training and Doctrine Command's Analysis Center at Fort Leavenworth, Kansas, analyzed the results of a Division Advance Warfighting Experiment in November 1997 and concluded that the experimental force was more lethal, survivable, sustainable, and able to better control tempo than a non-digitized force. However, the experiment was a simulation-driven command post exercise without maneuver units in the field. In our opinion, the efforts thus far designed to measure force effectiveness have produced inconclusive results with maneuver units in the field showing no significant increase in lethality, survivability, and operational tempo while modeling and simulation do show increases.

The 4th Infantry Division's brigade-size exercise at the National Training Center during the third quarter of fiscal year 2001 is described as a division

[11]To explore the FBCB2 concept, the Army acquired and installed sufficient quantities of equipment to field a brigade-size experimental force in June 1996. The experimental force then used FBCB2 prototype equipment in an Advanced Warfighting Experiment, which culminated in March 1997 during a 2-week deployment to the National Training Center.

capstone exercise and is expected to be a rich source of data for determining force effectiveness. The Army expects that the data derived from a maneuver brigade engaging an opposing force coupled with modeling and simulations will provide insight into digitization's expected increases in lethality, survivability, and tempo of operations. While some early analysis can be expected within 120 days after the conclusion of the exercise, we believe the length of time needed to analyze all the exercise data and complete the required modeling and simulations will likely result in conclusive force effectiveness determinations no sooner than fiscal year 2002. This means that if current procurement plans proceed, the Army will have obligated $128.5 million in fiscal year 2000 and 2001 FBCB2 appropriations to buy and install about two-thirds of the systems needed for the first digitized corps without such conclusive determinations.

Conclusions

Based on the acquisition status of the designated high-priority systems, the Army will consider the 4th Infantry Division as digitized by December 2000. However, there will be limitations to this first digitized division. Specifically, (a) not all 4th Infantry Division units will be equipped or trained by December 2000 and (b) the performance of many individual systems, particularly FBCB2, delivered to 4th Infantry Division units will be uncertain until the completion of their respective operational tests and evaluations. Therefore, while the Army will have outfitted a digitized division, its operational capability will not have been demonstrated. Furthermore, even if all individual system operational testing is successful, uncertainty about system interoperability and the overarching force effectiveness issues of increased lethality, survivability, and operational tempo will persist. Resolution of these issues will require time, perhaps as much as 2 or 3 years. Between now and then, the Army will be seeking funding to continue acquisition and fielding to its second digitized division and eventually its first digitized corps.

Balancing the competing demands of multiple acquisitions based on operational test results and the objective of increasing the functionality of Army units as expeditiously as possible poses a significant challenge for Army acquisition executives. Because of the high priority the Army places on digitization, significant quantities of individual systems such as FBCB2 are being procured prior to conclusive testing. We believe that such an acquisition strategy is highly risky. Furthermore, in our view, the resolution of performance uncertainties should be a key determinant in the pace of fielding throughout III Corps and the Army. Unless it develops a plan defining when and how the first digitized division will validate that

digitization has enabled the high-priority systems to interoperate effectively and enable increases in lethality, survivability, and tempo of operations, the Army runs the risk of fielding unproven systems beyond the three brigades of the 4th Infantry Division.

Recommendations

To optimize the multi-billion dollar investment needed to digitize all Army units, we recommend that the Secretary of Defense direct the Army to:

- Establish schedules and procurement quantities that minimize the risks associated with fielding FBCB2 without the benefits of operational testing by seizing on the opportunity provided by the current reassessment of the FBCB2 acquisition strategy.
- Develop a plan defining when and how the first digitized division will validate that digitization has enabled the high-priority systems to interoperate effectively so that expected increases in lethality, survivability, and tempo of operations have been achieved. The plan should provide for validation to be completed before digitization is extended to units beyond the first digitized division.

Agency Comments

In commenting on a draft of this report, DOD did not agree nor disagree with our recommendations. In its response, DOD made two points. First, DOD indicated that Overarching Integrated Product Teams—chaired by high-level DOD officials—are addressing the issues discussed in our report and that a Defense Acquisition Executive review of the FBCB2 program should be conducted during August 1999. The review, DOD stated, will include the acquisition strategy, cost, testing approach, spiral requirements and acquisition approaches, low-rate initial production approval request, and a determination of the appropriate acquisition category. Second, DOD stated that the Army's master schedule of tests and exercises will provide intermediate confirmation of interoperability and performance and that the FBCB2 initial operational test and evaluation is the culmination of the test and exercise process that includes the high-priority systems addressed in our report. DOD also stated that the Office of the Secretary of Defense will continue to perform its oversight function of Army digitization by maintaining test oversight and improved reporting on the progress of digitization.

While it appears that many critical FBCB2 issues will be addressed at the Defense Acquisition Executive review, we remain concerned about the

number of FBCB2 units that will be acquired before a determination is made in fiscal year 2002 of the system's operational effectiveness and suitability. We remain equally concerned about the quantities of other high-priority systems that will be acquired through fiscal year 2002, before the completion of the digitization test and exercise process. We continue to believe that until the Army validates that digitization has achieved increases in lethality, survivability, and tempo of operations, there is a high risk of fielding unproven systems beyond the first digitized division.

DOD's comments are reprinted in their entirety in appendix II, along with our evaluation. In addition, DOD provided technical comments that have been incorporated, as appropriate, in the report.

Scope and Methodology

To identify the high-priority systems being acquired to accomplish the digitization fielding goal and determine the acquisition status of each system, we reviewed the objectives of the Army XXI and Army After Next initiatives, the fielding plans for the 4th Infantry Division, and individual system cost, schedule, and performance data. We obtained briefings from program managers, testers, and users. We also analyzed the acquisition strategy of each high-priority program, critical program milestones, and the relationship between critical program milestones and fielding plans for the first digitized division. Our designation of high-priority systems was established in the following manner. During the course of our review different Army organizations identified 15 to 19 systems as high-priority systems. For example, when we met with Training and Doctrine Command officials in November 1998, they identified 17 priority one systems. One of those systems, Digital Topographic Support System, was not identified as a priority one system by other Army organizations. The 16 systems presented in this report represent a consensus of what systems were characterized as high-priority as of November 1998.

To identify any performance uncertainties that could confront the Army when its first digitized division is fielded, we reviewed the test and evaluation schedules of each high-priority system. We then compared these schedules with the fielding schedule for the first digitized division. We also analyzed the revised FBCB2 schedule, including test events and production decisions, regulatory criteria for low-rate initial production decisions, and 4th Infantry Division personnel and organizational changes that could impact test and fielding plans. We also reviewed the overall objectives of the FBCB2 initial operational test and evaluation event, including Army Tactical Command and Control System interoperability

objectives, and plans to use new and upgraded versions of communication equipment, weapons platforms, including Abrams tanks and Bradley Fighting Vehicles with FBCB2 embedded battle command software, and tactical operations centers during the test. We reviewed Army evaluations that have studied digitized force increases in lethality, survivability, and operational tempo, and plans to conduct future evaluations, including those contained in the final draft of the FBCB2 system evaluation plan.

In the course of our work, we interviewed program officials and examined program management and budget documents, system requirements, test plans, acquisition plans, and other program documentation. We performed our work primarily at the Army Digitization Office, Arlington, Virginia, and the Army Communications and Electronics Command, Fort Monmouth, New Jersey. We also gathered data from the Director, Operational Test and Evaluation, Arlington, Virginia; Army Training and Doctrine Command, Norfolk, Virginia; Army Operational Test and Evaluation Command, Alexandria, Virginia; the 4th Infantry Division, Fort Hood, Texas; and the Army Signal Center, Fort Gordon, Georgia.

We performed our review from September 1998 to July 1999 in accordance with generally accepted government auditing standards.

We are sending copies of this report to Representative John P. Murtha, Ranking Minority Member of the Subcommittee; Representative C.W. Bill Young, Chairman, and Representative David R. Obey, Ranking Minority Member, House Committee on Appropriations; and other interested congressional committees. We are also sending copies of this report to the Honorable William S. Cohen, Secretary of Defense; the Honorable Louis Caldera, Secretary of the Army; and General James L. Jones, Commandant of the Marine Corps. Copies will also be made available to others upon request.

Please contact me at (202) 512-4841 if you or your staff have any questions concerning this report. Key contacts and major contributors to this report are listed in appendix III.

Sincerely yours,

Allen Li
Associate Director,
Defense Acquisitions Issues

Contents

Abbreviations

AFATDS	Advanced Field Artillery Tactical Data System
ASAS	All Source Analysis System
ATM	Asynchronous Transfer Mode
CSSCS	Combat Service Support Control System
DOD	Department of Defense
EPLRS	Enhanced Position Location Reporting System
FAADC2I	Forward Area Air Defense Command, Control, and Intelligence
FBCB2	Force XXI Battle Command, Brigade and Below
GBS	Global Broadcast Service
HCLOS	High-Capacity Line-of-Sight
ISYSCON	Integrated Systems Control
MCS	Maneuver Control System
NTDR	Near-Term Data Radio
SINCGARS	Single Channel Ground and Airborne Radio System
SMART-T	Secure, Mobile, Anti-jam, Reliable Tactical Terminal
TOC	Tactical Operating Center

Summary of Acquisition Status of High-Priority Digitization Systems

System	Acquisition status
MCS	The Army fielded MCS with a software version called Block III to III Corps test units in fiscal year 1996 and planned to field a Block IV software version to the first digitized division in fiscal year 2000. However, the results of a recent initial operational test evaluation with the Block III software did not permit the Army to proceed to full-rate production. The Army is currently requesting authorization to proceed with a limited production of MCS sufficient to field the first digitized division and corps, using the Block IV software.
AFATDS	The software versions of AFATDS are designated by year. The Army fielded AFATDS 95 to the 4th Infantry Division in fiscal year 1996 and the system achieved an initial operational capability in January 1997. Annual software versions have been fielded to the 4th Infantry Division and the objective first digitized division software fielding is AFATDS 99. In addition, the 4th Infantry Division's AFATDS hardware is scheduled for upgrade during fiscal year 1999.
FAADC2I	Fielding of the FAADC2I with its first digitized division objective software and upgraded hardware was completed in fiscal year 1998.
ASAS	The ASAS has two main components: a Remote Workstation and an Analysis Control Element. The first digitized division requires Remote Workstations and the Army is currently completing operational testing of these workstations. The Army plans to field the Remote Workstation to the 4th Infantry Division during fiscal year 2000. While the Analysis Control Element is not required for the first digitized division, its operational testing is scheduled for fiscal year 2000.
CSSCS	The Army fielded CSSCS to the 4th Infantry Division in fiscal year 1996 and received approval for low-rate initial production in fiscal year 1998. The program has a new software release planned for fiscal year 1999. The 1999 release, version 4.1, is scheduled for fielding to the first digitized division.
ATM	The contract for the first digitized division ATM switches was awarded in June 1998. Fielding is scheduled for March through June of 2000.
HCLOS	The contract for the first digitized division HCLOS radios was awarded in June 1998. Fielding is scheduled for April 2000.
NTDR	The contract option for 174 NTDR radios was awarded in fiscal year 1998. Deliveries, including the 94 radios for the first digitized division, are expected in fiscal year 2000.
GBS	The delivery of the GBS Transportable Ground Receive Suite terminals was delayed because the contractor's initial design required too many terminal transit cases. The initial design, which required 10 to 14 transit cases, was considered operationally unsuitable. A redesign has resulted in the number of transit cases being reduced to six for the standard configuration and seven for the extended configuration. While there will be a delay in the delivery of the terminals, the fielding to the first digitized division is still expected to be completed during 2000.
SMART-T	Currently, there are two Milstar satellite designs: the low data rate version called Milstar I and the medium data rate version called Milstar II. Through 2006, the Milstar constellation will consist of two Milstar I satellites, which were launched in 1994 and 1995, and four Milstar II satellites, which are being launched from fiscal years 1999 through 2002.[1] The Army needs a medium data rate capability for the first digitized division. As a part of the approved SMART-T acquisition strategy, the Army is fielding SMART-Ts to the 4th Infantry Division in fiscal year 1999 so that they will be available when the first Milstar II satellite becomes operational.
Spitfire	The Army awarded the Spitfire production contract in 1994 and will have fielded about 50 percent of its planned 2,402 units throughout the Army by the end of fiscal year 1999. The first digitized division units are scheduled for fielding in fiscal year 2000.
ISYSCON	The Army awarded the ISYSCON development contract in 1992 and plans to field a software version 1 to the first digitized division in April 2000. However, a 1998 initial operational test and evaluation identified three significant problems: network planning, spectrum management, and network monitoring. The system was retested at the start of fiscal year 1999 and, while some deficiencies persisted, the system was approved for full-rate production in March. The Army plans to begin ISYSCON fielding in fiscal year 2000.

System	Acquisition status
TOC	The Army awarded its TOC hardware integration contract in February 1999. However, a competing contractor protested the selection. The protest resulted in a stop work order to the winning contractor in March. The program management office is currently assessing the impact of the stop work order on the digitization schedule.
FBCB2	The acquisition status of FBCB2 has changed significantly. The system's initial operational test and evaluation, originally scheduled for October 1999, has been postponed until November 2001. Despite the test restructuring, the Army still plans to start FBCB2 production in order to field the first digitized division by December 2000. This procurement was projected in last year's budget request, but was to have been made as a full-rate production decision after the October 1999 FBCB2 initial operational test and evaluation. Now, the Army plans to proceed with low-rate initial production of 5,100 systems over a three-year period. Approval of this acquisition strategy is expected in August 1999. The low-rate initial production phase decision is expected prior to the completion of the FBCB2 initial operational test and evaluation.
EPLRS (Very High Speed integrated circuit, value engineering change proposal)	The EPLRS began full-rate production in fiscal year 1997. About 450 units have been fielded to the 4th Infantry Division and the balance is scheduled for fielding between March 1999 and July 2000. While there are no further operational tests of the EPLRS planned, additional testing of the EPLRS is planned as part of the FBCB2 initial operational test and evaluation.
SINCGARS (Advanced system improvement program)	The SINCGARS is in its twelfth year of production, with over 165,000 radios fielded to date. The advanced system improvement program SINCGARS is scheduled to be fielded to the 4th Infantry Division by December 1999. The advanced system improvement program SINCGARS is scheduled for a customer test with the 82nd Airborne Division in fiscal year 1999 and, like EPLRS, will be evaluated as part of the FBCB2 initial operational test and evaluation.

[1]For additional information on the Milstar program, please see our November 1998 report, Military Satellite Communications: Concerns With Milstar's Support to Strategic and Tactical Forces (GAO/NSIAD-99-2, Nov. 10, 1998).

Comments From the Department of Defense

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

COMMAND, CONTROL, COMMUNICATIONS, AND INTELLIGENCE

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
6000 DEFENSE PENTAGON
WASHINGTON, DC 20301-6000

July 12, 1999

Mr. Allen Li
Associate Director, Defense
Acquisition Issues
National Security and
International Affairs Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Li:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "BATTLEFIELD AUTOMATION Performance Uncertainties Are Likely When Army Fields Its First Digitized Division," dated May 27, 1999 (GAO Code 707377/OSD Case 1832).

See comments 1 and 2.

The DoD has been exercising its oversight responsibilities of the Army's digitization efforts since its very inception. To reinforce this oversight, the Department established reviews by the Overarching Integrated Product Teams (OIPT) for both the Maneuver Control System (MCS) and Force XXI Battle Command Brigade and Below (FBCB2), which are directly involved in the issues identified in your report--none of which are new. All have been a significant part of various discussions associated with the OIPTs. We have also initiated Quarterly Army Tactical Command and Control System (ATCCS) Integrated Summary reporting which is aimed at providing information to OSD at the system-of-systems level of those systems, processes, and events that are vital to successful fielding and testing of the First Digitized Division (FDD). Specific comments to the GAO recommendations are enclosed. Additional technical corrections were provided separately to the GAO staff.

The Department is fully supportive of the Army's digitization efforts as they are a major contributor to achieving Joint Vision 2010. Our OIPT process has been successful in the past in resolving similar issues.

The DoD appreciates the opportunity to comment on the GAO draft report.

Sincerely,

Arthur L. Money
Senior Civilian Official

Enclosure

GAO DRAFT REPORT DATED MAY 27, 1999
(GAO CODE 707377) (OSD CASE 1832)

"BATTLEFIELD AUTOMATION: PERFORMANCE UNCERTAINTIES ARE LIKELY WHEN ARMY FIELDS ITS FIRST DIGITIZED DIVISION"

DEPARTMENT OF DEFENSE COMMENTS TO THE GAO RECOMMENDATIONS

Now on p.16.

RECOMMENDATION 1: The GAO recommended that the Secretary of Defense direct the Army to establish schedules and procurement quantities that minimize the risks associated with fielding Force XXI Battle Command, Brigade and Below (FBCB2) without the benefits of operational testing by seizing on the opportunity provided by the current reassessment of the FBCB2 acquisition strategy. (p. 21/GAO Draft Report)

See comment 1.

DOD RESPONSE: The Under Secretary of Defense for Acquisition and Technology (USD(A&T)), through the Director of Strategic and Tactical Systems, and the Assistant Secretary of Defense for Command, Control, Communications and Intelligence (ASD(C3I)), through the Deputy Assistant Secretary of Defense for Command, Control, Communications Intelligence, Surveillance, Reconnaissance & Space (DASD(C3ISR& Space)) have co-chaired the Overarching Integrated Product Team (OIPT) for FBCB2. This OIPT addressed the issues discussed in the GAO report. The Low Rate of Initial Production (LRIP) was addressed and included a detailed justification. The OIPT agreed that a Defense Acquisition Executive (DAE) review should be conducted during August 1999. The review will include the acquisition strategy, cost, testing approach, spiral requirements and acquisitions approaches, LRIP approval request and determination of appropriate ACAT I subcategory (C or D). Several working-level IPT meetings have been held and are planned to clarify and seek resolution of the issues. The testing of FBCB2 is a major issue being addressed at each OIPT.

Now on p.16.

RECOMMENDATION 2: The GAO recommended that the Secretary of Defense direct the Army to develop a plan defining when and how the first digitized division will validate that digitization has enabled the high-priority systems to interoperate effectively so that expected increases in lethality, survivability, and tempo of operations have been achieved. The plan should provide for validation to be completed before digitization is extended to units beyond the first digitized division. (p. 21/GAO Draft Report)

See comment 2.

DOD RESPONSE: The Army has established a master First Digital Division (FDD) schedule that implements the high priority systems in the FDD. This schedule includes comprehensive test and exercise program that provides the first opportunity to demonstrate and validate the benefits of digitization with an adequately equipped division size force in an operational environment. These events will provide intermediate confirmation of interoperability and performance. An important aspect of this schedule is that it also provides for continuing

assessment and validation of the impact of digitization on Army Tactics, Techniques and Procedures (TTPs). This is crucial to the realization of the benefits of digitization. The FBCB2 IOT&E is the culmination of the test and exercise process that includes the high priority systems addressed in the report. OSD will continue to perform its oversight function of Army digitization by maintaining test oversight and improved reporting on the digitization progress through the Quarterly ATCCS Integrated Summary. MCS and FBCB2 are currently and will continue to be addressed by OIPTs until OSD is satisfied that the OIPTs are no longer necessary.

The following are GAO's comments on the Department of Defense's (DOD) letter dated July 12, 1999.

GAO Comments

1. We believe that DOD's review by the Integrated Product Team should also include the analysis included in this report.

2. We believe that specificity and timeliness is critical to the overall evaluation process. The Army has framed its digitization expectations in the form of a hypothesis that, if within a digitized force different technologies and doctrine are properly integrated across the force, then increases in lethality, survivability, and tempo will be gained across the force. That hypothesis still needs to be proven. We recognize that proving the hypothesis involves both objective and subjective dimensions. As we recommended to the Secretary of Defense, the Army should specify how it intends to prove the hypothesis and build a consensus on an accepted methodology among material developers, users, testers, those providing oversight within DOD, and congressional decision-makers. Without an accepted methodology, questions on the benefits of digitization will persist. These questions, left unanswered, could weaken efforts to provide potentially beneficial systems to soldiers as expeditiously as possible.

GAO Contacts and Staff Acknowledgments

GAO Contact

Charles F. Rey (202) 512-4174

Acknowledgments

In addition to the name above, Robert J. Dziekiewicz, Christopher P. Galvin, Subrata Ghoshroy, and Paul G. Williams made key contributions to this report.

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