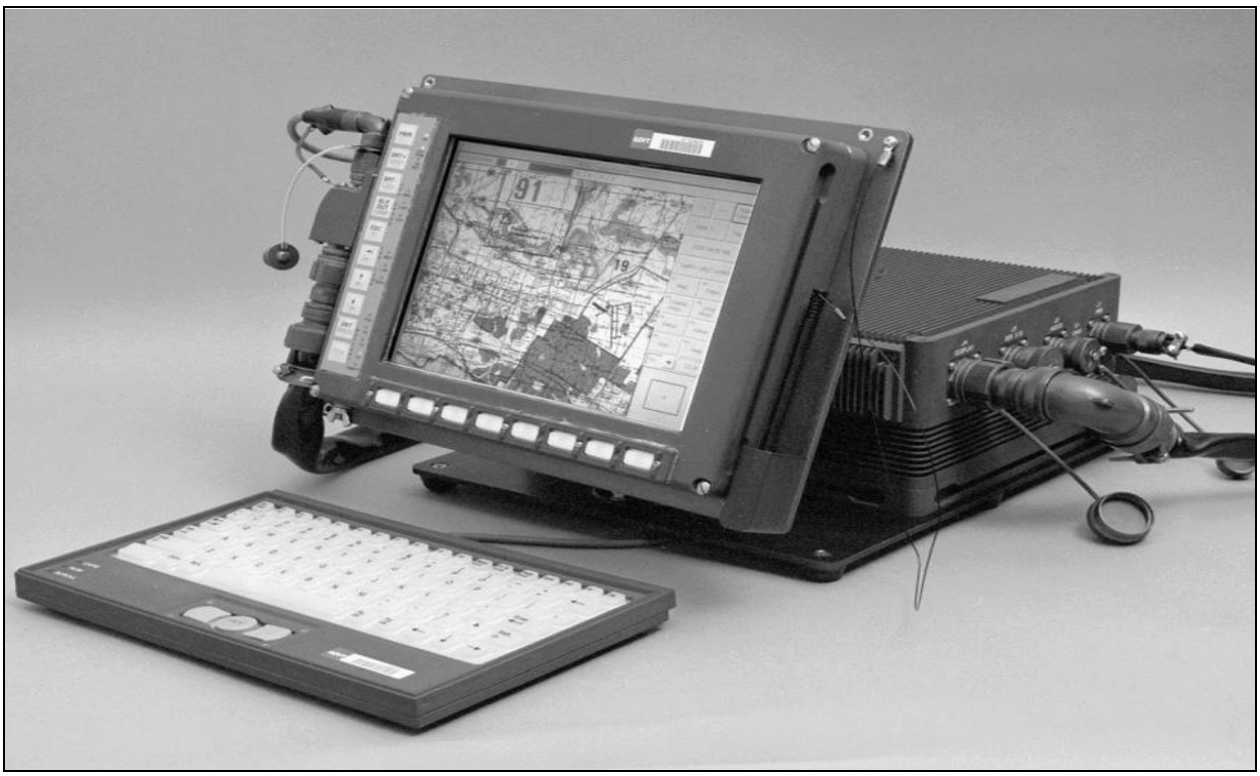
FORCE XXI BATTLE COMMAND, BRIGADE AND BELOW (FBCB2)



Army ACAT ID Program		**Prime Contractor**
Total Number of Systems:	59,522	TRW
Total Program Cost (TY$):	$1.8B	
Average Unit Cost (TY$):	$27K	
Full-rate production:	FY02	

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2020

Two important components of the Army's Battle Command System and the Battlefield Digitization effort are the Force XXI Battle Command, Brigade and Below (FBCB2) program and its supporting Tactical Internet. FBCB2 is a digital, battle command information system intended to provide commanders, leaders, and soldiers—from brigade to individual soldier, and across all the Battlefield Functional Areas—improved command and control and enhanced situational awareness information. FBCB2 primarily consists of software, but will also include a ruggedized computer for those users and platforms without an existing computer system. Systems with existing computers capable of hosting FBCB2 software will receive the Embedded Battle Command software—a sub-set of FBCB2—and additional hardware as necessary. Embedded systems for the near term include the M2A3 Bradley Fighting Vehicle, the M1A2 SEP ABRAMS Tank, and the Army Tactical Command and Control Systems (ATCCS).

FBCB2's primary functions are to send and receive automatic position location reports derived from its interface with the Global Positioning System, and to send and receive command and control

message traffic via digital over-the-air radio transmissions. The Tactical Internet is the network of radios and routers that provide linkages to connect the myriad FBCB2 platforms (both vertically and horizontally) across the combined arms force. The Tactical Internet consists of the Enhanced Position Location Reporting System, the Single-Channel Ground and Airborne Radio System, and the Internet Controller router.

FBCB2 and the Tactical Internet perform as a network within brigade-sized and smaller units. At the Brigade and Battalion Tactical Operations Centers, the Tactical Internet interfaces with ATCCS, an Ethernet-based local area network of computers representing the functional areas of intelligence, maneuver, air defense, combat service support, and fire support. This interface permits information collected and disseminated via ATCCS systems to be rapidly passed through the Tactical Internet to FBCB2 computers. Likewise, the position reports of individual and unit locations are passed upwards through the FBCB2 and Tactical Internet into the ATCCS system for dissemination throughout the force. The FBCB2 and Tactical Internet help provide ***information superiority*** to the ***dominant maneuver force***. The basis for the new operational concepts in ***Joint Vision 2020*** is improved command and control.

BACKGROUND INFORMATION

The Army initiated the Force XXI Battlefield Digitization program in 1994, with the intent to proliferate and integrate digital communications and information management technologies across the combined arms spectrum. The Army's efforts have been demonstrated in a series of Advanced Warfighting Experiments (AWEs). The central hypothesis throughout Digitization experimentation has been**: "If information age, battle command capabilities and connectivity exist across all battlefield operating systems, then increases in lethality, survivability, and op tempo will be achieved**." The first AWE to examine FBCB2 was Task Force XXI, conducted June 1996-March 1997, with the culminating event at the National Training Center.

The Task Force XXI AWE equipped a brigade from the 4th Infantry Division with FBCB2 (Appliqué) hardware and software on all of its 1,600-plus vehicles. The brigade trained with the new digital equipment, among dozens of other initiatives, for about eight months, then deployed to the National Training Center for a series of force-on-force battles with a live opposing force. Due to immaturity of the FBCB2 and Tactical Internet, the degree of digital connectivity achieved during the Task Force XXI AWE was not sufficient to achieve the premise of the central hypothesis and not suitable for tactical operations. The immaturity also impacted the training readiness of the unit and development of Digital Tactics, Techniques, and Procedures (TTPs). In spite of these challenges, the digitized brigade performed similarly to the non-digitized baseline brigades at the National Training Center, a result that, with follow-on constructive modeling, the Army used to support continued program acceleration.

A conditional Milestone I/II decision for FBCB2 was made in July 1997, pending completion and approval of the FBCB2 TEMP and ORD. The Joint Requirements Oversight Council approved the ORD in August 1998, but the TEMP was not approved by OSD until December 1999. The Army Milestone Decision Authority (the Program Executive Officer) directed that FBCB2 transition from an Acquisition Category (ACAT) III program to ACAT II at the July 1997 review. In spring 1999, when the ACAT I dollar threshold was exceeded, the Army Acquisition Executive recommended that FBCB2 be re-designated as an ACAT IC. In September 1999, the Defense Acquisition Executive determined that the programmatic challenges of FBCB2 warranted its designation as an ACAT ID program.

The most recent operational testing of FBCB2 and the Tactical Internet was conducted in FY98. Limited User Test (LUT)-1 was conducted at Ft. Hood with a Battalion Task Force of 232 platforms equipped with FBCB2. An opposition force was included to operationally stress the unit's employment of FBCB2, and passive electronic warfare monitoring was conducted. FBCB2 software tested during LUT-1 lacked several critical capabilities called for in the ORD requirement, and as a result of poor quality control during computer hardware assembly, many heat-related failures were experienced. Nonetheless, FBCB2 system performance during LUT-1 represented a significant improvement over that observed during the Task Force XXI AWE. The friendly situational awareness information provided by FBCB2 and the new Tactical Internet architecture was generally accurate and timely, and the improved system stability permitted soldiers to employ FBCB2 information during the execution of their missions. The stability also permitted the test unit to achieve a higher state of training than the Task Force XXI unit, and furthered the refinement of Digital TTPs.

A Reliability Demonstration Test (RDT) was conducted from June-July 1999 to demonstrate that commercially available technology and improved quality control in the manufacturing process could alleviate a large percentage of heat-related hardware failures experienced during LUT-1. A large increase in the number of hours between essential function failure was observed at the RDT when compared to LUT-1 results, but a comparable demonstration during an OT is required to determine that the improved performance can be reproduced in the operational environment when employed by soldiers. In addition to improved quality control, a re-configuration of the FBCB2 computer's internal components is planned to improve the heat transfer away from heat-sensitive components. It should also be noted that the RDT results did not factor in failures of non-FBCB2 equipment critical for FBCB2 to be effective, and that there is currently no system-of systems reliability requirement for FBCB2.

The first briefing of the SEP by the Army in December 1998 resulted in DOT&E rejection of the plan due to shortfalls that would preclude FBCB2 from being adequately tested. As outlined in a December 22, 1998 DOT&E memorandum, FBCB2 testing must be conducted in an operational system-of-systems environment with live force-on-force events comparable to an analog baseline supporting the force-effectiveness evaluation. In June 1999, the Army proposed a restructured FBCB2 Program with heavy system-of-system digitization emphasis. The revised T&E strategy included a force effectiveness evaluation at the National Training Center, (LUT-3), with three baseline events identified for comparison. The revised strategy also added 25 months to the schedule to ensure appropriate hardware and software maturity prior to IOT&E. The revised strategy was favorably received by DOT&E.

As the FBCB2 program was restructured, there was increased emphasis on the role of the Army Battle Command System (ABCS) hardware and software. Under the revised architecture, FBCB2 hardware will not be present in Tactical Operations Centers: situation awareness information will be processed by Embedded Battle Command software, and command and control functions (messages, orders, overlays, etc.) will be performed by ABCS software, both hosted on ATCCS workstations. Therefore, any testing that includes units above the company level must include ATCCS systems and requisite interoperability between FBCB2 and ABCS software. This resulted in the requirements that spiral development of FBCB2 must coincide with the multiple spiral developments of all the Battlefield Digitization programs, an enormous challenge for configuration management of software, testing, evaluation, and acquisition reform.

TEST & EVALUATION ACTIVITY

Scheduled FBCB2 testing in FY00 included Field Test-2 (a developmental test) and a combined LUT-2/Force Development Test and Experiment, where performance of FBCB2 and ABCS systems were

to be examined and critical tactics, techniques, and procedures for the Digital Battlefield were to be validated. As a result of immature ABCS software, the field test was repeatedly slipped and conducted without meeting entrance criteria over three phases from December 1999-March 2000. The Army downgraded LUT-2 to a Customer Test (CT) when it became clear that LUT-2 entrance criteria could not be achieved; and CT was conducted in April 2000. Although not technically an operational test, the CT was essentially the same test as planned when designated a LUT-2, at approximately the same cost. For the remainder of FY00, the FBCB2 T&E Strategy was under revision, and the Army attempted to preserve the approved TEMP. The Army was not able to accomplish LUT-2 objectives before October 2000, when the next phase of testing was scheduled to begin, so a new TEMP is now required.

The latest draft strategy for FBCB2 has Field Test-3 scheduled to begin in January 2001, and this field test may be followed by LUT-2 in April 2001 (at the National Training Center) in conjunction with the Division Capstone Exercise. Later in FY01, production-representative systems are scheduled for examination in Field Test-4 to determine their readiness for FBCB2 IOT&E in November 2001.

TEST & EVALUATION ASSESSMENT

The most recent information regarding FBCB2 operational performance is based on the LUT-1 conducted in August 1998 and April 2000 CT. Significant improvements over the Task Force XXI AWE results were demonstrated at LUT-1, albeit with smaller networks: command and control message completion rates increased from approximately 30 to 80 percent, and speed-of-service was improved from approximately 3 minutes to less than 4 seconds. Situational awareness message completion rates rose from 25 percent to nearly 65 percent, and speed-of-service decreased from approximately 1 minute to less than 8 seconds. Qualitative information indicated that the use of FBCB2 assisted commanders in control of maneuver and synchronization of combat power. An example of this occurred during LUT-1, when two companies successfully performed a passage of lines over difficult terrain, a feat that the battalion commander stated he would not have attempted without FBCB2. Other observations indicate that situation awareness provided by FBCB2 permits commanders to focus more of their time on actually commanding, as less time is required to track positions and movement.

Performance at the FBCB2 CT was similar to that of LUT-1 for command and control and situation awareness message completion rates—a positive indicator as the CT employed two battalion task forces and two brigade headquarters as compared to one of each for LUT-1. However, the speed of service degraded to 30 to 60 seconds for friendly situation awareness messages. These results leave open the question of "scalability," or whether the Tactical Internet will be able to support the greater demands of division-sized network. ABCS functionality that was immature and lacked stability during Field Test-2 proved ineffective at developing and disseminating operational orders and overlays during CT, hindering the attainment of the Common Tactical Picture and prosecution of the maneuver battle.

As we stated in last year's Annual Report, current FBCB2 capabilities are immature, with a number of critical enhancements needed to achieve an effective and suitable capability. These enhancements include a robust network management capability to monitor the network's health and respond to identified problems, interoperability with Army Tactical Command and Control Systems, and rapid re-establishment of the network when communication/combat losses occur or a task organization change is required. Digital Tactics, Techniques, and Procedures will also be critical to the success of a digitized force, and at this time remain poorly developed to take optimum advantage of existing digital capabilities.

We remain concerned that the pressure to achieve the Army's goal of First Digitized Division by the end of 2000—and the Division Capstone Exercise in April 2001—may result in expediencies that are not in the best long-term interest of the Battlefield Digitization effort. This occurred during the FY00 test schedule when the delivery of required functionality did not occur in time to adequately conduct preliminary risk-reduction or training events, yet scheduled testing was still conducted. Although the Army may state that "Go To War" capability exists at the conclusion of the Division Capstone Exercise, DOT&E will only consider FBCB2 operationally effective and suitable when it provides enhanced military capability in the non-benign, system-of-systems environment across the array of climates and scenarios. There is significant potential for FBCB2 to contribute to improved unit performance on the Digital Battlefield, wherever that may be, but this will only be realized through disciplined development, experimentation, testing, and performance evaluation across all appropriate employment scenarios.