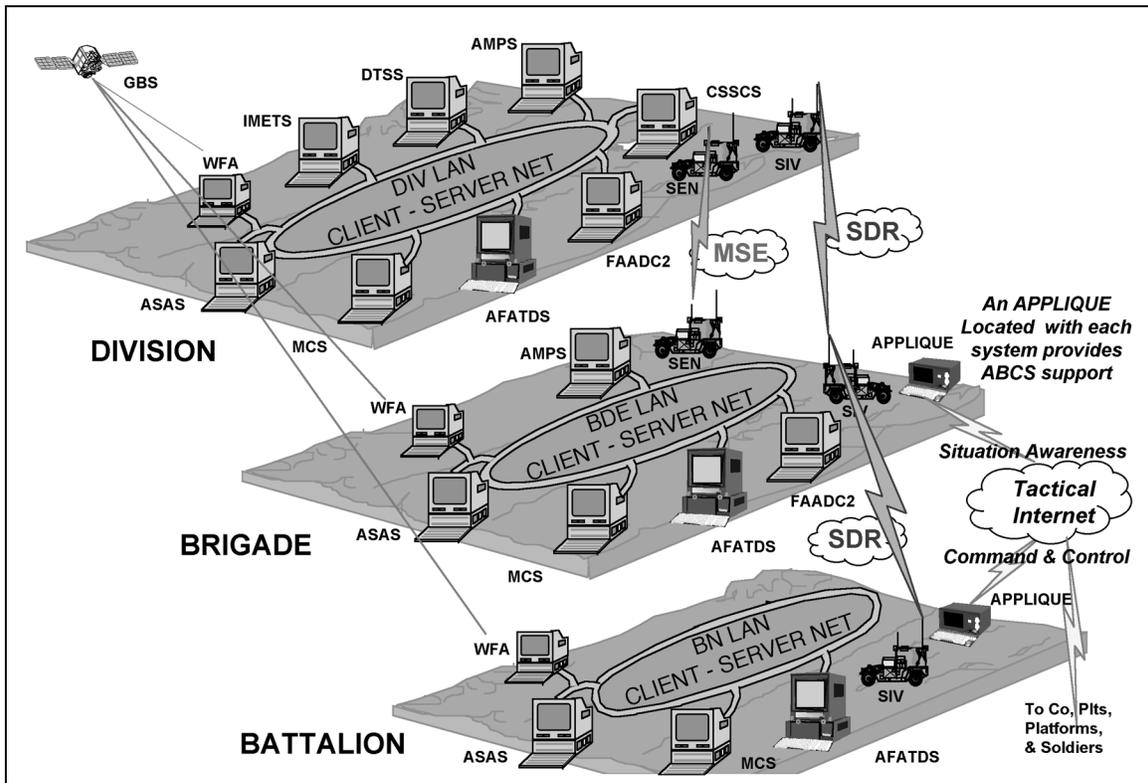


## BATTLEFIELD DIGITIZATION



### DIGITIZATION DESCRIPTION AND CONTRIBUTION TO JOINT VISION 2020

Battlefield digitization is viewed by the Army as the essential enabler that will provide *information superiority* on the tactical battlefield. Battlefield Digitization is intended to support the *Joint Vision 2020* concepts of *dominant maneuver*, *precision engagement*, *focused logistics*, and *full-dimensional protection* via improved command and control. Components of Battlefield Digitization include the computers, routers, and radios that comprise a vast network extending vertically from Corps down to individual platforms, and horizontally across all combined arms elements of the force. It can be decomposed into two major sub-networks: the lower Tactical Internet which encompasses the weapons platforms and vehicles (with their associated command, control, and communications systems), and the upper Tactical Internet which links the Tactical Operations Centers (TOCs) of the force from battalion through corps.

DOT&E currently performs oversight on many of the individual systems comprising Battlefield Digitization. Oversight systems that will operate on the lower Tactical Internet include Force XXI Battle Command, Brigade and Below (FBCB2) computers and software, the Enhanced Position Location Reporting System (EPLRS), and the Single Channel Ground and Airborne Radio System (SINGARS) and Internet Controller. Oversight systems that will operate within the upper Tactical Internet include the Army Tactical Command and Control System (ATCCS) components (MCS, ASAS, AFATDS, CSSCS, and FAADC<sup>3</sup>I) and the Mobile Subscriber and Near-Term Data Radio communication systems. The Joint Tactical Radio System (JTRS) is expected to replace the Near-Term Data Radio, SINGARS,

and EPLRS when it enters service, and will be a key element of the Warfighters Information Network-Tactical (WIN-T). The Command and Control Vehicle (C2V) was to be the vehicular shelter that housed many of the upper Tactical Internet components, however, the Army terminated this program during FY00. "Embedded Digital Platforms" include the M2A3 Bradley Fighting Vehicle and the M1A2 Abrams Tank System Enhancement Program. Each of the underlined systems is fully addressed in a separate section of the Annual Report, alphabetized under "Army Systems."

## **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), where the hypothesis: "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," has been examined. Although neither the antecedent nor the consequence of this hypothesis has been observed to date, the Army has accelerated the delivery of digital technologies to operational users and reduced the number of maneuver companies in each heavy division by 25 percent.

The Task Force XXI AWE equipped a brigade from the 4th Infantry Division with Army Tactical Command and Control Systems in its Tactical Operations Centers and Appliqué hardware and software on all of its 800-plus vehicles. The brigade trained with the new digital equipment and supporting communication systems 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 and limited interoperability of most of the digital equipment, the degree of digital connectivity achieved during the Task Force XXI AWE was not sufficient to meet the premise of the central hypothesis and was unsuitable for tactical operations. This immaturity also impacted the training readiness of the unit and the development of Digital Tactics, Techniques, and Procedures (TTPs).

MCS IOT&E and the 1998 FBCB2 LUT-1 demonstrated progress towards the Army's Digitization goals, but were limited in scope and size. The friendly situational awareness information observed during the FBCB2 LUT-1 was generally accurate and timely for the participating battalion task force, and the improved system stability permitted soldiers to employ this information during 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. MCS IOT&E demonstrated improved functionality within and between MCS systems, but interoperability with other command and control systems was inadequate and resulted in data base inaccuracies and poor user acceptance, especially at the lower echelons (battalion). Displacement of division-level TOCs did not occur, and the logistical supportability of MCS in the tactical environment was not adequately demonstrated.

In FY99, Army Battle Command System (ABCS) Version 6 software development was accelerated to bring new and common functionalities across the ATCCS systems. The new capabilities will include the TOC Server and the Joint Common Data Base, which together promise new levels of interoperability for the Digital Battlefield within the Defense Information Infrastructure Common Operating Environment. The first look at ABCS 6.0 occurred in conjunction with the FBCB2 Force Development Test and Experiment (FDTE)/Customer Test (CT) in April 2000, where performance of FBCB2 and ABCS systems were to be examined, and critical TTPs for the Digital Battlefield were to be validated.

The FBCB2 FDTE/CT was the first effort to fully integrate ATCCS with FBCB2, and the upper and lower Tactical Internets, in an operational test. The developmental test, which preceded the CT, was never successfully completed, and the operational test was downgraded by the Army from the originally planned LUT-2 to the CT when it became apparent that the entrance criteria for the LUT-2 could not be met. The primary reason for cancellation of LUT-2 was immaturity of the ABCS 6.0 software, which lacked critical functionality and was unstable during the developmental test. These shortfalls with ABCS software continued during the FDTE/CT, and the ABCS software was not operationally useful to the test unit. The performance of the FBCB2 component in the lower Tactical Internet was similar to that of the August 1998 LUT-1, although some degradation in situational awareness message traffic was observed and may be due to the increased network size in the FDTE/CT.

## **DIGITIZATION ASSESSMENT**

Although much progress has been made since the Task Force XXI AWE, the current state of Digitization capabilities is immature, with a number of critical enhancements necessary to achieve an effective and suitable capability. These include improved interoperability with and across the Army Tactical Command and Control Systems, a robust network management capability to monitor the network's health and respond to identified problems, the ability to allow rapid re-establishment of the network when communication/combat losses occur or a task organization change is required, and the ability to tactically move the large and complex tactical operations centers. Testing to date has been of limited scope and relatively benign, with much larger active networks and more advanced electronic and information warfare activities needed to understand true operational performance of the Digitization system of systems. In conjunction with the robust testing needed, development of Digital TTPs is also necessary to realize the full benefits of Digitization. Current TTPs are also immature, and funding/plans to improve TTPs are not in evidence.

Based on our experience, information technology (i.e., software-intensive systems) is generally complicated, fragile in the tactical environment, and requires well-trained operators and maintainers—skills that are difficult to maintain; thus, extensive contractor support may be required. Furthermore, these phenomena continue to be observed for Digitization systems even when software development and hardware integration have matured over several cycles of the spiral development process. We believe this is due in part to the underestimation of the challenge of employing commercial hardware and software technologies in systems subjected to the rigors of the military operational environment. It is also due to the excessive optimism regarding the development and integration challenges, and results in aggressive and unachievable schedules with no slack for the solution of problems that have become the norm. Although such optimism is not unusual in the materiel developer community, there appear to be extreme pressures to maintain the goal of equipping the First Digital Division by 2000. Even when software development and hardware integration fall behind schedule, deliveries often occur on schedule, albeit with significantly reduced software functionality and poor integration. This usually results in delivery of a version of the hardware/software that does not contain the full functionality originally specified for the test event, and/or which has not been adequately tested prior to operational use. This delay impacts the New Equipment Training the test unit must undergo, and undermines the effectiveness of the unit's collective training when it finally does occur. Not surprisingly, performance goals are seldom met in this schedule driven environment.

Only when the full array of Digitization capabilities and the requisite TTPs are resident with a well-trained unit, and demonstrated in a large-scale, system-of-system event, can the Army validate their Digitization Hypothesis. Under current schedules, the first operational test of the full array of Digitization capabilities will not occur until FBCB2 IOT&E in FY02. This IOT&E is to include all

ABCS systems and functionality, and will occur in two phases: the first at Ft. Hood, and the second at Ft. Irwin, in support of the required force effectiveness evaluation. Prior to IOT&E, the intermediate ABCS objectives and integration should be demonstrated in the FBCB2 LUT-2, which has yet to be rescheduled. The Army plans to conduct a two-phased Division Capstone Exercise in FY01, and has proposed to satisfy some OT requirements during these events for a number of Digitization systems. Formal submission of these plans has yet to occur, but such an approach would be viewed favorably if software deliveries and integration, unit training, and all other entrance criteria could be met prior to the scheduled exercise. DOT&E will observe both of the Division Capstone Exercises for insights into the progress of Digitization, but successful Beyond Low Rate Initial Production Reports for systems on oversight will depend upon demonstrated operational effectiveness and suitability in approved OT events.