West Point Cadets, Faculty Partner with PM FATDS

Advancing IT-based Knowledge and Experience of the Army's Future Military Leaders

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The United States Military Academy (USMA) at West Point has been educating, training, and inspiring the Army's cadre of future military leaders for two centuries. The "West Point Experience" for cadets has continually changed to keep pace with the evolution of technology and needs of our nation, while the Institution itself has remained true to its core values-based culture.

The Military Academy accomplishes today's mission through several fully coordinated and integrated programs that focus on intellectual, physical, military, and moral-ethical development. The rapid advance of Information Technology (IT), which has impacted our everyday lives dramatically, has also greatly influenced USMA's Academic Program. Revised program goals, which are designed specifically to meet the intellectual requirements of a commissioned officer in today's Army, reflect increased emphasis on Mathematics and Science, Engineering and Technology, and IT.

Technology-Driven Change

The Materiel Development community has similarly walked a path of technology-driven change to meet the complex evolving needs of the "digitized" warfighter leading the Army's Objective Force. Its Battle Command solution has capitalized on the dynamic innovations

West Point cadets test a call–for–fire mission.
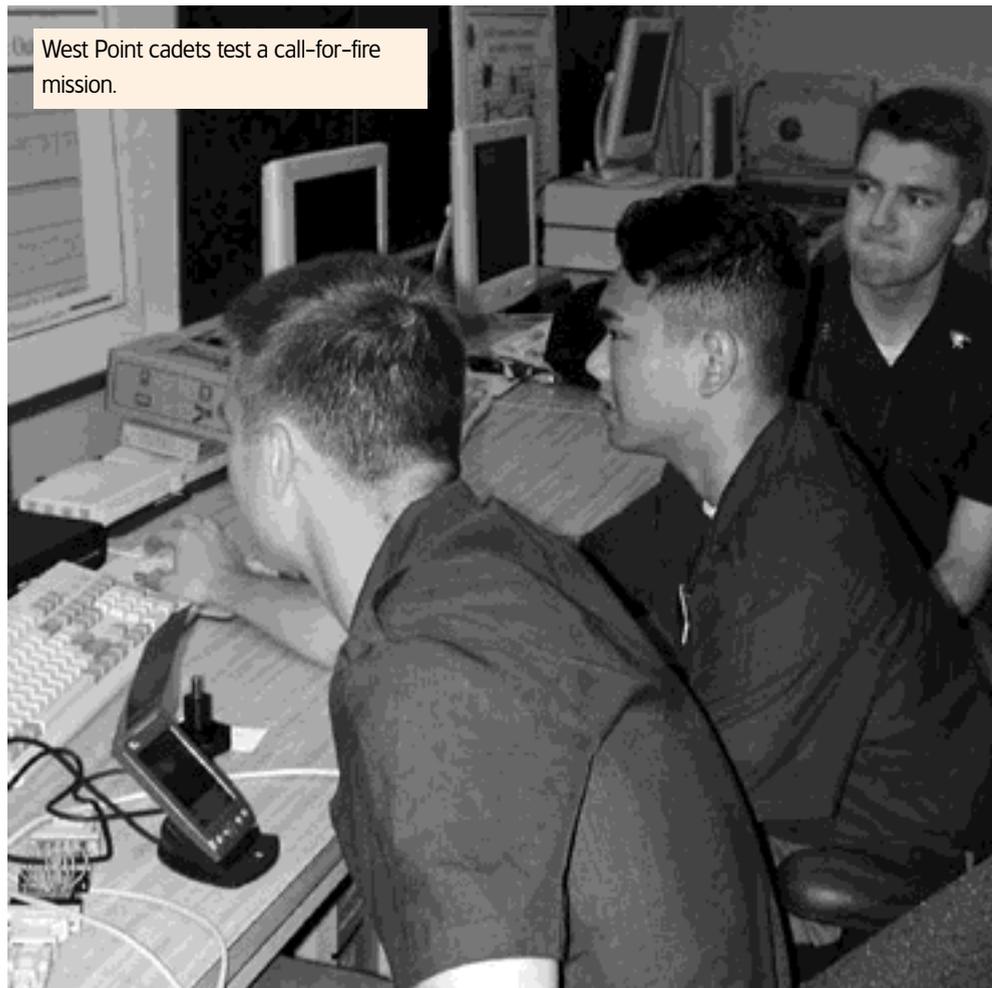
in IT made by the private sector and transformed the essence of Command and Control (C2). The Project Manager for Field Artillery Tactical Data Systems (PM FATDS), responsible for developing, acquiring, and fielding Fires and Effects C2 systems, represents one such activity that has successfully balanced

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current mission needs while proactively looking forward to reap positive benefits of future IT advancements.

Over the last two years, these two organizations have collaborated on several projects of mutual benefit. USMA's cadets and faculty have been academically and professionally involved in interesting, military-relevant, IT-related initiatives, while PM FATDS has leveraged non-parochial expert insight into challenging, IT-based issues and market-driven materiel solutions.

Information Warfare Analysis & Research (IWAR) Lab. Pictured are Single Channel Ground to Air Radio System (SINCGARS) radios used to talk to the Advanced Field Artillery Tactical Data System emulator.

Cadets' Software Development Team

Dual Information Warfare Effort

Future command and control systems for Joint Task Forces will be a network of applications running in a distributed environment. These applications, such as the Advanced Field Artillery Tactical Data System, will partially depend on timely distribution of data stored in the Joint Common Data Base. This project aims to create an initial capability for conducting metrics-based experiments concerning performance of distributed applications under a variety of operational conditions.

The test bed will use Army-developed models of the 4th Infantry Division network and the OPNET Modeler commercial network-modeling tool to achieve a capability to evaluate performance characteristics of distributed applications. Implementation of the test bed will depend upon use of a new capability for the OPNET Modeler — the Application Characterization Environment module, together with elements of the U.S. Army Communications-Electronics Command Research, Development, and Engineering Center-developed Next Generation Performance Model to support application assessments at the platform layer or network layer.

By modeling portions of the Army tactical local area network or the Joint Task Force network, USMA's Information Warfare Analysis and Research Laboratory will assess network-level attacks against C2 systems such as the Advanced Field Artillery Tactical Data System.

Using real-world Army Fire Support C2 and communications equipment, experiments will be conducted to estimate database latency metrics for mobile call-for-fire events. The network model can then be used to estimate database latencies for distribution of the data throughout the larger tactical Internet. By using OPNET's Defense Modeling and Simulation Office High-Level Architecture module to control the synchronization of distributed applications using timed events, it may be feasible to estimate latencies in a larger distributed context.

To determine whether delays in data base access times are "normal," due to equipment failures, or potentially deliberate interference with information system operation, the first step is answering such questions as:

- What is the data base access time for the Advanced Field Artillery Tactical Data System to obtain item X from the Joint Common Data Base?

- What is the change in the data base access time for the Advanced Field Artillery Tactical Data System to obtain item X from the Joint Common Data Base when change Y occurs in the network?

Dismounted Warrior Palm-Sized Device Market Survey

When informed that the prime contractor for the Handheld Terminal Unit (HTU) would shortly discontinue its support for this platform, PM FATDS wanted to explore the potential use of lighter weight, less expensive, commercial off-the-shelf (COTS) hardware platforms as replacement systems.

The faculty and staff at West Point were engaged to conduct a quick, cost-effective, and non-parochial market survey. In short order, the officers and civilian instructors at West Point scoured the literature, went to trade shows, purchased a number of boxes for evaluation, and provided a report that rated the latest available COTS hardware against the PM's requirements. While the faculty and staff determined that, at the time of the survey, no COTS hardware met the PM's requirements, they identified several promising candidates for follow-up review in the next commercial technology release cycle.

All investigators participating in this project had graduate degrees in electrical engineering or computer science, most with Ph.D.'s. The team included many active-duty Army officers with years of field experience. The veracity of their report was underscored by the fact that West Point did not "have a dog in the fight" and could, therefore, make an impartial, objective assessment.

For the faculty at West Point, the market survey project proved to be an opportunity to help solve an Army problem and work on a product that will help U.S. soldiers fight more effectively in future combat. For the PM, the project provided a very inexpensive and impartial assessment of technology in a short period of time.

Pocket-sized Forward Entry Device Project

Soon after West Point staff and faculty conducted the market survey, PM FATDS embarked on a multifaceted effort to develop a Pocket-sized Forward Entry Device for the dismounted Forward Observer. In addition to their prime contractor, the PM proposed that West Point cadets explore the application of leading-edge commercial technologies to demonstrate proof-of-concepts for replacing portions of the existing HTU-dependent Forward Observer solution with platform-independent software running on a variety of COTS personal digital assistants. This proposal provided an excellent opportunity for USMA since all West Point cadets, regardless of major, must complete a five-course engineering sequence — culminating in a senior design project.

USMA chose four Computer Science and three Electrical Engineering cadets to work on the proof-of-concepts. Two computer science active-duty faculty members and one electrical engineering active-duty faculty member acted as advisors and mentors to the cadet team.

The PM clearly understood that it would be unreasonable to expect these cadets — in addition to 18 credits of course work, parades, athletics, leadership activities, and military training — to build a complete working system in one semester. Nevertheless, PM FATDS offered to sponsor this effort since the project exposed the nation's future military leaders to the latest commercial information technologies with tangible military relevancy.

It should be noted that the PM's prime Pocket-sized Forward Entry Device contractor would take a lower-risk approach

to ensure the delivery of a fieldable system, while maintaining awareness of West Point's progress. Any technology "nuggets of success" identified by USMA would be leveraged and, as appropriate, incorporated into the contractor's baseline initiative.

The benefits of this project were many. The cadets glimpsed a real software and hardware development effort for the first time. For their design project, they were able to work on a real Army problem that was both intellectually and technically stimulating. Since the PM provided tactical radios, two Advanced Field Artillery Tactical Data System workstations, an HTU, and other equipment, the cadets became adept at working with fielded Army Command Control, Communications, Computers and Intelligence (C4I) equipment. The faculty mentors were also motivated, both professionally and personally, to work on a real Army project vs. a purely academic exercise.

The project also provided some independent validation and corroboration of the technology choices made by the PM's contractor such as Java 2 Micro Edition, personal Java, Bluetooth wireless connectivity, and the need for a personal digital assistant to control the Bluetooth connection near the radio. Finally, the cadets explored the potential for using eXtensible Markup Language in lieu of the current Variable Message Format-based information transfer methodology — a topic of current interest among the Defense C4I community.

As a credit to the partnership between USMA and PM FATDS, cadets built and demonstrated on the workbench at West Point, the first proof-of-concept implementation of the idea. The experience gained under the auspices of this project will also serve as an "honest broker" knowledge base for subsequent assessment of the contractor's final Pocket-sized Forward Entry Device work product.

Unified Data Bases for Joint Targeting

Each year, West Point conducts a summer Academic Individual Advanced De-

velopment Program, which provides cadets with an opportunity to apply knowledge they've gained in the classroom. USMA and PM FATDS are jointly sponsoring a project entitled "Unified Databases for Joint Targeting."

All Services need the capability to 1) process targeting information expeditiously from multi-echelon data sources; and 2) subsequently execute fire support and/or close air support missions in a synchronized, integrated manner at the national, strategic, operational, and tactical levels. The Joint Targeting Toolbox is focused on providing a Force-level targeting capability with intelligence support for target systems analysis, situation assessment, target development and selection, target nomination, "weaponeering," and the battle damage assessment necessary to conduct joint and combined theater campaign operations.

The Joint Targeting Toolbox is intended to run as a co-resident-targeting module on the Services' primary Battle Command systems such as the Army Battle Command System and the Theater Core Battle Management System. Current Service Battle Command systems use data bases that differ in both construct and content. The Theater Core Battle Management System uses the Modernized Integrated Data Base, while the Army Battle Command System uses the Joint Common Data Base. Objectively, the Joint Targeting Toolbox should be designed to execute Service Battle Command systems that fully support the required fire support and/or close air support doctrine.

The summer academic project consists of three phases:

- Joint Targeting Toolbox Assessment
- Joint Common Data Base/Modernized Integrated Data Base Comparison
- Findings

Assessment Phase
During the Joint Targeting Toolbox Assessment Phase, the first cadet would review the Target Weaponeering functions within the Joint Targeting Toolbox as

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well as the critical data elements, and also identify the core set of mechanisms used to process target information. Special attention will be directed at expected data structures and fields required by the Joint Targeting Toolbox module.

Comparison Phase
The Comparison phase will identify common and missing data base elements and functions in the Joint Common Data Base and Modernized Integrated Data Base required to execute the Joint Targeting Toolbox Weaponeering functions.

Findings Phase
The Findings Phase will review the essential disconnects found in the Joint Common Data Base and Modernized Integrated Data Base that prohibit tactical targeting by the Joint Targeting Toolbox.

Concluding the Project
The cadets will conclude the project by clearly identifying and documenting the required data base subset that must be supported by both the Joint Common Data Base and/or Modernized Integrated Data Base for true joint targeting. PM FATDS intends to use the results of this summer academic project to initiate changes and modifications to the Joint Common Data Base or Modernized In-

tegrated Data Base. This will facilitate integration of the Joint Targeting Toolbox into the Advanced Field Artillery Tactical Data System and the Army Battle Command System.

A Nurtured Collaboration
The partnership between USMA and PM FATDS has been fruitful and advantageous to the mission objectives of both organizations. The cross-fertilization of intellectual prowess from the academic and acquisition communities has positively impacted the knowledge and experience base of the nation's future commanders, while similarly contributing to materiel development solutions for the Army's Transitioning and Objective Forces. This nurtured collaboration continues to provide a grass-roots model for success as today's Army evolves to meet the challenges of technology-driven change and the need for a multi-disciplined cadre of military leaders.

The demonstrated grass-roots model is a triple win for the Army:

- First, the faculty at West Point continues to work on real Army problems while teaching cadets.
- Second, the West Point cadets continue to work on Army programs that challenge them intellectually and also provide a first, in-depth view of Army systems.
- Finally, the PM FATDS gains access to low-cost, unbiased technical expertise that can objectively examine complex problems or be used to "sanity check" the recommendations of contractors.

The results of this collaboration have indeed been beneficial, and we unreservedly recommend this model to others seeking insight into challenging, IT-based issues and market-driven materiel solutions.