Combat Terrain Information Systems (CTIS) Provide Geospatial Capabilities to Commanders and Warfighters

Mark A. Hainsey and Lesley M. Kennedy

Understanding the terrain is essential to accurately plan and effectively execute combat operations. CTIS is the Project Management Office (PMO) responsible for the acquisition of tactical terrain analysis capabilities for the U.S. Army. PMO CTIS is using commercial-off-the-shelf (COTS) technology to develop the Digital Topographic Support System (DTSS), a state-of-the-art terrain analysis and geospatial data management system to provide commanders and warfighters with unprecedented geospatial awareness. Geospatial refers to information referenced to a location on the Earth and, in this context, includes digital maps, elevation data, satellite imagery and derived terrain analysis products.

DTSS provides commanders and warfighters unprecedented geospatial awareness so they can safely navigate terrain anywhere the mission takes them. Here, Marines from Weapons Co., 3rd Battalion, 6th Marine Regiment, negotiate rough terrain in Khowst, Afghanistan, during *OEF* using DTSS JC2. (U.S. Marine Corps photo by LCPL Justin M. Mason, 2nd Marine Division Combat Camera.)

The DTSS is an integral part of the current Army Battle Command System (ABCS) and is migrating current capabilities to other network-centric systems, including the Distributed Common Ground System-Army (DCGS-A) in support of Joint Command and Control and Future Combat Systems (FCS). The network-centric Army of the future will deploy a robust, globally interconnected network environment in which data is shared seamlessly among users, applications and platforms.

Defining Today's Battlefield

PMO CTIS is the first formal program to create a system, the DTSS, that provides geographic information system (GIS), digital satellite image processing and 3-D terrain visualization capabilities, as well as high-volume digital map printing to the Army. DTSS is providing the Army — and Joint force commanders and warfighters at all levels — with the geospatial information needed to fight on current and future battlefields. DTSS is defining the way missions are planned and executed by providing terrain analysis and visualization, terrain data generation and terrain data management and dissemination.

DTSS provides up-to-date geospatial information that can be combined with military intelligence to provide commanders and warfighters with true geospatial intelligence. It used to take weeks to gather enough terrain data to plan and execute a mission. Real-time geospatial information and digital terrain imaging have given commanders and warfighters the ability to plan and execute missions in the span of minutes or hours versus days or weeks.

DTSSs compile data from a multitude of U.S. government, commercial, coalition and host nation sources. This information is used to create or enhance digital geospatial data that provides the common map background for ABCS.

> The network-centric Army of the future will deploy a robust, globally interconnected network environment in which data is shared seamlessly among users, applications and platforms.

Using COTS Technology

Interoperability is the building block of the "digital" Army. Using COTS technology has enabled PMO CTIS to develop the DTSS

DTSS-Light, one of the four systems that make up DTSS, is a mobile terrain analysis system that is housed in a climate-controlled shelter on a Humvee. (U.S. Army photo by CTIS staff photographer.)

The Humvee-mounted DTSS-L brings high-tech terrain analysis capabilities to the front lines. (U.S. Army photo by CTIS staff photographer.)

command information to support intelligence preparation of the battlefield.

PMO CTIS uses COTS software such as ESRi's ArcGIS software, ERDAS Imagine image-processing software and Skyline Terra software suite for 3-D terrain visualization. These powerful software packages provide DTSS with many of its core capabilities and are designed to work with commercial and military geospatial data formats. ArcGIS provides advanced geoprocessing capabilities that can be used to create, import, edit, query, map, analyze and view geospatial information.

ERDAS Imagine provides the tools necessary to process all types of satellite and aerial imagery. These tools can be used to extract vector data features from digital imagery and to create user-defined image maps.

The Skyline Terra software suite allows users to create, edit, annotate and view photo-realistic, geographically accurate, 3-D models of the Earth for their georeferenced applications. All these capabilities, along with CTIS-developed terrain analysis software, are fielded to Army terrain teams to meet mission requirements.

Topographic analysts who use DTSS receive many weeks of institutional training that focuses on the COTS software products. Soldiers are then trained on the custom software pieces and additional refresher training on the COTS software is provided when a new software "build" is fielded. By having access to a variety of powerful COTS, government-off-the-shelf and custom-developed software packages, Soldiers can complete many different missions using DTSS.

"One of the unique features of DTSS is that the user can utilize different

family of interoperable systems that provide commanders and warfighters with the tools necessary to effectively plan and execute missions in wartime and in peacetime.

When PMO CTIS began developing DTSS, COTS technology was not widely used to develop military systems. Most military systems consisted of contractor-developed custom software. However, custom software development is often very time-consuming, expensive and ties a system to a specific contractor. PMO CTIS wanted to implement an acquisition strategy that would maximize commercial technological capabilities and minimize costs. Developers realized that using COTS technology would allow them to create a system with greater capabilities at a lower cost.

Linda Graff, CTIS Technical Management Team Lead, conservatively estimates that nearly 80 percent of all software used in DTSS is COTS-based software that is procured from commercial

vendors. "One of the biggest successes with using COTS technology has been the ability not to have to put all our money into research and development," Graff acknowledges. "For example, ERSi (Earth Resource Surveys Inc.), one of our major COTS vendors, has more than 2,500 people working full-time on the COTS software that we use. We could never have funded that."

By using the cost-effective COTS technologies that are available, PMO CTIS has saved millions of dollars in software and hardware research, development and maintenance. PMO CTIS can continue to improve DTSS capabilities by leveraging the developments made by the COTS vendors.

The COTS DTSS software is used to collect, manage, distribute and analyze geospatial data from various sources. The geospatial data and products provided to the Army by DTSS can be displayed on other ABCSs or be combined with intelligence and battle

software components based on mission needs and available data," remarked Graff.

CTIS

The DTSS family of systems, developed under the purview of PMO CTIS, comprises a combination of operator workstations, software, scanners and large-format plotters. DTSS is capable of supporting the full spectrum of military operations, including peacetime stability and support operations. DTSS has the capability to analyze, generate, manage and disseminate geospatial information.

DTSS comprises four systems: DTSS-Base (DTSS-B), DTSS-Light (DTSS-L), DTSS-Deployable (DTSS-D) and High-Volume Map Production (HVMP) equipment. DTSS-B, is a theater-level, garrison-based system that provides increased data generation and production capabilities over the other DTSS configurations, as well as enhanced feature and elevation data extraction tools.

DTSS-L is a tactically mobile system for terrain analysis that is housed in an environmentally controlled shelter on a Humvee. DTSS-L includes the Army Map Server for data management and dissemination.

DTSS-D is a transit-cased mobile computer system for deployment with tactical forces having the same terrain analysis capabilities as the DTSS-L.

The HVMP is a tactically mobile, forward-deployed system that generates large volumes of hard-copy maps, charts and situation overlays. High-volume map reproduction is still needed by today's digital Army to support Coalition Forces and homeland defense.

> DTSS is defining the way missions are planned and executed by providing terrain analysis and visualization, terrain data generation and terrain data management and dissemination.

Enabling Today's Warfighters

DTSS is an integral part of the ABCS architecture. It provides geospatial information to all other battle command systems to support the common operating picture. DTSS supports the military decision-making process (MDMP) by providing the battle staff with the geospatial information needed to accurately plan and execute mission operations.

DTSSs are located with key U.S. Army terrain teams worldwide. DTSS is deployed with most units supporting *Operations Enduring Freedom (OEF)* and *Iraqi Freedom (OIF)*. DTSSs are supporting the
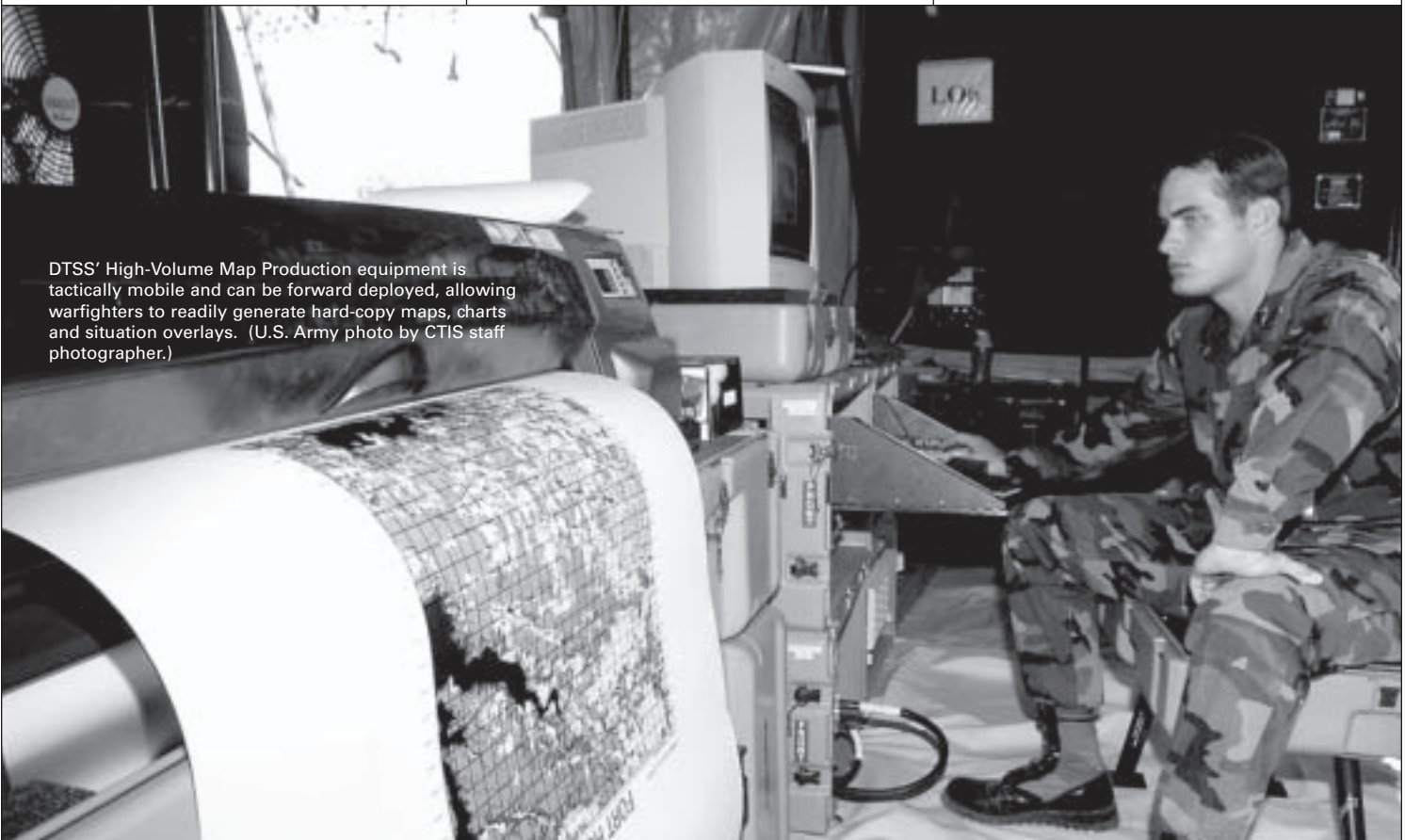
DTSS' High-Volume Map Production equipment is tactically mobile and can be forward deployed, allowing warfighters to readily generate hard-copy maps, charts and situation overlays. (U.S. Army photo by CTIS staff photographer.)
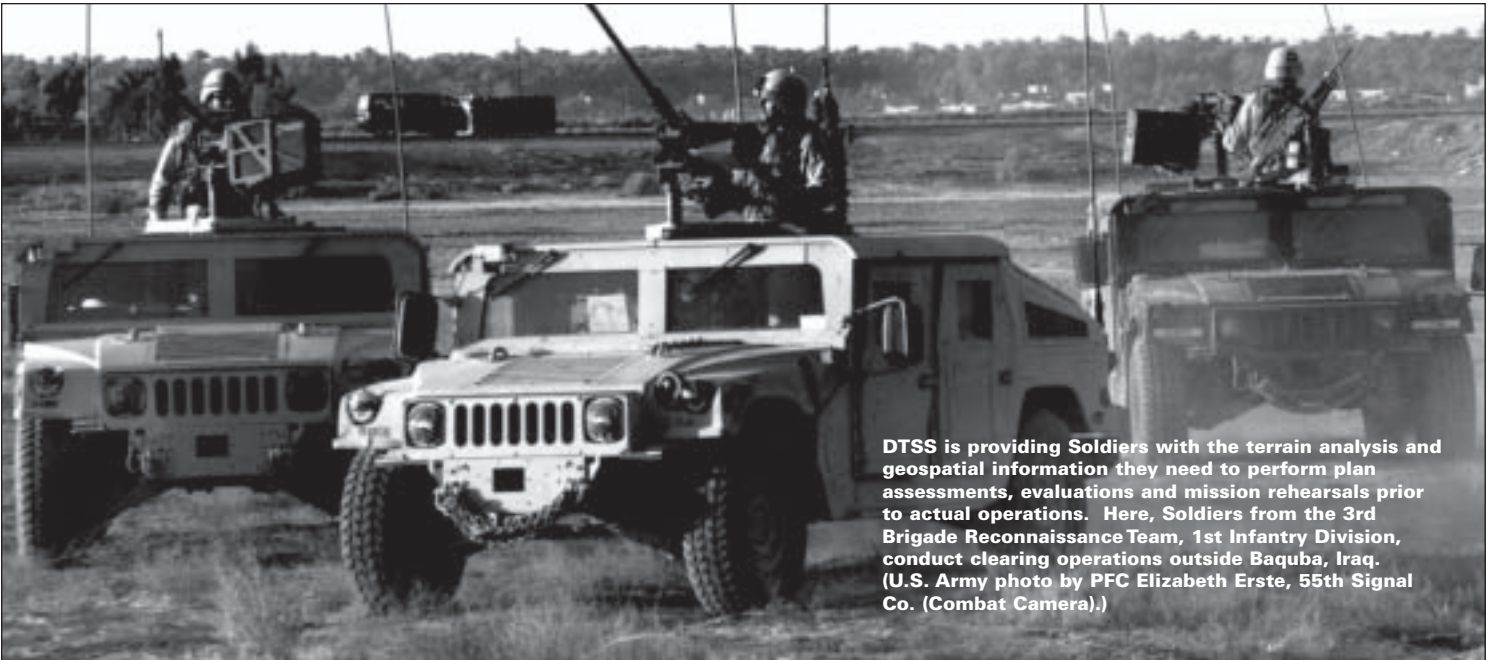
DTSS is providing Soldiers with the terrain analysis and geospatial information they need to perform plan assessments, evaluations and mission rehearsals prior to actual operations. Here, Soldiers from the 3rd Brigade Reconnaissance Team, 1st Infantry Division, conduct clearing operations outside Baquba, Iraq. (U.S. Army photo by PFC Elizabeth Erste, 55th Signal Co. (Combat Camera).)

deployed Army corps, divisions, maneuver combat brigades, aviation brigades, Stryker brigades and Special Forces groups. DTSS provides geospatial information in direct support of daily counterinsurgency missions to include combat patrolling, infrastructure, rehabilitation and counter-improvised explosive devices suppression.

DTSS is directly supporting *OEF* and *OIF* warfighters in visualizing the terrain in a 3-D view, with targets and buildings numbered for ready identification to immediate reaction missions. "The 3-D Skyline Terra suite software was procured and fielded by PMO CTIS in direct response to a need for this capability from the warfighters," Graff explained. During DTSS fly-through missions, this 3-D software is used to gather valuable information that is used to assist commanders during the MDMP."

CW4 Scott Owens, Directorate of Training, U.S. Army Engineering School, formerly a V Corps Terrain Analysis Technician, provided terrain analysis and geospatial support to V Corps during the fight to Baghdad. "Without the CTIS program and

DTSS, we would not have had the tools or the skills to accomplish our mission so successfully," Owens reflected.

What the Future Holds

"We are the recognized geospatial terrain information experts and we will migrate our systems capabilities to their environments," Graff continued. "We are rapidly moving toward transition of DTSS capabilities into DCGS-A and FCS."

By merging geospatial and intelligence capabilities into a single system, DCGS-A will provide full-spectrum intelligence, surveillance and reconnaissance functionality for the Army. As part of FCS, DTSS capabilities will be carefully integrated into the Battle Command Mission Planning and Preparation and the 10 Situation Understanding Packages. To support these packages, DTSS will provide terrain analysis and geospatial information to support the development of deliberate, anticipatory and rapid response plans. DTSS will also support the ability to perform plan assessments, evaluations and mission rehearsals.

With the emergence of new threat environments, new weapons systems and new Army systems, the demand for

specially tailored, high-resolution geospatial terrain products has increased. Our Army is equipped with the most technologically advanced geospatial tools and information, thereby reducing operational risk to our warfighters.

MARK A. HAINSEY is Program Director CTIS. He has a B.S. in geosciences from Pennsylvania State University and is a Defense Systems Management College Program Manager's Course graduate. Hainsey is also Level III certified in program management.

LESLEY M. KENNEDY supports the CTIS team in communications. She has extensive experience planning and implementing communications strategies for both government and private sector clients. Kennedy has a B.S. in business affairs and marketing from Towson University.

TERRAIN INFORMATION

COMBAT

SYSTEMS

CTIS