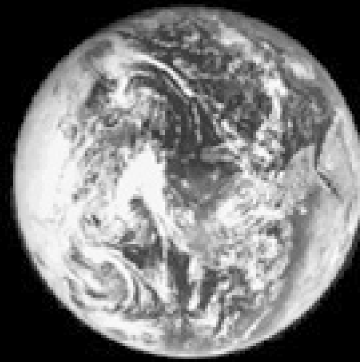

Operation Enduring Freedom: A Waypoint Toward Geospatial Engineering Transformation

By Chief Warrant Officer 3 David Kasten

In early December 2001, I was just settling down in Kosovo—doing my part toward fulfilling the 10th Mountain Division's Kosovo Force (KFOR) rotation—when I received a call to go to Afghanistan to support Central Command's (CENTCOM's) Operation Enduring Freedom. So I packed up and moved out, leaving a three-man element deployed in support of KFOR. The other personnel from our detachment remained at Fort Drum, New York, supporting the rear commander and performing force protection missions.

Terrain Team Mission

My unit, the 66th Engineer Detachment (Terrain), works for the 10th Mountain Division assistant chief of staff, G2 (intelligence), in support of the intelligence preparation of the battlefield (IPB). Being collocated with the G2 section is helpful in getting access to required geospatial information and imagery. However, due to our capabilities to rapidly visualize the terrain, we also stayed in the back pocket of the division chief of staff. Our main piece of equipment was the Digital Topographic Support System (DTSS)-Deployable (DTSS-D). We also had some augmentation equipment from the National Imagery and Mapping Agency (NIMA), headquartered at Bethesda, Maryland. Despite our small size and the austere environment in Afghanistan, we were still able to provide support to the division with on-demand, non-standard, unique terrain products in a timely manner.

The 10th Mountain Division had many successes during Operation Enduring Freedom. The terrain team supported the division during the deployment and was extremely successful during the planning and execution of Operation Anaconda. Adequate planning would not have been possible without the DTSS-D. The overall DTSS was christened during the combat operation. (To learn more about the DTSS, see the Topographic Engineering Center [TEC] Web site at *www.tec.army.mil*.) It enabled us to provide many tactical decision aids and other nonstandard products. Most engineers are familiar with the products we were asked to generate—elevation tints, shaded/painted relief maps, high-resolution image maps, multispectral image maps, combined-obstacle overlays, lines of communication overlays, hydrology overlays, limited map reproduction, perspective views using high-resolution imagery, threat domes, intervisibility products, and virtual fly-throughs. This may sound like "the short list," but every product was tailored to its intended user, and a lot of imagination from both the analyst and the user was required to make it useful.

One particular item we generated was the initial air insertion visualization product of the Shaikot Valley in southeastern Afghanistan. The aviation commanders needed to know what air routes were available from Baghram into the objective area of operation with specific cloud ceilings. These corridors had to be displayed using the Earth Resources Data Analysis System (ERDAS®) Virtual Geographic Information System (VGIS®), an invaluable commercial applications program included in the DTSS-D. Using the VGIS, the commander was given a better understanding of how rugged the terrain was and what options were available. After looking for air avenues with varying ceilings, the aviators and terrain technicians determined that the ceiling could not be less than 7,500 feet in order to use the corridors that were selected. The value of this information allowed premission decisions to be made by the division chief of staff in support of CENTCOM's overall mission.

Lessons Learned

The DTSS proved to be the right system to support warfighters of Operation Anaconda, aviation units, and division decision makers—it fulfilled its requirements. The many lessons we learned during this operation concerned things such as equipment challenges, the importance of maintenance, enhancements that the system should incorporate, understanding data and data limitations, new training we need, the importance of working closely with the G2 imagery section, the need to push software to users, and on-demand printing. Based on my recent experiences with the 10th Mountain Division, I will discuss these lessons in this article.

Equipment and Maintenance

Although it is labeled as a deployable system, the DTSS-D is geared more toward a garrison-type environment. Dust and heat will quickly render the system useless, and maintenance can't be stressed enough. The initial problem we had was that we were in a very dusty environment in Afghanistan, which took its toll on all our equipment. Saving factors were a good industrial vacuum cleaner and regular maintenance. Even then, we still lost the capability to output to soft mediums such as floppy, jazz, and digital video disks (DVDs) and compact discs-recordable (CD-Rs). Luckily, we brought extra (off-the-shelf) computers that had the same output capability that we connected through the DTSS.

The constant moving of systems also created havoc on external wires. We lost many small computer system interface (SCSI) cables and terminators and one power cable. These were mission stoppers. The bottom line is: gather spare parts prior to departure. The Department of Defense Manufacturing Technology (ManTech) Program, which provides DTSS contract support, will help obtain spare wiring.

Digital Topographic Support System-Deployable

It is important to understand the limitations of the system—both the hardware and software aspects of it. We thought we had a good handle on this until we really pushed the system. Bring your own networking tools, such as RJ45 (Internet) cable, testers, crimpers, and spare 6- to 8-port hubs. We need to take it upon ourselves to understand our systems so we can do our own basic troubleshooting.

Enhancements

We used VGIS exclusively in special operations mission rehearsals and quick-response force planning. This included helping users visualize their insertion route, extraction route, helicopter landing zones, and tactical operations. We used VGIS to visualize where the battle was taking place, determine mortar threat domes, build line of sight from known enemy and friendly locations, and assess possible exfiltration and infiltration routes from known enemy locations (commonly referred to as "rat trails"). However, VGIS would work even better if we incorporated a high-end graphics card to allow better resolution and larger-sized fly-throughs. Also, a better three-dimensional (3-D) fly-through program that could be rendered and flown in real time would be helpful in the future (such as Skyline's TerraExplorer Pro®).

Lack of Information

We sometimes take for granted that everyone understands the possible lack of geospatial information and the limitations of the data we use and require for geospatial analyses. As geospatial engineers, it is our responsibility to make our customers understand data accuracy and data resolution—for example, by creating line-of-sight or visible-area plots (360-degree line of sight) using Digital Terrain Elevation Data (DTED) Levels 1 and 2 or Shuttle Radar Topographic Mission (SRTM) Level 2. Very little vector data was available in December 2001. The terrain team extracted as much data as possible from 1:50,000 Russian maps, and then we used imagery for critical areas.

Training

Geospatial instruction taught in the U.S. Army Engineer School is only the basic building block. It's our responsibility to teach soldiers the reality of the field. We must give them realistic training, to include holding them to the time constraints we can expect in a high-tempo operation. Encourage creativity when producing a product, pass on the shortcuts we use when we produce products, and get soldiers to understand the mission of the customer. We have to prepare for the fact that we may have to deploy as a small element. We need to ensure that we cross train everyone from the bottom up, keeping in mind that the terrain technicians are still the experts. There will always be a learning curve to overcome, but there are basic items that must be addressed before any deployment. Following is a list of tasks with which all of us should be familiar. Most deal with computers, and many may think this is an assistant chief of staff, G6 (information management), function. This is correct, but if your G6 is as undermanned and overtasked as ours, you'll find that this knowledge will help cut out minutes, hours, or days of downtime. These skills include—

- Basic networking, such as setting up Internet protocol addresses for plotters, printers, and computers.
- Setting up gateways, workgroups, domains, and RJ45 cables, both standard and crossover; up-linking hubs.
- Basic computer operation and troubleshooting (including maintenance), such as file transfer protocol (FTP) and file allocation table (FAT) 16 versus FAT 32 versus New Technology (NT) file system.
- Understanding the common errors/problems/limitations with Environmental Systems Research Institute (ESRI™) ArcInfo®, such as missing information within vector coverages and inverted fly-throughs (VGIS).
- Understanding the problems/shortcomings of all data that is being used and being able to convey this to the customer.
- Understanding the IPB process better.

G2 Imagery Section

Understand the functions and limitations of your imagery section. The terrain team relied heavily on imagery during this operation. With the lack of standard maps, we filled the data gap by producing multiple image maps. Imagery was vital in producing products because NIMA maps that were available were at 1:100,000 scale and almost 20 years old. These did not provide the ground operator with enough information. Australia shared scanned Russian 1:50,000 digital maps that provided great detail but were still 15 to18 years old.

We created many updates using imagery provided from two main sources. The first was unclassified, high-resolution imagery that the TEC Imagery Library provided as soon as it was available. The second source was the NIMA support team (NST), formally called the Customer Support Response Team (CSRT), that provided high-resolution, georeferenced, classified imagery. The team could download current imagery (less than 30 days old) via the Secret Internet Protocol Router Network (SIPRNET) and could also create image maps. Later in the deployment, the NST brought its own dedicated satellite dish for connectivity, which improved the team's ability to download imagery that the division needed. Both sources were vital to the success of the mission.

One misconception many users have is that all imagery is accurate and precise; however, we found errors that were as great as 400 meters off of actual locations. Geospatial engineers must inform their users of the possible data inaccuracies.

National and Coalition Partners

There are many organizations that can assist us in just about every aspect of our job. During our deployment, we asked for assistance from ERDAS, ESRI, NIMA, TEC, ManTech, ILEX Systems (a software support contactor), and terrain units from the United States, Britain, and Australia. They all bent over backward to assist us; just like the old cliché, "no question is a dumb question."

Software and Data

Push terrain/map programs to the people we support. Give the tools and basic instructions to our customers. The programs that we pushed were Terrabase 2, FalconView™, ArcExplorer®, ERDAS Viewfinder®, SID® Viewer, and screen-grabbing software. We also pushed as much raw data as possible, such as DTED, raster product format (RPF) images, and raster data. This helped eliminate the small taskings that we were constantly receiving. The training that the customers need to use these map programs will take some time, but the payoff in time saved in the future will be worth it.

Printing

One of the functions of the DTSS-D is low-volume map printing. Although this is a thorn in the side of many terrain detachments, it is also a great asset. Due to the lack of information on standard NIMA 1:100,000 maps, we turned to printing some of the Russian 1:50,000 maps. These maps had an abundance of information that was helpful to the ground operators, such as water velocity, bridge information, and road width. The most helpful information was that contours on these maps were 20 meters versus the 50 meters on the 1:100,000 maps. Because of this, the terrain team overlaid World Geodetic Survey 84 grids on the Russian 1:50,000 maps and reproduced more than 500 copies to support the ground operators.

Conclusion

The DTSS is a great system. It works in combat, it works in the field, and it works in garrison. There are aspects that can be improved, and I challenge the Engineer School to make that happen. The terrain warrant officer and 81T soldiers are in high demand. There are many customers in your organization beyond the traditional support to the IPB. In my case, the division chief of staff and the aviation and special operations forces were new and prized customers. No information set is going to be perfect—and may not even be good enough to use—but I used imagery to improve upon existing NIMA- and Soviet-produced maps. Finally, the best job is done in collaboration with NIMA, TEC, and our allies. We really have the interoperability built in to allow us to work together smoothly.

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