proximate azimuth between the points. He should also know the methods of determining all cardinal directions day or night without using a compass.

Finally, orienteering courses should be sought out or established in order to train soldiers better in land navigation skills. Fort Benning, for example, has transformed its old, familiar Yankee and Furman Road courses into orienteering style courses. And the June 1986 edition of FC 21-26, Map Reading and Land Navigation, devotes 20 pages of Appendix B to orienteering.

Leaders should strongly encourage their soldiers to participate in the sport of orienteering, which is both challenging and enjoyable. Experienced orienteers can think on the move and are highly competent in quickly finding and reaching any point on a map.

In order to fight and win against superior numbers and possibly superior firepower as well, the U.S. Army must have soldiers who are confident of their ability to find and reach an objective. Such soldiers are much more likely to generate the kind of initiative and leadership necessary to accomplish the mission.

Unfortunately, mediocrity creeps into the fabric of every profession. Even among officers and NCOs at many levels, we find excuses instead of standards, flab instead of fitness, and consensus instead of excellence. When leaders plan training, they do their soldiers no favor if they settle for marginal standards. Marginal soldiers seldom survive desperate battles.

Captain H. Stogner, Jr., is chief of the Pathfinder School at Fort Benning. He served in Vietnam as a staff sergeant in the 1st Cavalry Division. He received a direct commission in 1982 while serving with the 82d Airborne Division.

Terrain Appreciation

LIEUTENANT KENNETH G. NIELSEN

One of the most vital skills a soldier can have is the ability to look at a map and visualize a three-dimensional image of the information he sees. As a unit training officer and a college laboratory instructor, I have used several techniques that others may also find useful in teaching soldiers how to interpret what they see on a map.

When I teach map reading and terrain appreciation, I follow a four-step process:

- Preparing a graphic cross-section.
- Constructing a cardboard contour model.
- Constructing a terrain model.
- Going on a terrain walk.

The goal of this teaching process is to take someone who is unsure of his map reading ability and teach him the skills that will enable him to pick up a map and conduct a reasonably accurate terrain analysis based on that map.

First, each soldier should have the following equipment:

- A local map (1:25,000 or larger scale, if possible).
- A pencil.
- One sheet each of plain paper, tracing paper, and graph paper.
- A scrap of cardboard (two to four square feet).
- A sharp knife or scissors.

The first step of this process, preparing a cross-section, helps a soldier get a better feel for the relationship of the space between contour lines on a map and the slope of the ground.

The soldiers should be given these directions to follow:

- Choose two points on a map. Draw a line between them, labeling one end A and the other B, as shown in the example in Figure 1.

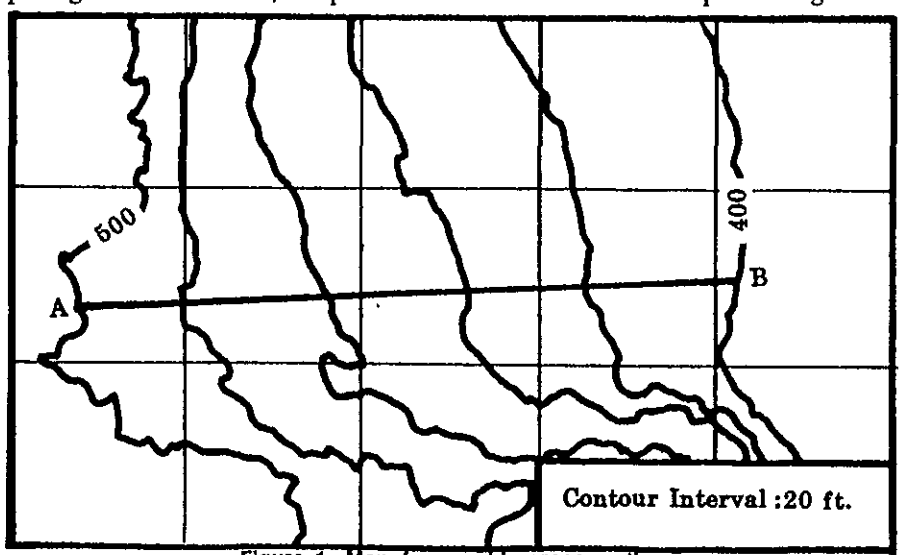

Figure 1. Map for graphic cross-section.

• Place the edge of a piece of paper along the line between A and B.

• Make a mark on the paper at each contour line, including the two end points, and note the elevation of each one.

• Draw a graph with the base representing the map's horizontal plane and the ordinate representing the elevation, in 20-foot intervals. Take the marked piece of paper and place point A at the lower lefthand corner of the graph. Make a dot at the elevation point for each mark on the piece of paper (Figure 2).

• Draw a line to connect all of the points.

Each soldier now has a completed cross-section. Although a cross-section has some built-in distortion along the elevation axis, it is a useful point from which to start the terrain appreciation process, because it lays the groundwork for the next step, constructing a three-dimensional cardboard contour model.

The purpose of this second step is to allow the soldiers to see a rough view of what the ground looks like without vegetation, buildings, or other features.

For this step, I recommend using large, hand-drawn contour maps. This prevents the problems that result from using anything smaller than a 1:5,000-scale map. (This will become clear in the first step of the process.) Again, the soldiers should be given the following instructions (see Figure 3):

• Place a sheet of tracing paper over the large map and trace the contour lines, numbering each one with the correct elevation. Another method of doing this is to project part of the map you are using onto a wall with an overhead projector and then have the soldiers trace the lines onto their paper.

• Go to the highest elevation line on the tracing and cut along that line. If the line forms a circle, use a sharp knife to cut that circle out so as not to ruin the rest of the tracing.

• Place the tracing over a piece of cardboard and use a pencil to trace the shape onto the cardboard; then label it in the middle with the correct elevation.

• Cut the shape out and set it aside for now.

• Repeat the second, third, and fourth steps until you have a cardboard piece for each contour line.

• Start with the lowest elevation piece and stack the pieces on top of each other, using the original map as a guide for alignment.

After doing this, the soldiers know what the ground shown on the map looks like and need only to smooth out the lines of the contour model and add other features such as trees, roads, and buildings.

Building a complete terrain model is the next step. A terrain model must be accurate since its purpose is to give the soldiers a detailed picture of what is out on the ground before they get there. The easiest way to insure accuracy is to build the model to scale. Although the scale will vary, I recommend using either 10-centimeter or 1-centimeter squares for reference because both are easy to divide by ten. This allows the soldiers to approximate grid coordinates so that they can put the terrain features where they belong on the model.

The soldiers, working in small groups, follow these instructions:

• Clear and level an area to work in.

• Place your grid lines on the model. Nylon cord with knots at the interval of the chosen scale work quite well.

• Use the map as a guide and build only the contour features on the model.

• Add the rest of the features such as vegetation, buildings, and streams.

• Once the model is complete, label grid lines, roads, and other features that should be identified.

The final step in teaching terrain appreciation is conducting a terrain walk. Although I usually do this after the first three steps have been completed, a terrain walk during each step of the process can be a valuable reinforcement.

The primary purpose of a terrain walk is to allow the soldiers to go out and physically confirm the fact that their models or cross-sections actually match the ground. This confirmation builds the soldiers' confidence in their map reading skills and in their ability to visualize a three-dimensional image from a two-dimensional picture.

There are two additional reasons for conducting a terrain walk. The first is to identify differences between the data shown on the map and what is really on the ground, such as new trails or recently cleared forest areas. The second is to get the soldiers into the habit of constantly analyzing the terrain as they cross it. They should be taught to stop occasionally, look around, and ask themselves what they would do if their unit were ambushed where they are standing, or to look at a small streambed and think about how difficult it might be to move a company down that route quietly and swiftly.

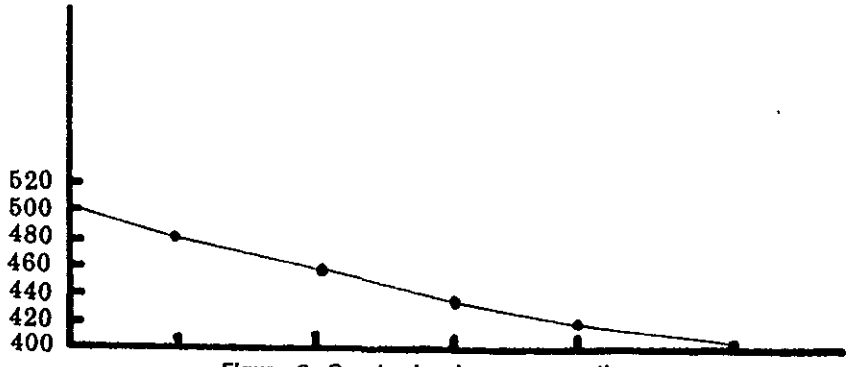

Figure 2. Graph showing cross-section.

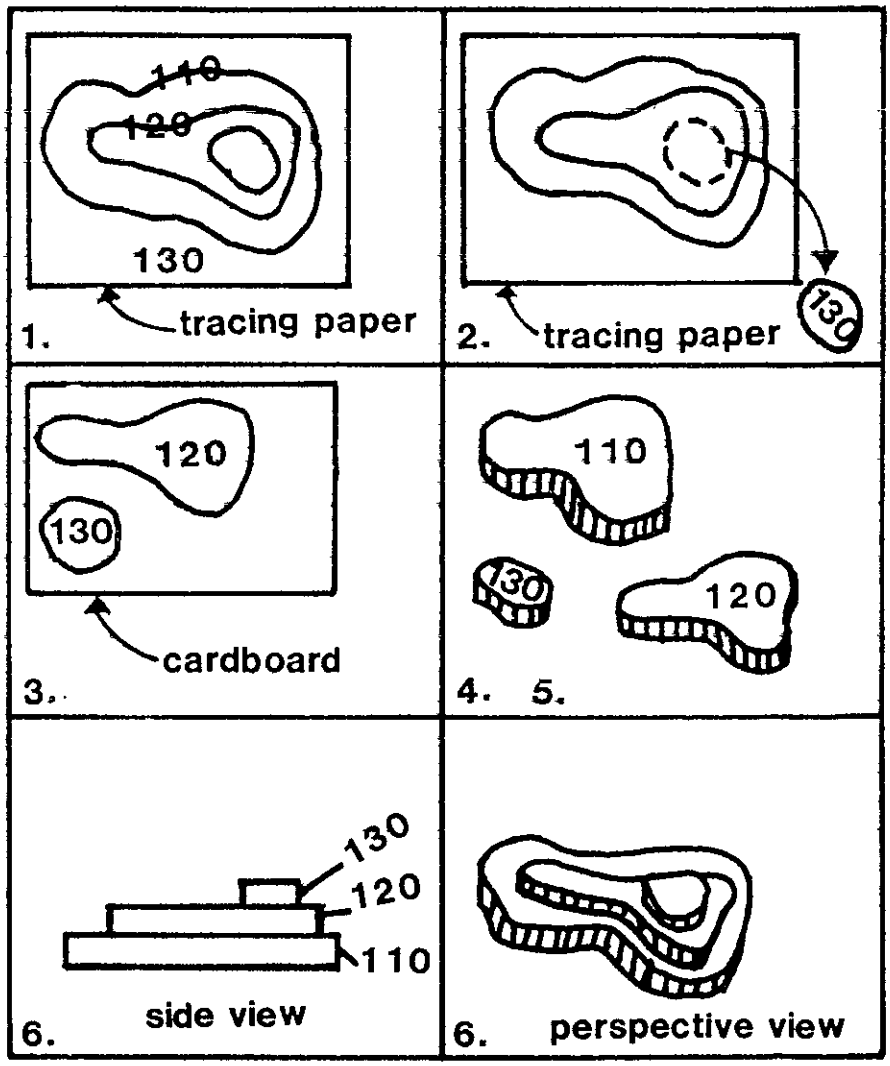

Figure 3. Steps in constructing a cardboard contour model.

A terrain walk is, in fact, an absolutely necessary part of the terrain appreciation process. If an instructor does not take the soldiers out to confirm and reinforce their confidence in their ability to visualize what is on the map, then he has wasted a lot of valuable training time. I have found that my soldiers have a much easier time using maps for field exercises after they have been through a few terrain appreciation problems.

Trainers who plan to use this technique in their units should allocate at least 16 hours per terrain appreciation exercise for the first one or two. After that, they can figure on between four and eight hours each, depending on the size of the group. (This estimate is based on a class of 15 to 20 people.)

For this entire process to be of any real use, local maps must be used. If you're stationed in Georgia, for example, don't use the old faithful Tenino, Washington, sheet. I use 1:24,000 U.S. Geological Survey (USGS) maps. These are readily available and have enough information in the marginal data that a grid system can be put on them for reference if the instructor so desires.

Too, in making the graphs for the cross-section step, I get the best results by using graph paper that is divided ten lines per inch or five lines per centimeter. These divisions are large enough to be seen easily but small enough to reduce vertical exaggeration to a tolerable level.

Anyone who has questions or comments concerning this method of instruction may write to me at 1685 Copeland Circle, Canton, Michigan 48187.

Lieutenant Kenneth G. Nielsen is a company commander in the 1st Battalion, 330th Infantry, Michigan Army National Guard. He is a 1983 graduate of Eastern Michigan University, where he is now enrolled in a graduate program in geography and land use analysis.

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MAJOR EDWIN L. KENNEDY, JR.

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