

Land Navigation

A COMMON TASK, NOT COMMONLY UNDERSTOOD

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Land navigation skills are among the few that just about everybody in the Army — at every level of command and leadership — needs to learn and practice to a high standard of competency: The vast majority of the Army's personnel, whether their duties are in combat, combat support, or combat service support units, have to know where they are and how to get where they need to be next to accomplish their mission.

Map reading and land navigation are the first step in placing every unit and every weapon system, no matter what size, into effective action on today's battlefield. Every combat service support requirement calls for several people (those who ask for the service as well as those who deliver it) to know how to read a map accurately and navigate to the correct point. In addition, the Army and Air Force are adopting increasingly accurate and lethal, not to mention expensive, weapons as part of the combat support umbrella covering the infantryman's and the tank's battlefield; but these sophisticated weapons can be no more accurate than the man who calls in his own location or that of the targets he wants engaged. As weapons become even more powerful and as their ranges stretch out, observers must report and others must plot enemy target positions faster and more accurately. Considering today's mobility, they rarely have time for more than one attempt to destroy a target before the opportunity is lost.

The AirLand battle of the future calls for both offensive and defensive operations consisting of nonlinear battles that attack enemy forces throughout their depth with fire and maneuver. These attacks require coordinated action by all available forces in pursuit of a single objective (and not necessarily a terrain objective) using the operational concepts of initiative, depth, agility, and synchronization.

The success of this concept rests in large part on the mental flexibility of the Army's leaders, who must act faster than the enemy. But it is equally important that these leaders direct the movements of units made up of personnel who can find their way quickly and accurately so they will be at the critical point at the critical time. But many of these leaders, and their soldiers too, know all too well that, today, they are not really learning and practicing these skills to any high standard.



Remedying this situation presents an obvious training challenge, and several factors get in the way of meeting it. The sheer number of people who need land navigation and map reading skills, for example, is one factor, and our present approach to teaching these skills is another.

First, our present approach assumes that soldiers naturally possess several of the prerequisite skills having to do with observing and interpreting their surroundings. But such natural skills were, in fact, lost to most of our population decades ago when we became an urban society.

In addition, there are many in the Army who disagree on how these skills should be taught and on what should be emphasized and what de-emphasized. And, finally, the Army has provided little in the way of new guidance or suggestions for presenting this instruction in ways that might produce better results. The most recent version of Field Manual 21-26 (Map Reading), for instance, is more than 14 years old and is based on manuals that have been used for several decades. And all the supplemental training circulars, TEC lessons, and pamphlets offer no more than the standard approaches found in the FM itself.

Perhaps the greatest barrier that stands in the way of strengthening land navigation skills, though, is our failure to recognize this weakness as a training problem rather than as a deficiency in the individual soldier and one that he can be expected to overcome with more of the same old training. If this same old training has not been adequate in the past and is not adequate in the present, it will probably be even less adequate in the future.

TWO METHODS

There are two basic methods of teaching land navigation: by dead reckoning and by terrain association.

A large group of people, including trainers in the Army and the Marine Corps, now favor the dead reckoning method. Land navigation by this method is a function of using a map and a protractor to determine the route and the direction of travel. These are then applied to the real world through use of a magnetic compass and various methods of estimating distances. (This procedure began centuries ago when sea captains on the Mediterranean sailed from port to port across open water in their trading ships.)

A much smaller group of people agree that dead reckoning is the best way to navigate over land but favor the techniques and equipment used in orienteering. They advocate throwing away the map protractor and the lensatic compass, saying that the orienteering style compass and pre-drawn north "grid lines" can do the job.

Then there is another group, growing in number, who advocate shifting back to the terrain association methods of the past. These people remind us that methods of estimating distance may not be precise and may become confusing when "the count" is lost. They say that paying close attention to the compass and the steering marks is



not always possible for soldiers and leaders who have other jobs as they move across the land. Further, they point to the difficulty our mechanized forces have in using a compass while moving in tanks and infantry vehicles; this requires stopping and walking away from the vehicle each time the compass azimuth is to be checked. Finally, they argue that since terrain will always present itself to the navigator and since the map can be carried along, it is more practical to navigate by terrain association.*

But there are certain problems in the thinking of each of these groups.

First, although dead reckoning is an effective method of teaching land navigation, there is no reason for excluding other effective methods. It would not be a good idea, however, for the Army to adopt the orienteers' idea of discarding the map protractor and adopting the orienteering compass with magnetic north "grid lines" drawn on the map. The present lensatic compass is superior in accuracy when locating steering marks along a given azimuth and when undertaking intersection and resection problems. It is also invaluable at night because of its luminous features. (Incidentally, magnetic north-correcting grid lines drawn on the map may not be accurate unless precision drafting tools are used, and these lines add extraneous clutter to military maps already full of detail. Even the Sierra Club in its Land Navigation Handbook, published in 1983, cautions against this practice.)

Meanwhile, those who advocate navigating exclusively by terrain features fail to appreciate the problems of moving during periods of limited visibility or at night and over terrain that is relatively flat or covered by vegeta-

*The Army's Engineer Topographic Laboratories at Fort Belvoir are presently working on the problem of providing an accurate compass reading to tank and infantry vehicle commanders as they move across the battlefield. The Combat Vehicle-Heading Reference System (CVHRS) is basically a magnetic compass that uses electronics to neutralize the effect of the magnetic field created by the metal vehicle. Therefore, a combined dead reckoning/terrain association approach will soon become feasible for mechanized forces.

tion. They often mistakenly believe that when visibility is extremely good and there are prominent terrain features, they can accurately determine their positions on the ground even when those terrain features are quite distant. True, a navigator may be able to continue to navigate to a known recognizable point by using distant terrain formations as a guide in a place such as the Mohave Desert. But this does not necessarily mean he can locate himself at any given time either on the ground or on the map without a compass. Indeed, it is easy for him to miss the mark by several grid squares.

A person driving along an interstate highway, for example, can travel substantial distances with barns, trees, and smaller hills several hundred meters from the road "moving by" quickly, while a distant mountain peak does not "move" at all. But this does not mean the driver is not moving toward that peak; it merely suggests that he needs a precision instrument to measure that movement.

BEST APPROACH

The best approach, then, to training people in land navigation is to recognize that, while dead reckoning is an effective method by itself, more emphasis on terrain association as a supplement would improve our training. This, of course, would have to be coupled with some additional instruction on certain prerequisite skills related to observing and interpreting terrain, which most of us now lack. Greater emphasis on observation and terrain association would also pay dividends in having soldiers and units make better tactical use of the terrain they travel across or occupy.

A good place to begin might be with the training literature. While the references on land navigation do not completely ignore terrain association, most of the pages in these publications and most of the hours set aside for actual training time overwhelmingly favor the dead reckoning method. (A quick count suggests the ratio is about 10 to 1.) In addition, a soldier looking for "land navigation" in the index of FM 21-26 is referred to a paragraph entitled "Dead Reckoning"; and the comic book circular, TC 21-26 (Don't Get Lost), teaches land navigation solely by the dead reckoning method. About the only terrain association aspect really emphasized is the location of unknown points on the map through methods of resection and intersection from known points on the map and on the ground.

Most of the training methods being used now are technically correct, but they can be improved upon in several ways. The following suggestions focus upon some additional things that might be done, some changes in the order in which a few of the tasks are presented, and some shifts in emphasis.

- Insist that troops always navigate and operate with a correctly oriented map (error of 30° or less).

Current training doctrine calls for instruction on how to orient a map either with a compass or by inspection, but the training does not emphasize a requirement to use

it that way all the time. Psychological research conducted at the State University of New York at Stony Brook recently confirmed the fact that even trained map users, with the simplest maps, become confused when the maps are misaligned with the actual lay of the land or the layout of a building.

These experiments also showed that as maps become more complex it becomes increasingly difficult for individuals to perform the complicated mental gymnastics necessary to get properly oriented on a misaligned map. Yet, many people in the field still use maps with the north side up, no matter in which direction they are observing or traveling.

- Include an introduction to fundamental map making techniques (survey and triangulation) in the program of instruction.

Students of map reading and land navigation must understand the fundamentals of how modern maps are made. A good example that might be used is the early scientific mapping of France in the 1670s by the Cassini family. These highly accurate maps (considering the time) were developed through a few simple but painstakingly accurate measured baselines and literally thousands of individual triangulation surveys.

- Change the order in which instruction is given on map and compass land navigation tasks.

Conversion between grid and magnetic azimuths is extremely important, but it should not be taught before instruction on intersection, back azimuth, and resection as it is now. The concept of conversion between grid and magnetic azimuths is the single most difficult map reading and land navigation skill to teach, learn, or retain. Taught first, it only interferes with the student's understanding of the concepts that follow. It should therefore be taught only after he has mastered these other skills.



- **Integrate more terrain association techniques into the land navigation skill package.**

Neither method — dead reckoning or terrain association — should ever be applied to the exclusion of the other. The farther a navigator travels by dead reckoning without a confirmed reference to some known point, the less accurate his course becomes. Conversely, hills, forests, ridges, and streams can all begin to look alike to him, but the compass and the steering marks can give him some important guidance when traveling across unfamiliar country. Type of terrain, amount of vegetation, visibility, and light factors can cause the navigator to vary his dependence upon one system or the other; but unless he is traveling across a featureless sea, he should never be encouraged or allowed to exclude either method.

- **Teach observation and interpretation of terrain features first from field to map and then from map to field. Also, require students to translate map terrain routing instructions from symbols into words.**

Except during the initial study of elevation and relief, which is introduced as part of map reading symbology, all practical instruction on the observation and interpretation of terrain features should begin with field-to-map exercises. After all, the French cartographers who first used contour lines in 1771 saw terrain features that they wanted to represent clearly on a map — not contour lines on a map that they wanted to envision as terrain features.

Today, British officer training at Sandhurst (The Royal Military Academy) includes several hours of practical “pin prick” exercises in the field. The idea is to have the student move down a known course and mark the locations of several designated terrain features on his map with pins. These experiences give the student an opportunity to observe and interpret these features and then to see how the mapmaker represented them on paper. After he becomes proficient in this skill, the student is ready to draw mental images of the various terrain features by looking at his map. (We seem to go through the process backward, or perhaps we just skip an important step.)

The final step is to have the student interpret his map along a particular route and translate the symbols into words. His translation should sound like the familiar, “Go to the third traffic light where you take a left and then to the fast food place on the right.” But the student would substitute terrain features and general directions (N,S,E,W) for traffic lights, left turns, and fast food places. This verbalization can greatly improve a land navigator’s chances of successfully reaching his destination, because he can now use dead reckoning, terrain association, and his own verbal instructions as guides.

- **Incorporate other miscellaneous helpful hints into the instructional program.**

An instructor can teach his students, for example, that a man cannot walk a straight line route unaided; that primitive man navigated by measuring the amount of travel in a particular direction in terms of time instead of distance; and that snow melts more on south-facing slopes in the northern hemisphere. He can also teach them how to use the direction of prevailing winds, slopes, stream flows, mountain ranges and ridges, along with the advantages of creating mental sound, sight, and smell maps while passing through unfamiliar country.

Incidentally, stars are not the only lights in the night sky that can be used for finding direction. Knowing where mortar or artillery illumination rounds are being fired, or in what direction a city that lights up a huge circle in the sky happens to be, can also provide important clues.

- **Familiarize military personnel with the topographic maps produced by the United States Geological Survey (USGS).**

Special Forces personnel and those in the Reserve Components particularly are often required to train in areas not covered by military maps. These soldiers should be told how to obtain U.S Geological Survey (USGS) maps and should be given some instruction on the special features of these maps. For example, coordinates for the Universal Transverse Mercator (UTM) grid system (used on military maps) are represented by blue tic marks along the margins outside the frame of USGS maps. By connecting the opposite tic marks from north to south and east to west, these soldiers can have an accurate military grid system of their civilian training area. In addition, all new 1:25,000 maps now being published by the USGS have full UTM grid lines printed on them.

- **Develop in leaders and trainers an increased awareness that our future success on the battlefield depends to a large extent upon our training in land navigation.**

Developing this awareness and improving our training in land navigation present some problems, but the problems are correctable. Although many factors have perpetuated the deficiencies that now exist in map reading and land navigation, the future success of the Army as it undergoes modernization depends to a large extent on correcting those deficiencies and bringing its soldiers up to a high standard in these critical skills.



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