Chapter 7

Navigation and Route Selection

7001. Cold Weather Navigation

Map reading and navigation in snow covered terrain follows the same principles as in temperate climates. In cold weather operations, however, navigation and route selection are complicated by:

- Snow covered terrain, which makes terrain look different and hinders orientation.
- Weather conditions can reduce visibility.
- Use of over-the-snow mobility devices such as snowshoes or skis with equipment loads (i.e., sleds) may determine route.
- Avalanche potential that constantly dictates the route. (see Appendix A)

7002. Navigation Challenges

Unlike any type of environment, a snow-covered environment provides many challenges to navigation and route selection. Deep snow will completely cover tracks, trails, streams and roads making map reading difficult. Other challenges unique in a CWE include:

a. Snowdrifts may hide small depressions and draws indicated on maps. They may even give the impression of small hills.

b. Lakes, ponds, marshes, and rivers are often covered with snow and/or ice, which make detection difficult. They may or may not be suitable to cross.

c. In Northern latitudes, increased periods of darkness during winter months will require more night operations.

d. Aerial photos taken during winter are difficult to read because of the monotony of detail, absence of relief, lack of contrast; and in more isolated areas, the absence of man-made works for reference points.

e. Handling maps, compasses, and other navigational equipment with cold weather clothing can be difficult.

7003. Navigational Techniques

The techniques of navigation are the same for snow covered terrain as under temperate conditions, although some additional considerations may be applied.

a. **Use of Compass.** The standard military, lensatic compass functions well in the cold. If you are using a liquid-filled compass, you will have to keep it warm, or it will become sluggish.

b. **Magnetic Force.** The lines of magnetic force run horizontal to the earth's surface near the equator but are nearly perpendicular close to the poles. Along the equator, a compass needle will lie horizontal. The further the compass is from the equator, either north or south, the more the needle will begin to pull toward magnetic vertical. In extreme latitudes, it is possible for the needle to dip enough to keep it from rotating freely.

c. **AN/PSN-11.** The AN/PSN-11 is a valuable navigational aid, but does have some cold weather considerations. To shorten warm-up time and conserve battery life in cold weather temperatures, wrap

the AN/PSN-11 in a parka, sleeping bag, or similar device during the warm-up period. The clothing acts as a thermal insulation. Keeping equipment heat from escaping to the ambient air results in a shortened warm-up period and extends battery life. The AN/PSN-11 will not operate at temperatures below –4 degrees.

d. Use of Altimeter. Many manufacturers now produce watches with altimeters. The altimeter is very useful for navigating in mountainous terrain and can be used as a second azimuth to obtain a resection from map. With known elevation, a navigator can trace his back-azimuth to the according map contour line as indicated with the altimeter. When moving parallel to the contour interval, the unit can maintain an elevation to within 5 to 10 meters. This technique can be used to maintain a certain elevation while traversing a slope. During periods of reduced visibility when landmarks are not available, the altimeter is a priceless tool for navigation. When lakes freeze and become covered with snow, they are indistinguishable for open fields. Use of a map, combined with an altimeter can help distinguish one from the other.

e. Determining Pace Count. Determining pace count in snow covered terrain is difficult on snowshoes and impossible if movement is on skis. This is because snow cover terrain will almost always dictate the route by long traverses and numerous kick-backs. Additionally, travel with sleds will require many turns through forested areas.

f. Compass March. In arctic regions without visible landmarks or in open terrain with reduced visibility, the compass march is a useful method to determine pace count. The team consists of a navigator with compass and two distance measuring men who have a 100 meter length of cord and nine trail markers.

(1) The lead man moves off dragging one end of the cord and carrying nine markers.

(2) The rear man jerks the cord when the lead man is at its end. This signals the lead man to drop his first marker.

(3) Both men move out dragging the extended cord between them.

(4) When the rear man reaches the first marker, he stops and jerks the cord. Then he picks up the first marker. When the lead man feels the jerk, he looks back to ensure the cord is not snagged and drops the second marker.

(5) Both men move out, and repeat the procedure until the rear man has all nine markers and the lead man is 1,000 meters out.

(6) The lead man stops. The rear man moves to the lead man's position. At this point, 1,000 meters have been covered. The navigator is responsible for directing the march.

g. Determining Location. Determining location can be difficult in snow covered terrain when using over-the-snow mobility device such as skis or snowshoes. While terrain will normally dictate routes, being able to dead reckon in a snow covered mountainous environment is almost impossible. Marines must rely more on terrain appreciation, but should not overlook vital navigational aids such as the AN/PNS-11 or altimeters.

7004. Route Planning Considerations

Before any movement, the following considerations should be used to determine your route.

a. Determine the Unit's Ability

- Are Marines on snowshoes or skis?
- How proficient are they on that equipment?
- What type of terrain can they handle?
- Will they be carrying heavy packs and pulling sleds?
- Are vehicles attached? What type of terrain can they handle?

b. Analyze the Terrain

- Is the route feasible with limited visibility?
- Does the route cross potential avalanche slopes as indicated by map reconnaissance and aerial photograph, if available?
- Does the route offer concealment from enemy direct observation?
- What obstacles can be anticipated? Example: a plowed road with high snow banks, farmland fences, and streams with steep sides are significant, especially if sleds are being pulled.
- Can the security element for the main body negotiate the terrain?
- How will snow condition impact movement (wet snow vs. ice)?

c. Analyze the Predicted Weather

- What allowance is made for weather?
- Are designated bivouac sites identified if weather turns bad?

d. Analyze the Tactical Situation/Mission

- How can tracks be camouflaged?
- Where can speed be accomplished without undermining total security?

e. **Plan the Route.** After all the route planning considerations are evaluated carefully, the route is planned and recorded on a map overlay or route card. The Time-Distance-Factor (TDF) is a guideline and should not be considered as the exact amount of time required for your movement. Furthermore, this formula is for use in ideal conditions.

- 3 kilometers per hour.
- Add 1 hour for every 300 meters ascent.
- Add 1 hour for every 800 meters descent.

7005. Route Selection

While the map overlay is constructed with the planned route, the detailed selection of route during movement is the responsibility of the unit leader. Some of the guidelines are as follows:

a. In open space terrain, break only one track. Follow the tree line or natural terrain feature.

b. Avoid dense forest, if possible. Stay at the edge of wooded areas or in less dense portions.

c. Use gentle traverses to ascend or descend mountainous terrain. Once altitude is gained, follow slope contours. Avoid avalanche-prone slopes.

d. Frozen streams can provide excellent routes. Check ice thickness before proceeding. (See Chapter 9) Move close to a shore or bank.

e. Bypass obstacles, if possible.

f. A route for night movement must follow the easiest possible terrain and should be well marked.

g. As you get close to the enemy, shift emphasis from ease of movement to concealment.

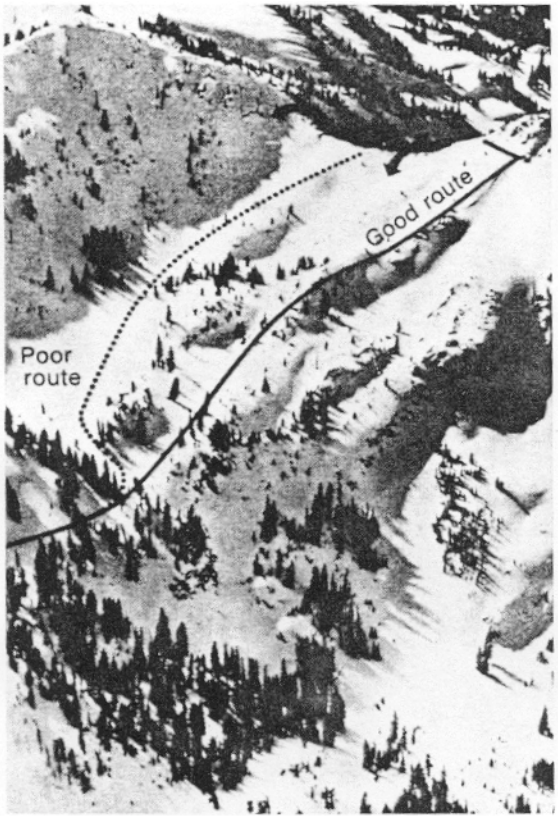

Figure 7-10A. Example of Route Selection in Area of Suspected Avalanche Hazard.

Figure 7-10B. Example of Route Selection in Area of Suspected Avalanche Hazard. – Continued