Land Navigation
Over Snow-covered Terrain

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Army units operating in the cold regions of the world often have trouble navigating because snow has concealed terrain features and landmarks.

For example, a helicopter landing zone is set up on what appears to be the only clear, level piece of terrain around. But when an aircraft descends into the blizzard of powdery snow blown up by its rotors, the surface turns out to be ice that is not thick enough to support its weight.

If the soldiers who set up this landing zone had been more suspicious, they may have noticed that the "field" was uniformly flat and level, while most fields have some degree of roll and slope, and that neither vegetation nor fence posts protruded through the snow. Even if the soldiers and the air crew had consulted the map, they may have failed to notice that the area was shown in pastel blue to indicate water drainage. Unfortunately, pastel blue does not show up in brilliant sunshine through dark ultra-violet (UV) protective goggles.

This situation could have been prevented if an intelligence preparation of the battlefield (IPB) had been conducted before the operation and if better maps had been available.

Such an IPB is conducted at division level by the engineer terrain team and by the staff weather officer under the supervision of the G-2. Together, these staff members analyze the military aspects of terrain in the division's area of operations, and also the effects of weather upon that terrain. The map operational products, climatological summaries, current weather data, and forecasts that they produce are primarily intended for staff planning. To the extent that these products are distributed down to battalion level, however, they can also enable S-2 sections to provide IPB support for battalion tactical operations.

Map operational products in black-and-white are not practical for navigation in mountains. Units that frequently operate on mountainous terrain—such as the 3d Battalion, 172d Infantry (Mountain), the 10th Special Forces Group (Airborne), and the 6th Infantry Division (Light)—should have 1:12,500-scale topographic maps overprinted with water drainage and avalanche hazard information. The production of such maps would require support—available on request—from the topographic engineers found at echelons above division.

The colors on the maps would have to be intense so they could be read in brilliant sunshine through dark UV protective goggles. For example, *medium blue* could indicate water drainage. In the northern hemisphere, *yellow* could indicate potential powder avalanche zones—northern slopes of 25 to 45 degrees (28 to 50 percent); and *orange* could indicate potential slab avalanche danger zones—southern slopes of 25 to 45 degrees. (In the southern hemisphere, the yellow and orange would be reversed.) *Red* could show known (historic) avalanche chutes, and *medium green* could show heavily forested areas that obstruct avalanches.

The staff weather officer prepares overlays that template current weather data—wind direction and force, temper-

ature, and depth of snowfall. This data is used along with the terrain team's map operational products to depict the way changing weather conditions affect terrain. *(See Annexes B and C, Field Manual 34-81 for specific effects and critical meteorological values.)*

Leaders should keep in mind that weather is not just a winter consideration, particularly in arctic and high-alpine regions. The effects of weather upon snow-covered terrain in these regions can change dramatically during the warmer months, and daily thaw-and-freeze cycles can trigger avalanches.

It is difficult to estimate range in snow-covered terrain. Keeping a pace count is impractical for a soldier on skis or snowshoes, as is measuring the kilometers traveled with a 50-meter length of Type II nylon (parachute suspension) line. Fortunately, laser range finders — and to a lesser degree, split-image (parallax) range finders — are practical and highly accurate.

In high-alpine regions, altimeters are also used along with maps and compasses to determine location. Altimeters are sensitive to changes in barometric pressure, however, and it takes experience to differentiate changes in altitude from changes in weather. In one of my units, for example, when a sudden change in barometric pressure preceded visual signs of an approaching storm, our altimeter gave us the first indication. If we had not dug snow caves immediately, instead of climbing on toward the summit, we surely would have died from hypothermia in a few hours. (Sometimes, the most reasonable course of action is to wait for better weather conditions.)

In arctic regions, land navigation is also made more difficult by large magnetic declinations, by limited hours of daylight during winter months, by the lack of landmarks, and by the disappearance of existing landmarks during white-out conditions. Loran (long-range navigation) beacon and GPS (global positioning system) locators are not affected by these factors, but care must be taken to keep liquid-crystal displays from freezing. Locators with light-emitting-diode displays are preferable, because they are much more rugged.

Crevasses present another navigation hazard commonly found on glaciers. The crevasses that have formed over convex terrain, such as those at the leading edges of glaciers, tend to be open at the top, tens of meters across, and tens of meters deep. The crevasses that have formed over concave terrain, such as those at the bases of mountains, tend to be narrow at the top and are sometimes concealed by snow bridges. Although hidden crevasses are extremely dangerous for soldiers on foot and in vehicles, they are often safe to cross on skis.

Navigating over snow-covered terrain requires deliberate planning. As with many other military activities that present special dangers and challenges, this skill is also improved by training. One such training opportunity is the 6th Infantry Division's Northern Warfare Course. Those who complete this course are awarded skill qualification identifier E, Northern Warfare Expert. *(Some helpful manuals for training are FM 5-33, Terrain Analysis, 11 July 90; FM 31-71, Northern Operations, 21 June 71; FM 34-81, Weather Support for Army Tactical Operations, 31 August 89; FM 34-130, Intelligence Preparation of the Battlefield, 23 May 89; and FM 90-6, Mountain Operations, 30 June 80.)*

Even professional mountain guides sometimes have difficulty navigating over snow-covered terrain. For example, when guides who have survived avalanches are asked why they chose routes across avalanche hazard areas, they often reply that they had hiked along these routes in summer and "knew the terrain." Their mistake is in failing to recognize that mountain terrain changes when it is covered with snow.

To overcome hazards in snow-covered terrain and navigate successfully, an Army unit must use the IPB process, use well-prepared map operational products, pay attention to the available weather information, and take full advantage of cold region training opportunities.

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The Light Infantry Chaplain

CHAPLAIN (MAJOR) KENNETH L. SAMPSON

A light infantry battalion places certain distinctive requirements on its personnel—physical stamina, tolerance for change, initiative, risk-taking, small-unit operations. To be effective, a light infantry battalion chaplain and his assistant must possess some of these traits as well as others specifically related to the demands of their positions.