MCRP 3-35.1A

Small Unit Leader's Guide to Mountain Warfare Operations

US Marine Corps

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FOREWORD

Marine Corps Reference Publication (MCRP) 3-35.1A, *Small Unit Leader's Guide to Mountain Warfare Operations*, is a reference for all Marine leaders (team through company) to use when conducting operations in mountainous terrain, snow, cold weather, and/or high altitude. This publication is to be used in conjunction with the Marine Corps Warfighting Publication 3-35.1, *Mountain Warfare Operations*, and its other associated MCRPs 3-35.1B, *Mountain Leader's Guide to Winter Operations*; 3-35.1C, *Mountain Leader's Guide to Mountain Warfare Operations*; and 3-35.1D, *Cold Region Operations*.

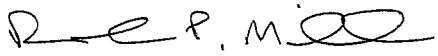
The series covers a broad spectrum of individual and small unit tactics, techniques, and procedures across all six warfighting functions. Topics include the environment, specialized clothing and equipment, weapons considerations, patrolling considerations, route selection and navigation, basic avalanche hazard assessment and mitigation, crossing streams/ice, snowshoeing, winter camouflage, logistics, fire support, helicopter operations, and casualty evacuation. It stresses only the skills necessary for Marines to function in combat.

Because of the rapid turnover in personnel, operational tempo, and the multitude of training commitments, the Marine Corps Mountain Warfare Training Center cannot train all Marines or units. In combat, Marines may need to learn through doctrinal references that are augmented with instruction from their unit's qualified summer and winter mountain leaders. This MCRP gives them that capability.

This publication supersedes MCRP 3-35.1A, *Small Unit Leader's Guide to Cold Weather Operations*, dated 16 November 1990.

Reviewed and approved this date.

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS



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CHAPTER 1
MOUNTAIN WEATHER

A Marine's ability to see the enemy, terrain, and troops around him is greatly affected by the weather he encounters. Having access to weather information can help Marines be prepared; therefore, whether traveling or in the patrol base, Marines should constantly evaluate the following:

- What is the weather currently?
- What was the weather recently and when did it change last?
- When is the next forecasted change coming?

Winds

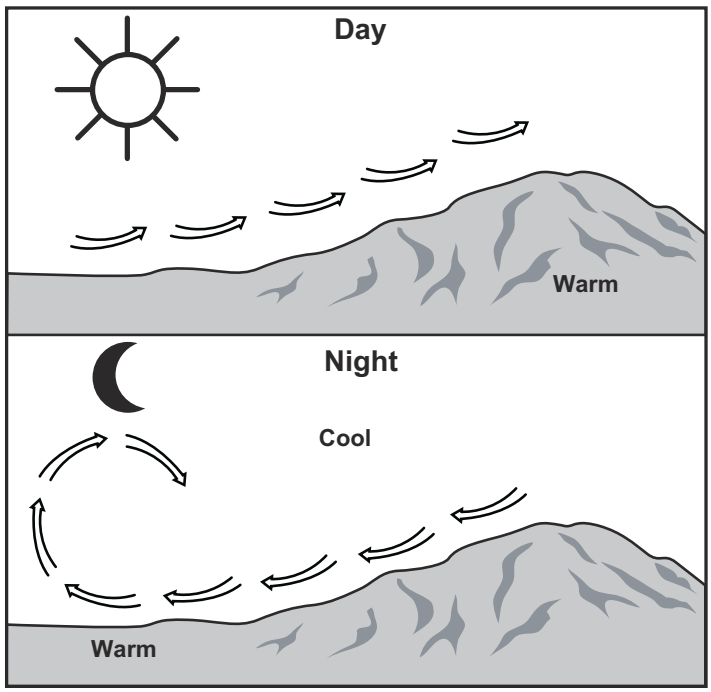
Warmed air, combined with the spinning (rotation) of the earth, produces winds that spread heat and moisture more evenly around the world. Wind is important because the sun heats the equator much more than the poles and, without winds to help restore the balance, much of the earth would be uninhabitable. Therefore, much of the world's weather depends on a system of winds that circulate in a set direction, thereby, establishing a pattern. The pattern is determined by the different amounts of solar radiation (heat) that a region receives and on the rotation of the earth.

Above hot surfaces, the air expands (air molecules spread out) and moves to colder areas where it cools, becomes denser, and sinks to the earth's surface. This process forms a circulation of air from the poles along the surface of the earth to the equator, where it rises and moves toward the poles again. This pattern of circulation becomes more complex once the rotation of the earth is considered.

Some types of winds that are peculiar to mountainous environments but do not necessarily affect the weather are anabatic and katabatic winds, as in figure 1-1 on page 1-2. Anabatic winds blow up mountain valleys to replace warm rising air and are usually light winds. Katabatic winds blow down mountain valley slopes caused by the cooling of air and are occasionally strong winds.

Jet Stream

A jet stream can be defined as a long, meandering current of high speed winds near the tropopause (transition zone between the troposphere and the stratosphere) that generally blows from the west and often exceeds 250 miles per hour. The actual path of the jet stream comes from the west, dips south, picks up air masses from the tropical regions, goes north, and brings down air masses from the Polar Regions. The jet stream results from circulation of air around the poles and equator and the direction of airflow above the mid latitudes.



Air flows up the mountain during the day and down the mountain at night.

Figure 1-1. Anabatic and Katabatic Winds.

Wind Speed

The wind speed affects projectile trajectory equipment, antennas, and personnel and can be determined by observing the environment (see table 1-1). When wind speed is combined with the air temperature, it produces a windchill index (see table 1-2). The windchill is the apparent temperature of air on exposed skin.

Table 1-1. Effects of Wind Speed.

The Beaufort Scale	
Wind Speed (miles per hour)	**Observable Wind Characteristics**
0–1	Smoke rises straight up; calm
2–3	Smoke drifts
4–7	Wind felt on face; leaves rustle
8–12	Leaves and twigs constantly rustle; wind extends small flags
13–18	Dust and small paper raised; small branches moved
19–24	Crested wavelets form on inland waters; small trees sway
25–31	Large branches move in trees
32–38	Large trees sway; must lean to walk
39–46	Twigs broken from trees; difficult to walk
47–54	Limbs break from trees; extremely difficult to walk
55–63	Tree limbs and branches break
64 and higher	Widespread damage with trees uprooted

Humidity

Humidity is the amount of moisture in the air. Although it is invisible, all air holds water vapor—the warmer the air, the more moisture it can hold. When the air has all the water vapor that it can hold, the air is saturated (100 percent relative humidity). If the air is then cooled, any excess water vapor condenses. The water molecules join to create water droplets that can be seen; the temperature at which this happens is called the saturation point or dew point. This

point varies depending on the amount of water vapor and the temperature of the air.

Adiabatic Lapse Rate

The adiabatic lapse rate is the rate that air will cool (-) on ascent and warm (+) on descent. The rate also varies depending on the moisture content of the air (see fig. 1-2). Saturated air cools at 3.2 °F per 1,000 feet, while dry air cools at 5.5 °F per 1,000 feet.

Note: For military planning purposes, 4 °F should be used.

Pressure

Air pressure is the weight of the atmosphere at any given place. High pressure generally

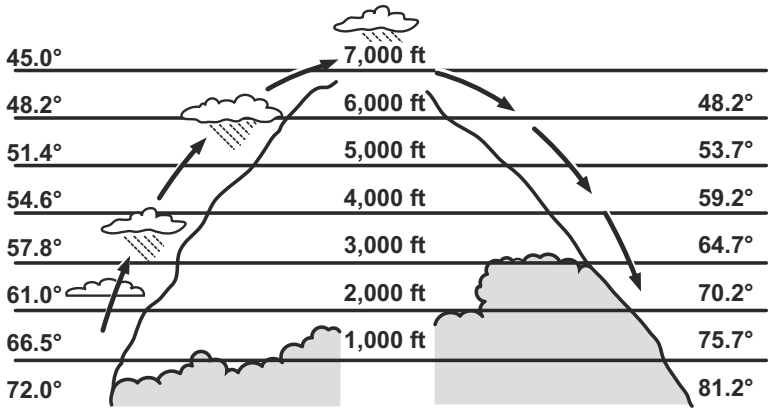
Table 1-2. National Weather Service Windchill Index.

Wind (mph) \ Temperature (°F)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite occurs in 15 minutes or less

Wind chill (°F) = 35.74 + 0.6215T - 35.75($V^{0.16}$) + 0.4275T($V^{0.16}$)

Where, T = Temperature (°F)
V = Wind Speed (MPH)



Add condensation/moisture to the mix and the air cools at a slower rate (approximately 3.2 degrees per 1,000 feet) and then warms at a slower rate too until the moisture evaporates, illustrating adiabotic cooling and warming.

Figure 1-2. Adiabotic Lapse Rate.

indicates fair weather and low pressure generally indicates inclement weather.

Air in the atmosphere acts very much like a liquid. Areas with a high level of this "liquid" would exert more pressure on the earth; hence, they would be called high-pressure areas. Areas with a lower level would be called low-pressure areas. In order to equalize, the areas of high pressure would have to push out to the areas of low pressure: high pressure area flows out to equalize pressure; low pressure area flows in to equalize pressure.

The air from the high pressure area gradually flows out to equalize its pressure with the surrounding air, while the low pressure builds vertically. Once the low has achieved equal pressure, it cannot stop and continues to build vertically, causing turbulence and bad weather.

Note: Weather maps indicate these differences in pressure with contour lines. These contour lines are called isobars and are translated to mean "equal pressure area." Therefore, areas of high pressure are called ridges and areas of low pressure are called troughs or depressions.

Pressure is measured in millibars or inches-mercury. Pressure (or weight) of the atmosphere decreases as the altitude increases. For example, at 18,000 feet, the pressure would be 500 millibars vice 1,013 millibars at sea level.

Lifting and/or Cooling

Air can only hold so much moisture, depending on its temperature. If this air is cooled beyond its saturation point, it must release this moisture in one form or another, such as through rain, snow, fog, or dew. There are three ways that air can be lifted and cooled beyond its saturation point:

- *Orographic uplift.* This uplift happens when an air mass is pushed up and over a mass of higher ground, such as a mountain (see fig. 1-3). Due to the adiabatic lapse rate, the air is cooled with altitude and, if it reaches its saturation point, will produce precipitation.
- *Convection effects*. Convection effects normally occur in the summer due to the sun's heat reradiating off the surface and causing the air currents to push straight up and lift air to a point of saturation (see fig. 1-4).

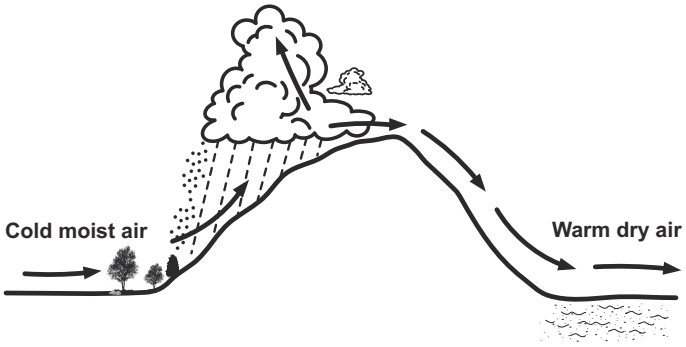


Figure 1-3. Orographic Uplift.

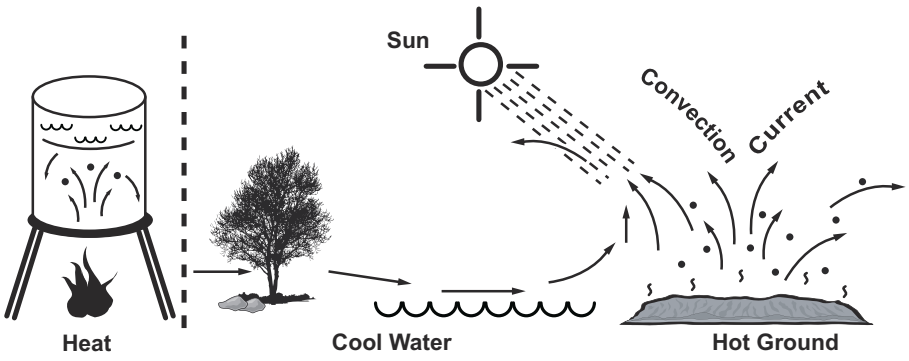


Figure 1-4. Convection Effects.

- *Frontal lifting*. Frontal lifting occurs when two air masses of different moisture and temperature content collide. Since the air masses will not mix, the warmer air is forced aloft (see fig. 1-5). Once there, it is cooled and then reaches its saturation point.

Most precipitation comes from frontal lifting. A combination of different types of lifting is normal.

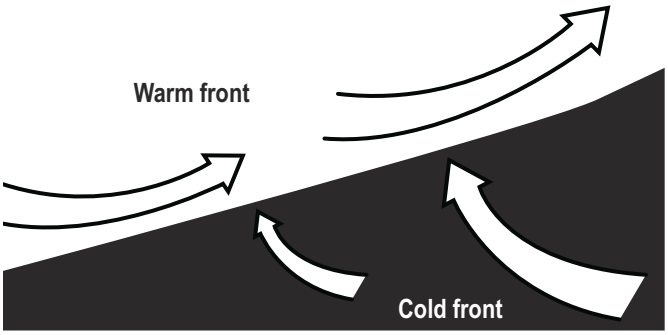


Figure 1-5. Frontal Lifting.

Clouds

Any time air is lifted or cooled beyond its saturation point (100 percent relative humidity), clouds are formed. Clouds are a Marine's weather signpost. They can be described in many different ways and classified by height, appearance, or even by the amount of vertical or horizontal area covered. In general, clouds are named using Latin roots: *cirrus* (ringlet) is used to designate wispy clouds; *cumulus* (heap) refers to puffy clouds; and sheet-like clouds are referred to as *stratus* (layer). Rain clouds contain the prefix or suffix *nimbus*, which means rainstorm.

Cirrus

Cirrus clouds are formed of ice crystals at very high altitudes (usually 20,000 to 35,000 feet) and are thin and feathery looking. Cirrus clouds can provide up to 24 hours warning of approaching bad weather as they build hundreds of miles in advance of a front (cold, warm, or occluded). Cirrus clouds look thin, frail, and feathery (see fig. 1-6). Types of cirrus clouds include sculpted (such as mare-tails and lenticulars), which show high winds in the upper atmosphere, and dense cirrus layers/scattered tufts, which are signs of fair weather.

Figure 1-6. Cirrus Clouds.

Cumulus

Cumulus clouds are formed due to rising air currents and are prevalent in unstable air that favors vertical development. Cumulus clouds look piled or bunched up like cotton balls (see fig. 1-7). There are three types of cumulus clouds that help to forecast the weather:

- Fair weather cumulus—scattered puffs of cotton in a blue sky.
- Towering cumulus—characterized by thick, vertical development like cauliflower.

Figure 1-7. Cumulus Clouds.

- Cumulonimbus—heavy, dark, towering, and anvil-shaped clouds that produce precipitation. These clouds are characterized by violent updrafts, which carry the tops of the clouds to extreme elevations. They are associated with short, heavy precipitation; strong winds; lightening; tornadoes; and hail.

Stratus

Stratus clouds are formed when a layer of moist air is cooled below its saturation point. Stratiform clouds form mostly in horizontal layers or sheets, resisting vertical development. Stratus clouds are associated with long, light precipitation, such as drizzle or snow flurries. Stratus clouds look uniform or flat, with a dull, gray appearance that resembles fog (see fig. 1-8).

Figure 1-8. Stratus Clouds.

Fronts

Fronts happen when two air masses of different moisture and temperature content interact. One of the ways a Marine can identify a frontal lift is by observing the progression of the clouds.

Warm Front

A warm front occurs when warm air moves into and over a slower (or stationary) cold air mass. Since warm air is less dense, it will rise naturally above the cool air and push it down (see fig. 1-9), producing a cirrus cloud. When it actually starts rising, the cloud becomes stratus. As it continues to rise, the cold air cools this warm air and it receives moisture at the same time. As it builds in moisture, it darkens and becomes nimbostratus, which means rain from thunder clouds. At that point, some type of moisture will generally fall. In short, the cloud progression for a warm front is cirrus to stratus to nimbostratus.

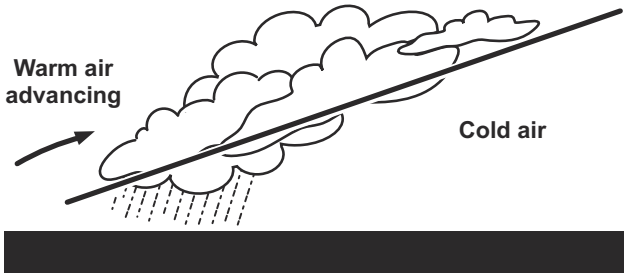


Figure 1-9. Warm Front.

Cold Front

A cold front occurs when a cold air mass (colder than the ground over which it is traveling) overtakes a warm air mass that is stationary or moving slowly. This denser cold air will go under the warm air, pushing it higher (see fig. 1-10). Of course, no one can see this "air," but they can see clouds, which indicate what is happening. The cloud progression for a cold front is cirrus to cirrocumulus to cumulus to cumulonimbus.

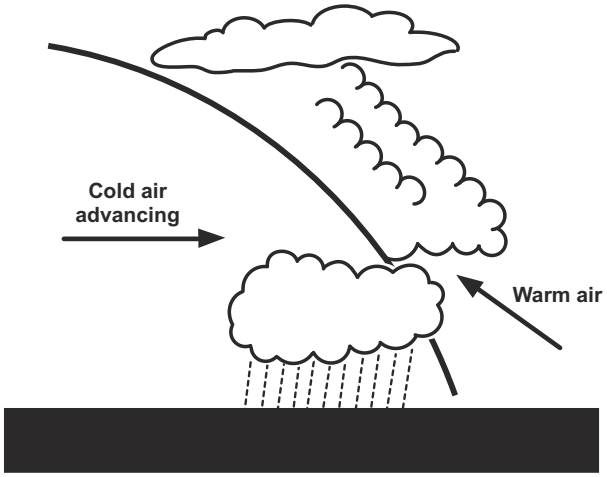


Figure 1-10. Cold Front.

Occluded Front

Cold fronts move faster than warm ones; eventually, a cold front overtakes a warm one and the warm air becomes progressively lifted from the surface. The zone of division between cold air ahead and cold air behind is called a cold occlusion. If the air behind the front is warmer than ahead, it is a warm occlusion. In the progression of clouds leading to fronts, orographic uplift can deceive the observer about the type of front—the progression of clouds leading to a warm front with orographic cumulus clouds added to them. The cloud progression for an occluded front is a combination of both progressions from a warm and cold front.

Indicators of Weather

Close observation of nature can indicate changes in the weather. Air pressure and other signs from nature can help to predict atmospheric conditions.

Pressure as a Weather Indicator

A very important weather indicator is the pressure. As Marines know, low pressure or dropping pressure normally indicates deteriorating weather; whereas, high pressure usually indicates good weather or clearing of bad weather. Pressure can be monitored using the following:

- *Barometer*. A barometer could be described as a pan of mercury with a tube leading out of the pan. Pressure from the atmosphere causes the mercury to rise in the tube. The tube is marked in millibars and the station that is reading these millibars will know how much it should rise for that location. If the barometric pressure rises more than normal, it would be considered a high pressure reading.
- *Altimeter*. Another means that is used to measure pressure is an altimeter, which is commonly used by mountaineers. As the Marine climbs and rises in elevation, the pressure lessens and allows the needle in the altimeter to rise. If the needle rises without the Marine rising with it, there is less pressure in the atmosphere than before—a lower pressure area.
- *Contrail lines*. A basic way of identifying a low pressure area is to note the contrail lines from jet aircraft. If they do not dissipate within two hours, there is low pressure in the area. This phenomenon usually occurs about 24 hours before an oncoming front.

Nature as a Weather Indicator

Signs from nature generally predict the incoming weather conditions. Using as many signs together as possible improves the prediction. These signs are rules of thumb and Marines should try to obtain an official weather forecast before depending on these methods. A Marine can gather as much information as needed and compile it along with his own experience of the area in which he works to help form a prediction of incoming weather. Signs from nature are as follows:

- A spider's habits are very good indicators of what weather conditions will be within the next few hours. When the day is to be fair and relatively windless, they will spin long filaments over which they scout persistently. When precipitation is imminent, they shorten and tighten their snares and drowse dully in their centers.
- Insects begin swarming two to four hours before a storm.
- Wild game, such as deer, elk, or coyotes, will feed heavily four to six hours before a storm.
- When the smoke from a campfire, after lifting a short distance with the heated air, beats downward, a storm is approaching. Steadily rising smoke indicates fair weather.
- "Red sky at night is a sailor's delight and red sky in the morning is a sailor's warning" is correct in only some places of the world. When the sun rises in the morning and there is moisture present, the sky will be red. If the wind is moving west to east, that moisture has already past. This occurrence does not mean that it will not rain; it just means that the moisture making the sky red has already past. When the sun sets

in the west and there is moisture in the sky, the sunset will be red. If the winds are moving west to east, it means that the moisture in the west making the sky red will move east and possibly form as clouds later.

- A gray, overcast evening sky indicates that moisture-carrying dust particles in the atmosphere have become overloaded with water; this condition favors rain.
- A gray morning sky indicates dry air above the haze caused by the collecting of moisture on the dust in the lower atmosphere; one can reasonably assume a fair day.
- When the setting sun shows a green tint at the top as it sinks behind a clear horizon, fair weather is probable for most of the next 24 hours.
- A rainbow in the late afternoon indicates fair weather ahead; however, a rainbow in the morning is a sign of prolonged bad weather.
- A corona is the circle that appears around the sun or the moon. When this circle grows larger and larger, it indicates that the drops of water in the atmosphere are evaporating and that the weather will probably be clear. When this circle shrinks by the hour, it indicates that the drops of water in the atmosphere are becoming larger, forming into clouds; rain is almost sure to fall.
- In fair weather, air currents flow down streams and hillsides in the early morning and start drifting back up near sunset. Any reversal of these directions warns of a nearing storm.
- When the breeze is such that the leaves show their undersides, a storm is likely on the way.
- It is so quiet before a storm that distant noises can be heard more clearly. This phenomenon is due to the inactivity of wildlife a couple of hours before a storm.
- When in the mountains, the sight of morning mist rising from ravines is a sign of clear weather the rest of the day.
- A heavy dew or frost in the morning is a sign of fair weather for the rest of the day due to the moisture in the atmosphere settling on the ground in the form of precipitation, such as rain or snow.

CHAPTER 2
COMMAND AND CONTROL

Leadership is a vital aspect of military operations in all environments, particularly in the extreme conditions encountered in mountain/cold weather operations. This chapter discusses key topics that, when applied, have proven to enhance leaders' success in the command and control of military operations in mountainous/cold weather environments. It promotes an understanding of the problems common to units operating in such an environment.

Leadership in a Mountainous/Cold Weather Environment

In addition to the traditional Marine Corps leadership traits and principles, there are four prevailing points essential to good leadership in mountain/cold weather operations—pre-environment training, preparation for increased casualties, understanding the unit's capabilities and limitations, and enhanced leadership awareness.

Pre-environment Training

Many of the casualties sustained in mountainous/cold weather environments result from Marines and Sailors not being physically and mentally prepared for the environment. Training for these environments should begin as soon as possible. Leaders should start the process by identifying the terrain and climatic conditions that the unit expects to encounter throughout the deployment or operation. Based on this information, leaders can identify specialized procedures and equipment needs specific to the environments and develop an appropriate training plan. Pre-environmental training can be accomplished by school-trained mountain leaders found throughout the fleet, by requesting a mobile training team from the Marine Corps Mountain Warfare Training Center (MCMWTC), or by requesting training from the special operations training groups.

Physical fitness is of particular importance in pre-environment training. Although the human body's adjustment to altitude is a lengthy process that cannot be accomplished at lower elevations, a high level of overall fitness will significantly increase the ability to acclimate once in theater. Training should focus on developing lower body and core strength. Circuit courses, combining cardio-vascular and strength exercises, and conditioning hikes over hilly terrain are excellent tools. Marches with heavy loads are more productive than running. Individual training should focus on familiarizing Marines with the use of mountain/cold weather clothing and equipment. Significant weather injuries result from the improper wear/care of cold weather clothing. Commanders should establish standing operating procedures (SOPs) for their units prior to deployment and then refine them once the unit is in a mountainous/cold weather environment. Particular attention should be devoted to tactics and procedures for employing specialized equipment, such as tents and sleds. Additionally, one must consider how the use of specialized equipment will affect traditional SOPs, such as immediate action drills. It takes time to learn how to efficiently live in harsh conditions. Training exercises should be of sufficient duration, generally at least 10 days, to enable the unit to learn to sustain itself in this environment.

Preparation for Increased Casualties

A standard Marine Corps infantry battalion suffers 15 to 30 injuries during summer operations and 30 to 45 injuries during winter operations while training at the MCMWTC. Regardless of the type or

severity, all injuries will have a significant impact on a unit's ability to complete its mission.

Cross-training will reduce the impact of casualties on the unit. Despite personnel shortfalls due to casualties, leaders must ensure that their units are still capable of accomplishing the mission. As an example, it takes three Marines to transport and operate a 60-millimeter mortar system. If the unit loses one or two Marines from that section, it will only be able to employ two systems, cutting the indirect fires by one-third at the company level.

Detailed casualty evacuation (CASEVAC)/medical evacuation planning enables mission accomplishment for the unit. Depending on the type of injury and the environmental/terrain conditions, moving a casualty from the point of injury to the collection point may require the Marine's entire squad and take significant time. Such movement not only endangers the mission, but also can be deadly for the patient. Realistic and detailed planning must be conducted and should include preplanned collection points and movement routes, extraction points, alternate transportation options, and availability of appropriate types of litters (equipment). Leaders must ensure the CASEVAC plan is supportable at all levels.

Individual medical training is essential as corpsmen are not always with dispersed units. Most Marines have never been exposed to many of the injuries that they will face in mountainous/cold weather environments. Prevention is the key to managing injuries. Marines must be trained to prevent, recognize, and provide initial treatment for high altitude and cold weather injuries.

Understanding the Unit's Capabilities and Limitations

Based on the estimate of the situation (mission, enemy, terrain and weather, troops and support available-time available [METT-T]), Marines predict the enemy's capabilities and limitations as well as his most probable and most dangerous courses of action. Most leaders, however, fail to estimate and understand their own unit's capabilities and limitations in the same conditions. Everything will be harder and take much longer in rugged terrain/cold conditions, so success depends on accurately understanding unit capabilities and realistically planning the operation.

From crossing the line of departure to consolidation, Marines must strive to account for the effects of the environment on all aspects of the operation. In mountainous/cold weather environments, particular attention must be given to the terrain, weather, equipment, level of training and fitness of the personnel, and exaggerated movement times. Incorporating these factors will help to accurately estimate the friendly and enemy situation and plan accordingly.

Documenting past performance will indicate future capabilities. Every time the unit conducts a movement, a route card should be created that predicts the movement time through specific terrain and environmental conditions. Upon completion, the actual performance can be compared to the estimated time to form a database. The only way that commanders will accurately be able to plan operations is to rehearse and document the results; the more variables a leader ignores, the more inaccurate his assessment of the unit's capabilities will be.

Enhanced Leadership Awareness

Rugged, mountainous terrain; high altitude; and cold weather will all increase the stress imposed on Marines. This stress is further complicated by the additional continuing actions and self-discipline required to survive. Without firm and proactive leadership, self-discipline and continuing actions will breakdown and injuries and mission failure will occur.

Individual and unit discipline will be a challenge. As environmental stresses increase, individuals will increasingly begin to focus internally and revert to a survival mentality. Marines will

become complacent and fail to execute proper continuing actions, ultimately resulting in unserviceable equipment, an increase in health problems, and a loss of focus on unit accomplishment.

Harsh conditions are not an excuse for failure. Maintaining discipline begins with strict enforcement of individual and unit continuing actions. Individuals who fail to properly complete assigned tasks must be held accountable; failure to immediately address small issues will quickly transform them into large problems.

> CAUTION:
>
> If a subordinate leader is not performing appropriately in a mountainous/cold weather environment then senior leaders must remove the subordinate leader from a leadership position. Ineffective leadership can get Marines injured or killed in this environment.

Leadership presence is critical to troop morale. Leadership presence through inspections and supervision is required at all levels. A unit must understand that their leaders put a high priority on individual discipline and continuing actions and will hold them accountable for violations of orders and SOPs. If Marines do not see their commanders personally checking the small, but important, details, they will underestimate the significance of these details.

Marines need to be kept informed. The mountainous/cold weather environment can cause Marines to feel more disconnected from the command faster than in normal environments. Marines who do not feel informed may soon become complacent, disgruntled, and detached from the mission. The more a Marine is involved in the mission, the better he performs. Good information flow allows subordinates to properly prepare and keeps leaders informed about the condition of their unit.

Common Leadership Problems

The following subparagraphs describe four negative trends that are associated with the highly stressful, extreme conditions found in mountainous/cold weather environments and how good leaders can mitigate those trends.

Cocooning

Cocooning is a condition that occurs when individuals begin to focus internally, being more concerned about their own comfort than achieving the mission. Cocooning results in diminished situational awareness, failure to properly execute continuing actions, and a loss of mission focus. While cocooning can happen in any environment, the unique stresses induced by the mountains and cold weather can trigger an epidemic of cocooning. Preventing cocooning depends on good leadership at all levels, with particular attention to environmental training and physical activity. Environmental training is important once in theatre because most Marines have not been exposed to mountainous/cold weather environments and do not naturally know how to cope with the conditions. Proper training aids Marines in coping with the stresses they face. Additionally, well-understood and rehearsed bivouac routines will make daily living less stressful and contribute to sustainable operations. Physical activity helps prevent cocooning. The monotony of the daily living routine and general inactivity are significant contributing factors to cocooning. Shortening watch rotations and increasing the number of security patrols can reduce the impact of long periods of inactivity, such as while maintaining a static defensive position.

Group hibernation is best described as collective cocooning. When leaders fail to stop the cocooning trend, it will continue to spread until it infects

the entire unit, to include the leadership—the culmination of complete leadership failure. The remedy, as always, is strong and demanding leadership. It is both the prevention and the cure. Additionally, leaders must rely on each other for mutual strength and accountability at all levels.

Loss of Personal Contact and Communication

A by-product of cocooning and group hibernation is the loss of personal contact and communication. When humans find temporary relief inside their shelters or by bundling up in warm clothes, they are reluctant to go back to unpleasant conditions. Leaders in this situation might not keep in touch with the condition of their unit and subordinates may become isolated. This loss of human contact and information flow degrades morale and the unit's ability to accomplish basic tasks. The remedy is to insist on the proper use of the chain of command, talk to the Marines at the lowest level, and inspect the Marines more often than normal in adverse conditions.

Inaccurate Time and Space Planning

Inaccurate planning often results in missed timelines and Marines suffering needlessly in the cold. Failure to accurately record movement rates, time requirements, and a unit's skill level from previous experiences in similar conditions will lead to continued failure.

The remedy is that leaders must conduct realistic and detailed planning, understanding that all tasks will be more difficult and time consuming in mountainous/cold weather environments. Accurate planning factors should be derived from past experiences to avoid repeating the same mistakes. Generally, if a unit lacks experience in a particular set of mountain/cold weather conditions, the planners should allow twice the time as appropriate to complete the task when conducted in flat terrain and warm conditions. With these factors in mind, back-planning and timely warning orders will allow subordinates to accomplish their missions. See chapter 4 for more information on route planning and selection.

Failure to Adequately Sustain the Unit

Well-led units and individuals are often capable of overcoming obstacles by sheer willpower; however, leaders must be aware of Marines pushing themselves to the mental and physical breaking point. If leaders fail to recognize such situations and plan accordingly, they risk their unit ultimately becoming combat ineffective before the mission is complete. Prevention is the key. Once an individual has reached the physical breaking point, rehydration will take a minimum of 6 hours and it takes almost 24 hours for the body to recover energy from food. Mental recuperation may take significantly longer. Sustainable operations depend on the following factors:

- *Good mission planning*. In addition to the planning factors already discussed, proper terrain selection and the reduction of unnecessary weight from the combat load will lessen the burden on Marines.
- *Logistical support*. Detailed logistical planning and coordination are essential to sustainable operations. Even great operational plans will fail if the unit is not adequately fed and equipped. The logistical tail for an operation can be significantly reduced if the units involved are properly trained and can efficiently use the available resources (see chap. 12 for more information).

Strong leadership can overcome many problems. The ultimate deciding factor is a leader's ability to recognize problems, persevere, and apply lessons learned as they lead their Marines in this harsh environment.

Communications Considerations

To ensure the ability to successfully execute command and control during mountain/cold weather

operations, battalion and company staffs must address the following planning considerations:

- Communication equipment.
- Communication maintenance and supplies.
- Safety.
- The equipment load that communications personnel must carry in addition to their required personal equipment.
- Communication plans.
- Additional personnel and equipment needed to staff retransmission sites and to conduct mountain-picketing operations.
- Command group communication system configurations.

Additional planning and communications information is discussed in Marine Corps Warfighting Publications 3-35.1, *Mountain Warfare Operations*.

Radio

Radios are the most common means of communicating; however, they are subject to many problems in the cold. Two major problems are reduced battery power and increased equipment failure.

Nonlithium Batteries

Nonlithium batteries, typically alkaline, lose capacity and produce less power if not protected from extreme cold weather (ECW). Cold weather batteries should always be used.

Spare batteries should be stored inside heated shelters at a temperature above 10 °F and gently warmed before use. One spare set of batteries should be carried in a parka or trouser pocket between the body and outside layer of protective clothing, but never placed in the snow or unprotected against the shell of a sled. If snow covers the pressure release cover on the radio battery box, ice may form over it, which may restrict it from air exchange.

The batteries should be rotated every 4 hours with a spare and labeled with the amount of time used. Log entries should be kept when batteries are changed.

Lithium Batteries

Lithium batteries are superior to magnesium batteries in the cold. They are lighter, last longer, and perform best when kept cool (but not cold or freezing). Lithium batteries are a hazardous material and may explode because of physical or electrical abuse, such as crush, puncture, short circuit, overcharge, or over discharge.

Batteries can be stored at a temperature between -40 and 160 °F and should be serialized and accounted for during and after each use. Radio operators shall keep batteries in a plastic bag and must repack the battery for turn-in once depleted. Repacking protects the battery from moisture.

Rechargeable batteries should be kept warm even when depleted. The cold can crack an internal gas tube, rendering them unchargeable.

Lithium batteries will start to show performance degradation (as high as 50 percent capacity decrease) at temperatures below -4 °F. If high power is needed below -4 °F, then batteries might need to be preheated.

Material Failures

The following considerations should be made with regard to maximizing materials in cold weather environments:

- When temperatures are below 10 °F, radio equipment becomes brittle and is very susceptible to breakage.
- The AT–271A antenna (10 foot whip), during movement in thick vegetation, may break if the radio operator falls. Company/platoon radio operators should carry a spare AT–271A.
- Coaxial cable, connectors, and antenna elements must have a thin coat of silicone lubricant.

- The H–250 handset cable and connector must have a thin coat of silicone lubricant.
- Press-to-talk buttons are subject to sticking from freezing. Company radio operators should carry a spare handset.
- Microphones need to be protected from moisture. Covers for handsets should be used to prevent moisture from freezing in the microphone or a plastic bag can be wrapped around the handset.
- Radios, remote sets, telephones, and cryptographic equipment should be kept off the ice and snow.
- Radio remote antenna stations should use an ECW tent at the antenna station to keep the radio equipment warm.
- Insulated cold weather bags should be fabricated for radios and equipment if a tent cannot be used.
- Radio equipment should not be transferred from 0 °F into warm tents above 40 °F because the equipment will condense, causing moisture to short the radio circuitry.
- Frost should be removed from the equipment before bringing it into the tent.
- Operators must gradually warm equipment and batteries.
- Radio equipment should not be turned off at night if on line and if needed for operation in the morning unless equipment is in temperatures above 10 °F.

Because the Polar Regions are subject to electromagnetic disturbances that affect radio reception, it is important to get the very best performance from radio sets and avoid radio failures. Operators must be familiar with their radio equipment and should keep it clean, dry, and as warm as possible. Operators should ensure that—

- Plugs and jacks are clean.
- Antenna connections are tight.
- Insulators are dry and clean.
- Snow and ice are removed.
- Power connections are tight.
- Motors and fans turn freely.
- Knobs and controls operate easily.
- Batteries are fresh, warm, and there are spares on hand.
- Breath shields are installed on all handsets.
- Cables and wires are coated with silicone.

Wire (Telephone)

Planners should consider the following wire laying methods:

- Wire line route maps should be drawn by the wire chief at the battalion headquarters (alpha command), so wiremen have a recommended wire laying path to each company and attachment.
- Vehicles for laying wire may be used, but may take extra time or be limited to plowed roads unless an over-the-snow-capable vehicle is available.
- A helicopter with a wire CY 1064A dispenser case, which holds five rolls of one-half-mile communication wire, can be used. Allowing for slack, the helicopter can lay about one and one-half miles of wire. Helicopters, however, usually cannot fly in high winds or high altitude.
- When crossing roads, any wires should be buried 6 to 12 inches underground or strung at least 18 feet above the road. Rocky or frozen ground may favor the latter technique.
- Wire may be laid by over-the-snow mobile troops on snowshoes or skis using any of the following reels:
  - DR-8 (15 lbs.).
  - MX306A (25 lbs.).
  - RL-159 and RL-27B (idiot stick) (70 lbs.).

  Note: Weights are total of wire and reel.

The following considerations must be made for telephone parts and batteries in a cold weather environment:

- Alkaline batteries are used in field telephones and are not reliable in temperatures below 30 °F.
- Below 10 °F, telephone equipment materials become brittle and are very susceptible to breakage.

- Field telephone handset cables must have a thin coat of silicone lubricant.
- The TA-312 field telephone provides the best wire communications; however, a microphone moisture cover must be installed on the telephone.
- TA-1 sound powered telephones have a carbon element microphone, which freezes and needs to be kept warm and dry to operate.

There are several plans that an infantry battalion can use to lay and retrieve wire. For example, infantry companies move forward into position. When a company takes a position, alpha command secures a position and dispatches an over-the-snow vehicle to the company's position. During this time, bravo command runs wire to alpha command and other attachments. When alpha command prepares the companies to move forward, bravo command sends vehicles and wiremen to receive the wire line route map, so wire retrieving can be started by bravo command. The unit retrieving the wire must carry empty RL-159 and DR-5 reels to retrieve the wire for reuse.

Messenger

Communicating by messenger is the most secure means; however, it is limited by the terrain and weather. Every Marine is a messenger, especially commanders who attend regular meetings. The use of messengers should be preplanned and they must *never* travel alone. There are several problems encountered by messengers in the mountains and cold—

- *The enemy*. What are their capabilities, equipment limitations, and numbers?
- *Personal survival*. Messengers must have the proper equipment. An estimated time of arrival and return must be set and contingency plans made.
- *Transportation over the snow*. An over-the-snow-capable vehicle should be used, if possible. The messenger must be properly trained in the use of skis or snowshoes and familiar with the terrain and with mountain/arctic navigation.
- *Wild animals*. Is there a threat from predators or venomous snakes?

Visual Communication

Visual communication is an accepted method in most situations, but, in a cold weather environment, such communications can be rendered ineffective by blowing snow, such as whiteouts. Visual signals should be prearranged and stated in the operations order. Some such communications include—

- *Air panel markers*. Air panel markers contain one set of white and black markers, each set contains 13 markers. Each marker is 2 feet wide and 3 feet long. The black marker shows up well against a snow background.
- *Fluorescent panel markers*. These panels are red and yellow and measure 18 inches wide by 26 inches long. These markers are excellent for ground to air signals by the air control party teams.
- *Semaphore flags*. Red and white flags are used on land and red and yellow flags are used on water.
- *Pyrotechnics*. Red and green colors can be most easily seen against a snow-covered background. A red signal is the international signal for distress or emergency.

Audio

Sound signals are satisfactory only for short distances; moreover, their effectiveness is greatly reduced by battle noise. Sound signals can be used in a cold weather environment; however, they must be kept brief and simple to prevent misunderstanding. Some examples of audio signaling devices are—

- *Whistles*. Whistles have a limited range, but they are small and lightweight for use while on the move.

- *Sirens*. Sirens are suitable for use in forward operating bases.
- *UIQ 10 loudspeakers*. These loudspeakers can project sound over a large area. A deception plan using tape recordings of mechanized vehicles can be projected by a two-man team in front of the enemy location.

Maintenance

Performance of preventive maintenance is essential to ensure the proper operation of communications equipment. The following are maintenance considerations:

- *Limited technical inspection*. All communications equipment to be used must have a second echelon limited technical inspection performed on it before going to the field.
- *Daily preventive maintenance by operator*. Personnel operating communication equipment in the field must perform daily preventive maintenance.
- *Communication contact team*. This team should attach to the logistic train to provide maintenance support for the infantry companies and attachments.
- *Maintenance personnel*. The communication contact team and headquarters groups must have maintenance personnel attached and a sufficient amount of pre-expended bin items and supplies. Such supplies include handsets, coaxial cable, connectors, whip and base antennas, silicone lubricant, plastic bags, duct tape, dry cloth, erasers, pencils, special cold weather electrical tape, and batteries.

Safety

The four safety precautions in operating communications equipment in cold weather are—

- Do not touch metal parts on communications equipment with bare hands if temperatures are below freezing.
- Construct antennas to be windproof.
- Ensure that the high frequency (HF) equipment is grounded properly.
- If the AN/MRC (a vehicle-mounted, integrated, multichannel system that provides two-way, secure, digital wideband transmission with two radios per system) communications equipment vehicle is operating constantly, check the exhaust system to ensure proper ventilation.

Equipment Load

During foot mobile operations, the battalion/company communication personnel may carry communications equipment listed in Table 2-1 in addition to the required cold weather pack.

Table 2-1. Additional Communications Equipment.

Quantity	Equipment	Weight (pounds)
1	PRC 77 with spare battery	23
1	KY 57 with spare battery	6
1	KY 38 with spare battery	27
1	RC 292 antenna[1]	45
1	DR 8 with handle, 1/4 mile reel of wire	18
1	MX 306 1/2 mile reel of wire	25
1	RL 159 with handle, 1 mile reel of wire	73
1	TA 312 field telephone	10
1	TAI field telephone	3
1	PRC 104 with spare batteries	25
1	PRC 75 with spare battery	10
1	PRC 68 with spare battery	4
1	PRC 18 with spare battery	27

[1]The weight of the RC 292 antenna can be reduced to 20 pounds by not carrying the 12 metal mast sections. Parachute cord 70 feet in length must be carried so that the RC 292 can be tree topped.

The following methods can reduce the communications equipment load on the individual Marine:

- Use logistic trains to provide a resupply of batteries, wire, preventive maintenance material, and maintenance support for the exchange of inoperable equipment.
- Spread load communications equipment and cold weather equipment among Marines of each command group tent team.

Configurations

Infantry battalions traditionally operate primarily on very high frequency (VHF) radio assets; however, when operating in a mountainous environment, the terrain greatly reduces the effectiveness of VHF. While retransmission sites can extend the coverage area of VHF assets, the requirement for security teams at those retransmission sites often exceeds what a unit is able to provide. Therefore, units must rely on other radio assets, such as HF and satellite communications (SATCOM), to communicate in a mountainous environment. Unlike VHF, both HF and SATCOM are capable of communicating over long distances and over terrain features.

Though SATCOM is typically easier to establish than HF, units generally receive a very limited number of SATCOM channels, which often results in numerous individuals trying to use a SATCOM net simultaneously. In order to prevent the net from becoming cluttered with traffic, it is important to establish and abide by SOPs that dictate who can talk on the net at what time and for what reason. One SOP that works well is to use SATCOM for all urgent and priority reporting events and to use HF for all routine reporting events.

Mechanized Communications Systems

Mechanized vehicles may provide additional equipment not identified in the infantry regiment table of equipment. All vehicles must be winterized. They also provide heated areas and additional mobility capability.

Communications Equipment Vehicles

When communications high mobility multipurpose wheeled vehicles (HMMWV) (AN/MRC) remain off in temperatures below 0 °F for more than 4 or 5 hours, operators must allow 10 to 15 minutes at a constant idle for the vehicle to warm. Once the AN/MRC vehicle is operating, operators should allow 5 to 10 minutes for the HF, VHF, or ultrahigh frequency mobile radios to warm up. If the radio does not key out, the problem may be that the radio set is not warm enough. Operators should start the AN/MRC vehicles every 1 to 2 hours for 5 to 10 minutes to prevent freezing of vehicle and radio components. All HF communications vehicles must carry their pioneer gear—a pick, sledgehammer, two 4- to 6-foot grounding stakes, and salt.

Amphibious Assault Vehicle C-7

This vehicle can move in the unfrozen waters of fords and streams. If snow is considerable (more than one foot), the amphibious assault vehicle will be road bound. Icy roads of 15 percent grade also stop the amphibious assault vehicle; however, these vehicles are relatively mobile and displace rapidly.

Light Armored Vehicle

Fast moving, the light armored vehicle (LAV) is equipped with chains and is mobile both on and off the roads in shallow snow (less than one foot). Self-recovery capabilities of LAVs make them ideal for quick displacement. In snow deeper than one foot, they will be road bound.

BV-206 Command and Control Variant

This vehicle provides exceptional combat operations center and/or command post displacement capabilities and its off-road capability is unsurpassed; however, it can only power one radio and, therefore, has insufficient vehicle power to run a command variant with multiple radios. These vehicles are only used by the Marine Corps and are prepositioned in Norway. Radios used in the BV-206 as a command and control variant must be provided from the unit's table of equipment. Mechanized infantry operations in mountainous terrain should be supported by BV-206 or a similar type of over-the-snow vehicle. Newer command and control-specific variants from the manufacturer are more conducive to supporting communications.

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CHAPTER 3
MOVEMENT AND NAVIGATION

Individual movement in the mountains is considerably more strenuous than movement on flat terrain. To prevent rapid exhaustion, there are techniques that Marines can apply to allow them to conserve energy during mountain movements. Besides aiding in mobility, these techniques will also help prevent injuries. This chapter details the principles of movement and navigation in mountainous terrain by discussing fundamentals; walking, navigation, and distance measuring techniques; use of ski poles; conduct of movement; and types of slopes that may be encountered.

Fundamentals of Individual Movement in Mountainous Terrain

The following principles apply while walking in mountainous terrain:

- Maintain body weight over the feet at all times. This technique places the body's weight on the skeletal system and avoids unnecessary strain on muscles. Leaning forward or backward places the weight on the muscular system and expends additional energy.
- Avoid walking up and down microterrain (small projections, such as fallen trees or boulders, that a Marine could step over or go around). Although these steps up/down are small, the excess expenditure of energy will compound on long movements.
- Step over, rather than on top of, obstacles, such as large rocks and fallen trees, to avoid excess energy expenditure.
- Make use of the rest step; lock the rear leg out with each step allowing the leg muscles to relax. The aim of the rest step is to rest the body weight onto the skeletal frame. The use of the rest step can reduce energy expenditure by up to 50 percent.

Special Walking Techniques

The herringbone, half-herringbone, and plunge steps are special walking techniques used in mountainous terrain.

Herringbone

A herringbone step pattern is used to maintain balance and flat feet while ascending a slope. Toes are pointed outward to allow the heel to rest and avoid walking on the toes. Walking on the toes will tire the calf muscles.

Half-Herringbone

The half-herringbone step pattern is used to maintain balance and flat feet while traversing up or down a slope. Ankles are rolled away from the hill with the uphill foot pointed in the direction of travel while the downhill foot stays at a comfortable downhill angle to maintain good sole to ground contact.

Plunge Step

The plunge step is a confident, aggressive move used when moving down loose slopes. Facing downhill, the traveler should step assertively away from the slope and land solidly on the heel with his leg vertical, transferring his weight to the new position. The lower leg takes all of the weight while the upper leg is used for balance only. Leaning back into the slope should be avoided because it can result in slipping or falling. When plunge stepping, the knees should be kept bent to maintain control of balance.

Ski Poles

Ski poles are not only for use with skis. They can be used to aid balance when moving with a heavy pack over slippery, rough, and loose ground or when crossing a stream. They provide a boost while hiking up a slope and take some of the weight off the lower body while descending. If used properly, they can significantly decrease energy expenditure and reduce lower body injuries during a movement. They should only be used during situations when enemy contact is not likely. The following are additional considerations and best practices:

- *Gripping the ski pole*. Slide the hand up through the wrist strap and grab the handgrip and the upper portion of the strap together. The bottom of the palm should rest on top of the middle portion of the strap. The bottom of the wrist strap should feel snug around the wrist.
- *Uphill and flat ground use*. Gripping the pole, extend the arms forward with a slight bend at the elbow. While walking, maintain natural arm swing and plant the pole next to the feet. When stepping forward, pull down on the planted pole while keeping the arms close to the sides to aid movement forward or up the slope.
- *Downhill use*. Lean at the waist and plant the poles to the front to aid with balance and to transfer part of the weight from the lower body to the poles themselves.
- *Traversing use*. On a traverse, the uphill ski pole should be held along the shaft versus the handgrip to accommodate for the slope angle.
- *Negotiating obstacles*. When negotiating small obstacles, the wrists can be left in the wrist straps while the hands are used for balance. When moving through thick vegetation, ski poles should be removed.
- *Weapons use*. When employing rifles, ski poles can be crossed to provide a stable bipod for supported firing.

Conduct of Movement in Mountainous Terrain

Mountain leaders must make other considerations while conducting movement in mountainous terrain. The way Marines are dressed, their pace, breaks, and formations all bear on mission success.

Uniform

Individuals should begin a movement dressed fairly cool, as they will generate body heat while moving. A vapor transmission layer should be worn next to the skin. A warming and protective layer should also be readily available to wear during breaks. The amount of personal protective equipment to be worn must be considered. Often, in mountainous terrain, it is advisable to lighten the personal protective equipment load in order to enable effective movement and maneuver. Overloading troops can easily result in mission failure, not just slower operational tempo.

Mountain Pace

Mountain pace is defined as the pace at which all members within the group can move together for the duration of the movement. This pace will vary, but is generally much slower than on other terrain.

Breaks

Factors that may affect the frequency and length of rest stops are the physical condition of the Marines, load weights, terrain, and weather conditions. The following recommendations apply to movement breaks in rugged terrain:

- The members of the movement should be given a chance to ventilate or adjust their layering after 10 to 15 minutes of movement with a 2-minute break. Breaks also provide troops the opportunity to make any gear adjustment.
- After the initial break, a 5-minute rest stop should be taken after every 30 minutes of movement.
- A longer break of 10 to 20 minutes should be taken after every two or three short breaks.
- When possible, halts should be planned to coincide with water resupply at streams or at positions that provide observation of key areas along the route.

Formations

Tactical formations appropriate to the terrain should be used. See Marine Corps Reference Publication (MCRP) 3-35.1B, *Mountain Leader's Guide to Winter Operations*, for detailed information on formations.

Types of Slopes

The following are the basic types of slopes commonly encountered in a mountainous environment, whether above or below the tree line:

- *Hard ground*. Hard ground is a slope of firmly packed dirt with vegetation that will not give way underfoot.
- *Grassy*. A grassy slope is covered with scattered clumps of grass known as tussocks.
- *Scree*. A scree slope consists of small rocks and gravel, which have collected below a rock ridge or cliff. The size of the rocks varies from sand size to rocks about the size of a man's fist.
- *Talus*. A talus slope is similar to a scree slope, but the rocks are fist size or larger.

Movement on Hard Ground

Hard ground movement considerations must be made for ascending and descending slopes.

Ascending

Maximum use of the rest step can be made by locking out the knee to relieve the muscle and use bone support to support the body. If the slope is gentle, Marines may be able to walk straight up the slope; however, as the slope becomes steeper, the herringbone technique should be employed.

Unless restricted by terrain, steep slopes should be traversed rather than climbed straight up. Traversing refers to zig-zagging up the slope. While moving horizontally across the slope, the traveler steps up with the uphill foot and, when turning at the end of a traverse, steps off in the new direction with the uphill foot. This pattern prevents crossing the feet and losing balance. When traversing uphill, travelers should not exceed an angle of 15 degrees. Traversing is intended to allow alternate legs to rest.

Descending

The rate of descent should be controllable. It is usually easiest to come straight down a hard ground slope without traversing; however, if the slope becomes too steep, traversing may be safer to avoid descending uncontrollably. Marines should keep their backs straight and their knees bent so that their legs act as shock absorbers for each step.

Grassy Slopes

Ascending

When ascending a grassy slope, the techniques described for hard ground slopes should be used,

that is, stepping on the uphill side of each clump or mound of grass where the ground tends to be more level and firm.

Descending

Due to the uneven nature of the ground it is easy to build up too much speed and lose control while descending. The plunge step should be used to traverse the descending slope.

Scree Slopes

Ascending

Ascending scree slopes should be avoided whenever possible as they do not provide stable footing. When it is necessary to cross a scree slope, Marines should traverse the area to reduce energy expenditure. Hard ground principles apply with the addition that each step must be chosen carefully and placed slowly so that the foot will not slide down when weight is placed on it. To do this, the Marine kicks in the toe of the upper foot so that a step is formed in the scree. After determining that the step is stable, the Marine carefully transfers weight from the lower foot to the upper foot and repeats the process. On a traverse, step kicking with an edged sole is more effective than flat footing. Additionally, to avoid a rock fall hazard when traversing, all personnel should be allowed to complete each traverse prior to beginning another traverse.

Descending

Scree fields often make a good route of descent. Marines should never run, as this may cause loss of control and result in injury. Instead, Marines should use the plunge step to come straight down a scree slope by driving the heel into the slope on a stiff leg. Screeing is a technique that is both timesaving and energy efficient. To conduct screeing, the slope must be sufficiently steep and the run-out zone visible and free of hazards. This technique resembles skiing or glissading on snow. The feet are shuffled along, allowing the small rocks to break away and pile up underfoot. Momentum must be maintained in order to "ride" the descending rock pile in a standing position. The small rockslides created should not present a significant hazard as long as personnel stay close together.

Note: If a rock fall hazard is present, helmets should be worn.

Talus Slopes

Ascending

Marines should always step on the top of the uphill side of the rocks to prevent them from tilting and rolling downhill. Marines should stay close together so that rocks, should they become dislodged, may be halted or directed away from the group before building speed and momentum. When traversing, as on scree slopes, all personnel should be allowed to complete a switchback before starting another traverse.

Descending

Marines should descend with caution. The likelihood of rock fall increases since the force placed on rocks will be much greater during the descent. Descent should be slow, with each step taken carefully. Just like the ascent, Marines should step on the top and uphill side of the rocks. The interval between Marines is the same as during the ascent.

Note: If a rock fall hazard is present, helmets should be worn.

Navigation

Navigation in a cold weather environment poses unique challenges. Heavy snowfall will alter or hide terrain features, severe weather conditions may cause periods of limited visibility, compass reaction may be slower, and the handling of maps will be increasingly difficult. The use of an altimeter in mountainous terrain is beneficial.

For Marines operating in a cold, snow-covered environment, each task becomes more difficult and land navigation is no exception. Long nights, fog, snowfall, blizzards, and drifting snow all drastically limit visibility. An overcast sky and snow-covered ground will create a condition of reduced visibility, which makes it difficult to recognize ground features. Before beginning a movement, the following factors that may affect the navigator's ability to find the way to the objective should be considered:

- In cold weather regions, visibility may be drastically reduced by long periods of darkness, snowfall, fog, and wind-driven snow. At times, overcast skies above open, snow-covered ground may produce a condition known as whiteout, where the surrounding terrain appears to blend into the sky; terrain features disappear, and depth perception becomes impossible.
- Deep snow may completely cover tracks, trails, streams, and improved roads, making them indistinguishable from one another or completely concealing their presence.
- Lakes and ponds, when snow-covered, may be confused with an area of open ground. If a body of water appears to have an easily recognizable and distinct shape on the map, this shape may not be as recognizable when it is blanketed with snow.
- Drifting snow may hide small depressions that appear on the map or may change the appearance of small hills by collecting on the leeward side, making the hill appear to be larger or shaped differently than the map indicates.
- Aerial photographs taken during the winter may lack detail and discernible relief or contrasts.
- Excluding population centers, maps of cold regions are notoriously inaccurate and outdated. In general, the cold regions of the world are sparsely populated and are characterized by very limited road networks and a lack of manufactured structures.
- Handling maps, compasses, and other navigational instruments in extreme cold temperatures is difficult due to the bulky handwear necessary to protect against cold weather injuries. Additionally, battery-operated global positioning systems (GPSs) may become unreliable or inoperable in the cold weather.
- In Polar Regions, there are often wide, open coastal plains or dense boreal forests. The lack of terrain features, or their total concealment by dense forest, may make terrain association difficult or impossible.
- The earth's magnetic poles cause increased compass deflection (expressed as the grid-magnetic angle). The further north or south Marines move, the more the ability to accurately determine direction is affected. At either of the magnetic poles, the needle of a compass will continually rotate about its axis.
- Cold regions are characterized by many magnetic ore deposits that, if encountered, can cause large deviations from the grid-magnetic angle listed on maps for that area.

Navigation Techniques

Direction method and distance measuring are two navigation techniques that have proven most successful in the conditions of both terrain and weather that are characteristic of cold, mountainous regions.

Direction Method

The direction method is navigation with a compass and map. Compasses, steering marks, dead reckoning, and altimeters are tools Marines use when employing the direction method.

Compasses. Dry filled compasses are more useful in the arctic, since standard, liquid filled compasses may become sluggish. Metal objects, such as ski poles or weapons, will affect the direction the compass needle indicates.

Steering Marks. In a barren region, Marines can be sent forward as steering marks. It is easier to take a bearing on a steering mark with a compass and then march to it than it is to continually refer to the compass.

Dead Reckoning. Dead reckoning refers to determining the current location by accurately and continuously plotting where the unit has been. The following equipment is needed to accomplish this technique:

- Appropriate map(s) or aerial photograph(s) of a known scale.
- Compass.
- Protractor.
- Route card.
- Pace counter.
- Known distance measuring cord.

Dead reckoning consists of—

- Selecting the route to the objective.
- Plotting it on a map or an aerial photograph.
- Completing a route card.
- Determining an accurate pace count for the method of movement one will employ, whether foot, snowshoe, or ski.

While navigating by dead reckoning, the navigator must—

- Trust the compass.
- Maintain an accurate pace count.
- Adjust the plotted route as required to negotiate obstacles.
- Record azimuths, distances, times, adjustments to the route, and any pertinent notes in the log.
- Update the log constantly during movement.
- Verify the location by terrain association or resection when possible.

Altimeter. By monitoring elevation and checking it against a topographic map, Marines can keep track of their progress, pinpoint their location, and locate intersections in their route. The following should be considered when using an altimeter:

- The altimeter should be calibrated at a known position before and during the march, keeping the altimeter current and accurate.
- Barometric air pressures will affect the accuracy of the altimeter's reading. As air pressure rises, the altimeter reading will be lower and vice versa.
- The altimeter should stay at a relatively constant temperature by carrying it next to the body, which helps prevent false readings.

Distance Measuring

Pacing. When the pacing method is used, the pace must be checked against a measured distance over terrain similar to that which will be encountered during movement, keeping in mind any aids to the movement that might be employed, such as snowshoes or skis. The pace count will be affected by the following:

- Slopes.
- Surface composition/snow density.
- Head/tail winds.
- Weight of clothing and equipment.
- Stamina.
- Level of proficiency (usually only applies if wearing skis).

Cord Method. Although skis are the fastest, most energy efficient, and least tiring method of dismounted movement (for Marines with a high level of proficiency) in snow-covered terrain, it is very difficult to maintain an accurate pace count. The technique for determining distance using the cord method starts with the lead man marching off in the desired direction and trailing the cord behind him while carrying markers. The rear man jerks on the cord when the lead man reaches the end, signaling the leader to place the first marker. The lead man then puts a marker down and starts again. The rear man follows, insuring the cord is kept taut. When the rear man comes to the marker, he stops, jerks the cord, and picks up the marker. The lead man stops, checks for snags, and then drops the second marker. This procedure is repeated until the required distance has been measured. When the rear man has all of the markers, the lead man must wait for him to catch up. The lead man can either retrieve all of the markers and begin again or they can switch roles.

Tick-off Features. Tick-off features are terrain features that are used to "tick off" on the route card as the navigator passes by them. Poor visibility may hamper this method.

Hints for the Navigator

The object of navigation is not only to get from point A to point B, but to get there by the best possible route in keeping with the tactical situation and with the minimum amount of delay and fatigue. The following hints are designed to help the navigator with this process:

- Keep the compass warm to speed up the taking of bearings.
- March on the back azimuth when no aiming marks exist to the front. The aiming mark may be a natural feature to the rear or an artificial aiming mark left behind by one.
- Check the compass frequently to ensure the correct bearing is maintained when visibility is poor. Only close in aiming marks will be seen. Under these conditions, the navigator should try to pick up further aiming marks along the correct bearing as he approaches each one, which can only be done accurately when the route to each mark follows a straight line. The compass should also be set for night marching.
- Measure accurately. When measuring distance, pace counting is useful only if the pacer knows the length of his pace and knows how to convert paces to meters. Measuring distance by a known distance length of cord is more accurate than pacing.

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CHAPTER 4
ROUTE PLANNING AND SELECTION

Movement in a mountainous environment is difficult, but, when combining it with the inexperience of Marines in mountains, changes in weather, altitude, snow/ice fields, vertical obstacles, water obstacles, mountainous terrain, and the tactical situation, movement becomes a monumental undertaking. The movement of a large unit across mountainous terrain requires more than just words of encouragement or demands by higher authority: it requires positive leadership at the small unit level and a keen sense of technical skill in route selection.

Route selection is the logical or systematic approach to determining one course over another. As a small unit leader or planner, the Marine is responsible to ensure that the route chosen is the best. An infinite number of routes across a single piece of terrain exist; however, there is only one most logical or common sense route that will optimize the unit's safe and efficient passage.

Route Considerations

The eight things to consider when selecting a route are terrain, weather, avalanche/rock slide potential, snow/melt-off conditions, unit ability, tactical situation/mission, equipment, and time.

Terrain

Terrain contours, natural lines of drift, altitude/elevation, and vegetation/rock type must be considered when determining an appropriate route.

Contour

In a mountainous/cold weather environment, the lay of the land greatly affects how Marines negotiate each piece of terrain. Routes that follow a contour line vice a straight azimuth may be optimal. Severe cross-compartment movement can expend energy and time and may jeopardize the success of the mission; moreover, moving directly up or down a slope without regard for gradient could be disastrous. Although routes that follow a contour line may not be as direct as following an azimuth, they will undoubtedly conserve valuable energy and time. Contouring also reduces the slope angle of the movement.

Natural Lines of Drift

A natural line of drift is a terrain feature that allows ease of movement—the path of least resistance. Although a natural line of drift may save time and energy, it also presents an opportunity for a well-trained enemy to establish an ambush. A small unit leader must balance his selection of this path of least resistance with a consideration of the tactical environment. The decision to follow a natural line of drift should be made only after carefully weighing the probability of ambush against the time and energy the unit will save.

Altitude/Elevation

The maximum and minimum altitude/elevation encountered on a route will contribute to the weather encountered, speed of movement, necessary clothing and equipment, and the capability of rotary-wing assets to assist in emergency extracts and CASEVACs.

Vegetation/Rock Type

The predominant vegetation/rock type within the microterrain must be determined. The microterrain will affect the assault climbers' equipment and climbing *GO/NO GO* selection, fire support

plan, camouflage pattern, and route selection (macro and micro).

Weather

Weather is perhaps the greatest hazard in a mountainous environment. Temperature, visibility, precipitation, and wind velocity can hamper movement and cause even the simplest tasks to become a burden, particularly security awareness. At elevations above 5,000 feet, it is not uncommon for winter-like conditions, such as snow, to suddenly occur in the middle of summer.

Avalanche/Rock Slide Potential

Route planners must identify and avoid any avalanche/rock slide hazards in the area of operations. Avalanche/rock slide initiation is a feasible means by which the adversary can destroy friendly forces. All movement on or near critical slopes must be carefully planned. Vital information that can assist a unit leader in making an appropriate hazards analysis includes local avalanche maps; local knowledge; current weather patterns; last two weeks' weather; historical trends and forecast; and areas of loose, near-vertical rock (identified from aerial photos and reconnaissance). Considerations should include advance initiation by supporting arms.

Snow/Melt-Off Conditions

Snow conditions can enhance or deteriorate a unit's ability to negotiate a particular route or segment of that route. Unpredictable changes in the snow conditions make it very difficult for combat-laden Marines to use a particular route, especially in areas that are windswept or crusted because of temperature changes. Depth, melt-freeze cycle, slope aspect and angle, the direction a slope faces, and the amount of sunlight and shadow a slope receives are factors that will determine whether or not over-the-snow mobility is required and, if so, what type should be used.

Unit Ability

Moving a unit across diversified terrain without regard to the degree of slope, snow/vegetation cover, temperature, and weight of combat load and mission-essential gear (see app. A for equipment weights) could be detrimental to both morale and mission accomplishment. Unit leaders should avoid the tendency to base the route on their own ability.

Tactical Situation/Mission

Speed and security must be balanced to match the threat condition. Consideration should be given to the employment of mountain pickets, possible cross-compartment movements, and the size and type of unit to use the route.

Equipment

The equipment available (e.g., the Marine assault climber's kit [MACK], skis or snowshoes, sleds, ropes, pack animals, crampons, ice axes) and the degree of training that Marines have received in the use of that equipment will directly influence route selection. A unit's ability to properly employ this equipment, combined with the overall weight each Marine is carrying, will determine how aggressive a route should be.

Time

Selecting a route that may appear to temporarily take the unit away from its march objective may in the long run save time. The tendency, however, is to sacrifice proper route selection in an attempt to save time by selecting an overly aggressive route. Due to the difficulty of movement, time-precedence missions are usually unrealistic in the mountains. If it is deemed necessary to use a time-precedence mission, a mountain leader should be placed in charge and three times the personnel needed should be allocated (due to straggling); otherwise, the mountain leader should task-organize a group of those in a high

state of physical fitness and acclimatization to accomplish the specific time-precedent mission.

Route Planning

When planning for unit movement in a temperate zone, axis of advance, boundaries, and other control measures are routinely established without regard for weather conditions or track discipline. In mountainous terrain, route planners must consider these additional factors. During this process, planners use the following route planning tools:

- Map/photo/imagery reconnaissance.
- Orders/overlays.
- Time-distance formula (TDF).
- Elevation gain/loss graph.
- Track discipline (if on snow).

Map/Photo/Imagery Reconnaissance

Before any route description or overlays can be established, a thorough map/photo/imagery study must be conducted. This study should concentrate on those items peculiar to a mountainous/cold weather environment. Determining the prevailing weather patterns of the area of operations can assist in determining correlations between the snowpack and terrain. For instance, knowing that the weather generally comes from the west/southwest, Marines can conclude that most north and east facing slopes will have the greatest deposition of snow and subsequent formations of cornices.

A common area of neglect is cross-compartment movement because of improper map reconnaissance. The tactical situation and the mission may dictate establishing cross-compartment movement to contact, so attention should be directed toward skirting/avoiding avalanche-prone slopes, scree, talus, or rock slide areas and staying in the tree line. Photos and imagery are particularly useful in identifying these types of terrain cover. From standard 1:50,000 or 1:25,000 maps, critical slopes can be determined easily by looking for a few key indicators, such as type of slope (either convex or concave), gradient of the slope, and vegetation on that slope (obvious cuts in the tree line).

When establishing routes using a map or photo/imagery, wider than normal boundaries should be established to allow the unit leader flexibility to select his route. The large contour interval in mountains can hide many obstacles. Aerial photos and satellite imagery show actual vegetation type and coverage as well as the hidden obstacles between contour lines, such as cliffs; however, snow can obscure or completely cover linear terrain features. An actual flyover will give planners an understanding of the difficulty of the terrain.

Orders/Overlays

The order should include movement based on the TDF. The overlay must include critical slopes, cliffs, avalanche paths, and other natural hazards because these terrain features may be part of the adversary's barrier plan.

Time-Distance Formula

Each route should show a completed TDF; however, commanders must be patient since the actual execution across that route may include hidden difficulties, such as streams, roads, or cross-compartments. The TDF (see table 4-1 on page 4-4) is made for acclimatized troops.

Route cards should include space to write in the actual and planned time for each leg. These figures will enhance the ability to estimate the actual time it takes the unit to cover a certain distance.

Elevation Gain/Loss Graph

This graph is made using graph paper or a ruler to plot out elevation from a map in a profile. It gives the Marine a "side" view of the terrain on the route, instead of the traditional/top-down map view. This perspective is helpful in recognizing how much up and down movement is on a route.

Table 4-1. Rates of March for Individual Movement.

Movement Mode	Unbroken Trail	Broken Trail
On foot, no ski or snowshoe, less than 1 foot of snow	1.5 to 3 kph	2 to 3 kph
On foot, no ski or snowshoe, more than 1 foot of snow	.5 to 1 kph	2 to 3 kph
Snowshoe	1.5 to 3 kph	3 to 4 kph
Skiing	1.5 to 5 kph	5 to 6 kph
Skijoring	Not applicable	8 to 24 kph (for safety, 15 kph is the highest recommended speed)
Note: Add 1 hour for every 300 meters of ascent and 1 hour for every 600 meters of descent. **LEGEND** **kph** kilometers per hour		

Track Discipline (if on snow)

Track discipline is required in snow because not all tracks can be hidden. Selecting routes below the tree line or on the windward side above the tree line must be considered. Selecting either the British technique of a single track that all stay in line or the Finnish technique of multiple tracks in all directions will impact time estimates for the route and selection of the specific route conducive to the technique to be used.

General Considerations

The following items should be considered during route planning:

- *Terrain negotiation*. By traversing slopes early, Marines eliminate the necessity for sudden gains or losses in elevation, which will ultimately add several minutes or hours to a previously short move. It may be more efficient to contour around an object, such as a slope, draw, or finger, than to travel in a straight line and may prevent unnecessary loss or gain in elevation. When descending slopes of scree or snow, the plunge step should be used.
- *Narrow depressions*. Marines should contour in and out of narrow depressions.
- *Waterways/Lakes*. If frozen, a body of water makes an ideal avenue of approach; otherwise, it is a large obstacle. See chapter 5 for guidelines on fording streams.
- *Commander's log and route card*. A commander's log (see fig. 4-1) and a route card (see fig. 4-2 on page 4-6). A copy should be completed for every route done by the whole unit or any subordinate unit. The more sheets accumulated, the more accurate the time-distance estimation will become.

FOR TIME-DISTANCE ESTIMATION IN MOUNTAINOUS/SNOW-COVERED TERRAIN
(Attach route overlay/route card, if possible)

UNIT:

DISTANCE (map):

ELEVATION GAIN, TOTAL:

ELEVATION LOSS, TOTAL:

WEATHER CONDITIONS (winds, precipitation, humidity, day/night):

TEMPERATURE (high and low):

ALTITUDE (high and low):

SNOW CONDITIONS (depth, hardness/flotation, dry/wet):

OVER-THE-SNOW MOBILITY EQUIPMENT (skis, snowshoes, sleds, combat boots, vapor barrier boots, ski/march boots, skins, wax):

REMARKS:

Figure 4-1. Commander's Log.

ROUTE CARD								
UNIT ID		UNIT CDR		# OF PERS		DTG		MAP REF
CHECK POINT	AZIMUTH	DIST	GRID LOCATION	ELEV GAIN	ELEV LOSS	ET	AT	DESCRIPTION

TOTALS:
DIST_____ ELEV GAIN_____ ELEV LOSS_____ ET _____AT_____

LEGEND

AT	actual time	**ET**	estimated time
CDR	commander	**ID**	identification
DIST	distance	**PERS**	personnel
DTG	date-time group	**REF**	reference
ELEV	elevation		

Figure 4-2. Route Card.

CHAPTER 5
CROSSING WATER OBSTACLES

Crossing Streams and Rivers

Mountain streams and rivers are military obstacles and danger areas for units crossing them. In order to reduce the time in the danger area, a reconnaissance team should precede the main body and select the best crossing site. The site selection for a stream crossing should include the following considerations:

- Look for logjams, rocks, or fallen trees that will provide a dry crossing.
- Select a wide and shallow crossing point where the current is slower if a dry crossing is not possible.
- Avoid sharp bends. They can be deep with a strong current on the outside of the bend.
- Look for a firm, smooth bottom. Large rocks provide poor footing and cause a great deal of turbulence in the water.
- It may be easier to cross several small channels of water rather than one large one.
- Do not cross just above rapids, falls, or logjams because taking a fall or slipping could have serious consequences.
- Cross in the early morning. The water level will be lower since there has been less daylight for the snow to melt and, on sunny days, there will be more time to dry clothing and equipment.
- There should be a suitable spot downstream for safety swimmers.

In a training environment, extra safety precautions are required to minimize the training hazard. There must be strong swimmers positioned downstream to serve as safety swimmers. Using a throw bag, the safety swimmers are positioned to rescue anyone who is swept downstream. As a last resort, safety swimmers will enter the water to attempt a rescue. In swift moving water, safety swimmers will not swim to a victim without a belay line. In a training scenario, the swimmers will wear life jackets.

There must be a safety line at a minimum of a 45-degree angle downstream skimming the top of the water. Anyone who slips and is swept downstream can grab the line and pull himself to shore. If the victim is unconscious and is caught on the line, the safety swimmer will enter the water and pull the victim to safety.

Combat safety precautions may differ from training safety precautions. Combat safety is just as important as training safety; however, in combat there may be the added concern of a hostile force.

Safety swimmers may be used if the unit members are crossing a stream where they can touch the bottom with their feet. Safety swimmers will be used if someone trips and begins rolling downstream toward a hazard, such as a rock jam or waterfall. They can make a field expedient throw bag with 550 cord and an isopor mat.

A safety line should be used if the stream current is strong or Marines cannot touch the bottom of the stream. The purpose of this line is to attach the Marine to the line and slide across the stream.

Individual Crossing Preparations and Methods

Before crossing a stream, there are six preparations that each individual should make—

- Wear pack with shoulder straps fastened snugly. Waterproof the pack for buoyancy, if possible.
- Wear weapons slung diagonally over the shoulder between the pack and the individual's back.

- Button all pockets and remove blousing garters to prevent the water from flowing into open pockets and creating added drag.
- Wear boots to protect the feet, but remove socks and insoles to keep them dry.
- Wear the minimum amount of clothing to reduce the amount of clothing that must be dried after the crossing.
- Do not wear helmets in swift moving currents; the current could force the helmeted head under water.

Staff Method

A strong staff or pole that extends at least one foot above the Marine's head is used as a crossing aid. It should be strong enough to support his weight and be trimmed clean of any branches. Placing both hands on the pole, he should place the staff upstream of his intended path, use the staff as the third leg of a tripod, and move only one leg or the staff at a time (dragging his feet instead of picking them up). The Marine should face upstream using the staff for balance (see fig. 5-1). The staff is also used as a probe to discover bottom irregularities that could be a tripping hazard.

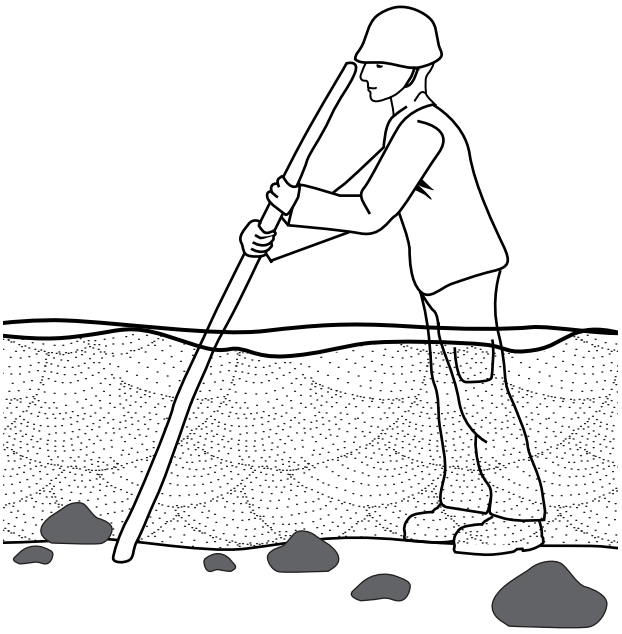

Figure 5-1. Staff Method.

Swimming

Swimming is an obvious method if unit members are good swimmers; since this is not always the case, this method is not usually preferred. In fast, shallow water, the Marine should cross on his back with his feet downstream and his head up. He will move at an angle across the stream, moving with the water. He should use his hands to tread water and his feet to fend off obstructions. In fast, deep water, the Marine should angle across the stream on his stomach with his head upstream, to establish a proper crossing angle.

Belayed Method

In chest deep water or water with a strong current, a rope can assist greatly. Marines would secure a rope from bank to bank with the far anchor downstream from the near anchor and anchor the rope so that it lays at a minimum of 45 degrees. The Marine attaches himself to the rope by using a sling rope as a safety line, tying a bowline around his waist and a figure-eight loop with a locking carabiner inserted. The figure-eight loop must be within an arm's length. He will attach his pack to the line and then attach himself. The Marine grasps the pack and crosses using the current to assist him.

Team Crossing Methods

There are three team crossing methods—line abreast, line astern, and huddle.

Line Abreast Method

Small units (squad to platoon) can cross in moderate currents up to chest deep by linking arms in a line abreast or chain method. The largest man of the chain is placed on the upstream side of the group. The group enters the stream parallel to the flow of the stream. The middle man in the chain controls the group's movement and gives the command to step. See figure 5-2.

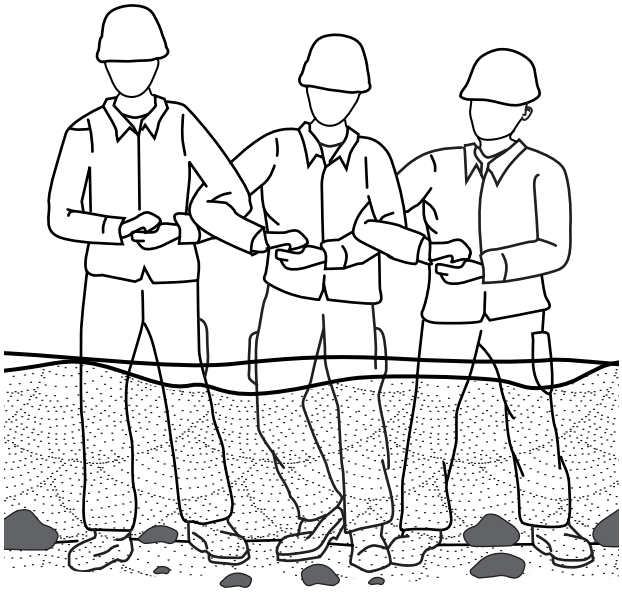

Figure 5-2. Line Abreast Method.

Line Astern Method

Three or more men can line up facing the current. The upstream man, who should be the largest man in the group, breaks the current while the downstream men hold him steady. The upstream man may use a staff, similar to the individual staff method, to steady himself. All men side step at the same time with one man calling the cadence. See figure 5-3.

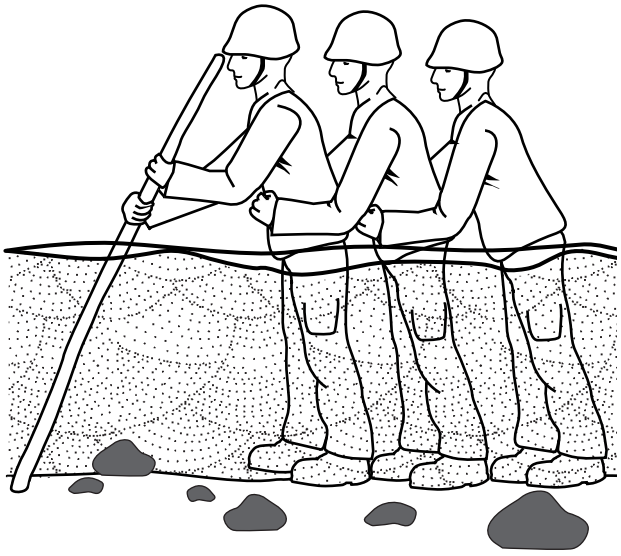

Figure 5-3. Line Astern Method.

Huddle Method

Three to eight men face inward as in a football huddle. They wrap their arms around each other's shoulders and cross the stream in this formation, as shown in figure 5-4. The upstream man changes position because the entire formation rotates as they cross, which prevents one man from becoming exhausted in the upstream position.

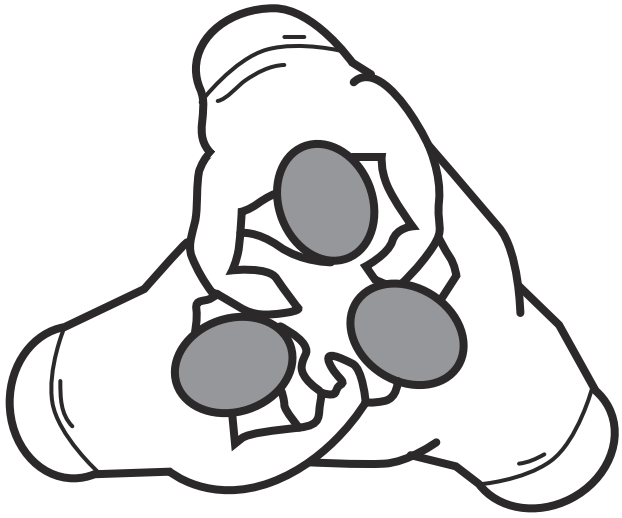

Figure 5-4. Huddle Method.

Tactical Stream Crossing

Figure 5-5, on page 5-4, is an example of a tactical stream crossing SOP. Leaders may use this SOP, modify it, or develop their own SOP.

Crossing Frozen Waterways

Reconnaissance is conducted by a winter mountain leader or combat engineer. Details on ice properties, equipment, and reconnaissance methods and procedures are found in MCRP 3-35.1B. Frozen waterways, such as rivers, lakes, or seas, are common obstacles to cross during winter.

The Crossing Route

The best conditions for ice crossing exists where the stream is broad and straight, with a bank that

TACTICAL STREAM CROSSING SOP

Team 1 (the last team to cross)
Upon reaching the stream—
- Conduct reconnaissance of crossing site.
- Establish near side security.
- Determine whether a snow bridge will have to be constructed (winter).
- Provide guide to bring remainder of the unit forward.

While crossing the stream, maintain security during the crossing.
After crossing the stream—
- Establish security as directed.
- Wait for the order to move out.

Team 2 (the first team to cross)
Upon reaching the stream—
- Set up rally point with team 3.
- Move forward to construct a snow bridge for the crossing, of necessary.
- Wait for guide from team 1.

While crossing the stream, maintain accountability of all Marines crossing the stream.
After crossing—
- Reconnoiter at the far side of the crossing site.
- Establish 360-degree security on the far side.
- Give signal for rest of unit to cross.
- Place other teams in 360-degree security as they cross.
- Wait for order to move out.

Team 3 (the second team to cross)
Upon reaching the crossing site—
- Establish 360-degree security.
- Wait for guide from team 1, then cross the stream.

After crossing—
- Establish security as directed by team 2.
- Wait for order to move out.

Actions if compromised:
- Prior to the crossing—the team leader will make the decision to attack or attempt the crossing, depending on the size of the enemy and the situation.
- During the crossing—depending on the situation, the team leader will make the decision to either cross the remainder of his unit or bring the Marines on the far side back across to engage the enemy.
- After the crossing—depending on the situation, the team leader will make the decision to engage the enemy or withdraw, possibly back across the stream.

NOTE: In most cases, the stream crossing may also be used as a water resupply point.

Figure 5-5. Example of a Tactical Stream Crossing Standing Operating Procedure.

is relatively low or has a gentle slope and is easy to prepare. It should also have an even bottom, well-defined channels, and a water flow that is reasonably deep with a low, uniform velocity. These conditions favor the formation of strong, thick ice suitable for ice bridges. Of particular interest is the effect of a small stream running into the outside curve of a main stream. Observations have shown that where a main current curves at a right angle and a secondary current enters perpendicular to or into the main current, there is a slowing of the entire water movement of that

particular area. This results in freezing from bank to bank, which is capable of supporting troops on snowshoes or skis.

When conducting the ice reconnaissance of the route, Marines must—

- Designate the proposed route, approaches, exits, and sounding holes with bags, ice blocks, snow piles, stakes, or tape, depending on tactical considerations.
- Determine the width of the water obstacle.
- Determine if any dams are upstream.
- Determine tidal rise and drop for bays and duration of high tide.
- Cut and drill holes along the axis and through the ice every 3 to 5 meters by the banks and every 10 meters in the channel.
- Sketch river profiles on special engineer paper.
- Determine alternate routes.

Special Considerations for Crossing Ice

Crossing a frozen waterway should be treated like crossing a linear danger area for a stream/river or an area danger area for lakes/bays. Frozen waterways may also be used as main supply routes (MSRs) for foot or vehicular traffic and as landing zones (LZs) for helicopters. It all depends on the thickness of the ice and the tactical situation. The following special considerations should be made for the route:

- Immediately adjacent to the shore, the ice formation is thin, weak, and more likely to develop cracks than ice in the center of a frozen stream. Depending upon the gradient of the riverbed and the thickness of the ice near the shore, it is generally safer to maintain a route near the shore if the ice rests upon the river bottom.
- Where a current of water flows under a large ice area, the ice in contact with the current is subject to a greater variation in temperature over a given time and is thicker than the ice in adjacent areas.
- Shallow water ice is usually thinner than deep water ice.
- Good quality ice is clear and free from bubbles and cracks. If a body of water contains clear and cloudy ice, the clear ice will frequently be thinner than the cloudy ice.
- Lakes contain a great deal of vegetation. The decomposition of this vegetation retards freezing and results in weak ice.
- Flooded snow, when frozen, produces white "slush ice," which may contain air bubbles. Slush ice has a load carrying capacity approximately one-quarter less than that of prime natural ice.
- During freezing weather, the thickness of ice is increased by removing its snow cover.
- Ice that remains unsupported after a drop in the water beneath it has little strength, as exemplified in reservoirs/lakes with runoffs and hydroelectric dams.
- During extremely cold weather, cracks caused by contraction of the ice may be enlarged by heavy traffic. In Norway, some rivers and lakes are controlled by floodgates and will be opened by home guard units upon attack.
- In spring, the main body of ice can be traveled over only if water is on the ice surface for a limited time. Potholes demand extra caution.
- A reinforced ice crossing close to a summer crossing site that uses floating equipment, should be located downstream of the summer crossing site to minimize the danger of damage to the bridging equipment during the thaw.

Ice is classified in three general types—salt water, fresh water, and land—and is detailed further in MCRP 3-35.1B. These types have widely different characteristics, occur in different areas, and present different problems. All may be used for construction. The strength of the ice depends upon ice structure, purity of water, freezing process, cycles of freezing and thawing, crystal orientation, temperature, ice thickness, snow cover, water current, underside support, and age. The amount of ice required to support men and vehicles with the proper distance apart is shown in table 5-1 on page 5-6.

Table 5-1. Ice Safety Table.

Item Loaded	Weight in Tons	Ice Thickness Needed (centimeters/inches)	Distance Apart Needed (meters/feet)
Man on skis/snowshoes	0.1	3/1.2	5/15
Man on foot	0.1	5/2	5/15
Horse	0.5	10/4	5/15
Horse-drawn sled/cart	1	15/6	15/50
BV-206	2	15/6	15/50
Armored personnel carrier	3	20/8	15/50
Bulldozer	5	25/10	23/75
7-ton truck and load	10	33/13	32/105
Tank	68	122/48	92/300

Having determined that the ice is sufficiently thick to cross, there are six safety precautions to take before crossing an ice-covered body of water—

- Loosen bindings on skis or snowshoes, if so equipped.
- Remove wrist loops of ski poles, if so equipped.
- Sling pack and weapons onto one shoulder.
- Only expose one person to the danger at a time or until weight factor is determined.
- Ropes should belay the first group of individuals. Belay is required if there is rapidly flowing water under the ice.
- Clothing should be worn snugly. All wrist straps, waist straps, collars, and trouser cuffs should be tied securely, which increases buoyancy if breakthrough occurs and reduces cold shock.

Fording Streams

Broad floodplains with sandbars and shifting water produce weak or unsupported ice with open water areas and difficult working conditions. Such locations will probably require a combination of an ice crossing and conventional floating bridges/winter ford. The fording of streams on foot is advised in summer months or during other times when weather and water conditions are favorable.

Summer

The variation in stream velocity and depth are important considerations, particularly in streams and rivers from glacial or ice cap areas. Fording of such streams may be feasible only during certain hours of the day—usually early morning—or after the spring/early summer thaw when volume and velocity of the water are at a minimum. Precautions are necessary to prevent fording at unfavorable times and to provide assistance when difficulties arise during actual crossing of equipment or personnel.

Winter

Fording streams in the winter should be avoided because of the difficulties encountered in the crossing and the effects of water on personnel and equipment when the ambient temperatures are very low. Some streams, particularly those flowing in broad flood plains in which valley icing occurs, have open channels that continually shift about the valley during early winter. Valley ice is treacherous because a shifting stream leaves sheets of ice unsupported. Equipment breaks through such ice and is difficult to recover. The sides of open water channels are frequently steep and water is generally deep. Passage, even by heavy tractor equipment, is hazardous. If such fording operations become necessary, the route should be marked with care, all unsupported ice

should be removed, and special precautions should be taken to provide safe passage through active stream channels. Continual reconnaissance should be maintained upstream from the ford to determine probable shifts in the water channel. Upstream damming and diversion can sometimes control the position of the active stream channel. The whole water channel should be kept clear to a point below the ford.

Rescue Techniques

If an individual or group breaks through the ice on an ice-covered body of water, they should be thrown a rope and the breach should not be approached. Marines who have fallen through carry out the following self-rescue techniques:

- Remove unnecessary gear, such as packs, weapons, and skis. Throw unnecessary gear onto the ice.
- Retain ski poles and use these as daggers to drag oneself up on to and across the ice by grasping each pole above the ski basket.
- Exit the hole by shallow swimming onto the ice. Do not push up on the edge because it may break off. If thrown a rope, twist the arm around it, as the cold will reduce grip strength. Let the others pull; do not climb the rope. Once out, remain flat; do not stand up near the hole.
- Carry out rewarming process immediately. The usual result of sudden immersion is severe hypothermia and shock. Rewarming is the most important rescue step.

Tactical Uses

There are several offensive and defensive tactical uses to consider while planning to cross frozen waterways—

- Deny the enemy use of a frozen river or lake as an avenue of approach or MSR.
- Protect defensive position on a lake or river line.
- Ambush troops, vehicles, or helicopters using a frozen body of water as an LZ.
- Use ice as a high speed avenue of approach.
- Use ice as an MSR to conduct and expedite resupply.
- Use ice as an LZ.

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CHAPTER 6
AVALANCHES

The following terms are necessary to understand when crossing an avalanche-prone slope:

- *Avalanche*. An avalanche is a falling mass of snow that can contain rock, soil, or ice, which will travel over terrain of least resistance.
- *Avalanche path*. The avalanche path is the area in which an avalanche runs. An avalanche is generally divided into three parts—starting zone, track, and runout zone, which are shown in figure 6-1.
- *Starting zone*. The starting zone is where the unstable snow failed and began to move.
- *Track*. The track is the downward slope or channel, in which snow moves at a uniform speed.
- *Runout zone*. This zone is where the snow slows, debris is deposited, and the avalanche stops.

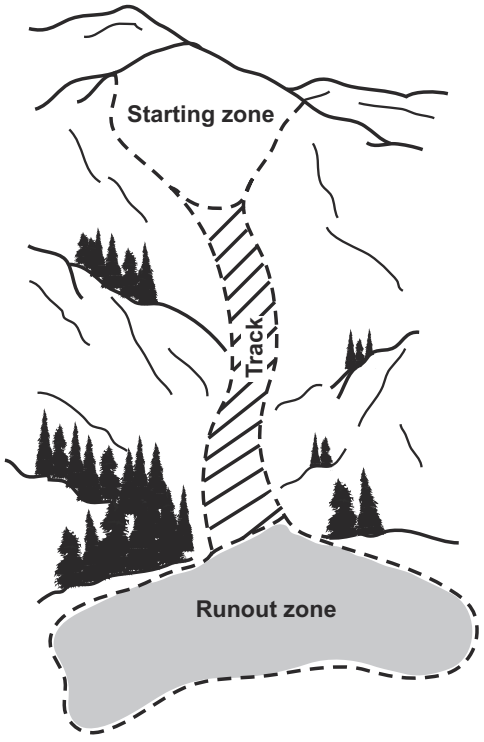

Figure 6-1. Avalanche Path.

Types of Avalanches

Loose Snow Avalanche

Loose snow slides, also called point releases, start with a small amount of cohesion and less snow and typically pick up more snow as they descend (see fig. 6-2). From a distance, they appear to start at a point and fan out into a triangle. They usually are small and involve only upper layers of snow, but they can become quite large and destructive depending upon how much material they entrain.

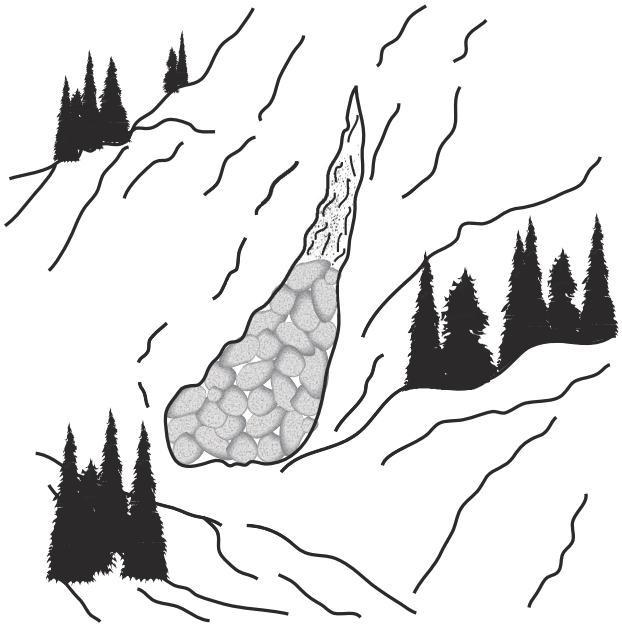

Figure 6-2. Loose Snow Avalanche.

Loose snow releases occur most often on steep slopes of 35 degrees or higher; during or shortly after a snowstorm; or during warming events caused by rain, rising temperatures, or solar radiation. The stress of the moving snow in a loose snow slide can also trigger larger and deeper slab releases.

Slab Avalanche

Slab avalanches occur when one or more layers of cohesive snow break away as a unit. As the slab travels down the slope, it splits up into smaller blocks or clods, as seen in figure 6-3. Slab failure is commonly initiated when the bond between the slab and the bed surface fails. This failure places tremendous stress on the other boundary regions that, in turn, are unable to hold the slab in place. Slab thickness can range from less than an inch to 35 feet or more and range in width from a few yards to well over a mile. Their makeup is also highly variable and may be hard or soft, wet or dry; however, they share the following features (see fig. 6-4):

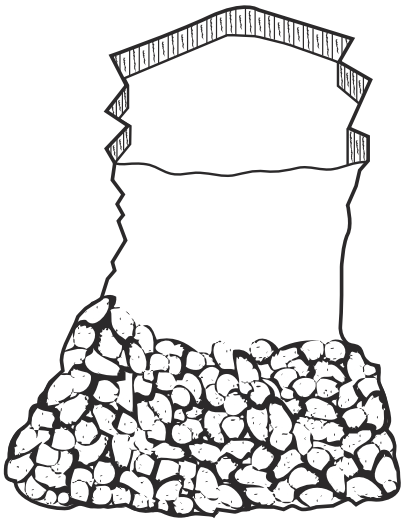

Figure 6-3. Slab Avalanche.

- *Crown*. The crown is the breakaway wall of the top periphery of the slab. It is usually at a right angle to the bed surface. It is formed by tension fracture through the depth of the slab from bottom to top.
- *Bed surface*. The bed surface is the surface over which the slab will slide and can be the ground.
- *Flanks*. The flanks are the left and right sides of the slab.
- *Stauchwall*. The stauchwall is the lowest down slope fracture surface. It is usually overridden by the slab material and it consists of a diagonal, wedge-like, shear fracture.

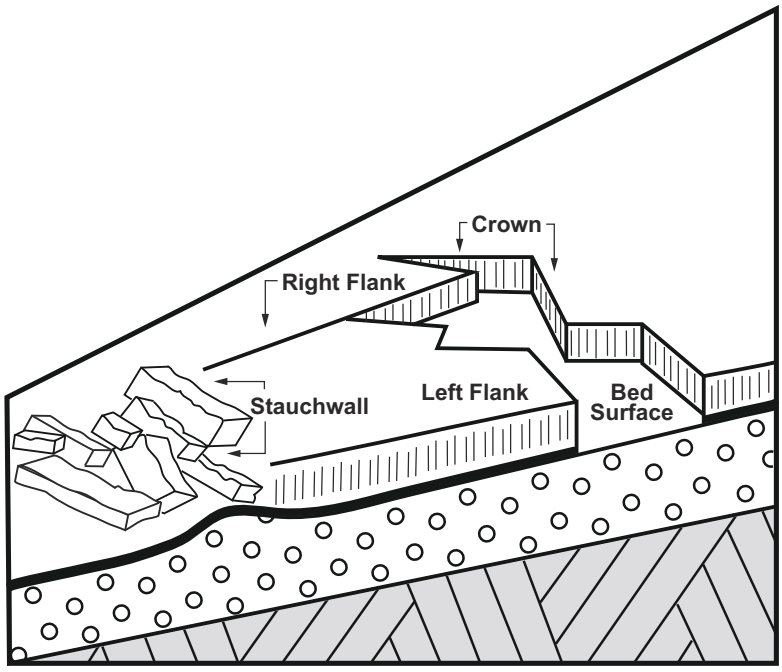

Figure 6-4. Slab Avalanche Nomenclature.

The speed of a slab avalanche can range from roughly 65 miles per hour for a wet slab to 150 miles per hour for a dry slide. Most slab avalanches release on slopes with angles between 35 and 40 degrees.

Avalanche Hazard Evaluation Process

The interaction of the following four critical variables (the first three make up the data triangle, as shown in fig. 6-5) will help to determine whether an avalanche is possible:

- *Analyze the terrain*. Is the terrain capable of producing avalanches?
- *Evaluate the stability of the snowpack*. Could the snow slide?
- *Forecast the weather*. Is the weather contributing to instability?
- *Consider the human factor*. To determine whether an avalanche hazard exists, Marines must add another variable—people. Without the presence of humans, there is no hazard. Consider the alternatives and their possible consequences.

Terrain

Learning to recognize avalanche terrain is the critical starting point in the avalanche hazard evaluation process. Thinking that avalanches occur on only a big slope is a very common mistake. Seven factors influence whether a given slope is capable of producing an avalanche. These factors help with the recognition of avalanche terrain—slope angle, slope aspect, terrain roughness, slope shape, vegetation, elevation, and path history.

Slope Angle

Slope angle is the most important terrain variable when determining the possibility that a given slope will avalanche. The underlying concept is that as the slope angle increases, so does the stress exerted on all boundary regions of the slab. The slope angle relationship to avalanche hazard is shown in figure 6-6.

Slope angles less than 25 degrees will rarely slide due to lack of stress to the snowpack. Slab avalanches in cold snow are possible between the slope angles of 25 and 60 degrees. Most slab avalanches release on slopes with starting zone angles between 30 and 45 degrees and with the

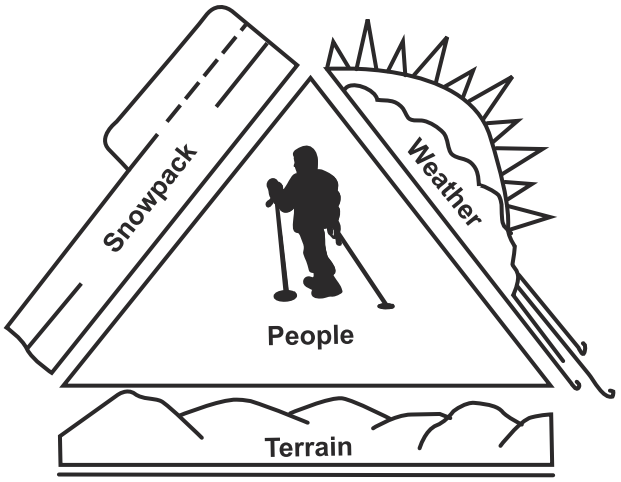

Figure 6-5. Data Triangle.

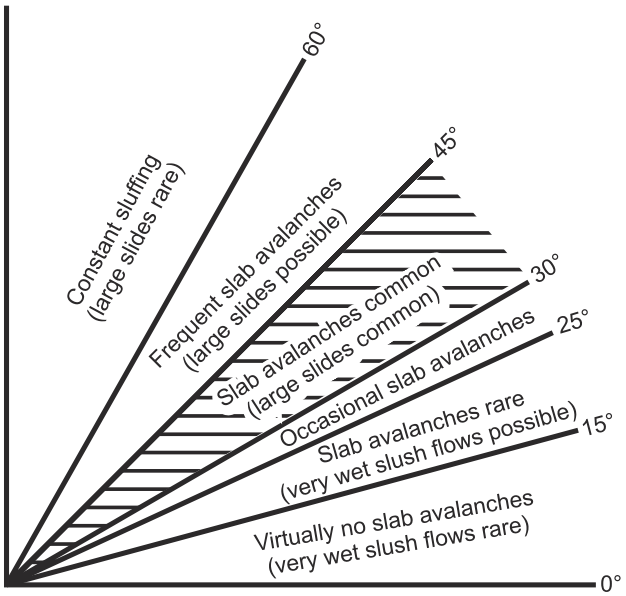

Figure 6-6. Slope Angle Relationship to Avalanches.

peak in frequency near 40 degrees. Slope angles 60 degrees or greater will continually slough due to large amounts of stress to the snowpack.

Note: It is important to know that motion or body weight can trigger an avalanche even if Marines are on a low angle slope or on the flats as long as this terrain is connected to a slope with an angle of roughly 25 degrees and instability exists.

Slope Aspect (Orientation)

The following subtle changes in slope aspect and their effects can greatly affect snow stability:

- Leeward deposits of wind-transported snow increase the stress on the snowpack and enhance slab formation.
- Moderate warming by the sun can help strengthen and stabilize the snowpack, but intense, direct sunlight has the opposite effect by weakening and lubricating the bonds between grains.
- Due to a lack of solar heat, weak layers may stay longer on shaded slopes; therefore, instability on shadowed slopes should be suspected.

Note: For operational planning purposes, north-facing and shaded slopes tend to be more dangerous during the mid-winter period. South-facing slopes tend to be most dangerous during spring thaw, especially on sunny days.

Terrain Roughness (Anchoring)

Slopes with anchors are less likely to avalanche than open slopes. Terrain anchoring is shown in figure 6-7. Boulders, trees, and ledges act as anchors and help hold the snow in place until they are buried. Smooth slopes (e.g., smooth granite or grass) may only need one foot of snow to release.

Anchors are commonly areas of stress concentration because the snow upslope of them is being held in place while the snow below or to the sides is being pulled downhill by gravity. For this reason, anchors can be starting points for initial failure to occur and fractures often run from tree to tree to rock.

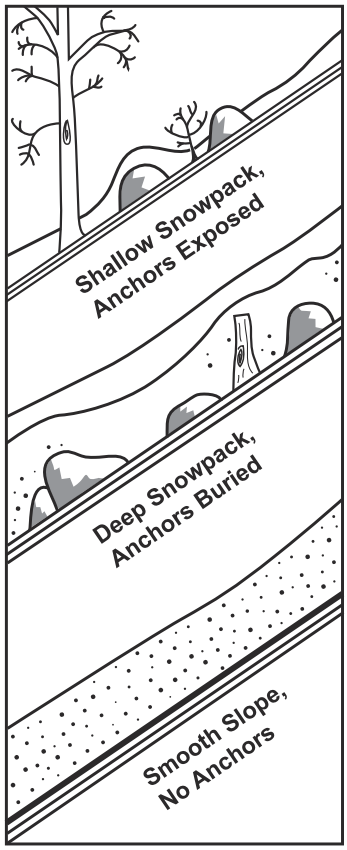

Figure 6-7. Terrain Anchoring.

Slope Shape

Avalanches can happen on any snow-covered slope steep enough to slide, such as on—

- *Convex slopes*. Slabs are most likely to fracture just below the bulge where stresses are greatest (see fig. 6-8).
- *Planar slopes*. On these broad, smooth slopes, avalanches can happen anywhere. Slabs often fracture below cliff bands.
- *Concave slopes*. These slopes provide a certain amount of support through compression at the base of the hollow, but they are still capable of avalanching, especially on large slopes (see fig. 6-9).

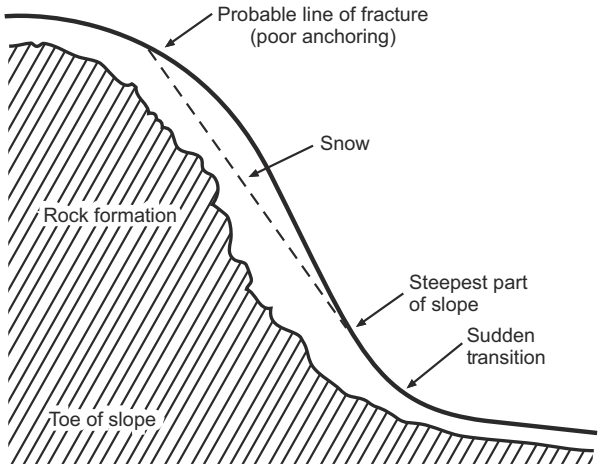

Figure 6-8. Convex Slope.

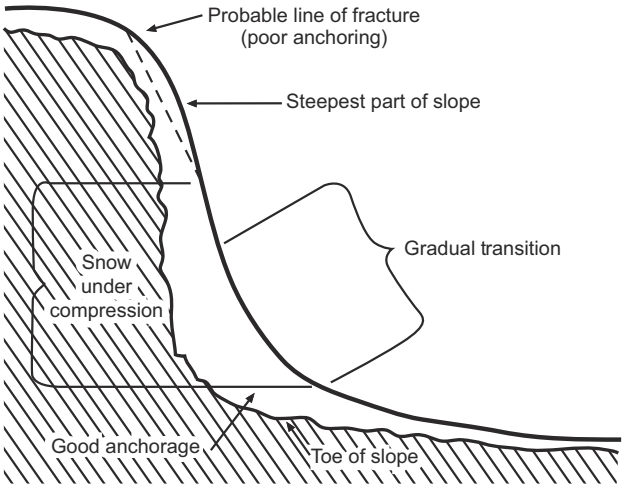

Figure 6-9. Concave Slope.

Vegetation

Vegetation can provide evidence of both the frequency and magnitude of past avalanche occurrences and indicate potential avalanche terrain as well as the capability of a given path (see fig. 6-10). Vegetative indicators include—

- Swaths of open slope between forested or vegetated areas.
- Bent, broken, uprooted, or "broomed" trees (previously broken but with new growth tops) and vegetation that is polished or "flagged" (missing branches on the uphill side). Flagging can also indicate the flow height of the avalanches that have affected the area.
- Presence of "disaster species," such as alders, willows, dwarf birch, and cottonwoods.
- Marked difference in height of trees, such as smaller spruce in the path and larger on the edges.

Figure 6-10. Vegetation Indicator of an Avalanche-Prone Slope.

Elevation

Temperature, wind, and precipitation often vary significantly at different elevations. Common differences are rain at lower elevations with snow at higher elevations or differences in precipitation amounts or wind speed with elevation. Never assume that conditions on a slope at a particular elevation reflect those of a slope at a different elevation.

Path History

All avalanche paths have some sort of history, whether it is their magnitude or how often they slide. Before going into avalanche country, as much information as possible should be gathered.

Snowpack

The snowpack accumulates layer by layer with each new snow or wind event. These layers are then subject to changes in texture and strength throughout the winter. The changes help determine snow strength by influencing how well individual snow grains are bonded to each other both within the layer and between layers. Many combinations of strong and weak layers can exist within the snowpack (see fig. 6-11). The structure of the snowpack varies greatly depending upon the particular season, location, climate, slope aspect, inclination, and shape. The unit's winter mountain leader can conduct snowpack analysis for an avalanche risk estimate.

Snow metamorphism describes the changes in structure that take place over time within the layers of the snowpack. There are several types of snow metamorphism. Each occurs under a different set of conditions and each affects the strength of the snowpack. As conditions change, the dominant type of metamorphism in a given layer may change. Also importantly, different types of metamorphism may be occurring in various layers of the snowpack at the same time. The three snow metamorphic types encountered in a snowpack are rounding, faceting, and melt-freeze.

Rounding

Rounded grains develop when temperatures in a layer or between layers are uniform. This process produces fine, rounded, well-bonded grains and the result is that relatively strong layers form within a snowpack.

Faceting

Faceted grains develop when a significant temperature change exists within or between layers. The shallower the snowpacks, the greater the temperature changes within the snowpack. This process produces large, angular grains, which are poorly bonded and weak. As a result, relatively weak layers form within a snowpack.

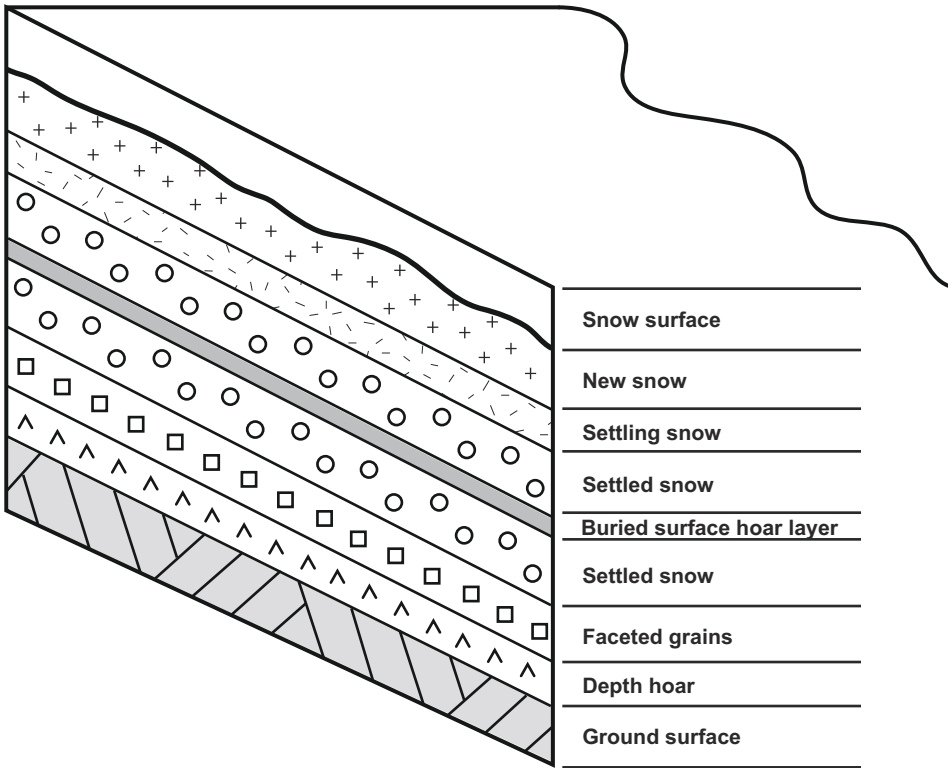

Figure 6-11. Example of Layers Within a Snowpack.

Melt-Freeze

This type of metamorphism occurs during mid-winter thaws or in the spring when melting snow or rain enters the snowpack and the snowpack temperature reaches 32 °F. In the freeze phase, these grains are well bonded and strong, creating a stable snowpack; however, the resulting ice crust can create a good bed surface for slabs to form on top of the crust. In the melt phase, the wet grains will weaken rapidly, as they are lubricated by the presence of free water, creating an unstable snowpack. Timing during movement is critical in the spring near steep slopes that are being subjected to warming cycles.

Weather

Weather has been termed the "architect of avalanches." Most natural avalanches occur during or shortly after storms because the snowpack often cannot adjust to the new weight added in a short time. Weather affects the stability of the snowpack by altering the critical balance between strength and stress. The three main contributing factors are the precipitation, wind, and temperature.

Precipitation

Precipitation increases stress exerted upon a snowpack by adding weight. New snow can provide a certain amount of strength to a snowpack, but can also cause rapid loading during a storm. Heavy rain weakens the snowpack by warming and eroding the bond between grains and slab layers.

Wind

Since wind speed and direction help determine which slopes are being loaded, they become very important avalanche considerations. Top loading is caused when wind accelerates on the windward side of terrain features, picks up loose snow, carries it over the crest, and deposits it on the leeward side where the wind decelerates, as shown in figure 6-12.

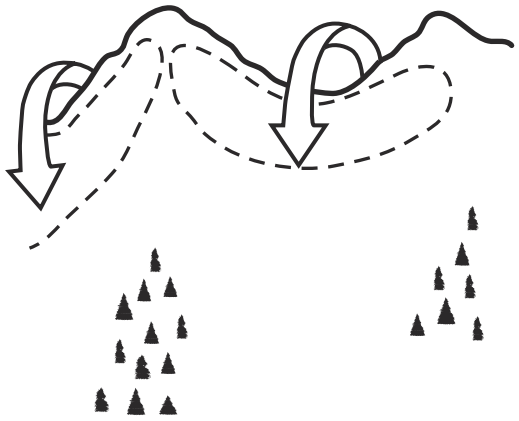

Figure 6-12. Top Loading.

Side loading, also known as cross loading, is sometimes more insidious because it can be harder to detect, especially in areas of gentle gullies, as shown in figure 6-13.

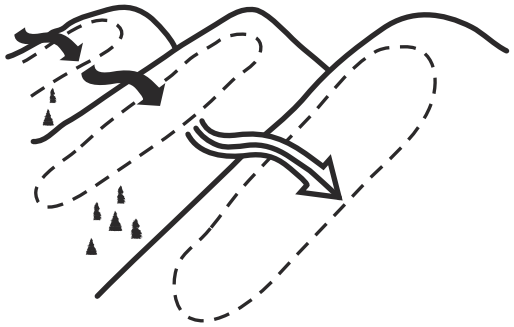

Figure 6-13. Side Loading.

Temperature

Changes in snow temperature can significantly affect snow stability. These changes are governed largely by ground and air temperatures, solar radiation, and terrestrial radiation. Temperature affects snow in the following ways:

- A warm snowpack will settle rapidly, becoming denser and stronger. It is associated with cloudy skies, since clouds trap warm air against the earth's surface.
- Though gradual warming encourages strength and stabilization, intense warming weakens the

bonds between grains and increases the rate of the down slope deformation in affected layers.
- On shaded slopes, the snowpack undergoes less (or slower) settlement due to cooler temperatures and develops weak layers, such as faceted snow or surface hoar. Temperature gradients within the snow surface and snowpack can be more pronounced and persist for longer periods.
- Storms that start out cold and get progressively warmer are more likely to produce avalanches than those that start out warm and progressively become cooler.
- Any rapid, prolonged rise in temperature following long periods of cold weather could lead to instability.

Human Factor

It is possible to travel at times of high snow instability by choosing safe routes. Similarly, it is possible to be caught in an avalanche during periods of relatively low snow instability due to poor route selection and stability evaluation. In other words, Marines can create a hazard by traveling in avalanche terrain; however, through careful route selection, preparation, and decisionmaking, they can limit the amount of danger that is involved.

Considerations for Crossing an Avalanche-Prone Slope

Careful route selection can greatly reduce the chances of being caught in an avalanche and, in some areas, make it possible to travel during periods of high instability (see fig. 6-14). The following route considerations should be made before crossing an avalanche-prone slope:

- Determine starting zones and cross as high as possible.
- Travel on high points and ridges.
- When ascending or descending, stay to the sides of the start zone and track.
- Avoid wind-loaded, leeward slopes.
- Favor terrain with anchors, such as a tree-covered area, over open slopes.
- Pick areas with flat, open runouts so burial depth is decreased. Avoid areas that feed into gullies, crevasses, and over cliffs.
- Avoid V-shaped valleys and travel in wide U-shaped valleys. In V-shaped valleys, avalanches could run from either side and continue up the opposite side, so there may be little or no safe ground.
- If the tactical situation permits, consider initiating avalanches with supporting arms. This eliminates the hazard, but may require engineer assets forward to clear roads after triggering.

Note: The enemy can use their supporting arms to initiate avalanches on Marine units as they cross on or below avalanche-prone slopes. Planning fires to initiate avalanches also mitigates this potential enemy threat.

Preparations for Crossing an Avalanche-Prone Slope

Occasionally, being reasonably sure that Marines will not fall, that they can travel quickly, or that all members of the patrol have rescue equipment and are proficient with it may allow travel across marginal areas. Before crossing a potential avalanche slope, the following preparations should be made:

- Loosen ski bindings and remove hands from ski pole straps.
- Loosen the pack and unbuckle the waist strap.
- Secure mountain/cold weather clothing system (M/CWCS) hood tightly, covering face, and trail a 10-meter avalanche cord if available.
- Go around if possible. Travel straight downhill/uphill on foot rather than ski and look for possible escape routes. Do not traverse back and forth.
- When traversing, cross as high as possible.
- Cross one at a time; belay if possible. Just because one Marine crosses safely, safe passage is not guaranteed for the rest. See figure 6-15 on page 6-10.

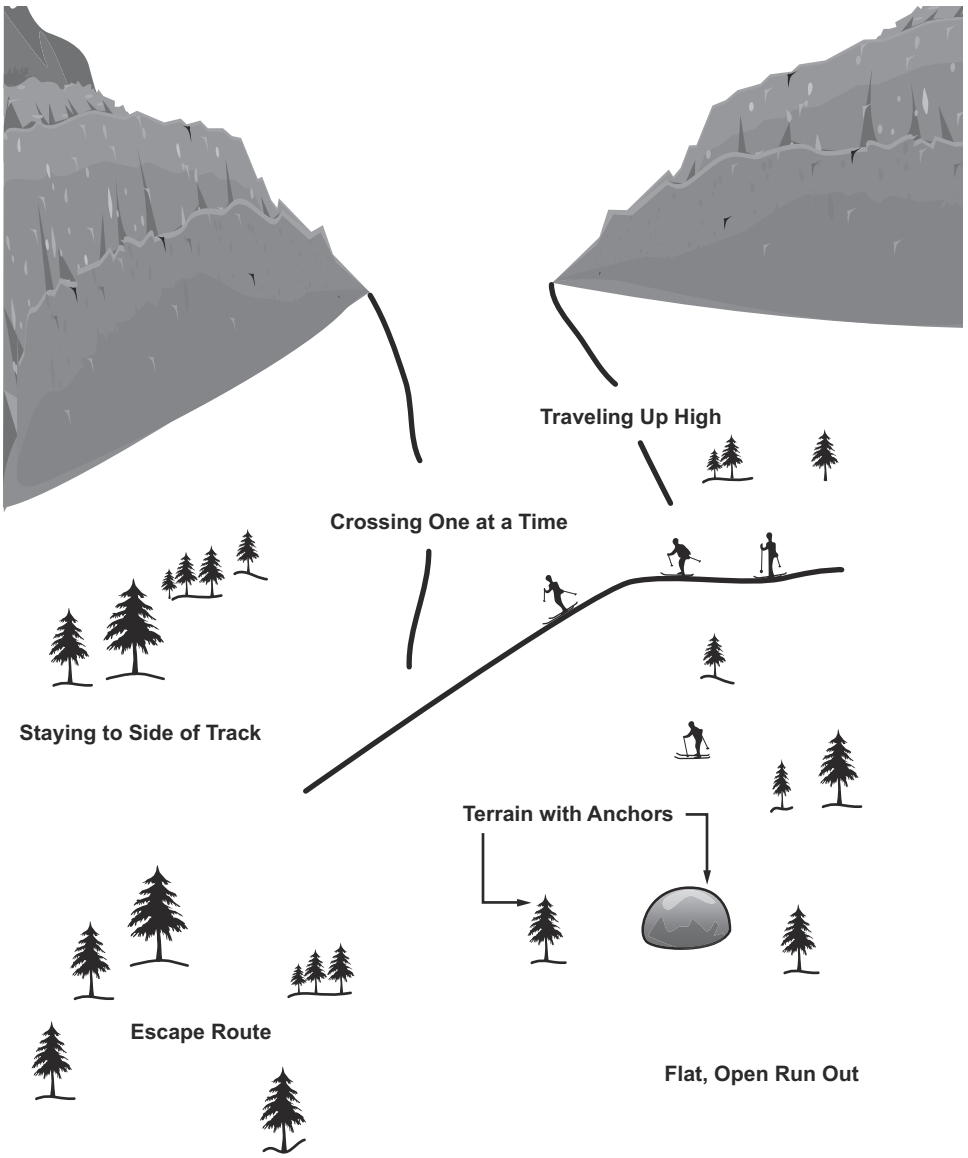

Figure 6-14. Crossing an Avalanche-Prone Slope.

Actions if Caught in an Avalanche

If a Marine is caught in an avalanche, he should—

- Call out so the other members of the patrol know to watch his path as he is carried down the slope and then keep his mouth closed to prevent ingestion of snow.
- Discard pack, skis, and poles, although this is much easier said than done. This gear tends to drag the Marine underneath the surface of the moving debris.
- Assess best line of escape.
- Delay the departure, letting as much of the avalanche as possible pass by.
- Try to work to the side. There will be less force of the avalanche at the edge of the flow.
- Try to swim out using swimming and rolling action to stay on the surface of the snow.
- When feeling the snow slow down, thrust an arm or hand or any part of the body above the snow surface so that others can see it. It is common to be so disoriented that the Marine will not know where the surface is, so just guess and lunge.

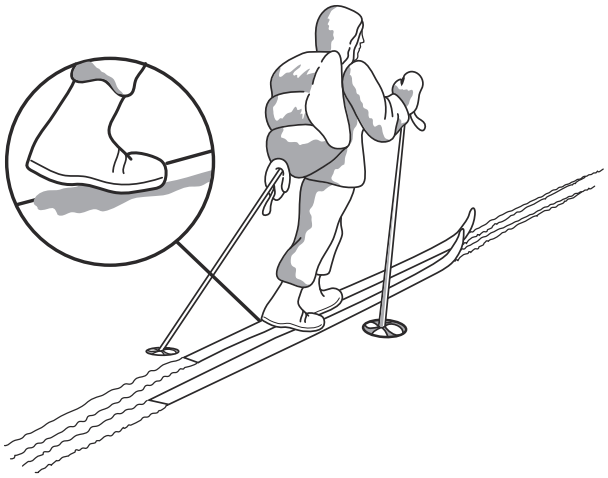

Figure 6-15. Preparations for Crossing an Avalanche-Prone Slope.

- Before the snow comes to a stop, cup the arm or hand in front of the face to clear an air space. If possible, try to expand the chest during this time.
- If buried, stop fighting and relax to preserve oxygen. Do not panic!

Rescue Actions

Rescue actions include—

- Use the memory aid STOP [stop, think, observe, and plan quickly] and GO [go into action, and organize the rescuers]. Do not panic! Rescue Marines are the victim's best chance of survival now.
- Watch the victim as he is carried down the slope. If the victim disappears under the moving snow, keep the eyes fixed on the mass of snow in which he was enveloped until it stops. The victim may be under the snow surface in that area.
- Using a ski pole, mark any position where he reappeared during his journey down the hill.
- Make a quick visual search of the area. Note any arms, legs, avalanche cord, and/or pieces of equipment that are sticking up and dig them out.
- At first, if nothing is apparent, make a quick surface search. If nothing is found, a more systematic search should be made from the bottom working up. If rescue Marines fail to find anything, the next step is to probe.
- Stay on site and search. Almost all hope of a live rescue depends on the Marines present. Statistically, a victim has only about a 50 percent chance of survival if buried 30 minutes. The first 15 minutes are critical. Outside help usually cannot arrive fast enough.

Avalanche Search Organization

In the event of an avalanche, it is critical for a unit to be familiar with the techniques and procedures for conducting a search in an expedient and methodical manner. There is only a 50 percent survival rate for victims buried 30 minutes and a 20 percent survival rate for those buried 60 minutes. Time is critical; search organization must be an SOP that is practiced in advance if victims are to be recovered alive. The following subparagraphs provide the basic avalanche search and rescue techniques that will form the basis of a unit's SOPs.

Hasty Search

When personnel are caught in an avalanche, time is the critical factor in their rescue; survivors should react calmly and methodically. The following actions should be taken by those witnessing an avalanche:

- Ensure all survivors are in a safe location.
- Immediately make note of the point the victims were last seen.
- Conduct a head count to confirm who the victims of the avalanche are.
- Assess the hazard of other possible avalanches. Post an avalanche sentry (most likely the radio operator) at a safe spot.

- Conduct a visual search of the deposit surface. Concentrate on locating parts of the victims and their equipment.
- Draw a line from where the victim was caught, to the location of equipment, and then to the victim's last seen point. The end of this line may point to the most likely burial site (see fig. 6-16).

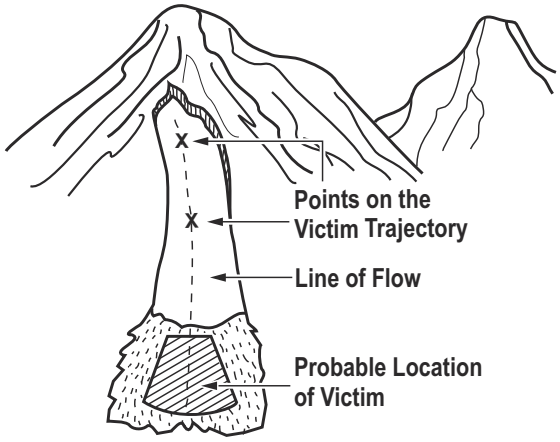

Figure 6-16. Suspected Location of Avalanche Victim.

- Alert higher headquarters of the situation, location, and number of victims. Request an avalanche search organization immediately (a company is the normal size needed).
- Begin a thorough search of the most likely burial areas.
- Make frequent stops to call out to the victims and listen for voices of the buried persons.
- Keep shovels, probes, and first aid equipment readily available.
- Upon location of victims, quickly dig them up and perform first aid as necessary.
- Determine if all victims are accounted for. If some victims are still missing, mark the locations of clues found on the surface and spot probe around them. Additional likely areas of burial include areas uphill of trees or rocks, in depressions, and in the runout zone, as depicted in figure 6-17.

Figure 6-17. Suspected Search Areas Near Obstacles and Runout Zone.

- Organize a hasty probe line to conduct a more thorough search of the most likely burial areas. Mark areas already probed with ski poles, skis, and branches.
- Continue the hasty probe line search until avalanche search replacements arrive.

Organized Rescue

An organized rescue is conducted by a unit trained in avalanche search and rescue techniques and equipment. The following is an example of actions to take when conducting an organized rescue for a company-sized unit:

Note: The tactical situation may dictate how long the search can be conducted.

Company Commander

- Evaluate the avalanche site.
- Make an estimate of the situation.
- Prepare to execute the appropriate avalanche rescue techniques using the following prioritized list:
  - Post an avalanche guard and arrange for a warning signal (such as a whistle blast) in the event of follow on avalanches.

- Designate escape routes.
- Question witnesses and survivors at the scene:
  - How the accident happened.
  - Number of persons buried.
  - Locations of victims when the avalanche occurred.
  - Last seen point of the victims.
  - Search efforts conducted so far.
- Provide care to the survivors.
- Determine most likely burial areas quickly and immediately commence a hasty search with those personnel available.
- Keep notes of actions and sketch a map of the avalanche site with location of clues.
- Establish a command post in a safe location, which can also serve as a warming tent.
- Designate a helicopter LZ.
- Consider the enemy situation.

- Execute the following upon arrival at the site:
  - Have the platoons stage equipment at a safe area away from the avalanche site.
  - Inform platoon commanders about safety measures, the accident, and actions taken so far.
  - Delegate tasks to each platoon, such as hasty search teams, avalanche guards, and probe lines.
  - Have platoon commanders organize the probe lines.
  - Consider equipment, food, and support that may be required for a prolonged rescue.
  - Keep the search organization focused.

Platoon

- Posting of avalanche sentries:
  - Sentries are established above natural anchors and starting zones.
  - Sentries must prevent anyone from entering starting zone areas.
  - Sentries must be in a position to observe any adjacent starting zones and prevent anyone from entering these zones.
  - Sentries must remain out of danger themselves.
  - Sentries must be equipped with a signal device that will warn everyone in the event of follow-on avalanche threats.
  - Sentries may also serve as a security element for the search organization.
- Establishing the command post:
  - Establish the command post close enough to support the search yet a safe distance from any avalanche hazards.
  - Establish warming tents for the searchers and victims and prepare hot wets.
  - Establish an aid station.
  - Prepare emergency medical sleds. Ensure sleds have sleeping bags and each team is assigned a corpsman. Teams should be prepared to react immediately to recovered victims.
  - Stamp out and mark the LZ.
  - Ensure that all radios are monitoring a common net and that communication is established to the next higher command.
  - Provide guides to escort personnel from the road head to the accident site.
- Hasty search teams:
  - Search gullies and ravines, which could channelize a victim.
  - Search uphill of avalanche runout areas that could be a potential burial site, such as gullies, ravines, rock outcrops, trees, fallen logs, and benches in the slope.
- Probe lines:
  - Snowshoes/skis should not be worn on the probe line, as the debris of a hard slab avalanche will make snowshoe/ski movement difficult.
  - The ends of two adjacent probe lines must overlap by two Marines to ensure that there is no gap between the lines.
  - Probe line leaders must ensure that the probe lines remain aligned and in order.
  - Flanks and runout zones are overlapped by at least 20 feet. Ensure there are no victims in these areas.
  - All search areas are marked to avoid confusion.

- Other considerations—
  - Dogs and individuals with transceivers will search independently of the probe line; however, they should have probers and personnel with shovels readily available to uncover any possible strikes.

All the elements of a company size avalanche search can be seen in figure 6-18.

Probing

There are two probing techniques—the coarse probe and the fine probe. Each probe line shall consist of two squads—personnel to mark and personnel to shovel. The platoon sergeant will be the probe line leader. His job is to control the tempo of the line and ensure that the probing squads remain aligned. Multiple probe lines abreast can be used simultaneously, depending upon the width of the avalanche's track and number of platoons available.

Coarse Probe

The coarse probe is used independent of the hasty search and prior to using the fine probe for speed purposes. The technique is performed as follows:

- With two squads on line, at double arms interval, each Marine places the probe between his feet.
- The probe line leader and markers will be located behind the probe line.
- The markers' mission is to place a mark where a strike has been indicated by a prober.

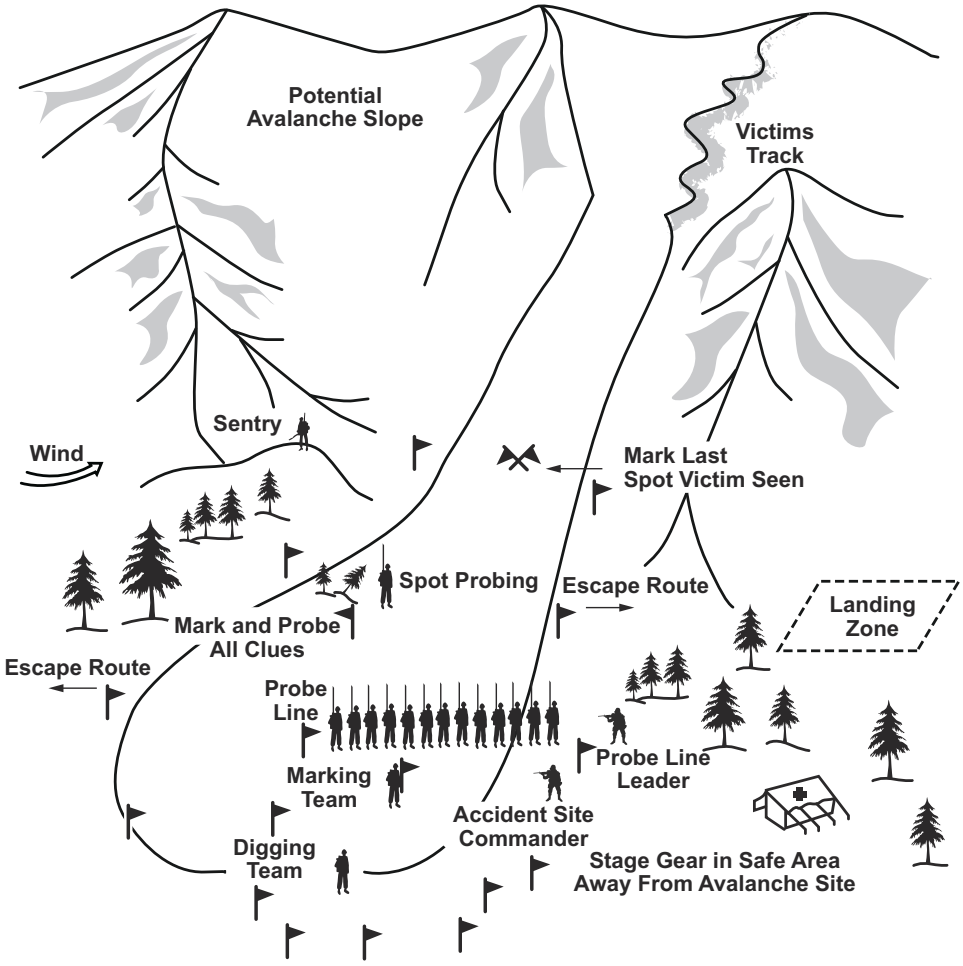

Figure 6-18. Avalanche Search Site.

- A two- to four-man team with shovels will follow the markers to uncover any probe strikes.
- The probe line leader will give the command DOWN PROBE and the probes are pushed down at a 15 degree angle to the left. The probe is pushed through each layer of the snow, being careful not to impale a victim if a strike is made.
- The probe line leader must continuously check the alignment, spacing, and penetration of the probes.
- The next command given is UP PROBE and all of the probes are withdrawn from the snow.
- The probe line leader will give the command DOWN PROBE and the probes are then pushed straight down.
- The next command given is UP PROBE and all of the probes are withdrawn from the snow.
- The probe line leader will give the command DOWN PROBE and the probes are pushed down at a 15 degree angle to the right.
- The next command given is UP PROBE and all of the probes are withdrawn from the snow.
- If a strike is made at any time, the prober signals to the marker to place a mark on the spot. The personnel with shovels will then dig to uncover the strike. The line will never stop at a strike.
- At the command STEP, each man takes a 30-inch step and the process repeats (see fig. 6-19).

Fine Probe

The fine probe is used after completing the course probe if there are still victims missing. Victims by this time are unlikely to be alive when found. The technique is similar to a coarse probe except—

- Probing is performed over the left, middle, and right foot, as in figure 6-20.
- A 15-inch step is taken rather than a 30-inch step.
- A fine probe is usually a body recovery and should only be started when all hope of a live recovery is exhausted.
- A fine probe search takes four to five times longer than a coarse probe.

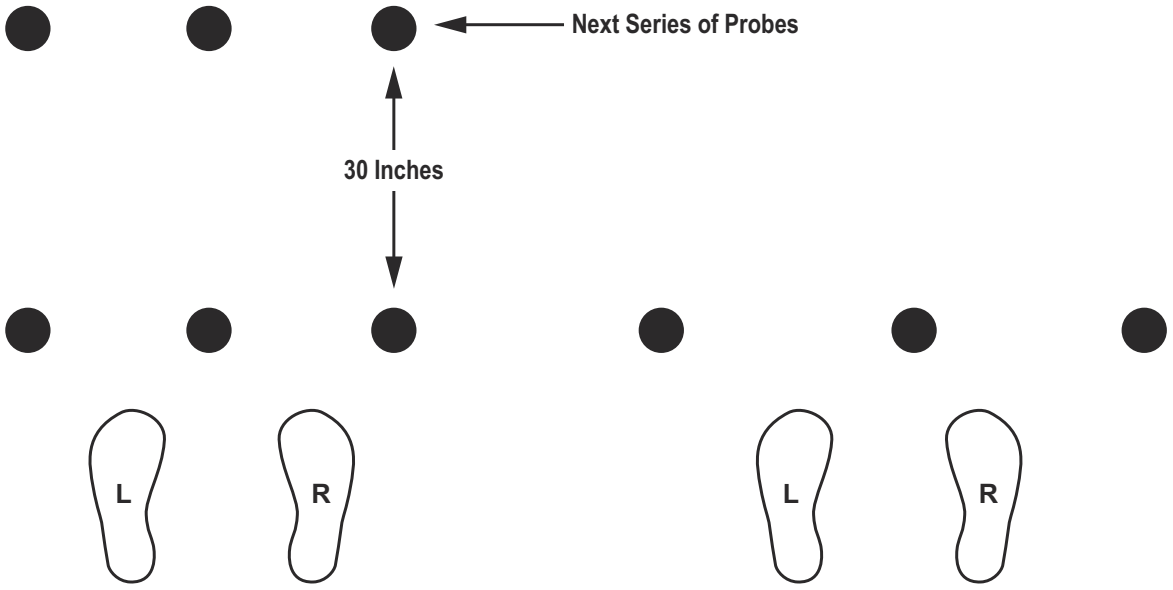

Figure 6-19. Coarse Probe.

Specialized Searches

The specialized searches operate independently from other searchers and include the use of dogs and transceivers.

Dogs

If available, the sensitive nose of a trained avalanche rescue dog is very efficient for locating buried persons and articles. Dogs search large areas rapidly and usually find victims within 10 minutes.

Transceivers

Transceivers are electronic devices used by mountain leaders or trained individuals to locate avalanche victims who were equipped with transceivers. Usually, those using transceivers are small teams of scout skiers operating independently as mountain pickets. This technique is discussed in further detail in the MCRP 3-35.1B.

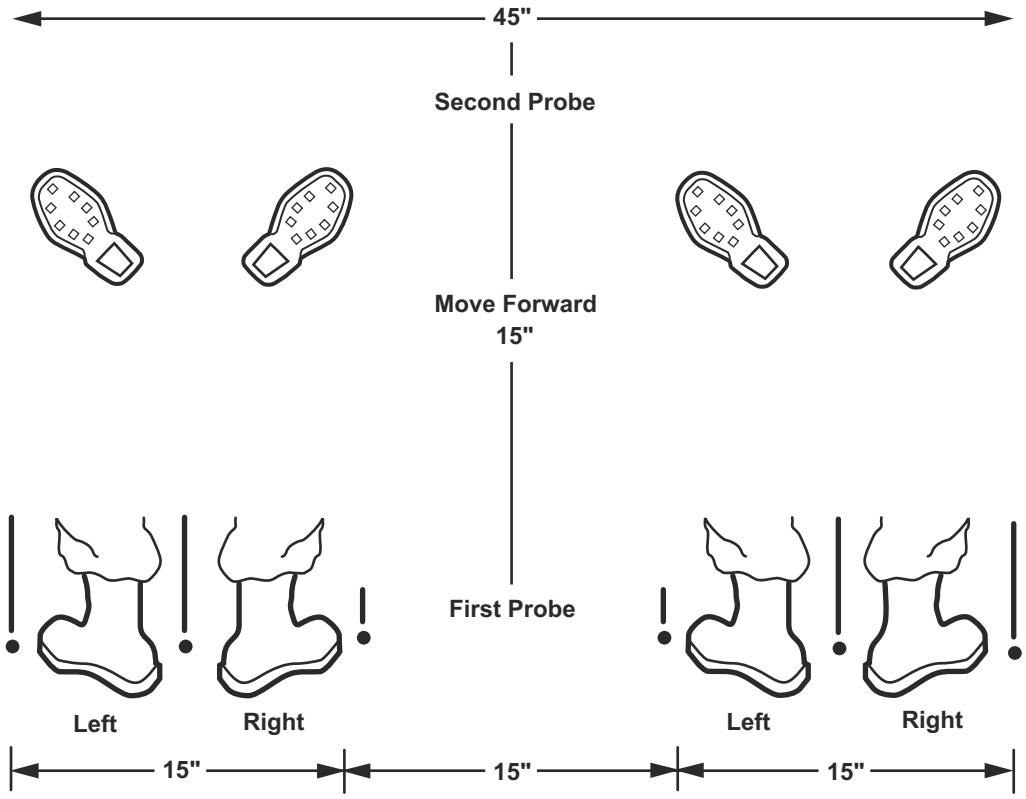

Figure 6-20. Fine Probe.

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CHAPTER 7
MOVEMENT BY SNOWSHOE

Snowshoes are used to provide flotation over snow-covered terrain. They help conserve valuable energy, but decrease movement rates. In general, snowshoes enable a Marine to move through the snow at approximately the same pace as he would achieve walking on hard ground; however, speed will vary with the depth and consistency of the snow. The more compact the snow, the faster a Marine will be able to move. There are advantages and disadvantages to snow shoes.

The advantages of snowshoeing are—

- Little training time is required to gain a high degree of proficiency in their use.
- Little maintenance is required.
- Carrying and pulling heavy loads on gentle terrain is relatively easy.
- Movement in confined areas and around equipment is relatively easy. Snowshoes are particularly useful for individuals working in confined areas, such as bivouac sites and supply dumps.

The disadvantages of snowshoeing are—

- Movement on moderate to steep slopes is extremely difficult.
- Movement through thick or cut-off brush is difficult.
- Quick movement, as needed during fires and maneuver, is difficult.

Snowshoe Movement Rates

For planning purposes, see table 7-1 for movement rates while wearing snowshoes over gentle terrain.

Note: Reduce by one third for mountainous terrain.

The Snowshoe

There is one type of snowshoe currently used in the Marine Corps. The modular snowshoe replaced the old magnesium snowshoe. It has a detachable, 8-inch tail for use with varying snow conditions and loads. It is more versatile and maneuverable than the old magnesium snowshoe because of the detachable tail and aggressive steel teeth under the footplate. See figure 7-1 on page 7-2.

Nomenclature

The modular snowshoe consists of the following general parts:

- Tip—the front portion of the snowshoe frame.
- Tail—the detachable, 8-inch back portion of the snowshoe frame.

Table 7-1. Rates of Movement on Snowshoes.

Movement Mode	Unbroken Trail (kilometers per hour)	Broken Trail (kilometers per hour)
On foot with less than 1 foot of snow	1.5–3	2–3
On foot with more than 1 foot of snow	.5–1	2–3
Snowshoeing	1.5–3	3–4

Figure 7-1. Modular Steel Traction Snowshoe.

- Binding—constructed of rubber straps that fit any boot.
- Footplate—where the ball of the foot is placed; the footplate pivots on an alloy crossbar.
- Window—the opening in the snowshoe through which the toe of the boot can pivot.
- Shovel—the curve at the front of the snowshoe, which looks like a shovel.
- Body—the tubular frame and plastic webbing, which provides flotation in snow.
- Teeth—located on the underside of the footplate; teeth create more traction on icy surfaces.

Care and Storage

Care and storage is simple for snowshoes. Marines should—

- Frequently check their footplates for pivot action and binding straps and buckles for serviceability.
- Check the tubular frame and plastic webbing for cracks.
- Dry snowshoes completely before storing.
- Conduct serviceability check prior to storage.

Binding Adjustment

Proper snowshoe binding adjustment (see fig. 7-2) ensures the following:

- The foot pivots freely about the ball of the foot so that the toe of the foot moves through the window of the snowshoe.
- The heel of the foot is centered on the snowshoe.
- The binding fits snugly to provide adequate control, but not so tightly that circulation in the foot is impaired. A sloppy fitting snowshoe will make movement extremely difficult.

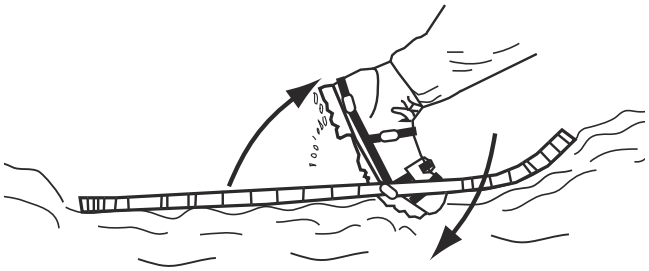

Figure 7-2. Proper Snowshoe Binding Adjustment.

Techniques of Use

There is little difference in snowshoeing and normal walking, except that the surface being walked on is inconsistent and snowshoes are longer; wider; heavier; and, consequently, more awkward. With standard military snowshoes, the stride is somewhat longer than in normal walking, but the shape of the snowshoe allows the wearer's stance to be a normal width, thereby reducing much strain and fatigue on hips and legs. It is important that the individual snowshoeing should walk in a relaxed and normal rolling

toe manner and should only lift the snowshoe high enough to clear the surface of the snow. Snowshoeing may be done with or without ski poles. Specific snowshoeing techniques are discussed in the following subparagraphs.

Kick Turn

The kick turn is normally the easiest way to change directions on level ground. One snowshoe is swung up to the front so that its tail is on the snow. Then, it is allowed to pivot toward the new direction. The other snowshoe is then brought around. On steep terrain, the uphill foot steps off when changing direction. Snowshoers should try to stay uphill of the previous trail; this trail has undercut the snow on which the Marine is now building the turn. As each succeeding man uses the turn, it will tend to slough on the shoulders and the men at the end of the column will have a hard time getting around. This difficulty can be prevented if care is used by each man in placing his snowshoes precisely where those in front of him have placed theirs.

Star Turn

The star turn can also be used to change direction by executing a series of half facing movements, pivoting around the tails. When climbing, gentle areas of each slope should be used for turns. Looking ahead, the snowshoer should pick the route and use the terrain to his advantage, avoiding the steep parts and not hesitating to make short switchbacks.

Side Step

The side step is used when the slope is at a critical angle. Short steps are taken directly sideways up or down a slope, keeping the weight over the teeth of the snowshoe for traction.

Herringbone

The herringbone is used when the slope is at a medium angle. Snowshoers take V-shaped steps.

Crossing Obstacles

Ski poles can be very helpful when crossing obstacles. There are several different types of obstacles and rules of thumb to consider when crossing them—

- Always step over obstacles to avoid damaging snowshoes and losing balance.
- Never bridge a gap with a snowshoe. If the tip and tail are higher than the center, the weight can damage the snowshoe.
- In shallow snow, there is a danger of tripping. Snowshoers may snag on tree stumps or bushes that are only slightly covered.
- Wet snow will frequently ball up under the feet, interfering with comfortable walking. This snow should be knocked off as soon as possible.
- Breaking trail in deep snow consumes much energy, so the lead man should be changed frequently.
- Stepping into water with snowshoes can form ice, to which significant amounts of snow can cling, making the snowshoe very heavy.

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CHAPTER 8
MOVEMENT BY SLED

Combat operations in a snow-covered environment will require Marines to carry increased amounts of specialized equipment. The transportation of team equipment over snow-covered terrain is achieved most efficiently through the use of sleds. By stowing equipment in sleds, Marines distribute the weight they are required to move and increase their individual mobility while preserving energy. In order to maximize the use of sleds, units should follow the proper techniques detailed in this chapter. These techniques include properly organizing the trail-breaking party, determining the equipment to be carried, and assigning specific duties to each Marine on a sled team.

Trail Breaking

The purpose of trail breaking is to use a small body of troops to prepare a track or trail so that the main body can move as easily and as quickly as possible, arriving at their destination fresh and ready for follow-on missions. A trail-breaking party is generally responsible for performing four tasks—reconnaissance and selection of the route, navigation, preparation of the route, and advanced guard for the main body.

Whenever a commander contemplates an over-the-snow movement that does not make use of existing tracks, he should automatically incorporate the use of a trail-breaking party into the plan. Detailed route selection will depend upon conditions underfoot and the responsibility for this decision will rest with the leader of the trail-breaking party.

Initial Selection

The initial selection of a route is made based upon maps, aerial photographs, and any information that can be gathered from reconnaissance reports or local inhabitants. Additional selection factors to be considered are—

- The tactical situation.
- The main body's method of movement and the equipment they will be required to carry.
- The terrain.
- Snow, weather, and light conditions.

Size of the Trail-Breaking Party

The commander will also have to determine the size of the trail-breaking party. This number could be as large as one third of the total force moving; a rule of thumb is that a squad breaks for a platoon, a platoon breaks for a company, and so on. The final determinating factors include—

- The size of the main body and the number of trails required to accommodate it. Often, the tactical situation will dictate that several trail-breaking parties be employed so that other formations besides a column can be used.
- The likelihood of enemy contact. A security force may need to accompany the trailbreakers.
- Anticipated difficulties in opening the route.

Lead Time for the Trail-Breaking Party

The commander will have to determine how far in advance of the main body the trail-breaking party should depart in time to reach the destination and to provide local security before the arrival of the main body. The trailbreakers should not be allowed to get so far ahead of the main body that they move outside of the radius of available indirect supporting fires. They must also maintain contact with the main body so that the commander can be made aware of any changes to the route or tactical situation. When

determining the trail-breaking team's departure time, the number of trails to be broken and the degree to which the trails need improvement must be considered.

Organization

Once a unit leader has been tasked to perform the trail-breaking mission, he must organize and assign duties within the team. The leader should make every effort to preserve the tactical integrity of the element. The order of march and organization of the trail-breaking party, shown in figure 8-1, is —

- The breaker is the point position within the trail-breaking party, who breaks the initial trail in the direction indicated by the section leader. He will attempt to travel the easiest route possible. In deep snow and steep terrain, this Marine will tire quickly so the breaker should be rotated frequently.
- The straightener straightens curves and improves the direction of the trail.
- The party leader selects the routes, navigates, and rotates tasks within the team. He will position himself to best control the team.
- The right cutter clears obstructions on the right side of the trail and might expand and level out the trail if necessary to clear the route for sleds.
- The left cutter clears obstructions on the left side of the trail and might expand and level out the trail if necessary to clear the route for sleds.
- The remainder of the party constitutes the packing team. They improve the trail by filling in depressions, flattening the trail where it is uneven, and marking the route.

Equipment

Each member of the trail-breaking party carries certain equipment—

- Party leader carries a compass, map, route card, and/or overlay.
- Breakers/straighteners carry a hatchet or machete and wire cutters.

Figure 8-1. Examples of Trail-Breaking Duties.

- Cutters carry a hatchet or machete.
- Packers carry trail-marking material and a shovel.

Rotation of Duties

Some trail-breaking tasks are harder than others. To avoid exhaustion, the party leader must rotate the duties regularly.

Marking the Trail

A trail will usually need to be marked to prepare for limited visibility. Methods for marking the trail are—

- Branches on trees and bushes broken in a predetermined manner.
- Flags, sticks, or guiding arrows placed in the snow.
- Markers made of rags or colored paper tied to trees.
- Cairns (manmade mounds) of snow or small piles of brush.
- Cyalume light may be used, but should be shielded from enemy observation. Remember the Cyalume, when cold, will illuminate weakly.
- The beverage base powder from meals, ready to eat (MREs) can be used.

Sled Pulling

Proper equipment is critical. Each sled team must be equipped with two waist harnesses, one 9-foot trace, and 60 feet of cordage. Leaders must select the movement technique most appropriate to the conditions and, most importantly, to the Marine's level of training. Trail-breaking techniques may be done on snowshoes or skis. Towing a sled while on skis demands a high level of proficiency. Snowshoes are usually the wiser choice insofar as movement techniques are considered, as shown in figure 8-2. If skis are used, the personnel doing the actual towing should be equipped with climbing skins; wax will often not provide the necessary traction and will wear off

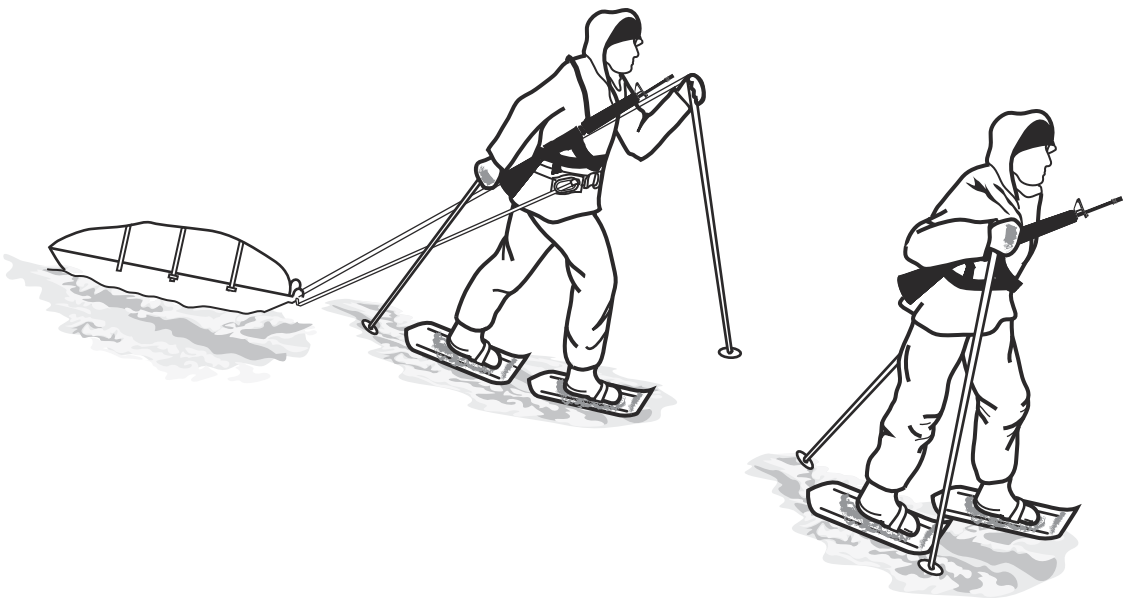


Figure 8-2. Snowshoe Movement with a Sled.

quickly. If skins are not available, snowshoes are the logical choice.

Personnel may have to disconnect the trace from the sled and reconnect it at a different attaching point as the terrain changes. The following tips offer different configurations for flat ground, ascending, descending, and moving sideslope whether Marines are travelling on skis or snowshoes:

- One team member can assist the sled puller by pushing the sled from the rear with his poles, as shown in figure 8-3.
- When descending moderate slopes, one Marine should attach a trace from himself to the rear of the sled and move behind the sled while assisting the sled puller in his descent, as shown in figure 8-4.
- Attach a trace to the sled when traversing a moderate slope. A Marine uphill from the sled attaches the trace from himself to both sides of the sled to maintain balance and prevent the sled from sliding out, as shown in figure 8-5.
- Sled-pulling teams must be rotated frequently to avoid exhaustion.
- A belay rope may be used to assist moving the sled on steep slopes.
- Ascending steep slopes may require two sled pullers with assistance from a third using ski poles, as shown in figure 8-6 on page 8-6.

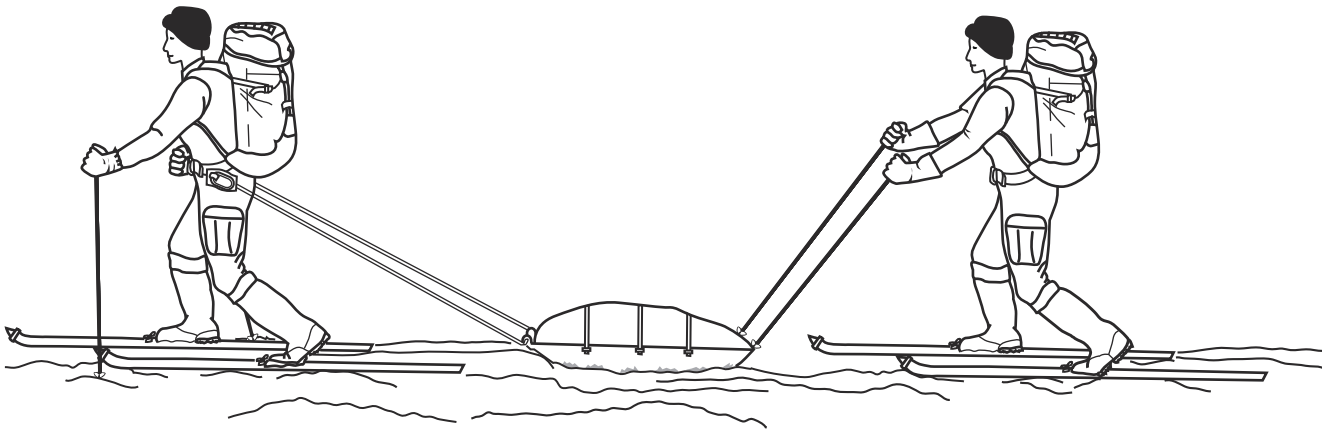


Figure 8-3. Assisting the Sled Puller.

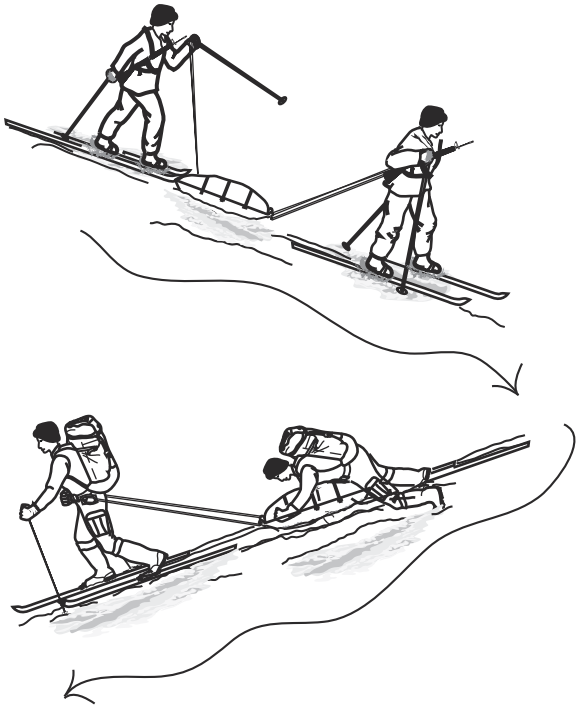


Figure 8-4. Moving Down a Moderate Slope.

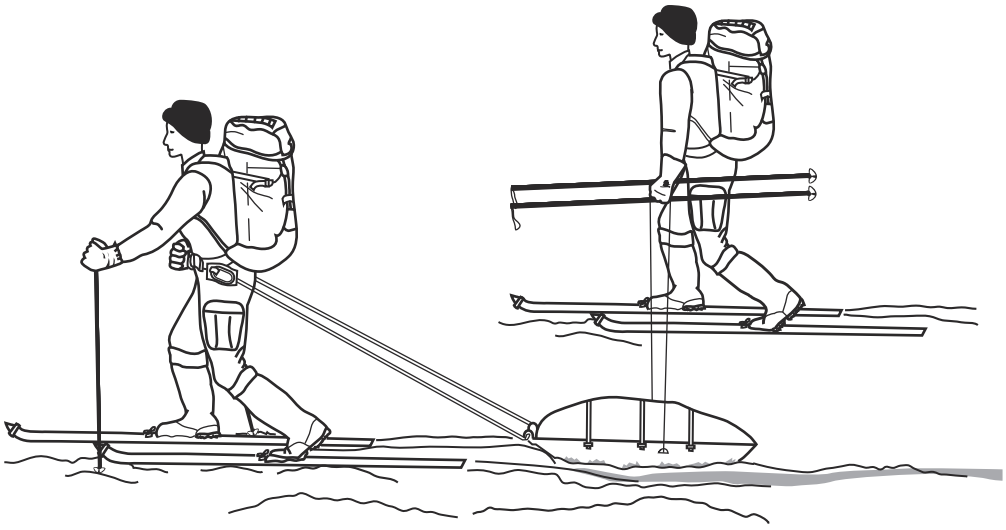


Figure 8-5. Traversing a Moderate Slope.

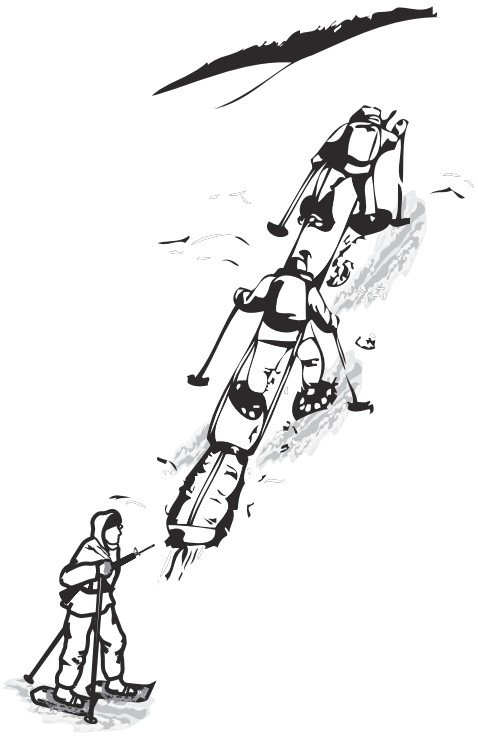


Figure 8-6. Ascending Steep Slopes.

CHAPTER 9
CASUALTY EVACUATION IN MOUNTAIN WARFARE OPERATIONS

General Considerations

The general considerations are a set of guidelines that can be used no matter how serious the injury is. They are remembered by "A PASS NGG"—

- *Apply essential first aid*. Apply lifesaving steps, such as splints or pressure bandages.
- *Protect the patient from the elements*. Provide the casualty with proper insulation from the ground, such as a sleeping bag, field tarpaulin, or bivy cover, ensuring that he is warm and dry. If there are any natural hazards, such as falling rocks or lightning, the casualty should be moved as quickly as possible or responders should ensure that he is well protected and helmeted.
- *Avoid unnecessary handling of patient*.
- *Select easiest route*. Send scouts ahead, if possible, to break trails.
- *Set up relay points and a warming station*. If the route is long and arduous, set up relay points where a fresh litter team may be waiting or where a system for raising or lowering has been emplaced. These relay points should also provide warming stations with minimum amount of medical personnel to—
  - Permit emergency treatment. Treat for shock, hemorrhage, or other conditions that may arise.
  - Re-evaluate the patient constantly. If patient develops increased signs of shock or other symptoms during the evacuation, he may be retained at an emergency station until stable.
- *Normal litter teams must be augmented in arduous terrain*. In a mountainous environment, a minimum of six Marines make up a normal litter team.
- *Give litter teams specific goals*. The litter team's job is extremely tiring, both physically and mentally. The litter teams must be given realistic goals.
- *Gear remains with casualty*. Ensure all of the patient's gear is kept with him throughout the evacuation.

Expedient Litters

There are five types of expedient litters that Marines use—the sling rope carry, rope coil carry, pole carry, the alpine basket, and the field tarpaulin litter.

Sling Rope Carry

The sling rope carry requires a 15-foot sling rope and two men. One man is the bearer and the other is an assistant to help in securing the casualty to the bearer. Casualties—conscious or unconscious—may be transported in the following manner:

- Bearer kneels on all fours and the assistant places the casualty face down on the bearer's back, ensuring the casualty's armpits are even with the bearer's shoulders.
- The assistant then finds the middle of the sling rope and places it between the casualty's shoulders and the ends of the sling rope are run under the casualty's armpits, crossed, over the bearer's shoulders, and under his arms.
- Then the ropes are run between the casualty's legs, around his thighs, and tied with a square knot with two overhands just above the bearer's belt buckle. See figure 9-1 on page 9-2.

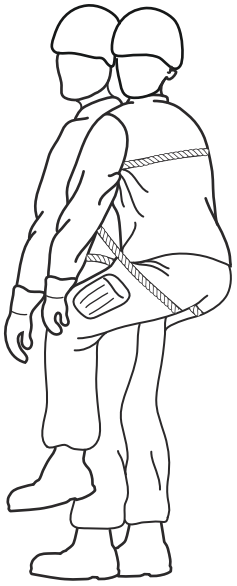


Figure 9-1. Sling Rope Carry.

The assistant ensures the rope is tight. Padding, when available, should be placed where the rope passes over the bearer's shoulders and under the casualty's thighs.

Rope Coil Carry

The rope coil carry requires a bearer and a rope coil and it can be used to carry a conscious or unconscious casualty—

- The bearer positions the casualty on his back.
- The bearer separates the loops of the mountain coil into two approximately equal groups and then slips one-half of the coil over the casualty's left leg and one-half over his right leg so that the wraps holding the coil are in the casualty's crotch and the loops extend upward toward his armpits. See figure 9-2.
- The bearer lies on his back between the casualty's legs and slips his arms through the loops. He then moves forward until the coil is extended.
- Grasping the casualty's right or left arm, the bearer rolls over, rolling to the casualty's uninjured side, pulling casualty onto his back.

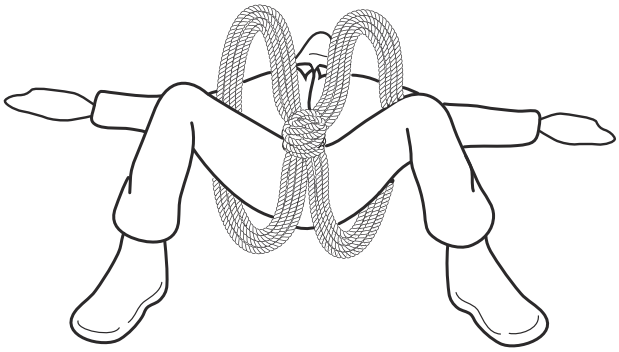


Figure 9-2. Rope Coil Carry Rope Placement.

- Holding the casualty's wrists, the bearer carefully stands, using his legs to lift up and keeping his back as straight as possible. See figure 9-3.

  Note: The length of the coils on the rope coil and the height of the bearer are to be considered. If the coils are too long and the bearer happens to be a shorter person, the coils must be uncoiled and shortened. If this is not done, then the casualty will hang too low on the bearer's back and make it a very cumbersome evacuation. A sling rope harness can be used around the victim's back and the bearer's chest, which will free the bearer's hands.

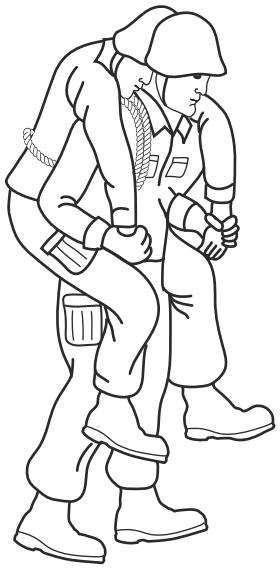


Figure 9-3. Rope Coil Carry.

Pole Carry

The pole carry is a field expedient method. This method should be considered as a last resort only when narrow ledges must be traversed or vegetation limits the bearers to a narrow trail. This method is difficult for the bearers and uncomfortable for the casualty. Two bearers, four sling ropes, and a 12-foot pole (3 inches in diameter) are required for this carry—

- The casualty is placed on his back in a sleeping bag or wrapped in a field tarpaulin or blanket, and then placed on an insulated pad.
- One sling rope is placed under the casualty below the armpits and tied with a square knot across the casualty's chest. The second sling rope is tied in the same manner at the casualty's waist. The third sling rope is placed at the casualty's legs below the knee. The fourth sling rope is tied around the ankles. See figure 9-4.

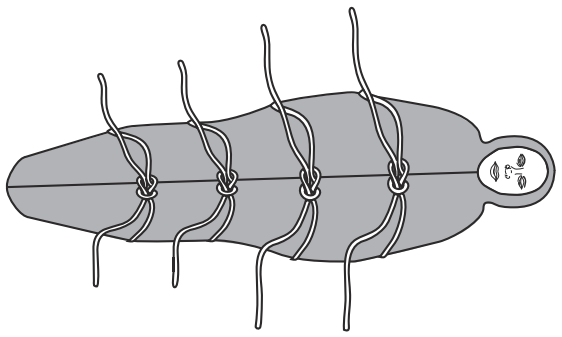


Figure 9-4. Pole Carry Rope Placement.

- The pole is placed along the casualty's length and secured using square knots with two overhands with the ends of the sling ropes. The square knots should be so tight that the overhands are tied onto themselves. See figure 9-5.
- The casualty should hang below the pole, as close to the pole as possible, to prevent swinging during movement.
- The casualty's head may be supported using a triangular bandage or a cartridge belt passed around the pole.

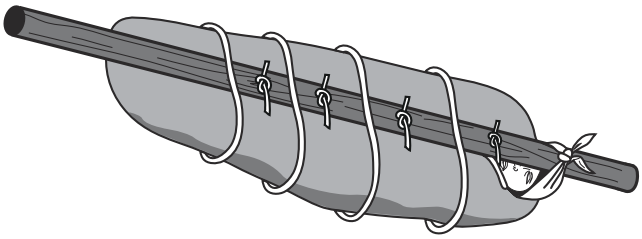


Figure 9-5. Pole Carry.

For additional support of movement, two additional bearers may be required, as well as a mountain coil. The mountain coil is split into two equal coils. Then the knot of the mountain coil is placed under casualty's lower back. Additional bearers slip into each half of the hasty coil, one on each side of casualty, aiding in support and movement of the casualty.

Alpine Basket

The alpine basket is an expedient rope litter constructed using a 165-foot static or dynamic rope.

Constructing the Alpine Basket

The following are instructions to construct an alpine basket:

- Start by tying an end-of-the-line figure-eight loop and then laying down the rope to make 24- to 36-inch long bights that span the height of the casualty's body. Ensure the bights stay no more than 4 inches apart from one another, as shown in figure 9-6.

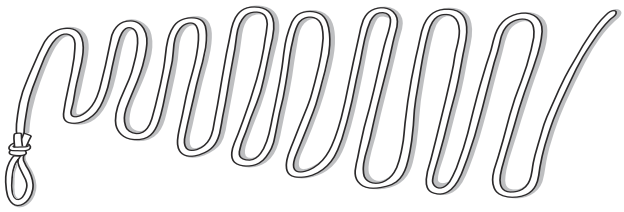


Figure 9-6. Laying the Rope to Construct an Alpine Basket.

- Place padding, such as an isopor mat or sleeping bag, on top of the bights and then lay the casualty on the padding and bights, as in figure 9-7. The litter can be made rigid by adding poles, sticks, or skis.
- Start at the casualty's feet and pull the first bight up around the casualty's ankles and through the figure-eight loop tied into the starting end of the rope, ensuring that the figure-eight loop goes around the soles of the feet, as in figure 9-8.
- Go to the opposite side of the casualty and pull up the second bight through the loop formed by the bight that was pulled through the figure-eight loop. Continue the process until getting to the casualty's armpits, as in figure 9-9.

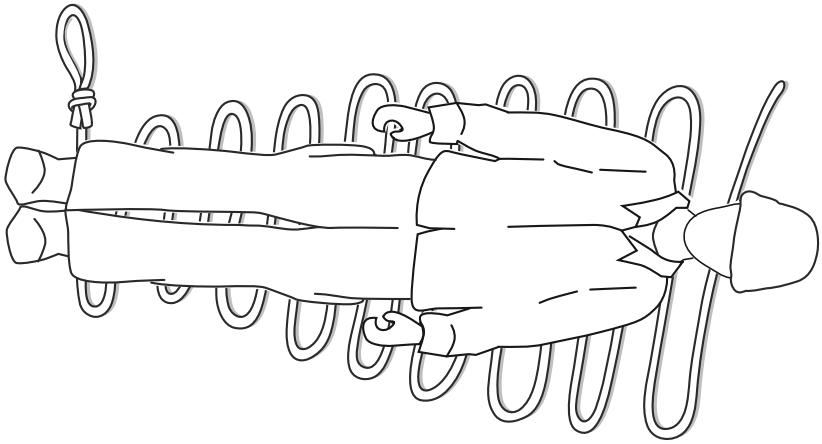


Figure 9-7. Placing the Casualty on the Rope.

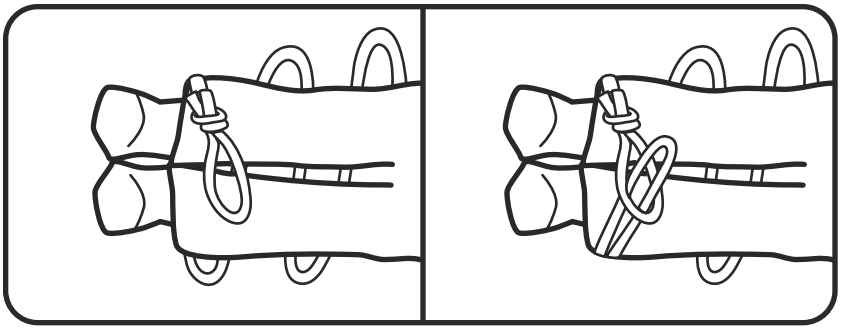


Figure 9-8. Securing the Casualty's Feet.

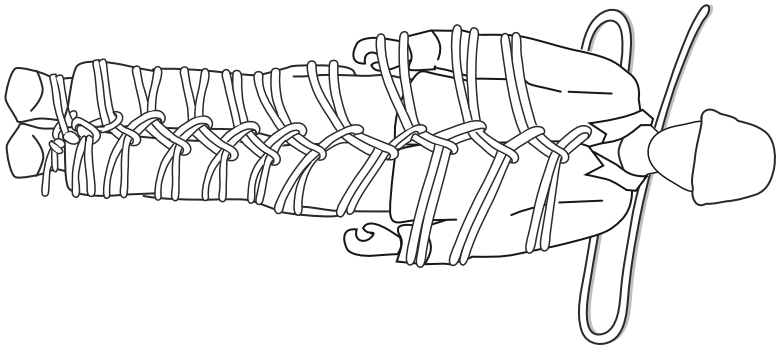


Figure 9-9. Securing the Casualty to the Rope.

- Twist the second to the last bight creating a half hitch underneath the back of the casualty and then bring it up over the casualty's shoulder and into the last bight formed.
- Twist the last bight creating a half hitch underneath the back of the casualty and then bring it up over the casualty's other shoulder and into the last bight formed.
- From the running end of the rope, bring a bight over the casualty's shoulder and through the last bight formed, as in figure 9-10.
- Secure the last bight with a round turn and two half hitches, leaving a big enough bight to tie a figure-eight loop at the end, as in figure 9-11. This loop will be the hook in point for vertical lowering.

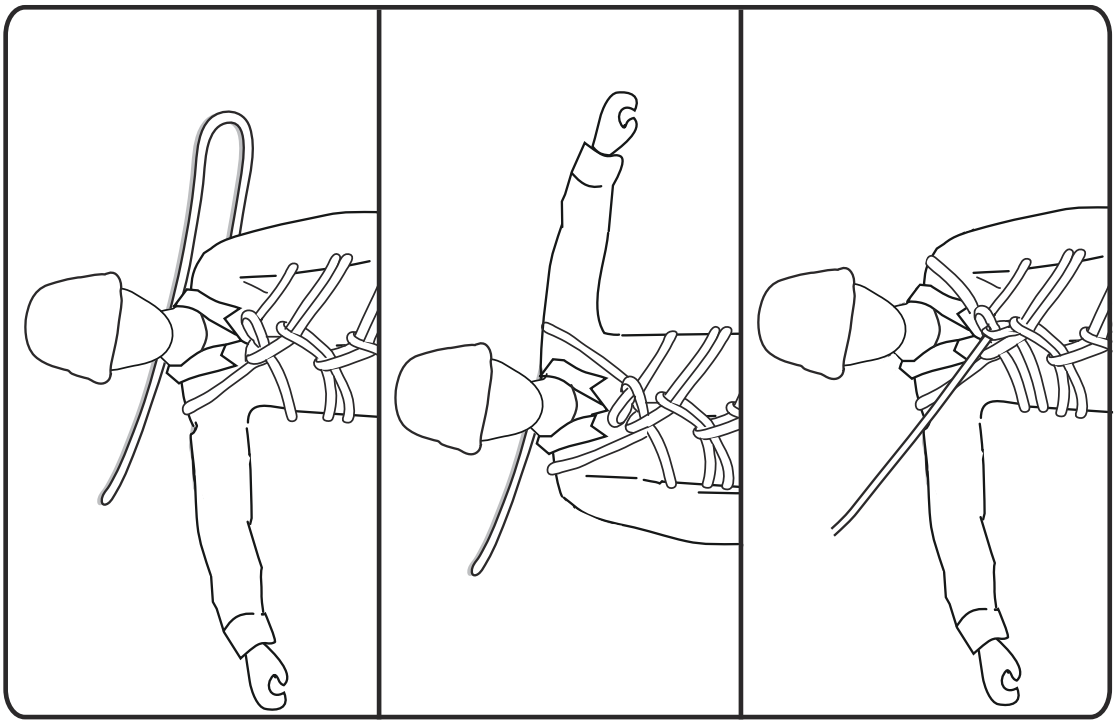


Figure 9-10. Securing the Casualty's Shoulders.

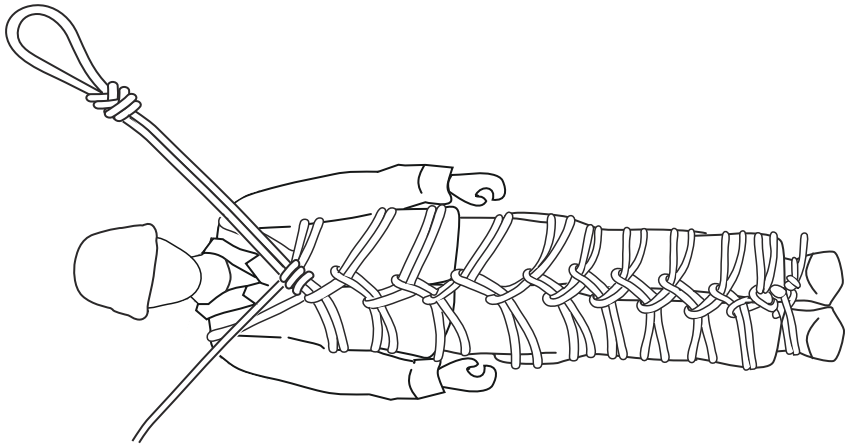


Figure 9-11. Securing the Last Bight.

Belaying the Alpine Basket

For vertical raising or lowering, hook the belay line into the figure-eight loop hook in point previously discussed. For horizontal raising or lowering, three pre-rigs are attached to the bights that were formed coming through the loops at the feet, at the waist, and at the chest. If a barrow boy is not used, then a tag line from the bottom must be implemented to keep the casualty away from the cliff face on the descent.

Field Tarpaulin Litter

A field tarpaulin, field tarpaulin liner, bivy cover, or similar piece of material may be used to create a field tarpaulin litter. In addition, six individuals with sling ropes are needed. The following are instructions on how to employ a field tarpaulin litter:

- Lay field tarpaulin litter flat on the ground.
- Select six rocks about the size of a golf ball. Place one rock in each of the corners and one in the middle on each side of the litter. The rocks are placed on the underside of the field tarpaulin or like material. If a bivy cover is used, the casualty should be zipped inside the bivy cover. The rocks should then be arranged in the same manner only on the inside below the zipper.
- Tie the sling rope together with an overhand knot. Take the middle of the rope and secure it around the rock with a clove hitch.
- Place the casualty on the litter. The sling ropes are adjusted by feeding the pigtails of the overhand knot through itself to adjust for length. The loop is then put over the inboard shoulder of the carriers. Ensure that the casualty is carried level.

  Note: An isopor mat may be laid on the field tarpaulin to help make the litter firmer.

Rough Terrain Litters

Two litters are used for rough terrain CASEVACs in moderate to vertical terrain—the Sked® litter and the Stokes litter. Each has a set of procedures for securing a casualty and rigging the litters for either raising or lowering.

Sked® Litter

The Sked® litter (see fig. 9-12) is constructed of thin plastic, straps, and grommets.

Figure 9-12. Sked® Litter and Components.

Securing a Casualty to the Sked®

To secure a casualty to a Sked® litter, the rescuer must—

- Unroll the litter. The litter must be rerolled the opposite way to allow the litter to lay flat. Then lay the litter next to the casualty.
- Spine splint any suspected spinal injury. Experienced medical personnel are recommended if spinal immobilization is necessary.
- Tie a safety line, using a sling rope, around the casualty with both an around-the-body bowline and an end-of-the-line figure-eight loop. Ensure the safety line is long enough to remain slack if the Sked® is connected to a lowering or raising system.
- Insulate the body as needed, such as with an isopor mat or sleeping bag, and place the casualty on the Sked®. If spinal injury is suspected, carefully roll the casualty onto the Sked®. Use the four body straps to secure the casualty to the litter. Secure the buckles by tying half hitches around the straps. Unless injuries prevent this, the casualty's arms should be at his sides to prevent further injuries to himself or the rescuers.
- Secure the feet straps once the casualty is secured with the body straps. The feet straps are secured last to ensure the casualty is in the proper position on the Sked®. The feet can be positioned in three ways: feet together with the straps running on the outside of the feet, feet apart with the straps running on the inside of the feet, or feet stacked. The third is the most uncomfortable position and not recommended for casualties with possible spinal cord injuries. This position is formed by placing the heel of one foot on top of the toes of the other and should only be used if in confined spaces. Once the feet are positioned, the feet straps must be secured. Bend the feet end of the Sked® to form a platform for the feet, loop the feet straps through the second grommets on each side, and feed them back through the buckles. Secure the buckles by tying half hitches around the straps.
- Form the head end to protect the casualty's head, but, if possible, he should wear a helmet. Form the head end by tying the pull strap up and securing it to the first body strap with a round turn and two half hitches.

Evacuating the Casualty

There are many ways to move a casualty once in the Sked®; however, the CASEVAC team must keep the general considerations in mind, including the possibility that Marines may not know what terrain will be encountered during a CASEVAC. Therefore, Marines should rig for the vertical and horizontal lifting before the CASEVAC begins. The two simplest methods that require the least amount of additional rigging are—

- To drag the casualty by the drag strap located at the head end of the Sked® on wet grass, scree, ice, or snow. Rescuers can also use the Sked®'s carrying bag as a harness with the pull strap and towing harness that is rated to 300 pounds. If additional bearers are required, cordage can be added to the pull strap or the front carrying handles.
- To carry the casualty using the carrying handles. Runners and sling ropes can be tied on carrying handles to create shoulder slings for initial bearers. Additional runners and sling ropes can be attached to intermediate grommets to create carry handles and slings for additional bearers.

Rigging the Sked® for Vertical Terrain and Helicopter Lift

On vertical terrain, the vertical raise or lower can be used if the cliff is not uniform, there is a chance of rock fall, or the casualty is to be lowered through trees. Ensure that the casualty's head is always above his feet. The following

special steps must be taken to vertically raise or lower a casualty in the Sked®:

- Identify the 30-foot practice coil, which is rated at 5,200 pounds, that comes with the Sked®. Then, tie a figure-eight loop in the middle of the rope.
- Pass each end of the rope through the grommets at the head of the Sked®, leaving approximately 6 inches of rope between the stretcher and the knot. The top of the loop should be within an arm's distance from the top of the Sked®.
- Tie an overhand knot on both lengths of rope just behind the grommets near the head. These stopper knots will prevent the Sked® from collapsing around the casualty when the line is pulled.
- Continue to feed each end of the rope through the grommets and the carrying handles toward the foot end of the Sked®. The rope must pass through a minimum of two carrying handles and five grommets per side.
- Pass the ends of the rope through the last grommets at the foot end, ensuring that they run below the feet, and secure the two ends with a square knot and two overhand knots.
- Connect the figure-eight loop from the 30-foot practice coil and the figure-eight loop of the safety line with the large locking carabiner that comes with the Sked® rated at 9,000 pounds. If the carabiner is worn or missing, opposing issue locking carabiners will suffice.

  Note: If the rope is worn or missing, the same process can be done with two sling ropes. Tie the sling ropes together with an end-of-the-line knot and offset the knot slightly before tying the middle-of-the-line figure-eight loop.

Rigging the Sked® for a Horizontal Employment

A horizontal raise or lower is preferred on uniform vertical terrain. The horizontal employment allows the rescuer to assist the casualty on either a raise or lower. It also allows the rescuer the ability to monitor the casualty's condition and to treat him, if necessary. Rigging the Sked® for horizontal employment is done by—

- Identifying the two nylon-webbing straps rated at 9,000 pounds each. They should be two lengths, one 4 inches shorter than the other. The shorter strap should be marked HEAD STRAP.
- Inserting one end of the head strap into the larger diagonal slot near the head of the litter, wrapping the rest of the straps under the Sked®, and passing the other end through the opposing slot. Do the same at the foot end of the Sked® with the other strap using the two diagonal slots found there, ensuring that the straps run smoothly under the Sked®.
- Connecting the strap ends and the figure-eight loop of the safety line with the large locking carabiner that comes with the Sked® rated at 9,000 pounds. If the carabiner is worn or missing, then opposing standard issue locking carabiners will suffice.

  Note: When lifting the casualty with a helicopter, a tag line should be employed to prevent the litter from spinning.

Stokes Litter

The Stokes litter is constructed of metal tubing with a plastic covering. The litter is formed in a rectangular basket shape with mesh attached to the frame, as in figure 9-13. The Stokes litter should be padded for the casualty as with any other type of evacuation method.

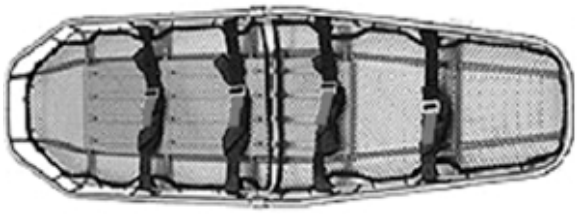


Figure 9-13. Stokes Litter.

In the event that the "seat belts" are missing, sling ropes can be used to secure the casualty into the Stokes litter:

- Tie two sling ropes together using square knots with overhand knots.
- Tie a stirrup hitch around the ankles and feet and feed the two pigtails through the right angles of the Stokes litter. Do not cross the ropes at the ankles.
- Lace the sling rope toward the casualty's head by passing the rope through the right angles—not over the top of the rails—of the Stokes litter.
- Secure the ends of the sling ropes by tying a clove hitch with two half hitches on the thick vertical bar located by the victim's shoulder.

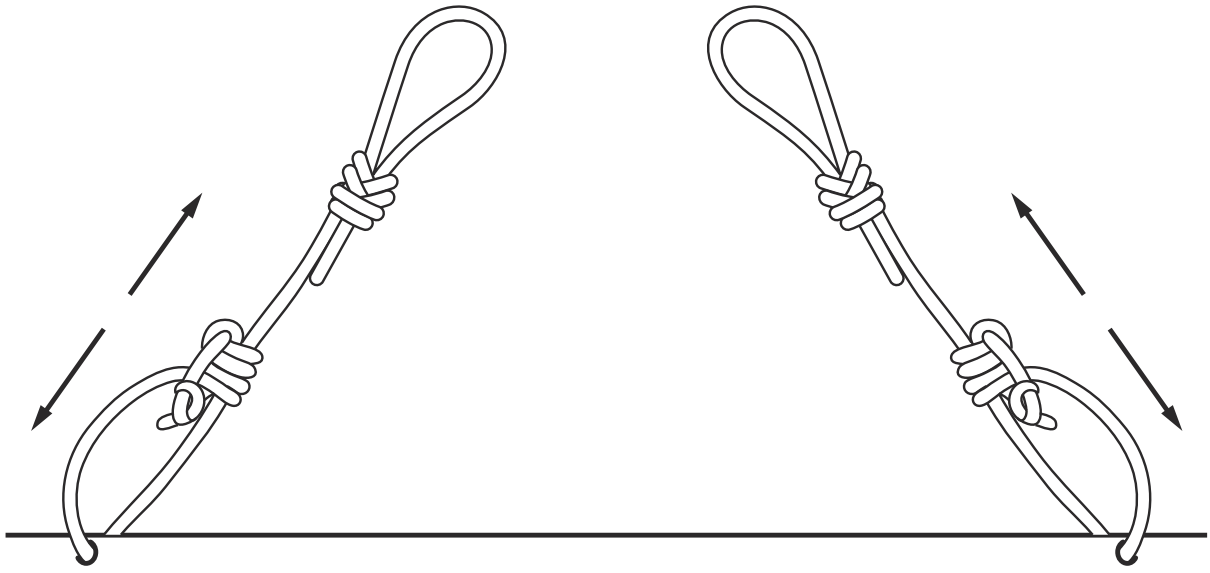
Yosemite Pre-rig

Pre-rig implies that the litter is "ready to use," but, in this case, the rig must be constructed. The purpose of the Yosemite pre-rig is to level a litter when lifting with a single or dual attachment point with an easily adjusted system. It is usually better to keep the patient's head slightly higher than his feet. The Yosemite pre-rig normally requires four sling ropes:

- Using one sling rope, tie a figure-eight loop with one tail.
- Take the remaining tail and run it through an attachment point on one corner of the litter.
- Tie a kragur knot onto the same sling rope.
- Repeat the steps above with the three remaining sling ropes for the respective corners.
- Suspend the litter to ensure that corners are balanced and the head rests above the feet. Adjust the sling ropes as needed. See figure 9-14.

Ascent or Descent Over Steep to Moderate Slopes

When the litter team is ascending or descending a slope, it must consider the potential for further injury to the casualty or to themselves. If the risk of injury is high, a belay line may be used to prevent injury to the casualty and the rescuers. The site selection considerations for a belay line are



Two Sling Ropes Tied for Pre-Rigging

Figure 9-14. Yosemite Pre-rig.

suitable anchor points, clearance for casualty along the route, and good loading and unloading points.

Preparing the Casualty

The casualty will always be rigged for vertical employment when on steep to moderate terrain. The smoothest possible route must be selected. Ensure that the casualty's head is above his feet. There are two methods that can be used for the rescuers for moving a casualty in steep to moderate terrain—standard and caterpillar.

Standard Method

The standard method requires that four men position themselves on each side of the litter. They can then carry the litter using the handles or shoulder slings. In steep terrain, rescuers are belayed by attaching themselves to the litter.

Caterpillar Method

The caterpillar method requires as many participants as possible. They split evenly into two groups and position themselves on each side of the litter forming a tunnel. As the litter is raised or lowered, each member will hand the litter to the next member in the tunnel. Each man, as the litter passes him, peels off and assumes the lead at either the top or bottom of the tunnel. This process continues until the litter reaches its desired destination.

Using a Belay Line

On steeper terrain or on vertical terrain no higher than 15 feet, one static rope from above can be used to belay the casualty and the rescuers. There are two belay methods that can be used—body and direct.

Note: Whichever system is used, the rescuers need to be able to disconnect themselves from the litter in an expedient manner.

Body Belay

This method should only be used over moderate terrain. After anchoring the rope, the belay man sits behind a suitable anchor, such as a rock or a tree and passes the standing end of the rope behind his back. The running end of the rope will feed out from the belay man's right side. A figure-eight loop is tied to the end of the running end of the rope. It is then attached to the litter's figure-eight loop with a locking carabiner. The belay man removes all of the slack between himself and the litter. The standing end of the rope should be stacked on the belay man's left side and run through his left side. As the casualty is lowered, the belay man will feed the rope from behind his back allowing it to run through his right hand. If the belay man needs to stop the casualty, he will clench the rope in his left hand and bring the rope to the center of his chest.

Direct Belay

The direct method is the safest for either raising or lowering a casualty in either moderate to steep terrain. If more than one lowering/raising system is required, relay teams must be sent out ahead of time to emplace the successive systems so that less time is lost during the process. The length of the rope used must be considered when selecting successive anchor points and loading and unloading stations. Whether or not additional ropes are used, the litter must be on belay on the new system before it is taken off belay and disconnected from the previous system. If additional ropes are not used on the litter, the standing end of the rope will not be connected to an anchor; instead, a stopper knot will be tied at the end. On the steepest of terrain, the rescuers may require a belay, which can be accomplished using one of several methods—

- Around the chest bowline with an end-of-the-line figure-eight loop.
- Swiss seat with or without a cow's tail.
- Sit harness with or without a cow's tail.

To Lower a Casualty. A swami wrap is first tied around a suitable anchor point. Two locking carabiners are clipped into all of the wraps of the swami wraps with gates up. A figure-eight loop is tied into the running end of the rope and attached to the litter with a locking carabiner. The standing end of the rope is secured around a suitable anchor. After all the slack has been taken up between the litter and the anchor, the rope must be tied through an appropriate belay device. The belay device is attached to the anchor through one of the two locking carabiners on the anchor (see fig. 9-15). A safety (end-of-the-line or middle-of-the-line) prusik will be tied to the running end of the rope and clipped into the second locking carabiner on the anchor. While the casualty is being lowered, one person controls the rope running through the belay device. The safety prusik is controlled by a second person. Should the primary belay man lose control, the person operating the safety prusik would let go and the prusik will bind onto the rope, stopping the casualty.

Note: If enough gear and suitable anchors are present, it is preferred to use a separate anchor and tie-in point for the safety prusik.

To Raise a Casualty. The anchors are established in the same manner as discussed in lowering the casualty with one minor change: instead of running the rope through a belay device, the rope will only run through a locking carabiner. The load will be raised using a mule team, which must consist of as many people as possible. The mule team will raise the load in as straight a line from the anchor as possible. If the space does not permit the mule team to walk straight back, a 90-degree offset from the anchor may be used. The mule team will walk backward until the last man reaches his limit of advance. Once he reaches that limit, he will peel off the end and return to the front of the mule team. This process continues until the casualty reaches the top. If the load becomes unmanageable, the safety prusik will be allowed to bind on the rope while the mule team repositions. If the person operating the safety prusik cannot see the casualty, a point noncommissioned officer will be in charge of communicating with the mule team. If a mule team is not available, a mechanical advantage system can be employed. If the path of the casualty does not run in a straight line, a redirect may be employed by slinging a suitable intermediate

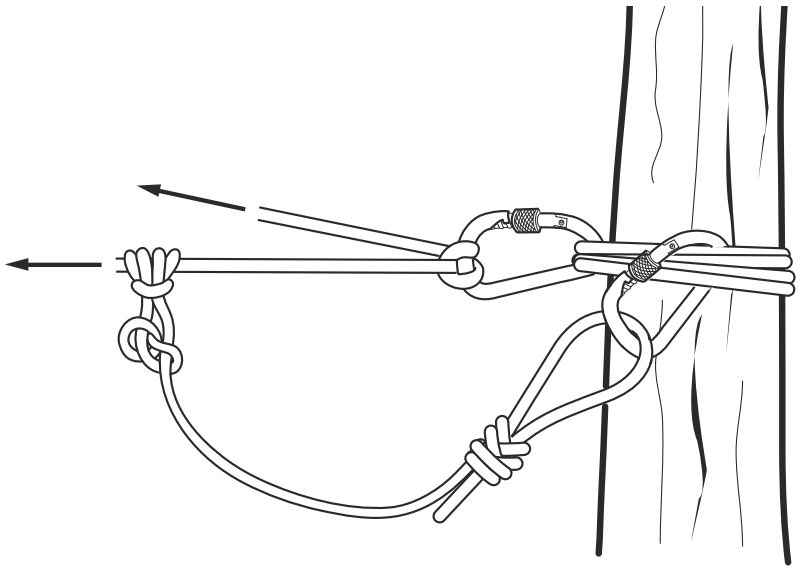


Figure 9-15. Direct Belay for Lowering.

anchor and clipping the rope to it using a non-locking carabiner.

Barrow Boy

A barrow boy is an assistant to the litter on vertical to near vertical cliff faces. The barrow boy can be used for the alpine basket, the Stokes litter, or the Sked® litter. For this situation, the Stokes litter should only be used horizontally; however, the Sked® and the alpine basket can be employed either horizontally or vertically.

Rigging the Barrow Boy

To rig the barrow boy, the rescuer must ensure that a suitable anchor has been established and the proper belay and safety prusik have been constructed for the system used on steep terrain. He must ensure that if an A-frame is used, it has been constructed and anchored properly, as in figure 9-16. The rescuer will then tie a rappel seat or put on a sit harness and ensure that a safety line has been tied onto the casualty.

After pulling the running end of the rope through the carabiners or pulley of the A-frame, the rescuer will tie a figure-eight loop at the end of the static rope. He will then attach the figure-eight loop to his hard point with a locking carabiner and tie a middle-of-the-line prusik above the figure-eight loop, attaching it to the same locking carabiner in his hard point. This type of attachment is called the adjustment prusik and is used to adjust the position of the barrow boy in relation to the litter. Next, the rescuer will take 6 to 8 feet of slack from the end-of-the-line figure-eight loop and tie a directional figure-eight loop with the direction of pull going down. The directional figure-eight loop is the attaching point for the litter and the casualty's safety.

Note: The prusik should be between the end-of-the-line figure-eight loop and the directional figure-eight loop, as in figure 9-17.

Executing the Barrow Boy

Once the rescuer and the litter are secured, the belay man must take all the slack out of the system. The rescuers then maneuver the litter through the apex of the A-frame with the help of the point noncommissioned officer.

Once onto the cliff face, the rescuer positions himself with his adjustment prusik so that he can be of most assistance to the litter on the raise or lower. The rescuer will pull the litter out away from the cliff face so that the casualty rides smoothly up or down the cliff face.

The point noncommissioned officer will be in charge of the belay men or the mule team. He will also communicate with the rescuer about the rate of speed, if the rescuer needs to be stopped along the route, and when he reaches the top or bottom of the cliff.

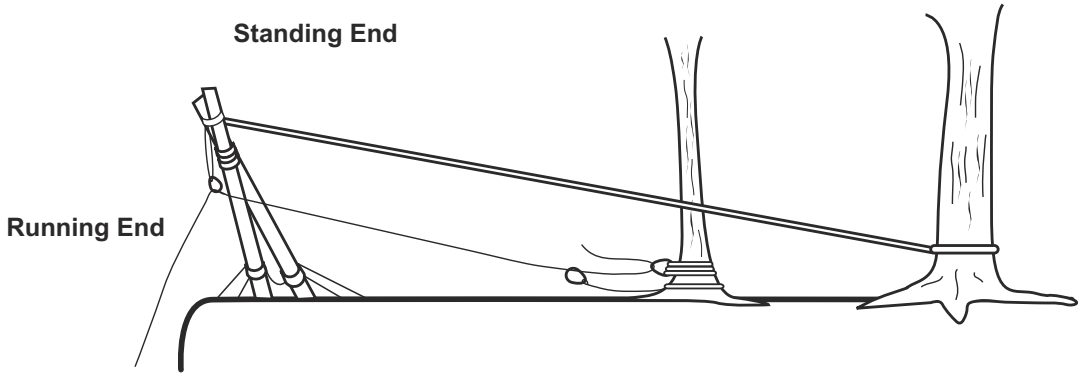


Figure 9-16. Belay Line and Anchor System.

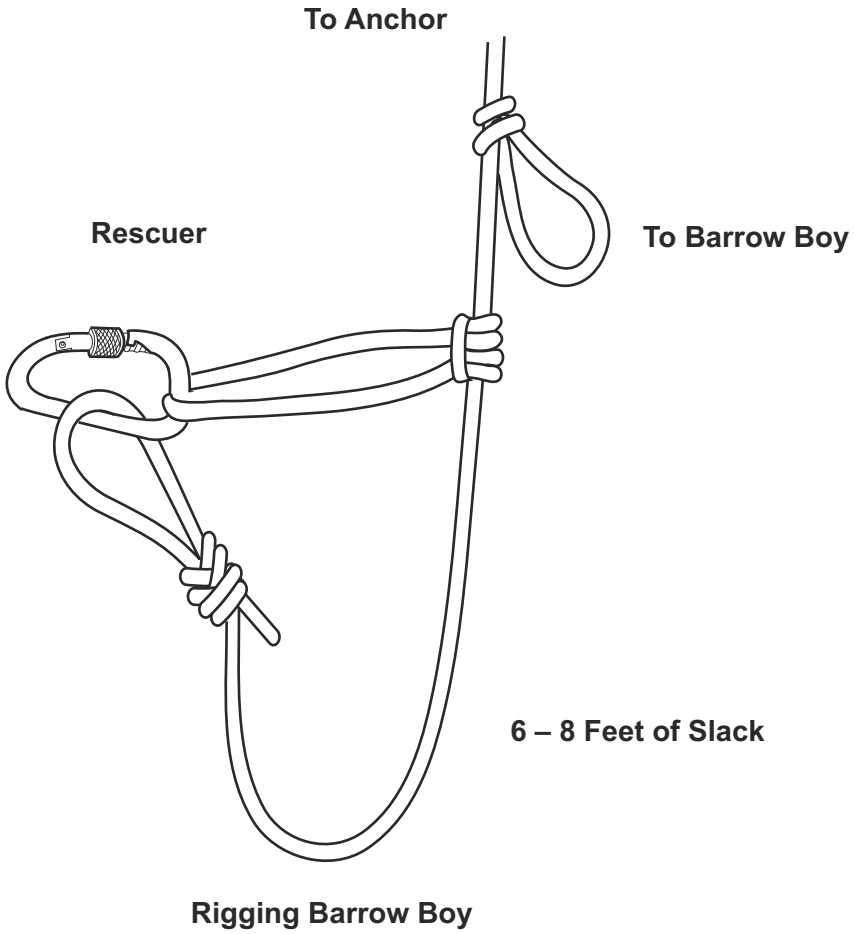


Figure 9-17. Rigging the Barrow Boy.

Tandem Lower

The tandem lowering system can be used for the walking wounded, prisoners of war, or more serious casualties when situation will not permit using the barrow boy. The belay line and anchor system are anchored in the same fashion as for the barrow boy.

Rigging

The assistant to the casualty should first tie a rappel seat and then assist the casualty with his; sit harnesses may also be used. The assistant ties an end-of-the-line figure-eight loop to the belay line and clips it into his rappel seat using a locking carabiner. A directional figure-eight loop with the direction of pull going down will be tied 12 to 18 inches up the rope from the figure-eight loop, as in figure 9-18, on page 9-14, and clipped to the casualty's rappel seat using a locking carabiner.

If needed, an adjustment prusik cord should be tied above the casualty's directional figure-eight loop. It is used to adjust the position of the rescuer in relation to the casualty. Like on the barrow boy, the prusik is clipped in the rescuer carabiner along with the end-of-the-line figure-eight loop.

Execution

The casualty will straddle the rescuer and both will lower as one, with the rescuer helping on the way down the cliff.

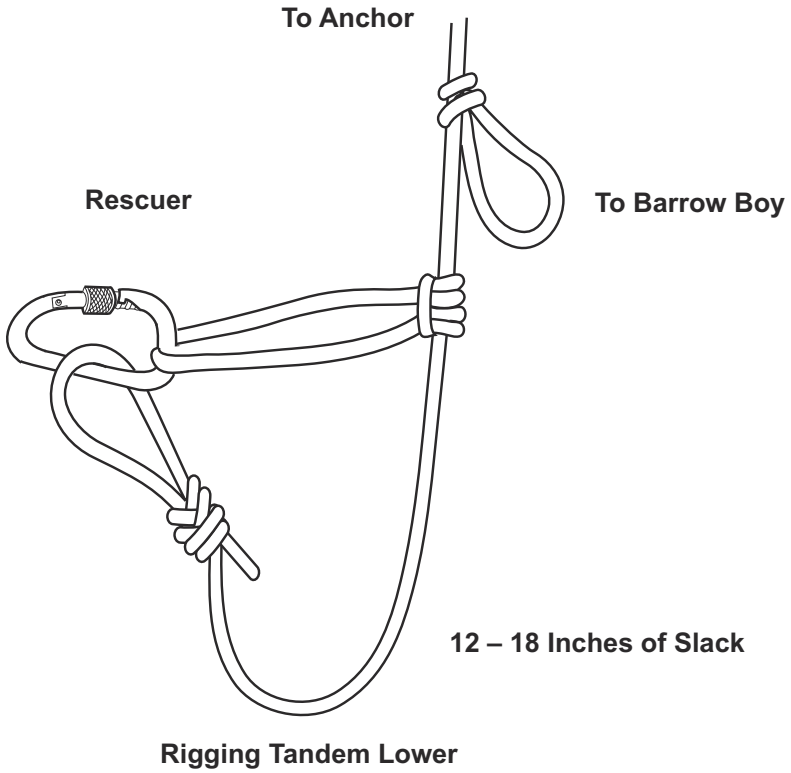


Figure 9-18. Rigging Tandem Lower.

Suspension Traverse or Rope Bridge Evacuations

All of the techniques discussed for the evacuation of a casualty from top to bottom can also be used on a suspension traverse or rope bridge, with a slight variation in the belay line. Two belay lines may be used for rope bridges and the suspension traverse, if they are available. No matter what type of litter is used, Marines involved in the evacuation must ensure that the head is always uphill or not lower than the feet.

Over-the-Snow Litter

There are two types of standard litters for over-the-snow CASEVAC—the team sled, which is the current fire team sled in the Marine Corps supply system and discussed more in chapter 14, and the large sled. There are two large sleds in the system—the old ahkio and new weapons/CASEVAC variant of the team sled. Casualties can be prepared for movement in both the team and large sleds in the following ways:

- *Team sled.* Place the casualty's isopor mat or extra clothing inside the sled as insulation and padding. Place the casualty's sleeping bag inside the team sled and him in it. Secure the straps across his chest, knees, and shins. Rescuers can also place skis under the victim to provide C-spine precautions and to help support the legs out of the sled. When transporting, try to keep his head uphill.
- *Large sled*. Place the casualty's isopor mat or extra clothing inside the sled as insulation and padding. Place the casualty's sleeping bag inside the sled and him in it. Secure the casualty with the internal straps and by closing the sled cover over him. Covering the face will depend on weather conditions. Try to keep the patient's head uphill at all times.

Evacuation by Ground Vehicles

Vehicle requirements vary depending on the type of operation and the terrain. Wheeled vehicles are usually limited to maintained roads (snow plowed). Chains are frequently required, even with four-wheel drive. Amtrak and LAVs are just as limited. Over-the-snow vehicles, such as snowmobiles or BV-206s, are best.

Evacuation by Air

Medical evacuation by air is ideal because it is quick and is frequently easier on the patient. However, there may be restrictions placed on the aircraft due to weather and altitude.

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CHAPTER 10
MOUNTAIN PATROLLING

Mountainous terrain will force decentralized operations by small units. While there are a variety of missions that will be executed in mountain operations, patrolling forms the backbone of all small unit actions. Patrol leaders need to ensure that all Marines are well informed of the mission, route plans, time estimates, key guiding features, catching features, lost Marine plan, CASEVAC plan, areas of hazard, and an overview of the terrain that will be traveled to include elevation gain and loss. It is critical to select the right equipment in order to balance weight, mission critical items, and personal survival items to conduct a successful patrol.

Equipment and Supplies

The following items are mountain-specific considerations to be made while planning to ensure mission accomplishment:

- Unnecessary equipment leads to unnecessary weight and strain on the body. Patrol leaders must decide what equipment is critical. Calculated risks must be accepted in light of reducing the individual's burden so that the patrol can physically complete the mission.
- Using the mountain/cold weather warfighting loads as a guide, leaders can ensure that their Marines are prepared for foul weather and, if necessary, capable of establishing an expedient shelter bivouac.
- Sleds may be used to carry mission-essential equipment, but may result in a reduction of the patrol's agility and overall speed.
- More water than food should be carried. The unit should carry a water purifier or each individual should carry purification tablets for use with natural water sources.
- Each individual should have a small trauma first aid kit and the unit should have some means of CASEVAC appropriate to the environment.
- Ropes can facilitate overcoming obstacles, but are heavy. Thorough planning must be conducted to determine the required number, if any.
- Since it is impossible to move in the snow without leaving tracks, track discipline must be strictly enforced. Whenever feasible, patrols should be inserted by air.

General Organization

General patrolling formations can be used effectively in the mountains with the following additional considerations:

- The exact size and composition of the patrol will depend on the mission; however, the "arctic buddy system" should be used for security, chow, and bivouac routine.
- Mountain and arctic patrols are usually larger to carry more gear, provide additional firepower, and assist in trail breaking and CASEVACs.
- The unit may have additional attachments, such as mountain leaders, assault climbers, scout swimmers, and animal packers.
- The use of sleds on patrols should be avoided, if possible.
- Compartmentalized terrain will limit communication and control of subordinate units. All elements should be capable of operating on their own and prepared to move in independent lanes as satellite units.

Estimate of the Situation

As in a temperate climate, a patrol leader must make an estimate of the situation. Although the basics are similar, some additional considerations must be addressed in a mountainous/cold weather environment with regard to METT-T, space, and logistics.

Mission

Along with reconnaissance and combat patrols, various additional applications for patrolling are peculiar to a cold weather environment. Some possible examples are—

- Reconnaissance of the battle area and particular targets, while establishing a forward presence.
- Harassing the enemy lines and depriving them of shelter and rest.
- Deep penetration by ski/helicopter to destroy logistic supply lines.
- Installation of observation posts and radio relay and retransmit sites.
- Picketing of high ground on the unit's flanks during the advance.
- Tactical recovery of aircraft and personnel due to the extreme weather in the mountains.

Enemy

A normal SALUTE [size, activity, location, unit, time, and equipment] report is still the standard format used with some additional considerations peculiar to this environment. A good method of determining these considerations is to evaluate one's own unit. The human nature aspect will likely influence how the enemy deals with the elements and play a crucial part in predicting how the enemy will select a route. Marines should be aware of how natural lines of drift tend to influence a unit and should consider the following:

- The type of mobility the enemy is using and his ability level.
- The unit's discipline.
- The unit's morale.
- The enemy's last known action.
- The unit's resupply capabilities.

Terrain and Weather

It is very important for the leader to gather as much information as possible about incoming weather patterns and do a thorough study of the terrain into which he will move.

Terrain

At high elevations, cold weather and even snow can be encountered all year. Slope angle and altitude will slow the unit more and more as they increase. Mobility will become extremely difficult due to these factors and very taxing to the endurance of the unit. The wide variety of terrain encountered will affect speed of movement, concealment, and security. The following items should be considered:

- Above the tree line, the exposed terrain makes movement and security more difficult. Micro terrain and shadows should be used as much as possible to make observation from the enemy more difficult. Units should move during the hours of darkness whenever possible.
- Below the tree line, movement and bivouac areas can be concealed by vegetation.
- Danger areas tend to be larger in the mountains and, due to the decreased mobility of a unit, must be given special consideration.

Weather

The uncertainty of weather in the mountains requires leaders to be flexible in their planning. Severe weather can move in suddenly and last for several days, so Marines should always plan for the worst-case scenario and be aware of the following:

- Cold temperatures and high winds affect Marines, their weapons, and equipment. Individual response time is slowed and the time schedule must reflect this.

- Snow cover affects the rate and mode of movement. Terrain can be affected if avalanche conditions exist. Snow depth and consistency may change considerably during the patrol and may greatly affect movement.
- Visibility will become reduced during storms.
- In the high latitudes, one will experience about four hours of daylight from November to February in the northern hemisphere (reverse seasons in the southern hemisphere). Mid-December has only a few hours of twilight per day.

Troops and Support Available

A mountainous/cold weather environment limits the use of some troop and fire support assets. The leader must consider how much support to expect from available assets.

Troops

Some personnel considerations include—

- The size of the patrol will depend on the mission and members should be employed in arctic buddy teams.
- Cold weather patrols are generally larger due to the gear requirements, such as clothing or CASEVAC gear, and substantial firepower assets must be spread loaded among the members of the patrol. Keep the gear list limited to only that essential to the mission. Anything more will hamper mobility.
- Personnel must possess the physical capabilities required to accomplish the mission under extremely arduous conditions. If in doubt about an individual's ability, leave him at the patrol base.

Support Available

These assets are going to be limited by the same conditions that the patrol is experiencing. Their reaction time may be slower due to the cold and they may have difficulties operating their equipment. Ammunition may be less effective against certain targets. See chapter 4 for more detail. General support considerations are—

- Air support may be grounded due to weather.
- Artillery may not be able to displace and will have a slower response time. In addition, terrain may mask portions of the area of operations.
- Mortars are an effective weapon in this terrain, but are limited by their firepower and range.
- Rockets are effective, but may be limited in extreme cold due to ice fog.
- Small arms may be limited in extreme cold because of reduced rate of fire and range of projectiles due to decreased burn rate of propellants, reduced chamber pressure, reduced muzzle velocity, and increased air density.
- Grenades/smoke must be pre-rigged with a floating device for snow before leaving the patrol base. Rocky terrain can absorb or amplify fragments depending on whether a grenade goes off above or below the rocks.

Time Available

In a cold weather environment, time planning will be affected more than anything else as shown in the following examples—

- March rate will be affected by terrain, weather, and visibility; type of mobility; danger areas; and avalanche conditions.
- Any simple task should be expected to take longer due to slower response times and difficulties handling gear in the cold.

Security is a consideration that will be affected to a large degree if the movement requires the commander to establish mountain pickets or use overwatch techniques. Speed, as a form of security, can be effective in some situations.

Space

In the mountains, distances on the map seem far more obtainable than what they actually are due

to the elevation lost and gained. A useful tool is the TDF, covered in chapter 4. Careful, detailed planning must be done using natural contours along a given route to avoid falling victim to moving along an azimuth.

Logistics

Unusual weather and terrain conditions make supply, CASEVACs, transportation, and services more difficult and more time-consuming. More time must be allowed for moving supplies and troops because of the environment. The capacity of any support element to provide adequate logistic support may be the determining factor when evaluating the feasibility of an operation. Leaders must always be prepared to alter the plan. More detail on logistical considerations is found in chapter 12.

Patrol Leaders' Considerations

Planning must be precise, extremely detailed, and continually improved. In a cold weather, mountainous environment, the planning and preparations for a patrol are similar to those in temperate climates, but with some additional considerations. See appendix B for an example of a patrol order bullet format sheet with winter considerations. See appendix C for an example of a winter warning order matrix blank. Specific mountain/cold weather considerations are—

- Wax designation and skins, if skis are used.
- Shelter and equipment to be carried (must be dependent on mission of patrol).
- Trail-breaking party designated and briefed on operation, if used.
- Immediate action drill considerations for the type of mobility.
- Establishment of objective rally points (ORPs) and patrol bases.
- Skijoring operations, if available, are used.
- Communication considerations (see chap. 2).
- Heliborne considerations (see chap. 12).
- Route considerations. A poorly selected route will jeopardize the mission of the patrol. Therefore, it is important that route selection be a priority in the planning of the patrol. More information on route selection is available in chapter 4.
- Accountability of personnel. Due to the varying skill level of unit members operating on skis/snowshoes, the possibility exists that personnel could become separated. It is essential to increase the frequency of head counts and always employ the buddy system, selecting personnel of the same skill level, if possible.

Patrol Preparation

Preparation of equipment and personnel must be thorough. The hostile environment places more dependence on everyone's equipment and fellow Marines. Orders should be complete and concise, using aerial photos, terrain models, and route cards. Every phase of the patrol must be rehearsed.

Camouflage

Overwhites need to be taken if there is snow anywhere on the route and they must be clean. The patrol leader dictates the overwhite pattern/outer camouflage layer in which to start and any changes during the patrol; individuals regulate their insulating layers. White tape should be firmly applied to all load-bearing equipment (LBE) and weapons when in snow.

Immediate Action Drills

It is not the purpose of this subparagraph to designate specific SOPs for immediate action drills; however, it is essential to rehearse immediate action drills for each mode of mobility until the reactions become second nature.

Note: The difference between this and other environments is that drills are conducted on

skis/snowshoes and on varying terrain. Training on appropriate firing positions and crawls should continue until the unit leader gets the results he desires.

Break Contact

The conduct of the drill remains the same as in other environments; however, the firing positions must be considered. The initial reaction of the personnel will be to drop down and return fire in order to suppress an engaging unit; however, due to snow consistency, Marines may drop into the prone position and be submerged into the snow, unable to return fire. Moreover, getting back up out of the prone position can be tiring and slow, causing Marines to be in the kill zone longer. Marines should lean or kneel behind cover and could use their rucksacks as a firing platform if out in the open. Depending on how weapon systems are being carried, reaction time will become a critical factor to the success of the break in contact.

Once the Marine's skis/snowshoes are in the opposite direction of the enemy, all firing will be done with the skis/snowshoes in the direction of movement, adopting a suitable firing position from this stance, such as stemming one ski out to the side and firing to the rear. Such a stance will allow simultaneous effective speed, movement, and fire.

Hasty Ambushes

The ultimate goal of the drill is the same as in a temperate climate; however, much more precaution must be taken in the emplacement and positioning of Marines into an ambush site due to the mode of mobility being used when they apply to the situation of the ambush. Marines should always be aware of the patrol's tracks, which may tip off the enemy.

If an enemy force is tracking the patrol during movement, it may be necessary to "button-hook" into the ambush site to be effective, which will deceive a tracking enemy into the kill zone while maintaining the unit's track discipline. The buttonhook should encompass terrain that favors the ambushing unit in security and observation of the oncoming enemy.

If the enemy is to the flanks or front, it may be advisable to go into the ambush site on foot to ensure noise discipline and avoidance of obstacles on skis/snowshoes. If the goal of the ambush is harassment, this option would probably not be a good course of action as rapid withdrawal from the ambush site would be difficult.

The ambush site should facilitate an efficient avenue of withdrawal should a superior enemy force be encountered. This route should allow rapid downhill movement in order to put as much distance between the ambush force and the enemy.

Counterambush

Drills for near and far ambush remain the same. The following considerations should be noted:

- Firing positions, along with placing weapon systems into action, should be rehearsed before patrolling operations.
- Snow has a dampening effect on explosives and smoke devices, so proper preparation of this ordnance before conducting the patrol should take place.

Skijoring

If an enemy force is encountered while skijoring, consider the following:

- All drivers should be aware of possible ambush sites and accelerate through these sites. If fire is received, skijoring Marines will present as low a silhouette as possible.
- If the vehicles are attacked and rendered inoperable, counterambush drills should be applied to clear the enemy force.
- Crew-served weapons can be mounted on the vehicle's roof for fire support.

Patrol Bases

Deceptive actions are mandatory in a snow-covered environment. Marines should use any of the following:

- *Jump-off point*. The jump-off point is made on slopes or in dense woods where it is possible to hide the real track and where enemy pursuit will have such a high speed of travel that it is difficult for him to discover where the real track or any boobytraps are. The deceptive track should be made as far away as time permits.
- *Buttonhook*. The buttonhook is the preferred method of setting in a track plan to a patrol base. This technique allows the track to be observed and covered by fire during the occupation of the position (see fig. 10-1).
- *Deceptive tracks*. Deceptive tracks are used to mislead the enemy from the jump-off point. They should be located in an area where one can observe them and cover them with small arms fire from the patrol base.
- *Dummy position*. The dummy position is located at the end of the deceptive track and used as a decoy to draw the enemy; realism should be emphasized as much as possible, even erecting tents and antennas. The dummy position should be continuously observed and located within small arms fire from the position.

During patrol base occupation, minimal activity should occur; therefore, it may not be advisable to dig communications trenches and defensive positions. All food preparation, water procurement, or weapon maintenance should occur in a

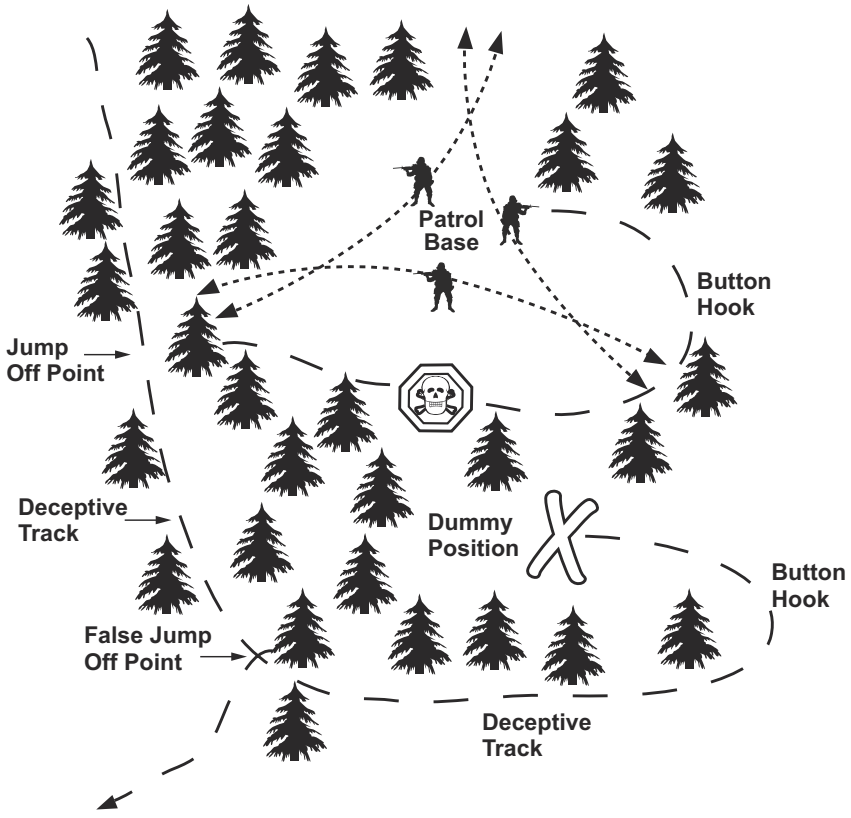

Figure 10-1. Patrol Base Plan.

covered area. Due to the possibility of the patrol base being detected and engaged by a superior enemy force, a contingency plan for escape must be made, practiced, and implemented. Impeccable bivouac routine and security are the best ways to prevent enemy detection. Since a Marine's equipment is so important in a cold weather environment, patrols operating out of a patrol base should take the following precautions prior to leaving in case the patrol base becomes compromised and the patrol must become self-sufficient:

- All equipment, such as sleeping bag, stove, fuel, or extra clothing, not in use will be in the Marines' packs.
- Each buddy team should have one combat load.
- All gear and equipment not going on the patrol should be packed before going out on patrol and cached outside of the patrol base.

Ambush in Cold Weather/Snow

When conducting a reconnaissance of an ambush site in a temperate environment, it is possible to get close to, or even on, the position, but it is much more difficult in a cold weather environment. Everywhere Marines go in a snow-covered environment, tracks follow. Since there are obvious consequences if the enemy finds these tracks, the route to the ambush site is very important. This route should be such that the chances of the tracks being discovered are negligible. The route in for approximately the last 1 kilometer will be at a 90-degree angle to the objective. The ideal times to move are in poor weather, during a heavy snowfall, or at night. These ideal conditions will not always be possible, so Marines will have to find terrain that will allow entering the position while concealing the tracks from all but a chance encounter.

The Ambush Position

The site for the ORP needs to be well chosen, affording concealment from enemy observation and cover from fire. It should also be reasonably close to the ambush line if the ambush lies on a linear feature. In the ORP, a warming tent may need to be set up; ideally, the four-man tent vestibule would be used. In an area ambush, there may be more than one ORP, so more than one warming tent will be required.

A decision must be made on whether the ambush party should take skis/snowshoes into the ambush position or leave them at the ORP. The decision-making will involve answering some of the following questions:

- Is it a near or far ambush?
- Does the ambush party have to move through heavy vegetation to get to the position?
- Is the route to the objective downhill or uphill?
- Is the route over easy terrain, which affords good concealment into the position?

Note: The previous questions should already have been answered by the reconnaissance element.

If Marines are not using skis/snowshoes, postholing is the only option whether or not they are carrying skis/snowshoes. If Marines do take skis/snowshoes to the ambush site, they may have to be bundled to prevent any excess noise or they may be towed to the position.

Actions in the Ambush Position

The method of occupation into the ambush position usually does not change. When moving into a position in snow-covered terrain, particular care must be taken to avoid tracking up the area. An approach should be chosen that provides as much concealment as possible from enemy observation. The firing positions inside the ambush site should be out of sight from the enemy, appearing natural and undisturbed. Additionally, they must provide adequate cover from enemy fire.

The success of the ambush force's concealment is governed by the good use of the terrain; however,

varying types of snow conditions can either hamper or help concealment. The following are factors that should be considered:

- Powder snow will enable easy creation of a fighting trench position in about 10 to 15 minutes, which, when smoothed out, will conceal Marines from enemy observation and provide some protection against small arms fire.
- Hard, compact snow will make it difficult to dig a fighting position and will take considerably longer—15 to 30 minutes. Hard, compact snow provides excellent protection against small arms fire.
- Hard, frozen ice will make it almost impossible to dig a fighting position.
- In most ambushes, the attacker will load the firepower in his favor by laying claymores and boobytraps near the boundaries of the kill zone. The employment of such devices is usually impossible in a snow-covered environment because of the tracks that are left by the installers. If using these devices, check all explosives inside a warming tent or in the patrol base, if possible. Waterproof any electric or time fuze connections with plastic bags and duct tape. Place dry rags inside the plastic to absorb moisture. Waterproof the fuze igniters.

The following are things a patrol leader can do to prolong the time a person can stay warm in an ambush area. He can—

- Instruct everyone, upon reaching ORP, to put on all warming layers.
- Select an ambush site out of the wind. Situation permitting, Marines may dig into fighting positions, adding a one-man sleeping bench along the back.
- Ensure all men have a dry isopor mat on which to lie. The thicker the insulation pad(s), the better.
- Ensure each man has a full, hot thermos. Heat sources should not be used in the ambush site to make hot wets. Buddy teams will only use one thermos at a time to maximize the heat maintained in the drink.
- Always employ Marines in buddy teams on 50 percent alert.
- Toes and hands need to be kept moving at all times to maintain circulation, because the extremities will be the first part of the body to get cold.
- Rotate a Marine back to the warming tent (tactical situation permitting), if he is getting near the stage where he is spending more time trying to stay warm than alert. The Marine may be experiencing the effects of hypothermia/frostbite; unfortunately, if one Marine is in that state, others may soon follow.
- One sleeping bag per buddy team can be used for hot bagging to warm-up for the man *not* on security.
- Set a no-show time for extraction. A Marine can only lie so long on an isopor mat in the cold before he starts to become hypothermic.

Weapons

When the signal to fire is given, everyone's weapon should operate at that precise moment in time. If it does not, the weight of fire may not be enough to destroy the enemy. Cold and snow can severely impact weapon reliability; for example,

> The A Company in Norway in the 1990s was tasked with an ambush 6 kilometers from their position. They moved out at last light and got into position at about 2330. On the way there, they had to move through a valley in which the temperature was much colder than the area they had left. About 3 hours into the ambush, the enemy was sighted, but, at the signal to fire, the machine gun next to the company commander, which was to commence the fire, would not fire. The second machine gun also malfunctioned, so the company commander attempted to give the signal with his personal weapon, which also failed to operate. The company commander then shouted, "FIRE." His company, seeing the enemy and hearing the order, tried to engage, but only 4 of the 120 weapons functioned. On the subsequent investigation, it

was found that the weather conditions had caused the problems. On the ski march to the ambush site, it had been snowing lightly, the temperature just below freezing. The temperature in the valley that they had moved through was around -12 °F. It was surmised that the snow on the weapons melted slightly and got into the working parts. The drop into the valley caused the melted snow to freeze and jammed the weapons.

It is also worth remembering that the propellant used in all weapon systems is affected by the cold. The burn time of that propellant is noticeably slower.

Illuminating the enemy works very well in snow-covered terrain as the light is reflected off of the snow. However, care must be taken where the light is placed in the sky, as the additional magnification afforded by the snow can highlight Marine positions just as easily.

Search Teams

The time and difficulty of the route into the kill zone and back should be considered. It may not be practical to use a search team in the mountains or deep snow.

Withdrawal

If the decision is to stay and search, Marines should wait for the search team's return before withdrawing to the ORP. If the skis and packs are there, Marines should put them on. If Marines carried their skis to the ambush position, then they have various choices of where equipment can be donned. The ORP party should take down the warming shelter and have sleds ready to retrieve any wounded personnel.

Firing Positions

The firing positions used in snow-covered terrain are standing, kneeling, sitting, and prone.

Standing

From a standing firing position—

- Point the left or the right ski/snowshoe in the direction of fire desired. Right-handed shooters will have their left ski/snowshoe toward the direction of enemy; left-handed shooters will have their right ski/snowshoe toward the direction of the enemy. Plant the opposite ski/snowshoe outward, edging the inside of the ski/snowshoe to form a half-herringbone.
- Remove the straps from the wrist if using ski poles. Next, plant one ski pole on either side of the ski/snowshoe pointing toward the target approximately 12 inches forward of the ski/snowshoe bindings. Cross the top of the ski poles forming an "X." The straps of the ski poles may be interlocked to provide a more stable platform.
- Unsling the weapon and assume a firing position, bending the rear knee forward toward the ski poles. Place the weapon in the cradle of the "X" formed by the ski poles. Place the nonfiring hand on the "X" of the ski poles, crouch forward, aim, and fire. See figure 10-2 on page 10-10.

Kneeling

From a kneeling firing position—

- Point either the right or left ski/snowshoe in the direction of fire desired. Plant the opposite ski/snowshoe outward, edging the inside part forming a half-herringbone. Bend the rear leg forward and rotate the ankle until the knee touches the snow.
- Remove the straps from the wrists, if using ski poles, and plant the ski poles as for the standing position. Form an "X" with the ski poles at approximately eye level with the nonfiring hand.
- Unsling the weapon and assume the firing position, placing the weapon in the cradle of the "X" formed by the ski poles. Grasp under the weapon with the nonfiring hand, just behind the "X" formed by the ski poles, lean forward, aim, and fire. See figure 10-3 on page 10-10.

Figure 10-2. Firing from a Standing Position.

Sitting

From a sitting firing position on skis—

- Stop movement.
- Face the target and sit down upslope as in a controlled fall position (on either the left or right side).
- Extend skis to provide support for the firing position, stabilizing elbows against the inner thigh or the knees.

This is a very stable nonmoving firing position. Firing adjustment will require that the position be modified to the comfort/build of the shooter.

Figure 10-3. Firing from a Kneeling Position.

Prone

From a prone firing position, with ski/snowshoes on—

- Assume a prone position by forming a herringbone and then bend both knees forward until they touch the snow. Once the knees make contact with snow, grasp both poles in the center with the nonfiring hand, fall forward, and break the fall with the ski poles.
- Place the ski poles perpendicular to the direction of fire, approximately 18 inches to the front.
- Bring the weapon to the prone firing position with the elbow resting on the ski poles. See figure 10-4.

Skis/snowshoes can be used as weapon supports (see fig. 10-5) using the following steps:

- Assume a prone firing position with the skis/snowshoes on or off.
- Place the ski/snowshoe perpendicular to the direction of fire, approximately three feet to the front. Place the ski poles at the side.
- Bring the weapon to the prone firing position with the forearm, or bipod, resting on the ski/snowshoe as in any prone-supported firing position.

Figure 10-4. Prone Firing Position with Ski Poles as Elbow Rest.

Figure 10-5. Prone Firing Position with Snowshoe Support.

The side prone variation should be used when confronted with the enemy to the right or left. To assume this position, Marines must—

- With skis perpendicular to the direction of the target, ski poles in one hand, and rifle gripped at the pistol grip in the other, fall to the ground using poles to break the fall.
- If falling to the left, fire the weapon right-handed. If falling to the right, fire the weapon left-handed. See figure 10-6.

Figure 10-6. Side Prone.

Firing Platform

Sleds also make stable firing platforms. Shooters can use them, but they are best used for crew-served weapons, such as machine guns. See figure 10-7.

Figure 10-7. Sled as Machine Gun Platform.

Considerations for Firing

The following items should be considered when firing in a cold weather environment:

- When moving downhill, it is easier to turn into the strong side and return fire vice trying to shoot on the move.
- If receiving fire from below while traversing a slope, sit when returning fire, because it is easier to sit uphill and face and fire downhill.
- If receiving fire from above while traversing a slope, kneel when returning fire, because it is easier to kneel and fire uphill.
- Always ensure to set the edges of the skis when firing to prevent slipping.
- The use of ski poles in the standing position is not practical for a quick-fire technique. It would be quicker to come to a stop, while bringing the rifle to bear and squatting down, using the thighs for support. This method is quicker and provides a much smaller target for the enemy.

CHAPTER 11
FIRES

Weapons Employment Considerations

Each type of environment has an effect on the operation of a weapon, whether dust in the desert or mud and rain in the jungle. Weapons are particularly vulnerable to a mountainous/cold weather environment. This chapter discusses the effects that cold weather and mountainous terrain have on weapon systems (individual and crew-served weapons, mechanical and electrical systems) and procedures to alleviate these problems.

Effects of Cold on Materials

Cold temperatures affect the material with which weapons are made. Each material is affected differently:

- Metal, plastic, and rubber become brittle and more susceptible to damage as temperature drops and need careful handling.
- The impact strength of steel will weaken slowly until it reaches a critical temperature, then it will drop drastically. This critical temperature can vary widely, depending on the quality and heat treatment of the steel.
- In cold weather, metal components of weapons will contract. This change can be particularly important in close tolerance parts, such as bearings. During firing, these components will heat up and expand rapidly and, possibly, unevenly, increasing the chances of breakage or malfunction.
- Lubricants and other liquids may freeze or become thick or gummy.
- Propellants will burn slower.
- Batteries deliver less power at low temperatures. Dry batteries should be stored above 10 °F and should be gently warmed before use. Lithium batteries perform best and last longer when kept cool, rather than frozen. Optimum storage temperature is 35 °F.

Common Cold Weather Problems and Solutions

The following seven subparagraphs discuss some of the difficulties Marines face with their weapons in a cold weather environment and how to solve such problems.

Sluggishness

Sluggishness is normally caused by improper lubrication. A cleaner, lubricant, and preservative (CLP) can operate in cold climates from -35 °F and above; however, in temperatures below freezing, CLP may become gummy. After cleaning a weapon with CLP, users should apply a light coat to provide extra lubrication and corrosion protection. In temperatures 0 to -65 °F, lubricant arctic weather (LAW) should be used because CLP will freeze at -35 °F. If LAW is unavailable, the weapon should be fired dry because normal lubricants will freeze at 0 °F. Ice or snow in the firing mechanism may also cause sluggishness. Should sluggishness occur, the weapon must be cleaned, dried, and the appropriate lubricant applied.

Breakage and Malfunction

Breakage normally occurs during the first few rounds. Uneven expansion of metal parts due to the rapid temperature rise is the primary cause. Firing slowly or in short bursts initially at the sustained rate will give the weapon time to warm up and lessen the probability of breakage. Careful handling and use of muzzle covers can reduce malfunctions due to ice and snow. Marines should be particularly cautious when moving through forested or brushy areas to avoid getting ice or snow in moving mechanisms.

Condensation

Condensation forms on weapons that have been brought from a cold environment into a heated shelter. When the weapon is returned outside, the condensation will freeze and cause malfunctions. Condensation will continue for approximately 1 hour from the time it is introduced to a heated environment. After an hour, the weapon should be cleaned and lubricated. To prevent or reduce condensation, weapons should be stored outside of the tent in the rifle pit. If the tactical situation does not permit the weapons to be stored outside, weapons can be stored in the vestibule of the ECW tent. Ammunition, including magazines, load-bearing vests (LBVs), and belts, should also be stored outside or in vestibule.

Visibility

In a cold weather environment, falling or blowing snow, whiteouts, and grayouts may severely hamper visibility and the ability to deliver accurate fire. Nights are longer in winter; the closer to the poles, the longer the night. Ice fog may occur in extreme cold (-35 °F and below) and where conditions of little or no wind exist (less than 3 miles per hour). It may form upon firing a weapon and can hover over the weapon and along the path of the projectile for several minutes, obscuring vision and pinpointing the weapon's position. Weapons must then be displaced to an alternate position.

Emplacement

Crew-served weapons requiring some type of base or platform for firing will need special consideration. Emplacement of a weapon on snow, ice, or frozen ground may result in breakage or inaccuracy, due to sinking or the inability to absorb shock.

Reduced Velocity and Range of Projectiles

As temperature drops, so does the muzzle velocity and the range of projectiles. Both internal and external ballistics affect velocity and range:

- *Internal ballistics*. As the burning rate of the propellant decreases, so does the rate of gas expansion and, in turn, the speed of the projectile down the bore.
- *External ballistics*. Decreased muzzle velocity reduces the stability of the projectile once it leaves the muzzle. This reduction in velocity may be severe enough to cause projectiles to tumble. At longer ranges, this further reduces velocity, range, and accuracy. Additionally, colder air is denser than warmer air, which increases drag on the projectile, further reducing range.

Weapons should be test fired to establish battlesight zero and new range cards. There may be different range cards for day and night due to significant temperature fluctuations or changing range cards due to significantly changing weather patterns.

Slope Angle Considerations

Gravity affects the trajectory of a round in the horizontal distance traveled when firing either uphill or downhill, causing overestimation of range (line of sight distance to target)—the shooter hits high whether firing uphill or downhill. To compensate for the effect of slope angle, Marines should—

- Use the map distance for sight settings.
- Estimate range in the horizontal plane if a map is unavailable.

- Aim at 6 o'clock or less.
- Adjust from impact (see fig. 11-1 on page 11-4).

Laser range finders may give line of sight range or compensate for slope angle (know which type is being used). If the laser range finder measures line of sight, the sight data will always be less. The steeper the slope angle, the greater the sight data estimation problem. Snipers use the cosine formula to get more precise sight data for first round accuracy when shooting at high angles. Refer to table 11-1 for the cosine of the respective angle; then, multiply the line of sight distance by the cosine for the sight data range.

Note: Zero degrees is flat and 90 degrees is straight up/down when measuring slope angle.

Infantry Weapons Problems and Solutions

Marines experience difficulties with infantry weapons in cold weather environments, but have found ways to mitigate those challenges.

M9 Pistol

Damage or breakage to moving parts may occur due to rapid warming or ice and snow in the weapon (firing pin, extractor/ejector). Marines may also have difficulty operating and firing the weapon while wearing mittens or gloves, so contact gloves can be worn. To mitigate the magazine freezing in the magazine well, Marines should extract and wipe off the magazine before leaving a shelter or vehicle.

Table 11-1. Cosine of Slope Angle.

Angle	Cosine	Angle	Cosine	Angle	Cosine	Angle	Cosine
0.0	1.00	23.0	.9205	46.0	.6947	69.0	.3584
1.0	.9998	24.0	.9135	47.0	.6820	70.0	.3420
2.0	.9994	25.0	.9063	48.0	.6691	71.0	.3256
3.0	.9986	26.0	.8988	49.0	.6561	72.0	.3090
4.0	.9976	27.0	.8910	50.0	.6428	73.0	.2924
5.0	.9962	28.0	.8829	51.0	.6293	74.0	.2756
6.0	.9945	29.0	.8746	52.0	.6157	75.0	.2588
7.0	.9926	30.0	.8660	53.0	.6018	76.0	.2419
8.0	.9903	31.0	.8571	54.0	.5878	77.0	.2249
9.0	.9877	32.0	.8480	55.0	.5736	78.0	.2079
10.0	.9848	33.0	.8387	56.0	.5592	79.0	.1908
11.0	.9816	34.0	.8290	57.0	.5446	80.0	.1736
12.0	.9781	35.0	.8191	58.0	.5299	81.0	.1564
13.0	.9744	36.0	.8090	59.0	.5150	82.0	.1392
14.0	.9703	37.0	.7986	60.0	.5000	83.0	.1219
15.0	.9659	38.0	.7880	61.0	.4848	84.0	.1045
16.0	.9613	39.0	.7772	62.0	.4695	85.0	.0872
17.0	.9563	40.0	.7660	63.0	.4540	86.0	.0698
18.0	.9511	41.0	.7547	64.0	.4384	87.0	.0523
19.0	.9455	42.0	.7431	65.0	.4226	88.0	.0349
20.0	.9397	43.0	.7314	66.0	.4067	89.0	.0174
21.0	.9336	44.0	.7193	67.0	.3907	90.0	0.0
22.0	.9272	45.0	.7071	68.0	.3746		

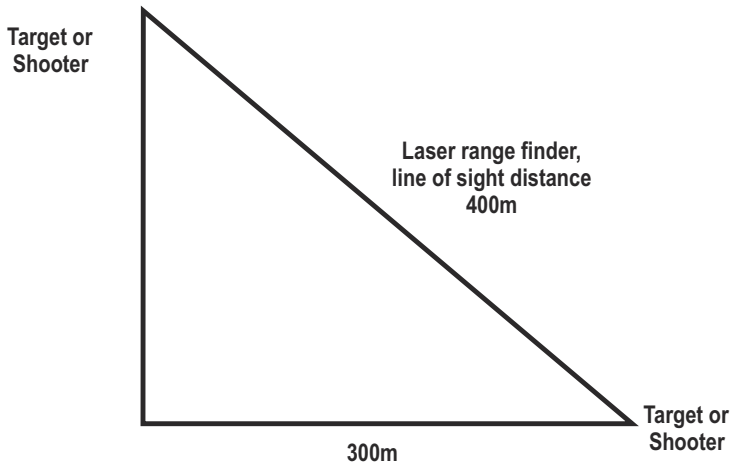

Figure 11-1. Example of Slope Angle.

M16A4/M4 Rifle

As with pistols, damage or breakage to moving parts of rifles may occur due to rapid warming or ice and snow in the weapon (firing pin, extractor/ejector). Firing at the slow rate of fire will allow the rifle to warm up and help to reduce breakage. Condensation in the buffer tube will hamper shock absorption, which may result in retarded recoil and breakage. Retarded recoil may also result in the omission of cocking in the cycle of operation. To prevent retarded recoil, seal the outlet hole with wax or gum and wipe out the buffer tube regularly. Rifles will create ice fog under the right conditions, so Marines should plan for and prepare extra firing positions. To prepare the rifle for snow, Marines should use white cloth tape for camouflage and reinforce plastic handguards and the buttstock. They should select a muzzle cover (must be able to shoot through it for immediate action) and carry a spare (cloth medical tape works well), select a magazine well cover (a magazine works easiest), ensure the ejection port is closed at all times, and open the trigger guard for use with mittens or thick gloves.

M249 Squad Automatic Weapon

Damage or breakage to moving parts of automatic weapons may occur due to rapid warming or ice and snow in the weapon. There is an increased instance of breakage, malfunction, and ice fog compared with the M16A4/M4 rifle due to the M249's increased rate of fire. The trigger control should be used for slow fire to warm up the metal to reduce breakage. Marines can attach ski pole baskets or improvised material to bipod legs for flotation in snow, protect the ammunition belt and feed cover, and use a muzzle cover.

M203 Grenade Launcher

With the exception of its handguards, the M203 is not very susceptible to breakage in extreme temperatures, but freezing may occur around the slide. The effectiveness of the round will be reduced because of the dampening effect of snow on shrapnel. Grenadiers may expect an increased number of duds due to the impact fuze not detonating in soft snow. Firing into trees for airbursts may be an effective option.

Grenades

The effective casualty radius is reduced due to the dampening effect of snow on shrapnel. Smoke or gas grenades must be tied to a platform to prevent sinking into the snow—one foot of snow absorbs most, if not all, of the smoke.

AT4 Light Antiarmor Weapon

The plastic sights and rubber end caps of the AT4 may become brittle and break or damage easily. Propellants burn slower and less efficiently in the

cold; hence, missile velocity is slightly decreased. Snow and ice buildup on the cocking mechanism can make the AT4 difficult to cock. Backblast area is increased due to unburned propellants, snow/ice projectiles, lack of vegetation to absorb the blast, and air density, making the AT4 susceptible to ice fog when those conditions exist. Reduce signature by choosing a firing position that is windswept or a crusted/frozen snow surface. Cover hands/face for firing in case slow burning propellants are still burning when the rocket exits the launch tube. Displace immediately after firing.

M153 Shoulder-Launched Multipurpose Assault Weapon

Propellants burn slower and less efficiently in the cold, causing missile velocity to be slightly decreased. When firing at temperatures below freezing, Marines should set the range drum selector switch to the blue mark to compensate for range drop in the cold. Users should ensure that the firing mechanism is clear of ice and snow.

Crew-Served Weapons Problems and Solutions

Because of the inherent complexity of crew-served weapons, more problems will arise in cold weather operations. The complexity of operations and subsequent problems encountered are far too difficult to cover in this publication; however, the major difficulties and solutions will be discussed in the following subparagraphs. For detailed operating instructions in a cold weather environment, refer to the particular technical manual pertaining to each weapon.

Machine Guns M60, M240G, M2, MK19

The following considerations should be made regarding machine guns:

- All machine guns have a high rate of breakage due, in part, to the cold and their high rate of fire, so gun crews should carry extra gear and bolt components.
- Short, violent recoil can be caused by slower burning propellants or by a frozen buffer mechanism. This shortened recoil results in the increased probability of breakage and malfunction.
- If temperatures are below -35 °F, all internal components should be lubricated with LAW. If LAW is not available, the weapon should be fired dry.
- Since ice fog greatly impairs the gunner's vision and identifies the gun's position, crews should be prepared to move to alternate positions.
- Firing platforms must be constructed to prevent the gun from sinking into snow, sliding on ice, or bouncing on frozen ground. Sandbags, MRE boxes, sleds (buffed and anchored), or evergreen boughs may be used to prevent sinking in snow or to cushion ice and frozen ground. Ski pole baskets may be wired to the bipod legs of medium machine guns for flotation. A sled may be used to provide a stable, yet mobile, platform for a tripod-mounted gun.
- Never place hot barrels directly on snow or ice because the sudden temperature change causes warping or cracking. The barrel may also sink out of sight causing a delay in changing barrels.
- Ammunition must be kept free of all snow and ice, but should be stored outside to stay at the ambient air temperature. Ammunition should be stored in its original container, raised off the ground 4 to 6 inches, and covered to provide protection from the snow.

Mortars

Seating the gun in snow and cold has the following considerations:

- Yokes and base plates on uneven or frozen ground have been known to crack at temperatures below -25 °F. When possible, a position should be selected that has vegetation under the base plate or sand bags can be filled with rocks, snow, and ice to buffer it. The buffer should be thick enough to provide shock absorption between the base plate and the frozen ground, but not so thick that the gun will bounce. If the

snow is too deep to dig down, a flotation base must be built on the snow for the mortar: digging to the ground and breaking it up is the most preferred method, the least preferred is to pack the snow and place logs or any suitable material firmly on the snow and then place snow-filled sand bags on top of the logs.

- Two Marines should man the bipod when seating the gun on ice or at high angle elevation.
- Sighting and fire control leveling vials will take longer to adjust due to the liquid thickening when cold.
- Marines should avoid breathing on the sights, as this will cause them to fog up.
- Aiming stakes can be placed by digging a hole, emplacing the stake, and then pouring water around the base and allowing it to freeze. Rocks or blocks of ice/snow may be used, but the melting of ice or snow may cause the stake to shift. This technique is called the chock method and is the most preferred. An ammunition can filled with rocks and dirt also works well.

  Note: The length of time in a position will dictate the method used to secure the aiming stakes.

- Variable time fuzes are preferred in snow due to their severe dampening on shrapnel effect, making airbursts preferable. Malfunctions will occur in direct proportion to the severity of the weather. Tests conducted at -25 °F showed a higher fuze failure at charge zero, but reliability increased when fired at a higher charge zone, such as one, two, three, or four.

Antitank Guided Missile Systems

All antitank guided missile systems (tube launched, optically tracked, wire guided missile [TOW]; Dragon; and Javelin) will operate effectively in cold weather down to -25 °F, which is the military specification criterion. Problems that can be expected include—

- During cold weather firing (10 °F and below), reliability of the TOW missile may be reduced due to blowout of the missile capstan block, which connects the launcher to the missile guidance wire.
- When firing in cold weather, the maximum effective range of the TOW missile is reduced.
- The TOW missile, Dragon, and Javelin can be operated at temperatures down to -25 °F and stored at temperatures down to -65 °F.
- Before firing the TOW, the night sight must be turned on and focused. The missile guidance system may select the night sight due to obscuration from ice fog or falling/blowing snow and the gunner may have no control over which sight is used.
- The backblast area is tripled.
- Snow glare may create difficulties in tracking the missile to its target for the TOW and Dragon. Eye protection should always be worn when looking through the sight.
- All exposed skin should be covered, including face, eyes, and hands to protect against burning launch propellants as the missile exits the tube.
- The Javelin has a slight drop when fired in the cold and should not be fired from partial defilade or reverse slope positions.
- The Javelin and Dragon are easily man-portable and emplaced in snow, but the TOW missile must be carried using a HMMWV.
- Marines may be needed to augment sled teams when moving bulk missile reloads.

Optics

Due to the delicate nature of optics, the following items should be considered when using them in a cold weather environment:

- *Night vision goggles*. The cold weather battery adapter and demisting shield should be used, but extra care must be taken when dealing with the moving parts because they may become brittle in extreme cold.
- *Thermal sights*. A cold weather environment enhances the thermal infrared signatures of targets unless weather conditions, such as falling snow, degrade them. An undisturbed snow cover will present a relatively uniform

and clutter-free background to a thermal infrared sensor if the snow is deep enough to completely cover a large area. Thermal camouflage, such as reflective insulation (space blankets) or one foot of snow on a field tarpaulin, can be used to defeat these systems; however, movement, such as ski, snowshoe, or foot, through snow will leave a thermal trail in the snow for a short time.

- *AN/PVS-4 light amplification sights*. The daylight cover should be used while on the move to protect the scene from snow and ice.
- *Lasers*. Visibility problems, such as ice fog and blowing snow, affect laser sighting. Lasing a snow- or ice-covered target may result in refraction of the laser up to several miles off target. The handheld laser rangefinder can only view for about 300 meters in heavy ice fog or snow due to light refraction. The human eye can see approximately 200 meters further in the same conditions. When the weather is clear, cold, and dry, the handheld laser rangefinder will be accurate to within 1 meter at a 10,000-meter range.

Demolitions

The cold affects the ability to employ demolitions effectively. The following considerations apply to demolitions:

- Handling becomes a team effort, due to the need to wear gloves.
- Plastic explosives, such as C-4, become very hard, making insertion of a blasting cap difficult unless done indoors prior to use.
- In extreme cold, C-4 has been known to shatter from the explosion of the blasting cap rather than to detonate.
- TNT [trinitrotoluene] blocks are excellent for use in cold weather for projects, such as hasty fighting or firing positions, due to the water resistance.
- Detonation cords become stiff, are difficult to tie, and will break easily in ECW.
- Time fuzes tend to maintain their curl when extremely cold. Unless done inside a warm shelter, uncurling usually results in breaking the fuze.
- Condensation also contributes to the increased chance of misfires. Misfire and hang fire waiting times should be doubled in a cold environment.

Fire Support Considerations in Mountain Warfare Operations

Ammunition

Storage and round effectiveness are to be considered for ammunition.

Storage

Proper storage of ammunition is paramount in extreme conditions as the cold weather may greatly affect the capabilities of the ordnance. Ammunition should be stored at the same temperature as its associated weapon system. If ammunition that is stored at inconsistent temperatures is fired, the fire direction center will have a difficult time maintaining accurate registration data. Consequently, the rounds will have varying ranges based upon how cold the propellant is, so proper handling and continual updating of propellant temperatures will help ensure effective gunnery.

Ammunition has a high malfunction/dud rate when brought from a warm environment to extremely cold temperatures due to condensation and freezing. The ammunition should not be stored inside tents or shelters that are warmed above freezing because the change in temperature can cause condensation. Projectiles, powder canisters, fuzes, and primers may freeze when exposed to the colder air, which may damage propellants, increase difficulty in handling heavy projectiles, or prevent the proper mating of fuzes and projectiles. Old firing positions can be effectively used as ammunition storage points.

When storing ordnance in the cold, it should be kept off the deck with at least 6 inches of air

circulating beneath the ammunition and as free of ice and snow as possible. The ammunition can be placed on dunnage or pallets and covered with a canvas tarp.

The effects of winter conditions on munitions will probably cause an increase in ammunition requirements due to a high dud rate, reduced visibility, and the decreased effects of ordnance in snow. Up to 80 percent of the fragmentation effects of the point detonating fuze can be absorbed by only 12 inches of snow. If the need for fuzes is improperly planned, an increase in ammunition requirements can occur because more rounds are being used to achieve the same effect on target. It may be necessary to establish predesignated levels of on-hand quantities and restrict firing when these levels have been reached. Every effort should be made to keep the basic load on hand to guard against interruption in resupply operations. Additionally, history has shown that ammunition requirements will increase two to four times for night operations due to more indiscriminate weapons firing.

Effects of Rounds

During extremely cold periods when temperature changes are sudden, the ballistic characteristics of weapons and ammunition are different than expected because the standard temperature for the firing table is 70 °F. Indirect fire support range errors of 100 meters short for each 1,000 meters of desired range can occur because the propellant burns slower and the round has a slower muzzle velocity when exiting the weapon system. For example, a 2,000-meter shot may fall 200 meters short of the target in ECW.

On frozen ground, ice-covered ground, and/or rocky terrain, point detonation will increase the fragmentation of high explosive (HE) rounds due to the secondary fragmentation effects from the terrain. Fuze quick is ineffective in snow-covered terrain because up to 80 percent of the fragmentation is absorbed; hence, proximity or variable time fuzes should be used in snow-covered terrain. A delay fuze is used for frozen waterways, such as lakes or deep rivers. In this case, the water is used as tamping in order to heave up and break up more ice. More casualties can be caused by drowning and cold weather injuries than by fragmentation.

During extreme cold, the rate of fire will be slow until the weapons have warmed up, especially with weapons that have a hydropneumatic type recoil. The rate of fire is also affected because users react slower and less deliberately in a very cold climate, so keeping personnel warm is of prime importance.

Smoke rounds and white phosphorus (WP) smoke can be used very effectively for marking air, but Marines must consider the following:

- The rounds must be deployed above the snowpack so the snow does not absorb the smoke.
- The color of the smoke must contrast with the snow or WP if in a wooded or nonwhite background.
- Illumination rounds are not very effective for adjusting close air support (CAS); however, they aid forward observers. The smoke cloud that the round makes helps artillery or mortar forward observers locate the spot of the round; whereas, an HE round is difficult to see.

Phosphorus shells, although producing desired smoke, contaminate the area of impact with phosphorus particles, which may remain buried under the snow. These particles will affect the targeted area and surrounding areas during the spring melt-off much like chemical weapons.

Family of scatterable mines (FASCAM)/dual-purpose improved conventional munitions (DPICM) have the following characteristics:

- Rapid temperature changes may cover or expose FASCAM/DPICM, rendering them ineffective.
- FASCAM/DPICM may come to rest in the snow at angles that cause a less effective, nonkilling orientation of some of the mines.
- The same applies for ground mine dispensers that shoot out mines from canisters.

Fire Support Assets

Fire support assets must be as mobile as the force that they support; therefore, clearing roads of snow is essential. Avalanche-prone slopes should be considered in the fire plan. Thousands of troops were killed in World War I on the Italian-Austrian front because of avalanche-initiating supporting arms. The enemy can also initiate avalanches by their supporting arms on Marine units as they cross on or below avalanche-prone slopes. Planning fires to initiate avalanches also mitigates this potential enemy threat. Engineer assets need to be positioned forward to clear roads, if applicable, when using this method.

Mortars

Mortars are the most dependable of supporting arms in mountainous, snow-covered terrain.

Artillery

Marines must make the following considerations regarding artillery:

- Artillery offers the longer range required and can be positioned further to the rear; nevertheless, it is often limited by higher terrain crest clearance and mobility.
- The advantage of medium-weight howitzers is that they have to displace less and have longer ranges, adding more firepower and flexibility to maneuver elements during operations. Increased amount of dead space cannot be covered by artillery, depending upon the positioning of the howitzers.
- Artillery is difficult to move in snow-covered terrain because it is carried largely by 7-ton trucks, which limits gun line selection to flat areas next to a maintained MSR. There are few MSRs in a winter mountainous environment and the BV-206 is not capable of towing artillery, but transport may be available by helicopter.
- The ability of artillery to maneuver on and off roads is restricted due to its size and weight.
- Defensively, well-positioned artillery batteries can deny advancing enemy units use of MSRs and likely avenues of approach.
- The rate of fire for artillery will be slower until the recoil system warms up and, when firing at a high angle of fire, the rate of fire will be slower because of breech loading (lowering and raising the tube between each round). Probable error in range is greater for high angle fires than low angle fires, which results in higher reliance on tabular firing tables for high angle fire.
- In snow, artillery must be dug in all the way to the ground.
- Meteorological data is generally only consistent to 20 kilometers, resulting in the need for individual meteorological capability for disaggregated positions.

Naval Gunfire

Naval gunfire, if available and within range, will be limited by its flat trajectory. Fire support stations with several alternate stations in phased sequence may be required due to mountain corridor angles, instead of the more flexible fire support areas. This support will permit shifting ships to support the operation, allowing them to be prepositioned to fire up valleys and corridors. In areas, such as Norway or the Aleutian Islands, the Marine air-ground task force (MAGTF) will most likely be amphibious with its own naval gunfire capability. The capabilities of this asset will be restricted by mountainous terrain and the extended coastal shelves found in these theaters. Targets in valleys or on reverse slopes will be very difficult to effectively engage due to the flat trajectory and high muzzle velocity of the rounds. The advantages of naval gunfire are that the weapon systems are neither affected by environmental conditions nor by limited rounds or sustainment considerations.

Close Air Support

Tactical air operations provide the most mobile and often the most economical fire support available. The hazards of flying place some limitations

on the use of low-flying aircraft, but the restrictive nature of the terrain and limited road networks present many opportunities for aircraft to render critical support, particularly against enemy positions on reverse slopes. Terrain may also limit attack options available to forward air controllers (FACs), who must be ski or snowshoe trained, and pilots.

Mountain/cold weather operating areas are constantly plagued by foul weather, which may sometimes prevent aviation capabilities for extended periods. Command and control may prove to be difficult due to impeded communications in Polar Regions and visibility encountered by FACs. On the other hand, CAS is less affected by climate and can play a key role in fire support in the cold.

Rotary-wing CAS at high altitudes is characterized by reduced ordnance/time on station due to reduced lift capability. Rotary-wing support is not usually used between 10,000 and 12,500 feet.

This environment is limiting to CAS aircraft. Typically, CAS missions are completed the same way as in a temperate, low-lying area. The limiting factor is the ability to get the bombs on the target. It is much more difficult to pick out targets or even see the mark in terrain that is characterized by steep valleys, rapidly rising mountains, different colored rocks, trees, and grasses. This terrain may be coupled with other challenges, such as dead space due to surrounding terrain for artillery/mortar rounds to mark or the inability for a FAC to maneuver into a position to make good corrections.

Marking for targets in a winter environment is similar to doing so in a temperate environment with the exception of a few nuances. Joint Publication 3-09.3, *Close Air Support*, describes numerous ways to mark for CAS aircraft. The following subparagraphs discuss some of these techniques and how a snow-covered environment may affect them.

White Phosphorous. The most popular mark used in training environments today is WP. Whether in the desert, jungle, or coastal plains, this mark provides the pilot with an adjustable, distinctive reference point. In a snow-covered environment, however, WP may prove almost useless since discerning a white cloud of smoke out of a white background from high altitudes is next to impossible. It is possible, though, to use WP for aircraft at low altitudes. For example, a helicopter that provides CAS or an A-10 that can remain low and at relatively slow airspeeds will still be able to see the vertical development from the white smoke. As an aircraft increases in altitude, this vertical development becomes increasingly difficult to discern. For night CAS, WP may still prove effective because it reflects off the snow.

An important aspect of CAS and marking is the reduction of effects from the blast. Studies by the Cold Regions Research and Engineering Lab have shown up to an 80 percent reduction in the blast effect of a round/bomb that detonates in the snow (depending on snow depth). Hence, it is important to have a good mark in order to generate desired effects on the target. This may also affect suppression of enemy air defense missions that are being conducted in conjunction with CAS.

Colored Smoke. Colored smoke is available in 105-mm rounds, which the Marine Corps no longer uses; however, other Services (US Army) and coalition forces use the 105-mm rounds so the information is included here. The round is equipped with a mechanical time fuze and several base-ejecting smoke canisters. The height at which the round is activated can be adjusted to provide colored smoke streamers from a point over the target down to the target. The round activation height should be as low as possible, but still able to get the desired effect. If the round is activated too high, the dispersion of the canisters when they hit the snow will be too great to pinpoint the target. Increased smoke from the canisters can also obscure the target.

Illumination Round. An illumination round on the deck to mark will quickly melt through the

snow. The round should be timed to detonate at an altitude above the ground that will allow the pilot to obtain a visual before it disappears into the snow. The difficulty will be for the FAC to make a correction from the round while it is still descending. This challenge, coupled with the instability of the mark due to winds from the time the correction is given, make this technique difficult. These factors are dependent upon the depth of the snow, but this option may be useful at night due to the amount of light that will be reflecting off/through the snow.

Laser. The laser systems are still useful in a snow-covered environment. One consideration is the reflectivity of snow/ice and how that may affect the laser energy. There have been documented cases during exercises in Norway of missiles tracking off the reflected energy from a laser.

High Explosive. These rounds may work well in this environment for marking depending upon the snow depth, since a dark cloud of debris may be easier to discern against the white background. When using HE rounds, bear in mind the path of potential avalanches out of the target zone so that friendly personnel do not become collateral damage.

Low Altitude Air Defense

Use of the Stinger weapon system in mountainous terrain requires considerations, such as—

- Elevated firing stations will provide a greater area of coverage, but may permit enemy air assets to transit below the position with relative safety.
- Conversely, firing stations on low ground will restrict coverage and mask possible targets.
- In cold, there is increased missile warm up time and a slower engagement sequence due to cold weather clothing.
- The Stinger can be fired down to -40 °F and stored to -50 °F.
- Personnel within 50 meters of a launch at -25 °F or below must hold their breath for 20 seconds.

WARNING

Inhalation of argon exhaust gas can be fatal; the dissipation time in the cold is slower.

Nonlethal Fires

Even when employing nonlethal tactics in mountainous/cold weather terrain, the following must be considered:

- *Information operations*. Compartmentalized terrain leads to isolated, often very different human terrain within relatively short lateral distances, requiring specialized products/materials. Effectiveness of equipment may be affected by complex terrain. Radio in a box and long-range acoustic devices are limited in distance.
- *Civil-military operations*. There is an increased security footprint necessary to mitigate dead space and potential enemy avenues of approach, such as when conducting medical civic action programs. The reparation process also takes longer due to the increased time it takes to travel to remote and isolated valleys.
- *Electronic warfare*. There are line of sight limitations when using improvised explosive device (IED) defeat equipment. There are force protection implications when considering how terrain affects electronic warfare capabilities.

Emplacement, Positioning, and Camouflage

Emplacement, positioning, and camouflage of guns must be considered in a cold weather environment.

Emplacements

Before occupying a position, the terrain should be carefully reconnoitered and gun positions, traffic lanes, and snow parapets should be prepared. Even in deep snow, bulldozers will be needed to dig all the way down.

Positioning

If no suitable position can be located off the MSR, positioning immediately adjacent on the

shoulders or in one lane can be substituted. Positions on commanding terrain should provide defilade. The relative scarcity of good firing positions increases the probability of receiving enemy fires when occupying a desirable position. Good gun positions are hard to find and are selected for flash defilade, cover, and accessibility to road networks and LZs. Positions on commanding terrain are preferable to low ground positions because they—

- Have less chance of being struck by rockslides or avalanches.
- Have a reduced amount of dead space in the target area.
- Are less exposed to small arms fire from surrounding heights.
- Avoid flooded, marshy areas during spring snow melt.

Camouflage

Camouflage discipline must be strictly enforced. Marines may have limited camouflage by using paints and nets, but tracks left in the snow cannot be effectively covered except by fresh snowfall. Vehicles and troops must move only on designated trails and roads.

Fire Support Planning

Considerations for fire support planning are—

- Rugged terrain and reduced mobility place increased reliability on artillery fire support and planners must consider the increased consumption rate of ammunition. The duration of a suppression mission will take longer to cover the slower moving unit.
- Communication between supporting fire elements and maneuver elements and the coordination of fire with organic infantry support weapons requires special attention. Retransmission sites may often be necessary.
- An infantry attack over rising terrain is easier to support than one over descending terrain. In the final stage of the attack, organic infantry support weapons may provide the most effective fire support.
- Fire support must be closer to maneuvering elements than normal to be effective.
- Combat outposts should normally have priority of supporting fires.
- Observed fires should cover obstacles, barriers, and dead space.
- More suppression missions and fewer destruction missions should be planned in snow or compartmented terrain.
- Frozen waterways, which are avenues of approach in the winter and not obstacles, should be covered.

Targeting

Because of the decentralized nature of mountain/cold weather operations, targets warranting massed fires may present themselves less often than in open terrain. Narrow defiles, used as routes of supply, advance, or withdrawal by the enemy, may be profitable targets for interdiction fires or heavy surprise concentrations. Large masses of snow or rocks above enemy positions and along MSRs are also good targets.

If a barrier is desired when targeting frozen waterways, then the ice must be breached daily, depending on temperatures, to avoid refreezing. If the enemy is likely to cross it, a perpendicular sheaf to the enemy will split his forces on each side of the ice obstacle. If the enemy is using it as an MSR, parallel sheaves to the enemy will kill as many as possible. If the enemy reaches the safety of the banks, airbursts should be used. Only one round in effect to breach ice using a delay fuze. The sheaf in effect is shifted and repeated based on the

length of the column or the enemy's attempt to maneuver around unbroken ice.

Fire Control

Gunnery can be difficult because—

- High angles of fire increase the time of flight for rounds to impact and the time between each round due to breech loading.
- Vast reverse slope areas are hidden from observation.
- There are increased amounts of dead space, which cannot be hit by artillery fire.
- There are usually differences in altitude between firing units and targets.
- Most indirect fires are observed, especially close support and defensive fires. Unobserved fires are frequently unreliable, since weather conditions change rapidly and registration corrections for high-angle fire are fleetingly valid.
- Firing tables must be constructed during extreme cold due to the slow burn of propellants. Many variables, such as temperature of the air and propellant, winds, barometric pressure, altitude, and humidity, must be entered into the fire direction center computer, which may be an advantage depending on the opposing force capability.
- Communication can be unreliable and may be the biggest obstacle to overcome. Digital is preferred to voice and SATCOM may be all that works in such extreme terrain.

Observation and Adjusting Fire

The forward observers will be greatly affected by highly compartmented, mountainous terrain when calling and adjusting missions and must remember that—

- The capabilities of aerial observers should be exploited, particularly for the adjustment of fires in dead spaces.
- Those adjusting indirect fire need to understand that a shift of deflection will often also affect range if on a slope. This spatial problem will cause more rounds in adjustment than on flat ground.
- During the winter months, good observation is limited due to short periods of daylight; however, reflected light caused by snow cover greatly enhances night observation and can be a valuable asset. Snow cover also reduces depth perception and obscures ground features and landmarks.
- Ice fog can limit observation during adjustment, if the conditions exist for it.
- Lasers can reflect off of ice or smooth snow when designating targets.
- Ground bursts may be difficult to observe due to the dampening effect of the snow. Preliminary adjustments may have to be made off airbursts.
- In compartmented terrain, there will be an increased number of lost rounds.
- Sheaf elongation will occur on slopes. The steeper the slope, the more spread out the sheaf will become, reducing the effect on the target.
- A forward observer inexperienced in compartmented, snow-covered terrain will likely call a few ineffective missions at first. This possibility should be planned by using computer simulators and walking rounds up, down, and oblique on a slope at a compartmented firing range.

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CHAPTER 12
LOGISTICS AND SUSTAINMENT

Logistical Considerations in Mountain Warfare Operations

For good leaders to properly prepare for success before execution, they must ensure that their plan is logistically supportable. The leadership of a unit should be constantly asking, "What does the unit need and how does it get the supplies and equipment to achieve the mission tomorrow, or the next week, or the next month?" Success on the battlefield is the primary concern. Failures in logistic planning can be lethal in a mountainous/cold weather environment. Each function of combat service support has considerations unique to mountain/cold weather operations.

Principles of Logistics in Mountain Warfare

The following simple, brief principles should be remembered when planning logistics:

- Logistic planning is good leadership.
- A sound logistic plan is essential to mission accomplishment.
- Transportation of supplies requires more time.
- Aircraft performance is severely degraded.
- Health service requirements are greatly increased.
- Essential equipment must be safeguarded.
- Measures must be taken at the individual level to safeguard sustainment.

Transportation

The main logistical differences between mountain operations and operations in other terrain are a result of the problems of transporting and securing material along difficult and extended lines of support. Any proposed support structure must plan for a redundant ability to distribute supplies directly to units operating from predetermined supply routes. Some forms of transportation used to supply units are air, helicopter, motor vehicles, and animal packing.

Air Delivery

Fixed-wing aircraft have the ability to air drop supplies in rural areas where surface resupply may not be feasible. In the past decade, great strides have been made in the field of aerial delivery with technology advancing to the point that supplies weighing as much as 10,000 pounds can be delivered an average of 150 meters from its target from altitudes as high as 25,000 feet.

The most recent technology is called the Joint Precision Airdrop System, which is a family of GPS-guided parachute systems. The parachutes vary in the amounts of weight they are capable of delivering and the Marine Corps uses three different versions—750 pounds; 2,000 pounds; and 10,000 pounds. Each system consists of the canopy and an airborne guidance unit. Prior to being deployed from the aircraft, a GPS coordinate is entered into the airborne guidance unit and guides the parachute in a planned trajectory. The system has been proven to be accurate within 75 meters of its intended target.

Drop zones are few in mountainous environments and accuracy is low due to steep terrain. Drops are best made in relatively secure meadows or valley floors. Supplies delivered to units on ridgelines or mountain peaks have a low rate of recovery. Door bundles thrown out of helicopters are better suited for mountain peaks and ridgelines. Air delivery should never be the primary method of resupply because of its cost in equipment and limited capabilities. It should be planned as an emergency reserve that is employed when other options are not practical.

Helicopter Support Teams

Helicopters should be employed as much as possible to increase responsiveness. They have a decreased lift capability at upper altitudes and an increased capability in colder weather; however, colder temperatures cannot make up for the high altitude deficiencies. Helicopter support teams must coordinate extensively concerning their need for trained personnel and regarding each helicopter's capabilities in the lift and drop LZs. Weather can also determine if helicopters can be employed. Redundant modes of transportation must always be planned when employing helicopters.

Motor Transportation

Historically, vehicles have been employed in severe weather and terrain conditions successfully and unsuccessfully. Creativity, such as supplying besieged cities by driving across frozen lakes and employing antiaircraft weapons on vehicles against ground targets on steep terrain, has fulfilled the needs of modern warfare. Most vehicles are not designed to perform at their optimal capability in extreme cold, at high altitudes, or in complex and compartmentalized terrain. Fuel consumption rates increase by up to 75 percent while carrying capacity is reduced by 20 to 25 percent. Factors that must be considered are—

- Plastic becomes brittle and belts snap if not warm.
- A starter should not be initiated for more than 15 seconds because it could burn out and drain the battery in one attempt.
- Vehicles should not be jumped or slaved head to head. If they "jump," they could kill people or damage the vehicles.
- Half water-half antifreeze mixture is stable down to -32 °F.
- At 0 °F, straight 20 weight oil is best because it does not gel and allows engines to start with less drag.
- Below -15 °F, vehicles should run constantly.
- Chains should be inspected before and during employment. Tire pressure must not be changed after chains have been applied and all hooks on the chains should face away from the tire. After the season, chains should be wire brushed clean, dipped in crankcase oil, drip dried, and then stored in a burlap or canvas bag.
- A covered vehicle usually sustains less damage. All doors, windows, and hatches should be closed, if possible.
- Vehicles should be gradually warmed or defrosted because windshields will crack when shocked with a change of temperature.
- Snow and ice should be cleared from steering and tracks with a wooden stick, such as a broom handle or a shovel handle, because an ice-covered steering mechanism can break.
- Drivers should slow down because the environment necessitates an extended stopping range and vehicles in front kick up mud and snow.
- The vehicle going uphill has the right of way and vehicles parked on slopes need to be chocked with big anchors because they will gradually slide.
- No one must ever sleep in a running vehicle because the carbon monoxide (CO) buildup is fatal.
- The small unit support vehicle/BV-206 has specific considerations—
  - It must never be sent out without a radio.
  - In 0 to -15 °F, vehicles should run 15 minutes per hour.
  - When using vehicle-powered radios, vehicles should run 15 minutes per hour.
  - When stopping for prolonged periods, grills should be covered.

Animal Packing

The transportation of supplies using pack animals can greatly support units operating for extended periods, away from a ground MSR and especially for units on ridgelines. The MCMWTC

is the only Department of Defense school currently training personnel and units in the employment of pack animals. A pack animal can carry between 50 and 300 pounds, depending on the type of animal available. Using pack animals will require acquiring them within the area of operations. Refer to MCRP 3-35.1E, *Special Forces Use of Pack Animals*, for more information.

Supply

Because of the burden on transportation, supplies should be prioritized and limited to essentials. The individual Marine's load should be lightened as much as possible. Certain items, such as demolitions, will most likely have an increased demand. Supply sources and limitations from the environment and even the enemy must be considered as should resupply options. Supply route considerations include—

- Existing roads should be rapidly analyzed for bottlenecks (prime IED/ambush locations), deployment areas, passing places, and turnaround locations for various vehicles.
- Routes should be classified as one- or two-way and staggered schedules developed for the use of one-way routes.
- Signs should be placed for both day and night moves on difficult and dangerous routes.
- Whenever possible, separate routes should be designated for vehicular and dismounted movement. Additionally, separate routes should be designated for wheeled and tracked vehicles, particularly if the latter are likely to damage road surfaces.
- Mountain pickets and overwatch should be in place to observe likely ambush locations.
- If operating in an IED-intensive area of operations, counter-IED SOPs must be employed for route clearance; however, mountain pickets are still needed for the safety of route clearance vehicles and personnel at likely ambush sites. Convoy operation SOPs should be rehearsed.

During operational pauses, Marines should stockpile and cache supplies to reduce future demands during combat operations. High altitude operations increase personnel energy requirements by as much as 50 percent and, coupled with cold temperatures and increased physical activity, may make Marines' missions a secondary thought to surviving. Four MREs per day should be carried for increased caloric requirements. Other options include the long-range reconnaissance ration; meal, cold weather (MCW); and First Strike Ration. Even with extra rations, weight loss is a characteristic of operations in high altitude.

Convoy Operations

Objective hazards for convoy operations are visibility, weather, and terrain.

Visibility

Fog, rain, and blowing snow can lead to disorientation. Marines should note their exact position and plan their route to safety before visibility decreases. Cold combined with fog can cause a thin sheet of ice to form on rocks. Whiteout conditions can be extremely dangerous.

Weather

Weather conditions in the mountains may vary from one location to another as few as 10 kilometers apart. Approaching storms may be hard to spot if masked by local peaks. A clear, sunny day in July could turn into a snowstorm in less than an hour. Emergency gear must always be available and conditions constantly evaluated. Under certain conditions, it may be advisable to re-evaluate unit capabilities. Pushing ahead with a closed mind could be disastrous for the mission and the unit. In winter months, mountain passes close due to heavy snowfall and avalanches and there is a loss of flight days due to cloud cover. In the summer months, the spring floods increase the chance of vehicles getting stuck or swept away by water.

Terrain

Route reconnaissance should determine likely ambush locations, which are predominately canalizing areas. Although valleys will most often be the easiest route, they may also prove to be the most dangerous since it is very difficult to engage an enemy that maintains the high ground. Route reconnaissance and mountain picketing should also focus on maintenance/recovery challenge areas, equipment collection points, locations where vehicle rollovers are likely, and the estimated maximum throughput of vehicles on a road network or bridge. Due to the increased travel times associated with moving in high altitude, combat trains should be positioned as close to the tactical unit as possible.

Engineering

The engineering capabilities of most units may be inadequate for the massive requirements of a mountainous/cold weather environment, so creative employment and augmentation must be considered. The demands may require a combined effort of all engineering units, yet the requirement to attach engineers to all units also exists due to isolation and difficult terrain. Increased demolition training for Marines who are not engineers should be conducted. Unit pioneer kit augmentation, such as adding snow shovels, ice augers, and chain saws, is also advised.

Mobility/countermobility will be the priority of the entire operation, but the earthmoving vehicles generally employed for these operations have difficulties in severe terrain and break down often. They can become an obstacle and add to the problem. Demolitions are used in much greater numbers than in most other environments.

Historically, mines have been employed in mountainous regions because of their quick ability to block entire geographical areas from foot and vehicle movement. Increased education on detection and clearing must be conducted and SOPs established. More detail can be found in Marine Corps Center for Lessons Learned reports from recent mountain warfare operations, such as Operation Enduring Freedom, for SOP development.

Maintenance

Operations of equipment in mountainous terrain have proven that maintenance failures far exceed losses due to combat and most breakdowns can be

> The most serious accidental risk is vehicle rollover. The terrain here is extremely dangerous. A good driver's training program will help prevent it, but they are still going to happen. I think the most important thing is to rehearse rollover drills and ensure everything in the truck is tied down IAW [in accordance with] the load plan. This will go a long way towards preventing injury when a rollover does happen. Also, using the HEAT [HMMWV egress assistance] trainer, to show soldiers what it feels like when the truck is about to rollover, helps.
>
> —Capt Ryan Workman, 10th Mountain Division, OEF VII
> Marine Corps Center for Lessons Learned Report
>
> Speaking of terrain, it is really canalized, and there aren't a lot of options as far as getting from point A to point B. With the cell phone coverage, the enemy can easily call ahead to let people know your route. The IED threat is very real and because of the terrain—irrigation canals, culverts, etc.—it is extremely difficult to predict."
>
> —Capt Jason Toole, 10th Mountain Division, OEF VII
> Marine Corps Center for Lessons Learned Report

attributed to the lack of or improper operator training. Training on all levels concerning environmental factors on vehicles and equipment should be considered. Preventive maintenance requirements must be supervised to ensure vehicle and equipment readiness. Operators need to maintain—

- *Tires*. A minimum of one extra tire per vehicle should be completely assembled to save time during combat operations. If possible, feasible, and economical, aftermarket tires with greater ply in the sidewall are recommended because most tire failure is due to sidewall blowout.
- *Batteries*. The vehicles should be equipped with a maintenance free, gel-type battery vice standard batteries.
- *Class IX*. Table 12-1 shows a list of parts the battalion should bring in addition to its standard Class IX block.

Health Services

Medical evacuation, CASEVAC, and Class VIII medical supplies are health service considerations.

Medical Evacuation

Transportation of casualties from a combat zone health care facility to a health care facility located outside the combat zone is conducted by vehicle or aircraft. It is a more administrative operation, usually conducted in less severe terrain since hospitals are few and far between in mountainous areas.

Casualty Evacuation

A well-led unit has a sound CASEVAC plan, which describes the process of moving casualties from a combat area to a health care facility. Transportation of casualties on foot, on a pack animal, on a sled over snow, in a vehicle, or in a helicopter can all be employed in a mountainous/cold weather environment, but all take much longer than in other environments. Litter teams require more personnel to move the casualty in compartmentalized terrain or at high altitude.

Table 12-1. Additional Class IX Block Considerations for Mountain/Cold Weather Operations.

Item	Quantity
Power steering pumps	2 per 10 vehicles
Steering gear box	1 per 10 vehicles
Heavy duty springs and shocks (for rough terrain, if not already on vehicle for additional armor)	2 per vehicle
Tires	1 spare per vehicle
Pitman arms	1 per 5 vehicles
Idler arms	1 per 5 vehicles
Upper and lower ball joints	1 each per 2 vehicles
Inner and outer tie rod ends	1 each per 2 vehicles
Front and rear tie rods	1 each per 2 vehicles
Half shaft bolts	10 per vehicle
Front and rear half shaft	1 each per 10 vehicles
Inner and outer constant velocity boots	1 each per vehicle
Gear hub input and output seals	2 each per vehicle
Differential yokes	1 per 20 vehicles
Gear hub plate bolts	25–30 total in PEB
Brake pads	2 each per vehicle
Brake rotors	1 per 10 vehicles
Front and rear brake lines	1 of each per 5 vehicles
Alternator mount bolts	1 set each per 5 vehicles
Starter mount bolts	1 set each per 5 vehicles
Power steering pump mount bolts	1 set each per 5 vehicles
Water pump	1 per 10 vehicles
Serpentine belts	1 per 5 vehicles
Air filters	2 per vehicle
Gel-type batteries	2 per 5 vehicles
Hardback door hinges	4 per vehicle
Hardback rear hatch shocks	2 per vehicle
Glow plugs	1 set of 8 per 5 vehicles
Glow plug controller	1 per 5 vehicles
Protective tool box	1 per 10 vehicles
Legend: PEB—pre-expended bin	

Class VIII Medical Supplies

The severe nature of a mountainous/cold weather environment greatly increases the demands for medical supplies. The standard individual issue should be increased accordingly.

Services

Services, such as postal, administration, legal, and exchange, are very difficult to support in a mountainous/cold weather environment. Efforts should be made to satisfy communication with others through a postal service, but most other services will not be able to be provided outside a base camp installation.

Force Protection

Force protection is not a function of combat service support, but it should be an organic capability in all environments. Force protection in a mountainous environment should be additionally emphasized because of the close terrain and predictable desire of any enemy to cut off or destroy logistic support from the combat arm's units. Dispersion of assets is a force protection and a flexibility issue.

Individual Sustainment

Self-sustainment measures must be employed at the individual level with regard to Class V, Class I, and Class II supplies.

Class V Ammunition

Certain types of ammunition, such as M203 grenades and demolitions, will be employed much more in mountainous terrain. While the individual Marine should attempt to travel as light as possible, ammunition should never be deficient.

Class I Water/Food

Ration requirements increase in severe terrain from 3,000 calories per day to approximately 4,500 calories per day for each Marine. A 180-Marine line company would need to be supplied with 315 cases (approximately 6.5 pallets) of MREs or MCWs to sustain a 3,000 calories per day diet for one week. Water requirements will increase as well in a mountainous/cold weather environment and Marines should make every effort to get water from the environment using chemical purification, boiling, filtration, or other methods. The MAGTF logistics combat element will most likely have reverse osmosis water purification systems for bulk water purification; however, smaller maneuver elements can self-support, making their own water by melting snow with small unit expeditionary stoves (SUESs) during the winter and by using commercial filters or iodine tablets during summer.

Class II Clothing/Personal Equipment

Personal equipment should be adequate for the environment and safeguarded by the individual because its loss could be life threatening and replacement may take days or weeks. Equipment and clothing should be constantly inspected by the chain of command. Table 12-2 lists required and suggest gear, along with sources of supply.

Mountain Warfighting Load Requirements

Combat operations in a mountainous/cold weather environment require Marines to use additional specialized gear in order to survive and negotiate terrain. Because of this increased requirement, each Marine's individual load will increase. The three warfighting loads—assault, combat, and existence—will assist unit leaders in determining appropriate levels of clothing and equipment for multiple situations. Applying these loads will ensure the safety of each Marine and maximize each Marine's tactical efficiency. Due to the severity and unforgiving nature of a mountainous/cold weather environment, each Marine shall also be required to carry a survival kit and the six pocket items described on page 12-10.

Table 12-2. Unit Clothing and Equipment for Mountain/Cold Weather Operations.

Organic Individual Mountain Equipment		
TAMCN	**Nomenclature**	**Quantity**
C5652	Gore-Tex® jacket	1 per
C6632	Gore-Tex® trouser	1 per
C3421	MSS (with bivy cover)	1 per
C1055	Watch cap	1 per
C3310	Isopor mat	1 per
C3400	Field tarpaulin	1 per
C3270	Field tarpaulin liner	1 per
C3060	Canteens	2 per
C3130	Canteen covers	2 per
	CamelBak®	1 per
C1261	Polypropylene/capilene top	2 per
C1091	Polypropylene/capilene trousers	2 per
C1107	Gloves, leather with green liners	1 per
C3498	LBV	1 per
C1250	100-weight fleece top	1 per
C3150	First aid kit, individual	1 per
C3215	Helmet, Kevlar®	1 per
	ILBE pack	1 per
V4561	Ski poles (optional)	1 per
Unit Equipment Requirements		
TAMCN	**Nomenclature**	**Quantity**
V00132B	SUES (stove)	1 per 2
K45232E	MACK (climbing kit)	1 per company
V4652	ECW tent (4-man tent)	1 per 4
Organic Individual Winter Equipment		
TAMCN	**Nomenclature**	**Quantity**
C5652	M/CWCS parka (Gore-Tex® top)	1 per
C6632	M/CWCS trouser (Gore-Tex® bottom)	1 per
C3421	MSS (with bivy cover for ECW)	1 per
C1055	Watch cap	1 per
C1120	Contact gloves	2 per
C3310	Isopor mat	1 per
C3400	Field tarpaulin	1 per
C3270	Field tarpaulin liner	1 per
N/A	ILBE Hydration System CamelBak®	1 per
C3060	Canteens	2 per
C3130	Canteen covers	2 per
C3040	Belt, individual	1 per
C1261	Polypropylene/capilene top	2 per
C1091	Polypropylene/capilene trousers	2 per
C1107	Gloves, leather	1 per
C3498	Suspenders/LBV	1 per
C3150	First aid kit, individual	1 per

Table 12-2. Unit Clothing and Equipment for Mountain/Cold Weather Operations. (Continued)

Organic Individual Winter Equipment (Continued)		
TAMCN	**Nomenclature**	**Quantity**
C3215	Helmet, Kevlar®	1 per
C1250	100 weight fleece top	1 per
C5440	ILBE pack	1 per
N/A	ILBE main waterproof bag	1 per
N/A	ILBE assault waterproof bag	1 per
N/A	Marine compression sacks	4 per
Unit-Issued, Facility-Supported Individual Equipment		
TAMCN	**Nomenclature**	**Quantity**
C0115	(FR) silkweight undershirt	2 per
C0116	(FR) silkweight drawers	2 per
C0117	(FR) midweight pullover	1 per
C0029	(FR) midweight drawers	1 per
V0017	Lightweight exposure suit jacket	1 per
V0018	Lightweight exposure suit trouser	1 per
V4126	Jacket, Windpro® fleece	1 per
V0015	ECW parka	1 per
V0016	ECW trouser	1 per
V0014	ECW bootie	1 per
VG003	ECW mitten system	1 per
VG003	Removable mitten liner	1 per
VG003	Mitten shell	1 per
VG003	Light duty glove insert (FR)	2 per
V4160	VB boots	1 per
V4320	Snow camouflage parka	1 per
V4390	Snow camouflage trouser	1 per
V4480	Snow camouflage pack cover	1 per
V4652	Tent, 4-man (ECW)	1 per 4
V4340	MCCWIK	1 per 4
V4005	Balaclava	1 per
V4601	Ski, military	1 per ISR asset
V4431	Binding, ski	1 set per ISR asset
V4561	Pole, ski	1 pair per
V4355	Snowshoe, modular steel traction	1 pair per
V4635	10-man arctic tent	1 per 10
V4550	Space heater, arctic (Yukon)	1 per 10-man tent
K4128	Fuel cans (use with heaters)	1 per 10-man tent
V00132B	SUES (stove)	1 per 2

Legend:
FR—flame resistant
ILBE—improved load-bearing equipment
ISR—intelligence, surveillance, and reconnaissance
MCCWIK—Marine Corps cold weather infantry kit
MSS—modular sleep system
TAMCN—table of authorized materiel control number
VB—vapor barrier

Assault Load

In addition to the basic uniform requirements, the assault load is defined as the equipment needed for short duration missions, such as security patrols, or during an assault. These items are carried at all times when away from the bivouac site:

- Extra insulating layer. This layer (usually the 100 weight fleece pullover) is in addition to what Marines are wearing with the basic uniform requirement.
- Cold weather hat or balaclava.
- Extra socks and gloves.
- Protective layer (M/CWCS parka and trousers).
- LBV/LBE, including—
  - Two quarts of water.
  - First aid kit (complete).
  - Canteen cup.
  - Ammunition.
  - Improved load-bearing equipment (ILBE) assault waterproof bag.
- Helmet with camouflage cover and flak jacket. This equipment should be appropriate to the environment with respect to the camouflage pattern and weight. The higher the altitude, the less personal protective equipment is practical to enable alert maneuver.
- Field stripped rations for use when away from the bivouac site.
- Individual mountaineering equipment is carried as required. A standard set of individual mountaineering equipment consists of one sling rope (15 to 18 feet), two carabiners (one locking and one nonlocking aluminum), and one pair of rappelling gloves.
- Specialized mountaineering equipment is carried as required. Examples include—
  - Over-the-snow mobility equipment—either skis (to include wax kit, skins, and poles) or snowshoes (modular steel traction snowshoe [MSTS] or trail/magnesium).
  - Repair/replacement items.
  - Overwhites (parka, trouser, pack cover, helmet cover, and over mittens).
  - Probe poles (one per buddy team, from Marine Corps cold weather infantry kit [MCCWIK]).
  - Shovels (one per buddy team, from MCCWIK).
  - Transceivers (one per man with extra batteries, if traveling in avalanche terrain as part of a small intelligence, surveillance, and reconnaissance [ISR] team). The tactical situation may preclude their use due to the possibility of being compromised by the international frequency.
  - MACK items, such as rock/ice/snow protection, ropes, cable ladders, harnesses, crampons, and ice axes.
- Isopor mat.
- Mission-essential gear.

Combat Load

Combat load equipment is carried for longer-duration missions. At a minimum, a unit with assault loads will have one man per squad with a combat load for safety. This equipment can be spread throughout the unit. The following items should be carried in addition to the items in the assault load:

- Sleeping bag system (see chap. 14).
- Stove and fuel bottle (full). Each man carries one item or the other.
- Thermos (one per buddy team).
- Cook set (one per four-man tent team). The canteen cup may be used in place of a cook set.
- Field tarpaulin for weather, expedient shelters, or CASEVAC.
- Personal hygiene equipment.

Existence Load

Existence load items are carried for extended-duration missions that may require supplementing or replacing items, such as extra insulating layers, extra socks and gloves, and a clean/spare vapor transmission layer (see chap. 14).

Pocket Items

As part of the basic uniform, each Marine should have the following six items in the pockets of his utility uniform:

- Knife (a multitool is best, but a pocketknife or bayonet/K-bar will suffice).
- Lip balm and sunscreen.
- Sunglasses that are polarized and have 100 percent ultraviolet (UV) protection.
- Note-taking material.
- Emergency ration.
- Flashlight/headlamp.

Survival Kit

Each Marine should have, at a minimum, two of each of the following survival kit items:

- *Signaling device (day and night)*. Examples of signaling devices include—
  - Whistle (without ball inside because the ball may freeze).
  - Mirror.
  - Cyalume light.
  - Pyrotechnics.
  - Flashlight.
  - Air panel, which is created by turning an assault waterproof bag or something that contrasts against the terrain inside out.
- *First aid kit*. The first aid kit includes an extra pressure bandage and is issued on LBE at the minimum. Personal blister kits are recommended for mountainous terrain.
- *Water gathering/purifying equipment*. Examples of water gathering items are zipper-type reclosable bags, canteens, canteen cup, thermos, and CamelBak®. Examples of water purifying equipment are water purification tablets, iodine, filter pump, and stove.
- *Fire starting items*. Examples of fire starting items are a lighter, flint and steel, or waterproof or windproof matches. Examples of tinder for fire starting are cotton balls, tampons, gauze, or anything that is 100 percent cotton and saturated with petroleum jelly. Prepackaged tinder, such as hexamine fuel or Xeroform™ sterile gauze, can also be used.
- *Shelter-building items*. Examples of shelter-building items are 10 meters of 550 cord, field tarpaulin/bivy cover (carried in combat load), and a space blanket/bag.
- *Food-gathering items*. Examples of food-gathering items are a fishing kit with bait, emergency ration, and snare wire.

Ideally, at least one of each item is carried in the pockets of the utility uniform. All other survival kit items should use the layering system, so that most items are on the body, some are in the assault load, and some are in the combat load.

Equipment Distribution Within a Unit

For safety, the following items should be distributed within the unit:

- One CASEVAC system per platoon, such as a MCCWIK sled/Sked®.
- At least one combat load per squad (may be spread loaded).
- At least one shelter per squad, such as a tent fly.

Unit leaders need to ensure Marines have all this gear prior to leaving the forward operating base, ship, or home station. Unit leaders and mountain leaders should not hesitate to modify these loads based on METT-T and common sense.

Packing Considerations

While packing for the mountains or cold weather, the following points should be considered:

- The stove and fuel bottle should be kept in the outside pockets of the pack. They may leak and soak equipment with fuel if stored inside the pack.
- The ski wax kit should be readily available in the outside pockets, allowing easy access to the wax during short halts. Keep skins warm inside the jacket next to the body, which helps the skin's glue adhere when mounting.

- When Marines are not wearing the protective layer or insulating layers, they should keep them at the top of the pack. When taking a break during a movement, Marines will be able to quickly don a layer to prevent becoming chilled.
- Climbing rope should be kept in the rope bag to reduce the rope's exposure to petroleum products, UV light, cuts, and abrasions.
- When not wearing them, overwhites should be kept handy under the map flap of the pack for a quick camouflage change as the terrain requires.
- Snowshoes should be secured to the pack with straps, parachute cord, or bungee cord. The tails of the snowshoes should point up and the shovels should point inward, wrapping under the bottom of the pack.
- Skis should be carried on the pack by sliding the tails through the external side pockets. The tips are then strapped together with a toe strap or cord. The tails are slid into the small pockets on the waistband, if applicable. The tails should not hang too low, as this will irritate the legs and interfere with walking.
- Some high-energy snacks should be handy (either on the Marine or in the exterior pockets of the pack), allowing Marines to refuel on short breaks during movements without the need to remove the pack.

Helicopter Considerations in Mountain Operations

The helicopter is the single best tactical mobility asset available to Marines during mountain/cold weather operations. Marine aviation can move farther and faster than any other means of transportation and provide a quick response to logistical requirements. However, the capabilities of the helicopter must be tempered with a sound understanding of the limitations of air support: the greatest limitations are decreased performance at high altitudes, lack of dependability due to unpredictable weather, and the extreme difficulty of performing maintenance in the cold. Although helicopters represent the opportunity to move quickly and efficiently, the unit leader must always have an alternate movement plan to ensure mission accomplishment in the event air support is canceled or unavailable.

The following items should be considered when deploying helicopters in a mountainous/cold weather environment:

- *Reduction in operational tempo*. Everything takes longer in a cold weather environment; that is, it takes the mechanics longer to fix, fuel, and perform routine maintenance on the aircraft. The aircraft may also have more maintenance problems due to the cold weather.
- *Vulnerability in the LZ*. Delays in the LZ will make helicopters particularly vulnerable targets to both direct and indirect fire. Helicopters often create large snow signatures when conducting landings and takeoffs in snow-covered terrain.
- *Temperature and altitude*. As temperature and altitude increase, helicopter performance decreases, affecting not only payload capability, but also time on station, airspeed, and maneuverability. Decreased temperature will not offset the effects of increased altitude when operating in high mountains.
- *Weight/bulk load*. Fewer men can be carried because Marines equipped for cold weather operations take up more space in the aircraft. It will generally take one and a half the normal seating space for a Marine with a full cold weather combat load.
- *Weather*. Mountainous/cold weather environments are often compartmentalized and subject to rapid and severe weather changes. Weather may be good in the pickup LZ and bad in the destination LZ. Consequently, commanders must have alternate plans for insertion and extraction, if possible.
- *Rotor wash identification and visibility*. On landings and takeoffs, helicopters recirculate large snow clouds that can be observed from considerable distances.

Safety Considerations

Marines must understand the safety considerations that apply to operating aircraft to reduce the risk of injury during cold weather, high altitude operations—

- *Frostbite*. Frostbite is a constant danger because of the combination of increased windchill from rotor wash and cold temperatures. Marines subjected to high winds and rotor wash should cover all exposed skin. The Gore-Tex® jacket hood should be up and fully zipped and the buddy method should be used to check for possible signs of frostbite.
- *Assembly areas*. Assembly areas should provide security, concealment, dispersion, and a windbreak for troops. Additionally, all other considerations for temperate environments apply. Any time Marines must wait longer than 40 minutes in freezing temperatures, they should erect warming shelters. This period may be substantially shorter in extreme cold temperatures or under severe windchill conditions.
- *Rotor blade hazards*. In deep snow-covered LZs, the helicopter may sink into the snow, reducing the rotor-blades-to-surface clearance. Use of the ahkio huddle for loading and unloading reduces the danger of being struck by the rotor blades. In sloping LZs, the helicopter should not be approached from the upslope side as rotor-blades-to-surface clearance is further reduced. Extreme caution must be exercised when operating in close proximity to the tail rotor. Refer to figure 12-1 for rotor blade clearances.
- *Cargo ramp hazards*. In deep snow, the crew chief may not be able to lower the cargo ramp completely. Marines must be aware that this significantly reduces head clearance. Users should be cautious when operating near the cargo ramp; it is hydraulically operated and can easily crush personnel. Hydraulic fluid or ice can also cause the ramp to be a slipping hazard for debarking Marines.
- *Ice shedding*. Under various conditions, ice may accumulate on the rotor blades of a helicopter. When it sheds, it produces many flying projectiles. The safest place to be is on the ground with the face covered (ahkio huddle).
- *Unprepared LZs*. When landing in an unprepared LZ, the fuselage will float on the snow's surface. Landing points should be probed and tramped down to discover possible obstacles.
- *Dynamic rollover damage*. A helicopter will normally settle through the snow surface. If the ground is uneven or there are obstacles beneath the surface of the snow, it may cause the helicopter to contact the ground at an angle. In this condition the helicopter may be in danger of dynamic rollover. Dynamic rollover is when the helicopter rolls over onto itself due to the landing gear/skids coming in contact with the surface while power is being applied to the aircraft. Time permitting, the landing spot should be probed for any obstacles. An avalanche probe pole from the MCCWIK or a ski pole without the basket can be used.

Helicopter Landing Zone Selection and Preparation

There are specific considerations for the selection and preparation of LZs in mountains and winter conditions.

Landing Zone Selection

The size of the LZ is determined by the number and type of helicopters to be employed. An LZ that is 50 meters by 50 meters is generally sufficient to land any helicopter, but consideration should be given to the altitude at which operations are being conducted. As operating altitudes increase toward 10,000 feet, the size of the LZ should also increase. For example, at 8,000 feet the dimensions would be about 75 meters by 75 meters due to the performance loss that a helicopter will experience while operating at higher altitudes. At higher

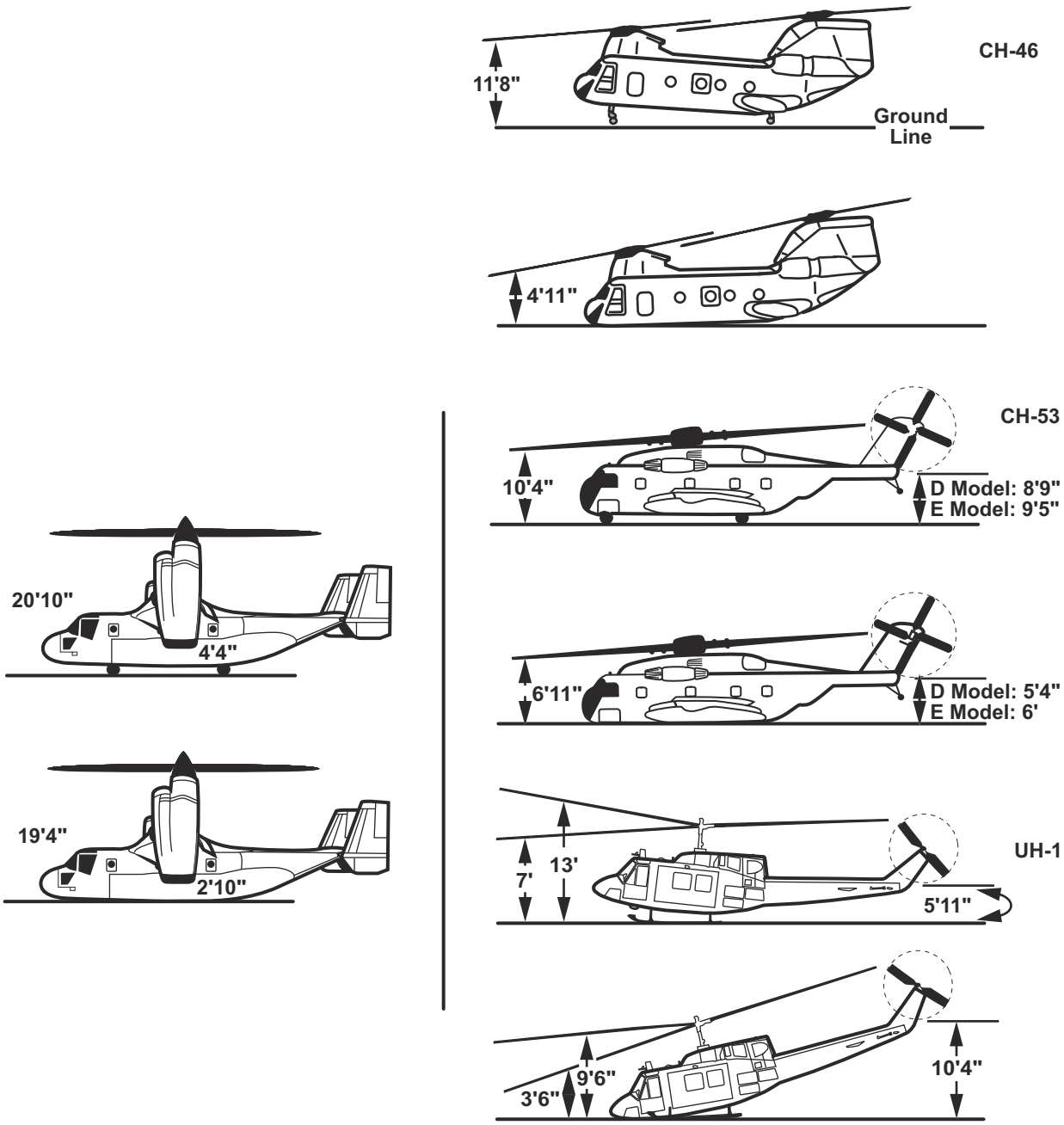

Figure 12-1. Rotor Clearance for Marine Corps Aircraft.

altitudes (above 10,000 feet), an LZ that measures approximately 100 meters by 100 meters will provide the necessary clearance for a safe approach and departure. Size considerations should also be increased if the LZ in question has significant obstacles surrounding the zone or on the approach/departure path.

Note: In all situations, a face-to-face brief with the pilots in the operating area will help planners determine the capability/limitations of the aircraft and what size zones they will be looking for. The air officer/FAC should be the leading authority on this matter.

Other factors also impact the selection of an LZ—

- *Wind direction*. The wind direction determines the approach and departure directions. Helicopters normally take off and land into the wind.
- *Ground surface*. Debris/snow/ice will be kicked up when the helicopter lands in the zone and most of the danger from this flying debris is to the Marines on the ground, so Marines should use caution when the aircraft is landing. Time permitting, Marines should pack down the area where the ahkio huddle will be located to minimize the effects that blowing snow and ice will have.
- *Ground slope*. Terrain with slopes of more than 8 degrees is usually considered too steep for helicopter landing due to the dynamic rollover characteristics of all helicopters. Individual helicopters have different limitations for sloped landings. A briefing with the aircrew in the operating area will clarify the capabilities/limitations of the aircraft.
- *Concealment*. Areas should be selected that will conceal both the helicopter and the snow signature from direct enemy observation. The signature that develops from the rotor wash can be observed up to 30 kilometers away.
- *Obstacles*. The unit to be loaded should look for obstacles that may be hidden under snow. Obstacles that are hidden are potentially dangerous to the helicopter. The LZ should be probed to locate tree stumps or large rocks that could place the helicopter in a dynamic rollover situation or rupture the skin on the belly of the aircraft.
- *Snow*. Depth and consistency of snow will have a major impact on LZ operations. Loose snow may cause the pilots to whiteout, lose reference to the horizon, and have to conduct a wave off. Hard or crusted snow may break up and become a hazard to Marines on the ground.
- *Lakes and rivers as LZs*. Commanders should consider using frozen lakes and rivers as alternate LZs. Frozen lakes and rivers do make excellent LZs since they are level and have little loose snow due to the scouring winds. The CH-53 and CH-46 need 15 inches of ice to conduct operations, while the UH-1N (utility helicopter [Huey]) and AH-1W/Z attack helicopter (Super Cobra) need 8 inches. No data currently exists for MV-22.

Landing Zone Preparation

Marines should make every effort to walk through the LZ to determine snow depth and appropriate locations for helicopter landing points. They should consider the following:

- *Packing the LZ*. Packing the LZ makes it easier for a pilot to find the landing point and for Marines to move about, which is particularly important when conducting external operations. Packing does take more time and the possibility of detection by the enemy may be increased. Time, conditions, and tactical situation permitting, the first area to be packed should be the area around the ahkio huddle. The next area will be for the landing point, which should be approximately 50 meters square. Packing decreases the amount of snow that will be kicked up by the rotor wash. If an LZ is in a safe area and will be used frequently, a request for engineer support to pack the snow should be made. Over-the-snow vehicles are most effective for packing landing points quickly. For Marines on snowshoes, skis, or just boots, the packing method can still be used, but it takes more time and is exhausting.
- *Marking the LZ*. Marking the LZ and the landing points is critical. The white, snow-covered zones can provide a difficult background for the pilots. Blowing snow can cause a whiteout condition and may cause the pilots to lose reference to the horizon. A reference point must be visible at all times. Any object that will contrast with the snow and does not move will provide a reference point.
- *Air panels*. Air panels contrast in color with the snow. They must be secured to ensure that they are not blown away by rotor wash.

- *Smoke grenades*. Smoke grenades should be used to mark the LZ only and not the landing points. When used in snow-covered LZs, a platform should be used to prevent the smoke grenade from sinking in the snow.
- *Chemical lights*. Chemical lights provide good close-in lighting at night, but are hard to see beyond one-half mile.
- *Tree boughs*. Lay or stick tree boughs into the snow to provide a contrasting reference for the pilots' orientation.
- *Sled teams*. Ahkio huddles are the primary method of marking landing points. The huddle should contrast in color to the background in the LZ. Individuals should remove overwhites, wear a protective facemask, have the hood up and zipped on the protective layer, and be sure that no bare skin is exposed to the rotor wash.

Landing Zone Brief

The following is the minimum required information for a LZ brief:

- Unit call sign.
- LZ location.
- LZ marking.
- Wind direction and velocity.
- LZ size.
- LZ elevation.
- Obstacles/snow conditions.
- Visibility.
- Approach/retirement direction (recommended).

Preparations for Embarkation

Helicopters will often have reduced payloads when operating at higher altitudes. In addition, high temperatures, high humidity, and high density altitude will degrade helicopter performance. Consequently, helicopter payloads may change significantly due to both the current and forecasted weather and LZ altitudes. Payload, personnel, equipment, and ahkio huddle procedures should be considered when preparing for embarkation.

Payload

Table 12-3 shows helicopter payload estimates and it should be used only as a guide. Actual lift capacity will vary depending on fuel consumption, ordnance on board, time of flight, and weather.

Table 12-3. Helicopter Payload Characteristics at Increasing Altitude.

Helicopter	Sea Level	5,000 ft MSL	10,000 ft MSL
UH-1N	6 pax and gear	4 pax and gear	2 pax and gear
CH-46E	16 pax and gear	8 pax and gear	4–6 pax and gear
CH-53E	37 pax and gear	24 pax and gear	18 pax and gear
MV-22	24 pax and gear	20 pax and gear	16 pax and gear

Legend:
ft MSL—feet mean sea level
CH-46E—medium assault support helicopter (Sea Knight)
CH-53E—heavy assault support helicopter (Super Stallion)
MV-22—medium assault support helicopter (Osprey)
pax—passengers

Personnel

A major hazard to personnel operating around helicopters in the cold weather is the windchill generated by the rotor wash. Exposed skin should be kept to a minimum. If a long wait is expected, warming tents should be erected.

Equipment

The team sled should be staged as near the landing point as possible. To prevent the team sled from being moved by rotor wash, the Marines embarking on the aircraft should lay on top of the sled (ahkio huddle).

Weapons should be in Condition 1 when embarking the aircraft. Muzzles should be pointed down on the CH-46 and CH-53, but pointed up or outward on the UH-1N. No equipment, such as skis, poles, or radio antennas, should be allowed to protrude above the height of a man so that no equipment goes into the rotor blades. Packs should not be worn aboard helicopters due to the

restricted movement and the requirement to fasten seat belts before departure. Packs and team sleds should be staged at the center of the aisle on assault aircraft.

Ahkio Huddle Procedures

The ahkio huddle is designed to get Marines on and off a helicopter as quickly as possible with minimum exposure to windchill. It must be rehearsed so that it can be accomplished in extreme weather and reduced visibility. Although normally used in a snow-covered environment, the huddle can be effectively used in any environment.

The ahkio huddle is established around the sled/tent equipment on the landing point. Packs are removed and skies are bound together. Marines group together on top of the equipment, face down, to keep the equipment from blowing away. Overwhite camouflage is removed so that the huddle contrasts the snow-covered background. All of the tent team's equipment necessary for survival against the environment is loaded on the same aircraft as the personnel. The helicopter will land so as to place the sled team huddle under its rotor arc at the 2 o'clock position.

Before conducting sled team huddle operations, all Marines, including pilots, aircrews, and troops to be lifted, must be properly trained in ahkio huddle procedures to eliminate the dangers of troops walking into the helicopter blades and reduce the problems of windchill. It will reduce the amount of time the helicopter must remain in zone by providing the pilots a solid reference point, reducing the distance Marines must move through the snow to the aircraft, and reducing the loading/unloading time.

Embarking the Helicopter

The ahkio team leader supervises the loading of the sled and any other equipment. See figure 12-2 for embarkation and debarkation routes for specific aircraft. The leader and team have specific responsibilities when embarking and debarking the helicopter. The ahkio team leader is responsible to—

- Load first, move to the front of the helicopter, and secure his gear by the left most forward seat.
- Immediately communicate with the pilot.
- Strap in for takeoff and landing.
- When in flight, observe from the cockpit between the pilots to maintain orientation.
- Designate Marines to load/unload equipment.
- Maintain accountability of the ahkio team.

The ahkio team members are responsible to—

- Load the helicopter only when directed by the crew chief, who will direct the team to load through either the side or rear door.
- Enter the aircraft quickly and move to preassigned seats.
- Hand carry snowshoes on board. Once seated, team members hold their snowshoes and weapons between their legs.
- Bind skis and poles together in pairs. When loading or unloading, keep them parallel to the deck at waist level. Once loaded, place skis on the deck of the aircraft beneath the feet.

The assistant ahkio team leader is responsible to—

- Supervise the loading and unloading.
- Ensure that all gear and Marines have boarded.
- Board last and signal "thumbs up" to the crew chief.

Debarking the Helicopter

As with embarking, the object during debarking is efficiency and safety. The offload generally follows the reverse order of the onload. The

debarking sequence, supervised by the assistant team leader, is as follows:

- The sled and any other equipment are unloaded first.
- All remaining Marines exit in reverse order of embarking.
- The ahkio huddle is assumed just off the ramp or outside the door under the rotor arc.
- Only after the helicopter lifts off does the ahkio team tactically deploy.

Casualty Evacuation Considerations in Mountains and Cold Weather

Combat casualties are complex enough for a small unit leader; cold weather, high altitudes, and mountainous terrain will make CASEVACs extremely critical. The following points apply to helicopter operations:

- Helicopter operations in this environment can be unpredictable, so alternate CASEVAC means must be planned.
- If possible, CASEVAC LZs should be planned and a dedicated CASEVAC helicopter should be on alert.
- Marines must be cautious when loading a patient aboard a helicopter in deep snow due to the reduced rotor clearance.
- The patient should be protected from the rotor wash. Any exposed skin will be subject to frostbite.
- A warming tent should be established for the patients and the loading teams. Handling CASEVACs is physically and mentally exhausting.

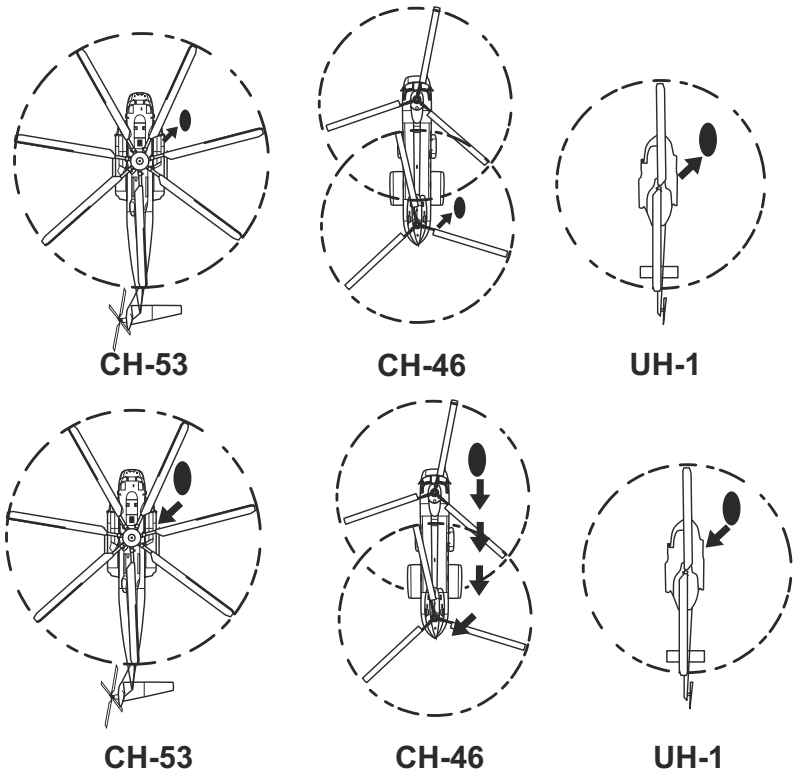

Figure 12-2. Embarking and Debarking by the Ahkio Huddle Method.

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CHAPTER 13
MOUNTAIN SAFETY AND HEALTH CONSIDERATIONS

Mountain Safety Principles

As in any military operation, planning and preparation constitute the keys to success. The following principles will help the leader conduct a safe and efficient operation in any type of mountainous environment. These 12 principles can be remembered as "BE SAFE MARINE."

B–Be aware of the group's ability.
E–Evaluate terrain and weather constantly.

S–Stay as a group.
A–Appreciate time requirements.
F–Find shelter during storms, if required.
E–Eat properly and drink plenty of fluids.

M–Maintain proper clothing and equipment.
A–Ask locals about conditions.
R–Remember to keep calm and think.
I–Insist on emergency rations and kits.
N–Never forget accident procedures.
E–Energy is saved when warm and dry.

Be Aware of the Group's Ability

It is essential that the leader evaluates the individual abilities of his Marines and uses this knowledge as the basis for his planning. His evaluation should include the following:

- *Physical conditioning*. Physical fitness is the foundation for all strenuous mountaineering activities. Leaders must be aware of their units' states of fitness and consider changes in altitude, climate, and the amount of time for acclimatization.
- *Mental attitude*. Units need to be positive, realistic, and honest with themselves. A "can do" attitude may turn into dangerous overconfidence if it is not tempered with a realistic appraisal of the situation and the unit's capability. A balance is needed.
- *Technical skills*. These skills include the ability to conduct a vertical assault, construct rope installations, maneuver over snow-covered terrain, and conduct avalanche search and rescue operations. Applying these skills increases a unit's ability to operate effectively in a mountainous/cold weather environment.
- *Individual skills*. Leaders must choose from among their troops the most proficient at the individual skills that will be required for the mission, such as navigation techniques, security, call for fire, track plans, bivouac site selection, and skijoring. Company leaders should be used to assist in training individuals for specific skills.

Evaluate Terrain and Weather Constantly

During the planning stages of a mission, the leader must absorb as much information as possible on the surrounding terrain and key terrain features involved in his area of operations. Considerations to any obstacles must be clearly planned, such as—

- The necessity of such things as ropes, crampons, climbing gear, or skins.
- The caution needed when moving in particularly dangerous areas, such as those with loose rock and avalanche-prone slopes.
- Knowledge of the unit's position on the planned route.

Mountain weather can be severe and variable. Drastic weather changes can occur within a few hours, resulting in gale force winds, reduced visibility, heavy precipitation (including snow), and extreme temperature drops. In addition to

obtaining current weather data, the leader must plan for the unexpected "worst case." During an operation, he must diagnose weather signs continually to be able to foresee possible weather changes and, under certain conditions, it may be advisable to re-evaluate unit capabilities.

Such conditions during which a Marine may need specific knowledge/training would be when faced with a lightning storm. During training, all radios should be off and staged with weapons away from personnel, who would preferably be in a low-lying area or around tall natural objects that are not trees. During combat, the unit commander must consider the tactical situation. To calculate the approximate distance in miles from a flash of lightning, the general rule of thumb is to count the number of seconds from when the flash is seen to hearing the thunder and then divide by five.

Stay as a Group

Individuals acting on their own are at a great disadvantage in this environment and should consider the following points:

- Adequate rest halts should be granted based upon the terrain and elevation, physical condition of the unit, amount of combat load, and mission requirements.
- The buddy system must be used in the group regardless of rank.
- A steady pace should be maintained to allow mission accomplishment as all members of the unit reach the objective area.

Appreciate Time Requirements

Efficient use of available time is vital. The leader must make an accurate estimate of the time required for his operation based on terrain, weather, unit size, abilities, and the enemy situation. This estimate should also take into account the possibility of unexpected emergencies, such as injuries or unplanned bivouacs, due to severe conditions.

The TDF (see fig. 13-1) is designed to be a guideline and should not be considered as the exact amount of time required for the movement. The TDF is made for acclimated troops on foot in the summertime/on skis with skins or snowshoes in the wintertime. The TDF will vary based on unit size, physical conditioning, experience, load carried, angle of slope, snow conditions, and surface conditions. A set of TDFs are used for planning as in the following examples:

- Mountain leaders/patrols with high altitude/cold weather experience—3 kilometers per hour plus 1 hour for every 300 meters ascent and 1 hour for every 600 meters descent.
- Assault climbers/scout skiers/patrols—2 kilometers per hour plus 1 hour for every 300 meters ascent and 1 hour for every 600 meters descent.
- Company/battalion movements—1 kilometer per hour plus 1 hour for every 300 meters ascent and 1 hour for every 600 meters descent.

Route cards (see chap. 4) are not to be used in place of an overlay, but as a tool for route planning. They force a detailed map study. Overlays/route cards should contain the following information at minimum:

- Unit designation.
- Unit commander.
- Number of personnel.
- Inclusive dates and times of movement.
- Grid of each checkpoint and bivouac.
- Estimated time (log actual time on route).
- Map references.
- Magnetic azimuth and distances for each leg.
- Elevation gains/losses per leg.
- Description of the ground.

The route card is an essential tool during storms/reduced visibility for dead reckoning navigation and should not be lost. As in any military operation, route planning and execution are of vital importance. Before departure, the unit commander

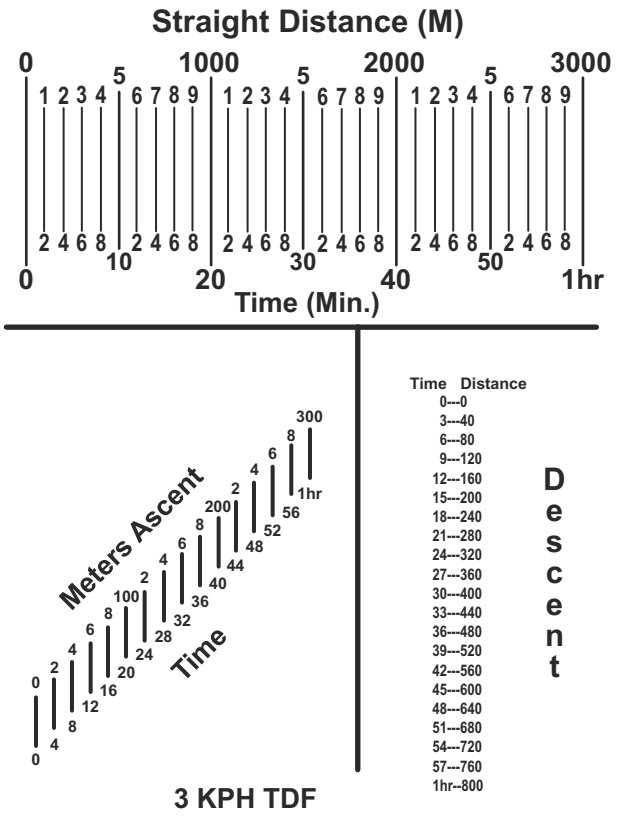

Figure 13-1. Time-Distance Formula.

must submit a route card/route overlay to his higher headquarters and keep a duplicate copy for himself. This preplanned route should be followed as closely as possible, taking into account changes based on the tactical situation.

Find Shelter During Storms

Under certain conditions, inclement weather can provide tactical advantages to the thinking unit commander, but, for the same reason, it can reduce the effectiveness of a unit to nothing if an incorrect evaluation of the situation is made. Though being lost will not directly kill an individual and starvation takes time, hypothermia can become serious or fatal in a matter of hours.

If there is a drastic change in the weather, tents should be erected immediately. If tents are not available, the unit leader should locate natural shelter or build a manmade shelter. Adhering to the following principles will give an individual the best chance to spend a relatively safe bivouac with the prospect of continued effort toward mission accomplishment:

- *Make shelter*. The basic requirement is protection from the wind and precipitation.
- *Keep warm*. The retention of body heat is of vital importance; any action in which body heat is lost should be avoided. Marines should—
  - Get adequate shelter.
  - Insulate themselves from the ground using branches, an isopor mat, or their pack.
  - Wear extra clothing.
  - Use extra equipment for insulation.
  - Produce external heat while trying to conserve fuel for future use.
  - Protect head, hands, and feet early, before getting cold.
- *Keep dry*. Marines must remove wet clothing, towel dry skin, and never sweat in their clothing or sleep system. Being wet causes the loss of body heat 32 times faster than when dry.

Adequate protection from the elements is of prime importance to prevent the onset of hypothermia.

Eat Properly and Drink Plenty of Fluids

The human body can be compared to a furnace, which runs on food to produce energy (warmth). By planning the consumption of food to suit the specific situation, adequate nutrition and extra warmth can be supplied.

Adequate hydration is of supreme importance in a mountainous environment. Everything is more difficult when dehydrated, so leaders should ensure that they and their troops are drinking water. The intake of adequate amounts of water will maintain the body. Danger from dehydration is as high in mountain regions as in hot, dry areas. Loss of liquids is easily seen and felt in hot climates; whereas, in the mountains, the loss of body fluids is much less noticeable. Water intake is at least 3 to 6 quarts per day (includes water in food), but may be as high as 6 to 8 quarts per day during intense physical activity to help prevent dehydration.

Maintain Proper Clothing and Equipment

The issued equipment is some of the best equipment available; however, it must be cared for properly, much like the Marine's rifle. He cares meticulously for his rifle because it keeps him alive in combat as does his clothing system in bad weather and his mountaineering or mobility gear in a mountainous environment. Maintenance must be appropriate because it may take a long time to get replacement items.

Ask Locals About Conditions

An often overlooked source of information is the indigenous population of an area. Local weather patterns, rock slide/avalanche areas, watering points, and normal routes are pieces of information that can be obtained by careful questioning. The unit leader must get current information regarding the actual conditions along his intended route.

Remember to Keep Calm and Think

Having recognized that an emergency situation exists, the following principles should be followed:

- *Keep calm and do not panic*. Marines must make every effort to conserve body heat and energy.
- *Think*. When an individual is cold, tired, hungry, or frightened, he must force himself to organize his thoughts into a logical sequence.
- *Help yourself*. The group must try to help itself by either finding the way back to safety or by preparing shelters and procuring food.
- *Keep unit cohesion*. Above all else, the group must act as a tight-knit unit. In emergencies, individual dissension can cause a total loss of control and unit strength.

Before the mission, all personnel must be briefed on the SOP for when a Marine becomes lost or separated from the group. In most situations, the safest approach is to retrace the route to the last known point and continue from there, which is especially easy when a Marine can see the tracks or he has a good route card. Leaders should not be afraid to get group input. They should refer to the navigation log, check all recorded bearings and distances, and then recalculate the position. When lost, Marines should perform the following actions in order—

- Check calculations with another person.
- Attempt resection.
- Do a cloverleaf or box pattern until he recognizes something.
- Shoot an escape azimuth toward a known point/area.

If still lost, stay put and the group will locate him.

Insist on Emergency Rations and Kits

Marines should have the following items with them in case of emergency:

- The emergency ration, which is the one that the Marine least likes, field stripped and placed at the bottom of the pack.
- Standard first aid kit, which may be augmented with blister items, such as mole skin or second skin, iodine, antibiotic ointment, and air-activated heat packs.
- Survival kit with fire starting, food gathering, first aid, water procuring, shelter, and signaling devices.
- Repair kit with tape, 550 cord, multitool, sewing awl, flex cuffs, and safety/diaper pins.

Never Forget Accident Procedures

The general procedures used to handle accidents differ little in this environment, but several distinct points should be remembered. The most frequent causes of accidents are—

- Overestimation of physical and technical abilities.
- Carelessness.

- General lack of observation of surroundings.
- Lack of leaders' knowledge and experience.
- The failure to act as a group.
- Underestimation of the terrain and the time requirements to move through it.

The only truly effective preventive measures for accidents lie in the education and experience of leaders at all levels. Too often, leaders sit by watching, rather than participating, during training and, as a result, have no concept of the requirements involved in the mountainous environment. Only by active involvement can a leader gain the knowledge and experience needed to effectively lead in this environment.

If an accident does occur, common sense and the following procedures will help Marines to handle it:

- Do not repeat the accident.
- Perform basic first aid.
- Protect the patient from the elements to include insulation on top and bottom.
- Evacuate, if necessary.
- Send for help, if required.
- If possible, never send a man for help alone.
- Send the following information regarding the accident:
  - Time of accident.
  - Nature and location of accident.
  - Number injured.
  - Best approach route to accident scene.
- If one man of a two-man team is injured, the injured man must be given all available aid before going for help. If the injured man is unconscious, he should be placed in all available clothing and sleeping gear and anchored if on steep terrain. A note explaining the circumstances and reassuring him should be left in a conspicuous spot. This note must also contain the following information:
  - When Marine expects to return.
  - Where Marine went.
  - What Marine did before leaving, such as medication given.

The international audio distress signal consists of six short blasts in 1 minute intervals from the person requesting help. The return signal is three blasts in 1 minute intervals from the respondent. Other methods of signaling include red pyrotechnics, SOS (…---…), and "mayday" by voice communications.

Energy is Saved When Warm and Dry

Marines can save heat and energy by—

- Dressing/sleeping to be comfortably cool. Avoid sweating by removing layers as needed to stay dry.
- Eating properly.
- Drinking properly.
- Ensuring shelter meets criteria.
- Producing external heat, such as with fires, stove, or extra clothing, to save body heat and energy for future use.
- Avoiding getting wet because this increases body heat loss.

Mountain Health Awareness

A study of military history in mountain regions reveals that success and failure rates are measured in terms of the regard held for the environment. Those who recognize and respect the forces of nature can do their jobs and even use these forces to their advantage; however, those who disregard or underestimate these forces are doomed to failure, if not destruction. In the mountains, care of the body requires special emphasis. If Marines fail to eat properly or do not get sufficient liquids, efficiency will suffer. In turn, decreased efficiency increases the possibility of casualties by either environmental injury or enemy action. The ultimate result becomes the unit's increased risk of mission failure. The following subparagraphs provide information to help prevent, recognize, and treat various health problems common to mountainous/cold weather environments.

Prevention

The body's ability to adjust to a harsh environment (acclimate) is greatly controlled by its physical condition, which is influenced primarily by fitness, nutrition, water intake, and hygiene.

Physical Fitness

Physical fitness is the foundation to successfully performing in a mountainous environment. The more fit an individual is, the easier it is for that Marine to move in harsh terrain, carry heavy loads, and ultimately adapt to the stresses of combat operations in a mountainous/cold weather environment.

Nutrition

An adequate number of calories must be consumed daily to maintain strength and conditioning. As a general rule, consuming four MREs or three MCWs each day provides sufficient vitamins and calories.

At sea level, when in garrison and not physically active, a Marine typically requires about 2,000 calories per day; however, at a high altitude, in the mountains, and especially in the winter, he requires at least 4,500 calories per day because he is much more physically active and, due to the cold, needs calories for heat generation.

In the mountains, an increase in the intake of carbohydrates, such as sugar, bread, rice, or pasta, is recommended since they are more easily converted into heat energy by the body and will aid in acclimatization.

Water Intake

The body loses liquid at an exceptional rate in mountainous/cold weather environments due to evaporation, exertion, and low humidity; however, careful Marines adjust clothing and ventilation to keep from adding to this loss of liquid through perspiration. The heavy exertion of movement on foot and preparation of bivouacs and defenses exacts its toll in sweat and loss of moisture in the breath. Water intake is at least 3 to 6 quarts per day (includes water in food), but may be as high as 6 to 8 quarts per day during intense physical activity to help prevent dehydration.

Hygiene

Poor personal hygiene coupled with extensive periods in any field environment can have fatal consequences due to such maladies as skin and other infections and intestinal illnesses. In a mountainous/cold weather environment, Marines may experience an elevated tendency to neglect personal hygiene due to the inconveniences of washing the body in a cold weather environment. Despite this concern, the importance of maintaining personal hygiene is paramount for ensuring physical and mental well being.

Recognition and Treatment of High Altitude/Cold Weather Injuries

The most prevalent injuries include—

- Dehydration.
- Heat cramps.
- Heat exhaustion.
- Heat stroke.
- Acute mountain sickness (AMS).
- High altitude cerebral edema (HACE).
- High altitude pulmonary edema (HAPE).
- Splenic syndrome.
- Hypothermia.
- Frostbite.
- Trench/immersion foot.
- Snow blindness.
- CO poisoning.

Dehydration

Dehydration is a deficit of total body water and is the most common illness seen, both in the winter and in the summer. Ultimately, the reason someone becomes dehydrated is from excessive

loss or inadequate intake. Excessive fluid loss may be caused by—

- *Urination*. Increased as a response to the cold and high altitude.
- *Cold, dry air*. In most mountainous areas, the air is often cold and dry, so inhaled air must be humidified and warmed by the body, which takes water.
- *Strenuous activity*. Marines in the mountains are always involved in strenuous activity that leads to sweating, even in the winter, which is exacerbated by overdressing.
- *Coffee and tea*. These are mild diuretics, which stimulate the kidneys to produce excess urine.

Inadequate fluid intake may occur from inaccessibility or using thirst as an indicator. Thirst is not a good indicator of the state of hydration, especially in a high altitude environment. If Marines are thirsty, it is too late; they are already dehydrated. An adequate amount of water may not be available if Marines are in a survival situation.

Some symptoms of dehydration are—

- Headache.
- Nausea.
- Dizziness.
- Fainting.
- Constipation.
- Dry mouth.
- Weakness.
- Lethargy.
- Stomach cramps.
- Leg and arm cramps.

Some signs of dehydration are—

- Swollen tongue.
- Dark urine.
- Low blood pressure.
- Rapid heart rate, greater than 100 beats per minute.

Since it is impossible to limit the water that a person can lose (except by limiting coffee and tea consumption), he must instead ensure adequate intake. To prevent dehydration, Marines must—

- Water intake is at least 3 to 6 quarts per day (includes water in food), but may be as high as 6 to 8 quarts per day during intense physical activity to help prevent dehydration.
- Watch the color of their urine. Try to keep it clear. The more yellow it gets, the more they need to drink water.
- Do not rely on thirst as an indicator.

To treat dehydration in the field, leaders should give Marines at least 6 quarts of water per day. Severe cases may require intravenous fluids.

Heat Cramps

Heat cramps are painful spasms of skeletal muscle caused by the excessive loss of body salt. Sweat is composed of water and salt, so when a Marine is involved in strenuous activity that leads to excessive sweating and replaces the lost water but *not* the lost salt, a salt imbalance within the body may result. This salt imbalance may then lead to muscle cramps in the arms, legs, or abdomen.

To prevent heat cramps, Marines must—

- Avoid overheating by proper ventilation.
- Eat correctly. There is no need to take salt tablets as long as proper diet is maintained (MREs and MCWs contain more than enough salt).
- Hydrate adequately.

To manage heat cramps in the field, leaders must—

- Have the patient stop moving (rest).
- Gently massage the affected muscles, which may help relieve the spasm.
- Stretch out the muscle.
- Ensure the victim is adequately hydrated. Replace the victim's salt by adding either one salt tablet or 1 tablespoonful of table salt (from an MRE accessory packet) to a quart of water. Have the victim sip the salted water over a period of a few hours.

Heat Exhaustion

Loss of body salt and dehydration from sweating are so severe that a person can no longer maintain adequate blood pressure. Heat exhaustion is a severe form of dehydration combined with or because of strenuous physical activity. Blood mostly consists of water. When a large amount of water is lost in the form of sweat, the amount of blood volume in the body drops. When the blood volume drops low enough, heat exhaustion results. A sign of heat exhaustion is fainting. Some symptoms of heat exhaustion are—

- Headache.
- Nausea.
- Dizziness.
- Fatigue.

Prevention of heat exhaustion is the same as for heat cramps: dress comfortably cool with adequate ventilation to avoid overheating. If heat exhaustion occurs, Marines should—

- Lay the victim down, with his feet higher than his head.
- Insulate the victim from the cold ground with an isopor mat.
- Ensure that he is well ventilated. Unzip his parka or take it off, until he feels cool. Make sure he does not get too cold.
- If he is awake and not vomiting, he may be given fluids by mouth. Ensure the victim sips the fluids. Usually 3 quarts at a minimum are required.

Heat Stroke

Also known as sunstroke, heat stroke is a failure of the body's cooling mechanisms to rid the body of excessive heat buildup, such as when exercising in a hot, humid environment. Typically, the air in a mountainous environment is cool and dry; nonetheless, heat stroke can and does occur in the mountains, even in the winter. Heat stroke can occur when body temperature levels are greater than 103 °F.

In most cases, the onset of heat stroke is sudden and the victim becomes delirious or comatose before he begins to complain of symptoms. Approximately 20 percent of victims will complain of—

- Headache.
- Nausea.
- Dizziness.
- Fatigue.

Some signs of heat stroke include—

- Altered mental status, including delirium or coma.
- Rectal temperatures of 103 °F or greater.
- Hot, flushed skin may be present.
- Sweating. It is often taught that sweating is absent in heat stroke, but this is untrue. Sweating often *is* present in heat stroke, so responders should not assume a victim does not have heat stroke simply because he is sweating. As with hypothermia, the only way to absolutely diagnose a victim as having heat stroke is with a rectal thermometer. Anybody with abnormal behavior, such as hallucinations, bizarre behavior, or confusion, and a rectal temperature of 103 °F or greater has heat stroke until proven otherwise.

To prevent heat stroke, the same principles apply as with heat exhaustion: drink 6 to 8 quarts of water per day and keep as well ventilated as possible. When the temperature and humidity are high, however, physical activity must be reduced.

Heat stroke is a true life and death emergency. The longer the victim remains overheated, the more likely it is irreversible. To treat heat stroke in the field, responders must—

- Reduce heat immediately by dousing the body of the patient with large amounts of cool water and fanning. This can be aided by applying wet, cool towels or cold water bottles to the neck, the groin, chest, and armpits; cold packs can also be used, if available.

- Maintain an open airway.
- Remove as much of the patient's clothing as possible.
- Give him nothing by mouth.
- When his rectal temperature has dropped below 102 °F, one may discontinue cooling. Be sure to recheck the temperature every 5 minutes. If his temperature rises to 103 °F or greater begin recooling.
- CASEVAC immediately.

Note: Heat stroke is lethal in up to 40 percent of cases and most of those who do live suffer permanent brain damage.

Acute Mountain Sickness

Rapid exposure of an unacclimatized individual to high altitude causes AMS and anyone ascending rapidly from sea level to over 7,000 feet may develop it. Approximately 25 percent of individuals who ascend rapidly to 8,000 to 9,000 feet will develop AMS, but virtually *all* unacclimatized persons will if they rapidly ascend to 11,000 to 12,000 feet. Factors that will increase the chance of developing AMS or make it worse are overexertion at altitude and dehydration. The cause of AMS or altitude illness in general is not well understood; however, it is known that the lower levels of oxygen's barometric pressure found at high altitude leads to a state of hypoxia, low levels of oxygen in the blood. The way in which the body responds to this hypoxia can lead to AMS or other altitude illnesses. Signs of AMS include vomiting. Symptoms, which will usually occur 6 to 48 hours after reaching altitude, include—

- Headache, the most common symptom, which may be severe.
- Nausea.
- Decreased appetite.
- Difficulty sleeping due to irregular breathing.
- Weakness, loss of coordination.
- Easily fatigued.
- Dizziness.
- Apathy.

The best prevention of AMS is a staged ascent. Table 13-1 provides ascent rates for personnel going to a high altitude from sea level. For rapid ascents from sea level to above 8,000 feet, there is a 20 percent incidence of AMS from 8,000 to 10,000 feet; moreover, there is a 40 percent incidence of AMS above 10,000 feet.

Table 13-1. Rates of Ascent.

Altitude	Rate of Ascent
7,000 to 8,000 feet	Optimal altitude to begin acclimatization process from sea level; allow for two overnights before further ascent
8,000 to 14,000 feet	Ascend at a rate of 3,000 feet per day
>14,000 feet	500 to 1,000 feet per day
Note: For every 4,000 feet of elevation gain add an extra day of acclimatization	

Above 14,000 feet, Marines should ascend no faster than 500 to 1,000 feet per day. If no symptoms occur after 48 hours at a given altitude, it is probably safe to ascend, but there are no steadfast rules or guarantees. Sustained human existence above 18,000 feet is not possible, therefore only limited operations occur above this elevation.

Certain drugs, including Diamox®, can be used to treat or even prevent AMS, but can only be used under the direction of medical department personnel. Certain Marines will have a drug allergy or a medical condition, which prevents them from taking Diamox®. (Such a medical condition may be a glucose-6-phosphate dehydrogenase [G6PD] deficiency, an inherited condition in which the body does not produce enough of the enzyme G6PD, which helps red blood cells function normally.) They may, however, be able to take alternate, though less effective, drugs. Treatment of AMS includes—

- Light duty (affected Marines should not ascend any higher as AMS may progress to HACE, a life-threatening condition that is discussed in the following subparagraph).
- Adequate fluid intake (since AMS is a fluid-retaining condition, Marines should be careful not to overhydrate).

- Drugs for AMS are Motrin® or aspirin for the headache and Diamox® or Decadron® (a steroid) as prescribed.

Most cases of AMS should resolve with 2 to 3 days of treatment; however, if this does not occur or if the symptoms are severe or worsening, then a descent of 1,000 to 3,000 feet should greatly improve the condition of the victim. He may ascend again after several days.

High Altitude Cerebral Edema

Symptoms and signs of HACE, a high altitude illness that is characterized by swelling of the brain, usually include those symptoms of AMS. In fact, AMS and HACE are points on a continuum as opposed to being two separate entities. Severe AMS can progress and becomes mild HACE, which can progress to severe HACE and death. This severity is why patients with AMS should not ascend any further. Other signs of HACE include—

- Poor coordination (responders can test the victim's balance by having him walk heel to toe [just like a field sobriety test]).
- Personality changes.
- Poor judgment.
- Bizarre behavior.

Symptoms of HACE include—

- Hallucinations.
- Confusion.
- Excessive fatigue.
- Coma in severe cases.

The preventive measures for HACE are the same as for AMS, but immediate descent is mandatory. Drugs prescribed by medical personnel include Decadron® (a steroid), Diamox®, and oxygen, if available.

Possible treatments also include using a Gamow bag, which is a man-portable (14-pound) hyperbaric chamber. The HACE patient is placed in the bag and zipped up. Using a foot pedal operated pump, the pressure in the bag is increased, simulating a decrease in altitude. Altitude "decreases" of up to 6,000 feet may be achieved; however, the use of this bag should only be reserved for emergencies when rapid descent is delayed. It is a very labor intensive method and only a temporary measure.

Note: HACE is fatal if not treated.

High Altitude Pulmonary Edema

Risk factors for HAPE, a high altitude illness that is characterized by the lungs filling with fluid, are the same as for AMS and HACE, except HAPE is rarely seen below 10,000 feet. Some symptoms of HAPE are—

- Decreased exercise performance and weakness that is worse than expected for the altitude.
- Cough.
- Chest tightness.
- Shortness of breath even while resting (the most significant symptom in the diagnosis of HAPE).

Signs of HAPE include—

- Increased respiratory rate.
- Increased heart rate.
- Detection of fluid in the lungs. Usually fluid can be heard in the lungs with a stethoscope, but occasionally it can be heard without it.
- Blue lips.
- Presence of pink, frothy sputum—a late sign.

The same prevention methods as for AMS, a slow graded ascent, can be employed for HAPE. Should HAPE present in a Marine, however, treatments include—

- A rapid descent to as low as possible, preferably to sea level.
- 100 percent oxygen by mask, if available.

- Administration by a medical professional of the drugs nifedipine, Diamox®, or albuterol inhalers (the medication for asthmatics), which have been shown to be of some benefit.
- Use of the Gamow bag. The HAPE patient is placed in the bag and zipped up. Using a foot pedal operated pump, the pressure in the bag is increased, simulating a decrease in altitude. Altitude "decreases" of up to 6,000 feet may be achieved; however, the use of this bag should only be reserved for emergencies when rapid descent is delayed. It is a very labor intensive method and only a temporary measure.
- Absolute bed rest. If the patient's heart rate is elevated, the amount of fluid in his lungs increases and makes his condition worse—a fact that should be considered when planning the patient's CASEVAC. If the patient is made to walk out, his condition may worsen and, in some instances, death may result.

Note: HAPE is fatal if not treated.

Splenic Syndrome

Splenic syndrome is a condition that can occur when Marines with the sickle cell trait deploy to a high altitude environment. When the red blood cells do not receive adequate oxygen, their shape changes and the blood starts to sludge. The spleen has narrow blood vessels that are prone to blood clots. In severe cases, sections of the spleen can die from lack of blood. This condition does not affect every sickle cell trait Marine—just a small number of the population—and every Marine is screened for this condition.

A symptom of splenic syndrome is the sudden onset of severe left upper abdominal pain, which usually occurs during heavy physical exertion. It is treated with aggressive hydration, using intravenous fluids, if available, and oxygen.

To prevent splenic syndrome, sickle cell trait Marines should be identified by screening medical records before deploying to high altitude environments. For deployments to moderate altitudes (7,000 to 10,000 feet), sickle cell trait Marines need appropriate hydration and 2 to 3 days to acclimate before heavy exertion. For deployments to higher altitudes, medical should be consulted before making a decision on whether to deploy sickle cell trait Marines.

Hypothermia

Hypothermia is the state in which the body's core temperature is 95 °F or less. At times, one may hear that an individual has "exposure," which is usually used in reference to hypothermia but should not be used to describe hypothermia.

It is a common belief that extreme cold is needed for hypothermia to occur. In fact, most cases occur when the temperature is between 30 and 50 °F. This temperature range is quite common in the fall, winter, and spring months.

Hypothermia occurs when heat loss from the body exceeds the body's ability to produce heat. Contributing factors include—

- Ambient temperature, which is the outside air temperature.
- Windchill, which only affects improperly clothed individuals.
- Wet clothing caused by precipitation and sweating from overdressing.
- Cold water immersion.
- Improper clothing.
- Exhaustion.
- Starvation.
- Dehydration.
- Alcohol intoxication and use of nicotine and drugs, such as barbiturates and tranquilizers.
- Injuries that cause immobility, major bleeding, major burns, or head trauma.

Severe hypothermia is life threatening and these patients must be handled very gently. In a field setting, any mild hypothermia casualty who is shivering, able to speak and make sense, and has a normal heart rate and breathing rate (even if it is fast) will eventually recover with minimal

intervention in the field. Severe hypothermia patients, however, must be evacuated as soon as possible. Therefore, it is important to be able to identify the following signs of severe hypothermia:

- Severely altered mental status—the brain is literally getting cold. Signs might include confusion, slurred speech, strange behavior, irritability, impaired judgment, hallucinations, or a depressed level of consciousness. The individual ceases to care about their personal safety and loses concern for rescue. As hypothermia worsens, victims will lose consciousness and eventually slip into a coma. Though a severely altered mental status is a sign of severe hypothermia, there could be many other causes for it.
- Core temperature of less than 95 °F. Body temperature is most accurately taken with a rectal thermometer. If the rectal thermometer is cold, such as if it had been left in a pack, then it will assume the ambient air temperature and will take a longer period of time to warm up to the individual's core temperature. If the rectal thermometer is not left in long enough, then it can give a false impression of severe hypothermia.

  Note: A core temperature is the temperature at the center of the body and is most accurate when measured rectally with a special, low range rectal thermometer carried by all corpsmen. These thermometers are available through the federal stock system (Federal Stock Number 6515-00-139-4593). If the conditions do not allow for a rectal temperature to be taken or if a rectal thermometer is not available, then a field expedient method is to place an ungloved hand on the torso of the patient. If the torso is cold to the touch then it is safe to assume hypothermia, but a rectal temperature should be taken as soon as possible.

- Depressed vital signs. The heart and lungs slow, so responders should look for decreased respiratory and heart rates.
- Shivering is a major way the body tries to warm itself as it first begins to get cold. Shivering stops either because the body has warmed back up to a normal temperature range or the body has continued to cool. Once the core temperature goes below about 90 °F, shivering ceases completely. A sign of severe hypothermia is when an individual has stopped shivering yet continues to cool. Obviously, continued cooling is bad. If an individual stops shivering, one must determine if that is because he has warmed up or continued to cool.

Prevention of hypothermia is always better and much easier than treatment. It is easier to *stay* warm than to *get* warm. To prevent hypothermia, Marines must—

- Wear and care for cold weather clothing properly.
- Keep clothing as dry as possible.
- Wear a hat if feet are cold, since up to 80 percent of the body's heat can escape from the head.
- Dress to be comfortably cool, especially before any activity. Overdressing causes sweating.
- Avoid dehydration by drinking 6 to 8 quarts of water per day.
- Eat adequately—at least 4,500 calories per day.
- Avoid fatigue and exhaustion. A person in a state of physical exhaustion is at increased risk for hypothermia.
- Increase levels of activity as the temperature drops. Do not remain stationary when the temperature is very low. If the tactical situation does not permit moving about, perform isometric exercises of successive muscles. Beware of long periods of inactivity in contact with the snow, such as laying in the prone position in an ambush or when a casualty is laid out on the ground. Make use of the isopor mat to decrease conductive heat loss.
- Use the buddy system to check each other for signs/symptoms of hypothermia.

Hypothermia is treated in the following ways:

- If the casualty is severely hypothermic, he must be handled gently because his heart will

be sensitive to movement and very prone to abnormal rhythms that can lead to sudden death.
- The patient should be removed from the environment in which he became hypothermic and brought into the battalion aid station, a tent, or a snow cave to prevent further heat loss. As soon as possible, his cold, wet clothes should be removed very carefully—if necessary cut the clothes off.
- The patient should be wrapped in a vapor barrier (VB) liner for insulation. A VB liner will *prevent* heat loss due to evaporation and *slow down* heat loss due to convection. The easiest way to insulate a patient in the field is by wrapping him in plastic trash bags (not covering his face) and then placing him in a sleeping bag.
- The easiest way to rewarm the patient in the field is to zip two sleeping bags together and place him in the zipped up bags with two stripped volunteers. While many Marines may be hesitant to perform this rewarming method, it could save the patient's life. In addition to the volunteers, place warmed materials on either side of the patient's neck, in his armpits, and his groin. Warmed rocks, bags of warm water, or heat packs can be used. The warmed materials should not be hot and the volunteers should be in contact with the items as well. A hypothermia victim may not be able to tell if his skin is burning but the volunteers will.
- Evacuate the victim. A CASEVAC may not be possible due to the tactical situation, weather, or other factors; however, the sooner a victim can be evacuated, the better. Severe hypothermia is a medical emergency.

Other points to remember include—

- Fluids may be given to the victim if he is mildly hypothermic. Otherwise, he should take nothing by mouth.
- Excessive movement of the victim should be avoided as his heart may stop beating if it is jarred.
- First aid should be applied to major wounds first (especially extremity wounds) before attempting to rewarm the victim. Rewarming a victim who has bled to death does little good.
- Alcohol should never be given to hypothermia victims.

Even after the rewarming process has begun, victim must be constantly monitored. A victim with severe hypothermia may actually appear to be dead (not breathing or without a pulse); however, people who have been found this way have been successfully "brought back to life" with no permanent damage.

Frostbite

Frostbite is the actual freezing of tissue. The high-risk areas for frostbite are fingers, toes, nose, cheeks, and ears. Three major risk factors are —

- *Improper clothing or improper care of clothing*. The proper use of cold weather clothing, as well as its proper maintenance in the field, is dependent on small unit leadership. Small unit leaders must ensure that their men are adequately clothed and that the clothing is adequately maintained. Examples of improper clothing/maintenance include—
  - Wearing gloves when mittens should be worn.
  - Failure to dry gloves or liners after they have become wet.
  - Wearing wet clothing of any kind.
  - Wearing improper footwear, such as summer combat boots when VB or ski/march boots should be worn.
  - Improper care of footwear, such as failing to remove boots at night, sleeping with boots on, or failing to dry boots when they become wet.
  - Wearing boots/gloves that are too tight. Also, the pack straps should not be secured too tightly as this may decrease circulation to the arms.

- *Dehydration*. Marines who are well hydrated are much better equipped to fight off frostbite.
- *Poor diet or starvation*. The body can be thought of as a furnace and food is its fuel. When food intake is low, there is less fuel to feed the furnace and the risk of frostbite goes up.

Other factors that contribute to frostbite are—

- Outside temperature; the colder it is, the greater the risks.
- Snow or ground temperature (snow temperature can be 30 to 40 °F colder than air temperature).
- Windchill should not be a factor with properly dressed Marines.
- Cold metals should never be touched with bare flesh. Only touch cold metals if wearing contact gloves.
- Petroleum products (fuels and oils) freeze at a much lower temperature than water.
- Spilling cold fuel, such as white gas or gasoline, on bare skin can cause immediate, severe frostbite.
- Exhaustion affects the body's natural defense mechanisms and lowers immunity.
- Hypothermia.
- Race/place of birth (e.g., African Americans and those from warmer climates are at increased risk for frostbite).
- Tobacco (nicotine) use decreases the amount of blood to the hands and feet.
- Prolonged immobility (as when sitting in an ambush position or a casualty who is laid out on the snow).
- Rotor wash from helicopters provides a significant amount of windchill.
- Previous cold injury.
- Women are twice as likely to incur cold injuries than men.

The signs of frostbite are—

- The skin may appear red, white, yellow, gray, blue, frosty, or even normal.
- The skin may feel waxy or firm.
- The joints may be stiff or immobile.
- The affected part may feel like a block of wood or even ice.
- Pulses may or may not be present.

The symptoms of frostbite are—

- Decreased sensation/numbness.
- Tingling.
- Aching cold.
- Sharp pain, usually after rewarming.
- Increased warmth.
- Burning, usually after rewarming.
- No sensation at all. The victim may describe the affected part as clumsy, lifeless, bulky, or club like.

Like burns, frostbite has been divided into first, second, third, and fourth degrees; however, it is much easier to divide it up into frosting, superficial frostbite, and deep frostbite—

- Frosting is when some part of the body (usually the toes, fingers, or nose) becomes painfully cold but does not freeze. It is a harmless condition and the affected part returns to normal with rewarming.
- Superficial frostbite occurs when the skin freezes, but not the tissue beneath it, such as muscle, nerves, and bone. Skin with superficial frostbite takes on the following characteristics:
  - Skin appears pale, white, gray, or even blue and has a waxy feel to it. After the tissue has been rewarmed it may be red.
  - Pulses will be present, but can be decreased.
  - The sensation of pain and light touch may be absent but deeper sensations, such as pressure, will be intact.
  - The joints will be mobile but stiff.
  - Movement of the frostbitten part by the victim will be possible although it may be difficult.
  - Blisters may form and be filled with a clear fluid.
- Deep frostbite affects patients in the following ways:
  - Initially, the skin may appear the same as with superficial frostbite.

- Pulses will not be present.
- Blisters form and may be filled with blood.
- The skin will feel wood-like, firm, or even rock hard.
- Tissues below will feel doughy or hard.
- All sensation will be absent.
- Skin will not move easily or at all.
- Joints will be stiff or immobile.
- Movement of the affected part will be minimal or absent.

It is often difficult to say exactly how severe a case of frostbite is until several weeks have passed; therefore, it is wise to assume the worst.

Note: Frostbite may be present in different degrees in the same affected part. For example, a frostbitten hand may have deep frostbite at the fingers, superficial frostbite at the palm, and frosting at the wrist.

Frostbite is an entirely preventable injury. Obviously, there is little one can do about the weather, but Marines can ensure that the other risk factors that can lead to frostbite are minimized. The best way to prevent frostbite is to prevent the three major risk factors (improper clothing or improper care of clothing, dehydration, and starvation) and by ensuring that Marines—

- *Dress in layers*. Marines should keep comfortably cool by adding or removing layers. The hands or feet should not be ignored and Marines should add more layers or change socks or gloves. If the wind is blowing, Marines should wear the correct protective layer and always have a balaclava or watch cap available and wear it if it is cold. If the fingers are getting cold in gloves, they should wear mittens.
- *Keep clothes dry*. It is vitally important that, if boots, socks, or gloves get wet, they are dried. Marines may have to change socks up to four to five times a day (especially with VB boots). If gloves or liners are wet, they should be warmed and dried. No one should continue to wear wet clothing.
- *Avoid dehydration*. When Marines become dehydrated, the amount of blood available to warm the fingers and toes goes down, greatly increasing the risk of frostbite.
- *Avoid starvation*. Food is fuel and the body uses that fuel to make heat. When Marines are low on fuel, they will be low on heat.

Though Marines are trained to be tough, the natural elements are tougher. If Marines notice their fingers or toes getting cold even after having tried to warm them, they should let their leaders know. Ignoring the problem will not make it go away; it will only make the problem worse.

Small unit leaders must ensure preventive measures are taken. Like dehydration, frostbite results from failure of leadership and lack of personal responsibility in performing continuing actions.

Only frosting should be treated in the field, all other patients with more severe frostbite should be evacuated immediately. If unsure, responders should assume the worst and evacuate. Frosting can be easily treated in the field using the 15-minute rule. Frosted skin will revert to normal after using this technique of body heat rewarming: hold the affected area skin-to-skin for 15 minutes; if the affected area does not return to normal, responders should assume a frostbite injury has occurred and report it up the chain. Marines should remember the following points when treating frosting:

- Rewarm face, nose, ears with hands.
- Rewarm hands in armpits, groin, or belly.
- Rewarm feet with mountain buddy's armpits or belly.
- DO NOT EVER RUB ANY COLD INJURY WITH SNOW.
- Do not massage the affected part.
- Do not rewarm with stove or fire because a burn injury may result.
- Loosen constricting clothing.
- Avoid tobacco products.
- Rapidly windmill arms because the centrifugal forces will force blood into the fingers.

Any frostbite injury, regardless of severity, is treated the same—evacuation and rewarming. Unless the tactical situation prohibits evacuation or the unit is in a survival situation, no consideration should be given to rewarming frostbite in the field because of the freeze, thaw, refreeze cycle of injury.

A freeze, thaw, refreeze injury occurs when a frostbitten extremity is thawed out, then, before it can heal (which may take weeks or months), it freezes again. This cycle has devastating effects and greatly worsens the initial injury. In an extreme emergency, it is better to walk on a frostbitten foot than to warm it up and then have it freeze again. Marines should follow these tenets—

- Treat frozen extremities as fractures—carefully pad and splint.
- Treat frozen feet as litter cases.
- Prevent further freezing injury.
- Do not forget about hypothermia. Keep the victim warm and dry.

Once in the rear, a frostbitten extremity is rewarmed in a water bath, with the temperature strictly maintained between 99 and 102 °F. This procedure can be extremely painful so medical should have pain medications on hand.

Trench Foot/Immersion Foot

Trench foot/immersion foot is a cold/wet injury to the feet or hands from prolonged (generally 7 to 10 hours) exposure to water at temperatures above freezing, immobility, and the use of VB boots. The major symptom will be extreme pain and the condition is classified from mild to severe. Trench foot and frostbite are often very difficult to distinguish visually. Often, both may be present, but signs include—

- Red and purple mottled skin.
- Patches of white skin.
- Very wrinkled skin.
- Severe cases may leave gangrene and blisters.
- Swelling.
- Lowered or even absent pulse.

To prevent trench foot and/or immersion foot, Marines should—

- Keep feet warm and dry.
- Change socks at least once a day. Let the feet dry briefly during the change and wipe out the inside of the boot. Sock changes may be required more often. DO NOT wear VB boots to bed!
- Exercise the feet constantly whenever the body is otherwise immobile to keep blood flowing.

Trench foot/immersion foot is treated in the following ways:

- Trench foot cases must be evacuated and cannot be treated effectively in the field.
- While awaiting evacuation, the feet should be dried, warmed, and elevated.
- The pain is often severe, even though the injury may appear mild; it may require medication, such as morphine.

Trench foot/immersion foot usually takes at least two months to heal, but may take up to a year. Severe cases may require amputation. Trench foot is not to be taken lightly. There were several cases of trench foot during the Falklands War (1982) and, decades later, trench foot clinics in Great Britain still treat the severe pain experienced by the veterans involved in this conflict.

Snow Blindness

Snow blindness is sunburn of the cornea. Marines in a winter mountainous environment are at increased risk for snow blindness because of the high altitude and snow. At high altitudes, fewer UV rays, which cause snow blindness and sunburn, are filtered out of the air, so more UV rays are available to cause damage. The white color of snow reflects more UV rays off the ground and back into the face.

Symptoms of snow blindness are —

- Painful eyes.
- Hot, sticky, or gritty sensation in the eyes, like sand in the eyes.

- Blurred vision.
- Headache, which may be severe.
- Eye muscle spasm.

Signs of snow blindness include—

- Excessive tearing.
- Bloodshot eyes.

Prevention of snow blindness is very simple: always wear sunglasses with UV protection. If sunglasses are not available, field expedient sunglasses can be made from a strip of cardboard with horizontal slits. Charcoal can also be applied under the eyes to cut down on reflection of the sun off the snow.

Snow blindness is treated in the following ways:

- Evacuate, when possible.
- Patch the eyes to prevent any more light reaching them.
- Apply wet compresses, if it is not too cold, to help relieve some of the discomfort.

Healing normally takes two days for mild cases or up to a week for more severe cases.

Carbon Monoxide Poisoning

Carbon monoxide is a heavy, odorless, colorless, tasteless gas resulting from incomplete combustion of fossil fuels. It kills through asphyxia, even in the presence of adequate oxygen, because oxygen-transporting hemoglobin has a 210 times greater affinity for CO than for oxygen, which means CO takes the place of the oxygen in the body and causes CO poisoning.

The signs and symptoms of CO poisoning depend on the amount of CO the victim has inhaled. In mild cases, the victim may have only dizziness, headache, and confusion. Severe cases can cause a deep coma or sudden respiratory arrest. The classic sign of CO poisoning is cherry-red lip color, but this is usually a very late and severe sign; the skin is normally found to be pale or blue. Whenever a person in a poorly ventilated area collapses, CO poisoning should be suspected. Recognizing this condition may be difficult when all members of the party are affected.

The first step in treatment of CO poisoning is to immediately remove the victim from the contaminated area. Victims with mild CO poisoning who have not lost consciousness need fresh air, light duty for a minimum of four hours, and oxygen, if available. More severely affected victims may require rescue breathing. Fortunately, the lungs excrete CO within a few hours.

Prevention is the key, so a high index of suspicion is required. Marines should—

- Cook in the vestibule of the tent except in ECW conditions. If conditions demand cooking inside the tent, no one should be asleep with a stove running without a mountain buddy present.
- Be familiar with the signs and symptoms of CO poisoning. If the arctic sentry hears a stove on inside a tent, then he must ensure that a mountain buddy team is awake with that stove.
- Ensure that there is adequate ventilation when operating vehicle engines and stoves in closed spaces (tents).
- Be vigilant when cooking over open flames.

Unit leaders need to check their Marines' tents periodically to ensure stoves are not running while Marines are sleeping.

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CHAPTER 14
COLD WEATHER CLOTHING AND EQUIPMENT

Cold Weather Clothing

In any tactical environment, the primary objective of the clothing system is not to provide comfort but to ensure safety. When worn and cared for properly, the M/CWCS provides Marines with adequate protection from the environment.

The M/CWCS is based on a layering principle, which Marines must understand in order to maximize the utility of the M/CWCS. The individual articles of clothing that comprise the M/CWCS are complementary and offer Marines options to suit their current activity or individual preferences. The system's design is flexible enough to both ventilate excess heat and insulate against the cold. The following subparagraphs discuss principles of use and design and review each item within the clothing system.

Principles of Use

The basic principles for properly wearing cold weather clothing can be remembered as "COLD:"

C is for Clean—keep clothing clean.
O is for Overheating—avoid overheating.
L is for Loose and Layered.
D is for Dry—keep clothing dry.

- *Keep clothing clean*. Clothing keeps a Marine warm by trapping warm air against his body and in the fabric of the clothing. If the fabric is filled with dirt, sweat, or other grime, it cannot do its job as efficiently. For example, soap left on wet weather clothing and equipment degrades its water repellency and vapor transmission rate.
- *Avoid overheating*. The appropriate amount of clothing should be worn such that, when combined with body heat and the environment, Marines stay cool enough to prevent overheating that can result in environmental injuries.
- *Loose and layered*. Clothes should be comfortably loose. If clothing is too tight, it will constrict the flow of blood to the extremities and cause limbs to get cold. Warm air can be trapped between the body and the clothes; it is this warm air that keeps Marines warm, not the clothes. The more layers, the more warm air that is going to be trapped. Several thin layers working together will work better than one thick layer working alone. Layers should be removed at the first sensation of sweating.
- *Keep clothing dry*. Wet clothing is less effective than dry clothing, so it is important to put on a shell/protective layer during wet conditions or when walking through wet snow.

Principles of Design

Mountain/cold weather clothing system was designed with three principle layers:

- *Vapor transmission layer*. This layer is also known as a "sweat transfer layer" and draws moisture away from the skin to keep the wearer dry and warm.
- *Insulating layer*. This layer can be one or several layers that hold the warm air around the body. Preferably, it is lightweight, very compressible, and fast drying.
- *Protective layer*. This layer protects the insulating layer(s) from becoming wet or dirty. It should be made of a windproof/waterproof material.

The two primary clothing systems currently used in the Marine Corps are the M/CWCS and the specialty clothing system developed to fit the specific needs of aviation and maintenance personnel (refer to NAVAIR Manual 13-1-6.7-1,

Aviation-Crew Systems Aircrew Personal Protective Equipment [Aircrew/Passenger Equipment]). This publication addresses the M/CWCS only.

Mountain/Cold Weather Clothing System

The M/CWCS was developed to provide lightweight, compressible, fast-drying clothing suited for the modern cold weather battlefield. It uses modern synthetic materials to manage moisture and transfer perspiration away from the skin, so the user remains warm and dry. It is a layered insulating system and is adjustable to personal preference, metabolism, and prevailing weather conditions. It is designed to maintain adequate environmental protection between +40 and -25 °F and survivability to -60 °F ambient temperatures (with moderate movement). The M/CWCS consists of the following five primary layers and accessories:

- Layer 1 (the next-to-skin layer)—Standard polypropylene T-shirt with boxers or flame retardant long underwear (silkweight) tops and bottoms.
- Layer 2—Flame retardant grid fleece, fleece bibs, or desert Marine pattern (MARPAT) Polartec® Wind Pro® fleece.
- Layer 3—Camouflage utility uniform.
- Layer 4—All-purpose environmental clothing system (APECS) camouflage parka and trousers, lightweight exposure suit (desert hard shell), or ECW parka and trousers. Though a consolidated issue facility item, APECS is part of the layering because the utility uniform is also a layer.
- Layer 5—Snow camouflage parka and trousers (overwhites).
- Accessories—Handwear, footwear, and headwear.

The M/CWCS can be broken down into eight categories, which are discussed in detail in follow on subparagraphs:

- Vapor transmission layer.
- Insulating layer.
- Protective layer.
- Snow camouflage (overwhites).
- Head gear.
- Hand gear.
- Foot gear.
- Suspenders.

The vapor transmission layer forms the base of all uniforms and is always worn next to the skin. Insulating layers are adjusted according to preference, metabolism, and weather conditions in order to avoid overheating when on the move or to avoid cold weather injuries when stopped. Take off insulating layers during movement to keep them dry, put on dry insulating layers upon halting. Protective layers are worn as necessary to prevent the insulating layers from becoming wet and protect the individual from wind and precipitation.

Overwhites are not protective outer garments; they are worn only as a camouflage outer layer. The unit leader may dictate either the outer camouflage layer or all layers for inexperienced troops, since inexperienced troops will usually overdress for movements. Experienced troops, on the other hand, should be allowed to wear the inner layers they wish for individual comfort and work efficiency. Individual metabolisms function differently (if one is cold, not all are cold and if one is hot, not all are hot).

The individual Marine is responsible for keeping his M/CWCS items in good serviceable condition; they will protect him only if he takes proper care of them. Marines must examine the M/CWCS items regularly for tears, punctures, bubbling (delaminating), or damage to the material. Punctures on the outer layer will produce leaks and eventually ruin the material if not properly maintained. Repairs should be made as soon as possible.

The M/CWCS clothing items should be cleaned regularly when in use. Dirty clothes wear out quicker because dirt cuts textile fibers, mats down insulating fibers, becomes saturated due to inhibiting water repellency, and retains moisture on the inside from perspiration (lack of ability to breathe).

Before laundering and drying, all the draw cords should be tied together, all zippers zipped, and all snaps and hooks fastened. Securing these items will result in a better-laundered garment.

Vapor Transmission Layer

This category of clothing is the next-to-skin layer and comprises both flame resistant (FR) silkweight and FR midweight long underwear sets of long-sleeved undershirts and drawers.

Silkweight underwear is produced in desert tan silkweight (a modacrylic/rayon blend) material to differentiate it from the non-FR coyote tan silkweight underwear (a modacrylic/rayon blend). The fabric is quick drying, moisture wicking, and includes antimicrobial properties. In addition, it provides Marines with FR protection when needed. Two sets per man are issued.

Midweight underwear is available in a coyote stretch polyester grid fleece (a Polartec® Power Dry® fabric) that has wicking properties, lowered bulk, and insulation characteristics. It provides improved moisture management, insulation, and comfort when worn in intermediate to cold weather environments and FR protection when needed. Two sets per man are issued.

The underwear layer is designed to draw moisture away from the skin and transfer it to the outer layers of the clothing system. Improved moisture management improves clothing system performance and comfort. Cotton undershirts and underwear should *not* be worn when using this clothing because it negates the wicking action of the material by causing moisture to be trapped against the skin.

This underwear should be machine washed with warm water on the permanent press cycle and dried with a low temperature setting. It should not be ironed or dry cleaned and fabric softener and bleach should not be used.

Insulating Layer

The fleece insulating layer is 100 percent polyester, light, low bulk, and comfortable. The basic material for the pullover shirt shall be a FR circular knit with stretch and moisture management provided either by yarn denier differential in the construction or by a chemical treatment.

The fleece 100 weight shirt is coyote tan in an anorak/pullover style. It has a front zipper to mid-chest, turtleneck, and a hand-warmer tube pocket in the front. This item can be used in a wide range of cold weather climates and activities; however, Marines should carefully consider wearing this item while moving, due to the risk of overheating. One top per man is issued.

The fleece 300 weight bib/overall is black and has adjustable elastic suspenders with quick release buckles located in the front, a front zipper, and full-length zippers at the outside seams. It may be put on or removed without removing footgear. One per man is issued.

The polyester fleece layer serves as the primary insulating layer and should be worn by personnel when stationary. Care and cleaning of the bib/overall is to machine wash with warm water using the delicate/gentle fabric wash cycle or to hand wash and machine dry with a low temperature on the delicate/gentle setting. The fabric should not be bleached, starched, or ironed. Garments should be removed immediately at the end of drying and not over dried. To drip dry, the water should be removed and the garment placed on a rustproof hanger.

Protective Layer

The APECS camouflage parka and trouser make up the M/CWCS protective layer. The material is a tri-laminate, comprising a waterproof, vapor permeable membrane laminated between two nylon knits. Both garments come in digital camouflage. These garments are windproof, waterproof, and breathable. They are local supply items and one set per man is issued.

The APECS parka has two hand-warming/cargo pockets, two side access breast pockets, two upper sleeve pockets, and a hood that rolls and stows in the collar. It also features water shedding slide

fasteners and zippered armpit vents. It has a two-way, full-front zipper to provide full-face protection, leaving only the eyes uncovered. There is an elastic draw cord at the hem and waist, Velcro® wrist tabs, and a rank tab at center chest.

The APECS trousers feature suspender attachments, belt loops, two side leg cargo pockets, and knee-high zippers for easy donning and doffing while wearing boots. The trousers have seat and knee reinforced patches and pass-through pockets.

The parka and trousers serve as the windproof and water repellent outer protective layer. The PTFE [polytetrafluoroethylene] laminate in the garment can block water while allowing perspiration (water vapor) to be expelled.

The care and cleaning of the protective layer is to machine wash with warm water and powdered detergent on the regular cycle. Bleach, fabric softener, liquid detergents, or starch should not be used. These garments should be tumble dried on high heat to help restore water repellency of the DWR [durable water repellant] finish. Steaming Gore-Tex® with an iron one-half inch above the garment will also help restore water repellency, but garments should not be pressed. When the water repellent finish is completely worn off (water will not bead after washing and drying), the garment should be replaced.

Snow Camouflage (Overwhites)

The snow camouflage parka, trousers, and pack cover are designed to be worn as an over garment when snow camouflage protection is required. The fabric features a disruptive digitized snow camouflage print that is effective in various winter environments. In addition, the fabric is lightweight, water resistant, and quick drying. The cloth for the parka, trouser, and pack cover shall be Unifi/Duro blizzard, 100 percent polyester. Overwhites are unit issue facility (UIF) items and one set per man is issued.

The snow camouflage (overwhite) parka is a hooded, white parka with drawstrings for adjustment at the waist and pass-through side and hip pockets. The snow camouflage (overwhite) trousers have pass-through side and hip pockets, knee pleats, and drawstrings at the ankles. The pack cover (overwhite) is large with an elastic band sewn into the edge. It is very easy to lose in a snow-covered environment and should be dummy corded when in use.

Overwhites are to be used as a camouflage outer layer in snow-covered terrain and are not a substitute for an outer garment. The nylon overwhites will offer some wind protection. They are worn over all other clothing when terrain dictates their use. Overwhite items are very easy to lose in snow-covered environment and should be secured to the body/item.

The care and maintenance is to keep them clean as they have no camouflage properties if they are not white. They should be machine washed in cold water and dried on a low setting. Using bleach on the cotton overwhites is acceptable, but they should not be starched or pressed.

Head Gear

There is a variety of head gear available to Marines, such as—

- The cap, hardface, microfleece, cold weather is a local supply item and one per man is issued.
- The neck gaiter is made of thin polypropylene and may be worn six ways. A versatile piece of gear, it is a UIF item and one per man is issued.
- The balaclava consists of a coyote tan, windproof hood that entirely covers the neck and head with a large hole for the face. It is a UIF item and one per man is issued.
- The APECS hood is attached to the APECS parka. Its use is discouraged during tactical operations because it impairs a Marine's hearing, unless in extreme cold environments or heavy wind/precipitation.

These items are designed to provide protection to the neck, head, and face in cold weather. Their care and maintenance is to machine wash in cold water and dry on the lowest setting.

Hand Gear

There is a variety of hand gear available to Marines, such as—

- Contact gloves, also known as liner gloves, are in the supply system with several types available. One type is the Manzella® thin green or black polypropylene glove with the raised dots to improve grip. The most common type is the thin, green, wool contact glove. These gloves may be worn under the Gore-Tex® shells of the heavier gloves to ensure the gloves stay dry. These gloves are local supply items and two pairs per man are issued. Contact gloves are designed to handle cold metal objects, such as weapons or hand tools and are not heavy-duty work gloves. They can be used as a lightweight liner for either the Gore-Tex® glove or mitten shells. Contact gloves are not to be worn inside either the glove or mitten when the liners are inserted; this could lead to frostbite because they will be too tight.
- The five finger Gore-Tex® glove has a rubber palm and an insulating liner that can be removed to speed drying. These gloves are UIF items and one pair per man is issued. The Gore-Tex® gloves can be used alone, with their liners, or with the contact gloves.
- The ECW mitten is a quilted, nylon mitten. It is a UIF item and one pair per man is issued. The Gore-Tex® mittens can be used alone, with the contact gloves, or with their liners. The mitten or glove liners should not be worn without the shell. They combine as one large modular system with redundancy in case one becomes wet or unserviceable.

The care and cleaning of hand gear is to machine wash in cold water with powdered detergent, drip dry or tumble dry without heat, and *not* to dry clean or iron.

Foot Gear

Foot gear consists of socks, boots, and gaiters. The sock system reduces blisters by allowing friction to occur between the socks instead of the sock and the skin. It also transports moisture away from the foot to the thicker sock (unless wearing the VB liner). The sock liner is a thin, lightweight, wicking liner sock. It is not yet an issued item, but the nylon dress sock will suffice as a liner sock.

The VB liner sock is a nylon bootie. It is not an issued item, but will increase the warmth of any leather boot because it creates a barrier to moisture, keeps the foot warm, and protects the insulating layer from perspiration. The VB liner sock should never be worn over the insulating sock. The liner sock must be removed and the foot washed and thoroughly dried at least every 12 hours. Marines should not sleep wearing the VB sock. A plastic bag over the sock is a field expedient VB sock.

The heavy blend sock is a thicker, insulating, acrylic or wool sock. A merino wool and a synthetic, wicking fiber mountain sock are in the system. They are the primary mountain operations socks. They are UIF items and four pairs per man are issued.

The mountaineering ski boot is a plastic boot with a removable liner. These boots are warm, they dry quickly, and they have a grooved toe and heel designed to work with crampons and ski bindings. The boot is currently in development for acquisition. It is designed for mountain leaders, scout skiers, assault climbers, and those personnel selected and trained to be mountain pickets/ISR assets for the unit. It is not a supply item and MCMWTC is the only facility that has this test item. Fielding will start after testing is complete and funding procured.

The VB boots (ECW type 2 white) are worn in a cold, dry environment and protect the feet down to -50 °F. The VB boots, shown in figure 14-1 on page 14-6, consist of a nonremovable inner and an outer boot made of rubber and filled with either wool fleece, felt, or closed cell foam (neoprene) insulation. They keep moisture out, while

Figure 14-1. Vapor Barrier Boots.

allowing heat to transfer quickly by moisture in the air. Whenever possible, the VB boots should be removed in order to air-dry feet throughout the day. Socks should be changed according to aforementioned instructions. The valve on the side of the boot should always be closed to keep moisture out, except during air transport in order to equalize pressure in the insulating cells. They are usually sized 1 to 1½ sizes smaller than a street shoe size. It is a UIF item and one pair per man is issued. This boot is not recommended for movements, just static work, such as bivouac routine.

Gaiters are leggings worn in conjunction with the boots to provide protection from snow or debris entering the boot. If wearing a cotton trouser, Marines should wear the gaiter on the outside of the trousers. If it is snowing heavily or Marines are wearing Gore-Tex® trousers, the gaiters should go under the trousers. Gaiters are UIF items and one pair per man is issued.

Three-quarter gaiters can be worn with any boot. They are a nylon or Gore-Tex® legging with a front Velcro® separation seam for donning and doffing. They have an adjustable bottom strap, which is placed under the boot instep, and an adjustable top draw cord.

Full gaiters, also known as "super" gaiters, are a fully insulated nylon or Gore-Tex® legging. They are not for use with the combat or VB boot, but only with mountaineering ski boots. To wear, the toe of the boot is fed through the front hole on the bottom of the gaiter. The heel of the boot slides through the rear hole in the rubber bottom. The toe of the gaiter is pulled over the toe of the boot, ensuring that the rubber seal is snug against the welt of the boot. If the rubber seal will not stay in place along the toe of the boot, a cord or strap may help, but it should not be secured permanently or the boot will curl. Skin adhesive will also help keep the seal in place.

These items are designed to provide protection to the feet from cold temperatures, wind, and moisture. Care and cleaning of foot gear varies by the specific item:

- Polypropylene inner socks are washed in the same manner as the polypropylene long underwear. Wool socks should be washed in cold water with a mild detergent and should not be machine dried.
- For boots, a stiff brush and water is used to remove dirt and snow. Soaking the inside of the boots should be avoided because lined boots take days to dry. The boots should air dry whenever possible, being careful not to use open flames or any method that will dry the boot too quickly. Keeping the boot dry will prevent freezing.
- Gaiters can be washed in cold water with powder detergent and dried on medium/low heat. If the rubber parts start to dry out, they can be coated with a silicone spray. Full gaiters should not be left on boots to dry because leather boots will be damaged and/or the rubber band worn out faster. The toe of the gaiter should be pulled off the toe box to avoid boot toe curl.

Suspenders

The suspenders (suspenders, trousers M-1950) are a carry-over item and are used with the field trousers, APECS trousers, and overwhite trousers. The olive drab suspender straps are scissor-back style (they cross over in the back).

The suspenders have two slide buckles and two hooks, which attach to the trousers. Suspenders are a UIF item and one set per man is issued.

Suspenders are designed to be used instead of a belt to allow body heat to rise to the torso. They help in holding multiple trousers up at the same time. Suspender care and cleaning is to machine wash in cold water and then dry them on low heat.

Personal Equipment

A Marine's personal equipment includes his sleeping system and his load carrying equipment.

Sleeping System

There are two sleep systems from which Marines can choose according to the temperature protection that best matches the operational environment—the three-season sleep system (3S) and the modular sleep system (MSS). These are local supply items and one per man is issued, depending on the climate to which he is traveling. A sleep system consists of multiple components—

- A bivy cover that protects the individual from rain and wind as the outer most layer.
- A sleeping bag that provides warmth from cold temperatures inside the bivy or tent.
- A foam isopor mat that provides warmth and padding from the cold ground under the bivy/sleeping bag.
- A compression sack that reduces the sleeping bag and bivy bulk and keeps it dry during load carriage.

The 3S is issued from the individual issue facility (IIF) for spring, summer, and fall conditions above 20 degrees. Table 14-1, on page 14-8, identifies the clothing layers used with the 3S to achieve 6 hours of protection at different temperatures. Cold sensitivity varies among Marines, so they would remove layers if too warm or add layers if too cold. Fewer layers are required for less than 4 hours of protection while more layers are required for protection exceeding 6 hours.

The 3S sleeping bag component is available in two sizes; Marines shorter than 6 feet use size regular and Marines 6 feet and taller use a size long bag. The long sleeping bag is identified by its olive green interior. The bivy and stuff sack are one size.

To use the compression sack, Marines must—

- Firmly and completely fill the bottom few inches of the sack with the sleeping bag and bivy as a firm base to achieve maximum volume reduction when cinched.
- Stuff the rest of the components in the sack to fill it.
- Push down the contents so that the top of the sack can be folded between black straps, rolled down, and the two side compression straps buckled. Trapped air will escape through the purge valve while the compression straps are cinched to reduce length.

In garrison, the sleeping bag, bivy cover, and compression sack shall be cleaned, dried, and stored in the mesh storage bag with little compression to maintain their warmth and waterproof properties for the next field use. The 3S should never be packed in the compression sack. The sleeping bag and bivy should be washed separately in home laundry with cold water and tumble dried on a low temperature. Laundry detergent not rinsed out completely will destroy water protection. The compression sack is *wiped* clean and then *air* dried. Machine washing/drying will destroy the waterproof coating.

The MSS is issued from the UIF for winter conditions from 15 to -12 °F for 6 hours of protection. The MSS consists of two sleeping bags: the green bag is placed over the black bag and snapped along the side zipper. The combined bags are used inside the woodland camouflage bivy cover and snapped along the bivy zipper. All MSSs are the same size.

Table 14-2, on page 14-9, lists the clothing layers used to achieve 6 hours of protection for different temperatures. Since cold sensitivity varies

Table 14-1. Three-Season Sleep System Temperature Prediction and Physical Properties.

Protective Layers Used with 3S Sleeping Bag, Bivy, and Isopor Sleeping Mat	Minimum Temperature for 6 Hours (°F)
Protective level 1: nude/skivvies	30
Protective level 2: lightweight thermal underwear	25
Protective level 3: warming fleece layers; top and drawers, and watch cap	20
Protective level 4: UIF cold weather parka, trousers, booties, and balaclava	10
Add tactical tent shelter to selected protective level	Subtract 5 °F for lower temperature usage given more protection
Remove bivy shelter from selected protective level	Add 5 °F for higher temperature usage given less protection
Remove isopor mat insulation from selected protective level	Add 10 °F for higher temperature usage given less protection
Physical Properties for Load Management	**Weights (pounds)**
Sleeping bag; size regular/size long	2.4 regular/2.8 long
Bivy cover	1.8
Compression stuff sack	0.5
Combined system weight	4.7 regular/5.1 long
Packed Volume	**Volume (cubic inches)**
Size, regular	800 (fits in bottom of ILBE main pack)
Size, long	840 (fits in bottom of ILBE main pack)

among Marines, they can remove layers if too warm or add layers if too cold. Fewer layers are required for less than 4 hours protection while more layers are required for protection duration exceeding 6 hours.

To use the compression sack, Marines must—

- Firmly and completely fill the bottom few inches of the sack with the sleeping bag and bivy as a firm base to achieve maximum volume reduction when cinched.
- Stuff the rest of the components in the sack to fill it.
- Spread the top flap over the sleep system and cinch the top of the bag closed.
- Compress the sleep system by evenly cinching the six lengthwise straps and the three widthwise straps into an acceptable shape for load carriage.

Care and cleaning for the MSS is the same as for the 3S. A closed cell foam mat weighs 1.2 pounds and provides warmth, padding, and protection from the cold, rough ground. The mat is used between the ground and the individual for sitting, sleeping, or when personnel lie prone for long periods, such as during ambushes. The Marine will be warmer if the mat is placed inside the bivy cover under the sleeping bag. The isopor mat is a local supply item from the IIF and one per man is issued.

To achieve the maximum protection from their sleep systems, Marines must—

- Read visual user guides available at IIF/UIF to understand adjustment features to achieve maximum protection and easy use.
- Keep the sleep system dry; moisture reduces warmth.

Table 14-2. Modular Sleep System Temperature Prediction and Physical Properties.

Protective Layers Used with MSS Sleeping Bags, Bivy, and Isopor Mat	Minimum Temperature for 6 Hours (°F)
Protective level 1: nude/skivvies	15
Protective level 2: lightweight thermal underwear	5
Protective level 3: warming fleece layers top and drawers and watch cap	0
Protective level 4: UIF cold weather parka, trousers, booties, and balaclava	-12
Add tactical tent insulation to selected protective level	Subtract 5 °F for lower temperature usage given more protection
Remove bivy insulation from selected protective level	Add 5 °F for higher temperature usage given less protection
Remove isopor mat insulation from selected protective level	Add 10 °F for higher temperature usage given less protection
Physical Properties for Load Management	**Weights (pounds)**
Sleeping bag; black inner bag	4.0
Sleeping bag; green outer bag	2.3
Bivy cover	2.2
Compression stuff sack	0.9
System weight	9.4
Packed Volume	**Volume (cubic inches)**
Complete two-bag system	1780

- *Never* add moisture to sleeping bag from sweat, wearing wet/damp clothing, or breathing inside the bag. Remove wet clothing and dry between bag and bivy. Wear the *minimum* number of dry clothing layers in the sleep bag to sleep cool and add layers during the night if needed. Always wear the watch cap and dry socks in cooler temps.
- Cinch hood around face keeping mouth and nose exposed. Wear a balaclava for face protection in cold temperatures.
- Place sleeping bag inside bivy when sleeping outdoors without shelter to keep dry. For maximum rain protection, adjust the two bivy wire standoffs to stand upright over the face for maximum rain runoff and close the bivy window. When weather permits, open the bivy window partially or fully for ventilation or fold down the top of the bivy on the chest to prevent condensation inside the bivy.
- Use the bivy as a blanket on top of the sleeping bag when sleeping inside a tent. This will quickly release any moisture from body heat.
- To prevent holes, punctures, and tears that let water in, *never* drag the sleep system across the ground.
- Air dry all sleep system components whenever practical before packing the sleep system in the protective stuff sack. Fluff the sleeping bag *before* it is stuffed into the sack so that moisture within is driven out when air is purged from the stuff sack.
- Fluff the sleeping bag (trapped air is the best insulator) to increase warmth *before* getting in to sleep and refluff during the night if getting cold; kick feet at bottom and grab top with hands and shake up and down a few times.
- Follow cleaning instructions and store in the mesh bag while in garrison to keep the sleeping bag fluffy for maximum warmth and to keep materials waterproof.

Load Carrying Equipment

The following items are used to carry loads:

- *Individual load bearing equipment pack*. Marines are now issued this woodland MARPAT pack for use in all environments. This pack has an internal frame, fully adjustable suspension, side external ski tunnel pockets, an internal divider for the side zippers that open on each side of the pack, a radio pocket, and numerous attachment points. This item should be cleaned with a brush and cold water and allowed to drip dry. The zipper may be lubricated with Tri-Flow® silicon lubricant. It is a local supply item and one is issued per man.
- *Cold weather hydration system*. The system consists of two wide mouth 32-ounce bottles with lids, two water bottle parkas with strap, and one cup. One set per man is issued from the UIF.
- *Waterproof bags*. Marines use a variety of waterproof bag sizes to waterproof ILBE contents. All bags close the same way and must be properly closed to be waterproof. To close a waterproof bag, Marines must—
  - Fold the top of each bag between the black straps flat and smooth.
  - Continue folding down to the maximum fill line marked on the bag.
  - Fasten the buckle closed. Trapped air inside the bags is eliminated through the purge valves on each bag. The valve on the ILBE pack liners must be opened for fast air escape when pressed from the top, then closed to be waterproof. The small Marine compression sacks let air escape from a one-way purge valve when the filled bag is pressed down while closing.
  - Always empty waterproof bags and allow them to completely dry when returning from the field to maintain their waterproof capability. All waterproof bags are cleaned by wiping clean and air drying; machine laundering will destroy their waterproof capability.
- *ILBE main ruck sack waterproof bag*. The ILBE main ruck sack waterproof bag lines the inside of large pack.
- *ILBE assault pack waterproof bag*. The ILBE assault pack waterproof bag lines the inside of this smaller pack. When the bag is turned inside out, its bright orange color serves as a emergency panel marker.
- *5-liter Marine compression sacks*. Four, small 5-liter sacks allow Marines to sort, protect, and manage individual items in the ILBE packs.

Marine Corps Cold Weather Infantry Kit

The MCCWIK was developed to enable forward deployed Marines, separated from their logistic train, a means of sustaining themselves. The MCCWIK enables a 4-man fire team to operate in a cold weather environment for an extended period of time, and it is used with the 4-man ECW tent and two 2-man stoves. The components of the MCCWIK consist of the fire team sled with transport bag and the following items (which fit inside the transport bag):

- One avalanche probe with stuff sack.
- Two snow shovels.
- Two 1-quart thermoses with spare stopper.
- Two 33-ounce fuel bottles.
- Two funnels.
- One cook set.
- Two ski wax kits with stuff sacks.
- Four climbing skins with stuff sacks.
- One hatchet.
- One whisk broom.
- One snow saw with sheath.
- One snow pit analysis kit.

Fire Team Sled

The fire team sled is designed to hold the entire group's stores contained in the MCCWIK system plus one fire team tent and two fire team stoves. Each sled protects the equipment from the elements and offers a method to more efficiently transport the equipment over snow.

The fire team sled comprises the following parts:

- *Hull*. The hull is made of high-impact plastic with three runners designed to keep the sled upright during movement. It has two clevises located in the front of the sled for attaching poles. The sled is also designed with a flanged top for securing the transport bag. There are three large metal D-rings located outside the hull. These D-rings are designed to assist movement of the sled by attaching traces. There are six, small metal D-rings located on the sides of the hull for securing the transport bag to the hull.
- *Transport bag*. This bag is made of nylon cordura and has a cinch cord on its rear corners and two plastic buckles on its front corners. It also has three adjustable compression straps with plastic buckles, two carrying handles, and a double zipper for top loading.
- *Aluminum pull poles*. There are four aluminum pull poles: two are "hooked" to attach to the clevis of the hull and have a small hole on the opposite end; the remaining two poles have a snap button for attachment to the "hooked" poles and a small hole on the opposite end for assembly to the pull harness.
- *Waist harness*. There are two different waist harnesses: the pull harness and the assist harness. The pull harness is equipped with a harness block, pin, and lanyard with carabiner and is the primary harness used to pull the sled. The assist harness is used when more than one Marine is needed to pull the sled. Both harnesses are constructed of nylon and have a plastic snap buckle.

Marines should make the following service checks to the fire team sled:

- *Hull*. The hull should be checked for cracks or holes. Two clevises should be present and inspected for cracks or fracture lines. All metal D-rings should be present and not fractured.
- *Transport bag*. The transport bag should be free of rips or holes and the zipper functional. All three compression straps should be present and all plastic buckles inspected for cracks or breakage.
- *Aluminum poles*. The poles should be straight, not cracked or bent. All snap buttons should be functional.
- *Waist harnesses*. The harnesses should be inspected for possible rips or tears and the plastic buckles for cracks or breakage. The pull harness should be inspected to ensure both harness blocks, lanyards, carabiners, and pins are present and not cracked, ripped, or fractured.

To assemble the fire team sled, Marines must—

- Place the transport bag into the sled hull with zipper and handles up and buckles toward the bow of the sled hull, as shown in figure 14-2 on page 14-12. Position the cinch cord under the flange located around the top edge of the sled hull. Stretch flap with the female buckle end over the front of sled. Couple each set of buckles under their adjacent clevis.
- Place the "hooked" end of the pole through the hole on the clevis while depressing the snap button and ensuring the bend is toward the outside of the sled. Assemble pole halves by depressing snap button into the larger sleeve, aligning the snap button with the hole (see fig. 14-3 on page 14-12).
- Adjust the waist harnesses in the front and rear, keeping pull points directly at the sides of the hip. Insert webbing loops through slot in harness block. Place carabiner through the protruding web loop to the outside of the harness block. Insert pole into the harness block and secure into place with pin.

Extreme Cold Weather Tent

The ECW tent is lightweight and portable, weighing only 17 pounds. The tent is a self-standing, dome-shaped, 4-season design capable of holding four Marines within its approximately 68 square feet of floor space (see figs. 14-4 and 14-5 on page 14-13).

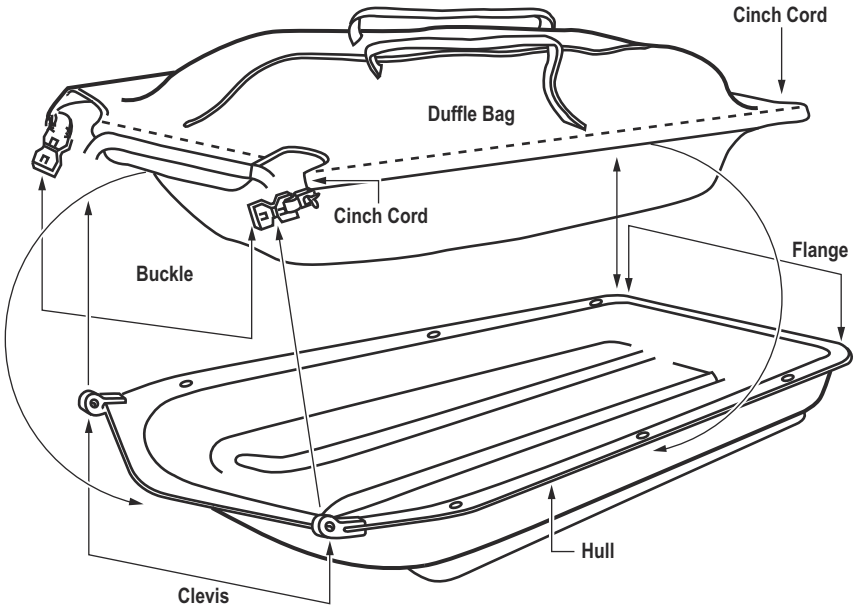

Figure 14-2. Assembling the Fire Team Sled.

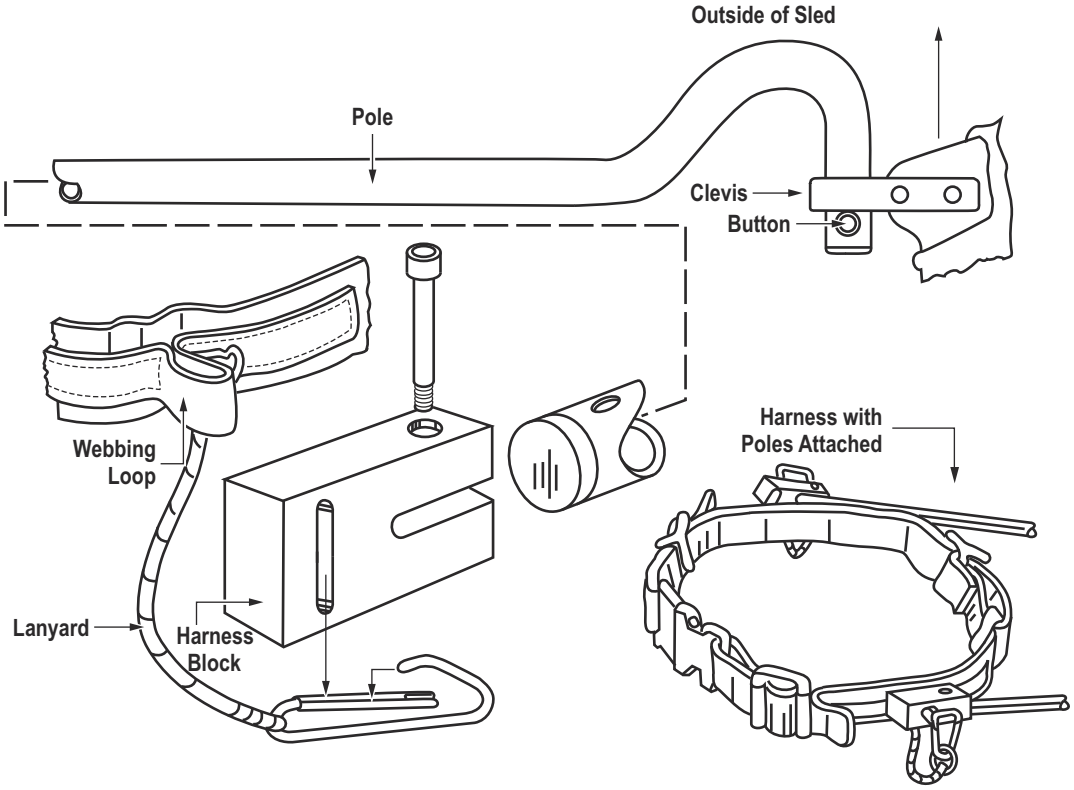

Figure 14-3. Attaching the Poles.

The ECW tent comprises the following parts:

- *Tent body*. The tent body is made of urethane coated taffeta nylon weighing 3 ounces per yard. Inside the top of the tent is a mesh drying rack (see fig. 14-6) and around the bottom are several mesh pockets for commonly used items. The entrance has a mesh panel designed to keep bugs out.
- *Flysheet*. The tent comes with two different flysheets: a woodland camouflage cover for forested areas and a white cover for snow-covered terrain. These sheets are also made of nylon with a heavy black urethane coating for light discipline. Figure 14-7 shows the parts of the flysheet.
- *Poles*. The pole configuration used with this tent allows maximum use of floor space. The poles consist of nine sections of 7075 aluminum that are held together by shock cords, which aid in connecting them when pitching the tent.
- *Accessory kit*. Each tent comes with an accessory kit: 2 pole repair sleeves, 24 aluminum stakes, 12 nylon tiedown cords, 12 line tighteners, a black foam spacer, and woodland colored repair tape 3 inches by 36 inches.

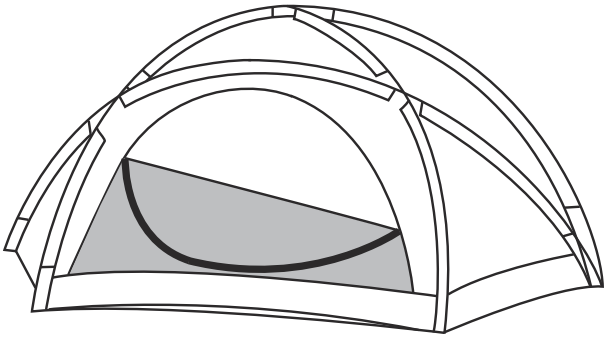

Figure 14-4. External View of the Extreme Cold Weather Tent.

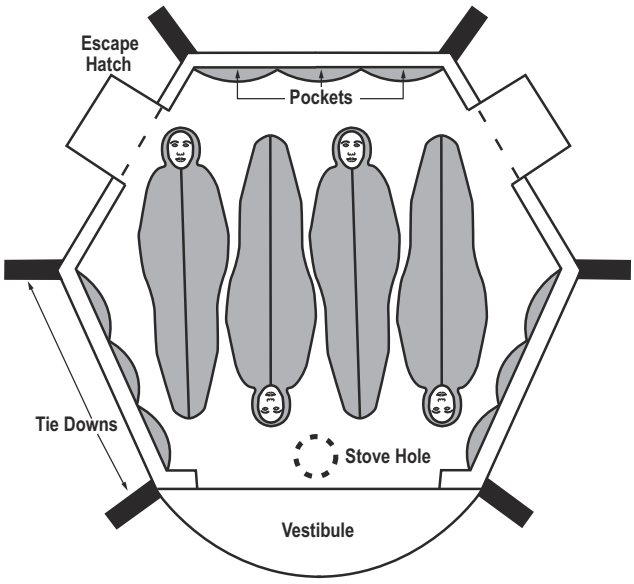

Figure 14-5. Internal View of the Extreme Cold Weather Tent.

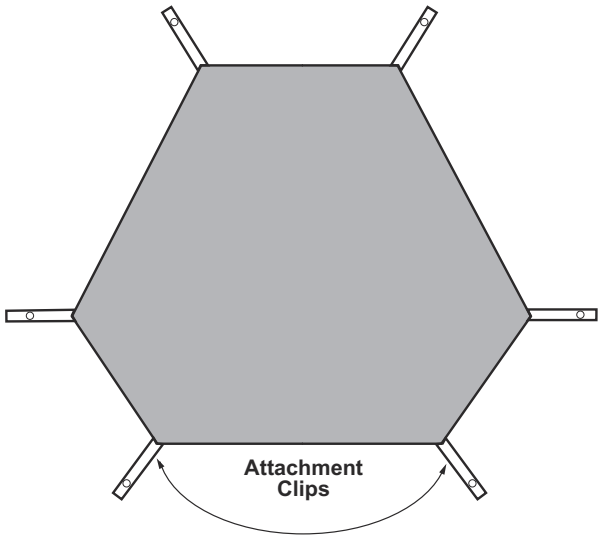

Figure 14-6. Mesh Drying Rack.

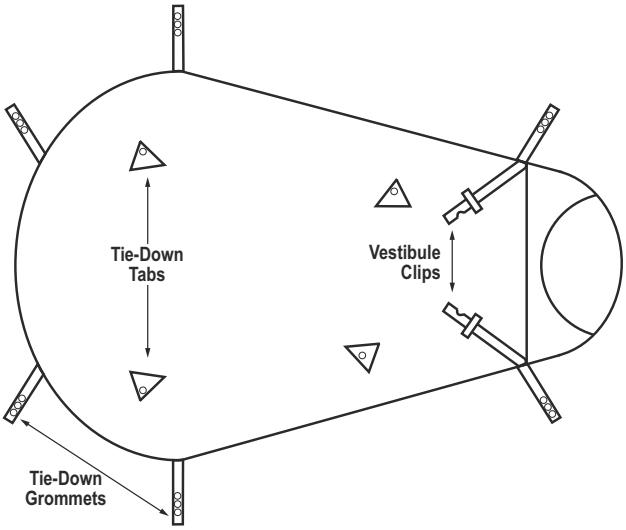

Figure 14-7. Flysheet.

Pitching the Tent

The following steps are taken when pitching the ECW tent:

- *Clear an area*. Ensure that there is sufficient room for the tent (approximately a 12- by 12-foot area) by spreading it over the ground and pulling the floor section tight. Once the circle is marked, it should be dug down 4 to 6 feet. Depending on the tactical situation and time limitations, Marines can pack down the snow to achieve some cover and concealment initially and then improve the position later by building up a surrounding snow wall.
- *Insert poles into sleeves*. Six of the poles go into the sleeves on the tent, with three being kept aside for the fly. The poles that form the triangle at the top of the tent should go in first, followed by the poles around the side. There are several grommets in each strap to adjust the tension of the tent.
- *Attach the foam spacer*. The foam spacer is attached to the snap located on the rear of the tent. The foam spacer is used to prevent the tent sheet from coming into contact with the tent, keeping water away from the tent and adding an additional insulating layer.
- *Hook the flysheet*. The flysheet is hooked onto the back of the tent and brought over the top, ensuring that the entrances on both are aligned. The remaining poles go into the sleeves and are adjusted for tension. The front of the fly is pulled out away from the tent for maximum tension. Inside the fly are two straps that attach to the triangular buckles on each side of the entrance. These straps are used to adjust tension and prevent the fly from blowing away. The fly may be used alone when the weight/load considerations override tent functionality, such as for a long reconnaissance patrol.
- *Secure the tent*. Use the tent stakes and guidelines provided to secure the tent. These tents, as with all tents, are vulnerable to wind damage. Therefore, it may be necessary to secure the corners before inserting the poles during pitching in high wind conditions. When pitching the tent in deep snow, it may be preferable to use a "deadman" (any weighted object available, preferably something natural that can be cut away and left) to hold the tent down. All tie-down points available should be used, depending on wind and tactical conditions.

Although the tent is designed with light retention material, it is not lightproof, but it may be possible to build a snow wall that shields light emissions and camouflages and protects the tent from snow. In deep snow, it is best to dig down into the snow-pack and keep a low silhouette; the tent should be camouflaged with overwhites or netting.

Striking and Packing the Tent

To strike the tent, the pitching instructions are performed in reverse order. The tent fly should be folded lengthwise into thirds and rolled tightly around the folded tent pole sections, squeezing trapped air out in the process, before placing it in the stuff sacks.

Note: When breaking down the tent poles, Marines may find the poles frozen together from the freezing of condensation. If this occurs, they should rub a gloved hand repeatedly up and down over the joining section to create friction. The pole will warm up enough to be broken down.

Tent Maintenance

The ECW tent requires the following maintenance:

- *Cleaning*. After each use, loose debris should be shaken from the tent and all dust and track marks sponged clean. If the fabric requires deeper cleaning, the tent should be hand washed in mild soap and warm water and air dried out of direct sunlight, ensuring the fabric is completely dry. The tent should never be stored wet as doing so causes mildew and damage to the tent fabric.
- *Tent pole care*. From time to time, a thin layer of silicon lubricant should be applied to all parts of the poles. This lubricant is excellent protection against corrosion, prevents the poles

from freezing together when they are very cold, and makes the joints work more smoothly in any weather.
- *Seam sealing*. To ensure the tent floor and fly-sheet are waterproof, the seams must be thoroughly sealed.
- *Zippers*. Zippers should be lubricated with a silicone spray to keep them running smoothly and to prevent freezing.

Safety Considerations

The following measures should be taken to ensure safety within the tent:

- *Ventilation*. The door should be kept open slightly to ventilate and prevent condensation from forming inside the tent. Such condensation would cause humid air and prevent the proper functioning of the drying rack.
- *Stoves*. Cooking or melting snow for water should be done in the vestibule because cooking inside the tent can lead to fires or spills that can harm Marines or gear. A lit stove placed inside the tent in the stove hole will heat the inside of the tent very quickly for rewarming and drying clothing, but it will also consume all of the oxygen in a sealed tent, which may result in asphyxiation from CO poisoning. Since CO is heavier than air and settles at the tent bottom, the tent should be vented as low as possible to the ground, leaving the zipper open 6 to 8 inches.

Small Unit Expeditionary Stove

The SUES is a multifuel stove that can burn JP-8 jet fuel or diesel fuel (see figs. 14-8 and 14-9 on page 14-16).

Serviceability Checks for the Stove

Service checks should be made on the following parts of the SUES:

- *Flame spreader*. The flame spreader should not be bent, loose, or damaged.
- *XJ jet*. Jet must be clean and tightened.
- *Needle weight assembly*. Weight must be free moving. The jet is cleaned by rotating the stove back and forth.
- *Leg/pot support assembly*. Legs and supports should be checked for bent or broken pieces.
- *Stove*. The stove should be checked for bent or broken parts.
- *Fuel pump*. Dry, cracked, or torn O-rings should be replaced. Replacement O-rings and pump seals can be found in the maintenance kit.
- *Pump seal*. Pump seal should be inspected and replaced, if damaged.

Maintenance for the Stove

To perform fuel tube O-ring maintenance, Marines must—

- Remove plunger (align, twist, and pull). See figure 14-10 on page 14-17.
- Remove the fuel tube bushing and O-ring. Remove the O-ring with the end of the fuel line or a safety pin (see fig. 14-11 on page 14-17).
- Inspect O-ring.
- Replace O-ring, if needed. A spare fuel tube O-ring is provided.
- Lubricate pump cup using a drop of pump cup oil or any mineral-based oil.
- Insert plunger by aligning plunger/bushing arrow with holes in the pump body and pushing the plunger/bushing into the pump body until it snaps in place (see fig. 14-12 on page 14-17).

To perform control valve O-ring maintenance, Marines must—

- Unscrew the stop nut two turns (see fig. 14-13 on page 14-17).
- Unscrew the control valve six turns.
- Unscrew the stop nut completely and remove the control valve.
- Inspect O-ring.
- Replace O-ring, if damaged, by disassembling the control valve assembly and removing the O-ring.
- Inspect pump seal and replace, if damaged (see fig. 14-14 on page 14-17).

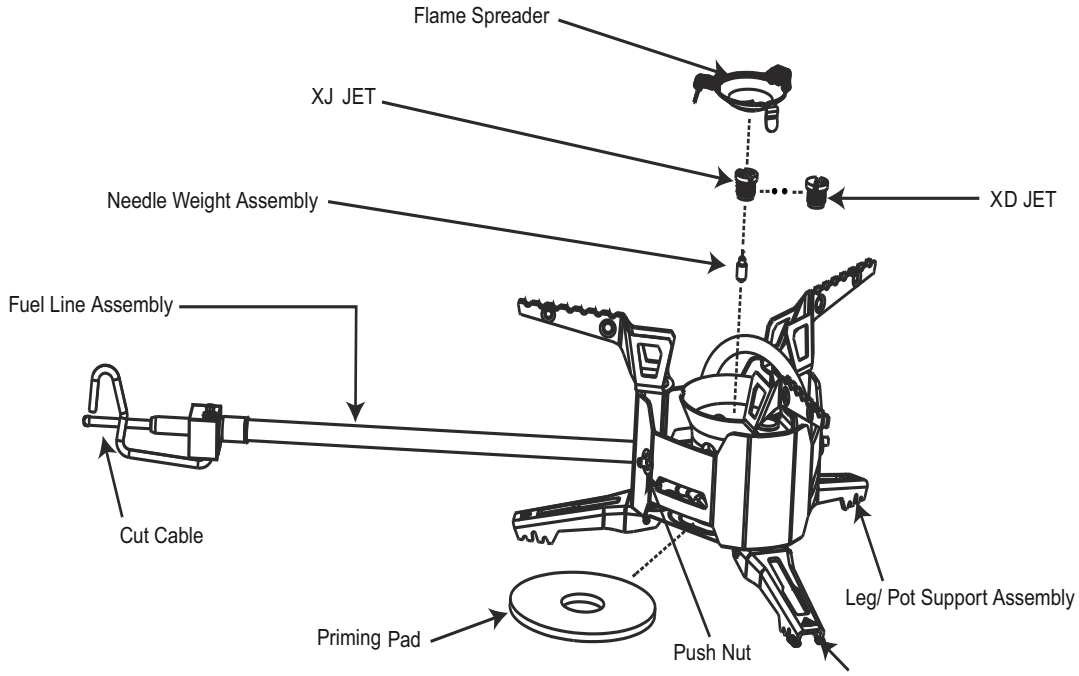

Figure 14-8. Nomenclature for Small Unit Expeditionary Stove.

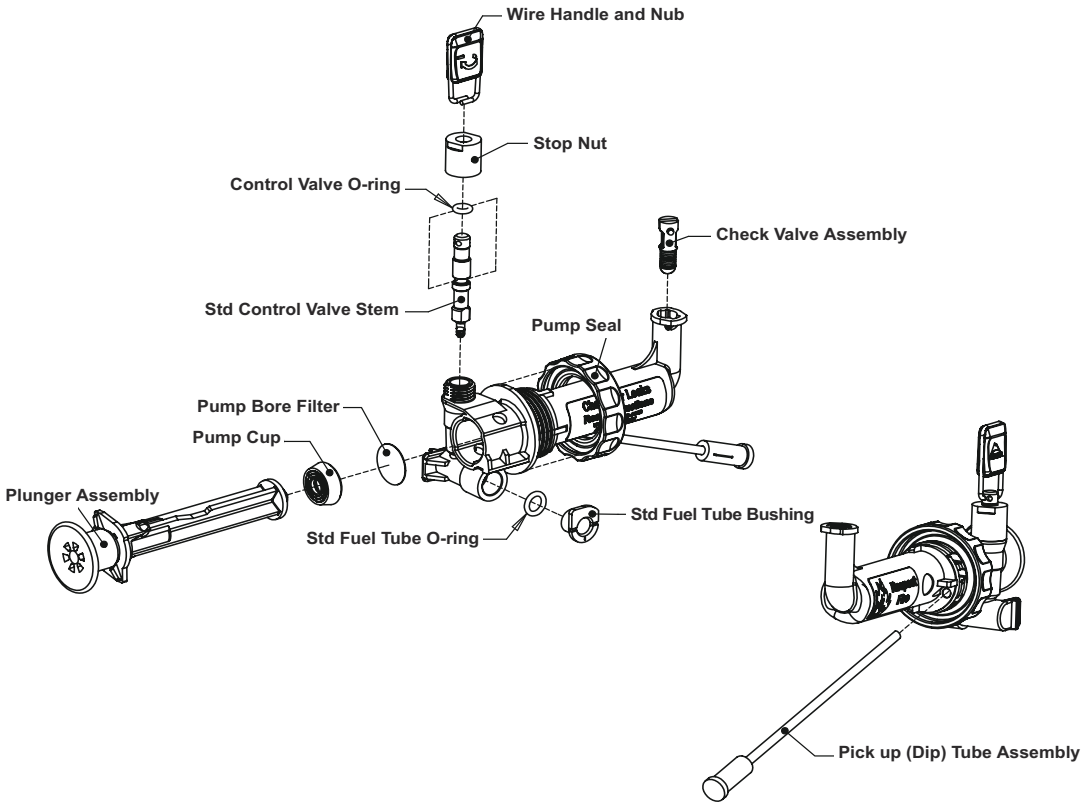

Figure 14-9. Nomenclature for Small Unit Expeditionary Stove Pump.

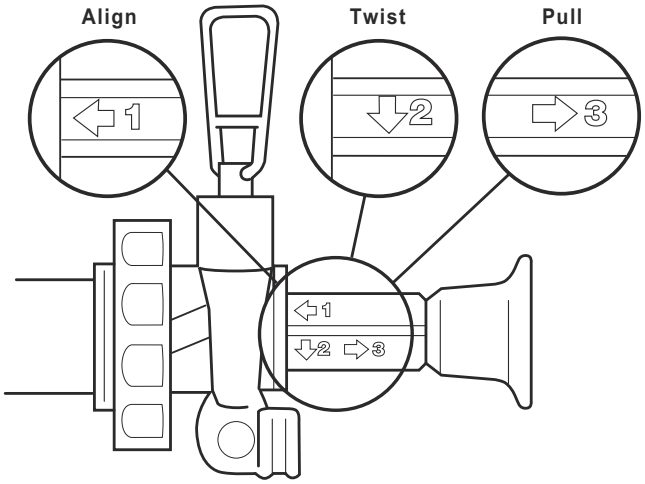

Figure 14-10. Remove the Plunger.

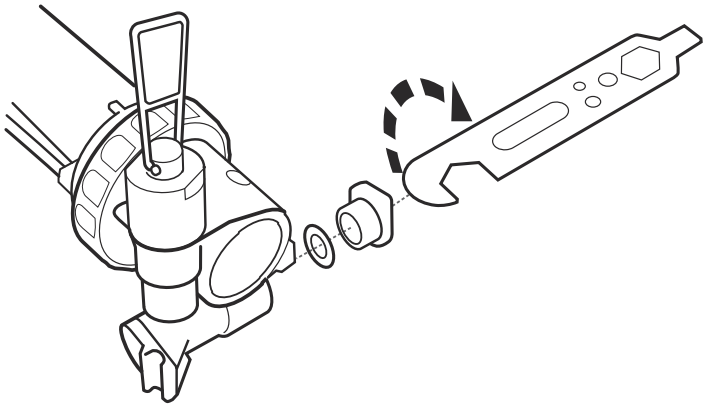

Figure 14-11. Remove the O-Ring.

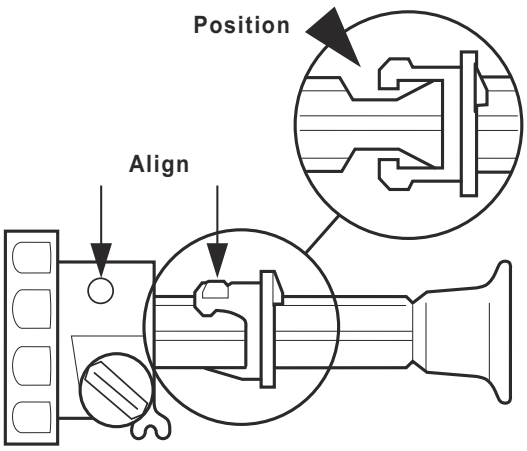

Figure 14-12. Insert the Plunger.

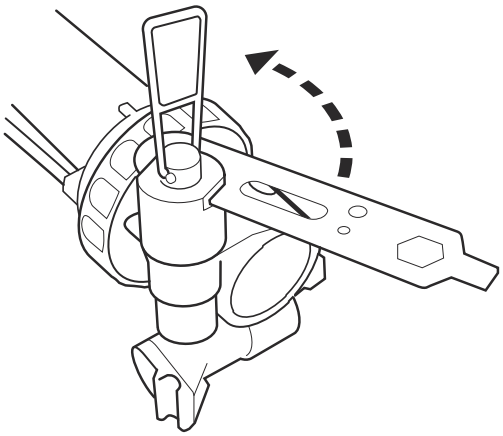

Figure 14-13. Unscrew the Stop Nut.

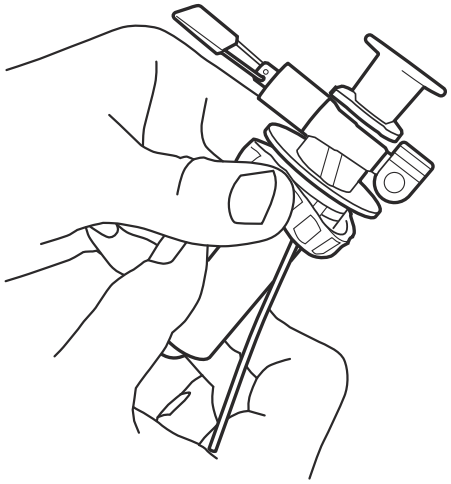

Figure 14-14. Remove the Pump Seal.

To clean the check valve, Marines must—

- Remove the check valve assembly (see fig. 14-15).
- Clean any debris from the check valve and pump cavity.
- Reinsert the check valve assembly.

To clear the jet with the shaker needle, Marines must—

- Close the control valve and wait 5 minutes for stove to cool.
- Shake the stove up and down (see fig. 14-16).
- Preheat and run stove. If performance does not improve, perform extensive cleaning of the jet and fuel line.

To perform extensive cleaning of the jet and fuel line, Marines must—

- Remove the flame spreader (see fig. 14-17).
- Unscrew the jet, using the jet and cable tool (see fig. 14-18).
- Remove the jet and shaker needle.

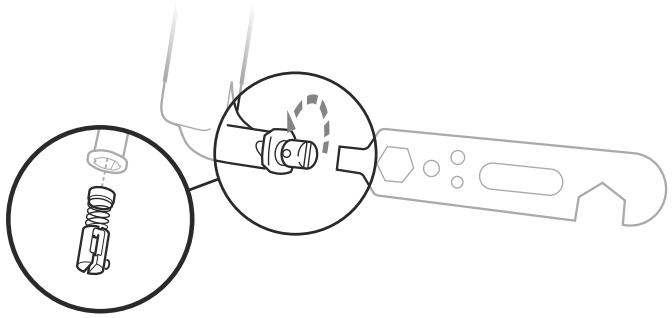

Figure 14-15. Remove the Check Valve Assembly.

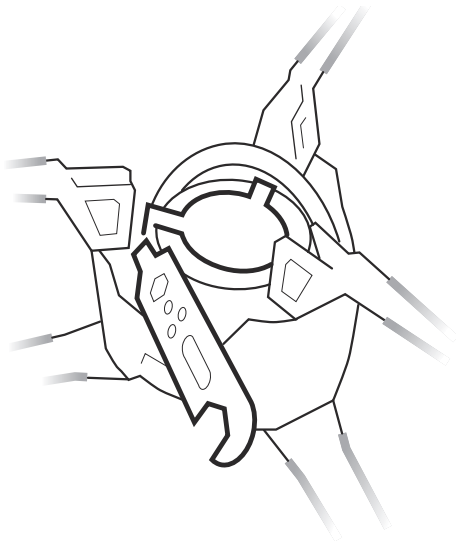

Figure 14-17. Remove the Spreader.

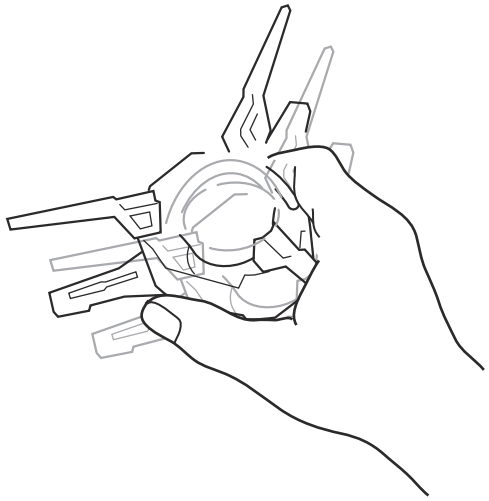

Figure 14-16. Shake the Stove.

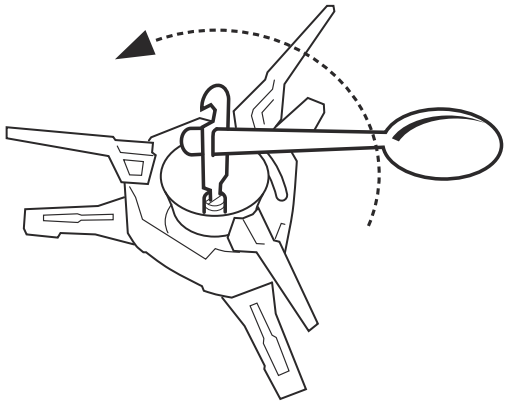

Figure 14-18. Unscrew the Jet.

- Clear the jet orifice with the jet cleaning wire (see fig. 14-19).
- Scour fuel line. Remove cable from fuel line (see fig. 14-20). Stubborn cables can be loosened with a common lubricant, such as WD-40® or pump cup oil. Wipe cable clean and fully reinsert it into the fuel line. Move cable in and out, using 5-inch strokes, 20 times (see fig. 14-21).
- Flush fuel line. Remove cable completely and insert the fuel line into the pump, securing the catch arm on the fuel pump groove. Pressurize the fuel bottle with 15 strokes. Open the control valve fully to flush 2 ounces (3 tablespoons) of fuel through the fuel line into an appropriate container. Keep away from ignition sources and safely dispose of fuel when flushing is complete.
- Reassemble stove. If stove performance is still impaired, repeat extensive cleaning of the jet and fuel line process.

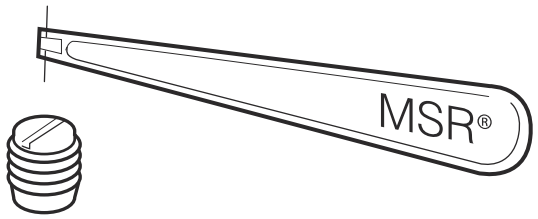

Figure 14-19. Clear the Jet Orifice.

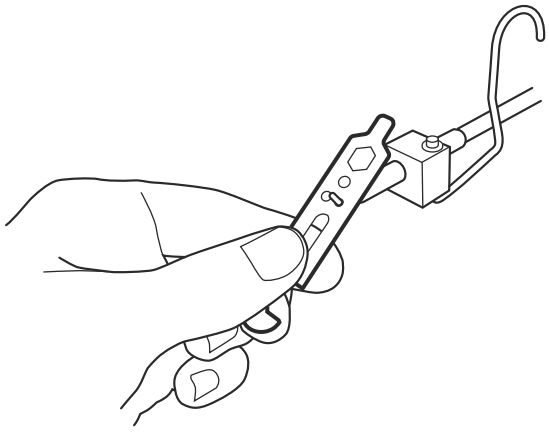

Figure 14-20. Remove the Cable.

Stove Use

To use the stove, Marines must—

- Fill fuel bottle only to fill line because air space is necessary for fuel pressurization.
- Insert pump into the fuel bottle and firmly tighten.
- Close the control valve and then stroke plunger. Less fuel requires more strokes/pressure.
- Set up the stove by rotating the stove legs and pot supports and placing the stove on the center of the heat reflector on a level surface. DO NOT TIP THE STOVE.
- Connect the stove and pump by inserting the fuel line into pump with the fuel bottle on its side and the control valve pointing up. Secure the catch arm on fuel pump groove. Keep fuel line straight for safety.
- Ensure that the control knob is in the OFF position.
- Open the pump knob one turn counterclockwise.

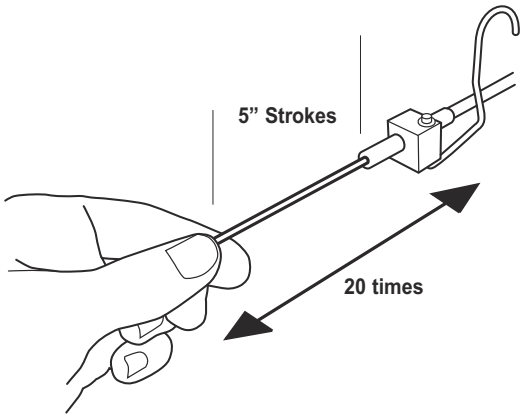

Figure 14-21. Scour the Fuel Line.

- Place the thumb over the hole in the pump knob and pump air into the fuel tank. DO NOT OVER PRESSURIZE THE FUEL TANK. If little or no resistance is felt, lubricate or replace the pump cup.
- Preheat the stove by releasing only one-half tablespoon of fuel. Open control valve one turn and let fuel flow for 3 seconds. Close control valve. Look for fuel in burner cup and on priming pad. Light the fuel. Initial flash can singe eyebrows if face is too close to stove due to flash size of up to 8 to 10 inches.

To turn stove on—

- Wait for preheat flame to reduce in size.
- Open one-half turn and wait for steady blue flame.
- Slowly open control valve.

To cook—

- Set up the windscreen to improve performance in all conditions, leaving a 1-inch gap between windscreen and pot for optimal performance.
- It may be necessary to repump the stove occasionally during use for full heat output, adding 10 strokes every 10 minutes is a rule of thumb.
- Turn the control knob between HI and LOW to regulate the heat.

To turn stove off—

- Close control valve. Because of residual fuel in the line, the stove will continue to burn with a small flame.
- Wait 5 minutes for stove to cool after flames are out.
- Unlock catch arm and remove fuel line from pump.
- Depressurize bottle and repack stove. Hold the fuel bottle upright, away from the face and any sources of heat or ignition. Slowly unscrew pump to depressurize bottle.

To transport or store the fuel bottle, the pump may be left inside a depressurized fuel bottle. The pump can also be removed and replaced with the fuel bottle cap.

Group Stores

Group stores are those items required to operate for a prolonged period in a cold weather environment. The fire team sled should not be used to haul individual gear, which should be carried in the individual's pack. The following items may be placed in the sled:

- Extra fuel for the team stoves.
- One case of extra MREs/MCWs.
- Candles or lantern.
- Trash bags.
- Crew-served weapons.
- Ammunition.

Packing the Sled

When packing the sled, the most important principle is to keep the center of gravity low, balanced side to side, and to the rear half of the sled. Packing the sled in this way will facilitate movement of the sled and help prevent it from tipping over or nosediving into the snow when being pulled. The heaviest items should be loaded first. Seldom used items, such as extra fuel, candles, and trash bags, should also be on the bottom, front half of the sled. The ECW tent should be in its stuff sack and placed inside the sled. Shovels and pioneer gear should be packed on top of all other components so that Marines can get to them easily during a movement or when first establishing a bivouac. Once all group stores are inside the sled, the canvas cover is zipped and all compression straps tightened to hold the gear securely in place.

10-Man Tent and Arctic Space Heater

The 10-man tent and Yukon stove are cold weather equipment items used primarily by

forces conducting rear operations (secure area or fixed location). The size and weight of the tent and stove limit their use to areas and units that can be supported by a vehicle.

This 6-sided tent is supported by a telescopic pole and accommodates 10 Marines and their individual clothing and equipment. The 10-man tent can accommodate additional Marines by either storing individual equipment outside, lowering the telescopic pole to spread the sidewalls, or both. The tent has two doors that allow tents to be joined together when larger spaces are required.

A snow cloth is attached to the bottom of the sidewalls. Piling and packing snow on the snow cloth seals the tent to the ground, improving general integrity and insulating qualities. Additionally, the tent has four built-in ventilators near the peak and four lines for drying clothing and equipment. Total weight, to include the pins and tent poles, is 76 pounds dry (heavier in snow).

Nomenclature and Serviceability of the 10-Man Tent

Each of the following items are part of the 10-man tent, some of which need periodic service checks:

- *Apex*—The metal plate found in the middle of the tent.
- *Stove hole*—The hole on the side of the tent with a rubber grommet. The grommet should be serviceable and the covers for the hole should be rolled up and tied off when a stove is used.
- *Front door*—The front door is nearest the stove hole. All zippers should work and all buttons should be present.
- *Back door*—The back door is opposite the front door and should always be secured. All zippers should work and buttons should be present.
- *Primary lines*—These are gold colored lines on the vertical seams of the tents. There should be one on each vertical seam.
- *Intermediate lines*—These are the white lines on the horizontal seam between the primary lines. There should be a line between each of the primary lines.
- *Secondary lines*—Secondary lines are white lines located above the primary lines on the vertical seams. There should be one secondary line above each primary line.
- *Canvas*—The canvas should be free of holes. Any holes should be patch sewn.
- *Tent cover*—The tent cover should be free of holes and should have straps to secure the folded tent.
- *Telescopic pole*—The tip of the telescopic pole must fit into the apex and be able to extend without collapsing when the weight of the tent is placed on it.
- *Liner*—The tent liner is white and should be free of holes. All holes must be sewn or patched. The liner doors must have zippers that work.

Site Selection

The following criteria should be considered when selecting a tent site:

- Forested areas in the mountains offer the best site.
- Forested areas provide cover and concealment for the Marines and the trees will provide protection from the wind.
- Wooded areas also provide firewood and other materials for construction of defensive positions.
- If fires are built, the trees overhead will help disperse the smoke.

Tent Erection

To erect the 10-man tent, a level area must be created. If the snow is deep, it can be shoveled

out or packed down. The diameter of the tent can be measured by using a ski pole held at arm's length. Two Marines are needed, each to hold one end of the ski pole. One man will position himself in the center of the prospected site for the tent; the other man will walk a complete circle around him to determine the diameter needed. To erect the 10-man tent, Marines must—

- Lay out the tent in a hexagonal shape, with the front door at 11 or 1 o'clock from the wind, canvas side up.
- Lay out the gold primary lines down the seams of the tent.
- Prepare to stake down the primary lines with tent pins, tie them off to trees, or use a "deadman" to anchor.
- One man, with the telescopic pole extended, opens the door, and enters the tent. He sets the pole in the ring at the apex of the tent and raises the pole to a vertical position. Use the tent cover as a base for the pole, so it does not sink in the snow. Do not twist the pole, or it will collapse.
- Once the tent is raised, the primary lines can be secured and tightened. Set in tent pins or "deadmen" about 5 feet away from the tent in line with the seams. Secure opposite lines to ensure an even pull and to keep the pole straight. The pole man still holds the pole until all primary lines are secure.
- Marines outside stake down the corners and doors.
- After the primary lines, stake and secure the secondary lines. Do this about 1 foot farther out than the primary anchors.
- Stake down and tighten intermediate lines.
- Adjust all tent lines to ensure a tight and secure tent.
- Tuck the bottom flap under and cover it with gear in wet-cold conditions to prevent snow freezing to the tent flap. Fold flap out and cover with snow in dry-cold conditions.
- Marry together several tents with the zippers to form command posts or battalion aid stations.

Striking the Tent

To take down the tents, Marines must—

- Remove the tent pins/stakes holding the tent lines down.
- Lay the tent out flat, close the door zippers and snaps, and tie up all lines securely. Now, the tent is ready to be folded.
- Lift the apex off the ground and pull the entire tent into the wind, folding the tent in half.
- Starting at one of the lower corners, pick it up and match it with the opposite corner of the tent, folding it in half vertically.
- Repeat, placing the corners together until all the panels have been folded into an accordion pleat.
- Ensure that, while bringing the corners together, the inside liner is folded smoothly alongside the tent.
- Lay the tent down, even out the folds, and place the tent lines into the tent.
- Fold the top half down to the eave and then fold the bottom up and over the eave.
- Place the folded tent in its original outside cover and strap it up tightly.

The 10-man arctic tent is ready for storage or movement by vehicle.

Yukon Stove

The Yukon stove is the primary heater of the 10-man tent. The Yukon stove is a multifuel stove that uses standard nonleaded gasoline as its normal fuel. The following SL [stock list]-3 parts should be carried:

- M-1950 60,000 BTU [British thermal unit] stove body.
- Five stove pipe sections.
- Three guy lines.
- Draft diverter.
- Burner plate and drip valve.
- Gas hose.
- Fuel can adapter with 5-gallon gas can.
- Vent tube (two sections).
- Stove grate.

A piece of plywood covered with aluminum foil and slightly larger than the base of the stove should be carried as part of the tent equipment. The plywood will provide a firm base for the stove and prevent it from melting into the snow.

Stove Serviceability

Upon checking for all required parts, Marines must check the stove's suitability for use. In doing so, they must—

- Check that all five stove pipes fit together in sequence. The #1 stove pipe must also fit snugly into the stove body. The stove body has stove legs that swing down to make the stove level.
- Ensure the draft diverter fits tightly on the pipe and the guy lines can be secured to it.
- Ensure that the burner assembly fits on top of the stove body with the retainer lugs holding it in place.
- Check the gasoline hose for holes and the brass connections on both ends should be tight and usable.
- Check the fuel can adapter and vent tube for a close fit.

Assembly of the Yukon Stove

Once the Yukon stove has been checked for parts and condition, Marines can prepare it for operation by completing the following steps:

- Attach the #1 stove pipe to the stove body by twisting the stove pipe under the clasps surrounding the thimble hole.
- Swing out the stove legs from underneath the stove body. The stove body should be level. It can then be put inside the 10-man tent and positioned so that the door and draft slide face out toward the tent door.
- Install the #2 through #5 stove pipes together with the draft diverter and guy lines. This section of stove pipe is best installed from outside the tent and attached by inserting the pipe through the stove pipe hole in the tent.
- Secure the stove pipe by lashing the draft diverter guy lines to the tent. By doing this, both the stove pipe and tent will move together in strong winds, preventing a hot pipe from burning the tent.

The burner assembly can be inserted after the stove pipe is installed by completing the following steps:

- Insert the burner assembly into the burner hole on the top of the stove body.
- Secure it by turning the retainers (spinnerets) until they catch under the burner hole.
- Lower the wire loop on the burner onto the ends of the retainers (spinnerets).
- Rotate the burner to ensure that the drip valve is offset to one side of the stove.
- Assemble the fuel can adapter and vent tube together as one part.
- Insert it into the fuel can with the cam handle free.
- Tighten down the adapter plug.
- Press down the cam handle on the fuel can to seat the adapter and fuel can together.
- Attach the fuel hose to the drip loop and the drip valve on the burner. Make sure the hose is not exposed to the stove. To ensure this, run the fuel hose over the drying line on the inside of the tent.
- Check to ensure that the drip valve is closed.
- Ensure a smooth flow of fuel by elevating the fuel can at least 3 feet higher than the stove by lashing it to a tree or by making a tripod.

Operation

To light the M-1950 Yukon stove, Marines must—

- Open the stove door. Wipe up any excess fuel that has collected inside the stove, making sure the tent door is open and keeping his face away from the stove door.
- Hold a lighted match under the edge of the burner plate.
- Turn drip valve counterclockwise until 12 to 15 drops of fuel flow through the glass window.

- Once lit, close the door of the stove and shut the draft slide.
- Adjust the drip valve to regulate fuel to heat the tent. The gas should drop slowly through the glass window and not flow freely.

  Note: The fuel can must be inverted outside the tent into position. Some fuel might leak out while this is being done because either the vent tube is clearing out fuel (it should stop within a few seconds), there is a bad seal/connection from the adapter to the fuel can, or there is a faulty or incorrectly inserted vent tube within the adapter. The spilled fuel should be wiped up immediately.

To turn the stove off, Marines must turn the valve clockwise while watching the glass window until the fuel stops dripping. The Yukon stove will burn 5 gallons of gasoline or diesel every 8 to 12 hours of operation and can burn kerosene, light fuel oil, naphtha, or JP-4 jet fuel without modification. To burn wood, the burner plate cover must be closed and the grate inverted to allow space for a draft and ashes. The draft vent on the stove door should be open. When lighting the wood, **EXTREME CAUTION** should be used; using any type of starter fuel on the wood should be avoided. Instead, a solid, flammable material, such as paper, dried vegetation, or fabric, should be used. Once the wood is lit, the door should be closed and wood added accordingly for moderate temperature control within the tent. The ashes should be emptied periodically from the stove for efficient operating use.

Safety

The following safety precautions should be observed to ensure safe operation of the stove:

- Never leave a stove running unattended.
- Turn the stove off if leaving, even for a short time.
- Make sure all fittings on the stove fit tightly.
- Keep the stove level at all times to spread an even flame on the burner plate by placing a piece of wood or an MRE sleeve under the stove legs and #1 stove pipe.
- Protect the gas hose from being pulled on or coming into contact with the stove.
- Do not use excessive force on the drip valve or the hose fittings. Too much pressure at these points will damage the threads and the stove will be useless.
- Check the rate of fuel flow at regular intervals. The drop in fuel will change the burn rate in the burner plate.
- If the stove goes out accidentally, close the drip valve and wait for the stove to cool down before relighting.
- Store all fuel supplies outside the tent to prevent an explosion.

Disassembly

Once the stove has cooled, it can be disassembled in the following manner:

- Lower the fuel can until it is standing upright.
- Disconnect the gas hose from the fuel can adapter and drip valve.
- Untie the guy lines from the draft diverter.
- Break down the stove pipe sections.

Packing

After the stove has been disassembled, it can be packed up and placed in the ahkio, large sled, or a vehicle for storage or movement. Packing is the reverse of removing the parts, which were inside the stove body before assembly. To pack the stove, Marines must—

- Nest the sections of stove pipe inside the base section.
- Place the draft diverter next to the stove pipes.
- Place the pipes inside the stove body.
- Place the burner assembly on top of the draft diverter.
- Coil the fuel hose and place the hose, fuel can adapter, and vent tube next to the burner assembly.
- Close the burner plate cover and the stove door and fold down the legs.

CHAPTER 15
DEFENSIVE POSITIONS AND FIELD FORTIFICATIONS

Defensive positions are inherently linked to bivouac sites; therefore, in addition to establishing a bivouac site, the unit leader will be concurrently concerned with establishing a sound defensive position. Specifically, he will need to organize the unit's assigned sector and design the strongest fighting positions that time and materials will allow.

Site Selection

The following items are considerations for site selection of defensive positions in the mountains:

- Establish the bivouac position in a concealed area and establish the fighting positions on the high ground, depending on the tactical situation. On the high ground, it is nearly impossible to conduct an attack over icy slopes or wading through knee- to waist-high snow uphill. Care should be taken to conceal the tracks to and from the bivouac position.
- Cover likely avenues of approach, such as frozen streams, lakes, ravines, or tree lines.
- Cover natural obstacles, such as avalanches, windfall, and water obstacles.
- Incorporate natural strengthening features, such as rocks, trees, fallen timber, small knolls, or depressions. It is less work and such features offer natural cover and concealment and their use makes these positions stronger.
- Use shaded areas to provide concealment and prevent the sun from melting snow/ice protection.
- Keep backs to the prevailing winds not only to keep Marines more comfortable and more alert, but also to give Marines the advantage of seeing more clearly and further while forcing the enemy to look into the wind. When such positioning is not possible, the positions can be modified to avoid the full force of the wind.

Characteristics

As with any fighting position, a low profile is desired. If the snow is shallow, a regular fighting position should be dug into the ground, taking care not to scatter the dirt across the snow, as this may give away the position.

The fighting position should be built to match nearby snow banks; if the surrounding area has powdered snow, so should the fighting position. The position should not contain straight or sharp lines, as in figure 15-1 on page 15-2.

The bottom of the fighting position should be kept camouflaged; Marines should not dig completely down to the dirt and then leave the dirt exposed. Insulation, such as MRE boxes, can be used at the bottom of the position for camouflage and to keep Marines warmer.

It is ideal to build the fighting position just before snowfall as fresh snow will help conceal construction efforts. It is, however, never a good idea to walk directly in front of a friendly position (see fig. 15-2).

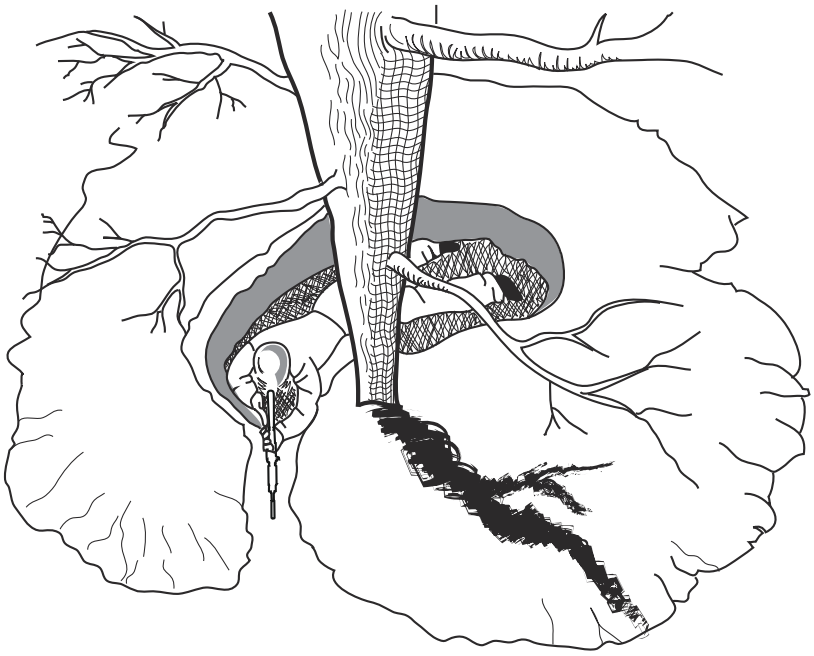

Figure 15-1. Individual Firing Position.

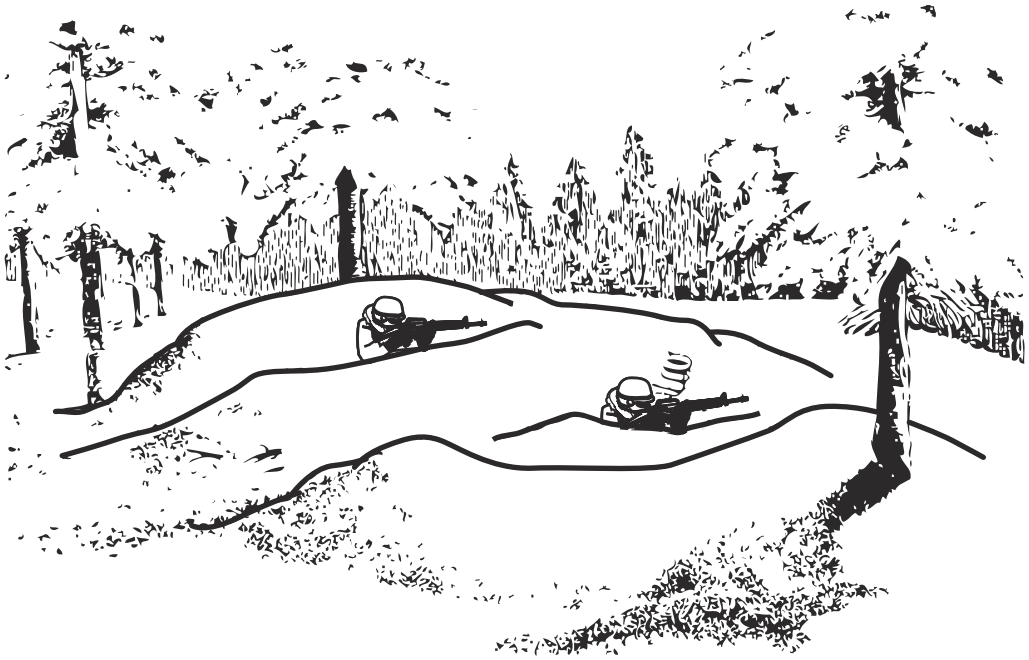

Figure 15-2. Two-Man Defensive Position.

Building a log roof and burying it with dirt and snow will provide overhead cover, as in figure 15-3.

Figure 15-3. Defensive Position with Good Overhead Cover.

Building Materials

There are several materials unique to the mountainous/cold weather environment that can be used to build fighting positions. Each of these materials has varying degrees of effectiveness in providing cover from enemy fire. The following data provides minimum construction specifications required to provide cover from small arms:

Newly fallen snow
- Minimum thickness is 13 feet.
- Construct by cutting into the back of a large snow bank or pile.

Packed snow
- Minimum thickness is 7 feet.
- Construct by stomping down snow in MRE boxes to form blocks.

Frozen snow/water and snow-crete
- Minimum thickness is 4 feet.
- Construct by pouring water onto packed snow and allow it to freeze.

Ice
- Minimum thickness is 3.5 feet.
- Construct by making ice blocks in empty ammunition cans or MRE boxes lined with trash bags and filled with water. Marines could also cut ice blocks out of lakes and streams, which not only builds the position, but also denies an avenue of approach.

Ice-crete
- Minimum thickness is 1 foot.
- Construct by mixing soil and water in empty ammunition cans or lined MRE boxes and allowing them to freeze. Marines could also build log forms, fill with dirt, and then pour water into the forms and allow them to freeze.

Rocks
- Many mountains will only have rocks available as a construction material, as digging down will prove impossible. This type of position is called a sangar, or sanger, from the British wars in Afghanistan in the late 1800s.
- Construct by building up with rocks at least two layers thick to offset and cover spaces/cracks between the rocks. Embrasures are formed by angling rocks with the wide part of the "V" inside and the narrow part of the "V" on the outside to prevent ricochets being angled in through the embrasure.

Field Fortifications

A Marine can enhance the capabilities of his defensive position by incorporating materials, such as rocks, logs, dirt, or sandbags, into his fighting position.

Rocks, Logs, and Dirt

Operating in snow-covered terrain should not prevent the use of normal defensive materials. If the situation permits, positions dug directly into the ground with overhead cover will provide the best protection. Eight inches of logs/dirt are required to stop mortar and artillery fragments.

Sandbags

Sandbags filled with snow, dirt, or rocks and then frozen provide increased protection from bullet penetration and are an expedient way to make packed snow. See figure 15-4.

Wooden Logs

It is possible to build the position out of wooden logs and is usually done with the regular fighting position. This option is labor intensive, but very effective (see fig. 15-5). There are three basic types of log walls: natural tree wall, artificial anchor wall, and tripod wall.

To create a natural tree wall, stack logs on the enemy side against any two sturdy trees (approximately 8 feet apart) until they stand approximately chest high. Pile snow, rocks, and branches against these logs to hold them against the trees (see fig. 15-6) or build a wall on both sides of the trees (see fig. 15-7).

It may be necessary to construct an artificial anchor wall when there are no suitable anchors to hold the wall up. An artificial anchor wall is very effective, but care must be taken for site selection and camouflage. To construct an artificial anchor wall, Marines must drive two logs into the ground approximately 8 feet apart and 3 feet deep, dig a

Figure 15-4. Fighting Position Using Sandbags.

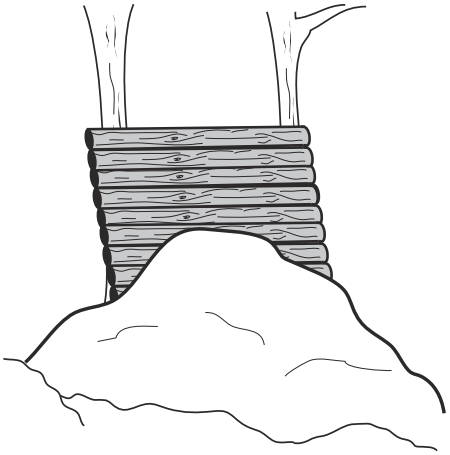

Figure 15-6. Tree Supported Wall.

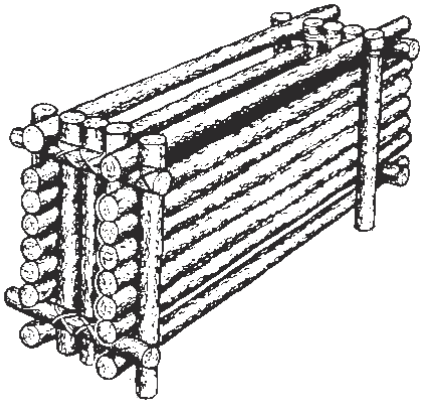

Figure 15-5. Example Log Form.

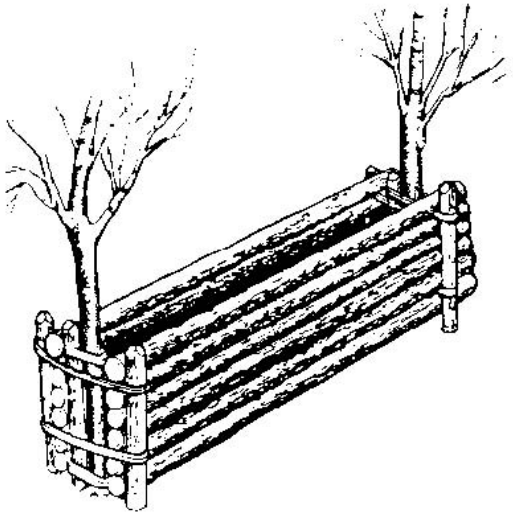

Figure 15-7. Tree Wall on Both Sides of Trees.

trench on the enemy side of the two logs about 1 foot deep and 8 feet long, lay a log in this trench to act as a deadman, and connect cordage from the ends of the deadman to the top and bottom of the two original logs (see fig. 15-8). Then stack logs on the enemy side of the two original logs and pile snow, rocks, and branches on the enemy side of the stacked logs to hold these logs in place and to make the position appear to be a snow bank (see fig. 15-9).

A tripod wall is constructed by lashing three logs together with cordage to form a tripod (see fig. 15-10 on page 15-6). The tripod legs are positioned so that two of the legs are facing the enemy; logs are stacked up on the enemy side of the tripod legs; and snow, rocks, and branches are piled up against the stacked legs to hold them in place and to make the position look like a snow bank (see fig. 15-11 on page 15-6). Care must also be taken to camouflage the apex of the tripod.

Note: Each of these positions is designed for two men. Each man fires from the outside edges of the position.

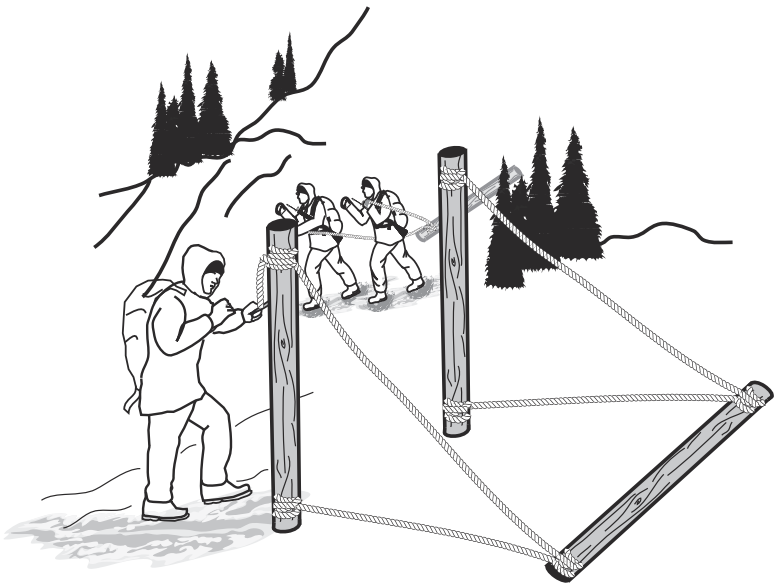

Figure 15-8. Artificial Anchor Wall Construction.

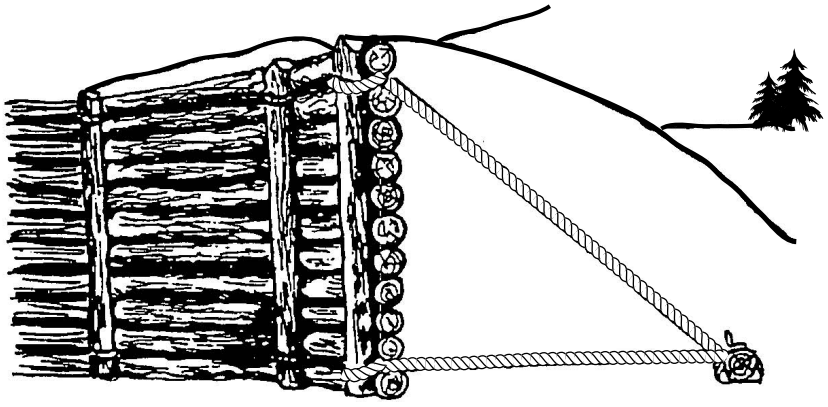

Figure 15-9. Anchor Supported Wall.

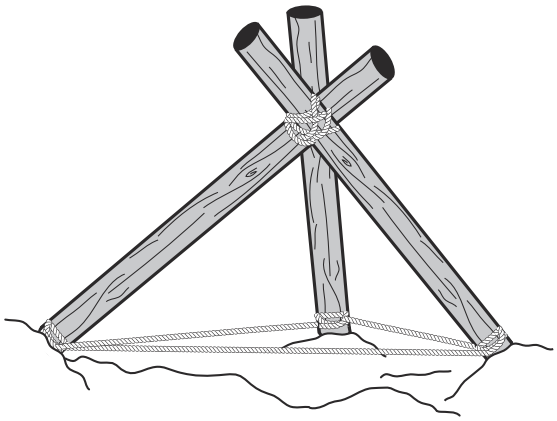

Figure 15-10. Tripod Wall Construction.

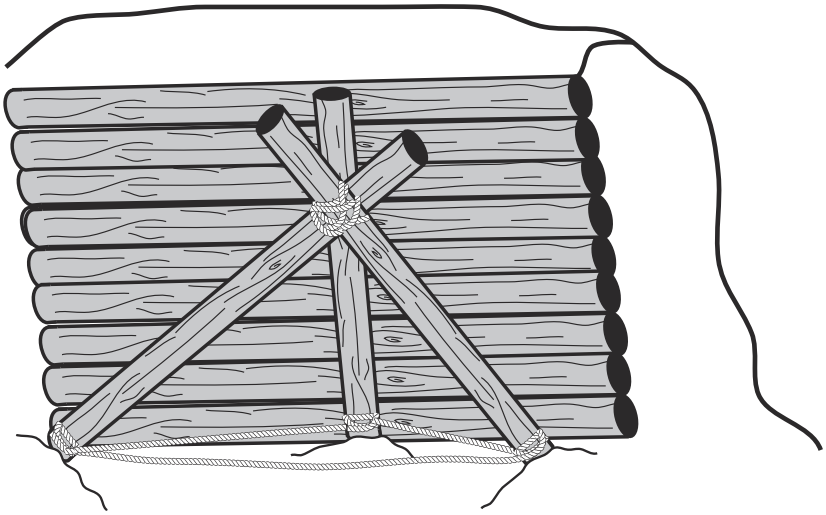

Figure 15-11. Tripod Supported Wall.

Emplacement of Obstacles

When emplacing obstacles, extreme care must be taken to minimize tracks that would reveal the obstacles or jeopardize positions. Obstacles can be natural or artificial.

Natural Obstacles

It is important to recognize natural obstacles and take advantage of them. An overall reconnaissance of the area for natural obstacles will dictate where to set up the principle direction of fires and final protective fires. Natural obstacles should be used to channel troop movement and enhance the effectiveness of artificial obstacles.

Artificial Obstacles

Barbed Wire

Barbed wire makes an effective obstacle in soft, shallow snow. Triple concertina wire is especially effective, since it is easy to install and difficult to cross (see fig. 15-12). However, as the snow gets deeper and more compact, a point is reached where it is possible to cross the barbed wire on top of the snow.

Tanglefoot

Tanglefoot is one of the most common types of obstacle. It is constructed by driving poles or logs into the snow with approximately 1 foot showing above the snow and zig-zagging barbed wire from pole to pole (see fig. 15-13). The disadvantage of tanglefoot is that if a large snowfall covers it up, it becomes useless.

Lapland Fence

The Lapland fence uses a floating type of anchor point or one that is not sunk into the ground. Poles are used to form a tripod. The tripod is mounted on a triangular base of wood. Six strands of barbed wire are strung on the enemy side of the fence, four strands along the friendly side, and four strands along the bottom (see fig. 15-14 on page 15-8). As

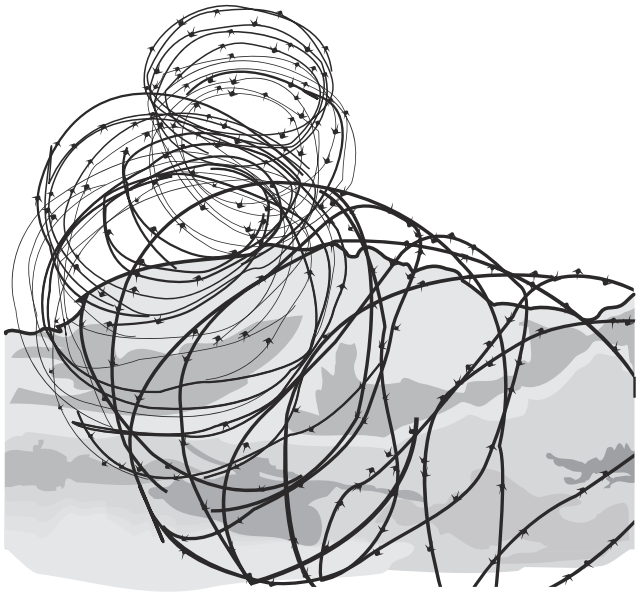

Figure 15-12. Barbed Wire.

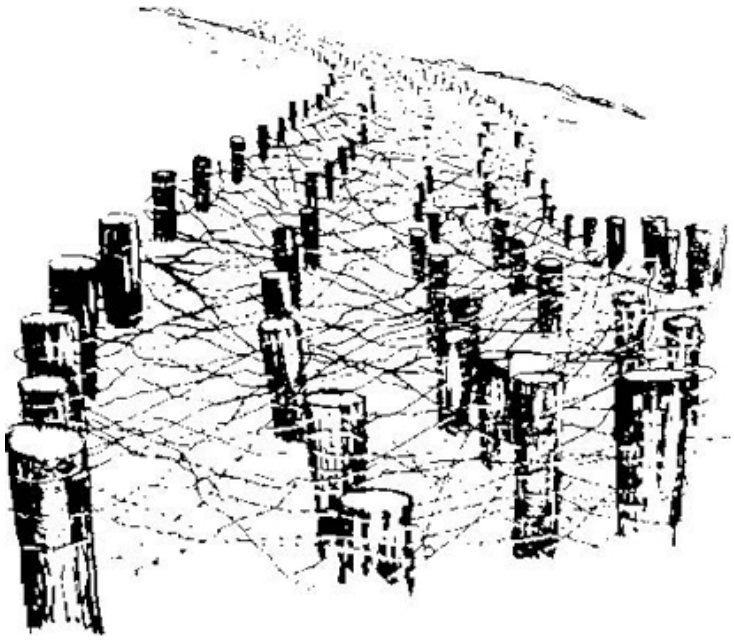

Figure 15-13. Tanglefoot.

the snow becomes deeper, the tripods are raised out of the snow to rest the obstacle on top of the newly fallen snow. The bottom of the tripod and the base wires give enough flotation to prevent the fence from sinking into the snow.

Knife Rests

Knife rests are portable, barbed wire fences, which can supplement obstacles partially covered by snowfall. They are constructed by tying two wood poles at their center, each approximately 4 feet long. The "Xs" are then lashed to a 10- to 12-foot pole, which forms a framework to which barbed wire is fastened on all four sides (see fig. 15-15). This obstacle can be stored until needed and then easily transported to the next desired location. It can also be lifted and set on top of fresh snowfall.

Ski Pit

A ski pit is a hasty and effective means of slowing down skiborne troops. They are constructed by cutting (digging) a wedge out of a slope

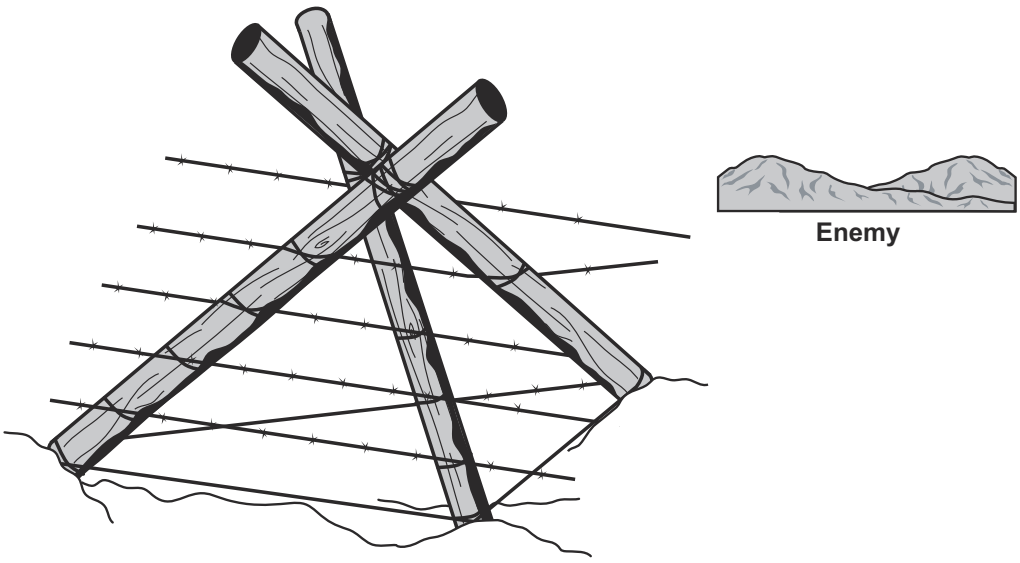

Figure 15-14. Lapland Fence.

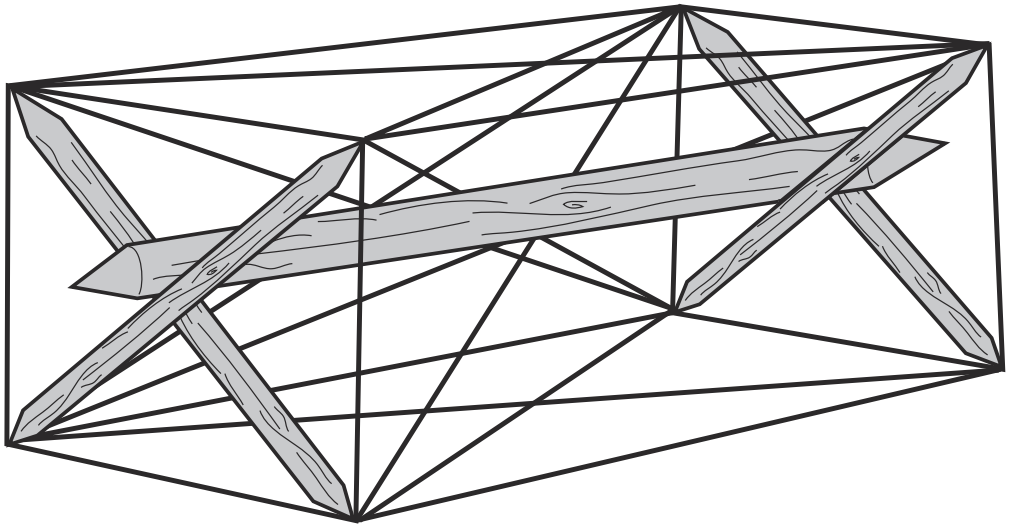

Figure 15-15. Knife Rest.

approximately 24 to 30 inches deep. The wedge points toward the friendly forces. Care must be taken to camouflage the snow that comes out of the pit and usually the snow is thrown on the downhill side. The object of the pit is to have skiers ski into the pit, catch their tips in the point of the wedge, flipping them over. Punji sticks can be placed where the enemy will fall. Ski pits are most effective where the enemy is moving downhill, as in figure 15-16.

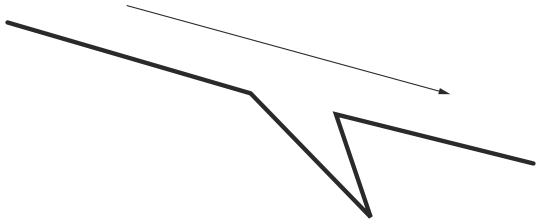

Figure 15-16. Ski Pit.

Abatis

An abatis is similar to a windfall. Trees are felled at an angle of 45 degrees to the enemy's direction of approach. The trees should be left attached to their stumps (see fig. 15-17) to retard removal along trails, roads, and slopes. An abatis can stop or inflict damage to wheeled or tracked vehicles, including tanks.

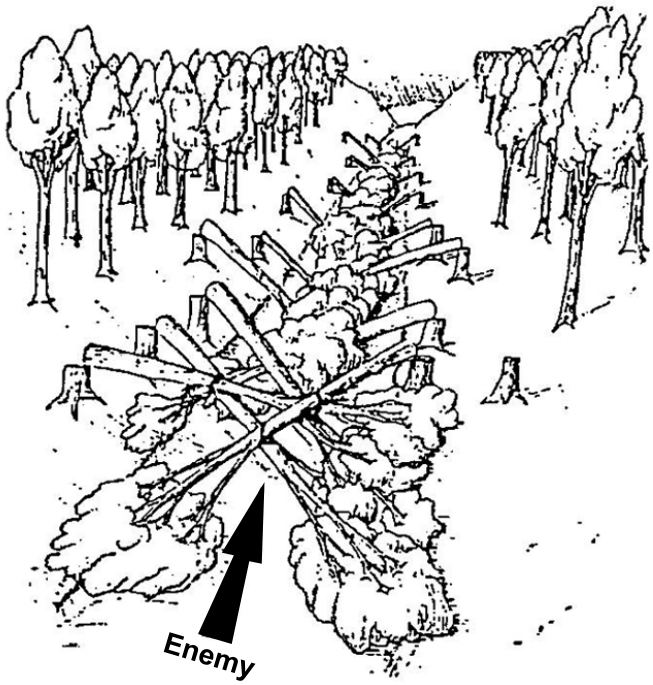

Figure 15-17. Abatis.

Trip Wire

A trip wire is a hasty obstacle that is effective in forested areas on skiborne troops. Trip wire works best on a downhill slope. It is constructed by stretching wire from tree to tree about throat level or ankle level. Punji sticks will help reinforce the ankle-level trip wire.

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CHAPTER 16
BIVOUAC ROUTINE IN SNOW

The efficient and tactically sound establishment of a bivouac site is fundamental and critical to success in mountain/cold weather warfighting; however, doing so in such an environment is more complex than customary bivouac sites. This chapter discusses the key criteria to consider when selecting a bivouac site, the order of establishing a bivouac, defensive considerations, and specific use areas; its guidance should be incorporated into unit SOPs and become routine to all Marines deploying to a mountainous/cold weather environment. See appendix D for the bivouac checklist.

Site Selection

A tactically sound bivouac site should be—

- Well clear of any suspected avalanche site/run-out zone.
- A good defensive position.
- Large enough to contain the entire unit.
- In a forested area. Forested areas provide—
  - Natural cover and concealment under the trees for tents, vehicles, and tracks and protection from the wind.
  - Firewood and defensive position construction material.
  - Branches, which provide concealment and dispersion of smoke.

  Note: If a forested area is not available, then Marines should select a depression or knoll and dig down.

- Near an adequate water supply. Snow can be melted, but this is both a time- and fuel-consuming process and it may not be as clean as a running stream.
- On the leeward sides of mountains. There is less wind and deeper snow for defensive positions and water supply.
- Off the valley floor. Cold air will settle during windless periods.

Establishment of the Bivouac

The complexity of establishing a winter bivouac dictates that units adhere to the following sequence: security, track plan, defensive positions, living areas, and specific use areas. Failure of the unit leader to fully address each of these considerations may unnecessarily expose his Marines to the enemy/weather.

Security

Security should be appropriate to the threat level.

Track Plan

A track plan in snow should be established during the unit leader's reconnaissance. Track discipline is essential to maintaining a secure and habitable bivouac. The primary elements of a track plan are—

- *Jump-off point*. The intersection of the main trail and the trail leading to the bivouac is called the jump-off point. The jump-off point must be well concealed, such as by large trees, a river, boulders, or other natural obstacles. Generally, when making the jump-off point, the main trail is left at a right angle or, for best deception, heading back toward the original direction of march. The jump-off point should be covered by fire from the defensive position, as in figure 16-1 on page 16-2.

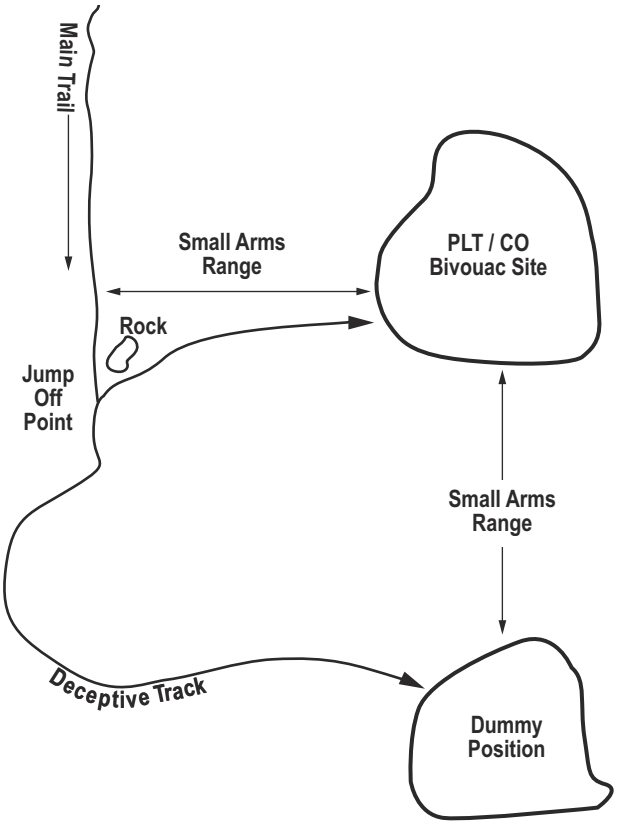

Figure 16-1. Platoon/Company Track Plan.

- *Deceptive track*. A deceptive track is a deceptive trail that extends past the jump-off point on the main trail. The main trail should extend well beyond the bivouac site to an area suitable for use as a dummy bivouac site. When returning to the jump-off point, care should be exercised to ensure that the unit is not leaving marks to indicate that they were returning on this track.
- *Dummy position*. A dummy position is a false bivouac located at the end of the deceptive track. This dummy position is a secondary deceptive plan. The primary defense of a bivouac is concealment. Use caution in establishing the dummy position to ensure it does not draw attention to the unit's general location.

Each area in the bivouac site should be designated in the track plan, including each team's tent site, defensive positions, and specific use areas. Camouflage is a continual process in the bivouac site. Tracks should meander in order to avoid straight lines and Marines should maximize tree cover.

Defensive Positions

The tactical situation and terrain will dictate the type of defense established (see fig. 16-2). Individual positions should be constructed as discussed earlier in this chapter and the following items considered:

- Automatic weapons are positioned to cover the jump-off point, dummy position, and likely avenues of approach.
- Defensive positions are established outside of the perimeter just beyond the range of the noises generated from inside the perimeter to prevent noises hindering the sentry from listening to his front. Approximately 30 meters is a good rule.
- All positions, such as fighting holes, tents, and heads, shall be connected by communication trenches.
- The walls of the trenches shall be constructed at an angle and the edges will be rounded off so that they do not cast shadows.
- Trenches should be chest to shoulder deep to provide protection from incoming fire and constructed to afford the best camouflage and concealment.
- Trenches should be made in a zig-zag pattern to avoid receiving fire down the long axis.
- At a minimum, two men at a time per squad should stand arctic sentry duty on the squad's sector of responsibility. Arctic sentry duty consists of a double-staggered watch to ensure that the sentries are fresh and alert at all times. For example: two men are in fighting positions at 0200 hours; one of these men came on post at 0130 and the other at 0200. The first man will be relieved at 0230 and the second man will be relieved at 0300, allowing one of the sentries to be fresh at all times.

In extreme cold temperatures or during storms, a fire watch may also be needed. His duties will be to—

- Maintain communication with the sentries through wire or other means.
- Prepare hot wets for the sentries upon their return from post.
- Alert the others in case of danger.
- Prevent the tents from collapsing from the weight of snow.

Living Areas

Once defensive positions are identified and staffed, the Marines should begin constructing living areas. Living areas must be clearly marked during the leader's reconnaissance and be connected to all other positions by communication trenches. The actual construction and organization of living areas will be discussed in detail in this chapter.

Specific Use Areas

The final step in establishing the bivouac site is to designate and establish specific use areas, as depicted in figure 16-3 on page 16-4.

Head Area

The head area is centrally located, but downwind of the living areas. It should neither be so close to the living areas that Marines may get sick, nor so far away to dissuade Marines from using the head area in bad weather. If the tents are dispersed

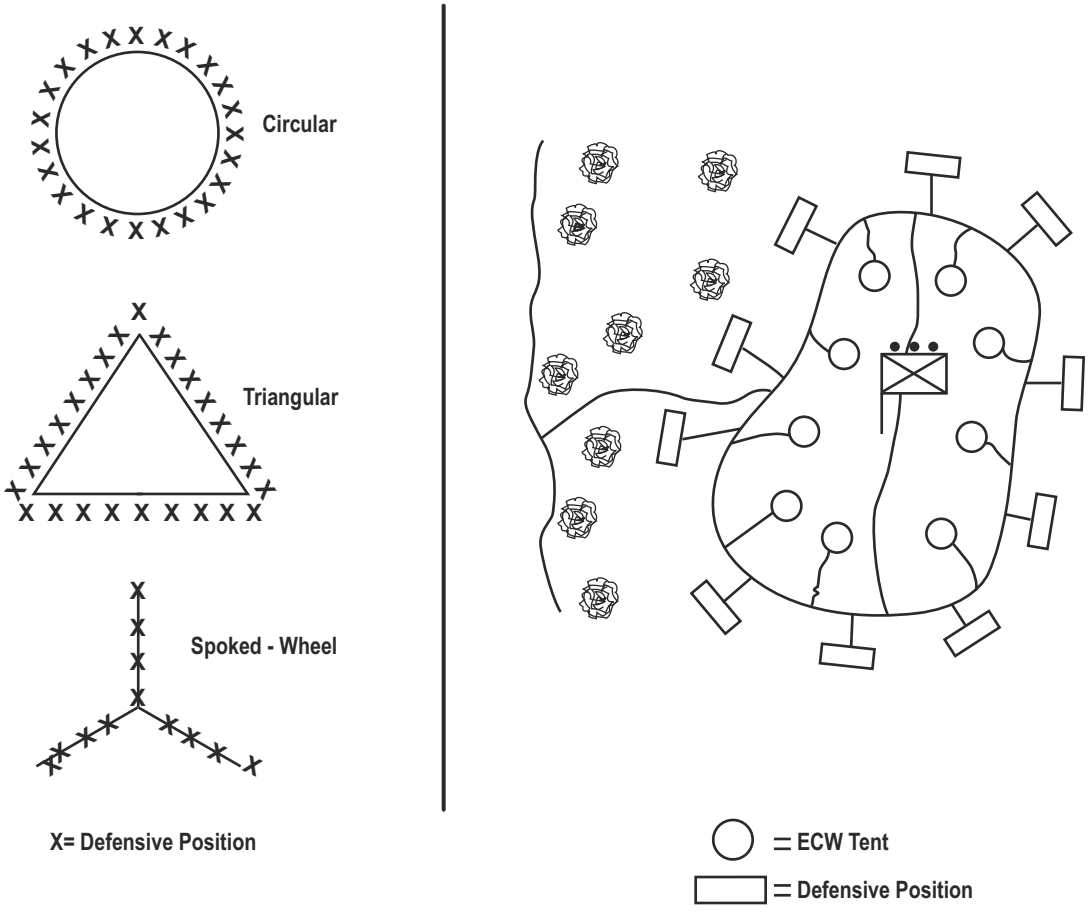

Figure 16-2. Defensive Position Types.

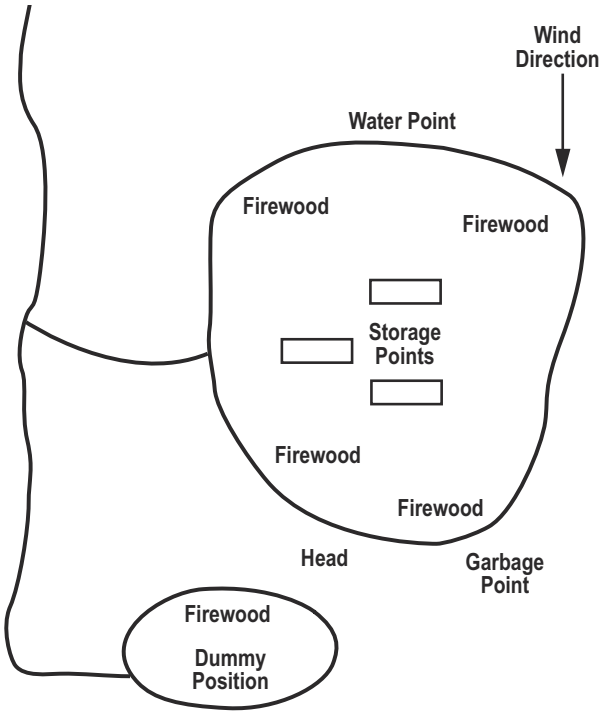

Figure 16-3. Specific Use Areas.

over a large area, more than one head area may be built. The head should be erected in a relatively sheltered area out of the wind or field tarpaulins/tarps should be erected as wind shields.

If establishing a long-term bivouac, a toilet can be made by lashing a sturdy pole in between two trees at about knee level. This pole can be used to sit on while defecating. A second pole can be lashed to the backside of the trees to provide a backrest.

Urinals may be placed outside the individual tents for easy access. Measures should be taken to avoid urinating anywhere besides the designated piss tree. This practice provides for field sanitation, hydration checking by the tent team and unit leaders, and track discipline.

Water Point

The water point is the next site designated. If it is a stream, it will be the furthest point upstream. If no stream is available, then a large, clean, sheltered snow bank must be identified and marked. It should be located upwind and as far from the head area as possible. If chemical or biological agents have been used at anytime in the past, the whole snow bank must be tested for contamination before use.

Garbage Point

The garbage point will be located next to the head area. In combat, the garbage could be disposed of in the dummy position.

Storage Points

Storage points are located inside the perimeter and fall under the control of the company gunny/police sergeant. These areas are for the unit's excess gear and equipment, such as vehicles, rations, fuel, ammunition, communications equipment, and extra skis. Key points to consider are—

- All gear shall be protected from the elements to maintain serviceability.
- Standard safety SOPs must be observed. For example, fuel should be stored at least 25 meters from any flame or explosives/ammunition.
- All gear/equipment should be dug down and properly camouflaged and concealed.

Scavenging Area

The scavenging area is the designated area for gathering fire wood and building materials. Key points to consider are—

- Avoid defiling a single area and giving the position away.
- Do any necessary cutting during daylight hours so natural noises will assist in concealing the activities.
- Consider cutting and gathering the wood from the dummy position.

Establishment of the Living Area

To maintain unit efficiency, unit leaders should ensure that tent sites are established and organized appropriately. The tent's exterior,

interior, and vestibule each have specific considerations as does the tent's placement.

Organizing the Tent Site

The tent site should be located under overhanging tree limbs or near bushes to provide anchor points for protection from the wind, concealment from enemy observation, and assistance in securing the tent. It should be located at least 10 meters off the main communication trench to provide ample room for the tent's members to perform necessary functions, such as equipment maintenance, without blocking access to the main trench line.

When digging the tent site, Marines must create a smooth, firm floor by packing down the snow. The site for the pit should be big enough to allow room to walk around the exterior of the tent, allowing for the removal of snow buildup on the roof during snowstorms.

The tent should be positioned in the pit with the entrance at the downwind side to reduce the wind blowing inside the tent when the door is opened. A snow wall should be built around the perimeter of the tent with the snow that was removed from the pit (see fig. 16-4). This snow wall will help protect the tent from the wind, conceal it from enemy observation, and limit the amount of light that escapes from the tent when entering/exiting at night. The tent trench should be dug with a sharp bend to prevent the possibility of the enemy shooting down the trench's axis and into the tent.

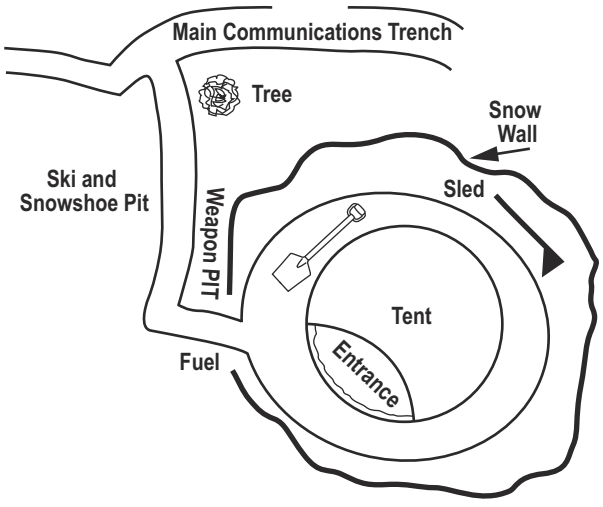

Figure 16-4. Tent Site.

The tent's entrance should be offset from the communications trench. This practice helps to enforce light discipline by reflecting the light from an opened tent door back into the tent vice down the length of the trench.

Organizing the Exterior of the Tent

Marine units carry much gear and equipment with them in a cold weather environment. Due to the size of the ECW tent, most of this gear must be left outside of the tent. To ensure accountability of gear when displacing the bivouac during periods of reduced visibility, a unit should have a set SOP regarding where and how gear is stored. Key areas to consider are—

- *Ski or snowshoe pit*. Build a ski/snowshoe pit on one side of the entrance track. This pit should be long enough to accommodate the skis/snowshoes while lying flat on the surface and wide enough to accommodate all of the tent team's skis/snowshoes and poles. It only needs to be deep enough to allow the skis/snowshoes to be stored below the surface of the snowpack. Place pine boughs or branches on the floor of the pit to prevent skis/snowshoes freezing to the snow.
- *Weapons pit*. Opposite of the ski/snowshoe pit, a pit for the team's weapons (personal and crew-served) and extra ammunition should be built. This pit is constructed in the same manner as the ski/snowshoe pit, but all weapons and ammunition are covered with a field tarpaulin to protect them from the elements. If weapons are kept inside a tent, strict attention must be paid to the effects of condensation as discussed in chapter 11.

- *Fuel storage area*. A fuel bottle storage area should be designated at least 1 meter from the tent. This storage area should be marked to facilitate locating the fuel in the event of heavy snowfall. To prevent a tent fire, all refueling of stoves/lanterns must be done at the fuel storage area.
- *Shovels*. Shovels should be kept near the door of the tent so Marines can keep the trenches free of new snowfall.
- *Team sled*. All unused gear and equipment should be stored inside the sled with the cover secured and the sled on its side against the back of the tent. A "cave" may also be dug into the trench to store the sled.
- *Piss tree*. A tree or mound of snow should be designated as the tent team's piss tree for urination only. This tree should be about 5 meters or so from the entrance of the tent. Leaders can check for hydration by the snow color.

Organizing the Vestibule Area of the Tent

When using ECW tents, the vestibule area should contain the following:

- *Cold hole*. A rectangular shaped hole about 1 to 2 feet deep should be dug between the vestibule door and the tent door. The cold hole serves two purposes. First, it traps cold air and prevents it from drafting into the tent. Second, it provides a place to cook and melt snow for water. Using the cold hole will prevent inadvertently spilling a pot of water or chow on the inside of the tent.
- *Packs*. The team's packs should be left outside the main tent and stored in the vestibule, creating more room inside the tent and preventing excess snow from being dragged in. All personal gear that is not being immediately used by the tent occupants should be stored inside their packs.
- *Whisk broom*. A whisk broom should be inside the vestibule to brush snow from occupants, before they enter the tent.
- *Trash bag*. A trash bag should be placed inside the vestibule so tent occupants can readily store trash as soon as it is created.
- *Stoves/cooking*. Great care should be taken when lighting the stove inside the vestibule because a flare up could result in igniting the tent fly or tent body. A squad stove will heat the vestibule and tent very quickly; however, it will also consume all the oxygen in a sealed tent, resulting in asphyxiation. Carbon monoxide poisoning is also a risk without ventilation, so the bottom of the door should be unzipped about 8 to 12 inches.

Organizing the Interior of the Tent

An effectively organized tent takes the following into consideration:

- *Sleeping arrangements*. In a 10-man tent the occupants' sleeping bags and mats should be laid out in a wagon wheel fashion with their feet toward the center of tent. In the ECW tent, the occupants should sleep head to toe.
- *Individual gear*. All individual gear that is not stored in the individual's pack should be staged in the individual's sleeping area. Gear should not invade each other's space.
- *Drying wet gear*. Both ECW tents and 10-man tents have means to dry wet clothing. The ECW tent has a mesh drying rack in the roof of the tent. All wet gear should be placed on the rack to dry. Too much gear on the rack will hinder the flow of air, slowing down the drying process. The 10-man tents have several drying lines that are suspended from the tent liner. These lines run along the circumference of the tent and are used to hang wet clothing. A lighted stove will speed up the drying of clothes immensely.
- *Lighting*. Flashlights or Cyalume lights should be hung from either the drying rack buckles or drying lines. Candles or lanterns are not recommended for use inside the tent due to the fire hazard they create. It's critical to ensure that light does not show through the tent or fly.

- *Ventilation*. Open all doors and escape hatches regularly. To prevent CO poisoning or asphyxiation, the doors should be unzipped several inches at the bottom to facilitate the flow of fresh air. Since CO is heavier than air and settles, tents should be ventilated at the bottom of the door.
- *Temperature*. Temperatures inside the tent should be kept comfortably cool, which helps to conserve fuel and maintain the acclimatization of personnel.

General Tips for Living in the Cold

In general, Marines should wear clothing in layers, stay hydrated, and drink plenty of hot wets throughout the day. Use of vasodilators, such as garlic or Tabasco, will help circulation; conversely, vasoconstrictors, such as cigarettes and coffee, should be avoided. Because the body requires extra fuel to stay warm in the cold, Marines should eat plenty of hot chow.

Hands

To keep hands healthy, Marines should—

- Move the fingers and spin the hands violently in a wide circle in order to stimulate and force warm blood to the extremities.
- Pull the fingers out of their respective finger pockets in the gloves and make a fist so that the fingers can warm each other.
- Ensure gloves fit loosely; tight gloves restrict blood flow.
- Replace gloves with mittens in extreme temperatures.
- Change wet gloves or mittens as soon as possible.
- Never wear just the glove's insulating inserts. Use the shells to keep the inserts dry.
- Remove gloves or mittens if fingers lose their sensitivity. Place hands in the armpits or another Marine's armpits. Skin on skin contact is essential.
- Do not use a VB on the hands, such as neoprene gloves. These do not breathe and may easily expose wet hands to cold temperatures and wind when the barriers are removed, which may result in a cold weather injury.

Feet

To keep feet healthy, Marines must—

- Avoid standing in one place for too long. Try to move around as much as possible.
- Change socks regularly.
- Put more insulation between boots and the ground when standing arctic sentry, such as standing on an isopor mat or other insulating material.
- Wear VB socks in extreme cold temperatures.

If toes lose their sensitivity, then put them on another Marine's stomach.

Sleeping

The following techniques can be used to ensure both restful sleep and efficient use of time in order to stay healthy:

- Eat a hot meal and drink a hot wet before going to sleep at night. Putting warm fluids/food into the body keeps it warm longer. Also, keep some snacks handy to eat during the night to maintain body heat. Food is fuel.
- Place extra insulation between the sleeping bag and the ground. Extra mats, empty packs, or pine boughs add extra insulation.
- Ensure that all Marines are warm. The more crowded a tent, the warmer it is. If one man does not have a sleeping bag or has a lightweight sleeping bag, place him in the middle.
- Wear a wicking layer when sleeping. Do not sleep naked to avoid skin oils from getting into the sleeping bag, which will degrade the insulating ability of the bag.

- Wear extra insulating layers when sleeping, if needed. No wet clothing or Gore-Tex® layers should be worn.
- Wear a balaclava or a hat when sleeping.
- Use canteens filled with warm water and placed in the sleeping bag as hot water bottles to preheat the bag. This also prevents the water from freezing overnight.
- Fill the thermos with a hot wet every night before going to sleep to provide something hot to sip during the night or in the event Marines have to make an unplanned move in the middle of the night.

Other Considerations

The following techniques should be considered to keep Marines healthy:

- Always keep gear neat, orderly, and packed in the event Marines have to displace suddenly.
- Take care of personal hygiene needs, such as shaving or washing, at night before going to sleep to allow time for the body to replenish natural skin oils that help prevent cold weather injuries, such as windburn, sunburn, and frostbite.
- Keep all battery-operated equipment, such as flashlights or handheld radios, inside the sleeping bag, if feasible. Leaving this gear on the tent floor overnight will kill the batteries.
- The 5-gallon water jug should be stored upside down to prevent the freezing of water at the pouring point. In extreme conditions, they should be buried in the snow, as snow is a natural insulating material.
- Handle all fuel outside the tent and always use contact gloves. Never handle fuel near a lighted stove. In extreme cold temperatures, fuel spilled on unprotected skin will freeze the skin tissue almost immediately.
- Whenever there is a stove or flame source inside a tent, maintain a fire watch.
- Damp clothes, such as socks and glove liners, may be placed in the sleeping bag overnight to dry them. Do not put extremely wet clothes in the sleeping bags, as this will only make the bag wet. Wet socks and contact gloves should be wrung out and placed directly against the chest to dry, if they did not completely dry while on the drying rack/line with the stove running.
- Headlamps are very useful in a tent.
- Have a sponge or rags handy to mop up spills or excess condensation.
- When melting snow, fill a bag with clean snow and stage it at the tent.

Pull Pole Procedures

When preparing to leave a bivouac site, it is a tendency among Marines to begin tearing down too early in an effort to ensure they are not the last team ready. Security should not be sacrificed when conducting pull pole procedures. When planning a pull pole, as much advance warning as possible—such as a specific time, staging area, direction of movement, order of movement, camouflage pattern, and over-the-snow mobility type—should be given so Marines can plan their schedules and ensure rest and readiness. The goal of the following steps is to avoid standing around in the cold waiting for others to finish:

At 30 minutes prior to the pull pole time—

- All personnel should have gear packed and ready, including all water containers topped off and skins on the sled pullers' skis (if skiing).
- Any trenches dug to fighting positions should already be filled.
- Marines on security should be in buddy teams with combat loads and over-the-snow mobility with them.

- Marines in the tents should be wearing appropriate layers for the movement.
- Marines should be sitting on sleeping mats or packs with a stove burning waiting for the pull pole time.

At 15 minutes prior to the pull pole time—

- The stove should be turned off and packs and sleds staged outside of the tent site.
- Sleeping mats should remain in the tent until the last moment in the event of postponement.
- All snow and ice should be removed from tent and tiedown lines.
- "Deadmen" should be dug out of the snow/ice.

At 5 minutes prior to the pull pole time—

- Isopor mats should be stowed.
- All equipment pits should be filled in and personnel should staff their designated pull pole positions, including the personnel who will strike and stow the tents and stoves (if any) and personnel who will fill in the tent site.

On order (pull pole), the tents will be dropped simultaneously and, upon completion, staged at the designated spot in the order of movement. Security is brought in and the unit moves.

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CHAPTER 17
CAMOUFLAGE, COVER, AND CONCEALMENT

This chapter addresses camouflage, cover, and concealment principles directly related to the mountainous/cold weather environment, including light and noise discipline considerations.

In snow-covered terrain, the stark contrast between light and dark emphasizes any item that does not blend naturally with its surroundings. Furthermore, every movement by vehicles or dismounted troops leaves readily identifiable tracks in the snow, which can provide detailed intelligence to an enemy. Before any movement, whether by foot or vehicle, track planning (balancing a minimal track pattern with a track deception plan) must be instituted with high priority.

In snowy terrain, backgrounds are not necessarily all white. Rocks, bushes, trees, and shadows sharply contrast with the snow. Snowy terrain in wooded regions, when viewed from the air, has a high proportion of dark areas, which may influence the camouflage plan. Thermal signatures are easier to detect because of the background contrast.

Firing of weapons, vehicle exhausts, stove vents, and breathing will, in extreme cold, cause local ice fog or vapor clouds that can be readily observed, even though the weapons, vehicle, tent, or Marine is well concealed. Smoke from fires may hang immediately above a position if there is no wind. It may be necessary to move weapons frequently, shut off vehicle engines, or keep vehicles in the rear area to reduce these signs. On the other hand, deception or concealment may be enhanced by deliberately creating vapor clouds or smoke clouds.

Individual Concealment

Individual concealment (see fig. 17-1 on page 17-2) requires the individual to be familiar with the various types of terrain over which he will pass, to know how to adjust his clothing to adapt to his surroundings, and to know how to move through an area in the least obvious manner.

Clothing Combinations

By using a combination of outerwear, four different color combinations can be attained—all green, all white, white over green, and green over white. The four camouflage combinations are considered the basics the individual Marine can build upon by using his initiative and imagination in the following terrain possibilities:

- *Thickly wooded areas*. These areas consist mainly of secondary growth coniferous or deciduous trees with thick underbrush. An *all green* clothing combination is normally best for these conditions.
- *Low brush or light scrub areas*. These areas are often found at and above the tree line or in hilly areas with poor soil. In most cases, an open snow background predominates and a combination of *white over green* is usually found to be suitable.
- *Forested areas*. These areas are covered with primary growth, coniferous and deciduous, of varying density and with little underbrush. The normal clothing combination in these instances is *green over white*.

Figure 17-1. Camouflaged Marine.

- *Above tree line*. Except in very mountainous regions where rock faces and large areas of talus may interrupt the whiteness, areas above the tree line form a vast unremitting expanse of white. The only relief to it is offered by different textures in the snow where it has been compressed by the wind or smoothed by the sun and, of greater tactical importance, by shadow. An *all white* clothing combination is the most suitable and care must be taken to ensure that weapons and other equipment items are similarly camouflaged. Even the straps of a pack, if not camouflaged, will stand out clearly at great distances. Only with experience will the individual become fully proficient in the art of camouflage above the tree line, but the following points are worth remembering:
  - On bright days, a person may be more difficult to spot when he has the sky as a background, because the sky, in these conditions, will usually be darker than the terrain.
  - Backgrounds of unbroken snow should be avoided as snow-covered ground reflects many times more light than bare ground and any deficiencies in camouflage will be exaggerated.
- *Mixed surroundings*. In mixed surroundings frequent changes of camouflage may become necessary. Camouflage changes must be unit-wide to aid in friend or foe identification. Overwhites must be quickly available to change as the terrain changes.

Weapons and Equipment Concealment

Small items of equipment are relatively easy to camouflage; good results have been achieved by using matte white paint or white tape. Though white tape is particularly useful for camouflaging webbing equipment, some types of tape have a tendency to crack and peel at low temperatures. Care must be taken when camouflaging weapons to ensure that the material used does not interfere with the working parts or the cooling system. Such camouflaging can also provide insulation from the cold for the individual user. The methods of concealing larger items apply in principle to other large pieces of equipment. Ice fog must be considered for all long-range weapons. Secondary and even tertiary positions may be used to "shoot and move."

Tents and Vehicles Below the Tree Line

The specific camouflaging methods used depend largely on the intensity of the tree cover, the materials available, and whether white or dark colors predominate in the area. If the region is thickly wooded, the tent (or vehicles) can be camouflaged by thickening the area around it with branches. Care must be taken not to disturb the snow cover or the trees being thinned. In other instances in which white predominates, the main object is to break up the shape of the tent and the easily recognized shape of a vehicle by digging the tent or vehicle into the snow, which provides both cover and concealment, and then by draping white camouflage netting, clothing, or other materials over the tent.

Tents and Vehicles Above the Tree Line

If above the tree line, tents can be concealed by—

- Digging them into snowdrifts and smoothing the excavated snow to erase the change in texture and making it conform to the surrounding drift.
- Using white camouflage netting and garnish.
- Using white parachutes as tent and vehicle camouflage sheets.
- Using the liner from a 10-man tent as camouflage over the tent. This option is a last resort particularly because the texture of the liner is different from the snow and the liner must be cut to allow proper draping over guy lines.

In addition to the above tent-concealing principles, the following items are significant when considering the camouflage of vehicles:

- Vehicles should be prepared for operations in this environment by painting them in accordance with the current edition of the respective vehicle's technical manual. As terrain changes, so must the camouflage, so the most universal paint scheme should be used.
- Each vehicle should be equipped with an all-season camouflage net to be used as needed.
- Whenever possible, a vehicle should be parked so that its shadow falls on a bush, which interrupts the straight lines of its shadow.
- In wooded areas, lean-tos or snow shelters can be built to provide cover and concealment for vehicles.
- In cold conditions, consideration must be given to the exhaust from vehicles, since it will form ice fog or vapor clouds that are easily detected.

Camouflage Materials

Since white is the dominant color in winter, snow becomes a most important camouflage material. By intelligent use of camouflage clothing and equipment together with what nature makes available, effective individual and group camouflage can be achieved:

- Improvised camouflage clothes can be made from sheeting, tape, whitewash sacking, or painted canvas.
- White paper, when wet, can be applied and allowed to freeze on all kinds of surfaces.
- Snow thrown over an object helps to increase the camouflage effect.
- White paint has many uses in winter camouflage. Weapons, vehicles, skis, and sleds can be effectively painted with white, matte/flat paint. In some cases, white smoke may be used to help the camouflage plan. As in any use of smoke, wind conditions must be carefully considered.
- Camouflage face paint, white and loam color combination, may be applied to exposed areas of the face and hands to blend effectively with the snow cover.

WARNING

Frostbite signs may be covered by camouflage paint.

- White zinc oxide ointment may be used in place of camouflage sticks for several reasons. It has a sun block factor, is easier to apply and remove for changing conditions, and it is easier to perform buddy checks for frostbite without the danger of causing additional damage to a frostbitten face.
- The use of winter camouflage nets and parachutes is effective in concealing tents and vehicles. Careful use of garnish is especially important in this environment.
- The use of natural vegetation is highly recommended, but, as in any environment, the age of the cut vegetation and collection procedures are important. Vegetation must be changed before it begins to wilt and the individual must be very careful to selectively gather vegetation to not make his positions obvious because of stripped areas or indiscriminate tracks.

Concealment of Positions

All defensive positions must be camouflaged, whether they are dug into the ground or snow or are built above the snow level. They should be connected with well-camouflaged communication trenches and should be located under the brush or tree line when possible. The following points should be considered when building and camouflaging defensive positions in the snow:

- The sides and ends of all trenches should have pronounced slopes and rounded edges to reduce shadows, as in figure 17-2.
- When vegetation is gathered, it is important to selectively gather small amounts from varied areas to not leave obvious stripped areas.
- Marines must carefully clear fields of fire in order to not leave obvious tracks.
- If there is sufficient snow cover, trenches should not be dug to ground level as grass, leaves, and dirt will be mixed with the excavated snow, which will make these areas obvious, especially from air observation.
- The constant use of trails and trenches will glaze and dirty these avenues. New snow should be added frequently to improve the overall camouflage plan.
- The snow excavated from positions should be smoothed out and not left in humps and uneven piles that cast obvious shadows, see figure 17-3.
- Positions should be selected such that the least amount of modification to the natural surroundings is required, as in figure 17-4.

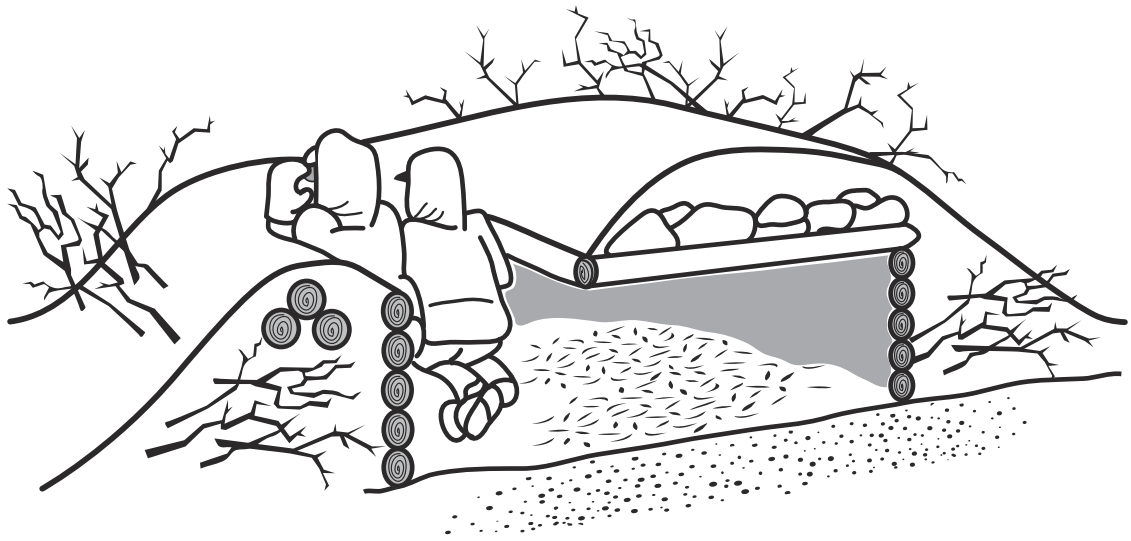

Figure 17-2. Camouflaged Position.

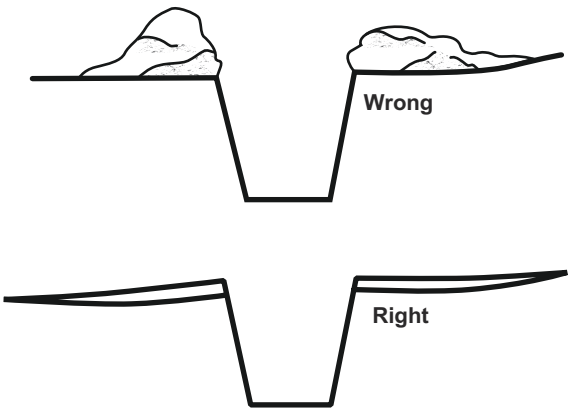

Figure 17-3. Snow Removed from a Trench.

Figure 17-4. Camouflaged Shelter and Observation Post.

- Overhead cover and concealment should be considered in all cases.
- Approaches to positions should be made under the concealment offered by trees or bushes, behind snowdrifts or slopes, and in shaded areas. They should also lead through the position to one or more dummy positions. Trails should never end at a camouflaged position.
- In selecting a position, it is important to consider the background against which the position will be constructed. Appropriate inspection and camouflaging is necessary. The individual must consider the attackers view of the positions.
- Positions should be camouflaged as much as possible before they are occupied.

Light and Noise Discipline Considerations

Light and noise travel great distances in cold temperatures. Snow acts as a natural insulator, which bounces sound waves off its surface. Since snow is actually crystallized water, it reflects light tremendously, especially at night. Using the techniques discussed in the following subparagraphs will aid in avoiding any compromises.

Light

Various tasks and duties carried out during the bivouac routine can produce enormous amounts of light in the winter environment. Light considerations are as follows:

- There is a flash of light when lighting a stove. If the stove must be lit after dark, care must be used to light the stove with the tent flaps closed.
- Tents and shelters should be placed in defilade so that light escaping from doors and vents has less effect. When entering or leaving an ECW tent, Marines should exit the tent's main body and step into the vestibule, ensuring to close the flap behind oneself before opening the flap to the vestibule. If not using the fly, they could place a field tarpaulin over the doorway as a second flap.
- Snow should be packed around the base of the ECW tent, taking special care around the vestibule area, to keep light from stoves, flashlights, and lanterns from escaping. Snow walls must be built with an offset entry.

- When entering or leaving a 10-man tent, Marines should unzip the liner and step between it and the outside flap, ensuring that Marines zip the liner closed before opening the flap to the outside.
- To keep light discipline in a survival shelter, Marines must double up a field tarpaulin to create a double flap.
- Flashlights, even with red/blue lenses, and Cyalume can be seen from a great distance. Their use should be restricted to emergencies. Night vision goggles or infrared Cyalume can be used in the track plan to reduce the possibility of compromising the position.
- Cigarette smokers are also light hazards. Personnel around the tent or on sentry routine should not have a lighted cigarette.

Noise

Sound travels far in cold, thin air and/or across rocky compartments, so the following considerations should be made:

- When entering or leaving the tent, the zipper should be opened or closed slowly to prevent amplifying the noise.
- Voices must be kept low or silent.
- Care must be taken when preparing chow to minimize noise.
- Caps on fuel cans can be loosened to equalize pressure.

The more organized the bivouac, the less noise Marines are likely to make.

Noise Created by Troops on the Move

Consider the following when moving:

- *Skis or snowshoes*. As a Marine moves on skis or snowshoes, he makes noise. Poles may strike the skis or snowshoes and the snow may crunch under his weight.
- *Falling*. Falling in snow creates noise as weapons and over-the-snow equipment bang into each other and by Marines swearing in frustration. Slipping and falling on icy surfaces is even noisier as the sound itself is louder and more of the sound is reflected.
- *Radio operators*. Radio operators must ensure handsets are turned down or are in whisper mode.

CHAPTER 18
MOUNTAIN WARFARE SKILL SETS, CAPABILITIES, AND TRAINING REQUIREMENTS

There is currently no secondary military occupational specialty for military mountaineers. There are, however, several core plus courses that provide specific mountain warfare instruction to individuals, which are force multipliers for units conducting mountain warfare operations. Understanding these skill set capabilities is important to the unit leader, because the unit can identify trained personnel by school codes. The recommended number of trained personnel for each skill by unit size is included in this chapter as are the names, school codes, and descriptions of each.

Mountain Leaders (M7A, M7B)

Summer mountain leaders (M7A) are the unit's subject matter experts for operations in complex, compartmentalized, and mountainous terrain. Their knowledge of mountain operations tactics, techniques, and procedures will enable enhanced movement, control of fires, intelligence gathering, sustainment, and force protection in highly complex terrain (including high to very high altitude, alpine, and glaciated terrain) that is inaccessible to untrained Marines. Mountain leaders are proficient in the following skills:

- Rope system usage for CASEVAC, logistics, and weapons raising/lowering.
- Rope bridging and rappelling.
- Maintenance and use of all equipment contained in the MACK.
- Employment of fixed ropes and pack animals.
- Survivability and bivouac and mountain patrol techniques.
- Tactical considerations.
- Navigation, weather forecasting, and route planning/selection.
- Weapons employment and fire support and communications considerations.
- Operations on or across glaciers and steep earth, as well as near vertical to vertical rock.

Summer mountain leaders are trained to—

- Plan, organize, and lead mountain/cold weather operations.
- Plan/lead cliff assaults.
- Plan/lead long range patrols on complex ridgelines for mountain picketing/overwatch, conduct reconnaissance, and control fires.
- Train their units for mountain/cold weather operations.
- Advise MAGTF or MAGTF element commanders and staffs.

Summer mountain leaders are recommended as the assault climber platoon commanders and platoon sergeants for Marine expeditionary units. Three summer mountain leaders per reconnaissance company are recommended for a reconnaissance battalion; two per team for United States Marine Corps Forces, Special Operations Command; and two per scout sniper platoon.

Winter mountain leaders (M7B) are the unit's subject matter experts for operations in cold weather and on snow-covered terrain. Their knowledge of cold weather and over-the-snow mobility tactics, techniques, and procedures will enable enhanced movement, control of fires, intelligence gathering, sustainment, and force

protection in complex, snow-covered terrain that is inaccessible to untrained Marines. Winter mountain leaders must be proficient in the following skills:

- Avalanche hazard assessment and crossing avalanche-prone slopes.
- Avalanche rescue procedures.
- Over-the-snow mobility, including being basic ski instructors.
- Survivability, snow bivouac routine, and defensive positions of snow and ice.
- Use/care/maintenance of cold weather clothing and equipment.
- Over-the-snow patrol techniques, navigation, and route planning/selection.
- Tactical considerations.
- Weapons employment, and fire support considerations.

They have the necessary skills to—

- Plan, organize, and lead over-the-snow/cold weather operations.
- Act as scout skier element leaders on ridgeline flank security, picketing, and reconnaissance patrols.
- Train ISR personnel to operate as scout skiers.
- Train their units for over-the-snow/cold weather operations.
- Advise MAGTF or MAGTF element commanders and staffs.

Three winter mountain leaders per reconnaissance company are recommended for a reconnaissance battalion; two per team for United States Marine Corps Forces, Special Operations Command; and two per scout sniper platoon.

A Marine who has been through both mountain leader courses (M7A and M7B) has the knowledge and skills to operate in all types of mountainous terrain and weather conditions (high to very high altitude, wet/dry/extreme cold, rock/snow/ice-covered slopes, and vertical terrain). He is able to train and lead small units in disaggregated operations in those parts of complex, compartmentalized terrain that would otherwise be inaccessible to the unit commander and is likely the most experienced mountain leader. It is recommended that the most experienced (not necessarily highest ranking) mountain leader be attached to the S-3 during mountain operations as a subject matter expert planning resource.

Assault Climbers (YAK)

Assault climbers are trained by the special operations training groups for the Marine expeditionary unit. They have the rope skills and rock climbing skills that the summer mountain leader has. They are experts at establishing lanes for crossing various obstacles found in the mountains and acting as lane noncommissioned officers for troops moving through those lanes. These skills include rope systems for CASEVAC, logistics, weapons raising/lowering, rope bridging, rappelling, fixed and steep earth lanes, and maintenance and use of all equipment contained in the MACK (except some glacier-specific equipment). Assault climbers have the knowledge and skills to build rope systems to overcome steep earth to vertical rock obstacles. The assault climber may also be trained in urban climbing skills, but is not trained in snow, alpine, or glacier operations or tactical considerations across the warfighting functions. Assault climbers form a platoon for the Marine expeditionary unit requirement.

Scout Skiers (no code)

Scout skiers are ISR personnel trained in skiing and they enable the unit commander to have eyes and ears on top of and along ridgeline crests in snow-covered terrain. Regular troops will be on snowshoes, but mobility is slow and limited, so some personnel (usually ISR, but can be task

organized based on the skill sets of available personnel) are trained in military skiing to enable mountain picketing in snow-covered terrain. Their skills include skiborne operations; tracking and/or countertracking in snow; cold weather long range patrols; winter survival; avalanche assessment and/or avoidance; mountain communications; and calling and/or adjusting supporting arms in snow-covered, compartmented terrain. All ISR personnel and additional personnel as required are recommended as scout skiers to provide sufficient security throughout snow-covered, complex, compartmentalized, mountainous areas of operations.

Animal Packers (MN6)

Animal packers are Marines trained to care for, pack, and lead animal trains through terrain inaccessible to vehicles in order to conduct resupply, move crew-served weapons, and perform CASEVAC for the unit. They are trained on the use of various types of pack animals found worldwide. Four animal packers per platoon are recommended.

Mountain Communicators (CXJ)

Mountain communicators are communications personnel who have been trained in radio communications in complex, compartmentalized, mountainous terrain, which includes high altitude and winter conditions. They understand the advantages and disadvantages of each piece of communications gear and field expedient techniques to mitigate the effects of this type of terrain. Four mountain communicators per company are recommended.

Mountain/Cold Weather Medicine (KAR, WAC)

Corpsmen and doctors can receive training on specific environmental illnesses and casualty handling and processing issues unique to cold weather, high altitude, mountainous, and vertical terrain. They are trained in the prevention, diagnosis, and treatment of cold and altitude injuries, over-the-snow CASEVAC, high angle raising and lowering of casualties, rough terrain CASEVAC, and rigging litters for vertical extract. Four corpsmen/doctors per company are recommended for each seasonal skill set.

Mountain Scout Snipers (UNC)

Snipers that go through the mountain scout sniper course are trained in high angle marksmanship; stalking in snow-covered and rock-covered terrain; tracking and countertracking in rock, snow, and ice-covered terrain; communications; supporting arms considerations; and long range patrols in high altitude, complex, compartmentalized, mountainous terrain. Four snipers per platoon are recommended.

Mountain Operations Staff Planners (M3D)

These Marines are staff personnel who have been specifically trained in considerations for planning mountain warfare operations across the six warfighting functions during the Marine Corps Planning Process. Two mountain warfare trained Marines per staff are recommended.

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APPENDIX A
CLOTHING AND EQUIPMENT WEIGHTS

Clothing	Weight (pounds)	Clothing	Weight (pounds)
VB boots (7R)	6	Bivy cover	1.9
Super gaiters (Black Diamond®)	1.5	MSS sleeping bag (winter only)	2.2
Three-quarter gaiters (Black Diamond®)	.75	3S sleeping bag	2.5
Gor-Tex® trousers	1.25	3S compression sack	.5
Gor-Tex® parka	3	Skins (set)	1
ECW mittens (pair)	.75	Isopor mat	1.25
Gore-Tex® gloves (set)	.75	Canteen cup	.5
Poly Pro set (heavy weight)	2	Field tarpaulin	1.25
Patagonia Capiliene® underwear set	1	Avalanche probe pole	1
Fleece (100 weight)	.75	Transceiver, SOS	.5
Overwhite parka	1.5	Headlamp	.5
Overwhite bottom	1	Canteen 1 qt (full)	2.5
ECW 4-man tent repair kit	1	Snow shovel	1.5
Body	8	LBV with H-harness and first aid	4
Fly	8	MRE	1.5
Poles	6	Sling rope	1
Snowshoes (pair)	5	Asnes® skis with cables 190 cm	10
Sked® (complete)	18	Adjustable ski poles	1.5
Fuel bottle (22 oz, filled)	2	Peak 1 stove (filled)	2
ILBE/Arcteryx® pack	9	Cookset (MSR®)	2
ILBE/Arcteryx® day pack	2.5	Ski wax kit	.5
ILBE main waterproof bag	.85	Overwhite pack cover	.75
ILBE assault waterproof bag	.75	Fire team sled (SL-3 complete)	15
Marine compression sacks (set of 4)	.8	Thermos (1 qt filled)	4
Legend: cm—centimeters oz—ounce qt—quart			

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APPENDIX B
PATROL ORDER WITH WINTER CONSIDERATIONS

Orientation
- Terrain model should include avalanche-prone slopes.
- Avalanche conditions—(aspect, angle, elevation, location, severity).
- Full weather report—(including wind direction and speed, temperatures, precipitation).
- Snow conditions for travel—(depth, wet/dry/crust/frozen, over-the-snow mobility).

Situation
- Enemy (include both foot and vehicle over-the-snow mobility assets/capabilities).
- Friendly.
- Attachments.

Mission
Ensure it is realistic for terrain and weather conditions, unit experience, and conditioning.

Execution
- Intent.
- Concept of operations:
  - Scheme of maneuver (route overlays should have avalanche-prone slopes marked and the TDF totals annotated).
  - Fire support plan.
- Tasks; for example, winter-specific collateral duties:
  - Avalanche search teams and probe line, marker, shovel, and hasty teams.
  - Trail-breaking team and rotation.
  - Sled team rotation, if sleds are used.
  - Litter teams, augmentation litter teams.
  - Snow pit analysis and rutschblock team, if scout skiers.
  - Ice reconnaissance team.
- Coordinating instructions:
  - Initial camouflage pattern for movement.
  - Over-the-snow mobility selection, including sleds or no sleds, skins or wax type, snowshoes or skis, below or out of snow line.
  - Transceiver checks, when and where.
  - Priorities of work in a winter bivouac.
  - Track discipline for travel and bivouac.
  - When and where weapons will be cleaned/bores punched.
  - Pull pole time.
  - Shelter selection—(tent, fly only, bivy cover only).
  - Final inspection includes ski/snowshoe binding adjustment, thermos/canteens topped off, camouflage pattern check, pack and sled check.

Administration and Logistics
- Type of ration resupply, water/no water resupply, and fuel resupply.
- How to protect prisoners of war from elements.
- How to conduct resupply from MSR to position, if applicable.

Command and Signals
- Hand and arm signal modification for cold weather clothing, if needed.

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APPENDIX C
EXAMPLE OF A WINTER WARNING ORDER FORMAT

A. SITUATION

1. Enemy:

2. Friendly:

B. MISSION

C. GENERAL INSTRUCTIONS

1. Overwhite Pattern:
2. Shelter Type:
3. Chow per Man:
4. Over-the-Snow Mobility:

NAME	CHAIN OF COMMAND	GENERAL ORGANIZATION (ELEMENTS)	SPECIFIC ORGANIZATION (TEAMS)	DUTIES	ARMS, AMMUNITION, AND EQUIPMENT	GEAR COMMON TO ALL	TIME SCHEDULE			
							When	What	Where	Who
						☐ Pocket items		Draw ration		
						☐ Assault load		Draw fuel		
						☐ Combat load		Draw weapons		
						☐ Transceiver		Draw communications		
						☐ Overwhites		Test communications		
						☐ Helmet		Draw ammunition		
						☐ VB boots		Draw		
						☐ Ski boots		Fire support coordination		
						☐ Gaiters				
						☐ Water		Foreign/adjacent unit coordination		
						☐ First aid kit				
						☐ Daypack		Chow		
						☐ Large pack		Patrol order		
						☐ Skis w/skins		Initial inspection		
						☐ Ski poles		Rehearsal		
						☐ Snow shoes		Final inspection		
						☐ Goggles		Pull pole		
						☐ Headlamp		Fill in position		
						☐ Overboots		Test fire		
						☐ Shovel		Transceiver check		
						☐ Thermos		Time of departure		
						☐ Sling rope		Time of return		
						☐ Carabiners		Debrief		

D. SPECIFIC INSTRUCTIONS

1. Assistant patrol leader is in charge when I am gone. One will supervise patrol preparation and drawing of equipment. Adhere to schedule.

2. Element leaders supervise preparation of respective elements and report compliance to assistant patrol leader.

3._____will construct terrain model.

E. SPECIFIC ORGANIZATION TEAMS

Aid/litter team(s), hasty avalanche search team, transceiver search team, probe team, shovel team, marker team, ice reconnaissance team, rutschblock/snow analysis team, trail-breaking team, and navigation team.

F. GEAR THAT MAY ONLY BE CARRIED BY CERTAIN MEMBERS

Machine gun, bulk ammunition, mortar, mortar round, rope, chemlights, radio, extra batteries, night vision goggles, sleeping bag with bivy, snow shovel, probe pole, thermos, field tarpaulin, fuel bottle, pyrotechnics, grenades, binoculars, team or large sled, ski litter, stove, compass, map/protractor/pens, wax kit, litter, cook set, altimeter, snow analysis kit, ice auger, snow saw, map, route card, rope, hatchet, wire cutter, other.

APPENDIX D
BIVOUAC CHECKLIST

__ **Site Selection:**
__ Clear of avalanche path/runout zone
__ Good defensive position
__ Large enough for whole unit
__ In a forested area
__ In depression or knoll, if above tree line
__ Adequate water supply
__ Leeward side
__ Off valley floor

__ **Security:**

__ **Track Plan:**
__ Jump-off point
__ Dummy track
__ Dummy position
__ Track plan in bivouac site
__ Defensive positions marked
__ Living areas marked

__ **Specific Use Areas:**
__ Head area
__ Trash point
__ Water point
__ Storage point
__ Firewood scavenging area

__ **Living Areas:**
Outside the Tent:
__ Security posted
__ Track plan established
__ Defensive position completed
__ Tent erected correctly
__ Entrance downwind and offset
__ Sled staged and cover closed

__ Snowshoe/ski pit built and organized
__ Piss tree designated and marked
__ Tent free of snow/ice

Inside the Tent:

__ Clothes brush at entrance
__ Sleeping space allocated
__ House duties assigned:
  __Rotation of stove man/cook
  __15 minute early stove lighter
  __Dressing sequence
  __Two men moving at a time
__ Sentry roster/alert state
__ Cold hole dug in vestibule
__ Packs and weapons arranged in vestibule
__ Isopor mats laid out

__ **Tent Routine:**

__ Stove on, only the cook operates the stove
__ Melt water, hot wet first
__ Top off all water bottles/thermos before sleeping
__ Gear drying rotation
__ Air out feet and change socks
__ Extremity check, self and buddy
__ Fire/snow watch with arctic sentry
__ Weapons cleaned/lubricated
__ Skis scraped before put in ski pit
__ Ski skins off, placed between sleeping bag and isopor mat
__ No gear adrift
__ Shave/hygiene before sleeping (not after)
__ Light and noise discipline
__ Track/camouflage improvement
__ Ensure all eat and drink
__ Piss tree check for hydration
__ Ensure cleaning cooking utensils
__ Fire precautions with stove, lighting, and operating
__ Tent free of snow/ice
__ Security rotating properly
__ Word passed

__ **Pull Pole:**

Minus 15 Minutes:

__ Stove turned off
__ Packs packed and staged
__ Sled staged
__ Isopor mats left out
__ Snow/ice removed from tent and lines
__ Deadmen dug out or cut away

Minus 5 Minutes:

__ Isopor mats stowed
__ Pits/piss tree filled in
__ Team members occupy pull pole position

Pull Pole:

__ On order, collapse tent
__ Pack tent, fly, poles
__ All holes filled in
__ When ready, stage on track in order of movement

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GLOSSARY

SECTION I. ACRONYMS AND ABBREVIATIONS

AMS . . . . . acute mountain sickness
APECS . . . . . all-purpose environmental clothing system

C-4 . . . . . plastic explosives
CAS. . . . . close air support
CASEVAC . . . . . casualty evacuation
CLP . . . . . cleaner, lubricant, and preservative
CO. . . . . carbon monoxide

DPICM . . . . . dual-purpose improved conventional munitions

ECW . . . . . extreme cold weather

°F. . . . . degrees Fahrenheit
FAC. . . . . forward air controller
FASCAM . . . . . family of scatterable mines
FR . . . . . flame resistant

GPS . . . . . global positioning system

HACE . . . . . high altitude cerebral edema
HAPE . . . . . high altitude pulmonary edema
HE . . . . . high explosive
HF . . . . . high frequency
HMMWV . . . . . high mobility multipurpose wheeled vehicle

IED . . . . . improvised explosive device
IIF . . . . . individual issue facility
ILBE . . . . . improved load-bearing equipment
ISR . . . . . intelligence, surveillance, reconnaissance

LAV . . . . . light armored vehicle
LAW . . . . . lubricant arctic weather
LBE . . . . . load-bearing equipment
lbs. . . . . pounds
LBV . . . . . load-bearing vest
LZ . . . . . landing zone

m . . . . . meter(s)
MACK . . . . . Marine assault climber's kit
MAGTF . . . . . Marine air-ground task force
MARPAT . . . . . Marine pattern
MCCWIK . . . . . Marine Corps cold weather infantry kit
MCMWTC . . . . . Marine Corps Mountain Warfare Training Center
MCRP . . . . . Marine Corps reference publication
MCW . . . . . meal, cold weather
M/CWCS . . . . . mountain/cold weather clothing system
METT-T . . . . . mission, enemy, terrain and weather, troops and support available-time available
MRE . . . . . meal, ready to eat
MSR . . . . . main supply route
MSS . . . . . modular sleep system

ORP. . . . . objective rally point

S-3. . . . . operations officer
SATCOM . . . . . satellite communications
SOP . . . . . standing operating procedure
SUES. . . . . small unit expeditionary stove
3S . . . . . Three-Season Sleep System

TDF . . . . . time-distance formula
TOW . . . . . tube launched, optically tracked, wire guided

UH-1Y . . . . . utility helicopter (Huey)
UIF . . . . . unit issue facility
UV . . . . . ultraviolet

VB . . . . . vapor barrier
VHF . . . . . very high frequency

WP . . . . . white phosphorus

SECTION II. TERMS AND DEFINITIONS

abatis—A vehicular obstacle constructed by felling trees (leaving a 1- to 2-meter stump above the ground on both sides of a road, trail, gap, or defile) so that they fall, interlocked, toward the expected direction of enemy approach. The trees should remain attached to the stumps and be at a 45-degree angle to the roadway. The obstacle itself should be at least 75 meters in depth to be most effective. (MCRP 5-12A)

ahkio—A boat-like sled used for pulling equipment over snow. (MCRP 5-12C)

Marine pattern—The pixel camouflage pattern used for the Marine Corps combat utility uniform. Also called **MARPAT**.

meal, cold weather—A packaged ration used to sustain an individual engaged in operations or training in cold weather environments or under arctic conditions. Also called **MCW**.

meal, ready to eat—The Marine Corps primary packaged operational ration. This packaged operational ration is designed to provide prepackaged individual meals containing food components that are ready to eat. It is suitable for use in the combat zone and under circumstances where resupply is established or planned but operational conditions preclude other means of preparing subsistence. Also called **MRE**.

REFERENCES AND RELATED PUBLICATIONS

Joint Publications (JPs)

1-02 Department of Defense Dictionary of Military and Associated Terms
3-09.3 Close Air Support

Army Field Manuals (FMs)

3-97.6 Mountain Operations
3-97.61 Military Mountaineering
9-207 Operations and Maintenance of Ordnance Materiel in Cold Weather
31-70 Basic Cold Weather Manual
31-71 Northern Operations

Marine Corps Publications

Marine Corps Doctrinal Publications (MCDPs)
1 Warfighting
1-0 Marine Corps Operations
1-2 Campaigning
1-3 Tactics
4 Logistics
5 Planning

Marine Corps Warfighting Publications (MCWPs)
3-35.1 Mountain Warfare Operations (under development)
5-1 Marine Corps Planning Process

Marine Corps Reference Publications (MCRPs)
5-12C Marine Corps Supplement to the Department of Defense Dictionary of Military and Associated Terms
3-35.1B Mountain Leader's Guide to Winter Operations (under development)
3-35.1C Mountain Leader's Guide to Mountain Warfare Operations (under development)
3-35.1D Cold Region Operations
3-35.1E Special Forces Use of Pack Animals

Fleet Marine Force Reference Publications (FMFRPs)
12-6 Commentary on Infantry Operations and Weapons Usage in Korea
12-48 On Winter Warfare
12-78 The White Death: The Epic of the Soviet-Finnish War

US Navy Naval Air Systems Command (NAVAIR) Technical Manual (TM)

13-1-6.7-1 Aviation-Crew Systems Aircrew Personal Protective Equipment (Aircrew/Passenger Equipment)

Miscellaneous

A Guide to Cold Weather Operations. Booklet 8. Fieldworks and Camouflage. Headquarters Defence [sic] Command Norway. The Army Staff.

Manual of Military Mountaineering. Royal Marines Mountain Leaders. Mountain Leader Training Cadre.