United States Army Alaska
Northern Warfare Training Center

Basic Mountaineering Course Student Handout

2010

"Battle Cold and Conquer Mountains"

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SECTION II. INTRODUCTION

Motivator: Mountain terrain presents unique challenges to individuals and units conducting military operations. You must understand the significant impact that mountain terrain can have on you and the extreme difficulty of ground mobility in mountainous terrain. Your ability to assess the terrain and make decisions about routes and hazards can mean the difference between a successful operation and one in which you never even make the objective. This lesson provides you with the tools to conduct terrain analysis of mountain regions.

Terminal Learning Objective

ACTION	Analyze mountain terrain
CONDITION	Given a specified route or location on the ground or on a map in a mountain region, and a map sheet of the route/location.
STANDARD	Analyze the route or location in terms of the five military aspects of terrain and determine how each aspect affects the mission/training.

Safety Requirements: For classroom training discuss emergency procedures in case of fire or natural disaster.

Risk Assessment: Low

Environmental Considerations: None

Evaluation: You will be tested on your knowledge of mountain terrain during a one hour written examination at the conclusion of the course (Refer to training schedule for date/time of exam). You must score a 70% on the written exam. If you fail the written exam, you will be given a second exam after re-training has been conducted. If you fail this second examination, you will be dismissed from the course.

Instructional Lead-In: Operations in Afghanistan routinely take place in a mountainous region at elevations of 5,000 to 17,000 feet. Operation Anaconda was conducted against well fortified Taliban and Al Qaeda forces. The enemy fought from the high ground, while many coalition troops began the fight in a valley (Shah i Kot Valley). As part of OEF, or in other mountain regions, you may plan for and/or conduct mountain operations. It is your responsibility as a military mountaineer to be able to analyze terrain in a mountain area of operations in order to use the terrain to your advantage and prevent it from adversely effecting operations.

SECTION III. PRESENTATION

Learning Step/Activity 1 – Define the acronym OAKOC.

a. (Slide 4) You can use the acronym OAKOC (observation and fields of fire, avenues of approach, key terrain, obstacles, cover and concealment to help analyze terrain.) This analysis allows you to identify potential movement routes, patrol base or assembly area locations, possible enemy avenues of approach and any potential hazards in the area of operations. You can use a map or aerial photographs to initially analyze the terrain and confirm this during a reconnaissance of the area.

(1) Observation and Fields of Fire.

(a) Observation requires terrain that permits a force to locate the enemy, either visually or through surveillance devices. The best observation is obtained from the highest terrain features in an area. Analyze the effects of visibility on observation with weather rather than terrain, because visibility varies with weather, whereas observation varies with terrain.

(b) Fire encompasses the influence of the terrain on the effectiveness of direct and indirect fire weapons. Indirect fire is mainly affected by terrain conditions within the target area. Fields of fire for direct weapons are mainly affected by terrain conditions between the weapon and target.

(c) Identify the terrain features in and by the area of operations (AO) that gives the friendly or enemy force favorable observation and fire. Consider these terrain features in your subsequent analysis of key terrain, enemy forces, and cover and concealment.

(2) Avenues of approach.

(a) An avenue of approach is a route for a force of a particular size to reach an objective or key terrain. To be an avenue of approach, a route must be wide enough to deploy the size force that will be using it.

(b) Analyze an avenue of approach solely on the following terrain considerations:

(1) Observation and fire. Determine if the avenue of approach provides favorable observation and fire for the force moving on it.
(2) Concealment and cover. Determine if the avenue of approach provides cover and concealment. Both can conflict with observation and fire.
(3) Obstacles. Determine if the avenue of approach avoids obstacles that are perpendicular to the direction of advance and, when practical, that takes advantage of those that are parallel to the direction of advance.
(4) Use of key terrain.
(5) Adequate maneuver space.
(6) Ease of movement.

(3) Key Terrain. A key terrain feature is any point or area that seizure or control affords a marked advantage to either force. "Seizure" means physical occupation of the terrain by a force whereas "control" might or might not include physical occupation. The selection of key terrain varies with the level of command, the type of unit and the unit's mission.

(4) Obstacles.

(a) An obstacle is any natural or artificial terrain feature that stops or impedes military movement.

(b) The mission influences consideration of obstacles.

(c) An obstacle might be an advantage or disadvantage. Consider each on its own merits, and for each specific mission. For example, obstacles perpendicular to a direction of attack favor the defender because they slow or channelize the attacker. Obstacles parallel to the direction of attack can help protect the flank of the attacking force.

(5) Cover and concealment.

(a) Cover is protection from the effects of fire. Concealment is protection from observation. You must determine cover and concealment available to both friendly and enemy forces.

(b) Concealment might be provided by terrain features, vegetation (such as wood, underbrush, or cultivated vegetation), or any other feature that denies observation. Concealment does not necessarily provide cover.

b. Overall, mountain terrain favors the defender. Before you can utilize OCOKA to analyze mountain terrain, there are some characteristics and hazards of mountain terrain that you must be familiar with.

Terrain Analysis: OAKOC

Observation and Fields of Fire

Avenues of Approach

Key Terrain

Obstacles

Cover and Concealment

Learning Step/Activity 2 – Define mountainous regions.

a. (Slide 4) Mountains are generally defined as land masses which rise higher than 1000 ft. above the surrounding terrain, and are characterized by steep slopes. Mountains may be composed of exaggerated terrain features, heavy woods or undergrowth, rocky peaks, glaciers, snowfields, escarpments, and extremely erratic weather conditions. Slopes in the mountains generally vary from 15º to 45º, while cliffs and precipices may be vertical or even overhanging. Mountains may consist of isolated peaks, single ridges or complex ranges extending for many miles.

Mountainous Regions

- ***Isolated peaks and complex ranges***
- ***Steep slopes (generally 15 to 45 degrees)***
- ***Vertical obstacles, swift streams, ravines, gorges***
- ***Heavily forested or sparse vegetation***
- ***Common feature is that there is significant local relief (1000 ft. or more)***

b. (Slide 5) Mountains are generally classified as low or high depending upon their local relief and to some extent elevation. Low mountains have a local relief of 1000-3000 feet (300-900 meters) with summits that are below tree-line. The Appalachian mountains in the eastern United States are low mountains. High mountains generally have a local relief exceeding 3000 feet (900 meters) and are characterized by barren alpine zones above timberline and difficult forested areas below timberline. Glaciers and perennial snow cover are common in high mountains and usually present commanders with more obstacles and hazards to movement than do low mountains. Examples of high mountain ranges include the Hindu Kush Range in Afghanistan, and the Alaska Range.

Local Relief

- ***Low Mountains***
  - ***Local relief of 1000-3000 ft.***
  - ***Usually below timberline***
- ***High Mountains***
  - ***Local relief of 3000 ft. +***
  - ***High alpine zones above timberline***
  - ***Glaciers and perennial snow cover***
  - ***Effects of altitude***

Learning Step/Activity 3 – Define the operational terrain levels.

a. (Slide 6) Mountain operations are generally carried out at three different operational levels. The military defines these levels as:

(1) Level I terrain is located at the bottom of valleys and along the main lines of communications. At this level, heavy forces can operate, but maneuver space is often restricted to main roads.

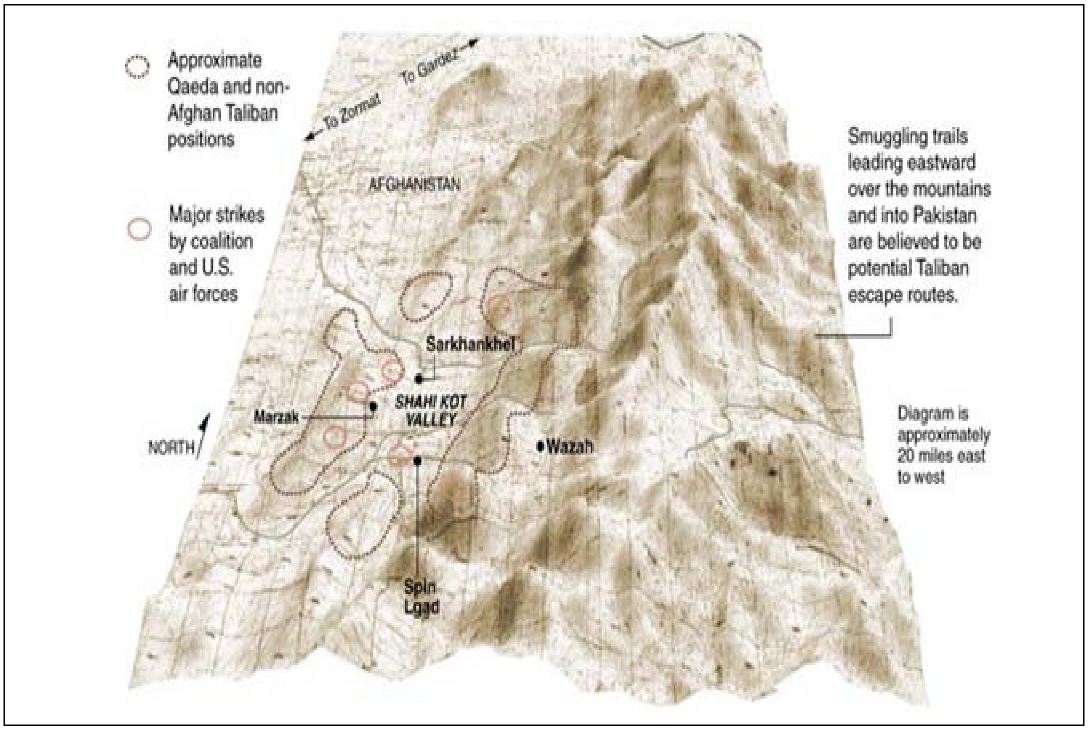
(2) Level II terrain lies between the valleys and the shoulders of mountains. Narrow roads and trails, which serve as secondary lines of communication, cross this ridge system. Ground mobility is difficult and you will expend great effort on these ridges to maintain control of them. Command of this terrain can significantly impact operations in Level I terrain making it key terrain in military operations.

(3) Level III terrain includes the dominant terrain of summit regions. Mobility in these areas is the most difficult to achieve. Assuming you are part of a well trained unit, you can infiltrate to attack enemy lines of communications, logistics bases and command and control infrastructures.

Operational Terrain Levels

Level	*Description*
I	**The bottoms of valleys and main lines of communication**
II	**The ridges, slopes and passes that overlook valleys**
III	**The dominant terrain of the summit region**

(4) (Slide 7) This map shows the Shahi Kot Valley during Operation Anaconda. Notice the Taliban positions. What terrain level did they occupy prior to the start of operations? What terrain level did coalition forces occupy? Who had the advantage during this operation?



Learning Step/Activity 4 – Describe the modified Walzenbach rating system and how it is used to classify mountain terrain.

a. (Slide 8) Mountain terrain can be classified by the equipment and techniques required to conduct movement. This system is known as the modified Walzenbach rating system. You can use this system to give others an idea of the difficulty of the terrain you are planning to move over. The classes of difficulty listed here do not take weather into account. Exposure is a term you will often hear when routes in the mountains are described. Exposure indicates that there is the possibility of a long fall, even if the climbing is not particularly difficult.

Dismounted Mobility Classification

Class 1 - Gentler slopes/trails; walking techniques

Class 2 - Steeper/rugged terrain; some use of hands

Class 3 - Easy climbing; fixed ropes where exposed

Class 4 - Steep/exposed climbing; fixed ropes required

Class 5- Near vertical; technical climbing required

Learning Step/Activity 5 – Describe slope surfaces typically found in mountain terrain.

a. (Slide 9) It is also important to identify and evaluate the slope surfaces to understand how travel will be affected. Each slope type offers degrees of difficulty for traveling up or down. There are generally 4 types of slope surfaces: hard pack, grassy, talus, and scree.

(1) Hard pack is considered earth that will not give way under the weight of an individual. It usually consists of packed dirt or sand and may contain scattered rocks and vegetation.
(2) A grassy slope is seldom covered with a smooth carpet of green grass. Movement techniques are the same as on hard pack.
(3) Talus slopes generally offer a fairly easy accent. One must avoid dislodging rocks, which could cause larger rocks to break loose and injure someone below. It is difficult to descend on this slope rapidly.
(4) Scree slopes act like sand underfoot and can be very tiring on the ascent. Steps often can be kicked into scree on the ascent, but scree offers an easier decent where one can move with a sliding action.

Techniques for negotiating these slopes surfaces will be discussed in the mountain walking techniques portion of training.

Slope Surfaces

- ***Hard Pack- soil with sparse vegetation that will not give way underfoot***
- ***Grassy- made up of grassy clumps (tussocks) or carpeted with alpine tundra***
- ***Talus - slopes comprised of large rocks/boulders formed from rockfall accumulation***
- ***Scree - slopes comprised of smaller rocks/gravel formed from rockfall accumulation, will give under body weight***

b. (Slide 10) Snow adds another dimension to mountain travel. Snow is in a state of constant change. It can be hard packed or unconsolidated powder. It can be stable and provide an efficient means of travel or it can be prone to deadly snow slides or avalanches. Route planning must take into account snow consistency. Effective travel through snow covered terrain requires use of skis, snowshoes or crampons. Additional specialized equipment is often required for Class 4 and 5 terrain. Use of this equipment as well as various movement techniques will be demonstrated during field training.

Snow Surface Considerations

- ***Can aid movement by covering rough terrain with a consistent surface***
- ***May require special training and equipment - glaciers***
- ***May require snowshoes or skis to help with movement***
- ***Presents new hazards (avalanche, cornice collapse, etc.)***

Learning Step/Activity 6 – Define mountain specific terrain features.

a. (Slide 11) There are 10 terrain features that you are already be familiar with (these will be covered in detail again during land navigation training): hill, saddle, valley, ridge, depression, draw, spur and cliff, cut and fill.

You need to know some additional terrain feature descriptions commonly used to describe mountain terrain by the mountaineering community. Some of these correspond to the ten terrain features but are usually significantly larger in scale.

Mountain Specific Terrain Features

1. **Peak or Summit – looks like a *Hilltop* on a map**
2. **Col – looks like a *Saddle***
3. **Pass – also looks like a *Saddle* but is significantly larger. Often of significance to military operations as a main avenue of approach. An example is the Salang Pass in Afghanistan. Isabel Pass, 30 miles south of the Black Rapids Training Site, is one of three major avenues of approach into interior Alaska.**
3. **Glaciers often create *valleys* as they carve out the surrounding terrain. They will be U-shaped if this is the case.**
4. **Cirque – looks like a large *Draw* on a map; significant high ground on three sides; often described as a bowl.**
5. **Arete – a sharp narrow mountain *ridge* or *spur***
6. **Buttress – a rock formation that projects out from the line of the face – *spur***
6. **Couloir – narrow mountain gulley (*draw*) often prone to avalanche or rock fall**
7. **Horn/Gendarme – an abrupt, sharp peak usually occurring on a ridge. It can present a formidable obstacle to movement along a ridge.**

b. (Slide 12) A peak or a summit will look like a hilltop on a map.

Peak or Summit: Hilltop

c. (Slide 13) A col resembles a saddle on a map. It may provide the only relatively easy passage point through difficult Level II or Level III terrain.

Col: Saddle

d. (Slide 14) A pass also looks like a saddle or valley on a map, but is significantly larger. This is often key terrain for military operations as the pass will allow large scale movement of troops through mountainous terrain.

Pass: Saddle or Valley

e. (Slide 15) A glacier is a perennial accumulation of snow and ice. It can allow you easy passage through the mountains, but due to unique hazards of glaciers, you must be specially trained and equipped for travel.

Glacier: Valley

f. (Slide 16) This will look like a huge draw on a map. It is sometimes referred to as a bowl. A snow covered cirque can be a terrain trap, with avalanche potential from three sides.

Cirque: Draw

g. (Slide 17) A sharp narrow ridge or spur.

Arete: Spur

h. (Slide 18) Buttress is a rock formation that projects out from the line of the face.

Buttress

i. (Slide 19) A narrow mountain gulley (draw) often prone to avalanche or rock fall. In the right conditions however, the couloir can be a main dismounted movement avenue.

Couloirs: Draw

j. (Slide 20) Movement often occurs along a ridgeline. Gendarmes or horns can block movement along these routes. They are usually small enough that they do not appear on maps.

Gendarme or Horn

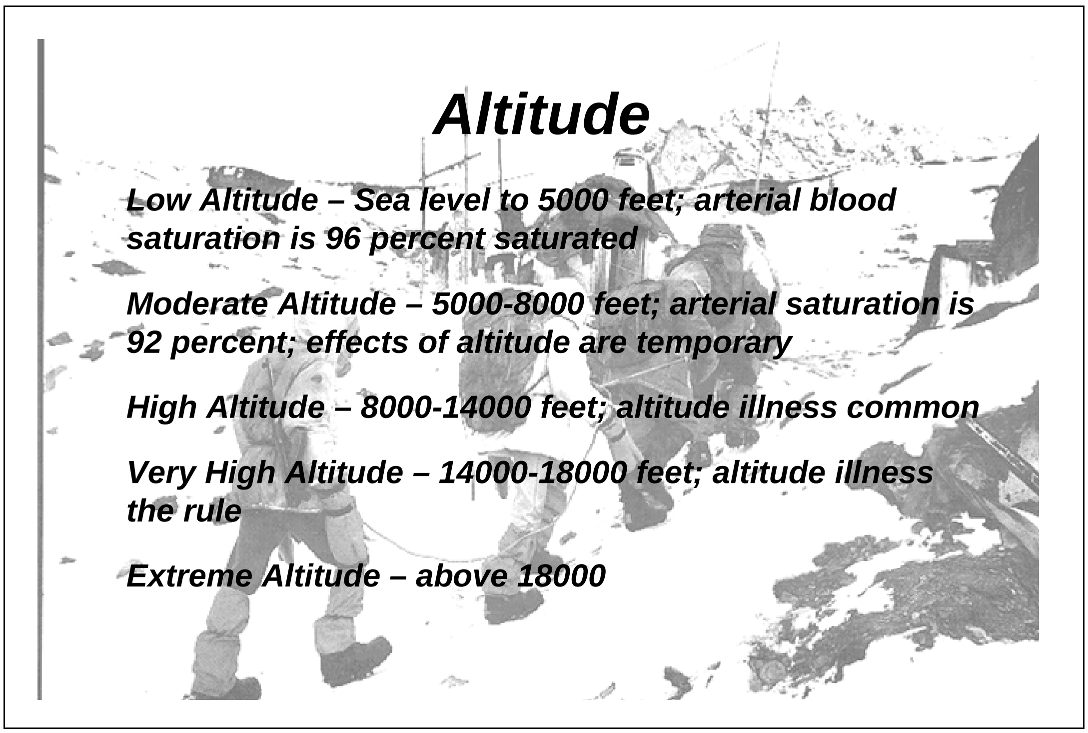
Learning Step/Activity 7 – Identify mountain hazards.

a. (Slide 21) There are numerous objective hazards present in the mountains that you must consider. Ignorance of these hazards can lead to casualties and lost or damaged equipment.

b. (Slide 22) Altitude is a factor that can have a significant impact on operations. There is less oxygen available to your body as you go up in altitude. This leads to a degradation of performance and may cause altitude related illnesses. The military classifies altitude into five categories:

(1) Low altitude – sea level to 5,000 feet; arterial blood saturation is 96 percent saturated
(2) Moderate altitude – 5000-8000 feet; arterial saturation is 92 percent; effect of altitude are temporary
(3) High altitudes – 8000-14000 feet; altitude illness common here
(4) Very High altitude – 14000-18000; altitude illness the rule
(5) Extreme altitude – areas above 18,000 feet

More on the effects of altitude is presented in the medical considerations class.



c. (Slide 23) An avalanche is nothing more than a mass of snow moving down a slope – this one was triggered by Canadian Army Artillery as part of a avalanche control effort along a main road and rail network.

Avalanche

d. (Slide 24) Avalanche of ice and snow from a hanging glacier.

Avalanche

e. (Slide 25) Glaciers are rivers of ice that develop over time because snow accumulation exceeds snow melt. Glaciers can provide fast, efficient movement or can be obstacles to movement depending upon the conditions of the glacier, the time of year and level of training.

Glaciers

f. (Slide 26) A crevasse is formed as a glacier flows over an irregularity causing a split or crack in ice surface. These can be bridged by snow much of the year. Snow bridges can be strong enough to support travel or may create hidden traps depending upon the condition of the snow. During the summer months the crevasses are often exposed. This can make movement tedious as you will have to traverse around the crevasses to make forward progress.

Crevasse

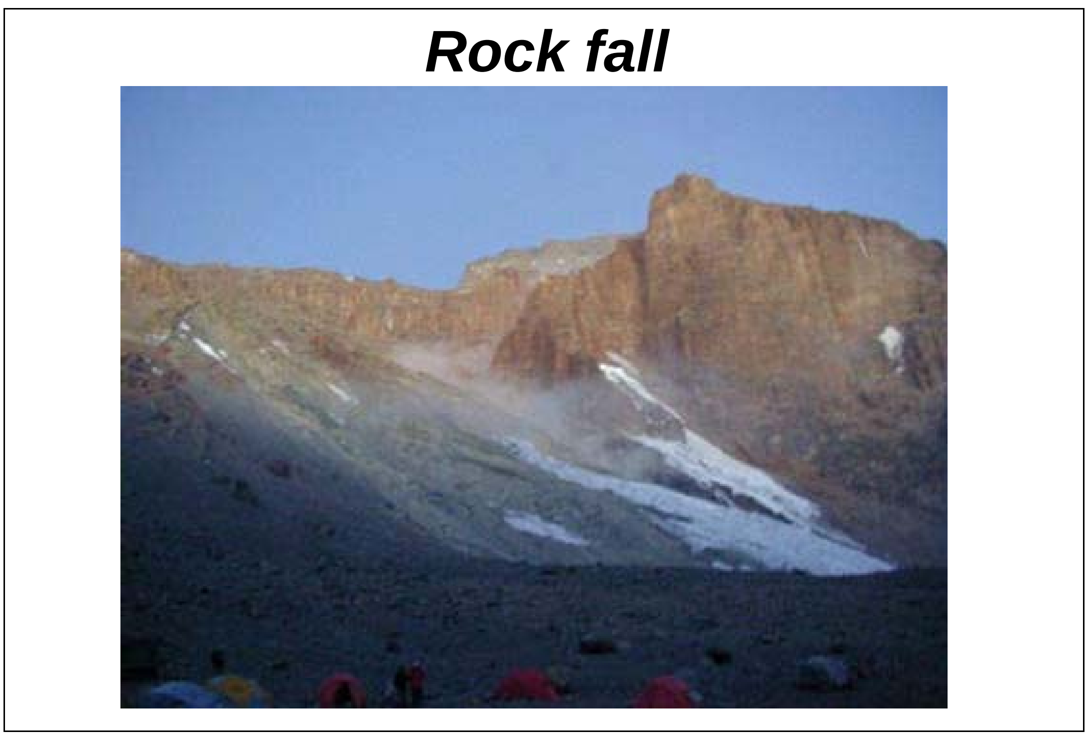
g. (Slide 27) Rivers found in cold regions may aid movements or be major obstacles, depending upon the time of year.

(1) Arctic/Sub-Arctic rivers are usually glacier-fed, with many braided channels and swift currents.
(2) Glacier-fed rivers change course frequently, making river navigation difficult, and rendering map data suspect.
(3) If shallow-draught boats are available, rivers may provide valuable lines of communication in summer, and once firmly frozen, may offer high-speed routes for both mounted and dismounted movement. During spring and early winter (break-up and freeze-up) however, rivers may be impassable. Some rivers, especially in temperate areas, may not freeze solidly enough to allow for winter movement.

Rivers

h. (Slide 28) Rivers often change and may deviate significantly from what is depicted on your map. Glacial fed rivers are often laden with silt and may contain many braided channels.

i. (Slide 29) Rock fall is a frequent hazard in a mountainous environment. In regions with snow cover, as temperatures warm during daylight hours, the bond that snow, ice and rock have with underlying layers is weakened, often creating rock and ice fall hazards. When you are moving on steep terrain you can dislodge loose rock and create a rock fall hazard to those below you.



SECTION IV. SUMMARY

The first step to successful mountain operations is a thorough analysis of the terrain in the AO. You now have a basic understanding of mountain terrain and some of the hazards it can present to military operations.

Check on Learning.

1. What operational terrain level is the Richardson Highway (in this immediate area) considered?

Level I terrain, suitable for heavy or light forces, though vehicles will be restricted to the highway.

2. Name hazards typically associated with mountain operations.

Avalanches, crevasses, rock fall, swift, cold rivers and streams, altitude.

3. What obstacles are typically encountered in the mountains?

Vertical obstacles such as cliffs, buttresses and gendarmes. Glaciers, crevasses, rivers, and cirques are also obstacles.

4. What is typically considered key terrain in the mountains?

Passes and cols, Level II terrain that overlooks vital road network in valleys, built up areas.

5. What avenues of approach are typical in the mountains?

Avenues of Approach in mountain regions are often along or through ridgelines, passes, cols, or couloirs. Glaciers can also be used as an avenue of approach for units that are properly equipped and trained.

SECTION II. INTRODUCTION

Motivator: In the mountains, the weather can significantly influence the success or failure of your mission. You may be able to move through an area with little difficulty one day and then be completely shut down the next because of new conditions created by the weather. Deep snows can create avalanche conditions, high winds can create dangerously low temperatures, blowing snow can reduce your visibility to a few feet, and whiteout conditions can shut down your movement altogether.

Terminal Learning Objective

ACTION	Analyze mountain weather
CONDITION	Given a training mission that involves a specified route or location on the ground or a map in a mountainous region, a map sheet of the route/location, a current weather forecast for the general area, altimeter and/or barometer (if available) and any other pertinent weather information or data.
STANDARD	Analyze the weather for the route/location in terms of visibility, survivability and mobility and determine how each of these aspects affects the training/mission.

Safety Requirements: For classroom training discuss emergency procedures in case of fire or natural disaster.

Risk Assessment: Low

Environmental Considerations: None

Evaluation: You will be tested on your knowledge of weather during a one hour written examination at the conclusion of the course (Refer to training schedule for date/time of exam). You must score a 70% on the written exam. If you fail the written exam, you will be given a second exam after re-training has been conducted. If you fail this second examination, you will be dismissed from the course.

Instructional Lead-In: You probably already know that weather can have a large impact on military operations. You probably all have a story of a time when you were promised an air movement back from a long field problem, but had to walk back instead because the of weather. Weather information can be hard to come by in mountain regions. Observatories may make generalized forecasts for large unpopulated areas that may or may not be accurate. A call for moderate weather conditions in the forecast may not be relevant to your particular area of operations and you can quickly find yourself overwhelmed by the local conditions. Your ability to make observations and predict the weather can help you prepare your Soldiers for the worst.

SECTION III. PRESENTATION

Learning Step/Activity 1 – Describe how weather is created.

a. (Slide 33) Weather Basics: The earth is surrounded by an atmosphere that is divided into several layers. The world's weather systems are in the lower of these layers known as the troposphere. This layer reaches as high as 40,000 feet. The forces that create the weather are:

(1) Sun
(2) Air Movement
(3) Earth's Rotation
(4) Ocean's and Land Masses
(5) Fronts

<u>Forces that create weather:</u>
Sun, air movement, earth's rotation, oceans and land masses, cold fronts and warm fronts

<u>Weather depends upon:</u>
Air temperature, humidity, air pressure, how air is being moved and if the air is being lifted or not

<u>You should observe:</u>
Clouds, air pressure, wind direction/speed, temperature and humidity to help predict weather

Some tools that you can use are thermometer, barometer/altimeter and wind meter.

b. ***The Sun*** (Slide 34) is the major force behind the weather. The sun provides the heat that creates the temperature variations that are ultimately responsible for all weather. The sun does not heat the earth evenly. At the equator it heats the earth's surface with greater intensity than it does at the poles. This uneven heating results in air movement.

The Sun

- ***is the major force behind the weather***
- ***does not heat the earth evenly; at the equator it heats the earth's surface with greater intensity than it does at the poles***
- ***uneven heating results in air movement; temperature variations are ultimately responsible for all weather***

c. ***Air Movement.*** (Slide 35) You are all familiar with wind. But you must also understand vertical movement of air. As air is heated it becomes less dense (lighter) and rises. As air is cooled, it becomes denser (heavier) and sinks. These temperature differences equate to air pressure differences. There are some basic facts about air pressure that you should be familiar with:

(1) Air pressure is the weight of the atmosphere at any given place.

(2) The average air pressure at sea level is 29.92 inches of mercury (hg) or 1,013 milibars (mb).

(3) Air that is cooled is dense (heavier) air – therefore the air pressure is high. High pressure areas have the following characteristics:

- The airflow is clockwise and out
- Otherwise known as an anticyclone
- Associated with clear skies
- Generally the winds will be mild
- Depicted as a blue H on weather maps

(4) Air that is heated is less dense and rises – therefore the air pressure is low. Low pressure areas have the following characteristics:

- The airflow is counterclockwise and in
- Otherwise known as cyclone
- Associated with bad weather
- Depicted as a red L on weather maps

(5) Pressure differences cause air to move from a high pressure area to a low pressure area which creates wind. Just think of the air compressor you use to inflate your tires – air under high pressure moves into your tires that have a lower air pressure. Air from a high pressure area is basically trying to

flow out and equalize its pressure with the surrounding air. Low pressure on the other hand, is building up vertically by pulling air in from outside itself.

(6) As air moves from high pressure areas to low pressure areas it carries moisture with it. In the low pressure areas, the air rises up. As this air rises up, it is cooled. As air cools, its capacity to hold water is reduced. Clouds are formed, and precipitation often follows. The opposite effect happens at the poles. Polar air sinks and as it does so it creates high pressure areas of very cold air. As it sinks it actually warms. This warming evaporates any moisture present. This is the reason that the arctic receives very little precipitation. This warming is a relative thing and does little to warm the overall climate of the Arctic.

(7) The higher in altitude you go, the lower the air pressure will be.

Air Movement

- ***Air pressure is the weight of the atmosphere at any given place.***

- ***Air that is cooled, sinks and is dense (heavier) air – therefore the air pressure is high.***

- ***Air that is heated is less dense and rises – therefore the air pressure is low.***

- ***The higher in altitude you go, the lower the air pressure will be.***

d. ***The Earth's Rotation.*** (Slide 36) If the earth was stationary, air masses would move from the poles to the equator and back to the poles as it was heated and cooled. But the earth rotates. The rotation of the earth deflects the air masses influencing wind movement. Much of the world's weather depends upon a system of winds that blow in a set direction.

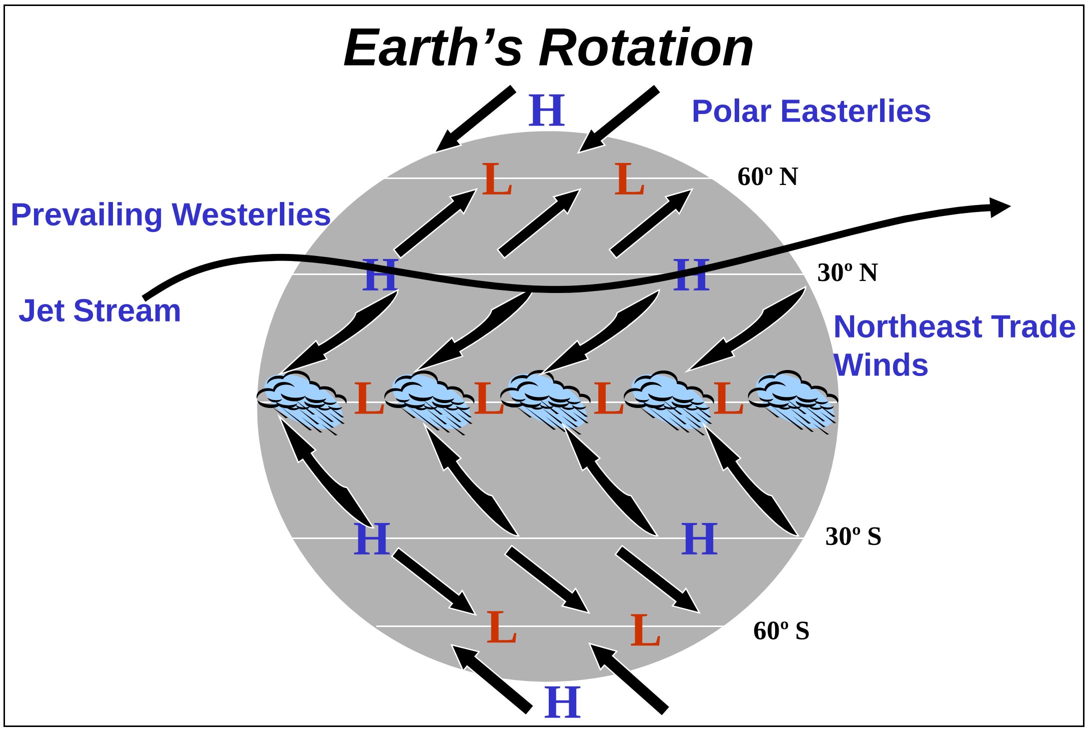
(1) In the Northern Hemisphere there are three prevailing winds:

- ***Polar Easterlies***. These are winds from the polar region moving from the east. This is air that has settled at the poles.

- ***Prevailing Westerlies***. These winds originate from approximately 30 degrees north latitude from the west. This is an area where prematurely cooled air, due to the earth's rotation, has settled to the surface.

- ***Northeast Trade Winds.*** These are winds that originate from approximately 30 degrees north from the northeast.

(2) The ***jet stream*** is a long meandering current of high speed winds often exceeding 250 miles per hour; it is located near the transition zone between the troposphere and the stratosphere known as the tropopause. These winds blow generally from a westerly direction dipping down and picking up air masses from the tropical regions and going north and bringing down air masses from the polar regions.



e. ***Oceans and Land Masses.*** (Slide 37) The patterns of wind mentioned above, move air. This air comes in parcels called ***air masses***. These air masses can vary from the size of a small town to as large as a country. The air masses are named from where they originate:

- Maritime – over water
- Continental – over land
- Polar – north of 60 degrees north latitude
- Tropical – south of 60 degrees north latitude

Combining these parcels of air provides the names and descriptions of the four types of air masses:

- Continental Polar – cold, dry air mass
- Maritime Polar – cold, wet air mass
- Maritime Tropical – warm, wet air mass
- Continental Tropical - warm, dry air mass

For general planning purposes, you should consider if the area is influenced by large land masses or large bodies of water, as these will generally have the greatest effect on the weather in mountain regions.

- A ***maritime zone*** is influenced by large bodies of water, be it an ocean or large lake. Typically, maritime zones see cool summers and milder winters with heavy precipitation. Ft. Drum, New York (temperate), Ft. Richardson, Alaska (sub-arctic) and Murmansk, Russia (arctic) are considered maritime zones.

- ***Continental Zones*** are inland areas; the climate is generally influenced by large land masses. These zones are typically drier, though in mountainous areas there may be heavy snowfall. Extreme cold temperatures in winter and warm to hot temperatures in summer are the norm. Ft. Carson, Colorado (temperate), Ft. Wainwright, Alaska (sub-arctic) and Anaktuvak Pass, Alaska (arctic) are all considered continental zones.

Oceans and Land Masses

Maritime Zones:

- ***influenced by large bodies of water***
- ***moderate to heavy precipitation is typical (deep snow pack)***
- ***cool, wet summers and moderate, wet winters***
- ***freeze thaw cycles more common in winter***

Continental Zones:

- ***inland areas; influenced by large land mass***
- ***moderate to light precipitation is typical (shallow snow pack)***
- ***hot summers, very cold winters***
- ***freeze thaw cycles are rare in winter***

f. (Slide 38) Typically cold regions can be categorized as having cold wet or cold dry conditions during the winter months. In ***cold wet conditions***, you will experience temperatures that are near freezing and freeze thaw cycles are common throughout the winter. Wet snow, sleet and rain are also common conditions. Temperatures are usually above 14º F. Typically maritime zones experience cold-wet conditions.

In ***cold dry conditions***, average temperatures are lower than 14º F. The ground usually remains frozen throughout winter, freeze thaw cycles are rare and the snow is dry. Continental zones generally experience cold dry conditions.

Cold Wet vs. Cold Dry Conditions

Cold Wet Conditions:

- ***temperature- ranges from 14°F and above***
- ***precipitation- rain, sleet, snow (wet or dry)***
- ***ground- muddy, wet slushy snow***
- ***frequent freeze / thaw cycle***

Cold Dry Conditions:

- ***temperature- ranges from 14°F and below***
- ***precipitation- dry snow***
- ***ground- frozen throughout winter***
- ***freeze / thaw cycles are rare***

g. (Slide 39) Overall mountain climates are cooler, wetter versions of the lowlands surrounding them. For planning purposes, you should consider whether the climate is a continental or maritime zone, the latitude of the mountains and the altitudes you will be working at.

Mountain Climates

- ***Generally cooler, wetter version of nearby lowlands***
- ***Maritime vs. Continental influence***
- ***Climate variations more drastic in high mountains***
- ***Major differences due to changes in altitude and relief***

h. ***Fronts***. (Slide 40) Fronts occur when two air masses of different moisture content and temperature meet. One indicator that a front is approaching is the progression of the clouds.

Fronts

Warm Front: warm air mass moves into and over a slower or stationary cold air mass; warm air is less dense and therefore moves up and over the cold air mass

Cold Front: cold air mass overtakes a slower or stationary warm air mass; cold air forces the warm air up

Occluded Front: Combination of warm front and cold front characteristics; occurs frequently over land

Stationary Front : no significant air movement is occurring

i. ***Clouds*** (Slide 41) are indicators of weather conditions. By reading cloud shapes and patterns, you can forecast weather without any extra equipment. Any time air is cooled or lifted beyond its saturation point (100 percent relative humidity), clouds are formed.

(1) Humidity is the amount of moisture in the air. All air holds water vapor even if it cannot be seen. Air can hold only hold so much water vapor; however, the warmer the air, the more moisture it can hold. When the air holds all that it can, the air is saturated or has 100 percent relative humidity.

(2) If air is cooled beyond its saturation point, the air will release its moisture in one form or another (clouds, fog, rain, snow etc.). The temperature at which this happens is called the condensation or dew point. The dew point varies depending upon the amount of water vapor contained in the air and the temperature of the air. If the air contains a great deal of water, dew can occur at temperatures of 68º F, but if the air is dry and does not hold much moisture, dew may not form until the temperature drops to 32 º F or even below freezing in which case you see frost.

The four ways that clouds are formed are:

(1) ***Convective Lifting.*** This effect happens due to the sun's heat radiating off the earth's surface causing air current (thermals) to rise straight up and lift air to a point of saturation.

(2) ***Frontal Lifting.*** A front is formed when two air masses of different moisture content and temperature collide. Since air masses will not mix, warmer air is forced aloft over the colder air mass. From there it is cooled and then reaches its saturation point. Frontal lifting creates the majority of precipitation.

(3) ***Cyclonic Lifting.*** An area of low pressure pulls air into its center from all over in a counterclockwise direction. Once this air reaches the center of the low pressure, it has nowhere to go but up. Air continues to lift until it reaches the saturation point.

Cloud Formation

<u>Convective Lifting</u>:* *Sun's heat radiating off the earth's surface causing air currents (thermals) to rise straight up and lift air to point of saturation.

<u>Frontal Lifting</u>:* *A front is formed when to air masses of different moisture content and temperature collide. Since air masses will not mix, the warmer air will lift until it reaches its saturation point. Produces majority of precipitation.

<u>Cyclonic Lifting</u>:* *An area of low pressure pulls air into its center from all over in a counterclockwise direction. Once air reaches the center of low pressure, it has nowhere to go but up. Air continues to lift until it reaches the saturation point.

(4) Orographic Lifting (Slide 42). This happens when an air mass is pushed up and over a mass of higher ground such as a mountain. Air is cooled due to the adiabatic lapse rate until the air's saturation point is reached.

Cloud Formation *(cont.)*

***<u>Orographic Lifting</u>*: This happens when an air mass is pushed up an over a mass of higher ground such as a mountain. This is typical along coast regions with mountains. As the air mass moves up the mountain range, the moisture is released quickly and typically produces heavy precipitation. This is evident in the Cascade Range of the Pacific Northwest.**

Learning Step/Activity 2 – Explain the significance of different cloud types.

a. (Slide 43) Clouds can be described in many ways. They can be classified by height or appearance, or even by the amount of area covered vertically or horizontally. Clouds are classified into five categories: Low, mid and high level clouds; vertically developed clouds and less common clouds.

Cloud Types

Low Level

Mid Level

High Level

Vertical-Development Clouds

Less Common Clouds

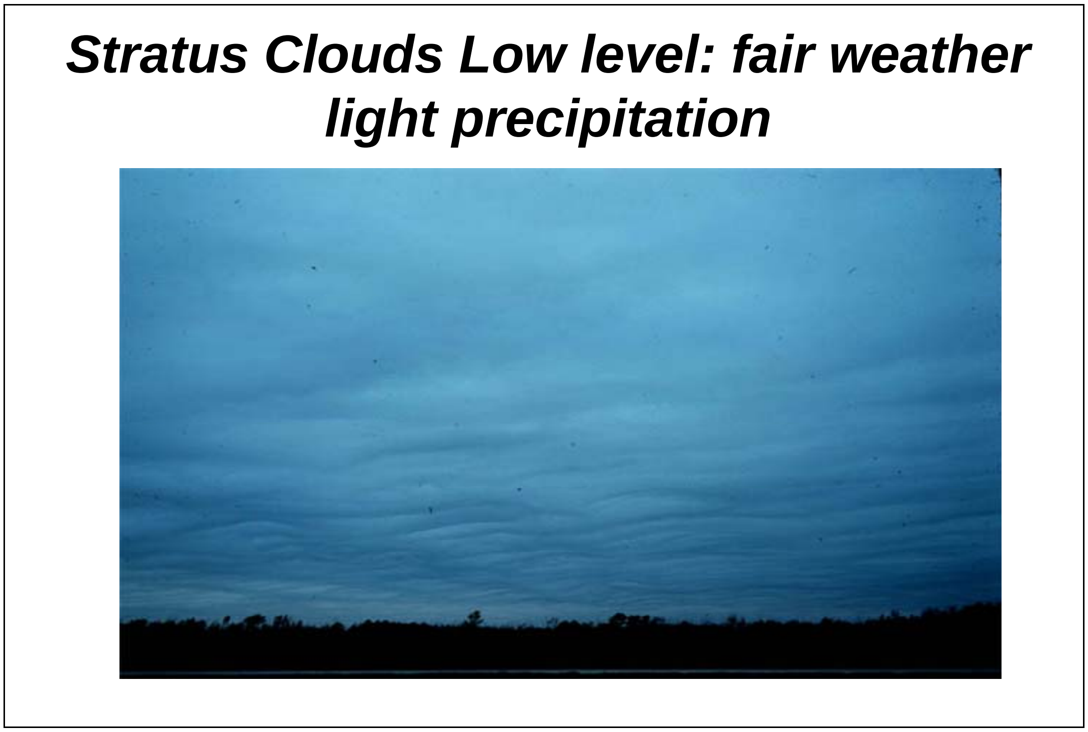
b. (Slide 44) ***Low level clouds*** (0-6,500 feet) are either cumulus or stratus. Low-level clouds are composed mainly of water droplets since their bases lie below 6,500 feet. When temperatures are cold enough, these clouds may also contain ice particles and snow. Low-level clouds may be identified by their height above nearby surrounding relief of known elevation. Most precipitation originates from low-level clods because rain or snow usually evaporates before reaching the ground from higher clouds. Low-level clouds usually indicate impending precipitation, especially if the cloud is more than 3,000 feet thick. Clouds that appear dark at their bases are more than 3,000 feet thick.

<u>Low-Level Clouds:</u> ***Either Cumulus or Stratus; mostly composed of water; two of the precipitating low level clouds are Nimbostratus clouds and Stratocumulus clouds***

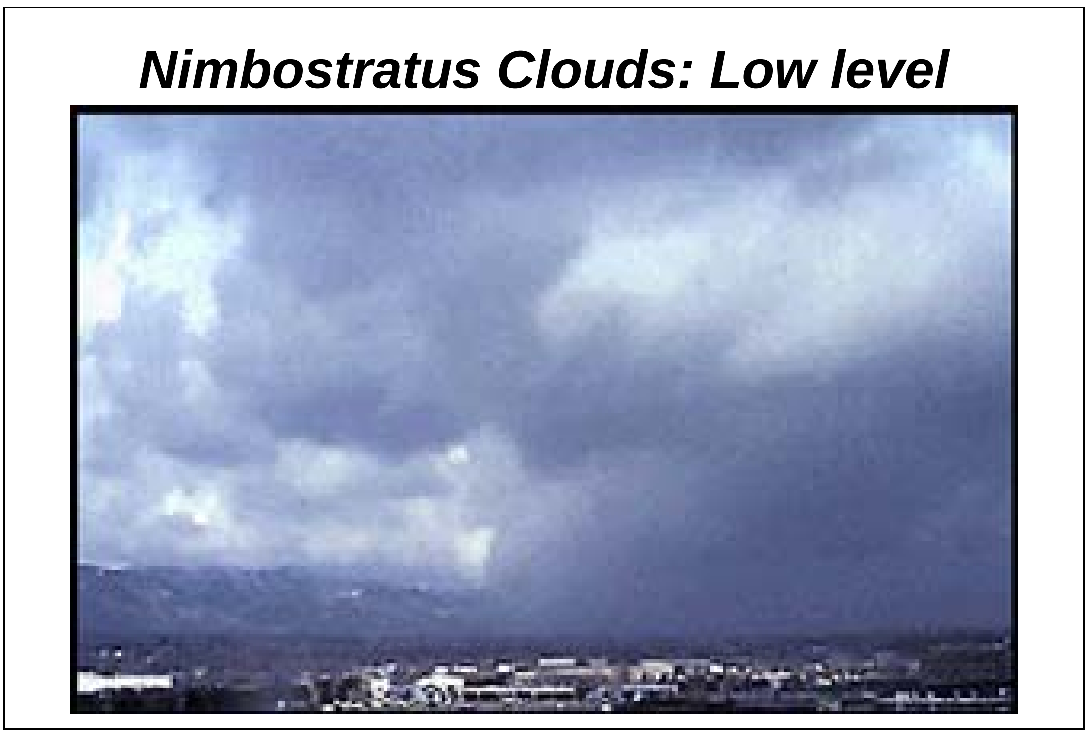
c. (Slide 45) ***Cumulus clouds*** indicate fair weather. Resembles cotton balls.

Cumulus Clouds: Low level; fair weather

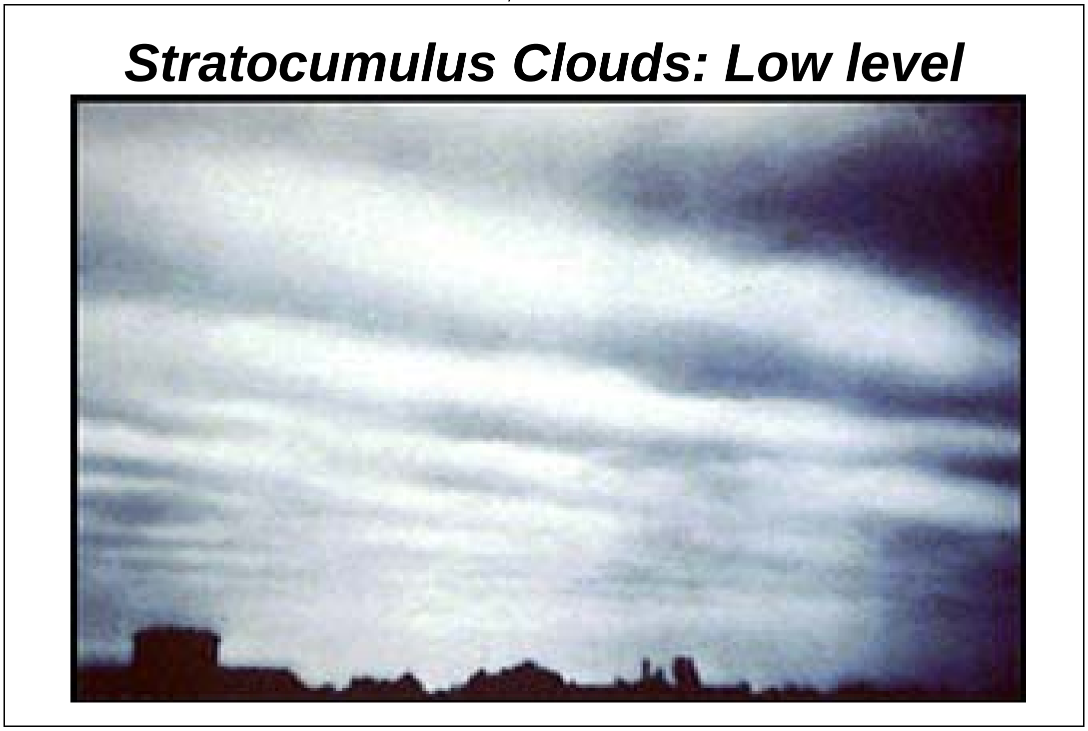
d. (Slide 46) **Stratus clouds** indicate fairly stable weather. Resembles lumpy sheets.



e. (Slide 47) ***Nimbostratus clouds*** are dark low-level clouds accompanied by light to moderately falling precipitation. The sun or moon is not visible through nimbostratus clouds, which distinguishes them from mid-level altostratus clouds. Because of the fog and falling precipitation commonly found beneath and around nimbostratus clouds, the cloud base is extremely diffuse and difficult to accurately determine.



f. (Slide 48) ***Stratocumulus clouds*** generally appear as a low, lumpy layer of clouds that is sometimes accompanied by weak precipitation. Stratocumulus vary in color from dark gray to light gray and may appear as rounded masses with breaks of clear sky in between. Because the individual elements of stratocumulus are larger than those of the mid level cloud, altocumulus, deciphering between the two cloud types is easier. With your arm extended toward the sky, altocumulus cloud elements are about the size of a thumbnail, while stratocumulus elements are about the size of a fist.



g. (Slide 49) ***Mid-level clouds*** (between 6,500 to 20,000 feet) have a prefix of alto. Middle clouds appear less distinct than low clouds because of their height. Alto clouds with sharp edges are warmer because they consist of water droplets. Cold clouds, composed mainly of ice crystals and usually colder than – 30 degrees F, have distinct edges that fade gradually into the surrounding sky. Middle clouds usually indicate fair weather, especially if they are rising over time. Lowering middle clouds indicate potential storms, though usually hours away. There are two types of mid-level clouds, altocumulus and altostratus clouds.

Mid-Level Clouds: ***Middle clouds generally indicate fair weather, especially if they are rising over time. These clouds have the prefix 'alto'. Deteriorating weather is indicated by lowering middle clouds though these storms are usually hours away.***

h. (Slide 50) ***Altocumulus clouds*** can appear as parallel bands or rounded masses. Typically a portion of an altocumulus cloud is shaded, a characteristic which makes them distinguishable from high-level cirrocumulus. Altocumulus clouds usually form in advance of a cold front. The presence of altocumulus clouds on a warm humid summer morning is commonly followed by a thunderstorm later in the day. Altocumulus clouds that are scattered rather than even are often called fair weather cumulus and suggest the arrival of high pressure and clear skies. Resembles a fish fillet.

Altocumulus Clouds: Mid level

i. (Slide 51) ***Altostratus clouds*** are often confused with the high level cirrostratus clouds. The one distinguishing feature is that a halo is NOT observed around the sun or moon with altostratus. Also, with altostratus the sun or moon is only vaguely visible and appears as if it were shining through frosted glass. Resembles bed sheets.

Altostratus Clouds: Mid level

j. (Slide 52) ***High level clouds*** (more than 20,000 feet above the ground) are usually frozen clouds, indicating air temperatures below -30 degrees Fahrenheit, with a fibrous structure and blurred outlines. The sky is often covered with a thin veil of cirrus that partly obscures the sun or, at night produces a ring of light around the moon. The arrival of cirrus and cirrostratus clouds indicates moisture aloft and the approach of a traveling storm system. Precipitation is often 24-36 hours away. As the storm approaches the cirrus thickens and lowers, becoming altostratus and eventually stratus. Temperatures warm, humidity rises and winds become southerly or south easterly. The two types of high level clouds are cirrus and cirrostratus.

High-Level Clouds: ***These clouds are in the upper reaches of the troposphere and indicate moisture aloft and that precipitation is 24-36 hours away. Cirrus and Cirrostratus are the most common. The only indicators of these clouds may be a halo or ring around the moon or sun.***

k. (Slide 53) ***Cirrus clouds*** are the most common of high-level clouds. Typically found at altitudes greater than 20,000 feet, cirrus are composed of ice crystals that form when super-cooled water droplets freeze. Cirrus clouds generally occur in fair weather and point in the direction of air movement at their elevation. Cirrus can be observed in a variety of shapes and sizes. They can be nearly straight, shaped like a comma, or seemingly all tangled together. Extensive cirrus clouds are associated with an approaching warm front. Resembles Mare's Tails.

Cirrus Clouds: High level

l. (Slide 54) ***Cirrostratus clouds*** are sheet like, high level clouds composed of ice crystals. They are relatively transparent and can cover the entire sky and be up to several thousand feet thick. The sun or moon can be seen through cirrostratus. Sometimes the only indication of cirrostratus clouds is a halo around the sun or the moon. When seen around the sun, this halo is often referred to as a Sun Dog. Cirrostratus clouds tend to thicken as a warm front approaches, signifying an increased production of ice crystals. As a result, the halo gradually disappears and the sun or moon becomes less visible.

m. (Slide 55) ***Clouds with vertical development*** can grow to heights in excess of 39,000 feet, releasing incredible amounts of energy. The two types of clouds with vertical development are fair weather cumulus and cumulonimbus.

(1) ***Fair weather cumulus clouds*** have the appearance of floating cotton balls and have a lifetime of 5-40 minutes. Known for their flat bases and distinct outlines, fair weather cumulus exhibit only slight vertical growth, with the cloud tops designating the limit of rising air. Given suitable conditions, however, these clouds can later develop into towering cumulonimbus clouds associated with powerful thunderstorms. Fair weather cumulus clouds are fueled by buoyant bubbles of air known as thermals that rise up from the earth's surface. As the air rises, the water vapor cools and condenses forming water droplets. Young fair weather cumulus clouds have sharply defined edges and bases while the edges of older clouds appear more ragged, an artifact of erosion. Evaporation along the cloud edges cools the surrounding air, making it heavier and producing sinking motion outside the cloud. This downward motion inhibits further convection and growth of additional thermals from down below, which is why fair weather cumulus typically have expanses of clear sky between them. Without a continued supply of rising air, the cloud begins to erode and disappears eventually.

(2) ***Cumulonimbus clouds*** are much larger and more vertically developed than fair weather cumulus. They can exist as individual towers or form a line of towers called a squall line. Fueled by vigorous convective updrafts, the tops of cumulonimbus clouds can reach 39,000 feet or higher. Lower levels of cumulonimbus clouds consist mainly of water droplets, while at higher elevations, where temperatures are well below freezing, ice crystals dominate the composition. Under favorable conditions, harmless fair weather cumulus clouds can quickly develop into large cumulonimbus clouds associated with powerful thunderstorms, known as super-cells. Super-cells are large thunderstorms with deep rotating updrafts and can have a lifetime of several hours. Super-cells produce frequent lightning, large hail, damaging winds and tornadoes. These storms tend to develop during the afternoon and evening when the effects of heating from the sun are strongest.

Vertical Development Cloud Formations

Fair Weather Cumulus: ***resemble floating cotton balls with a short lifespan***

Cumulonimbus: ***generally in the shape of anvils. Produce the majority of thunderstorms.***

n. (Slide 56) Thunderhead. Impending thunderstorms.

Cumulonimbus Clouds: Thunderhead

o. (Slide 57) Less Common Clouds:

(1) ***Orographic or lenticular*** clouds develop in response to the forced lifting of air by the earth's topography. Air passing over a mountain oscillates up and down as it moves downstream. Initially, stable air encounters a mountain and is lifted upward and cools. If the air cools to its saturation point during this process, the water vapor condenses and becomes visible as a cloud. Upon reaching the mountain top, the air is heavier than the environment and will sink down the other side, warming as it descends. Once the air returns to its original height, it has the same buoyancy as the surrounding air. However, the air does not stop immediately because it still has momentum carrying it downward. With continued descent, the air becomes warmer and ascends back to its original height. Lenticular clouds are cloud caps that often form above pinnacles or peaks and usually indicate higher winds aloft. Cloud caps with a flying saucer shape, indicate extremely high winds (over 40 knots). Lenticular clouds should always be watched for changes; if they grow and descend, bad weather can be expected.

(2) ***Contrails*** are clouds that are made by water vapor being inserted into the upper atmosphere by the exhaust of jet engines. Contrails evaporate rapidly in fair weather. If it takes longer than two hours for contrails to evaporate, then there is impending bad weather.

Less Common Cloud Formations

Orographic or Lenticular Clouds: ***Look similar to contact lenses. Indicate poor weather in the near future.***

Contrails: ***Exhaust from jets creates clouds in the upper atmosphere; evaporate quickly in fair weather; contrails that takes longer than 2 hours to evaporate indicate impending bad weather***

p. (Slide 58) Lenticular Clouds: High winds aloft; can indicate approaching storm if they lower and grow over time.

Lenticular Clouds

q. (Slide 59) High winds aloft

Lenticular Clouds

Learning Step/Activity 3 - List the indicators of impending bad weather.

a. (Slide 60) You can make a number of general observations that can give you a sense of what the weather will do. By combining your knowledge of winds, clouds and noting temperature changes, and changes in air or barometric pressure you can determine the probability that weather will effect your operation. Inclement weather is not an excuse to stop training or halt operations, but by making predictions about the weather, you can take the necessary steps to mitigate the effects of the weather on your mission.

b. The following are often indicators that the weather is deteriorating:

(1) Lenticular clouds, plumes of blowing snow off ridges and peaks indicate high winds and an approaching, often fast moving storm system.
(2) Mares Tales (Cirrus Clouds) or a halo around the sun/moon indicate that a storm system is approaching and is about 24-36 hours away.
(3) Lowering, thickening cloud layers.
(4) Thunderheads (cumulonimbus clouds)
(5) Falling barometer.
(6) You may notice the temperature fall as a winter storm comes to a close. Colder temperatures often precede clear weather. Conversely, a general warming trend often precedes a storm system.
(7) Sudden changes in wind direction or intensity may also be indicative of an approaching storm.
(8) Contrails that do not dissipate within 2 hours

Weather Prediction

Some of the indicators that weather conditions will change/deteriorate significantly in the near future are:

- ***lenticular cloud formation***
- ***cirrus clouds or halo around sun or moon (24-36 hours)***
- ***thunderheads (cumulonimbus)***
- ***thickening, lowering clouds***
- ***falling barometer - decreasing barometric pressure***
- ***general warming temperatures***
- ***marked wind increases or direction shifts***
- ***contrails that do not dissipate after 2 hours***

Learning Step/Activity 4 – Use an altimeter to predict weather.
(Slide 61)

Use altimeter to predict weather

- ***The altimeter is a barometer that uses the atmospheric pressure to determine the altitude. You can use it when you are in a stationary position to help predict weather (e.g. in a patrol base overnight).***
- ***Readings are typically shown in feet, meters or both.***
- ***Digital and analog altimeters are available.***
- ***Sea level air pressure is 29.92 inches of mercury (1013 millibars). A change of 1,000 feet corresponds to about 1 inch of mercury or 10 millibars of pressure on a barometer.***
- ***In a stationary position, changes will usually not exceed 500 feet.***
- ***If you have not moved in a number of hours, but the altitude reading goes up, the pressure is falling. This indicates that a low pressure system is approaching.***
- ***The opposite is also true. If your altitude reading goes down, a high pressure system is moving in. Stable weather can be expected. Rapidly approaching high pressure systems are often associated with high winds.***

Learning Step/Activity 5 - Describe mountain weather hazards.

a. Winds (Slides 63 & 64). In high mountains, the ridges and passes are seldom calm; however, strong winds in protected valleys are rare. Normally, wind speed increases with altitude since the earth's frictional drag is strongest near the ground. This effect is intensified by mountainous terrain. Winds are accelerated when they converge through mountain passes and canyons. Because of these funneling effects, the wind may blast with great force on an exposed mountainside or summit. Usually, the local wind direction is controlled by topography.

(1) The force exerted by wind quadruples each time the wind speed doubles; that is wind blowing at 40 knots pushes four times harder than a wind blowing at 20 knots. With increasing wind strength, gusts become more important and may be 50 percent higher than the average wind speed.

Winds

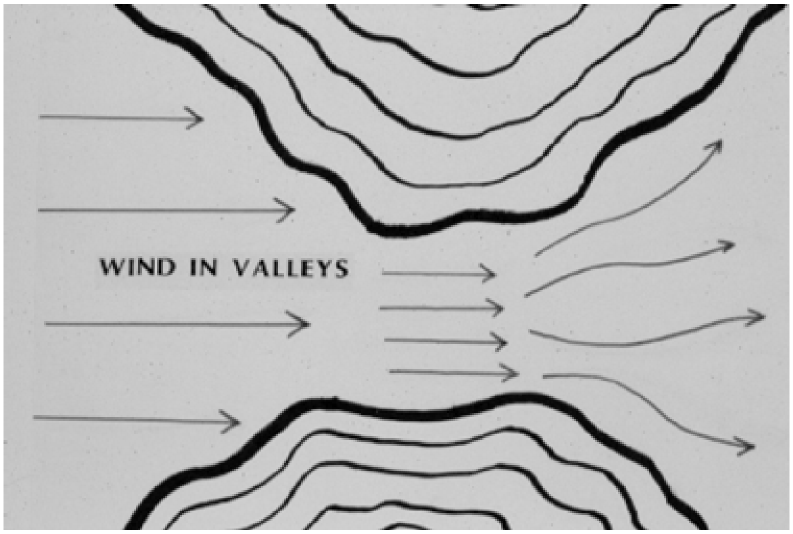
Velocity increases with altitude and is further enhanced by rapid rise over mountain barrier (orographic lifting)

Velocity increases as wind funnels through narrowing valleys and passes (venturi effect)

As the wind speed doubles, its force on an object quadruples

Wind chill is another hazard created by winds

Wind velocity increases as it moves through a narrow pass or col.



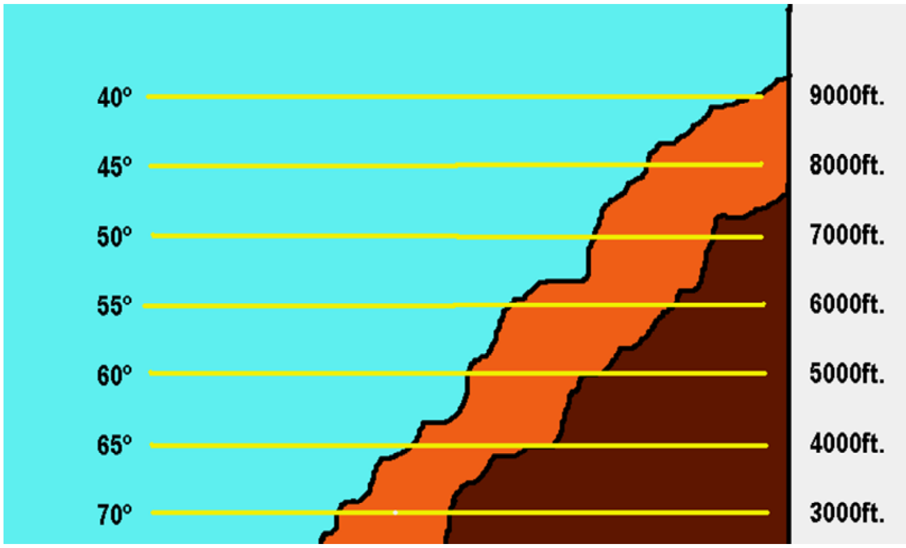
b. Temperature. (Slide 65 & 66) The ***adiabatic lapse rate*** is the rate at which air cools as it rises or warms as it descends. This rate varies depending on the moisture content of the air. Saturated air will warm and cool approximately 3.2º F per 1,000 feet of elevation gained or lost. Dry air will warm and cool approximately 5.5º F per 1,000 feet of elevation gained or lost. For planning purposes use 4° F per 1,000 feet of elevation gained or lost.

Temperature

Temperature:

- ***Typically, temperature decreases 3-5º degrees (F) for every 1000 ft. gain in elevation***
- ***Temperature inversion- during clear, calm weather, valley temperatures may be significantly cooler than those higher upslope***
- ***Temperature inversions are common in the daytime during winter***

Temperature Change as Altitude Increases



c. (Slide 67) You can manage cold temperatures with appropriate training, clothing and equipment. But when strong winds are added to the equation, wind chill temperatures can easily freeze your flesh within minutes or seconds. ***Wind chill*** is the combined cooling effect of ambient temperature and wind on your exposed skin. You can figure out current and projected wind chill temperatures using this chart. This can be used as a tool to plan the clothing and precautions required to prevent cold injuries. You simply cross reference the ambient air temperature with the current wind speed to find the equivalent wind chill temperature.

For example if the temperature is 20º F and the wind speed is 35 mph, the equivalent wind chill temperature is 0º F.

Wind Chill

AIR TEMPERATURE IN FAHRENHEIT

WIND SPEED	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

WIND SPEED BASED ON MEASURES AT 33 FEET HEIGHT. IF WIND SPEED MEASURED AT GROUND LEVEL, MULTIPLY BY 1.5 TO OBTAIN WIND SPEED AT 33 FEET IN HEIGHT AND THEN UTILIZE CHART.

d. You are on the valley floor at 2,000 feet. You are moving to the top of Gunnysack Mountain at approximately 6,000 feet. The current ambient temperature is 24° F with at wind speed of 25 mph at 33 feet height. What is the equivalent wind chill temperature at you elevation?______
What is the ambient air temperature on top of Gunnysack Mountain?_______
What is the wind chill temperature on top of Gunnysack Mountain (assume wind speed is the same on top)?________

e. (Slide 68) Visibility

(1) A ***whiteout*** is caused by sunlight being diffused through an unbroken cloud layer onto an unbroken snow surface. What this means for you is that you have no depth perception and any movement becomes extremely dangerous. The horizon effectively disappears and you cannot distinguish irregularities in terrain. Whiteout is often referred to as ‘flat light’.

(2) A ***blizzard*** is a severe weather condition characterized by low temperatures, winds 35 mph or greater, and sufficient falling and/or blowing snow in the air to frequently reduce visibility to 1/4 mile or less for a duration of at least 3 hours. A severe blizzard is characterized by temperatures near or below 10°F, winds exceeding 45 mph, and visibility reduced by snow to near zero.

f. (Slide 69) ***Lightning*** is frequent in the mountains and is normally attracted to high points, metal objects, and dominant features such as lone trees, buildings, and ridges. Lightning is a major hazard in the mountains and you should always treat it with respect. Lightning can occur miles from an approaching or retreating thunderstorm. Lightning is the main hazard during a thunderstorm and accounts for many hundreds of deaths each year, with the most immediate danger due to cardiopulmonary arrest. The danger from lightning is greater on rock than on snow or ice.

Lightning strikes can be categorized by the type of contact or effective contact with either humans or objects:

1. direct strikes- direct contact
2. splash strikes- jumps from a struck object to another
3. contact injury- touching an object that received a direct strike
4. step voltage- current transmitted on the surface, (rock, ground)
5. blunt trauma- shock wave from nearby strike

Lightning

- ***Continental ranges invite thunderstorm conditions more than maritime ranges***
- ***Topography of mountains contributes to the formation of thunderstorms***
- ***Ridges and peaks are focal points for lightning***
- ***Valley breeze in AM; mountain breeze in PM***

g. (Slide 70) Severe static electricity is a precursor to lightning. If your hair stands ups, or you feel as though your scalp is being tickled, or if you notice that metal objects have a blue appearance (St. Elmo's Fire), you can expect to see lightning in short order and you must find cover or move immediately.

Precautions in a Lightning Storm

You should:

- ***avoid high risk areas for bivouacs such as peaks and high passes***
- ***take note of building cumulonimbus clouds and plan to be in a low risk area as the day progresses***
- ***seek lower ground if you are caught by a fast moving storm***
- ***avoid wet lichen covered rock, drainages, standing under tall trees, crouching in shallow caves or under overhangs and being connected to climbing ropes***
- ***insulate yourself from the ground; squat or sit on a sleeping pad or a bunched up climbing rope for example***
- ***be spaced at least 15 feet apart from other individuals***

SECTION IV. SUMMARY

You now have a general understanding of some of the weather hazards and phenomena that affect military operations in the mountains. The weather can quickly compound difficulties of mountain operations; by watching the weather and predicting changes in the weather you can mitigate risks presented by the weather.

Check on Learning.

1. You have been in a patrol base for the past 18 hours. You checked your position and set your altimeter to 6500 feet when you arrived. Now your altimeter is reading 6650 feet, but you have not moved. What happened?

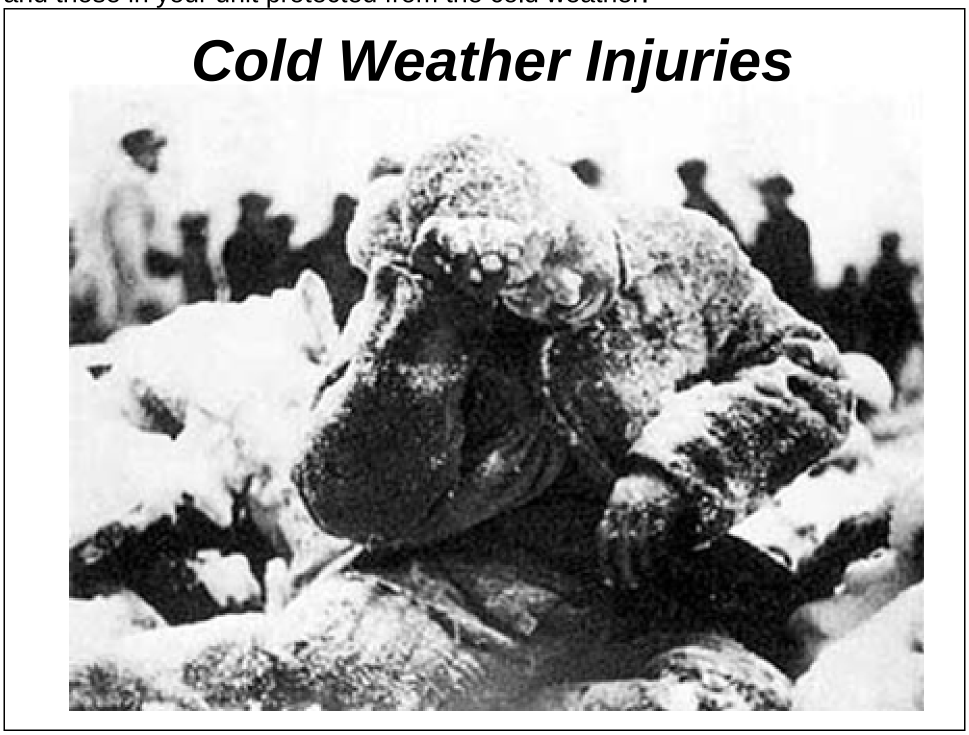
The pressure is dropping, causing your altimeter to rise even though you have not moved. You should expect the weather to deteriorate in the very near future.

2. Your unit began a movement on a snow covered ridgeline on an overcast day. After a short time, the light goes flat and your point man has lost all sense of direction. What is going on and what should you do?

Your point man is not lost, he is in a whiteout. If you can afford to, you should halt the unit and wait until conditions improve. If you cannot wait, movement must be slow and methodical.

SECTION II. INTRODUCTION

Motivator (Slide 1) You must learn to survive in the cold weather environment before you can learn to fight in it. Military history has proven this again and again. This Russian Soldier froze to death during the Russo-Finnish war. The Russians invaded Finland with 26 motorized divisions that were unprepared for cold weather operations. The cold weather and an undermanned but well prepared Finnish Army took their toll. Through sheer numbers the Russians later prevailed, but they suffered an estimated one million dead; one Russian Commander remarked "We have gained just enough ground to bury our dead". You must understand the effect that cold weather has on your body and make preparations to keep yourself and those in your unit protected from the cold weather.



Terminal Learning Objective (Slide 2)

ACTION	Protect yourself and your fellow Soldiers from cold weather injuries
CONDITION	You are a Soldier deployed to the field in conditions that range from 50° to -60° F. You are given the Extended Cold Weather Clothing System (ECWCS), other issued cold weather clothing items, the issued cold weather sleep system with insulating pad, access to a warming shelter and the requirement to protect yourself and your fellow Soldiers against cold injuries.
STANDARD	Apply preventive medicine countermeasures to prevent cold weather injuries. Perform first aid for cold weather injuries. Do not sustain a cold weather injury during the course.

Safety Requirements: For classroom training discuss emergency procedures in case of fire or natural disaster.

Risk Assessment: Low

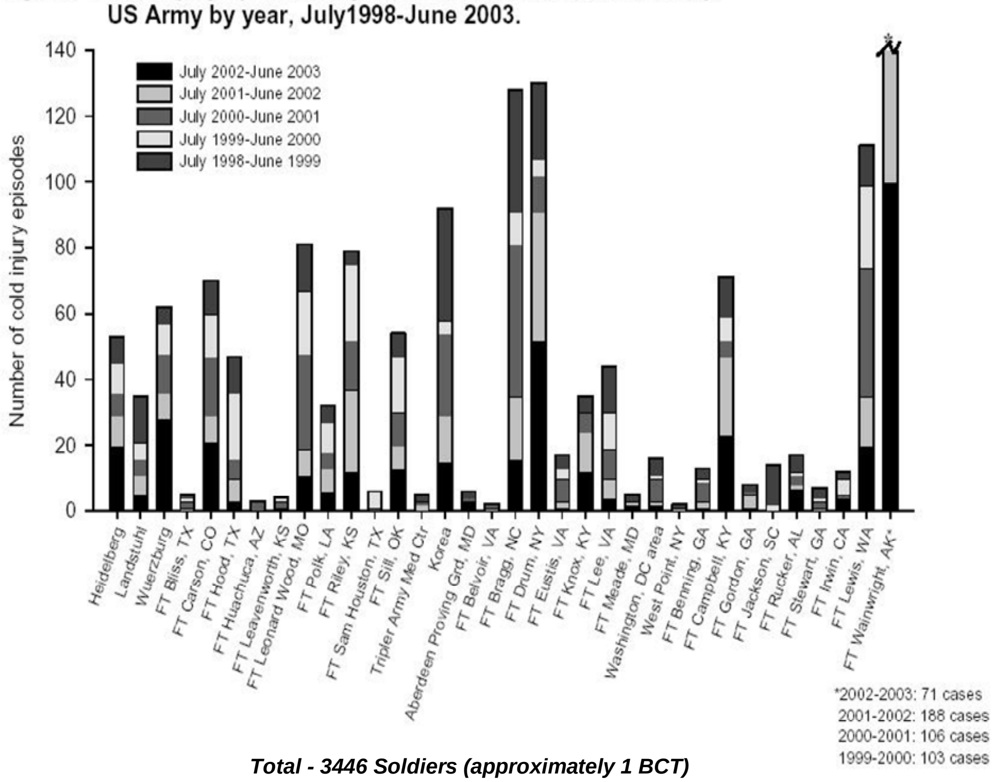
Environmental Considerations: None

Evaluation: You will be tested on your knowledge of cold weather injuries during a quiz (see training schedule for date and time. You need to score a 70% on this quiz in order to receive a GO. There are also questions related to this lesson on the final written examination (CWLC only; see training schedule for date/time of exam). You must score a 70% on the written exam in order to receive a GO. If you fail the written exam, you will be given a second exam after re-training has been conducted. If you fail this second examination, you will be dismissed from the course. In addition, you are expected to practice countermeasures that will prevent you from sustaining a cold weather injury. If you sustain a cold weather injury you will be dismissed from the course (at the discretion of the Commander).

Instructional Lead-In (Slide 3) One of the biggest threats to Soldiers and their family members in Alaska is cold weather injuries. You must understand how to care for yourself in one of the harshest environments in the world. You are also responsible for preventing these injuries in your Soldiers. This block of instruction provides you with TTPs to prevent cold weather injuries. It also provides you with the first aid procedures for cold weather injuries.

Cold Weather Injuries

Figure 2. Cold injury episodes, by installation/location, active duty, US Army by year, July1998-June 2003.



Total - 3446 Soldiers (approximately 1 BCT)

SECTION III. PRESENTATION

Learning Step/Activity 1 – (Slide 4-5) Identify the environmental risk factors that make you susceptible to cold weather injuries.

a. Obtain a current weather forecast.
b. Determine current temperature and wind speed.
c. Determine the equivalent wind chill temperature using the wind chill chart. Wind chill is the combined cooling effect of wind and ambient temperature on your skin (convective heat loss). Given the current ambient temperature of _____ and the current wind speed of ____, what is the wind chill temperature?_____

Wind Chill Chart

AIR TEMPERATURE IN FAHRENHEIT

WIND SPEED	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

WCT (°F) = 35.74 + 0.6215T - 35.75(V0.16) + 0.4275T(V0.16)
Where T is temperature (°F) and V is wind speed (mph)

WIND SPEED BASED ON MEASURES AT 33 FEET HEIGHT. IF WIND SPEED MEASURED AT GROUND LEVEL, MULTIPLY BY 1.5 TO OBTAIN WIND SPEED AT 33 FEET IN HEIGHT AND THEN UTILIZE CHART.

Learning Step/Activity 2 - (Slide 6) Identify the mission risk factors that make you susceptible to cold weather injuries.

a. Determine the work intensity. What type of training or mission will you be conducting (Ambush vs. foot march vs. firing range)? Will you be stationary, moving or a combination of both?

b. Determine the duration of cold exposure. How long will you be exposed?

c. Determine the availability of heated shelters, cold weather clothing and equipment, food and water. Will heated shelters be available during the mission? Do you have to set-up your own shelter? Do you know how? Do you have the proper resources to heat the shelter – stove, fuel? Will shelter be available when you arrive at your destination or will you need to wait for support? How will you get water? Do you need to melt snow, or is water resupply a possibility? What type of rations are available (MCWs or MREs)? Do you and your Soldiers have adequate, serviceable clothing and equipment (sleeping bags with insulating pad)?

Mission Risk Factors

- How intense is the workload for this mission/training?
- How long will you and your Soldiers be exposed?
- What is the availability of heated shelters, cold weather clothing and equipment, food and water?

Learning Step/Activity 3 - (Slide 7) Identify individual risk factors that make you more susceptible to cold weather injuries.

Individual risk factors

- How does your body regulate heat (heat gain vs. heat loss)?
- How does your body respond to the cold weather environment?
- What types of cold weather injuries can you sustain and how do you treat them?
- What other individual factors make you more or less susceptible to cold weather injuries?

a. (Slide 8) Describe how your body regulates heat (thermoregulation). Your body maintains a relatively constant core temperature by balancing heat gain from the environment and metabolism with heat loss. When the two are equal, you lose very little heat and you are able to maintain a body core temperature that averages 98.6° F.

(1) **Heat gain.** Your basal metabolism produces heat as you consume energy to maintain basic life functions. At rest this is known as the basal metabolic rate (BMR). You also generate heat through normal daily activities. You can generate up to 18 times the normal BMR through vigorous exercise; this is known as exercise metabolism. Finally you can gain (a very little bit) heat through external heat sources such as the sun, fires, stoves, etc.

(2) **Heat loss: Radiation** is the normal loss of body heat to the surrounding air. This is direct energy emission usually in the form of infrared radiation. Clothing manufacturers have tried to create clothing that re-captures this lost heat without much success (eg. Space Blanket). There is very little you can do to prevent this form of heat loss. Even with the best cold weather clothing, radiated heat will be transferred to the clothing and then out to the surrounding atmosphere. This form of heat loss generally does not become an issue until temperatures reach -20º F.

(3) **Conduction** and **convection** both involve the transfer of heat energy between two objects of different temperatures that are in contact with one another. These forms of heat loss are the most dangerous to you. Fortunately, you can use cold weather clothing and equipment to reduce the effects of heat loss from conduction and convection. Conduction occurs as heat is transferred from a warm object to a cold object. When you lay down on cold, bare ground, you lose heat to the ground. Convective heat loss occurs as a surrounding colder medium (air or water) is heated by your skin. This type of heat loss is generally negligible in temperate climates. ***In cold weather climates convective heat loss is the major contributor to heat loss.*** Wind increases the effects of convective cooling by maintaining the temperature difference between the body and the air. The stronger the winds, the faster heat is stripped away from the body; the amount of heat extracted by moving air increases as the square of the velocity. This effect is known as wind chill.

(4) **Respiration** is the loss of body heat (and water loss) as you breathe.

(5) **Evaporative** heat loss occurs as you sweat and the sweat converts from a liquid to a gas.

If the body is exposed to the cold, and heat loss occurs, the balance is disrupted. So how does your body cope with this heat loss/cold exposure?

b. (Slide 9) Describe how your body responds to the cold weather environment.

(1) SHELL/CORE EFFECT: As you begin to experience heat loss, your body will pull blood from the extremities (shell) and into the core of the body (torso) in order to ensure that critical systems (heart, lungs, kidneys, liver etc.), stay at the proper temperature. You gain very little from the shell/core effect; you would get the same benefit from putting on a light business suit. The negative side of the shell/core effect is that your fingers, toes, facial features and other extremities begin to feel and are colder.

(2) COLD DIURESIS: Due to the shell-core effect, the kidneys sense an increase in blood volume and some of this fluid volume is converted to urine. The increase in blood volume in the core also disrupts your thirst mechanism. You will urinate more frequently, and you are less likely to drink liquids making you more susceptible to dehydration and cold weather injuries.

(3) SHIVERING THERMOGENESIS: If the shell core effect does not counteract the cold stress and/or you do not take voluntary steps to reduce the cold stress, you will begin to shiver. Heat production (thermo genesis) from shivering can be up to six times your resting metabolic rate. Your coordination can be significantly impacted by shivering that cannot be controlled.

c. (Slide 10) Identify individual factors that can make you more/less susceptible to cold weather injuries. Consider:

(1) During most deployments, fatigue, under-nutrition and dehydration are ever present problems for you. Fatigue, low blood sugar and dehydration all decrease the ability of your body to deal with cold stress. You may be at further risk from a number of factors which may or may not be within your control.

(2) **Body composition.** Some individuals seem to be able to maintain body core temperatures better than others. This is due to individual variability in body composition. Convective heat loss at the skin is the main way the body loses heat in the cold weather environment. Individuals that are short and stocky have a reduced skin surface area and are less prone to heat loss than taller, leaner individuals. Body fat is also a better insulator than other body tissues; those with higher body fat composition typically lose less heat to the environment.

(3) **Age** has been shown to play a role in the susceptibility of Soldiers to cold weather injury. Soldiers older than 35 years of age may suffer the effects of cold more readily than younger Soldiers. Recent data has shown that cold injury rates are higher in young male Soldiers, from warm climates, with less than eighteen months of service. This is probably due to the fact that these individuals are typically exposed to cold, adverse conditions for longer periods of time.

(4) **Gender and Race.** Women sustain twice the number of peripheral cold injuries than men. African American male and female Soldiers sustain two to four times the number of cold weather injuries than their Caucasian counterparts. These gender and race differences are due to variability in body composition.

(5) **Fitness** level does not directly affect the Soldier's ability to handle the cold. However, Soldiers with a high fitness level will be able to sustain work for longer periods of time before fatigue sets in. These Soldiers also recover faster and are often less susceptible to injury or illness.

(6) **Experience.** The morale of Soldiers thrust into a cold weather environment can quickly decline. Basic survival often becomes the only focus. Soldiers may withdraw and mission requirements can take a backseat to individual needs. Conversely, meeting mission requirements can quickly override basic Soldier needs. **While it is often possible to tough it out in temperate climates, in the cold weather environment this mentality will lead to cold injuries and combat ineffective Soldiers.** Experiential based training for Soldiers reduces the physiological and psychological difficulties associated with the cold weather. Practical experience in the cold weather environment is invaluable to ensuring the success of a unit conducting operations in cold regions.

(7) **Level of training.** IAW USARAK Regulation 350-1, ALIT is the minimum cold weather training requirement for all Soldiers in USARAK. CWLC graduates are the trainers for ALIT and serve as unit subject matter experts. CWOC provides senior leaders and staff with 'what right looks like' for ALIT.

(8) **Drugs and alcohol.** Tobacco and/or alcohol use can be a contributing factor to cold weather injuries. Tobacco is a vasoconstrictor and therefore can increase the likelihood of cold injuries to extremities. Alcohol can create an artificial feeling of warmth, mask the symptoms of cold weather injuries and suppress normal body reactions to the cold. Some prescription drugs may contain substances that will increase the likelihood of cold injuries.

(9) **Diseases or injuries** that interfere with circulation (e.g. Raynaud's Syndrome, diabetes, poor circulation) can increase the likelihood of cold weather injury.

(10) **Prior cold weather injuries.** Soldiers that have sustained cold weather injuries in the past are at increased risk for similar injuries in the future. Unit SOP should dictate a marking system to ensure that these individuals can be easily identified for monitoring.

When your body cannot keep up with the demand for heat, you will sustain a cold weather injury…

Learning Step/Activity 4 - (Slide 11) Identify and treat cold weather injuries.

a. (Slide 12) Identify **Chilblain**.

(1) Chilblain (also known as pernio or kibe) is a non-freezing cold injury typically occurring after 1-5 hours in cold-wet conditions, at temperatures below 50º F.
(2) Small lesions appear on the skin usually on the tops of the fingers. Ears, face, and exposed shins may also be involved. The lesions are swollen, tender, itchy and painful.
(3) Upon re-warming, the skin becomes inflamed, red and hot to the touch and swollen with an itching or burning sensation that may continue for several hours after exposure.
(4) Eventually all symptoms subside. There are no lasting effects from chilblain.

Chilblain

- Non-freezing cold weather injury
- Occurs n cold-wet conditions below 50° F
- Small, red, itchy or painful lesions appear on the skin
- No long lasting effects

b. (Slide 13) Perform first aid for chilblain.

(1) Re-warm the affected part using skin to skin contact.
(2) Do not rub or massage affected areas.
(3) Do not place the affected part close to a heat source.
(4) Contact medical personnel for further evaluation.

c. (Slide 14) Identify **Frostbite.**

NOTE: All cases of frostbite must be evacuated to a medical facility for treatment.

(1) Frostbite occurs when you freeze your body tissue. The ambient air temperature must be below 32º F for this injury to occur. ***If the ambient temperature is above 32º F, but is below 32º F with wind chill, frostbite cannot occur.***

(2) Frostbite generally occurs in exposed skin or extremities such as the nose, ears, cheeks, hands and feet.

(3) Contact frostbite can occur when bare skin is cooled quickly from contact with an extremely cold object. Frostbite can also occur instantaneously when skin comes in contact with super-cooled liquids that do not freeze at 32º F, such as gasoline, petroleum products, antifreeze etc.

(4) There are four degrees of frostbite and each is defined by the level of tissue involvement. A diagnosis by medical doctor is required to determine the degree of frostbite. **For field identification and treatment, frostbite can be classified as superficial or deep.**

Frostbite

- Frozen body tissue; usually the extremities – hands, face, ears, feet and (rarely) eyes.
- Ambient air temperature must be below 32° F for frostbite to occur.
- Gradual onset progressing from painful, tingling sensation to cold and numb OR
- Contact frostbite from super-cooled objects or liquids such as fuel.
- Identify frostbite as superficial or deep.

d. (Slides 15-18) Identify **Superficial frostbite.**

Superficial Frostbite

Involves the upper layer(s) of skin only

Skin is:

- white, waxy and pale in lighter skin types
- red, pale or darkened in darker skin types
- numb
- moves over underlying layers
- relatively soft and pliable

Superficial Frostbite

e. (Slide 19) Perform first aid for superficial frostbite.

(1) Re-warm the affected part using skin to skin contact. Use a warm hand, armpits, a warm belly etc.

- Face, ears and nose. Cover the casualty’s affected area with his/her and/or your bare hands until the sensation and color return.
- Hands. Place the affected part under the armpit’s or on the belly. Cover with clothing.
- Feet. Remove the casualty’s boots and socks and place the affected parts under clothing and against the body of another Soldier.

(2) If possible, submerge the affected part in water heated to 104-108° F. You must maintain this temperature range while soaking; if you choose this method be sure you can monitor the temperature and replace with warm water as necessary.

(3) Take ibuprofen immediately – this drug will help reduce the damage as the frostbite re-warms.

(4) DO NOT ALLOW THE INJURY TO RE-FREEZE. In almost all cases, re-freezing the injury will lead to deep frostbite.

(5) DO NOT rub or massage the affected area.

(6) DO NOT place the affected part close to a heat source.

(7) DO NOT allow tobacco or alcohol use.

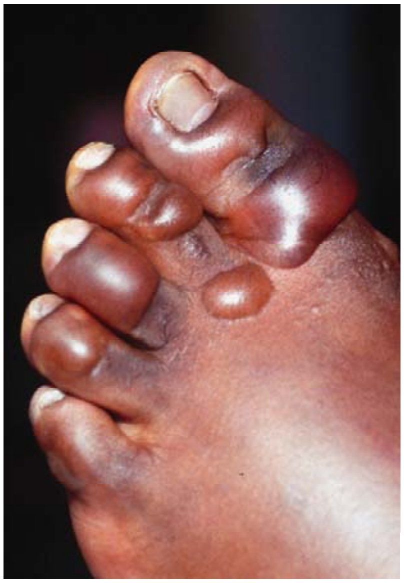
(8) Aloe can help with the healing process.

(9) Contact medical personnel for further evaluation/evacuation.

f. (Slides 20-24) Identify **Deep frostbite.**

Deep Frostbite

- Can be down to and include the bone
- Blisters (blebs) often form after re-warming
- Skin is:
  - similar in coloration to superficial frostbite
  - not pliable – dents when you push on it
  - patient describes ‘wooden’ feeling
  - pale white and frozen solid in extreme cases



g.(Slide 25) Perform first aid for deep frostbite.

(1) Treatment steps are the same.
(2) Protect blebs with dry, sterile dressings.
(3) Cover ruptured blebs with antibiotic ointment and a sterile dressing.
(4) Contact medical personnel for further evaluation/evacuation.

WARNING: DO NOT attempt to thaw the casualty's feet or other seriously frozen areas if the Soldier will be required to walk or travel to a medical care center to receive medical treatment. The possibility of injury from walking is less when the feet are frozen than after they have been thawed (if possible, evacuate by litter and/or avoid walking). Thawing in the field increases the possibility of infection, gangrene or injury.

h.(Slides 26-30) Identify **Immersion syndrome**.

Immersion Syndrome

- **non-freezing cold weather injury that usually involves the feet**
- **also known as immersion foot or trench foot**
- **requires prolonged exposure to cold-wet conditions - at least 12 hours but usually 4-5 days**
- **blood flow is reduced to the extremity by the cold**
- **foot is cold to touch, with some swelling, and is white or bluish; may be numb**
- **Upon re-warming there is swelling; the foot will be red and blisters may form accompanied by tingling pain that is often severe**
- **Symptoms can last for weeks to months and include tingling, creeping pain, increased sensitivity to cold and increased perspiration of the foot**

i. (Slide 31) Perform first aid for immersion syndrome.

(1) Re-warm the injured body part gradually by exposing to warm air.
(2) If possible, submerge the affected part in water heated to 104-108° F. You must maintain this temperature range while soaking; if you choose this method be sure you can monitor the temperature and replace with warm water as necessary.
(3) Clean and dry the foot carefully to prevent infection.
(4) Administer ibuprofen.
(5) DO NOT rub or massage the affected area.
(6) DO NOT place the affected part close to a heat source.
(7) DO NOT allow tobacco or alcohol use.
(8) DO NOT allow the individual to walk on the injury; evacuate by litter.
(9) Contact medical personnel for further evaluation.

j. (Slides 32-33) Identify **Hypothermia.**

(1) Hypothermia occurs when your core body temperature falls below 95º F.

(2) Hypothermia is characterized as mild, moderate or severe, based upon core body temperature.

(3) Mild hypothermia occurs when the core body temperature is between 90 and 95º F.

(4) Moderate hypothermia occurs at core body temperatures of 80-89º F.

(5) Severe hypothermia exists when the core body temperature falls below 80º F.

(6) Rectal temperature measurement is the only way to determine an accurate core body temperature. As it is unlikely that this method will be used in the field, obvious signs and symptoms can be used to make a diagnosis.

(7) ***All levels of hypothermia are potentially life threatening medical emergencies and require immediate care in a medical facility.***

(8) Warning signs. As core body temperature begins to fall, shivering will be the most noticeable symptom. Shivering alone does not indicate hypothermia, but it does indicate that the body is having a problem with the cold.

Hypothermia

- Body core temperature falls below 95° F from exposure to cold conditions
- Onset is more likely if you are dehydrated, are not eating properly and/or are over fatigued
- Cold-wet conditions are most likely to bring on hypothermia
- Cold water immersion can induce hypothermia
- Varying degrees of hypothermia:
  - Mild hypothermia
  - Moderate hypothermia
  - Severe hypothermia
- ***Hypothermia is a medical emergency!***

(9) **Mild hypothermia** symptoms:

(a) Shivering
(b) Lack of sound judgment; confusion, apathy and “mild stupidity”
(c) Pale, cool skin
(d) increased heart rate and respiratory rate
(e) “umbles” – stumbles, fumbles, grumbles, mumbles. Gross motor skills function (stumble just walking) as well as fine motor skills (fumble with tasks that require manual dexterity such as manipulating a rifle). Personality changes that include grumbling and incoherent mumbling.

(10) **Moderate hypothermia** symptoms:

(a) Uncontrollable shivering
(b) Worsening of the “umbles”
(c) Increased confusion
(d) Increased heart and respiratory rates
(e) Cold and pale skin

(11) **Severe hypothermia** symptoms:

(a) Cessation of shivering
(b) Muscle rigidity
(c) Stupor progressing to unconsciousness
(d) Slow and/or non-palpable pulse and respirations
(e) Cold, bluish skin

NOTE: All cases of hypothermia must be evacuated to a medical facility for treatment.

k. (Slide 34) Perform first aid for mild and moderate hypothermia.

NOTE: All cases of hypothermia must be evacuated to a medical facility for treatment.

(1) Change the environment the casualty is in from cold and wet to warm and dry.
(2) Replace damp clothing with dry clothing.
(3) Add a windproof/waterproof layer and/or place the casualty in a shelter.
(4) Add extra insulation under and around the casualty.
(5) Provide the casualty with food and warm liquids.
(6) Exercise mildly hypothermic patients.
(7) Package a moderately hypothermic casualty in a hypothermia wrap.
(a) Lay a poncho on the ground.
(b) Lay an Insulating pad on top of the poncho.
(c) Lay a closed sleeping bag on top of the insulating pad.
(d) Lay an open sleeping bag on top of the first one.
(e) Place the patient inside. Add a hot water bottle to the chest area. Do not place it directly against the skin. Zip the sleeping bag closed.
(f) Place a third, open sleeping bag on top of the second.
(g) Fold the poncho around the patient like a burrito.

l. Perform first aid for severe hypothermia.

(1) Handle with care. Rough treatment can cause the casualty’s heart to stop.
(2) Contact medical personnel immediately.
(3) Use supplemental oxygen, if available or begin rescue breathing if breathing has stopped or is barely detectable. Breathe for the patient for 3-15 minutes before moving or beginning evacuation.
(4) Change the environment the casualty is in from cold and wet to warm and dry.
(5) Carefully remove damp/wet clothing.
(6) Package in a hypothermia wrap.
(7) Evacuate using the gentlest means available.
NOTE: Ask the students if they have any questions. Put them on a five minute break.

Learning Step/Activity 5 – Assess the hazards to determine the risk of sustaining a cold weather injury.

a. (Slide 36) Determine the risk level for frostbite.

Is the ambient temperature less than 32° F? If it is, use the risk of frostbite chart to determine the amount of time it will take to develop frostbite. Determine the level of danger. Given the current ambient temperature of _____ and the current wind speed of ____, how long will it take your flesh to freeze? What danger level does this indicate?

Risk Of Frostbite

AIR TEMPERATURE IN FAHRENHEIT

WIND SPEED	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	>2H	>2H	>2H	>2H	31	22	17	14	12	11	9	8
10	>2H	>2H	>2H	28	19	15	12	10	9	7	7	6
15	>2H	>2H	33	20	15	12	9	8	7	6	5	4
20	>2H	>2H	23	16	12	9	8	8	6	5	4	4
25	>2H	42	19	13	10	8	7	6	5	4	4	3
30	>2H	28	16	12	9	7	6	5	4	4	3	3
35	>2H	23	14	10	8	6	5	4	4	3	3	2
40	>2H	20	13	9	7	6	5	4	3	3	2	2
45	>2H	18	12	8	7	5	4	4	3	3	2	2
50	>2H	16	11	8	6	5	4	3	3	2	2	2

GREEN-LITTLE DANGER (frostbite occurs in >2H in dry exposed skin)

YELLOW - INCREASED DANGER (frostbite could occur in 45 minutes or less in dry, exposed skin)

RED- GREAT DANGER (frostbite could occur in 5 minutes or less in dry exposed skin)

Time to occurrence of frostbite in the most susceptible 5% of personnel.
Wet skin could significantly decrease the time for frostbite to occur

b. (Slide 37) Determine the overall risk level for cold weather injury. At this point, you should have a clear picture of the risk factors and hazards. You can use this information to determine the risk level for the training or mission.

(1) Determine the probability of a cold weather injury occurring.

(2) Determine the result or severity if a cold weather injury occurs.

(3) Using the chart below, determine the level of risk for cold weather injury for your mission or training event.

What is the risk level for cold weather injury?

Risk Assessment Matrix					
	Probability				
Severity	**Frequent A**	**Likely B**	**Occasional C**	**Seldom D**	**Unlikely E**
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**
E –Extremely High	**H – High**		**M – Moderate**	**L - Low**	

Learning Step/Activity 6 – (Slide 38) Develop controls that reduce the risk of cold weather injury.

a. Use the Temperature Zone Guidance in USARAK 385-4, Appendix A to determine special requirements and recommended actions for the current and forecast temperatures.

b. Use additional resources and develop controls that will reduce the possibility of cold weather injuries for your training event.

(1) U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) website. http://usachppm.apgea.army.mil/

(2) U.S. Army Research Institute of Environmental Medicine (USARIEM) website. http://www.usariem.army.mil/

Learning Step/Activity 7 - (Slide 39) Take steps to prevent cold weather injuries during the mission/training event.

a. Wear the cold weather uniform properly. See below for details.
b. Drink 3.5-5 quarts of water per day.
c. Eat 4,500-6000 calories per day.
d. Conduct personal hygiene in cold weather.
(1) Shave prior to the rest cycle to allow your body to replenish oils that protect your face and reduce the risk of frostbite.
(2) Do not wear skin camouflage at temperatures below 32° F – camouflage makes it difficult to detect frostbite.
(3) Wash your entire body weekly.
(4) Clean feet, crotch and armpits daily.
(5) Remove boots and air dry feet daily. Change to dry socks daily.
e. Practice field sanitation in cold weather.
(1) Designate and use designated field latrines only.
(2) Designate and use snow collection points for melting snow for water/cooking.
(3) Pack out all trash. If you generate the trash, keep it with you until it can be collected and carried to the rear for proper disposal.

Learning Step/Activity 8 - (Slide 40-41) Wear cold weather uniform properly.

a. You are issued the Extended Cold Weather Clothing System (ECWCS). With moderate movement it should keep you warm and dry down to -60° F. All cold weather clothing systems have three layers that are required for proper function.

(1) (Slide 42) Wear a Base Layer (also known as Inner or Wicking layer) – The base layer(s) are those adjacent to your body. They should be comfortably loose. The main purpose of these garments is to wick excess moisture away from your body.

(2) Wear an Insulation Layer – The insulation layer(s) are the intermediate layer(s). They provide volume to enable you to trap warm air between your body and the outer garments. In addition, the insulation layer(s) help wick away excess moisture. These layers should be comfortably loose to trap a sufficient volume of air.

(3) Wear an Outer Shell Layer – The outer shell layer(s) are the external layers that protect you from the elements in your environment. A main function is to keep you dry. In addition, they provide additional volume for trapping warm air. These layers should also be comfortably loose.

b. (Slides 43-47) Follow clothing guidelines for wearing cold weather clothing and equipment.

You can use the acronym C.O.L.D. to ensure the proper wear of cold weather clothing and equipment. Keep it CLEAN. Avoid OVERHEATING, wear clothing LOOSE and in LAYERS and keep clothing DRY.

(1) Keep it CLEAN. Clothing keeps you warm by trapping warm air against your body and in the pores of the clothing itself. If these pores become filled with dirt, sweat or other grime, the clothing will not be able to do its job efficiently. Therefore, your clothes should be kept as clean as possible to keep you as warm as possible. Dry rub and air clothing when washing is not possible (demonstrate rubbing).

(2) Avoid OVERHEATING. The key is not to be hot, but comfortably cool; not cold, but cool. If at any time you are sweating, you are too hot. Sweating is a sign that your body wants and needs to cool down. Let the environment cool you down, not sweat. This may be as simple as opening buttons or unzipping zippers, instead of removing a whole layer of clothing. Once you stop work, or feel yourself getting cold, bundle up again just enough to keep cool.

(3) Wear clothing LOOSE and in LAYERS. Clothes should fit loosely for comfort. The more layers used, the more warm air will be trapped. Tight clothing will prevent air from becoming trapped between your body and clothes. It is the warm air that keeps you warm, not the clothes. Several thin layers working together will work better than one thick layer alone.

(4) Keep clothing dry. Once your clothing is wet, the water or sweat evaporates, drawing warmth away from your body. Moisture will enter clothing from two directions:

(a) Inside- perspiration and condensation/frost at cold temperatures from the moist heat put off from the body.

(b) Outside- Precipitation- rain, snow, ice, frost. Moisture reduces insulating properties of clothing. Brush snow and ice off clothing before entering heated shelters. Clothing can be dried by air outside or inside heated shelters away from heat source. Leather items should be dried slowly. Turn GORE-TEX® clothing inside- out to facilitate drying in a heated shelter.

c. (Slide 48) Wear the Generation II ECWCS.

NOTE: CIF and/or your unit may issue other/additional items based upon your clothing menu and mission.

NOTE: The instructor will talk a demonstrator through the different layers of clothing and proper wear of each layer. The demonstrator will start with the base layer and add items as indicated by the instructor.

(1) (Slide 49) Wear the Base Layer-

(a) Polypropylene undershirt and drawers with standard wool socks (commonly referred to as polypro)
(b) You may be issued a lightweight and/or mid-weight polypropylene undershirt and drawers
(c) Wear the polypro next to your skin. DO NOT wear cotton undergarments under polypro. DO NOT wear ACUs on top of the base layer in the field. Cotton absorbs and traps moisture. Wear a pair of nylon shorts as an alternative to cotton underwear. Women should wear a nylon sports bra.
(d) The issued polypro has a zipper that can be used to form a mock turtle neck or allow you to ventilate as workload increases.
(e) You can layer the lightweight and mid-weight and heavyweight versions of polypro. This allows you more flexibility to remove garments as workload increases.
(f) You can wear a single wool sock or a two sock system. Wear the nylon dress sock or a polypro liner sock under the wool sock for more effective wicking.
(g) Wear an Arctic necklace: A 550 cord necklace with a lighter and chap stick can be worn next to the body. This allows you to keep the lighter warm and at your disposal when required.

GEN II ECWCS: Base Layer

Polypro undershirt and drawers:

- **Wear next to skin**
- **DO NOT wear cotton undergarments under polypro**
- **Standard issue is shown; lightweight and mid-weight are available and may be issued**
- **Worn with single wool sock or two sock system**

(2) (Slides 50-51) Wear the Insulation Layer-

(a) Shirt, Cold Weather, Black Fleece and Overalls, Cold Weather, Black Fleece (commonly referred to as Polar Fleece top and bottom)

- Wear the polar fleece over the base layer.
- The shirt has “pit zips” for ventilation. The full length zipper can be used to form a mock turtle neck or for ventilation as required. There is also a draw string at the bottom that can be cinched tight to keep wind from coming up under the shirt.
- The bibs are also intentionally sized short. There are full length zippers on each pant leg to allow you to don and remove the bibs without removing your boots.
- The Army has approved the use of this garment as an outer shell layer. However, it offers little protection from the wind and no protection from moisture. ***IAW USARAK Pamphlet 600-2, the black fleece will not be worn as an outer garment.***

GEN II ECWCS: Insulation Layer

- **Polar Fleece Shirt**
- **Polar Fleece Overalls**
- **IAW USARAK Pamphlet 600-2, the black fleece WILL NOT be worn as an outer garment.**

(b) Liner Cold Weather Coat and Liner Cold Weather Trousers (commonly referred to as smoking jacket and pants)

- This layer is made from the same material as the poncho liner – 1 ounce rip stop nylon quilted over polyester batting. Wear this item over the base layer.
- The coat has slits under the arms for ventilation.
- The trousers are intentionally sized short, to avoid the need to tuck them into the boot.

GEN II ECWCS: Insulation Layer

Liners, Cold Weather – Coat and Trousers:

• Wear over base layer

• Same material as poncho liner

• Coat has slits under arm for ventilation

• Trousers are sized short intentionally

(3) (Slide 52) Wear the Outer Shell Layer-

(a) Wear the ECWCS Parka, Universal Camouflage Pattern, Generation II, parka and trousers (commonly referred to as Generation II GORE-TEX® top and bottom)

- Generation II GORE-TEX® is issued in woodland camouflage, desert camouflage or the universal camouflage (ACU) pattern. The Parka has does not have an inner liner. There are hand warmer and cargo pockets at the waist as well as two map pockets adjacent to the zipper and two sleeve pockets. The hood can be stowed away, but does not have points of attachment for a fur ruff. There is a snow skirt to prevent snow and wind from entering underneath the jacket. It also has “pit zips” for ventilation. The trousers have two hand warmer pockets and two cargo pockets.
- Wash GORE-TEX® in any commercially available detergent. Setting should be permanent press or cotton sturdy. Garment must be thoroughly rinsed – residual detergent will decrease the water repellency qualities. Over time the water repellent qualities of GORE-TEX® will be degraded by washing and normal use. There are products and procedures that can help restore the water repellent qualities of GORE-TEX®. Some post laundry facilities will do this for you. 24 8 oz bottles NSN 8030-01-408-9446 Cost $102.91. Post Laundry can get in 5 gallons NSN 8030-01-408-9444. 55-gallon drums are also available with NSN 8030-01-408-9455. Some commercially available products that are authorized for use are StormShield (877-330-8760), Protex 2000 (800-658-5958) or X-pel (800-652-2533). To treat with any of these products wash the GORE-TEX® according to the label instructions. Then run the GORE-TEX® through a wash cycle without any detergent to ensure that it is completely rinsed clean of any soap residue. Set the machine again to the wash cycle and set the temperature to warm. Fill the machine until the clothing is completely covered with water. Add the water repellent (two ounces for the parka or 3 ounces for parka and trousers) and continue the wash cycle until it is completed. Tumble dry the clothing on permanent press and at medium heat (less than 130º) until dry.
- In the field, dry rub clothing to clean it.
- Wear the suspenders with the trousers. Put suspenders on so that the x pattern is centered between your shoulder blades. Wear the metal hook so that the piece of fabric is against your body to prevent the metal hook from rubbing against your body.

(b) Wear the Wool balaclava, ***and/or*** OR Windstopper Balaclava. There are three configurations:

- As a hat. Fold the bottom of the balaclava to the inside to form a hat. Place the hat onto your head with the face opening to the rear. As you breathe, condensation from your breath will form on your forehead. If you need to change configurations later, this will prevent you from placing wet material onto your face.
- Balaclava down, face exposed. Pull the balaclava over your head. Pull the lower portion of the face opening under your chin.
- Balaclava down, face covered. Pull the lower portion of the face opening up over your mouth and nose. Use goggles to cover eyes and remaining exposed skin if required.
- Never change the configuration of the balaclava during PT. Anticipate the configuration that will work best for the activity. This will come with experience. If you start with it down, leave it down; changing the configuration exposes wet skin to the cold air and is the cause of many of the frostbite cases in USARAK. Reference USARAK/CofS Policy Letter #0-08.

(c) Wear GORE-TEX® gloves with inserts OR trigger finger mittens with inserts OR arctic mittens

(d) Wear issued cold weather boots.

- Intermediate Cold-Wet Boots (ICWB) with removable liners (tan) NSN 8430-01-527-8274, are rated from 68º F to +14º F. You should receive two pairs of liners with this boot.
- Army Combat Boots (Hot Weather), NSN 8430-01-514-4935, are not acceptable for cold weather environments.
- Army Combat Boots (Temperate Weather) NSN 8430-01-516-1506, are acceptable until the temperature drops below 32º F.

- Extreme Cold Weather Boots (ECWB) NSN 8430-00-655-5535. They are also known as White Vapor Barrier boots, VB boots, and bunny boots. They are rated 14º F to -60º F and are for use in cold dry environments. Some VB boots have a pressure relief valve. The valve is used for airborne operations; when you change altitude rapidly, open the valve briefly to equalize pressure and then close the valve. For all other operations, keep the valve closed to prevent moisture from entering the boot. Wipe VB boots out at least once daily and change socks at the same time.
- Black Vapor Barrier Boots are rated to -20º F and are for use in Cold Wet Environments. These are no longer issued in Alaska.
- There is a fine line in between the point at which soldiers should switch from the ICW to the VB boot. The USARAK 385-4, Risk Management for Cold Weather Operations gives guidelines based on temperature zone. ***Temperature zone III 14º F to -19º F is the recommended time to switch to VB boots.*** It must be stressed that this is dependent on workload and that leaders should ensure that both pairs of boots are available to Soldiers in the event of a temperature swing or change of mission. This will give maximum flexibility.

(e) Wear the neck gaiter. It can be worn in three configurations:

- Wear it around your neck as a turtle neck.
- Wear it pulled up over your head, with the face exposed.
- From the second configuration, pull the bottom of the gaiter up over your mouth and nose.

(f) Wear gloves and mittens. ***At a minimum, always wear a contact glove when working in the cold.***

- Wear the **leather GORE-TEX® gloves with the wool inserts.** Try these on at CIF to ensure proper fit with inserts. The inserts serve as a contact glove. You are issued 2 pairs of wool inserts.
- The **trigger finger mittens** are made of canvas and deer skin palms (maintains flexibility in cold). Wear the trigger finger mittens with the wool trigger finger inserts. You are issued two pairs of inserts.
- The **arctic mittens** are made of canvas with deer skin palm and a polyester fiber backing that serves as a face warmer. They have a removable liner made from the same material as the poncho liner. Pull the liners out and inspect for holes, especially near any seams.
- Both the trigger finger mittens and arctic mittens have lanyards that allow you to remove the mittens without losing them. Wear the lanyard over your head. If you are not wearing the mittens, tuck them inside your outer shell to keep snow out of them and to keep them warm for later use.
- Fuels do not freeze and will be the same temperature as the air. ALWAYS wear POL handler gloves when working with fuels to prevent frostbite.
- Keep routine tasks routine by rehearsing with mittens.
- Make every effort to dry out clothing as soon as possible so that it can be re-used when needed. Damp clothing items can be worn close to the body (between the inner and intermediate layer) to dry or can be placed in the sleeping bag to dry out overnight. Larger items that have become wet should not be placed in the sleeping bag. Instead place them between the sleeping bag and sleeping mat or on drying lines in a heated tent.

Gen II ECWCS: Outer Shell Layer

- **Wear GORE-TEX® over base and insulation layers or over base layer for heavier activity levels**
- **Wear the GORE-TEX® trousers with suspenders**
- **GORE-TEX® water repellency can be restored**
- **Three balaclava configurations**
- **Three neck gaiter configurations**
- **Boots issued in basic training are NOT for cold weather**
- **Below 14º F, you should wear the white VB boot**
- **Always wear a contact glove when temperatures are below 32º F**

d. (Slide 53) Wear Generation III ECWCS (7 layer system).

(1) (Slide 54) Wear Level 1: Lightweight Cold Weather Undershirt and Drawers

(a) Long sleeve top and full-length bottom garments constructed out of silk-weight moisture wicking polyester. The material aids in the movement of moisture from the skin to the outer layers both while the wearer is moving or static.

(b) The top has holes in the sleeves for the thumbs. Place your thumbs through the holes to keep the garment down around your wrist.

(c) Wear next to skin or with the mid-weight cold weather shirt and drawers for added insulation and to aid the transfer of moisture.

Generation III ECWCS Level 1: Base Layer

Lightweight Cold Weather Undershirt and Drawers

Long sleeve top and full-length bottom constructed from silkweight moisture wicking polyester

Material aids in movement of moisture from the skin to the outer layers

(2) (Slide 55) Wear Level 2: Mid-Weight Cold Weather Shirt and Drawers

(a) Long sleeve top and full-length bottom garments constructed out of polyester “grid” fleece. Provides light insulation for use in mild climates as well as acting as a layer for colder climates. Provides an increase of surface area for the transportation of moisture away from the wearer during movement.

(b) The top has a zipper that can be used to form a mock turtle neck or allow you to ventilate as workload increases. The top has holes in the sleeves for the thumbs. Place your thumbs through the holes to keep the garment down around your wrist.

(c) Wear over lightweight cold weather undershirt and drawers or next to skin.

Generation III ECWCS Level 2: Base Layer

Mid-Weight Cold Weather Shirt and Drawers

Long sleeve top and full-length bottom garments constructed out of polyester ‘grid’ fleece

Grid fleece provides an increase of surface area for transportation of moisture away from the wearer during movement

Can be worn next to skin or over Level 1 for additional insulation

(3) (Slide 56) Wear Level 3: Fleece Jacket

(a) Acts as the primary insulation layer for use in moderate to cold climate. “Thermal Pro”, animal fur mimicking insulation provides an increase in the warmth to weight ratio along with a reduction in volume when packed.

(b) There are two inner mesh pockets. The zipper will from a mock turtle neck or can be used to ventilate the garment as required.

(c) Wear underneath shell layers. It is approved for use as an outer layer by the U.S. Army. However, it offers little protection from the wind and no protection from moisture. Therefore, during all NWTC courses the Green Fleece WILL NOT be worn as an outer garment.

Generation III ECWCS Level 3: Insulation Layer

Fleece Jacket is the primary insulation layer for use in moderate to cold climates.

Thermal Pro, animal fur mimicking insulation provides an increase in warmth to weight ratio along with a reduction in volume when packed.

Authorized for use as an outer garment in USARAK. Not authorized for use as an outer garment during NWTC courses.

(4) (Slide 57) Wear Level 4: Wind Cold Weather Jacket.

(a) Made of a lightweight, windproof and water repellant material. Acts as a minimum outer shell layer, improving the performance of moisture wicking of the insulation layers when combined with Body Armor and/or Army Combat Uniform.

(b) It has two sleeve pockets, and a mock turtle neck. Two chest level pockets are designed with mesh pocket linings to aid in ventilation while wearing body armor.

(c) Wear as wind protection during windy cool days.

Generation III ECWCS Level 4: Outer Shell

Wind Cold Weather Jacket is made of a lightweight, windproof and water repellant material

Acts as a minimum outer shell layer, improving the performance of moisture wicking layers when combined with Body Armor and/or the ACU

(5) (Slide 58) Wear Level 5: Soft Shell Cold Weather Jacket and Trousers Outer Shell Layer.

(a) Made of a highly water resistant, wind proof material that increases moisture vapor transfer over current hard shell garments. Provides a reduction in weight, bulk and noise signature during movement. Increase of breath ability improves performance of insulation layers by decreasing saturation due to moisture accumulation.

(b) It has a storable hood that works with the ballistic helmet. It has two hand warming pockets on the chest with mesh lining to aid in ventilation. It has pit zips and two sleeve pockets. Draw cords on the bottom prevent snow and wind from entering the system.

(c) Wear when the average temperature is below 14º F. You will determine the base and insulation layers necessary dependent upon temperature, wind and activity level.

Generation III ECWCS Level 5: Outer Shell

Soft Shell Cold Weather Jacket and Trousers

Made of a highly water resistant, wind proof material that increases moisture vapor transfer

Increase of breathability improves performance of insulation layers by decreasing saturation due to moisture vapor accumulation

Provides a reduction in weight, bulk and noise signature during movement

Best used when temperature is below 14º F.

(6) (Slide 59) Wear Level 6: Extreme Cold/Wet Weather Jacket and Trousers Outer Shell Layer.

(a) A waterproof layer for use in prolonged and/or hard rain and cold wet conditions.

(b) It has two pass through chest pockets for ventilation. It has a storable hood that works with the ballistic helmet.

(c) Wear when the average temperature is above 14º F and alternating between freezing and thawing. You will determine the base and insulation layers necessary dependent upon temperature, wind and activity level.

Generation III ECWCS Level 6: Outer Shell

Extreme Cold/Wet Weather Jacket and Trousers

A waterproof layer for use in prolonged and/or hard rain and cold wet conditions

Best used when temperatures are above 14º F and alternating between freezing and thawing

(7) (Slide 60) Wear Level 7: Extreme Cold Weather Parka and Trousers.

(a) Provides superior warmth with high compact ability, low weight, and low volume. Highly water resistant and windproof to provide wind and moisture protection.

(b) Sized to fit over the Body Armor during movement or static activities requiring maximum insulation. Trouser design incorporates full side zips for donning and doffing over boots and other layers.

(c) Wear in extreme cold weather and climates over all other layers; it is the last layer of protection. It is meant for static positions.

Generation III ECWCS Level 7: Outer Shell

Extreme Cold Weather Parka and Trousers

Provides superior warmth with low weight, and low volume

Highly water-resistant and windproof in order to provide wind and moderate moisture protection

Sized to fit over body armor

For extreme cold weather climates; the outer most layer of protection. Meant for static positions

e. (Slide 61) Use the issued sleep system.

(1) The Modular Sleep System (MSS) is designed for a temperature range of +50º F to -40º F. At the low end of this range, you will only be comfortable for about four hours of sleep because as you sleep, you compress the sleeping bag material. This system will replace all other sleep systems issued in the US Army.

(a) Use the patrol bag (Green/Foliage Green) when temperatures are above 30º F. If you do not have a shelter, use it with the bivouac cover.
(b) Use the Intermediate cold weather bag (Black/Gray-Green) from 30º F to -10º F. If you do not have a shelter, use it with the bivouac cover.
(c) In temperatures below -10º F, insert the Black Bag into the Green bag and snap and zip them together. Use this inside the bivouac cover for a temperature rating of -40º F. The newer ACU style is rated to -45º F.
(d) Wear no more than a single base layer inside the bag. You should not sweat inside the bag.

(2) You are also issued a 24'' x 72" x 3/8" thick polyethylene foam pad that is designed to put insulation between you and the ground. This insulating layer is essential to the sleep system as it prevents conductive heat loss to the ground. Use pine boughs, cardboard etc. as an insulating layer if the sleeping pad is lost or destroyed.

(3) You may be issued an air mattress. Open the valve to allow the mattress to self-inflate. This feature can fail in the field and you may need to blow the air mattress up. This introduces moisture into the air mattress and may cause problems with the valve freezing in the open or closed position.

Modular Sleep System (MSS)

The complete MSS system weighs about 7 pounds and includes:

- **Patrol Bag is rated 50º F to 30º F**
- **Intermediate Cold Weather Bag is rated 30º F to -10º F**
- **Vapor Permeable GORE-TEX® Bivouac Cover**
- **Intermediate Cold Weather bag goes inside the Patrol Bag which goes inside the Bivouac Cover. This provides protection from -10º F to -40º F for 4 hours of sleep.**
- **The newer ACU style is rated to -45º F**

f. (Slide 62) Care for the ECWCS.

(1) Before laundering make sure all zippers are zipped and all snaps and hooks are fastened. Tie draw cords together.
(2) For MSS use front load washing machine.
(3) Machine launder using delicate/gentle fabric cycle or by hand.
(4) Use lukewarm water (90º F) and cold water laundry detergent (i.e. Liquid Tide or Era Plus).
(5) Rinse in clean cold water.
(6) Dry in tumble dryer. Do not exceed temperatures of 130º F as degradation of component materials will occur. For Level VI, set on permanent press.
(7) Avoid over drying.
(8) To drip dry, place on a rust proof hanger.
(9) Do not press; Do not starch; Do not use fabric softeners; Do not bleach.

Learning Step/Activity 9 - (Slide 63) Take steps to prevent cold weather injuries during movement.

a. Start movements slightly cool to prevent profuse sweating during the movement.
b. Make adjustments to clothing and movement rate to prevent profuse sweating. Take a brief halt, 10-15 minutes after movement begins, to adjust clothing.
c. Keep clothing upgrade items like mittens and additional layers easily accessible for quick adjustments on the move.
d. Carry a minimum of 2 quarts of water.
e. Drink sufficient fluids (potable water, juices and warm, non-alcoholic beverages).
f. Eat food on the move.
g. Avoid lengthy halts. Take brief halts every hour. Halts of more than 5-10 minutes open you up to cold weather injuries because you are dressed for movement.
h. For vehicle movements, when exposed you must:
(1) Wear eye protection.
(2) Cover all exposed skin.

Learning Step/Activity 10 – (Slide 64) Fix cold challenges immediately to prevent a simple problem from becoming a cold weather injury.

NOTE: IF YOU SUSPECT THAT YOU OR SOMEONE ELSE HAS OR ARE DEVELOPING A COLD WEATHER INJURY, CORRECT THE PROBLEM IMMEDIATELY.

a. Remove wet clothing (if applicable) and replace with dry clothing.
b. Upgrade clothing as required.
c. Exercise. Perform exercises that involve the entire body.
d. Eat and hydrate.
e. If possible, get into a heated shelter.

Learning Step/Activity 11 – (Slide 65) Prevent cold weather injuries during PT.

(1) Follow the guidelines set forth in Appendix E: USARAK CG/CofS Policy Letter #0-08 Cold Weather Physical Training Policy.

(2) PT is no different than any mission or training event. Follow the above guidelines to identify and assess hazards and implement control measures that will protect you and your Soldiers from cold weather injury.

Learning Step/Activity 12 – Supervise and evaluate the effectiveness of controls.

a. Evaluate the controls constantly during the mission for effectiveness.

b. Take immediate action if additional controls are required.

c. Be disciplined enough to take care of yourself.

d. Look out for your fellow Soldiers and make corrections on the spot.

SECTION IV. SUMMARY

You must be able to prevent cold injuries before they happen. A Soldier that receives a cold weather injury is put on a 30 day profile. This means a minimum of 30 days that the Soldier cannot participate in outdoor training.

Check on Learning.

1. For any suspected cold weather injury you should:

a. Have the individual complaining drive on and tough it out.
b. Have medics look at the individual when you get around to it.
c. Evaluate the individual, make a diagnosis and decide what you should do next.
d. Stop what you are doing and focus on treating that individual immediately.

2. What is the treatment for superficial frostbite?

- Re-warm the affected part using skin to skin contact. Use a warm hand, armpits, a warm belly etc.
    - Face, ears and nose. Cover the casualty's affected area with his/her and/or your bare hands until the sensation and color return.
    - Hands. Place the affected part under the armpit's or on the belly. Cover with clothing.
    - Feet. Remove the casualty's boots and socks and place the affected parts under clothing and against the body of another Soldier.
- If possible, submerge the affected part in water heated to 104-108° F. You must maintain this temperature range while soaking; if you choose this method be sure you can monitor the temperature and replace with warm water as necessary.
- Take ibuprofen immediately – this drug will help reduce the damage as the frostbite re-warms.
- DO NOT ALLOW THE INJURY TO RE-FREEZE. In almost all cases, re-freezing the injury will lead to deep frostbite.
- DO NOT rub or massage the affected area.
- DO NOT place the affected part close to a heat source.
- DO NOT allow tobacco or alcohol use.
- Aloe can help with the healing process.
- Contact medical personnel or further evaluation/evacuation.

SECTION II. INTRODUCTION

Motivator A two man fuel handler team deployed to the field in support of maneuver units in preparation for an upcoming exercise. Although the plan called for the team to support from the main area in garrison, the participants decided to stay in the field to avoid traveling back and forth from the rear. The team stayed in the UMCP in a soldier crew tent using a commercial off the shelf heater to warm-up the tent at night (temperatures at night were between 30-40 degrees). The chain of command was aware that the team was using the commercial off the shelf heater to heat their tent. The team departed early afternoon to support the maneuver units, and because of various missions did not return until early morning. Late the next morning some Soldiers in the UMCP attempted to wake the team to obtain fuel. One of the Soldiers noticed a peculiar smell coming from the tent and made a comment to his supervisor about it. The supervisor investigated and found that the two man team had passed away during the night. It is suspected that they started the heater to warm up when they returned from their mission. They closed all of the vents and door flaps to keep the heat in and then went to sleep. The carbon monoxide build-up from the heater caused the deaths.

Terminal Learning Objective (Slide 2)

ACTION	Protect yourself and your fellow Soldiers against common cold weather and mountain environmental injuries
CONDITION	You are a Soldier deployed to the field in conditions that range from 50° to -60° F. You are given the Extended Cold Weather Clothing System (ECWCS), other issued cold weather clothing items, the issued cold weather sleep system with insulating pad, access to a warming shelter and the requirement to protect yourself and your fellow Soldiers against environmental injuries.
STANDARD	Apply preventive medicine countermeasures to prevent environmental injuries. Identify the signs and symptoms of environmental injuries. Perform first aid for environmental injuries. Do not sustain an environmental injury during the course.

Safety Requirements: For classroom training discuss emergency procedures in case of fire or natural disaster.

Risk Assessment: Low

Environmental Considerations: None

Evaluation: You will be tested on your knowledge of cold weather and mountain environmental injuries during a quiz (see training schedule for date and time. You need to score a 70% on this quiz in order to receive a GO. There are also questions related to this lesson on the final written examination (CWLC only; see training schedule for date/time of exam). You must score a 70% on the written exam in order to receive a GO. If you fail the written exam, you will be given a second exam after re-training has been conducted. If you fail this second examination, you will be dismissed from the course. In addition, you are expected to practice countermeasures that will prevent you from sustaining an environmental injury. If you sustain an environmental injury you will be dismissed from the course (at the discretion of the Commander).

Instructional Lead-In: Cold weather injuries are only part of the challenge in cold and mountainous regions. There are other hazards that you need to understand in order to prevent disease and non-battle injuries (DNBI). This lesson identifies these hazards and gives you an understanding of how to prevent and treat cold weather and mountain DNBI.

SECTION III. PRESENTATION

Learning Step/Activity 1 – Identify, treat and prevent snow blindness.

a. (Slide 3-4) What is it? Snow blindness is sunburn of the eyes (corneas). Overexposure to the sun that causes this condition can occur in less than an hour, especially in a snow covered environment at altitude. Snow blindness can occur even when the sun is diffused by clouds. Symptoms include:

(1) eyes feel like there is sand in them.
(2) severe eye pain.
(3) pink or red eyes.
(4) extreme sensitivity to light.

b. Perform first aid for snow blindness:
(1) Loosely bandage the eyes with sterile gauze. Wet the gauze with cold water to help with pain.
(2) Do not allow any exposure to light.
(3) Provide care for the individual over the next 24-48 hours as the individual is essentially blind.
(4) Administer OTC pain medications.

c. Prevention is simple – wear sunglasses or tinted goggles (preferably with UV protection) in a snow covered environment. (Slide 5) Improvised slit glasses can be used in survival situations.

Improvised Slit Glasses

Learning Step/Activity 2 – Identify, treat and prevent carbon monoxide poisoning.

a. (Slide 6-7) What is it? **Carbon monoxide poisoning** occurs when individuals breathe fumes from improperly ventilated heat sources (vehicles, space heaters etc.). Carbon monoxide is an odorless gas that replaces oxygen in the blood stream. Red blood cells actually bind with carbon monoxide more readily than with oxygen. Because your body requires oxygen, you slowly die from asphyxiation. Even just a few hours of exposure, can result in death.

(1) Initially symptoms include:
(a) headache
(b) confusion
(c) tiredness
(d) excessive yawning

(2) In more severe cases symptoms include:
(a) cherry red lips
(b) unconsciousness
(c) cardiac arrest

b. Perform first aid for CO poisoning.

(1) Move the individual to fresh air OR remove the source of the carbon monoxide and ventilate the area.
(2) Administer 100% oxygen.
(3) If breathing and/or heart has stopped, begin rescue breathing/CPR.
(4) Evacuate to definitive care.

c. Prevention:

(1) IAW USARAK CG/CofS Policy Letter #0-14, use only Army approved heaters. Army approved heaters are the only heaters authorized for use in sleeping areas, living areas or administrative work areas occupied by personnel.
(2) Ventilate all tents/shelters when running a heater/stove.
(3) Operate stoves only when a licensed, fully dressed, alert fire guard, with an operational fire extinguisher (5lb minimum), is present.
(4) If you suspect a problem with the heater (i.e. soldiers are exhibiting the signs and symptoms of CO poisoning) shut the heater down and rectify the problem.
(5) DO NOT sleep in a running vehicle.

Learning Step/Activity 3 – Identify, treat and prevent treat giardia.

a. (Slide 8-10) **Giardia** and another related parasite, **cryptosporidium** are commonly found in backcountry and third world water sources. Nearly 2.5 million cases are diagnosed in the United States annually. When ingested, these parasites cause:

(1) intense diarrhea.
(2) nausea.
(3) weakness.
(4) loss of appetite.

NOTE: It generally takes 10 days to two weeks after ingestion for symptoms to appear.

b. Perform first aid for giardia. If you suspect giardia, contact medical personnel for evaluation.

NOTE: Diagnosis and treatment must be determined by qualified medical personnel. Antibiotics are used to treat the illness.

c. Prevention:

(1) Use a treatment method for questionable water sources.
(a) Bring water to a rolling boil – this will kill all waterborne pathogens OR
(b) Use a commercial off the shelf water purification device (not a filter) – refer to the manufacturers instructions.
(2) Refer to FM 21-10 Field Hygiene and Sanitation for additional guidance on water purification methods.

Learning Step/Activity 4 – Identify, treat and prevent constipation.

a. (Slide 11) Constipation is infrequent and/or difficult movement of the bowels. Some individuals are reluctant to relieve themselves in cold or less than ideal conditions. Cold weather, wind and poorly constructed or maintained latrines create less than ideal conditions for heeding nature's call. This can all lead to constipation, an embarrassing and potentially serious and debilitating condition.

b. Perform first aid for constipation: Take a stool softener provided by medics.

NOTE: Medics may prescribe an enema or in extreme cases manual removal/surgery may be required.

c. Prevention:

(1) Use the latrine when you need to. You lose heat maintaining the temperature of your stool.
(2) Hydrate and eat properly.
(3) Provide a sheltered latrine area for Soldiers to utilize.

Learning Step/Activity 5 – Identify, treat and prevent heat exhaustion.

a. (Slide 12-13) What is heat exhaustion? Dehydration leads to heat exhaustion. Heat exhaustion is a volume problem – you do not have enough water in your system. Symptoms include:

(1) Increased heart rate.
(2) Increased respiratory rate.
(3) Headache.
(4) Dizziness.
(5) Nausea and vomiting.
(6) Thirst.
(7) Fatigue.
(8) Profuse sweating, cool clammy skin.

b. Perform first aid for heat exhaustion.

(1) Change the environment from hot to cool. Place casualty in a shady spot; pour water on the head and fan the casualty.
(2) Hydrate – oral rehydration salts (ORS) are very effective in replacing lost fluids especially in a cold weather environment where it may be difficult to administer IV fluids and/or
(3) Administer IV fluid.
(4) Rest.
(5) Contact a medic for further evaluation/evacuation.

NOTE: It will take 1 hour to replace 1 liter of fluid in a casualty who is resting.

c. Prevent heat exhaustion.

(1) Hydrate. Drink .5 to 1 liter with each meal. Drink .25 liters of water for every 20 minutes of strenuous exercise.
(2) Avoid overdressing for cold weather activities.
(3) Monitor your urine output – it should be clear and you should have to urinate often.
(4) Avoid diuretics – coffee, soft drinks.

Learning Step/Activity 6 – Identify, treat and prevent heat stroke (hyperthermia).

a. (Slide 14-15) What is heat stroke? Heat stroke is the opposite of hypothermia – body core temperature is elevated above 104º F. Onset of heat stroke can be sudden (less than 30 minutes). Like hypothermia, it is a medical emergency that must be dealt with immediately. Symptoms include:

(1) Altered level of consciousness.
(2) Increased heart rate.
(3) Increased respiratory rate.
(4) Hot, red skin. Skin may be wet.
(5) Loss of coordination.
(6) Seizures.

b. Perform first aid for heat stroke.

(1) Remove clothing that retains heat.
(2) Keep the patient wet while you fan the body.
(3) Apply ice packs under the armpits and in the groin area.
(4) Massage arms and legs.
(5) If possible, have the casualty hydrate; if not administer IV fluid.
(6) DO NOT under any circumstance provide drugs (OTC or otherwise).
(7) Evacuate to definitive care immediately.

c. Prevention measures are the same as for heat exhaustion.

Learning Step/Activity 7 – Identify, treat and prevent hyponatremia (water intoxication).

a. (Slide 16-17) Hyponatremia is also known as water intoxication. This results from an excess intake of water (there are other forms of this illness caused by different mechanisms). The excess water in the system causes an imbalance in electrolytes. The symptoms mimic dehydration, heat exhaustion and heat stroke making it very difficult to diagnose. Symptoms include:

(1) Headache.
(2) Weakness.
(3) Dizziness.
(4) Nausea.
(5) Sweaty skin.
(6) Clear, copious urine output.
(7) Lack of thirst.
(8) Sloshing sounds in the stomach.
(9) Altered level of consciousness in severe cases (requires evacuation).

b. Perform first aid for hyponatremia.

(1) Move to a shaded area and rest.
(2) DO NOT allow casualty to drink.
(3) Slowly allow casualty to eat (preferably salty) food.
(4) Contact medic for evaluation and evacuation.

WARNING: If treated as for heat exhaustion, serious brain injury or death can occur.

c. Prevention:

(1) Follow sensible hydration and dietary guidelines.
(2) DO NOT drink large quantities of water in a short period of time.
(3) DO NOT force subordinates to drink large quantities of water in a short period of time.

SECTION IV. SUMMARY

You should now have a good understanding of some of the more common environmental injuries that can take you and your Soldiers out of the fight. Use this information to prevent these injuries from occurring in the first place.

Check on Learning.

1. What are the common causes of CO poisoning?
Exhaust from improperly vented heaters in enclosed, un-vented shelters or vehicles.

2. How long should you boil water before using it for drinking?
It should be brought to a rolling boil in order to kill all waterborne pathogens.

SECTION II. INTRODUCTION

Motivator (Slide 1) Operations in Afghanistan routinely take place at altitudes above 8,000 feet. In addition to the complications presented by the enemy and difficult mountain terrain and weather, the lack of available oxygen at altitudes above 8,000 feet has created problems for Soldiers. At best, operating above 8,000 feet will reduce your physical and mental performance; at worst it can kill you.

Terminal Learning Objective (Slide 2)

ACTION	Protect yourself and your fellow Soldiers from altitude illness
CONDITION	You are a Soldier deployed to the field at altitudes of 8,000 to 18,000 feet. You are given the Extended Cold Weather Clothing System (ECWCS), other issued cold weather clothing items, the issued cold weather sleep system with insulating pad, access to a warming shelter, a portable hyperbaric chamber, and the requirement to protect yourself and your fellow Soldiers against altitude illness.
STANDARD	Apply preventive medicine countermeasures to prevent altitude illness. Identify the signs and symptoms of altitude illness. Perform first aid for altitude illness.

Safety Requirements: For classroom training discuss emergency procedures in case of fire or natural disaster.

Risk Assessment: Low

Environmental Considerations: None

Evaluation: You will be tested on your knowledge of cold weather and mountain medical considerations during a one hour written examination at the conclusion of the course (Refer to training schedule for date/time of exam). You must score a 70% on the written exam. If you fail the written exam, you will be given a second exam after re-training has been conducted. If you fail this second examination, you will be dismissed from the course.

Instructional Lead-in (Slide 3) Altitude illness is potentially life threatening. This lesson gives you the knowledge to prevent and treat altitude illness.

SECTION III. PRESENTATION

Learning Step/Activity 1 – Identify the factors that make altitude a hazard.

a. (Slide 4) Where does the hazard exist? Performance issues begin at altitudes as low as 4,000 feet. At this altitude, you start to breathe faster and you cannot perform aerobic exercise as well. Most serious problems with altitude do not occur until you reach an altitude of at least 8,000 feet. The U.S. Army classification system for altitude is:

(1) Low: Sea Level to 5,000 feet
(2) Moderate: 5,000 to 8,000 feet
(3) High: 8,000 to 14,000 feet
(4) Very High: 14,000 to 18,000 feet
(5) Extreme: Above 18,000 feet

b. (Slides 5 and 6) Why does the hazard exist? The higher the altitude, the lower the barometric pressure, so this means that the amount of oxygen available to you decreases. At 18,000 feet, the barometric pressure is half of what it is at sea level and there is about half the amount of oxygen available to you. When you decrease the amount of oxygen available to your body, you begin to suffer from performance issues, and possibly altitude illness. The technical term for this state of decreased oxygen in your blood stream is hypoxia.

c. Weather also has an effect on the barometric pressure. In Alaska for example, a strong low pressure system can ‘increase’ the altitude by as much as 1,000 feet even if you have not moved.

d. Higher latitudes have lower pressures than lower latitudes. This means that the available oxygen at 14,000 feet in the Alaska Range is less than the available oxygen at the same altitude in the Hindu Kush, Afghanistan.

e. In the winter, pressures are lower for a given altitude than they are in the summer months. This means that in winter there is less oxygen available to you than in summer. This effect is more pronounced at higher latitudes.

f. (Slide 7) What are four factors that affect your response to altitude?

(1) The altitude to which you ascend.
(2) Your rate of ascent to the new altitude.
(3) The altitude at which you slept before moving to the new altitude.
(4) Individual factors such as your genetic make-up and physiology.

g. (Slide 8) What happens to your body?

(1) In most cases, given enough time, you will adjust to the altitude (acclimatize). Everyone acclimatizes at different rates. In some instances, you may become ill.
(2) Your response to altitude will probably be different than that of other Soldiers.
(3) You will never acclimatize enough to perform as though you were at sea level.
(4) Your response to a given altitude this time does not predict how you will respond the next time at the same altitude.

h. (Slide 9) What happens during acclimatization? Acclimatization is your body’s physiological adjustment to altitude. There are a number of changes that take place:

(1) You breathe deeper and faster. This is an immediate response that helps you get more oxygen into your blood stream.
(2) Your heart rate and blood pressure increase initially. This allows you to carry oxygenated blood to the tissues that need it. After 7-10 days heart rate and blood pressure decrease.
(3) Your bone marrow is stimulated to produce more red blood cells. More red blood cells allow you to increase the ability of your blood to get oxygen where it is needed.

(4) You experience changes at the cellular level that allow more oxygen to get into action faster and more easily. These changes usually take weeks.
(5) 80% of overall acclimatization is complete after 10 days. At 6 weeks, 95% acclimatization is complete.
(6) You lose these gains at about the same rate. A significant loss occurs after 2 weeks. By 6 weeks the benefits of acclimatization are gone.
(7) You may experience periodic breathing (a.k.a. Cheyne-Stokes breathing) while sleeping. Your breathing rate speeds up and then stops for a few moments. You will wake up feeling like you cannot breathe. This is normal and not cause for alarm, but it may interfere with sleep.
(8) You know you have acclimatized if:
(a) You are sleeping well.
(b) You are eating well.
(c) You have a normal resting heart rate.

NOTE: An excellent tool that medics may have at their disposal is the pulse oximeter. It can read heart rate and blood oxygen saturation levels in less than a minute. Medics can get a sea-level baseline of each of the Soldiers they provide care for and monitor the health of Soldiers when conducting operations at altitude. The caveat is that a Soldier may show no signs or symptoms of altitude illness even though readings for heart rate and blood O2 are bad. These readings may be what are normal for the Soldier at a given altitude.

Learning Step Activity 2 – (Slide 10) Identify the signs and symptoms and perform first aid for altitude illness.

NOTE: The individual pictured was suffering from altitude illness during a climb of Denali. This led to a fall of over a thousand feet. The individual suffered severe injuries in the fall and frostbite while awaiting rescuers.

a. (Slide 11) **Identify Acute Mountain Sickness (AMS).** AMS is a collection of symptoms that can resemble carbon monoxide poisoning, the flu, a hangover and even hypothermia. AMS is the start of altitude illness that is associated with the brain. If you have recently moved to an altitude over 8,000 feet, you should assume that it is AMS and not something else. Signs and symptoms include:

(1) Headache.
(2) Nausea with vomiting in some cases.
(3) Loss of appetite.
(4) Insomnia.
(5) Exhaustion.
(6) Unusual fatigue.
(7) Dizziness.
(8) Shortness of breath during activity that does subside at rest.

b. (Slide 12) **Perform first aid for AMS.**

(1) Stop moving up until symptoms resolve.
(2) Hydrate and eat.
(3) Light exercise to alleviate symptoms.
(4) Take Ibuprofen and something to settle the stomach.
(5) If symptoms do not resolve in 24 to 48 hours, descend a minimum of 1,000 feet.
(6) If available, under the supervision of medical personnel, take Diamox (Acetazolamide) 125-250 mg twice daily.
(7) Contact medical personnel for further evaluation.

NOTE: Diamox is in the sulfa class of drugs. It aids in acclimatization and is often prescribed for this purpose. Side effects include increased urination (mild diuretic) and a tingling sensation in the extremities. Some individuals may be allergic to this drug.

c. (Slide 13) **Identify High Altitude Cerebral Edema (HACE).** Fluid is leaking out of the capillaries of the brain. This increases pressure inside the skull making the signs and symptoms appear similar to those of a severe head injury. HACE is a life threatening emergency. A wait of just a few hours to treat HACE can result in death.

(1) Ataxia – inability to maintain balance, stumbling like a drunk.
(2) Altered mental status – severe changes in personality.
(3) Headache.
(4) Lethargy.
(5) Weakness.
(6) Vomiting.

Have the Soldier stand straight up (if able) with boots pressed together, eyes closed and hand pressed into the sides of the thighs. If the Soldier cannot maintain balance, he/she is suffering from ataxia and probably has HACE and not AMS.

d. (Slide 14) **Perform first aid for HACE.**

(1) Move the Soldier down a minimum of 1500 feet immediately. DO NOT WAIT.
(2) Administer oxygen and ibuprofen to help with headache.
(3) Under the supervision of a qualified medical professional, administer Diamox and/or dexamethasone (a powerful anti-inflammatory steroid).
(4) (Slide 15) Use a portable hyperbaric chamber (Gamow bag), if immediate descent is delayed. The Gamow bag is portable hyperbaric chamber. It can 'lower' the altitude by 3000-5000 feet and cause HAPE, HACE or AMS symptoms to subside for up to 12 hours though usually the effect only lasts for 3-5 hours. Still, this can allow the patient to self-evacuate to a lower altitude. Though this sounds minor, those who have operated at altitude know how difficult a medical evacuation of a litter patient without air support can be. It generally takes 2-6 hours for the symptoms of altitude illness to subside once the system is pressurized. It weighs about 15 pounds. The patient is placed inside the Gamow bag with warm clothing a sleeping bag with pad, water and an altimeter. The bag is then pressurized using a foot pump; the foot pump must be utilized at a rate defined in the instruction manual to maintain the pressure (usually around 20-30 times a minute). An altimeter is used to monitor the effective drop in altitude created by the bag.

e. (Slide 16) **Identify High Altitude Pulmonary Edema (HAPE).** Fluid leaks out of the capillaries of the lungs. This causes obvious problems with breathing. If not treated quickly, the Soldier will drown in his/her own fluids. HAPE is also a life threatening emergency.

(1) Sudden decreased ability to exercise.
(2) Dry cough progressing to productive cough with white to pink frothy sputum.
(3) Shortness of breath, even at rest.
(4) Crackling or gurgling breath sounds (rales).
(5) Increased heart rate and respiratory rate.
(6) Chest pain.

f. (Slide 17) **Perform first aid for HAPE.**

(1) Move the Soldier down a minimum of 1500 feet immediately. DO NOT WAIT.
(2) Administer oxygen.
(3) Use a portable hyperbaric chamber (Gamow bag), if immediate descent is delayed.

Learning Step/Activity 3 – Prevent altitude illness.

a. Before you go:

(1) Get fit. A key lesson learned from OEF is that "You can train a Soldier to fight in country, but if he shows up unfit, he will NEVER catch up" (from AWG personnel).
(2) Quit smoking. Another key lesson learned from OEF "Smokers habitually under-perform physically as compared to their non-smoking counterparts" (from AWG personnel).
(3) Perform long ruck movements in the mountains with your unit. This will help you to:

- Determine the slowest Soldier – you must move at that rate of march.

- Determine the overall rate of ascent and descent for your unit. 100-300m/hr is realistic.
- Get used to long, slow movements.

(4) Educate your Soldiers about how to prevent, identify and treat altitude illness.

b. During operations. For the most part, you do not have control over the acclimatization process but there are steps you can take to tip the scales in your favor.

(1) Stay put for 2-3 days if you move to an altitude of 8,000-12,000 feet.
(2) Control your rate of ascent. You can climb as high as you want (within reason), provided you do not sleep more than 1,000-1,500 feet higher than your previous location (climb high, sleep low).
(3) Drink enough water. Set a goal for at least 4 quarts of water per day. It is nearly impossible to over-hydrate at altitude.
(4) Eat a high calorie, high carbohydrate diet.
(5) DO NOT take sleeping pills or alcohol. These depress the respiratory system and can help bring altitude illness.
(6) Take Diamox as a prophylactic drug before and during your operation. One 125-250 mg tablet, twice per day is the recommended amount. You must get this prescription from a doctor.
(7) Maintain a physical fitness program.

SECTION IV. SUMMARY

You now have a general idea of the medical conditions that can develop when operating at altitudes above 8,000 feet. This knowledge will allow you to take steps to prevent altitude illness from occurring and allow you to treat altitude illness if it does occur.

Check on Learning

1. Where do most problems with altitude begin?
Most problems occur at altitudes above 8,000 feet.

2. What is the treatment for AMS?
(1) Stop moving up until symptoms resolve.
(2) Hydrate and eat.
(2) Light exercise to alleviate symptoms.
(3) Take Ibuprofen and something to settle the stomach.
(4) If symptoms do not resolve in 24 to 48 hours, descend a minimum of 1,000 feet.
(5) If available, under the supervision of medical personnel, take Diamox (Acetazolamide) 125-250 mg twice daily.
(5) Contact medical personnel for further evaluation.

3. What is HAPE? High altitude pulmonary edema. Fluid leaks out of the capillaries of the lungs. This causes obvious problems with breathing. If not treated quickly, the Soldier will drown in his/her own fluids. HAPE is a life threatening emergency.

(1) Sudden decreased ability to exercise.
(2) Dry cough progressing to productive cough with white to pink frothy sputum.
(3) Shortness of breath, even at rest.
(4) Crackling or gurgling breath sounds (rales).
(5) Increased heart rate and respiratory rate.
(6) Chest pain.

SECTION II. INTRODUCTION

Motivator: There are times when you will need special equipment to conduct mountain operations. Movement up steep slopes and cliffs, across swift flowing streams, over deep ravines, and over glaciated terrain will often require roped movement in teams, or movement on fixed rope installations to travel safely and quickly. The choice of what equipment to carry depends on mission, terrain, and to some extent - experience. It is important that you become familiar with this specialized equipment so that you can inspect, care for and properly utilize it to accomplish the mission.

Terminal Learning Objective

ACTION	Maintain military mountaineering equipment
CONDITION	In a classroom or field environment, with all issued mountaineering equipment
STANDARD	Student inspected all issued mountaineering equipment and identified any deficiencies within 20 minutes.

Safety Requirements: Ensure students have issued mountaineering equipment and are properly dressed for the conditions, prior to moving to the training area.

Risk Assessment: Low

Environmental Considerations: None

Evaluation: You will be tested on your knowledge of mountaineering equipment during a one hour written examination at the conclusion of the course (Refer to training schedule for date/time of exam). You must score a 70% on the written exam. If you fail the written exam, you will be given a second exam after re-training has been conducted. If you fail this second examination, you will be dismissed from the course.

Instructional Lead-In: Operations in mountainous terrain often require the use of specialized equipment. Today I will introduce to you the basic equipment you will use in the mountains. I will talk about the uses and characteristics of the equipment and how to inspect and maintain it. It is important for you to become familiar with this equipment as its use will be vital to safe mountain travel.

SECTION III. PRESENTATION

Learning Step/Activity 1- Describe the characteristics of ropes.

a. A rope is a bundle of fibers that can carry a load. How much depends on the material, type of construction, age, and amount of wear. Originally, climbers used ropes made from natural fibers such as hemp, sisal or manila. During World War II, a product known as perlon was developed in Germany. This product was procured by the US military and re-named nylon; ropes were developed from this strong, lightweight and elastic product. The original nylon ropes were laid ropes. A laid rope, also known as Army Greenline, is made of nylon fiber that has been twisted into three strands which are then twisted around each other in a clockwise direction giving it a right-hand lay. ***This rope is still available in the military supply system, however it does not meet international standards (UIAA or CE). For this reason it is no longer used in NWTC courses.*** For years the nylon laid rope was the standard, however. Nylon ropes had (and still have) remarkable elasticity – they stretch under load. The original natural fiber ropes did not stretch; this lack of stretch meant a hard, jolting stop to a falling climber, potentially producing serious injury or rope/system failure. The energy applied to the rope by the force of a falling climber is absorbed and dissipated by the stretch of today's ropes.

b. Today the nylon kernmantle rope is the industry standard. A kernmantle rope is constructed of an inner core (kern) and an outer case (mantle). The kern is made by twisting nylon fibers into a bundle and then laying or twisting the bundles together. The kern is then covered by a woven sheath (mantle). The kern is the main load bearing portion of the rope taking 80-90 % of the total load. The mantle holds the kern together and protects it. It bears approximately 10-20% of the load. Parachute cord or 550-cord is a type of kernmantle rope you are probably familiar with.

c. The kernmantle rope is the only climbing rope approved by the Union Internationale des Associations d' Alpinisme (UIAA). This organization is the internationally recognized authority in setting standards for climbing equipment. The Comitee Europeen de Normalisation (CEN) is the European group responsible for creating and maintaining equipment standards. ***Any rope used for climbing should have a UIAA or CEN rating.***

d. One other term you need to be familiar with is kilo Newton (kN). This is a measure of force. One kilo Newton is equal to approximately 225 foot pounds.

e. There are two types of kernmantle ropes, the dynamic rope and the static rope.

1. A ***static rope*** has a kern that is laid straight, giving it little stretch. This rope is used when there is a constant high load, in rappelling, hauling or rescue situations. The mantle is also more resistant to abrasion making it stiffer than the dynamic rope. These ropes also vary in diameter from 8mm-13mm. They should never be used in situations where the rope will be shock loaded (i.e. lead climbing). The minimum tensile strength for 11mm static ropes for military use is 4500 pounds.

2. The ***dynamic rope*** has a kern that is twisted in much the same manner as a laid rope, giving it the ability to stretch. This type of rope is used in situations where the rope may be shock loaded. The built in stretch will absorb most of the shock helping to prevent failure. Dynamic ropes are generally offered in lengths of 50-70 meters; they are offered in diameters from 8mm to 11mm. The minimum tensile strength for 11mm ropes for military use is 4500 pounds. UIAA/CEN requires that the rope be rated for 5 falls with impact forces of less that 12kN for each fall. This fall test as well as other requirements for dynamic ropes are beyond the scope of this text. For more information refer to the UIAA website.

Learning Step/Activity 2- Care for ropes.

a. The following general rules should ALWAYS be observed when handling rope.

(1) Keep ropes off the ground. Lay the rope on a poncho or tarp to protect it when it is use. Do not step on ropes. Small particles of dirt will be ground between the mantle and cut or abrade the fibers of the kern.

(2) The rope should never come in contact with sharp edges of any type. Nylon is easily cut, especially when under tension. If a rope must be used on an edge, which could damage the rope, then the edge must be padded.

(3) Keep the rope dry if possible. A wet or frozen nylon rope may lose 10-20% of its original strength. If it should become wet, hang it in large loops on wooden pegs, above the ground, and allow it to dry. Do not hang a rope on metal objects. A rope should never be dried out close to an open flame or other high heat source.

(4) Never leave a rope knotted or tightly stretched for longer than necessary.

(5) Never allow a moving rope to rub against a non-moving rope. The stationary rope will become extremely weak or may be cut from the friction produced continually over one spot on the rope. This is especially important when the stationary rope is under tension.

(6) Climbing ropes should never be spliced since the handling characteristics will not be acceptable at the point of the splice and rope strength will be greatly reduced.

(7) For rope length reference, mark all climbing ropes at their midpoints. This will help in determining remaining rope length in later installations. Use cotton or first aid tape or a rope manufacturer's recommended marker designed for rope marking.

(8) Nylon is a petroleum based product. The rope should not be marked with paints or allowed to come in contact with oils or petroleum products as these products will weaken or dissolve it. Acids do the worst damage to a nylon rope. Care must be taken when stowing a rope in a vehicle. Never place the rope near a battery or where a battery has previously been.

(9) A climbing rope should never be used for any purpose except mountaineering.

(10) New ropes ends are normally fused, but an older rope or a fresh cut rope may need protecting. The end strands can be melted together with heat or a flame, ensure the ends of the core strands fuse with the end of the sheath. Another method is to tape the end first, this will prevent unraveling while cutting. Use the following procedure:

-Place one inch of tape tightly on the end
-Cleanly cut 1/2 inch from the end of the tape
-Melt end, fusing all strands together

(11) Clean ropes using a mild soap and lukewarm water. Never use a harsh soap or bleach. Dry ropes after washing.

(12) When not in use, ropes should be coiled and can be hung on wooden pegs or plastic hangers, or placed in or on clean storage shelves. Keep ropes away from high temperatures and direct sun.

(13) Ultraviolet radiation (sun light) will deteriorate nylon over a period of time. This becomes important if rope installations are left in place over a number of days, especially at high elevations where UV rays are stronger. Noticeable color fading or a bleached appearance is a good indicator that ultraviolet rays are deteriorating the rope. A stiff feel is another sign of deterioration. This deterioration is not just in appearance but in strength also.

(14) When in areas of loose rock, inspect the rope frequently for cuts, abrasions, or other signs of impact from falling rocks.

(15) Inspect the rope prior to each use for frays, cuts, excessive wear and weak spots. Look and feel along the entire length of the rope. The following is a general guideline for determining serviceability:

(a) Discard if outer sheath is worn, exposing the inner core strands
(b) Discard if smaller cuts are numerous, or there is extensive fraying along the entire rope
(c) Discard if the rope can be pinched, or has a flat spot more than one-half the rope's original diameter (possible core damage)
(d) Discard after a serious leader fall (20ft or more)

NOTE: Strengths kernmantle rope can vary from manufacturer to manufacture. Service life of a climbing rope is a controversial subject. While a given rope might be deemed unsafe for holding a severe fall, it might be regarded as safe to use for rappels or as a hand line in a stream crossing. Try to use common sense. The rule "when in doubt - throw it out" cannot be overemphasized because the climbing rope is your LIFELINE!

Learning Step/Activity 3 – Describe the characteristics of webbing.

a. Webbing. Webbing is constructed in two ways- flat and tubular. Here at the NWTC you will use one inch, 9/16 inch or 11/16 inch nylon tubular webbing. Webbing is more resistant to abrasion that ropes because it is flat. Webbing is also less bulky and is preferred when you need a lot of material. Tubular webbing is stronger due to its double thickness and more flexible than flat webbing of the same diameter. Flat webbing should not be used for climbing.

(1) Material- nylon

(2)Tensile strength 4000 lbs 1inch, 2400 lbs 9/16 or 11/16 inch

(3) Length- spools of various length.

(4) Diameter- 9/16 up to 2 in.

(5) Stretch- 5-15%

Learning Step Activity 4 - Maintain webbing.

a. Care of nylon webbing is the same as for nylon rope, however; the ends of a webbing sling need only to be melted to eliminate fraying. The following general rules apply when determining serviceability of nylon webbing:

(1) Discard if webbing has any cuts.

(2) Discard if a hole wears through either side.

(3) Discard if excessively frayed or faded- again use common sense.

Learning Step/Activity 5 – Describe the characteristics of slings.

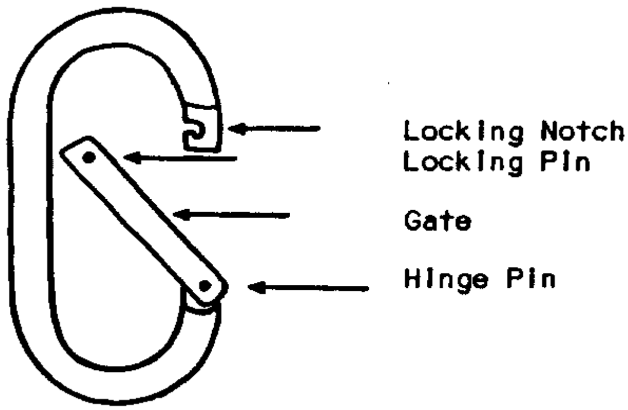
a. ***Slings*** are short lengths (usually between 5 and 30 feet) of rope, cordelette or webbing and have many uses. Sling material is purchased in spools and cut to the desired length. Rope slings can also be made from retired climbing ropes. You have been issued items that are used as slings. You have 16 foot sling ropes, 1 inch tubular nylon webbing of various lengths and cordelette of various lengths.

b. Kernmantle ropes between 5mm and 7mm are called ***cordelette.*** Construction is similar to a static kernmantle rope. Tensile strengths vary but as a general rule of thumb 7mm cordelette has a tensile strength of 2400 pounds. Kernmantle ropes smaller than 4mm are accessory cord and are not to be used for climbing.

(1) An unserviceable length of sling material can be re-used by cutting at the damaged section or removing the damaged section and connecting the “new ends” with the appropriate knot. This adds another knot to the material but recycles it for use again.

(2) While sling material can be cut to any desired length, the standard lengths issued to you will fit most applications in general mountaineering and glacier travel. Remember, these materials and sizes can have numerous applications, not restrictions to these suggested uses.

Learning Step/Activity 6 - Describe the characteristics of carabiners.



a. The term snap link is "military slang" for an item named a carabiner. The carabiner is used as an attachment point to ropes and slings. Specific uses are described in later classes. The parts of the carabiner are:

(1) The spine is the long portion of the carabiner opposite from the gate.
(2) Gate (spring loaded)
(3) Locking Notch
(4) Locking Pin
(5) Hinge Pin
(6) Locking mechanism (locking carabiners only)

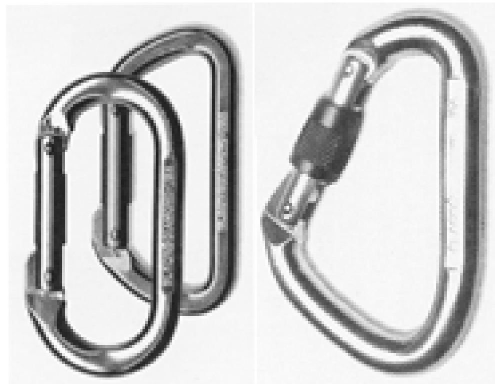
b. ***Steel Oval Carabiner.*** The standard carabiner used by the military since WWII is constructed of steel, is oval in shape, and was originally tested to a "minimum" tensile strength of 2000 lbs. They are heavy, but very durable.

c. ***Aluminum Oval Carabiner.*** Most carabiners on the market today are constructed of aluminum alloys to reduce weight, and have an approximate tensile strength of 4000 lbs with the gate closed. Aluminum carabiners can wear out relatively quick under the high heat generated in long rappels or raising and lowering systems. When many carabiners are needed during a climb, it is much easier to carry a large quantity of “aluminums” (aluminum carabiners) because of the reduced weight.

d. ***Aluminum Locking D Shaped Carabiner.*** While oval-shaped carabiners are still the most versatile, "D" shaped carabiners allow the spine, to absorb more of the load, and are therefore stronger in design. Some carabiners also incorporate a knurled locking sleeve. When in the closed position, the locking sleeve will prevent the gate from opening. Both locking "D" shaped and non-locking "D" shaped carabiners are available. Both have an approximate tensile strength of 5000 lbs (gate closed).

f. ***Aluminum Locking Pearabiner.*** A pear-shaped locking carabiner, often referred to as a "pearabiner" has an approximate tensile strength is 4000 lbs (gate closed).

g. ***Large Steel Locking D-shaped Carabiner*** has a tensile strength of approximately 9000 lbs (gate closed).



Carabiners and Locking Pearabiner

Learning Step/Activity 7 – Maintain carabiners.

a. To inspect the serviceability of any carabiner:

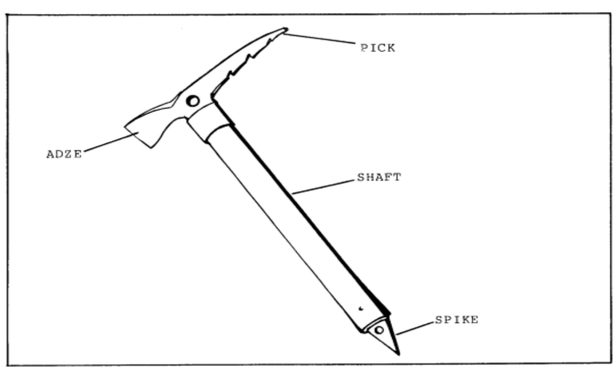
(1) Check for burrs, cracks or bends. Small burrs can be removed with light sandpaper. Large burrs render the carabiner unserviceable as do bends and cracks.

(2) With the gate open, check for side play in the gate. Discard if side play exceeds half the thickness of the carabiner. The weakest part of any carabiner is the gate. Check that the gate opens freely and snaps shut. If lubricant is required, use a very small amount of graphite or vegetable oil. Do not use petroleum based lubricants.

(3) Check the locking pin and notch. If either is missing or deformed, discard the carabiner.

(4) DO NOT mark carabiners with an engraver; this removes a small portion of metal that is used to give the carabiner its rated strength - use colored tape or small dabs of paint on the spine.

Learning Step/Activity 8 – Describe the characteristics of the ice ax.



F

a. All axes have the following characteristics:

(1) Shaft
(2) Spike
(3) Head which has the pick and an adze or a hammer
(4) Pick
(5) Leash – made of 9/16 inch webbing or may be manufactured

b. ***General-purpose Mountaineering or Alpine Ice Ax.*** For years the long 90cm wooden-shaft ice ax was used by the military. Modern axes can be found in many different lengths and head configurations; each design is intended for a more specific use. An ice ax designed for general-purpose mountaineering is best for military operations. Ax head design should feature the standard adze and curved pick. Shaft length should be between 70-80cm. Some of these axes come with a leash from the factory, however, if the ax has a "glide ring," replace this with a full-length leash, it will be stronger and more useful.

c. ***Ice tools.*** These are specialized tools for climbing steep, vertical or overhanging ice, rock or snow. They have a dropped or reverse curve picks that allows for easy penetration of ice or can be used to hook rock edges.

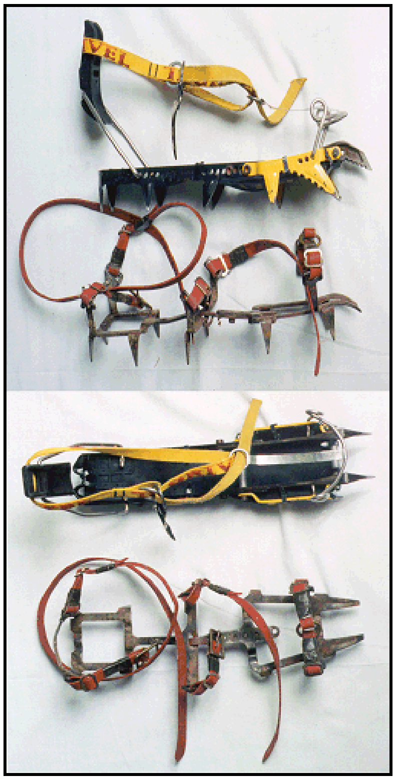
d. A leash made from 9/16 webbing is attached at the hole in the head of the ax. It is tied through this hole. Do not tie the leash over the top of the head. There is a wrist loop at the end of the leash. The bottom of the loop should be at the base of the shaft. A one inch piece of webbing can be used to protect the leash. Simply open the end of the one inch webbing and slide it over the leash.

Learning Step/Activity 9 – Maintain the ice ax.

a. Inspection and Care: The ice axe should be inspected for loose rivets, cracks, burrs, and any other deformities that may impair its strength or function. If any cracks, bends, or loose parts appear on the ice axe, it should be turned in for a new one. A file can be used to remove burrs and sharpen the head and spike. Steel wool can be rubbed on the metal surfaces to remove rust. All points should be kept sharp and covered when not in use.

b. The leash should be inspected like any other webbing.

Learning Step/Activity 10 - Describe the characteristics of crampons.



a. Crampons are devices worn over boots to provide firm footing on ice or hard snow. They consist of light metal frames normally with 10-12 points protruding from the bottom or front.

b. Crampon mounting systems are varied, but all use either a strap system or a clamping system or a combination of both.

(1) The strap mounts are most useful as the boot type or size is of little consequence to the fit.

(2) The clamping system consists of steel bails that fit horizontally into specific grooves in the toe and heel of the mountain boots. These type crampons will have the tightest fit and provide the best precision for vertical ice climbing. With this precise fit come a few limitations: all clamp type crampons do not fit all mountaineering boots without modification and this type crampon will not remain on any boot other than boots manufactured specifically to use this type of crampon.

c. Most crampons used for lower angle snow and ice will mount with a strap system. A double strap system is sometimes used although the single continuous strap is simpler. Nylon or neoprene straps are more common now than the previously used leather straps and tend to stay tighter when wet than do leather straps.

d. Before use, insure boot to crampon fit is perfect. If necessary, adjust the shape of the bails to match the shape of the grooves at the toe and heel of the boots. An incorrect match in this area could result of in loss of a crampon at a critical time. Ensure the strap(s) work correctly before you need to use the crampons. Locate buckles to the outside to prevent snagging on boot/clothing. Trousers should be bloused to prevent catching on crampons.

Learning Step/Activity 11 – Maintain crampons.

a. Inspection and Care: Make sure all straps are in good condition and try to keep them dry as possible. Sharpen dull points with a hand file. Remove any surface rust with vegetable oil and a scrub pad or steel wool.

Learning Step/Activity 12 – Describe the Figure Eight Descender

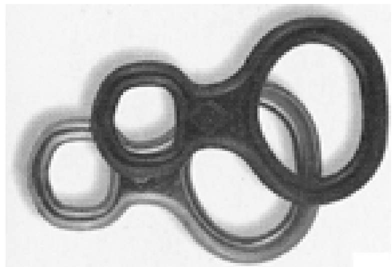
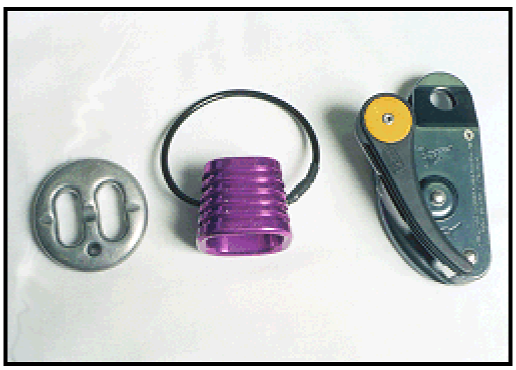


Figure Eight Descender

a. The figure eight is a device, which offers a very safe alternative to the standard military rappel technique (carabiner-wrap). It is especially useful when rappelling on kernmantle rope as this rope type kinks and tangles horribly in the carabiner-wrap rappel. A figure eight can also be used as a very safe mechanical belay device.

Learning Step/Activity 13 – Describe belay devices used in mountaineering.

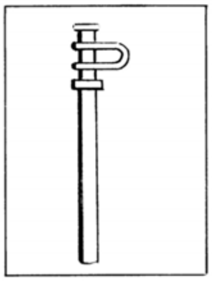


Assorted Tuber Type Belay/Rappel Devices

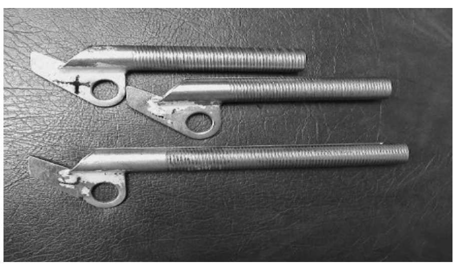
a. Belay devices range from using equipment at hand (carabiner with a Munter Hitch) to high tech metal alloy pieces of equipment. Regardless of the belay device chosen, the basic principal remains the same – friction around or through the belay device controls the rope's movement. Belay devices are divided into three categories: the slot, the tuber, and the mechanical camming device.

1. The slot is a piece of equipment that attaches to a locking carabiner in the harness; a bight of rope slides through the slot and into the carabiner for the belay. The most common slot type belay device is the Sticht plate.
2. The tuber is used exactly like the slot but its shape is more like a cone or tube.
3. The mechanical camming device is a manufactured piece of equipment that attaches to the harness with a locking carabiner. The rope is routed through this device so that when force is applied the rope cams into a position that prevents further movement of the rope.

Learning Step/Activity 14 – Describe the characteristics of ice pitons and snargs.



a. The ice piton is used to establish anchor points. The ice piton is not seen in modern ice climbing but may still be available to the military. The standard ice piton is made of tubular steel and is 10 inches in length. Ice pitons installed in pairs are a bombproof anchor, however, ice pitons have no design feature, such as threads for friction, to hold them in the ice once placed, and are removed easily. Safe use of ice pitons requires placement in pairs. Used singularly, these are a strong anchor but easily removed, decreasing the perceived security of the anchor.



Snarg

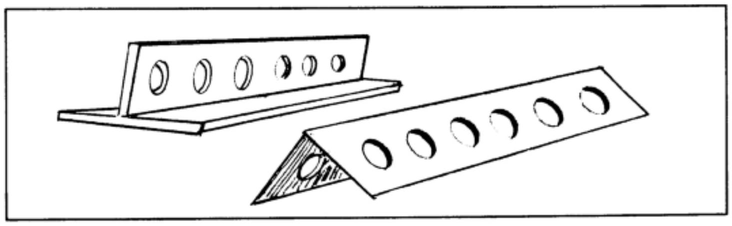
b. Snargs are a combination of both the ice pitons and the ice screws. They are put in the same as an ice piton but removed like an ice screw.

Learning Step/Activity 15 – Describe the characteristics of ice screws.

Ice screws

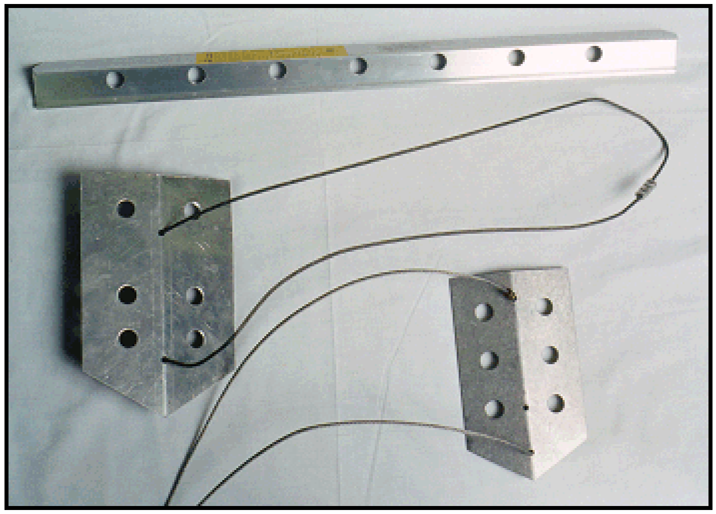
a. Ice screws are similar to ice pitons but have very deep threads spiraling down the outside of the shaft from sharp starter points on the end opposite the "hanger." They come in a variety of lengths and styles. Constructed from steel or titanium, contemporary screws are hollow and are the preferred type. Screws are designed to be turned into the ice by hand or tool. The common length for both types is 8 inches, although some are produced from 4 to 12 inches in length. These odd lengths have limits on usage- the shorter ones are not as strong and the longer screws require thicker ice for proper insertion.

Learning Step/Activity 16 – Describe the characteristics of snow pickets and snow flukes.



e 8-1Ø. Snow pickets.

a. Pickets are stakes made from aluminum angle stock. They are used as snow anchors the same way ice screws are used in ice. Holes are drilled in the pickets for insertion of webbing, rope, or carabiners.



Snow Picket (top) and snow flukes

b. A snow fluke is used as a dead man anchor in snow. It is constructed from an aluminum plate with holes drilled to reduce weight, and looks like a shovel blade. It normally has a wire cable attached. When placed properly the fluke is designed to bury deeper into the snow under load, however, they tend to "pop-out" if they contact a hard layer underneath. They work best in wet, heavy, springtime snow.

Learning Step/Activity 17 – Inspect mountaineering equipment for serviceability.

a. You now have twenty minutes to inspect all of your issued mountaineering equipment. If you find or suspect any deficiencies with your equipment, bring it to my attention.

SECTION IV. SUMMARY

You now have a general understanding of the equipment you may need in a mountain environment. You will learn to use this equipment as the coursed progresses.

Check on Learning.

1. What part of the rope is the mantle?

The sheath of the rope or the outside of the rope.

2. What is the minimum tensile strength of the steel non-locking carabineer (military)?

2000 lbs.

3. How does the soft-iron piton conform to the rocks?

By bending when hammered into the cracks.

4. What can the figure eight descender be used for?

As a rappel or mechanical belay device

SECTION II. INTRODUCTION

Motivator: (Slide 1) In every operation, whether tactical training, combat, or operations other than war, force protection is essential to success. Historically, the U. S. Army has suffered more losses to accidents and non-battle related injuries (including fratricide) than to enemy action while deployed in combat; it appears we are our own worst enemy. Typically, these accidents are the same types experienced in peacetime, during exercises at home, and at combat training centers. If we can learn to recognize the hazards that contribute to accidents, we can avoid or reduce the risks from the hazards.

Composite Risk Management (CRM) is the Army's principle risk-reduction process to help protect the force. CRM is a decision making process used to mitigate risks associated with all hazards that have the potential to injure or kill personnel, damage or destroy equipment, or otherwise impact mission effectiveness.

Terminal Learning Objective (Slide 2)

ACTION	Apply the CRM process and principles to cold weather operations or training
CONDITION	You are a small unit leader, in a training environment, given NWTC Risk Management Guide for Mountain Operations
STANDARD	Apply the CRM process to the given mountain operations scenarios.

Safety Requirements: For classroom training discuss emergency procedures in case of fire or natural disaster.

Risk Assessment: Low

Environmental Considerations: None

Evaluation: You will conduct two practical exercises during this lesson. You are also expected to conduct a thorough risk assessment prior to each outdoor training event. If you fail to conduct two risk assessments you may be removed from training as a safety risk (NWTC Commander's discretion).

Instructional Lead-In: Composite Risk Management (CRM) is everyone's responsibility. The NWTC has produced a pocket guide to allow you to integrate CRM into the planning and execution of any operation, training or off-duty activity. This block of instruction will introduce you to the CRM process and provide instruction on the use of the NWTC Risk Management Guide for Mountain Operations. During this course, you will have repeated opportunities to use the guide and the CRM process as you learn about the hazards associated with mountain operations and the tactics, techniques and procedures to reduce or eliminate these hazards. By the time you leave this course, CRM should be second nature to you.

SECTION III. PRESENTATION

Learning Step/Activity 1- (Slide 3) Identify the principles of Composite Risk Management (CRM).

a. CRM is a decision making process used to mitigate risks associated with all hazards that have the potential to injure or kill personnel, damage or destroy equipment, or otherwise impact mission effectiveness. The guiding principles of CRM are as follows:

(1) Integrate CRM into all phases of missions and operations.
(2) Make risk decisions at the appropriate level. CRM is only effective when the information is passed to the appropriate level of command for decision. Approval authority for risk decision making is based on guidance from higher HQ.
(3) Accept no unnecessary risk.
(4) Apply the CRM process cyclically and continuously.
(5) Do not be risk averse. Identify and control hazards- then complete the mission.

Learning Step/Activity 2 – (Slide 4) Identify the five steps of the CRM process.

a. The composite risk management process is a five step process used to identify and control hazards; risk management applies to any mission and any environment.

(1) Identify the hazards.
(2) Assess hazards.
(3) Develop controls and make risk decisions.
(4) Implement controls.
(5) Supervise and evaluate.

b. NOTE: (Slide 5) Orient students to the contents of the pamphlet. The NWTC Risk Management for Mountain Operations is a pocket guide for CRM that you can use for cold weather training and operations.

Learning Step/Activity 3 – (Slide 6) Identify and assess hazards.

a. METT-TC provides the framework to identify hazards. In a garrison or off-duty environment consider:

(1) Activity (Mission)
(2) Disrupters (Enemy)
(3) Terrain and Weather
(4) People (Troops)
(5) Time
(6) Legal considerations (Civil Considerations)

b. You can also use regulations, accident data, AARs, experience, subject matter experts, training assessments, war-gaming, what-if scenarios, or risk assessment matrices.

c. (Slide 7) Risk levels are low, moderate, high or extremely high. In a moment we will use the Risk Assessment Matrix for Mountain Operations to come up with a score that corresponds to a risk level. This matrix and the corresponding worksheet on pages 8-9, help you to identify and assess the hazards and determine the initial risk level. **Keep in mind that if any individual score for a table indicates a high or extremely high risk, the overall risk level is high or extremely high even if the cumulative score indicates a low or moderate risk.**

d. (Slide 8-9) Use the risk assessment matrix and worksheet on pages 8-9 to identify and assess hazards and get an overall initial risk level for the mission or activity. This matrix allows you to compare different elements of METT-TC in order to come up with a numerical value that you can equate to a risk level. Look at each element of the matrix in detail:

(1) Planning: Compare the amount of time you have to prepare vs. the type of guidance you receive. Circle the corresponding number and write the score in the upper right hand corner. Do the same with each remaining element.

(2) Command and Control: Compare the maneuver element size with the level of mountain experience of the leadership.

(3) Soldier Endurance: Compare the level of environmental preparation of your Soldiers with the fitness level of your Soldiers.

(4) Troop to Task: Compare the complexity of the task with the Soldier experience level (see FM 3-97.61 for levels of military mountaineering).

(5) Weather: Compare the exposure duration to the temperature (consider wind chill).

(6) Terrain: Compare the environmental hazards present with the terrain classification.

(7) Rest and Maintenance: Compare the equipment status to the amount of rest time that has been allotted to Soldiers.

e. (Slide 9) Record all of this information on the risk assessment worksheet and determine the initial risk level. Add the scores up and use the table to determine the initial risk level. **Do not forget the caveat - you can have a cumulative score that gives you a low or moderate risk level, but if you have a single element that is high or extremely high, the initial risk level defaults to that higher level.**

Individual Area	1,2	3,4	5,6	7,8,9
Risk Level	Low Risk	Moderate Risk	High Risk	Extremely High Risk
Cumulative Score	7 to 12	13 to 23	24 to 35	36 to 40

Learning Step/Activity 4 – (Slide 10) Develop controls and make risk decisions.

a. Address WHO, WHAT, WHEN, WHERE and HOW.

(1) Use the NWTC Risk Management Guide for Mountain Operations, Appendix A: Planning Considerations for Mountain Operations and Appendix B: Planning Considerations for Cold Weather Training and Operations to help you develop controls.

(2) Use the example worksheets in Section II of USARAK 385-4. These show you generic examples of some of the training events you will conduct in this course.

b. Reassess the risk after controls are in place.

c. Involve the appropriate level of command based upon the residual risk level. Approval authority guidance is found in USARAK Regulation 350-1.

Risk Level	**Low**	**Moderate**	**High**	**Extremely High**
Who can approve the mission or activity?	**Company Commander**	**Battalion Commander**	**Brigade Commander**	**Commanding General**

Learning Step/Activity 5 – (Slide 11) Implement controls.

a. Ensure controls are converted into clear and simple execution orders.

b. Controls must be understood by all personnel.

Learning Step/Activity 6 – (Slide 11) Supervise and Evaluate.

a. Implement and enforce risk controls to standard. Designate the personnel who will supervise and evaluate controls.

b. Supervise the process – this is also a control measure – DO NOT EXPECT WHAT YOU DO NOT INSPECT.

c. Evaluate and make adjustments as necessary.

Learning Step/Activity 7 – Use DA Form 7566, Composite Risk Management Worksheet to record the CRM process you used for your training or operation.

(Slide 12) DA Form 7566 is the Composite Risk Management Worksheet. It allows you to document the CRM process you have applied to your mission or tasking, make a decision about the overall risk level for the operation and involve the appropriate level of command in approving the operation.

COMPOSITE RISK MANAGEMENT WORKSHEET
For use of this form, see FM 5-19; the proponent agency is TRADOC.

1. MSN/TASK:	2a. DTG BEGIN	2b. DTG END	3. DATE PREPARED *(YYYYMMDD)*

4. PREPARED BY		
a. LAST NAME	b. RANK	c. POSITION

5. SUBTASK	6. HAZARDS	7. INITIAL RISK LEVEL	8. CONTROLS	9. RESIDUAL RISK LEVEL	10. HOW TO IMPLEMENT	11. HOW TO SUPERVISE (WHO)	12. WAS CONTROL EFFECTIVE?

13. OVERALL RISK LEVEL AFTER CONTROLS ARE IMPLEMENTED *(Check one)*

☐ LOW ☐ MODERATE ☐ HIGH ☐ EXTREMELY HIGH

14. RISK DECISION AUTHORITY			
a. LAST NAME	b. RANK	c. DUTY POSITION	d. SIGNATURE

Learning Step/Activity 8 – (Slide 13-15) Identify and assess the hazards and determine the initial risk level for this scenario. Record your results in the risk assessment matrix and worksheet. Be prepared to brief your results. You have ten minutes.

You are a Light Infantry BN rifle platoon leader with a platoon currently at full strength. You have just been tasked by your company commander to prepare your soldiers for an OPFOR mission and have been provided with a detailed OPORD. In 72 hrs. you will depart on foot for training area 4A and prepare a linear ambush. Area 4A is mountainous terrain with several creeks in deep ravines(very steep banks), similar to the environment around your post, Ft. Hayes, AK. There are no roads that support vehicle traffic and the closest LZ/PZ is 13Ks away where Bear creek meets a fire break. You will have 2 hrs. upon arrival to prepare positions. Your route to the ambush site will require you to use the creek bottom as the main avenue of approach. Once you arrive at the ambush site you will need to negotiate the 65 ft., rock/dirt bank of Bear creek to establish your positions. Your unit will be carrying all required equipment/rations to last for three days and you must evacuate all casualties to the pre-determined PZ 13k away. After 72 hrs. at this location you will be extracted by two CH-47s.

You and your PSG have been stationed in Alaska for two years and have both attended a Basic Mountaineering Course. The rest of your platoon is generally new and three other NCOs have limited mountaineering experience. All weapon systems are operational and you do have basic mountaineering equipment. Prior to this mission, your platoon was pulling security for the BN TOC.

The weather over the past week has been generally mild with temperatures in the mid 30s at night and reaching the low 50s during the day. Winds have been generally calm at approximately 10 mph. There has been enough rain to bring the water level up in all creeks/rivers around Ft. Hayes. No more precipitation is expected, however, daytime highs may reach the high 50's and the nighttime lows could drop below freezing

Learning Step/Activity 11 – (Slides 16-18) Apply the CRM process to this scenario. Record your results on DA Form 7566, Composite Risk Management Worksheet. Be prepared to brief your results. You have 15 minutes.

You are the commander of B Company, 2/287 IN and are currently participating in Operation Mountain Warlord, a major NATO exercise in northern Alaska designed to measure your unit's war fighting capabilities in a mountainous environment. Your company completed a road march about 6 hours ago and is now finishing up the last maintenance tasks for the day. The troops did very well on the march, arriving in the new area of operations a full hour ahead of the rest of the battalion. It appears that your pre-exercise training back at Fort Hayes has paid off. You Soldiers have been eating and drinking well, but some appear to be a little run down from the march. It is now 2030 hours. At 2300 (about two hours after racking out), you are awakened by the battalion commander and told that your company must be prepared to move out at 0900. You have been tasked to help 1st battalion secure an airfield 3 km away. He gives you a brief order defining the situation. You will depart on foot and move cross country linking up with 1st Battalion just south of the airfield. While conducting a map recon, you discover a glacier fed stream your company must cross. It appears to be approximately 70 feet wide and the S-2 estimates that it is about 4 feet deep and fast moving. You have all required equipment to conduct a stream crossing except PFD's. You must provide your own food, ammo and other mission essentials. PFDs can be acquired from C Co. 225 EN).
Though you do not relish the tasking, you know your Soldiers have been eager to prove themselves during the exercise and will handle the mission well. You are fortunate that your company is full of highly qualified, basic level mountaineers who have been training in this environment since the beginning of last month. You decide that the Soldiers can sleep until 0500 hours; four hours will be sufficient time to prepare for the mission. The temperature is expected to be 50 degrees by morning, and there is virtually no wind. The terrain from your present location to the airfield is generally rolling with the stream being the only natural obstacle.

SECTION IV. SUMMARY

(Slide 19-20) You are required to develop a written risk assessment for all outdoor training for the rest of this course. You may be called upon by your squad instructor to brief this risk assessment to the squad. This will get you into the habit of assessing risk for all training and operations.

Check on Learning.

1. What are the five steps to the risk management process?

   (1) Identify the hazards.
   (2) Assess hazards.
   (3) Develop controls and make risk decisions.
   (4) Implement controls.
   (5) Supervise and evaluate.

2. For a HIGH risk operation, who must approve the mission?

Brigade Commander

SECTION II. INTRODUCTION

Motivator: You are probably already accustomed to long hard foot marches on flat terrain. Walking in mountain terrain for the first time can make you feel as though you have never done a foot march at all. Efficient movement in mountainous terrain is a combination of physical fitness and correct technique. While physical fitness is important, effective mountain walking will allow you to increases the distance you can cover in a given time period and allows you to arrive at the final objective with the energy to continue with other important tasks.

Terminal Learning Objective

ACTION	Demonstrate mountain walking techniques
CONDITION	In a field environment, given the requirement to move on a route (with 1^{st} through 4^{th} class terrain), individual weapon, helmet, load bearing equipment and a rucksack with not less than 35 pounds
STANDARD	Soldier moved over the designated route to the objective at a pace and rate that allowed him to conduct combat operations at the end of the movement.

Safety Requirements: Ensure that students are properly dressed and equipped prior to conduct of training. Squad leader will conduct a risk assessment with students based upon the current conditions. Squad leader will assign buddy teams. Squad leader is responsible for taking breaks as required.

Risk Assessment: Initial assessment is low. OIC/NCOIC evaluates just prior to movement; dependent upon current weather conditions.

Environmental Considerations: None

Evaluation: You are required to negotiate a route up to the grassy knoll on Gunnysack mountain. You are also required to negotiate routes during the Mountain Stakes portion of testing. You must negotiate terrain during the Alpine FTX. If you are not able to complete any of these exercises, you may be dismissed from the course. You will be tested on your knowledge of mountain walking techniques during a one hour written examination at the conclusion of the course (Refer to training schedule for date/time of exam). You must score a 70% on the written exam. If you fail the written exam, you will be given a second exam after re-training has been conducted. If you fail this second examination, you will be dismissed from the course.

Instructional Lead-In: You will often move on foot in the mountains. Weather and terrain often preclude the use of wheeled vehicles or aviation assets. Techniques you use on flat ground to road march do not translate to the mountains; using flat ground techniques can render a you and your unit non-mission capable upon arrival at an objective. In this block of instruction, you will learn some basic movement techniques that will allow you to arrive at your objective fit to fight.

SECTION III. PRESENTATION

Learning Step/Activity 1 – Pack a ruck sack for mountainous terrain.

a. The first thing you must understand is that the optimal total load for a person has been determined to be 30% of his body weight. This translates to about a 50 lb. load for an average-sized person. The maximum load should not exceed 45% of the body weight, or about 70 lbs. for the average individual. This is often difficult to achieve for an extended mission in the mountains and planners must consider ways to reduce the load, by utilizing ammunition, food and fuel re-supply points on movement routes. If you carry excessive loads you will not be effective after long movements. You may need to assume some degree of risk, by electing to leave behind some equipment.

b. There are a few tricks to packing and carrying a heavy pack that will make life a bit easier during movement. First, pack "like items" together in separate nylon stuff sacks or plastic bags. Extra clothing is packed in one sack, food in another sack, mountaineering equipment in another, and so forth. Pack the lighter sacks in the bottom half of the pack. Place the heavier items in the upper half of the pack and towards the frame side where they will be closest to the body. If the pack has compression straps, snug them up tight to reduce the bulk of the pack and to keep the weight as close to the body as possible.

c. Hanging equipment on the outside of the pack is a very poor practice. Heavier items can be felt swinging with each step. Items will snag on brush, make excessive noise, and may break or be lost in a tumble. When rock climbing, they will get caught on nubbins and in cracks and cause a loss of balance or a fall. Try to keep all items inside the pack until needed. Obviously, items like a machine gun tripod or the ice ax will usually be carried on the outside of the pack. Attach them in a secure manner where they will be least likely to create problems on the move.

d. Carry the load on the hips and legs, not the shoulders. Tighten the waist-strap to a “very” snug fit, just above the bony portion of the hips. The pack should remain in place on the pelvic area without any help from the shoulder straps. Tighten the shoulder straps so the pack is snug against the body.

e. Carrying a weapon. Attach the sling to the rear sling swivel and the slip ring (where the hand guards attach to the receiver). Hang the weapon over your neck and firing side shoulder, muzzle down. The weapon can be placed behind the canteen on the firing side hip to keep it out of the way while using ski poles. Or attach the sling at the slip ring and the small of the butt stock and hang in the same manner. Another method is by use of a “three point sling” available commercially.

Learning Step/Activity 2 – Show students different slope types in snow free mountainous terrain.

a. There are 4 different types of slopes found in mountainous terrain

(1) Hard Packed Slopes: Hard pack is considered earth which will not give way under your weight. It usually consists of packed dirt or sand and may contain scattered rocks and vegetation.

(2) Grassy Slopes: A grassy slope is seldom covered with a smooth carpet of grass. It normally is made up of small, grassy clumps, known as tussocks.

(3) Talus Slopes: Rock fall from peaks, ridges and cliff bands is often canalized onto the lower slopes in large "fields", referred to as talus. A talus field is made up of rocks which usually do not move under your weight. Rock sizes may range from small, all the way up to large boulders.

(4) Scree Slopes: Slopes comprised of the smallest rocks are called scree slopes. Scree varies in size from the smallest gravel to about the size of a man's fist. Like the larger talus, scree normally collects at the bases of ridges and cliff bands. The rocks that make up a scree field are generally uniform in size and act like sand or loose snow underfoot.

Learning Step/Activity 3 – Demonstrate use of an ice axe in snow free mountainous terrain.

a. On the pack. If the ice ax is not being used at all, it should be carried on or in the pack with the head down, and well secured.

b. On a good trail. Grasp the shaft at the balance point, with the spike forward and the head to the rear with the pick down. This prevents the man behind from accidentally running into the spike, and the pick is less likely to do you harm in a fall.

c. On rough terrain. The ice ax may be used as a third point of contact in difficult terrain. When the footing is poor, you can use the ax for a cane. Always carry the ax in the uphill hand. Grasp the ax by the head with the pick to the rear.

Learning Step/Activity 4 – Demonstrate mountain walking techniques.

a. On the ascent:

(1) Center your weight directly over your feet. This position provides maximum balance and support for the load. It also maintains stability between the foot and the slope. The chance of the foot slipping or the ground surface giving way underfoot is reduced.

(2) Place your feet flat on the ground to obtain as much boot, (sole), ground contact as possible. Along with correct weight distribution, this "flat-foot" technique places the workload on the larger thigh muscles and prevents the lower leg muscles (calves) from overworking.

(3) Lock your trail or downhill knee after each step. This technique, called the "rest-step", allows body weight, and your load, to be supported by the leg bones of the trail leg. The leg muscles get a momentary rest which, though brief in duration, greatly reduces energy expenditure over the long haul. You also momentarily rest the muscles of the uphill leg, before they contract to take the next step up.

b. The descent is where the majority of all mountaineering accidents occur. On the descent, it is easy to let your desire to get down take over, leading to improper technique, which could cause falls and injuries. The majority of knee and ankle injuries are caused as body weight and load drop abruptly on the knee and ankle joints. On the descent:

(1) You must control your rate of descent to prevent injuries and falls. Keep your upper body erect to maintain balance. Keep your knees flexed to absorb shock. On gentle to moderate terrain, descent is directly down the fall line. On steep slopes it is often best to traverse in order to keep from building too much speed.

(2) The foot tends to jam forward into the toe of the boot creating “hot spots” and blisters. Tighten the boot laces prior to the descent to help keep the foot in place. It is also a good idea to change socks prior to a long descent. An additional pair of socks may be used for increased cushioning and to help prevent the foot from sliding around in the boot.

c. Most of the mountain walking techniques described are designed to minimize a common mountaineering hazard – rock fall. During training, if a rock is kicked loose, or rocks let loose from upper slopes, the warning “ROCK” should be shouted and repeated by everyone. If you are within a few feet of protective cover, get behind it and protect the face and head. If directly below steep cliffs, DO NOT look up. Immediately lean into the rock, again, protecting the face and head as much as possible. Lacking any cover, try to anticipate which way the rock will go and move right or left of its path. DO NOT run away downhill. If you are directly in the path of rock fall, and don’t have time to get out of the way, minimize your exposure by lying flat on the ground, protecting your face and head. What might have been a “direct hit” could miss you entirely if you hit the ground quickly.

Learning Step/Activity 5 – Demonstrate march discipline in snow free mountainous terrain.

a. March discipline in the mountains is the skillful control of pace and rest. The proper pace is a complex equation between your conditioning, your load, the distance to be traveled, and the time available to complete the mission.

(1) The most common mistake of the beginner is walking too fast for the two components of the body that control pace - you can only go as fast as your legs and lungs allow. When either component is overtaxed, a slowdown is required.

(2) Start off slowly to warm up. Allow your body to become gradually aware of the demands being placed on it, until the familiar second wind takes over. Take a short break or shakedown rest, 15-20 minutes after starting the movement to allow everyone to adjust clothing and equipment.

(3) Set a tempo, or number of steps per minute, that the entire group can maintain. Soldiers should try to maintain this tempo and compensate for changes of slope or terrain by adjusting the length of stride, similar to an automobile driver downshifting gears to maintain engine RPMs when he starts up a hill. Physical differences, of course, mean that the tempos of two people exerting similar effort will not necessarily move at the same speed.

(4) Tempo, pace, and rhythm are also enhanced when an interval of 3-5 paces is kept between individuals, tactical situation permitting. This interval will help to lessen the "accordion" effect of people at the end of the file constantly having to stop and start, sapping valuable energy.

(5) Take rests once every 1.5-2 hours. Rests should be no longer than 10-15 minutes in length. When the proper pace is set, the need for breaks decreases, the chance of over-heating is reduced, and a group can cover a given distance in a shorter overall time than if it had set a faster pace. During the early part of the day, rests should be infrequent and short. Train Soldiers to remove the heavy pack during short breaks to rest the legs; remain standing so leg muscles don't have a chance to tighten up.

(6) Walking above other individuals of a group can expose those individuals to rock fall generated by your movement. Close order movement can minimize this hazard by preventing any rocks that are dislodged from picking up much speed before they reach the next individual. Dislodging rocks is more likely on the descent and the same safety measures are taken as on the ascent; close order movement with no one descending directly above or below another in a traverse.

Learning Step/Activity 6 – Demonstrate techniques for moving on hard pack and/or grassy slopes.

a. On gentle portions of the slope, the individual can walk straight up the hill.

b. As the slope angle increases, use a "herringbone step" to maintain balance and the flat-foot technique. The toes are pointed outward while movement is straight up.

c. On the steepest slopes, use a "switch back" or traverse technique. The steep angle of the slope is reduced by traversing the slope in a "zigzag" pattern. The ankles can be rolled downhill to maintain good sole-ground contact. This can sometimes strain the ankle joints, especially if the individual is carrying a heavy load. Alternatively, point the uphill foot in the direction of travel and the downhill foot at a comfortable downhill angle to maintain the flat-foot technique. The ice ax can be used in the cane position on the uphill side to assist with balance.

d. When changing direction during a traverse, a loss of balance may occur if the legs are crossed. To avoid this, step off with the uphill foot when changing directions. Maintain balance by keeping the weight centered over the feet. Avoid the natural tendency to lean into the slope. The ice ax can be used in the port-arms, or cross body, position, with the spike on the uphill side, as a third point of contact to help maintain the center of balance.

e. Step around or over obstacles in the path, such as fallen timber and boulders, rather than on top of them. Stepping onto and off of objects increases the workload on the legs.

f. Techniques for ascending and descending a grassy slope are the same as for hard pack. Tussocks can be bypassed or used as "steps" during the ascent. Step on the uphill side of each tussock where the underlying earth and tussock will support your weight.

Learning Step/Activity 7 – Demonstrate techniques for moving on scree slopes.

a. The rocks on a scree slope tend to break away from the slope in small, minor slides with each step. Ascending scree can be very tiring and is usually avoided. A scree field is often traversed to get to a more stable slope. Steps often have to be kicked into scree to create a more stable platform for the feet. If additional switchbacks are made, personnel should stay close together and the entire group should complete a traverse before starting another. The ice ax can be very beneficial as a third point of contact on scree. Again, it is used in the "port-arms" position, with the spike on the uphill side to help maintain balance.

b. Scree fields often make the best routes of descent. If the slope is steep enough, "screeing" is a technique which is both timesaving and energy efficient. Screeing is like skiing, or glissading on snow. The feet are shuffled along allowing the small rocks to break away and pile up underfoot. The individual tries to keep his momentum going and "ride" the descending rock pile in a standing glissade position. The ice ax can be a big help here in maintaining balance when the feet want to come out from underneath you. Again, use it in the port-arms position with the spike on the uphill side. The minor rockslides that develop from screeing are usually not much of a hazard as long as personnel stay close together, one right behind another. Ensure that the bottom of the slope is visible and no hazards exist.

Learning Step/Activity 8 – Demonstrate techniques for moving on talus slopes.

a. Generally talus is a fairly easy ascent route. The rocks can be used like a staircase. Pick out rocks with the smoothest tops and step on the uphill sides to avoid kicking them loose. Sometimes larger rocks are held in place by smaller "key stones". Dislodging one of these key stones may tip the balance causing the larger rocks to break loose, possibly creating a dangerous rock slide. Be aware of this potential hazard and avoid talus fields that feel unstable underfoot. When ascending, keep personnel at close order, one right behind another. Rocks that are dislodged can be halted or directed away by the group before they have a chance to build up speed and momentum. When traversing, allow all personnel to complete a switchback before starting another. This prevents personnel at the head of the group from climbing directly above trailing individuals, who would otherwise be in the direct path of any rocks kicked loose by those above. Talus slopes must be descended with caution. The force placed on the rocks by the individual will be much greater during the descent, increasing the likelihood of rock fall. Descent should be slowed and steps taken very carefully. Large talus fields are normally avoided for the descent.

Learning Activity/Step 9 – Select routes for individual and small unit movement.

a. Route selection involves locating a route within the limitations of the party. Along with hazard evaluation, it is a very important skill in mountain terrain. Route selection is based on:

(1) The easiest terrain should be selected when the enemy threat is low. More difficult terrain may be the optimum choice when the enemy threat is high, because it will be the route with the least enemy direct/indirect coverage (making the assumption that the enemy has left it relatively unprotected due to the difficult nature of the terrain). Map reconnaissance may give some insight, but in general, actual route reconnaissance is preferred as mountain terrain is difficult to appreciate from

a map. A suitable route on a map may have obstacles that are non-negotiable in actuality. Consider the type of terrain, the condition of personnel (level of mountain training, experience and fitness), the size of unit that the route will be able to support (usually smaller self-sufficient units on multiple routes is preferable to a large unit on a major avenue of approach). Re-supply and casualty evacuation must also be considered. Air insertion should never be the only method of infiltration/exfiltration, re-supply and medical evacuation. Weather and objective hazards along the route also need to be considered.

Learning Activity/Step 10 – Develop a physical training plan for mountain operations.

a. Sustained training with far less than maximum loads is a proven contributor to combat readiness. The idea that training with heavier loads somehow will increase a Soldier's combat readiness is as silly as thinking that bleeding during training will increase his ability to withstand battlefield wounds. Train with 35-50 pounds maximum. In general, the Army PT program and the road march standard of 12 miles in 3 hours DOES NOT translate well to mountain operations. Soldiers need to move up and down difficult terrain with moderate loads to become accustomed to moving in mountainous terrain. This includes developing balance, confidence, and muscular endurance that allows Soldiers to get to the objective with enough energy to execute the mission. Weight training is also important to strengthen tendons, ligaments and muscles in order to prevent injury.

b. Operating in the mountains is undoubtedly one of the most demanding activities, both mentally and physically, that the average Soldier ever engages in. Add altitude to the mountain equation and you have the strong possibility of losing combat power to environmental injuries. Any physical activity is most easily performed by a body in good condition from frequent exercise. The best exercise for getting in shape for mountain travel is mountain travel itself. Frequent training exercises in the mountains will strengthen the leg muscles and develop stamina, while at the same time reinforce correct mountain walking technique. From a physical fitness standpoint, training in the mountains often cannot be performed frequently enough to gain any real benefit from the exercise. In such cases, a training program should be implemented that emphasizes development of leg muscles and cardiovascular endurance. The muscles that are most important to climbing are those of the legs, which carry the load and take the pounding. The thigh muscles (quadriceps) and hamstrings are the ones that will be worked the most.

c. Training should concentrate on developing strength in these upper leg muscles. Good exercises for this are squats, the leg press, deadlifts, lunges, knee benders, and walking up and down flights of stairs or using *stairmaster* type exercise machines. Running, bicycling, and jumping rope not only work the legs, but also build stamina required for mountain travel. Any aerobic type exercise is beneficial for increasing endurance. Swimming is excellent, however it must be performed along with exercises that toughen the leg muscles for the loads and the pounding.

d. Of secondary importance is strengthening of the upper body. When the pack is fitted and worn correctly, the weight will be on the hips, but shouldering a heavy pack, steep rock and ice climbing, and movement on various rope installations all require a certain degree of arm and hand strength. Exercises should emphasize pulling exercises for developing the arm and back muscles used most in climbing. Core body exercises are also important as the climbing becomes more technical. A few pushing exercises should be chosen to balance the overall training program.

e. Two sample physical training programs are listed below; one for a unit with six months to train, one for a unit with three months to train. It gives an idea of the level of fitness that Soldiers operating in the mountains should strive for. The Army PT program provides a good base for Soldiers, but it is the mountain specific training outlined in this program that will be a combat multiplier when operating in mountainous terrain. Units with other pre-deployment demands should make every effort to meet the guidelines outlined in this training program. It should also be noted that upon deployment this training should not stop. Squad and team leaders may need to become creative with training, but there should be ample time in a day to find time to fit in mountain specific physical training.

f. Six month program:

(1) Month 1:
(a) Aerobic training 4 day per week – 30 minutes per session minimum
(b) Strength training 3 days per week – focus on large muscle movements for arms, shoulders, back, legs and abdominals. Larger muscle movements such as squats, lunges, rows and dead lifts are excellent exercises. Three sets per exercise, 8-15 reps per set. Aim for muscle failure in third set.

Aerobic training should focus on running or road marches preferably on hilly terrain. Rucksacks should weigh no more than 50 pounds. Ski and/or snowshoe movements are also appropriate.

(2) Month 2:
(a) Aerobic training 4 days per week – 40 minutes per session minimum
(b) Strength training 3 days per week - same focus as month 1.

(3) Month 3:
(a) Aerobic training 5 days per week – 45 minutes per session minimum; include at least 2 hill climbs per week
(b) Strength training 4 days per week – same focus ; add one day

(4) Month 4:
(a) Aerobic training 5 days per week – 50 minutes per session minimum; include three hill climbs per week, focus on long movements in hilly terrain with a 50 pound rucksack. Begin to conduct long movements (2-6 hours) over rough or hilly terrain.
(b) Strength training – 4 days per week; three sets per exercise, increase weight and decrease repetitions.

(5) Month 5:
(a) Aerobic training 5 days per week – one hour per session minimum; long movements with a 50 pound rucksack should become the norm (up to eight hours of movement)
(b) Strength training 4 days per week – same focus

(6) Month 6:
(a) Aerobic training 5 days per week – one hour per session minimum; continue with long movements
(b) Strength training 4 days per week – shift all strength training to less weight, higher repetitions and avoid going to failure.

g. Three month program:

(1) Month 1:
(a) Aerobic training 4 days per week – 45 minutes per session minimum. Aerobic training should focus on running or road marches preferably on hilly terrain. Rucksacks should weigh no more than 50 pounds. Ski and/or snowshoe movements are also appropriate.
(b) Strength training 3 days per week - focus on large muscle movements for arms, shoulders, back, legs and abdominals. Larger muscle movements such as squats, lunges, rows and dead lifts are excellent exercises. Three sets per exercise, 8-15 reps per set. Aim for muscle failure in third set.

(2) Month 2:
(a) Aerobic training 5 days per week - 50 minutes per session minimum; include three hill climbs per week, focus on long movements in hilly terrain with a 50 pound rucksack. Begin to conduct long movements (2-6 hours) over rough or hilly terrain.
(b) Strength training – 4 days per week; three sets per exercise, increase weight and decrease repetitions.

(3) Month 3:

(a) Aerobic training 5 days per week – one hour per session minimum; continue with long movements

(b) Strength training 4 days per week – shift all strength training to less weight, higher repetitions and avoid going to failure.

SECTION IV. SUMMARY

You now have the fundamental skills required to move efficiently in mountain terrain. You probably also have a better appreciation for the type of fitness and mindset required to move day after day during mountain operations.

Check on Learning.

1. What are the three fundamentals of mountain walking?
Maximum foot to ground contact, weight centered over the feet and the rest step.

2. What slope type should be avoided during a descent?
Talus slopes

3. What type of slope should be avoided for an ascent?
Scree slopes

SECTION II. INTRODUCTION

Motivator: During your class on mountaineering equipment, you probably had questions as to how use the equipment. All of these uses require that you tie knots. This next block of instruction focuses on knot tying and is the foundation for much of the remainder of activities in this course.

Terminal Learning Objective

ACTION	Tie knots common to military mountaineering
CONDITION	Given a climbing rope and adequate sling material
STANDARD	Soldier - tied each knot IAW the student/instructor evaluation plan. - constructed mountain coil IAW the student/instructor evaluation plan. - constructed a butterfly coil in carry configuration IAW the student/instructor evaluation plan. - met all critical performance measures IAW the student/instructor evaluation plan

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training.

Risk Assessment: Low

Environmental Considerations: None

Evaluation: You will be tested on all knots presented in this lesson. You have two minutes to tie each knot given. You must tie all knots IAW the student evaluation plan. If you fail to tie a knot correctly you will receive a NO-GO. You will be counseled and receive retraining. After re-training you will be given a second opportunity to re-test. If you fail to tie the same knot(s) correctly a second time, you will receive a NO-GO and you will be dismissed from the course. You will have ten minutes to construct the mountain coil and ten minutes to construct the butterfly coil in carry configuration IAW the student evaluation plan. If you fail to construct either of these coils to standard you will receive a NO-GO. You will be counseled and receive retraining. After re-training you will be given a second opportunity to re-test. If you fail to construct the coil(s) correctly a second time you will you will receive a NO-GO and you will be dismissed from the course. Refer to the student evaluation plan for specific performance measures.

Instructional Lead-In: You have already learned about the characteristics, care and maintenance of mountaineering equipment. You now have the opportunity to put the ropes and sling material to use by tying knots and constructing coils.

SECTION III. PRESENTATION

Learning Step/Activity 1 – Demonstrate the eleven rope terms fundamental to knot tying.

a. There are eleven rope terms that you should be familiar with. They develop a common language so that knots and coils are easier to explain.

(1) **Bight**-a simple bend in the rope in which the rope does not cross itself.
(2) **Loop**-a simple bend in the rope in which the rope does cross itself.
(3) **Half Hitch**- a loop which runs around an object in such a manner as to lock on itself.
(4) **Static End**- the end of the rope that is tied off or rigged to an anchor.
(5) **Standing Part**- includes all the remaining rope that is not tied off or attached to the anchor point.
(6) **Working end**-the end of the rope that is being utilized.
(7) **Running End**- the free end of the rope that is not rigged.
(8) **Stacking or flaking the rope**- laying the rope out in a loose pile in preparation for use
(9) **Round Turn**- two wraps of a rope around an object create a single round turn. Both ends of the rope exit a round turn in the same direction. The number of round turns you have is always one less than the number of rope parts you see encircling the object.
(10) **Dressing a knot**- arranging the parts of a knot so that all unnecessary twists and kinks are taken out and all the rope parts are properly aligned. A finished knot will have a minimum tail length of 4 inches and a maximum tail length of 12 inches unless otherwise noted.
(11) **Setting a knot**- tightening the parts of a knot so that all remaining slack is taken out and all the rope parts make contact and create friction. To be properly set, no more than ¼ inch slack can be pulled from the knot. The knot is operational after it has been set.

Learning Step/Activity 2 – Tie an overhand knot.

a. The overhand knot is a **special purpose knot**, used to secure the ends of knots.

b. Steps:
(1) With a running end in each hand, put the right over the left to form a loop
(2) Now bring 1 running end thru the loop
(3) Dress and set the knot <u>(As in tying your shoe)</u>

c. The checkpoints of the overhand knot are:
(1)Single overhand knot
(2) Standing parts exit the knot opposite one another

Learning Step/Activity 3 – Tie an overhand loop knot.

a. The over hand loop is **a special purpose knot** that can be used for steps in long prusiks or to construct “aiders”, (webbing ladders); gives an attachment point for raising moderate loads.

b. Steps are the same as the overhand except now you start with a bight of rope. After dressing and setting the rope parts run parallel to one another.

c. Checkpoints are:
(1) Overhand knot on a doubled rope forming a fixed loop.

Learning Step/Activity 4 – Tie a water knot. (JOINING KNOT)

a. The water knot is used to attach two webbing ends. It is also known as a ring bend, overhand retrace or tape knot. Set this knot with body weight. This knot can work loose over time under continued use, check it often.

NOTE: For testing purposes this knot is tied around the rope of the rope corral.

b. Steps:
NOTE: SGL explain the ‘clean and dirty sides’ of webbing
(1) Tie an overhand knot in one of the ends.
(2) Feed the other end back through the knot, following the path of the first overhand knot in reverse.
(3) Draw tight and pull all of the slack out of the knot. The remaining tails must extend at least 4 inches beyond the knot in both directions.

c. Checkpoints are:
(1) There are two overhand knots, one retracing the other.

(2) There is no slack in the knot, and the working ends come out of the knot in the opposite directions.
(3) Ends of the knot are at least 4 inches long.
(4) Knot is properly dressed and set.

Learning Step Activity 5 – Tie a square knot. (JOINING KNOT)

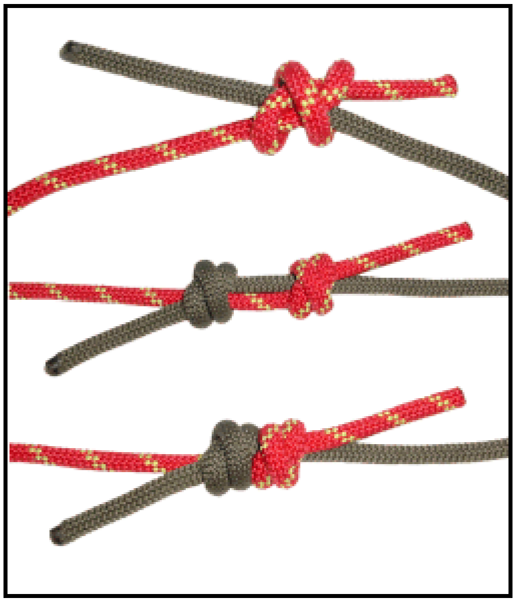
a. The square knot is used to tie the ends of two ropes of equal diameter together. It should be secured with an overhand knot on both sides of the square knot.

NOTE: For testing purposes this knot is tied around the rope of the rope corral.

b. Steps:
(1) Holding one working end in each hand, place the running end in the right hand over the one in the left hand.
(2) Pull it under and back over the top of the rope in the left hand.
(3) Place the running end in the left hand over the one in the right hand and repeat Step 2.
(4) Dress the knot down and secure it with an overhand knot on each side of the square knot.

c. Checkpoints of the square knot are:
(1) There are two interlocking bights.
(2) The running end and standing part are on the same side of the bight formed by the other rope.
(3) The running ends are parallel to and on the same side of the two standing parts.
(4) Ends of knot on same side of standing parts.
(5) Ends of knot secured with overhand knots.
(6) Ends of completed knot are at least 4” long.
(7) Knot is properly dressed and set.

Learning Step Activity 6 – Tie a double fisherman's knot (JOINING KNOT)



a. The double fisherman knot (also called double English or grapevine) is used to tie the ends of equal or unequal diameter ropes together. The double fisherman's knot is preferable for tying sling ropes into runners, as it is more secure than the square knot. The double fisherman is the most secure end of rope knot that NWTC instructs.

NOTE: For testing purposes this knot is tied around the rope of the rope corral.

b. Steps:

(1) Take the running ends and place one on top of the other so that they are parallel to each other with 12 inches on each end, with left index finger pointing to the right on top of both rope parts.

(2) With the right hand take the right running end and bring towards body, wrapping over finger and continuing under back towards body forming a half hitch and continuing with another wrap towards knuckle. Secure running end with thumb.

(3) With thumb and index finger of right hand secure the all parts of rope, then carefully remove the left index finger and insert the running end thru the loops going from left to right.

(4) Secure the knot and all rope parts with the left hand, then with right hand grasp the running end and set the knot.

(5) Rotate 180 degrees, and then repeat steps 1-4.

c. Checkpoints of the double fisherman knot are:

(1)Two double overhand knots securing each other as the standing parts of the rope are pulled apart.

(2) Four rope parts on one side of knot form two "X" patterns; four rope parts on the other side of knot are parallel.

(3) Ends of knot exit knot opposite each other.

(4) Ends of completed knot are at least 4" long.

(5) Knot is properly dressed and set.

Learning Step Activity 7 – Tie a figure eight bend (JOINING KNOT)

a. The figure-eight bend is used to join the ends of two rope parts of equal or unequal diameter within 5-mm difference.

b. Steps:

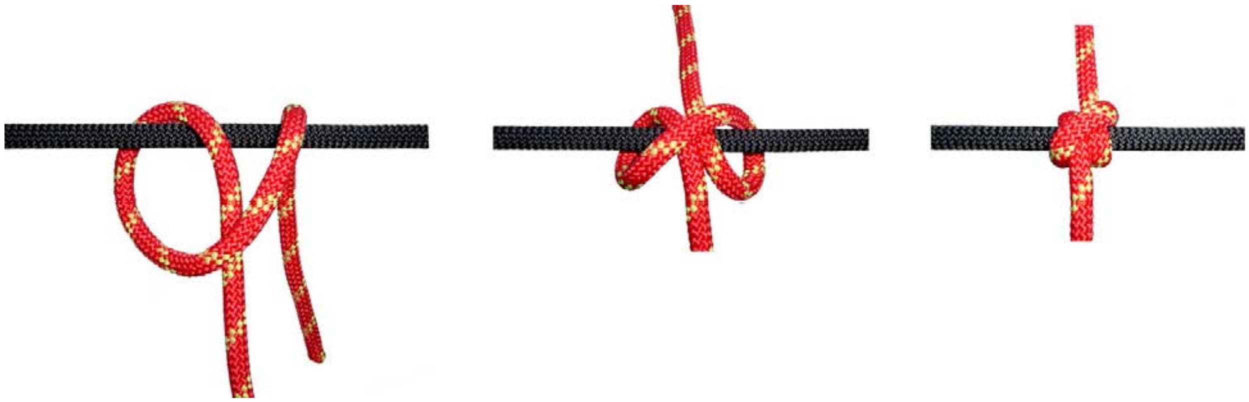
(1) Grasp the top of a 2 foot bight.
(2) With the other hand, grasp the running end (short end) and make a 360-degree turn around the standing end.
(3) Place the running end through the loop just formed creating an in-line figure-eight.
(4) Route the running end of the other rope back through the figure eight starting from the original rope's static end.
(5) Remove all unnecessary twists and crossovers. Dress the knot down.

c. Checkpoints of this knot are:

(1) There is a figure eight with two ropes running side by side.
(2) The running ends are on opposite sides of the knot.
(3) Ends of completed knot are at least 4" long.
(4) Knot is properly dressed and set.

Learning Step Activity 8 – Tie a clove hitch (ANCHOR KNOT)

End of rope clove hitch



Middle of the rope clove hitch

a. The clove hitch is an adjustable anchor knot that can be used in the middle of the rope as well as the end. The hitch must have constant tension on it once is tied to prevent slipping. It is easily adjusted and does not use a lot of rope.

NOTE: For testing purposes this knot is tied around the rope of the rope corral.

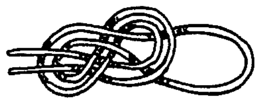
NOTE: If this hitch is tied at the end of a rope (less than 18 inches from the end) it must be secured with a bowline tied to standard.

b. End of rope clove hitch (around the rope corral):
(1) Throw a part of the rope over the rope corral (or around the object to receive the clove hitch)
(2) With your right hand going on the right side of the rope and under the rope corral grasp the other rope part and bring it back towards your body
(3) Going over the standing part of rope from right to left and then back over the rope corral
(4) With left hand going on left side and under the rope corral, grasp the rope part and then bring it up thru the locking bar and then back over the rope corral
(5) Dress and set the hitch.

c. Middle of the rope clove hitch (insert into a carabiner):
(1) Form a loop with your left hand and form a loop with your right hand, so that you have 2 loops. One loop will have the standing part towards you and the other loop will have it away from you.
(2) Take the one that the standing part is away and place it in front of the other loop and then place both loops on a carabiner.
(3) Dress and set the hitch.

d. Checkpoints of the clove hitch are:
(1) The knot has two round turns around the anchor with a diagonal locking bar.
(2) The locking bar is facing 90 degrees from the direction of pull.
(3) The ends exit 180 degrees from each other.
(4) Knot is properly dressed and set.

Learning Step Activity 9 – Tie a figure-eight loop knot. (ANCHOR KNOT)



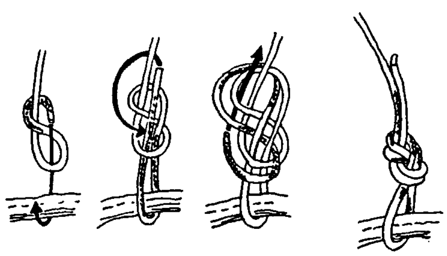
a. The figure-eight loop, also called a figure-eight on a bight, is used to form a fixed loop in a rope. This knot is very strong and can be tied in the end or in the middle of the rope. Finish with an overhand knot if the eight is used at the rope end.

b. Steps:
(1) Form a bight in the middle of the rope about as large as the diameter of the desired loop.
(2) With the bight as the working end, form a loop in the rope (standing part).
(3) Wrap the working end around the standing part 360 degrees and feed the working end through the loop. Dress the knot tightly.

c. Checkpoints for the figure eight loop are:
(1) The loop is the desired size.
(2) A distinct figure-eight pattern on double rope forms a fixed loop.
(3) The ropes of the figure-eight pattern are parallel and do not cross over each other.
(4) End of knot is at least 4" long; overhand safety used if tied at the end of rope
(5) Knot is properly dressed and set.

Learning Step Activity 10 – Tie a figure-eight retrace knot (Re-woven Figure Eight Knot) (ANCHOR KNOT)

NOTE: For testing purposes this knot is tied around the rope of the rope corral.



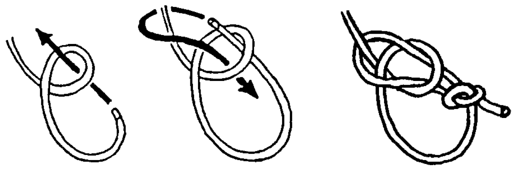
a. The figure eight retrace knot produces the same result as the figure eight loop. However, by tying the knot in retrace, it can be tied around an object. **Finish the figure-eight retrace with an overhand knot.**

b. Steps:
(1) Use a length of rope long enough to go around the anchor, leaving enough rope to work with.
(2) Tie a figure-eight in the standing part of the rope, leaving enough rope to go around the anchor. To tie a figure-eight, form a loop in the rope, wrap the working end around the standing part and route the working end through the loop. Dress the figure-eight down.
(3) Take the working end around the anchor.
(4) With the working end, insert the rope back through the loop of the figure-eight in reverse.
(5) Keep the original figure eight as the outside rope and retrace the original figure eight with the working end back to the long standing part.
(6) Dress and set the knot.
(7) Secure the knot with an overhand around the standing portion of the rope.

c. Checkpoints for the figure eight loop are:
(1) A figure-eight on a doubled rope running side by side, forming a fixed loop around an object.
(2) Secured by an overhand knot
(3) End is at least 4 inches long.
(4) Knot is properly dressed and set.

Learning Step Activity 11 – Tie a bowline knot (ANCHOR KNOT)

NOTE: For testing purposes this knot is tied around the rope of the rope corral.



a. The bowline is used to tie the end of a rope to an anchor (object) or to tie a fixed loop in the end of a rope. Advantages are the size of the fixed loop is easily adjusted and it is easily untied after loading. A possible disadvantage is when a single bowline is constantly weighted and unweighted, it tends to work itself loose and may turn into a slip knot or come untied when loaded again later. Finish the bowline with an overhand knot.

b. Steps:

(1) With app 1 arms length of rope, drape the rope in your left hand so that the arms length is going towards the left

(2) Grasp the rope with both hands with the palms facing each other.

(3) Make a loop with your right hand so that the standing part of rope is on top

(4) Now go down through that loop with your right hand and grasp the standing part of rope, then bring the standing part back thru the loop so that the standing part is away from the body

(5) Now with your left hand, take the running end from left to right to form a bight, through the bight that was formed in your right hand

(6) Grasp the rope parts with your left hand and with your right hand pull the standing part of rope so that the knot will start to dress itself

(7) Put the knot in your left hand and pull all rope parts individually to properly set the knot

(8) Secure the rope part on the inside with an overhand knot to the rope part that is parallel to that rope part.

c. Checkpoints of the bowline are:

(1) Loop locked in place by a bight.

(2) End of knot comes out on the inside of the fixed loop.

(3) End of knot secured around fixed loop with an overhand knot.

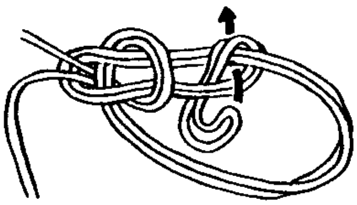
(4) Standing part of rope exits knot through the bight.

(5) End of completed knot is at least 4 inches long.

(6) Knot is properly dressed and set.

Learning Step Activity 12 – Tie a double bowline knot (Three loop bowline knot). (SPECIAL PURPOSE KNOT)

NOTE: For testing purposes this knot is tied around the rope of the rope corral.



a. The double bowline knot is simply a bowline tied on a doubled rope. The knot forms three fixed loops in a rope.

b. Steps:
(1) Tied the same way as the bowline except now you are using a double rope. One tip is to ensure that the rope parts remain dressed as you tie the knot to make dressing and setting the knot simple.

c. Checkpoints of the double bowline are:
(1) Two loops locked in place by two bights forming three fixed loops
(2) Third loop formed comes out on the inside of the first two loops; third loop secured around first two loops with overhand loop knot; remaining end is at least 4 inches long.
(3) Knot is properly dressed and set.

Learning Step Activity 13 – Tie a two loop figure of eight. (SPECIAL PURPOSE KNOT)

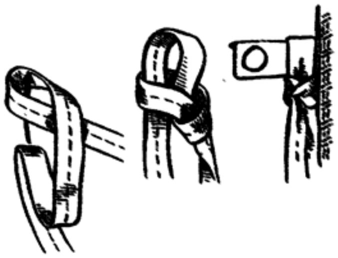
NOTE: For testing purposes, this knot is NOT tied around the rope corral.

a. The two loop figure of eight is used to form two fixed loops in the middle of the rope.

b. Steps:
(1) Hold and an 18 inch bight in one hand.
(2) With the other hand, make a 360-degree turn around the standing end.
(3) With the working end, form another bight and place that bight through the loop formed in step 2. (see the first picture in the figure above). These will become the two loops.
(4) Hold this bight and place the original bight over the knot. Dress this bight to the bottom of the knot. This bight becomes the common locking bar.
(5) Set the knot.

c. Checkpoints of the bowline on the bight are:
(1) There is a double figure-eight knot with two loops that share a common locking bar.
(2) The two loops must be adjustable by means of a locking bar.
(3)The common locking bar is on the bottom of the two loop figure eight knot. Knot is properly set.

Learning Step Activity 14 –Tie an overhand slip knot (SPECIAL PURPOSE KNOT)



a. The overhand slip knot forms an adjustable bight in a rope or webbing.

b. Steps:
(1) Make a loop in the rope.
(2) Pass a bight through the loop.
(3) Tighten down the knot.

c. Checkpoints of the overhand slip knot are:
(1) Bight secured by an adjustable loop.
(2) Knot is properly dressed and set.

Learning Step Activity 14 – Tie a figure-eight slip knot. (SPECIAL PURPOSE KNOT)

a. The figure-eight slip knot forms an adjustable bight in a rope.

b. Steps.
(1) Form a 12-inch bight in the end of a rope.
(2) Hold the center of the bight in the right hand. Hold the two parallel ropes from the bight in the left hand about 12 inches up the rope.
(3) With the center of the bight in the right hand, twist two complete turns clockwise.
(4) Reach through the bight and grasp the long, standing end of the rope. Pull another bight (from the long standing end) back through the original bight.
(5) Pull down on the short working end of the rope and dress the knot down.

c. Checkpoints.
(1) The knot is in the shape of a figure eight.
(2) Both ropes of the bight pass through the same loop of the figure eight.
(3) The sliding portion of the rope is the long working end of the rope.

Learning Step Activity 14 – Tie a girth hitch (SPECIAL PURPOSE KNOT).

a. The girth hitch is used to secure a rope or webbing to an object.

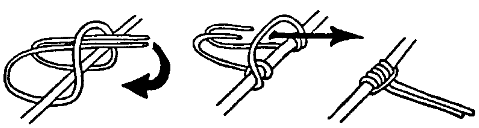
b. Steps:

(1) Form a bight.
(2) Bring the rope or webbing back through the bight.
(3) Dress and set the knot.

c. Checkpoints of the girth hitch are:
(1) Two wraps exit with a locking bar running across the wraps.
(2) The knot is dressed tightly.

Learning Step Activity 15 – Tie a prusik. (SPECIAL PURPOSE KNOT)

NOTE: For testing purposes this knot is tied around the rope of the rope corral.



Middle of the rope (MOR) Prusik

End of the rope (EOR) Prusik

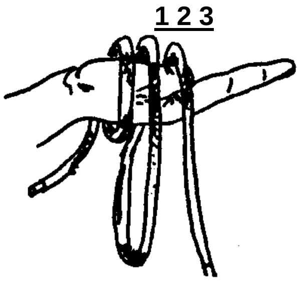
a. The prusik is similar to the girth hitch except that there are two or more wraps.

b. Steps (Middle of the rope prusik):
(1) Form a girth hitch in the middle of rope over the rope corral
(2) Form a second girth hitch over the rope corral so that the standing parts are now exiting through the center of the wraps

c. Steps (End of the rope prusik):
(1) Place an arms length of rope around the rope corral.
(2) For a complete round turn in the rope.
(3) Cross over the standing part of the rope with the working end of rope.
(4) Form another complete round turn in the rope, working back toward the middle of the knot.
(5) There are four wraps and a locking bar running across them on the rope corral. Dress the wraps and locking bar down.
(6) Finish the knot with a bowline to ensure that the prusik knot will not slip out during periods of varying tension.

d. Checkpoints of the prusik knot are:
(1) Four parallel wraps with a locking bar securing the standing parts.
(2) Standing parts exit from the two innermost wraps.
(3) Knot is properly dressed and set; end of rope prusik secured with bowline tied to standard.

Learning Step Activity 16 – Tie a wireman's knot (SPECIAL PURPOSE KNOT)

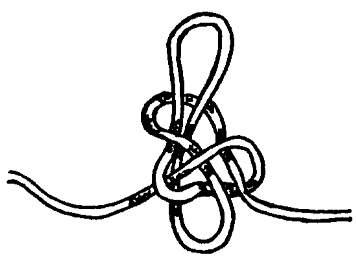


a. The wireman's knot forms a single, directional fixed loop in the middle of the rope. Its primary use is in rope installations where the fixed loop is subjected to a high load. Once tension is released from the system, the wireman's knot is easier to untie than other knots that seize when subjected to a high load.

b. Steps.

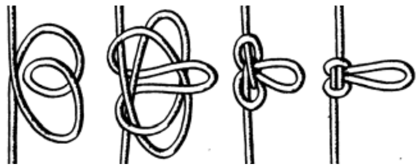
(1) Refer to the picture above. Make two wraps around the right hand. Using the left hand take center rope part (number 2) and place it over rope part number one.
(2) Take the center rope part and place it over rope part number three.
(3) Take the center rope part and place it over rope part number one.
(4) Gently pull the center rope part up. This will become a fixed loop. Take care to pull each of the four rope parts individually so that you correctly dress the knot.
(5) Set the knot.

c. Checkpoints of the wireman's are:
(1) Completed knot should have four interlocking bights.
(2) Standing parts of the rope exit knot 180 from each other.
(3) Fixed loop exits knot at a right angle to the standing parts of the rope.
(4) Knot is properly dressed and set.



NOTE: When set, the loop of the wireman's knot naturally lays in one direction. When tying the knot, make the initial wraps taking slack from the standing part which is in the same direction as the intended pull on the fixed loop. This will eliminate kinking of the fixed loop under tension and retain higher knot strength.

Learning Step Activity 17- Tie a butterfly knot (SPECIAL PURPOSE KNOT)



a. The butterfly knot can be used for bi-directional loads on a rope. The butterfly can be used to connect to the middle of the rope instead of the figure 8 loop.

b. Steps:

(1) Drape the rope over the left hand and then form a loop with the right hand. Have app 12 inch loop in your right hand.

(2) Grasp the rope parts(the X) with the left hand and then form a second loop with the right hand.

(3) With your right hand bring the loop over and under the X in your left hand and then bring the loop through both original loops.

(4) Properly dress and then set the knot.

c. Checkpoints of the butterfly are:

(1) Single fixed loop hangs perpendicular to the rope.

(2) Standing parts exit the knot in opposite directions.

(3) Parallel rope parts on one side; distinct X pattern on the opposite side.

(4) Knot is properly dressed and set.

Learning Step/Activity 18 - Construct the mountain coil.

a. The mountain coil is a traditional configuration to carry a rope, usually placed around the head and shoulder. Coil the rope as follows:

(1) Flake the rope. The rope is grasped approximately 1 meter from the end with the right hand (approximately one arms length).

(2) Holding the rope with the right hand, move the left hand down the rope until both arms are outstretched.

(3) While holding the rope firmly in both hands, coil the rope in a clockwise manner, placing the rope that is in your left hand into the palm of the right hand. You may need to give a twist to the rope to keep it coiled neatly. Grasp the rope with the right hand.

(4) Continue making coils following the above procedure until you have no rope remaining.

(5) Make a bight (about twelve inches in length) with the 1 meter portion of rope you started with.

(6) Uncoil the last loop you made and use this length of rope to make wraps around the coil and the bight. Start at the open end of the bight and work towards the closed end. The first wrap should bind against itself. Make six to eight wraps and then place the end of the rope through the bight. All wraps should be tight.

(7) Pull the running end of the bight to secure the coil. The ends of the rope should not hang below the coil. Tails at least 4".

b. This coil may be carried either in the pack (by forming figure eight), doubling it, and placing it under the flap, or by placing it over the shoulder and under the opposite arm. If the rope to be coiled is anchored, as in coiling a belay or rappel line, begin the coil near the end closest to the anchor in order for the kinks to work themselves out of the free end.

c. The checkpoints for the mountain coil are:

(1) Rope coiled in a clockwise direction.

(2) Tie off knot or hitch remains secure.

(3) Coil secured with a minimum of 6 wraps; wraps do not exceed ¼ the circumference of the coil.

(4) When worn over shoulder, coils do not hang below the individual's knee.

(5) Running ends do not hang below coil.

(6) Loops relatively uniform in size (within approximately 4 inches of each other).

Learning Step Activity 19 – Construct the Butterfly Coil (Carry Configuration)

a. Carry Configuration: To start the butterfly coil, grasp both ends of the rope and begin back stacking. Find the center of the rope, forming a bight. With the bight in the left hand, grasp both ropes and slide the right hand out until there is approximately one arms length of rope. Place the doubled rope over the head, draping it around the neck and on top of the soldiers. Ensure that it hangs no lower than the waist. With the rest of the doubled rope in front of you, make doubled bights placing them over the head in the same manner as the first bight. Coil alternating from side to side (left to right, right to left), while maintaining equal length bights. Continue coiling until approximately two arm-lengths of rope remain. Remove the coils from the neck and shoulders carefully, and hold the center in one hand. Wrap the two ends around the coils a minimum of three doubled wraps, ensuring that the first wrap locks back on itself.

b. Tie off and Carrying- Take a doubled bight from the loose ends of rope and pass it through the apex of the coils. Pull the loose ends through doubled bight and dress it down. To carry the rope on the back, separate the two ends. Place the coil in the center of the back of the carrier and run two ends over the shoulders from back to front to form shoulder straps. The ends are brought under the arms, around the back over the coil, brought around the front of the carrier, and tied off with a square knot at the stomach.

c. The checkpoints for the butterfly coil are:

(1) Rope coiled from center of rope or one end of rope.

(2) Loops relatively uniform in size (within approximately 4 inches of each other).

(3) Coil secured with a minimum of 3 doubled wraps and a doubled bight from the running end is passed through the apex of the coils and girth hitched.

4. Rope is routed correctly. Coiled rope ends are routed over shoulders from back to front, run under the arms from front to back over the coil, and brought back to front for tie off.
5. Tie off knot (square knot) is tied to standard, with tails no longer than 3'.

BUTTERFLY COIL IN CARRY CONFIGURATION

d. Storage Configuration. If you will be storing the rope or carrying it in a rucksack or rope bag, you can finish the butterfly coil in the storage configuration. Begin coiling the rope the same way you did for the carry configuration. Continue coiling until approximately one arms length of rope remains. Secure the coil with a minimum of 3 doubled wraps. Pass the remaining doubled rope through the center of the coils making a wrap around one side of the coils. Make another complete wrap around the other side of the coils. Pass the ends through the center of the last complete wrap. The ends of the rope should be at least 3 inches long and will not extend below the bottom of the coil.

SECTION IV. SUMMARY

Knots are a fundamental skill for mountaineering. All of the rope installations require that you tie knots quickly and correctly. Practice these knots as you will be tested on all of them.

Check on Learning.

1. What are the eleven rope terms?
   Bight, Loop, Half Hitch, Static End, Standing Part, Running End, Working End, Stacking or flaking the rope, Round Turn, Dressing a knot, Setting a knot

SECTION II. INTRODUCTION

Motivator: You have already received a class on mountaineering equipment and rope management and knots. You will now apply that knowledge and those skills to construct anchors. Failure of any system is most likely to occur at the anchor point(s). If the anchor is not strong enough to support the intended load, it will fail. All of the rope systems you will construct in this course must start with a solid primary and back-up anchor. Proper selection and placement of anchors is a critical skill that requires a great deal of practice.

Terminal Learning Objective

ACTION	Rig anchors for mountaineering
CONDITION	Given an area with suitable natural anchors and anchor material, sling material, rope, carabiners, entrenching tool, ice ax and padding
STANDARD	Soldier: - Rigged drape, wrap and girth anchors and attached climbing rope directly to an anchor within 20 minutes. Rigged one anchor for high load. Rigged one anchor for alternating tension. - Constructed a deadman anchor for a load designated by the grader within 30 minutes. Anchor did not fail under load. Designated low load anchor will be tested by three individuals. Designated high load anchor will be tested by six individuals. - met all critical performance measures IAW the student/instructor evaluation plan.

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training.

Risk Assessment: Low

Environmental Considerations: None

Evaluation: You will be tested on all anchors presented in this lesson IAW the student evaluation plan. If you fail to rig an anchor correctly, you will receive a NO-GO. After re-training you will be given a second opportunity to re-test. If you fail to rig the same anchor(s) correctly a second time, you will receive a NO-GO and you will be dismissed from the course.

Instructional Lead-In: This lesson gives you a number of anchor options that will later be used to rig rope installations.

SECTION III. PRESENTATION

Learning Step/Activity 1 – Define anchors.

a. What is an anchor? Consider the following scenario. You have a steep muddy hill that you must negotiate to get into and out of your fire base. Two Soldiers have slipped and badly injured their knees trying to get up to the hill after a long patrol. There is a large tree at the top of the hill and you decide to tie a rope directly to it to use as a hand line. The tree is the anchor. You know that the tree is stronger than the rope that is attached to it – it is considered "bombproof". "Bombproof" does not mean that it can take a hit from a cruise missile, it simply means that **the anchor is strong enough to support the intended load – in this case you and your equipment.**

Learning Step/Activity 2 – Select natural anchors.

a. Types of natural anchors. Trees, boulders, and other terrain irregularities should be your first choice when establishing an anchor point. They are already in place and simply require a method of attaching the rope. There are a few things to consider prior to using any natural feature as an anchor.

(1) ***Trees*** are probably the most widely used of all natural anchors depending upon the terrain. You must carefully check trees to see if they are a suitable anchor.

(a) In rocky terrain trees generally have a shallow root system. Tug and push on the tree to ensure it is well rooted into the surrounding earth. Ensure that the tree itself is not dead or rotting away.

(2) **Boulders** and rock protrusions (also called chicken heads or nubbins) can make ideal anchors. Check the rock to ensure it is solid. Push on boulders to make certain they do not move. Sedimentary and other loose rock formations are not stable. Talus and scree fields are an indicator that the rock in the area is not very solid.

(3) Sometimes you can use small trees and bushes when nothing else is available. Slings can be woven through and around the base of a number of bushes and tied off. This technique can be quite strong. Again, ensure all vegetation is healthy and well rooted to the ground.

(4) Use padding when climbing equipment (ropes and webbing) will come in contact with sharp edges of rocks, rough surfaces or tree sap.

Learning Step/Activity 3 – Rig natural anchors.

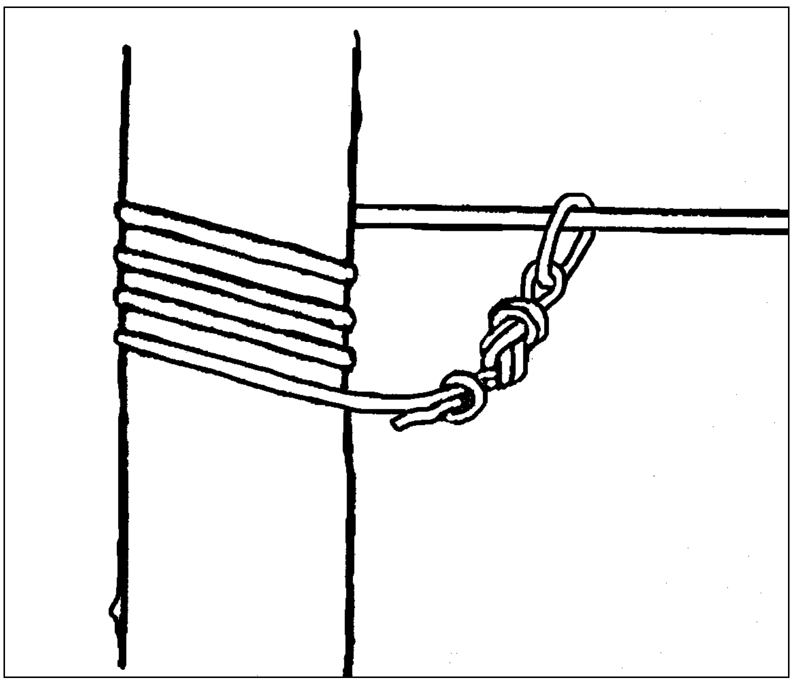
NOTE: Use padding for each method of rigging natural anchors.

a. ***Attach the rope directly to the anchor.***

(1) ***Use a bowline to tie a climbing rope directly to an anchor.*** Place the knot approximately the same distance away from the anchor as the diameter of the anchor. The knot should not be placed up against the anchor because this can stress and distort the knot under tension. The bowline is easily untied after it has been loaded. The disadvantage of using the bowline is that the knot can work itself loose over time if the tension placed on it alternates.

(2) **The *tensionless anchor knot*** can also be used; be wary of rough surfaces that could abrade the rope.

(a) Tie a figure eight loop at the end of the rope.
(b) Wrap the end of the rope around the anchor three or more times. Wrap down.
(c) Attach the fixed loop of the figure eight loop to the standing part of the rope with a carabiner.
(d) Once the rope is under tension, the wraps should take a significant amount of the load; the figure eight loop does not have any tension on it. If there is tension on the knot, add additional wraps.
(e) Avoid excess slack between the figure 8 loop and the wraps.

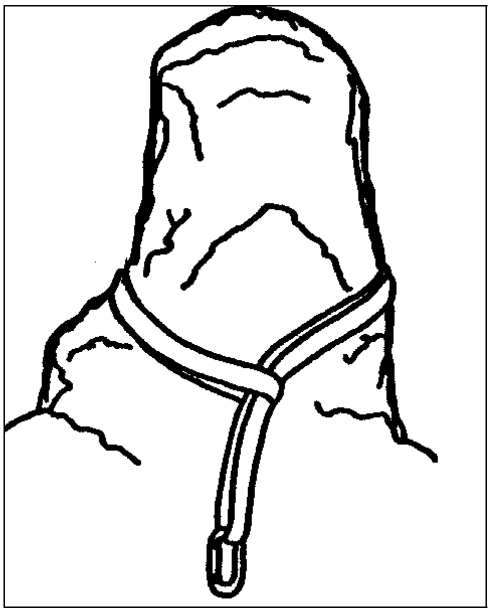


b. ***Sling natural anchors.*** Three methods are used for attaching a sling to a natural anchor: ***drape, wrap and girth.*** The water knot is used to join the ends of the sling material with all of these methods.

(1) ***Drape.*** Drape the tied sling over the anchor. You can also tie the webbing around the anchor using the water knot. This method takes more time, but can be used when the top of the anchor is either out of reach or too large. With all of these methods, set the knot in the sling off to the side where it won't interfere with normal carabiner movement, and ensure the knot will not rub on a rough surface. Also, ensure that there are no unnecessary twists in the webbing. Insert a steel or aluminum oval carabiner onto the sling. The carabiner gate should face away from the ground, and open away from the anchor for easy insertion of the rope. Place low on the anchor.

(2) ***Wrap*** the sling around the anchor and connect the two ends together with a carabiner(s). Insert a steel or aluminum oval carabiner onto the sling. The carabiner gate should face away from the ground, and open away from the anchor for easy insertion of the rope. Again, ensure that there are no unnecessary twists in the webbing. Place low on the anchor.

(3) ***Girth.*** Tie the sling around the anchor with a girth hitch. The girth hitch can be used in active or passive mode. The picture shows the passive mode. Use the girth hitch in active mode if there is a chance that the load, or rope drag, might pull the sling up and off the anchor. To do this, simply slide the webbing around the anchor until the girth hitch locks down upon itself and prevents the webbing from moving when the anchor is loaded. Insert a steel or aluminum oval carabiner onto the sling. The carabiner gate should face away from the ground, and open away from the anchor for easy insertion of the rope. Again, ensure that there are no unnecessary twists in the webbing. Place low on the anchor.



Learning Step/Activity 4 – Rig natural anchors for high and low loads and/or for alternating or constant tension.

a. ***Loads and tension on anchors.***

(1) An anchor can be constructed for a ***high load or a low load***. A ***low load*** supports the weight of one individual. A ***high load*** supports the weight of more than one individual.

(2) The tension on the anchor can be ***constant or alternating***. ***Alternating tension*** means that the anchor is loaded and released as the anchor is used. With ***constant tension*** the anchor is under constant load.

b. This knowledge gives you some rules of thumb to follow when rigging anchors:

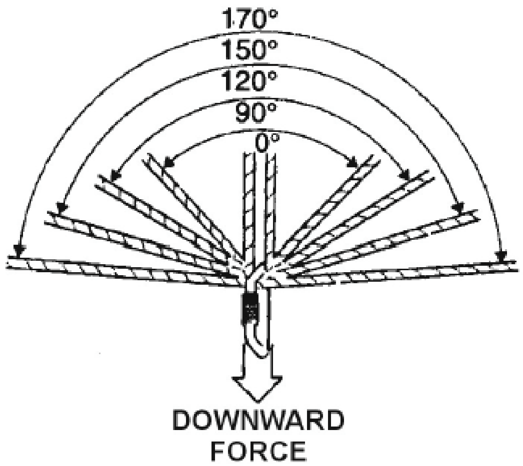
(1) If the load on an anchor is low and is under constant tension, use a single non-locking carabiner.

(2) If there is alternating tension and/or a high load will be placed on the anchor, you must use a locking carabiner or two opposite and opposed gate carabiners. For two opposite and opposed gate carabiners, insert one non-locking carabiner with the gate opening up and away from the anchor. Insert a second non-locking carabiner so the gate opens down and away from the anchor. When both gates are opened you will see a distinct X pattern.

CARABINER GATES OPPOSITE AND OPPOSED

c. A load will stress an anchor in various ways. The angle of the sling must be equal to or less than 90 degrees in order to avoid undue stress on the sling. Angles wider than 90 degrees will actually begin multiplying the forces on the sling. 45 degrees or less is the optimum angle when rigging anchors.

d. Check the anchor. The angle formed by making a peace sign with your index finger and middle finger is approximately 45 degrees – if the anchor falls within this angle it is optimum. If it is greater than 45 degrees, ensure that the angle is less than 90 degrees. The angle of the sling should be between the “L” shape formed by your thumb and forefinger. If it is greater than 90 degrees the anchor is a loser and should be re-rigged.



TENSION IN MULTIPLE ANCHOR RIGGING	
ANGLE	RESULTING LEG TENSION*
170°	1150%
150°	200%
120°	100%
90°	70%
0°	50%

On each leg relative to downward force.

Learning Step/Activity 5 – Construct a below ground "deadman" anchor.

a. A deadman anchor is any solid object buried in the ground and used as an anchor. Deadman anchors, are made from an object that has a large surface area and some length to it. Many items can be used for a dead man anchor: a hefty timber, large rocks, a bundle of smaller tree limbs or poles, an alpine ax, skis or a rucksack are all good examples. As with natural anchors, ensure timbers and tree limbs are not dead or rotting and that boulders are solid. Construction is as follows:

(1) Dig a trench 2 to 3 feet deep (deeper in loose soil) and at a right angle (90º) to the direction of pull. The trench should be dug just large enough for the anchor (timber, rock, or whatever is selected), to fit. The front wall of the trench is undercut by digging down at an angle.

(2) A second trench, or rope trench, is dug from the direction of pull at ground level angling downward to the bottom of the main trench, forming a "T" with the main trench. It should be wide enough for a rope, or sling to fit in.

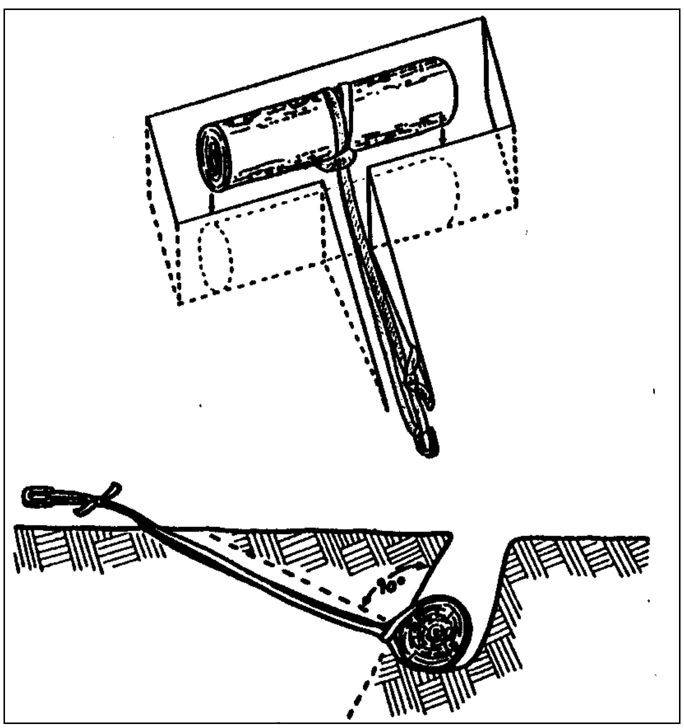
(3) Ensure the vertical angle between the front wall of the main trench and the rope trench is slightly less than perpendicular (<90º). This will keep the anchor from being pulled up and out under load.

(4) Place the anchor in the main trench and attach a sling to it. The sling is placed in the adjoining trench. It should be slightly longer than the trench it lays in. Keep knots out of the hole for easy inspection.

(5) Both trenches should be filled back in and packed down. The end of the sling is exposed for attachment of the rope and the knot in the sling is exposed for inspection.

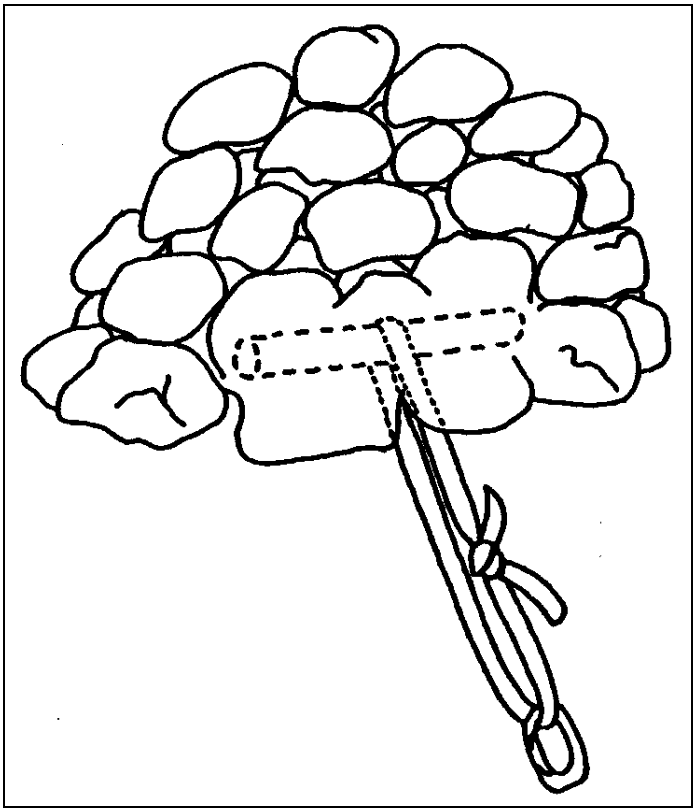
(6) The rope is attached to the sling with a carabiner(s). The gate should face up, and open away from the anchor. Alternatively, use two carabiners with opposed gates or a single locking carabiner for high load and/or alternating tension installations.

NOTE: If the dead man is to be reused a number of times, consider using steel cable rather than sling material. The buried sling will deteriorate over time. The main trench could also be constructed in a way allowing the middle of the log and sling to be exposed, while the remainder of the log is buried. The sling could then be easily replaced when necessary. Revetment will also strengthen the anchor.



Learning Step/Activity 6 – Construct an above ground “deadman” anchor.

a. In extremely hard, rocky terrain, a variation of the dead man can be constructed by building above the ground when digging a trench would be impractical, if not impossible. The sling is attached to the anchor, which is set in the ground as deep as possible. Boulders are then stacked on top of it until the anchor is strong enough for the load. Though normally not as strong as when buried, this method can work well for low load installations. Ensure that boulders do not affect the webbing. Most of the mass should be on the front and top of the anchor.



Learning Step/Activity 7 – Demonstrate the purpose of a primary and a back-up anchor.

a. You have already learned to rig anchors. As you begin to rig anchors for rope installations, you MUST construct a primary anchor AND a back-up anchor.

b. There are some basic principles to keep in mind when rigging the primary and back-up anchors:

(1) The primary anchor bears the load while the rope installation is in use.

(2) It must meet all of the performance measures that you learned earlier in this lesson.

(3) The back-up anchor must also meet all of the performance measures for rigging anchors, but MUST NOT bear or share any part of the load when the rope installation is in use. This means that there is a minimal amount of slack between the back-up anchor (2-6 inches) and the rope installation.

(4) The purpose of the back-up anchor is to ‘catch’ the load if the primary anchor fails. As such, it must be rigged so that it catches the load as quickly as possible if the primary anchor fails. If too much slack exists, the back-up anchor may be shock loaded and fail. If too much slack exists, personnel may be injured or equipment damaged even if the back-up anchor holds. Minimal slack is key.

(5) If the primary anchor fails, use of the rope installation must stop until the deficiency is corrected.

SECTION IV. SUMMARY

You now know how to build solid, ‘bombproof’ anchors. Future lessons will apply this knowledge as you construct ropes installations
.

Check on Learning.

1. What are the three methods of slinging an anchor?
   Drape, wrap and girth.

2. If there is a chance the sling could slip off of the anchor, what method should be used?
   The girth hitch in active mode.

3. What is the optimum angle for an anchor and how do you determine it?
   45 degrees or less. Give it the “peace” sign.

4. If you have a high load and/or alternating tension, what type of carabiner should you use?
A locking carabiner or two opposite and opposed gate carabiners.

SECTION II. INTRODUCTION

Motivator: During military movement in mountainous terrain, you will always search for the simplest, safest route for travel. However, you may not always be able to walk around an obstacle such as steep rock. Even small cliff bands can present major obstacles to your unit. This block of instruction will provide you with the basics of balance climbing so that you can overcome these obstacles and continue the mission.

Terminal Learning Objective

ACTION	Demonstrate basic rock climbing techniques
CONDITION	Given adequate 4th and 5th class terrain, helmet and standard military issue leather boots (jungle/desert boots not authorized)
STANDARD	Soldier negotiated basic bouldering problems (rock obstacles) using proper technique.

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training. Ensure that students understand the duties of a spotter and spot personnel who are climbing. Ensure that students do not climb above head height. Ensure that ambulance with medical personnel is at the rock site prior to the conduct of training.

Risk Assessment: Medium.

Environmental Considerations: None

Evaluation: You will be evaluated on your ability to negotiate basic bouldering problems during the practical exercise. The instructor will demonstrate a problem and then you will negotiate the same problem. The climbing technique that you learn in this lesson will again be used in 699-9021: Top Rope Climbing. Refer to the student evaluation plan for GO/NO-GO testing criteria.

Instructional Lead-In: This lesson gives you basic climbing skills that will allow you to negotiate 4th and 5th class terrain.

SECTION III. PRESENTATION

Learning Step/ Activity 1 - Prepare for climbing.

a. ***Preparation:***
(1) Clean and dry the boot soles. A small stick can be used to clean out dirt and small rocks that might be caught between the lugs of the boot sole. If the soles are wet or damp, dry them off by stomping and rubbing the soles on clean, dry rock.

(2) Remove all jewelry, watches and rings. Watches and bracelets can interfere with hand placements and may become damaged if worn while climbing. Rings can become caught on rock features or lodged into cracks, which could cause injuries during a slip or fall.

(3) Wear the helmet properly. This will protect your head from injury if an object falls from above, such as a rock or climbing gear from climbers above.

Learning Step/Activity 2 – Spot a climber.

a. Spotting is a technique used to add a level of safety to climbing without a rope. A second man stands below and just outside of the climber's fall path and helps (spots) the climber to land safely if he should fall. Spotting is only applicable if the climber is not going above the spotters head on the rock; beyond that height roped climbing should be conducted. If an individual climbs beyond the effective range of the spotter(s), he has climbed TOO HIGH for his own safety. ***As a spotter your duties are:***

(1) to help prevent the falling climber from impacting the head and/or spine.

(2) to help the climber land feet first.

(3) to reduce the impact of a fall.

b. Do not push or catch the climber against the rock, additional injuries could result. If the climber falls from the rock, you should try to place your hands under the armpits of the climber and guide him safely down to the ground. If this is not possible you should cradle the neck and upper spine to prevent it from impacting the ground.

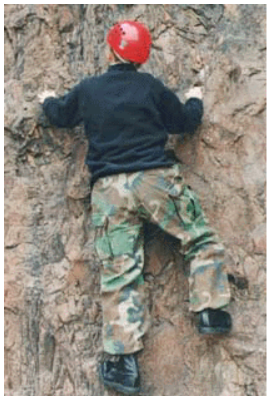
Learning Step/ Activity 3 - Balance climb.

a. ***Route selection*** for military climbing requires that you pick the easiest and quickest possible route for all personnel to follow. Before you begin to climb, you should first climb with your eyes. Even before getting on the rock, you should study all possible routes or "lines" to the top looking for cracks, ledges, nubbins and other irregularities in the rock that you can use for footholds or handholds, taking note of any larger ledges or resting places. When picking the line, you should mentally climb the route, rehearsing the step-by-step sequence of movements that will be required to do the climb, ensuring that the route has an adequate number of holds and the difficulty of the climb is well within your ability.

b. ***Actual climbing involves linking together a series of movements, based on foot and hand placement, weight shift, and movement.*** When this series of movements is combined correctly, a smooth climbing technique results. This technique reduces excess force on your limbs, helping to minimize fatigue. The basic principle is based on the five definable body parts used to climb.

c. ***Five body parts.*** The five body parts used for climbing are the right hand, left hand, right foot, left foot, and the body or trunk. To climb smoothly and efficiently, you move only one body part at a time. The basic principle to achieve smooth climbing with the five body part definition is to move only one of the five body parts at a time. The trunk is not moved in conjunction with a foot or in conjunction with a hand; a hand is not moved in conjunction with a foot, etc. Following this simple technique forces you to do all the lifting with one or both of the legs.

d. ***Stance or Body Position.*** Body position is probably the single most important element to good technique. A relaxed, comfortable stance is essential. Your body should be in a near vertical or erect stance with the weight centered over the feet. Do not lean in towards the rock - your feet will push outward, away from the rock, resulting in a loss of friction between the boot sole and rock surface. Keep your legs straight and your heels low to reduce fatigue. Bent legs and tense muscles tire quickly. If strained for too long, tense muscles may vibrate uncontrollably. This vibration, known as “Elvis-ing” or "sewing-machine leg" can be cured by straightening the leg, lowering the heel, or moving on to a more restful position. Use your hands to maintain balance. Keep your hands between waist and shoulder level to reduce arm fatigue.



CORRECT CLIMBING STANCE, BALANCED STANCE OVER BOTH FEET

INCORRECT STANCE, TOO STRETCHED OUT

(1) Whenever possible, you should maintain 3 points of contact with the rock. Proper positioning of your hips and shoulders is critical. When using 2 footholds and 1 handhold, center your hips and shoulders over both feet. In most cases as the climbing progresses, your body is resting on 1 foot with 2 handholds for balance. Center your hips and shoulders over your weighted foot to maintain balance. This allows the un-weighted foot to maneuver.

(2) The angle or steepness of the rock also determines how far away from the rock your hips and shoulders should be. On low angle slopes, move your hips out and away from the rock to keep the body in balance with your weight over your feet. Move your shoulders closer to the rock to reach handholds. On steep rock, push your hips closer to the rock. Move your shoulders away from the rock by arching the back. This maintains your balance and weight over your feet and allows your eyes to see where to place hands and feet. If the footholds are small, move your hips back to increase friction between your feet and the rock. This is normally done on quick, intermediate holds. This is not a restful position as you will use your arms and hands to support your body weight. If you must weight the hands and arms, keep them straight to reduce fatigue. Again, flexed muscles tire quickly.

e. The basic ***climbing sequence*** is foot or hand placement, weight shift and movement. The steps listed below provide a complete sequence of events to move you on the route.

(1) Shift your weight (trunk) from both feet to one foot. This will allow you to lift one foot with no effect on your stance.

(2) Lift your foot and place it in a new location. Move your un-weighted foot and place it within one to two feet of the starting position, (higher placement will result in a potentially higher lift for the legs to make, creating more stress and is called a high step)

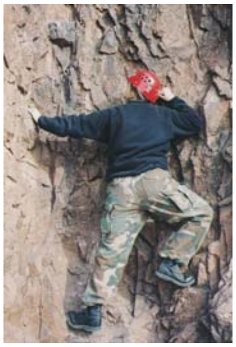
(3) Shift your weight (trunk) onto both feet. Repeat steps 1-3 for remaining foot.

(4) Straighten your legs.

(5) Move one hand to a new position. During this movement, the trunk should be completely balanced in position and the removed hand has no effect on stability.

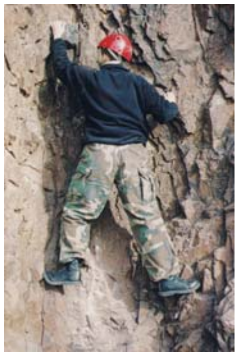
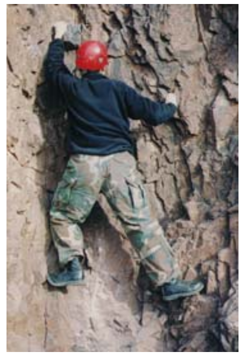
(6) Move your other hand as in Step 5.

Now your entire body is in a new position and ready to start the process again. Following these steps will prevent you from pulling up with your arms and hands. Leg extension, can be performed as soon as one foot has been moved if both legs are bent. Hand movements, can be delayed until you have made numerous foot movements. This will not only give you shorter lifts with the legs but may allow you a better choice for the next hand movements as your reach will have been increased.

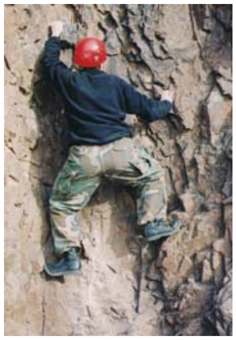


WEIGHT SHIFT ONTO RIGHT FOOT, LEFT FOOT MOVED

WEIGHT SHIFT OVER BOTH FEET, EXTENDING THE BODY OR LIFTING THE BODY WITH BOTH LEGS

MOVING THE LEFT HAND, WEIGHT SHIFT TO LEFT FOOT




MOVING RIGHT FOOT, WEIGHT CENTERED ON BOTH FEET

RIGHT HAND MOVED

f. Some general rules for climbing:

(1) Use your legs to move up the rock – you do not pull yourself up a ladder and you should not pull yourself up the rock. You may need to hold or pull your body into the rock with your arms and hands as the angle increases; this is still not lifting with the arms.

(2) Do not move more than one body part at a time.

(3) Do not move on the knees or elbows. Besides being uncomfortable, these bony portions of the limbs offer little friction and "feel" on the rock and are easily injured using this poor technique.

(4) Check each hold prior to use. This may simply be a quick visual inspection if he knows the rock to be solid. Knock on the rock with the palm of your hand. If it sounds dull and hollow like a drum, the rock is not solid. When in doubt, you should grab and tug on the hold to test it for soundness, BEFORE DEPENDING ON IT.

Learning Step/ Activity 4 - Demonstrate foot placements.

a. In the early learning stages of climbing, you may rely heavily on the arms, and forget to use your feet properly. Continually remind yourself, "climb with the feet and use the hands for balance". It is true that solid handholds and a firm grip are needed, however even the most strenuous techniques require good footwork and a quick return to a balanced position over one or both feet. Poor footwork is the most likely reason for failure to climb a route.

b. You have a natural tendency to look up for handholds. Keep your hands low and train your eyes to look down for footholds. Even the smallest disconformities in the rock can support you once the foot is positioned properly and weight is committed to it.

c. Your foot remains on the rock as a result of friction. Maximum friction is obtained from a correct stance over a properly positioned foot. To maximize friction you should:

(1) Apply maximum sole contact to the rock. Maximum friction is obtained by placing as much of your boot sole on the rock as possible. Your leg muscles can relax the most when the entire foot is placed on the rock. Use this technique on smooth, low-angled rock (slab) and rock containing large "bucket" holds and ledges.

(2) On some large holds, like bucket holds that extend deep into the rock, the entire foot cannot be used. You may not be able to achieve a balanced position if your foot is stuck too far underneath a bulge in the rock. In this case, place only part of the foot on the hold to achieve a balanced stance.

MINIMUM SOLE CONTACT
POOR

MAXIMUM SOLE CONTACT

MINIMUM SOLE CONTACT
POOR

MAXIMUM SOLE CONTACT
GOOD

d. Use ***edging technique*** where horizontal crack systems and other irregularities in the rock form small, well-defined ledges. Place the edge of the boot sole on the ledge for the foothold. It is best to use the inside edge of the boot or the edge area around the toes. Whenever possible, turn your foot sideways and use the entire inside edge of the boot. More sole contact equals more friction and the legs can rest more when the heel is on the rock. On smaller holds, edging with the front of the boot, or toe, may be used. Use of the toe is most tiring because the heel is off the rock and the toes support your weight. Remember to keep the heel low to reduce fatigue. Curling and stiffening the toes in the boot increases support. On small edges, turn your foot at about a 45º angle to obtain the strongest position. This uses the strength of the big toe and the ball of the foot. Effective edging on small edges requires stiff-soled footwear. The stiffer the sole, the better the edging capability.

POOR EDGING TECHNIQUE

BETTER EDGING TECHINQUE

EDGING ON A SMEAR
POOR

GOOD SMEARING TECHNIQUE

e. When the rock is smooth and you cannot edge, you should “smear” the ball of the foot on the rock – this is known as ***smearing technique.*** Point your toes towards the rock and attempt to place as much of the boot sole on the rock as possible. Keep your heel low to reduce muscle strain and increase the amount of surface contact between your foot and the rock. Flex the ankles and knees slightly to place your weight more directly over the ball of the foot and increase friction.

f. You can jam your feet into cracks in the rock. Set your foot into the crack in such a way that it "jams" into place and allows you to stand on it. ***Jamming technique*** in itself is a specialized skill used to climb vertical or near vertical cracks when there are no other available holds on the rock face. Jamming holds can be used in a crack while other hand/foot holds are used on the face of the rock. Many cracks will have facial features such as edges, pockets, etc., inside and within reach; always look or feel for easier to use features.

(1) The foot can be jammed in a crack in two ways:

(a) Insert your foot above a constriction and set it into the narrow portion.

(b) Place your foot in the crack at an angle and then cam it into place by twisting or rotating the foot. You can use your toes, the ball of the foot, or the entire foot. Try to use as much of the foot as possible for maximum surface contact. Some positions are more tiring, and even more painful on the foot, than others. Practice jamming the foot in various ways to see what offers the most secure, restful position.

(2) When removing the boot from a crack, remove it in reverse of the way it was placed to prevent further constriction. Some foot jams may be difficult to remove once weighted. The foot is less likely to get stuck when it is twisted or "cammed" into position.

FOOT JAM
HEEL IS PUSHED TO THE RIGHT

FOOT JAM WITH ENTIRE FOOT

BOTH FEET JAMMED USING
CAMMING TECHNIQUE

Learning Step/ Activity 5 - Demonstrate the use of hand holds.

a. The hands can be placed on the rock in many ways. Exactly how and where to position the hands and arms depends on what holds are available, and what configuration will best support the current stance as well as the movement to the next stance.

b. Select handholds between waist and shoulder level. Circulation in the arms and hands is best when the arms are kept low. You also have less of a tendency to "hang" on your arms when the handholds are at shoulder level and below. Both of these contribute to a relaxed stance and reduce fatigue in the hands and arms.

c. As you climb, continually reposition your hands and arms to keep your body in balance, with the weight centered over the feet. On lower angled rock, simply place the hands up against the rock and extend the arm to maintain balance; just like using an ice ax as a third point of contact in mountain walking. Sometimes, you can push directly down on a large hold with the palm of the hand. More often though, you will need to "grip" the rock in some fashion and then push or pull against the hold to maintain balance.

d. As stated earlier, the beginner will undoubtedly place too much weight on the hands and arms. If you think of climbing a ladder, your body weight is on your legs. Your hands grip and your arms pull on each rung only enough to maintain your balance and footing on the ladder. Ideally, this is the amount of grip and pull that should be used in climbing. Of course, as the size and availability of holds decreases, and the steepness of the rock approaches the vertical, your grip must be stronger and more weight might be placed on the arms and handholds for brief moments. The key is to move quickly from the smaller, intermediate holds to the larger holds where the weight can be placed back on the feet. This allows the hands and arms to relax. The following describes some of the basic handholds and how to position the hands to maximize grip on smaller holds.

(1) ***Push holds.*** Apply "downward pressure" on a ledge or nubbin with your hand. You can also push sideways, and on occasion, even upward on less obvious holds. Push holds often work best when used in combination with other holds. Pushing in opposite directions and "push-pull" combinations are excellent techniques.

PUSH HOLD- SIDE PRESSURE

PUSH HOLD USING DOWNWARD PRESSURE

PUSH HOLD ON RIGHT HAND

(2) ***Pull holds***, also called "cling holds", which are grasped and pulled upon, are probably the most widely used holds in climbing.

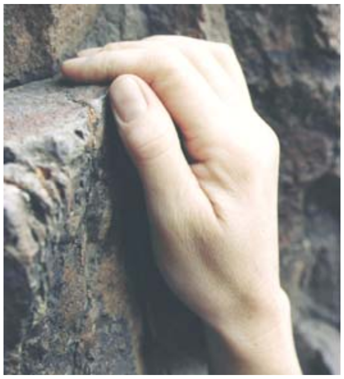
(a) You can use open hand technique on large ledges or sloping holds.

(b) The crimp grip increases grip strength on smaller holds.

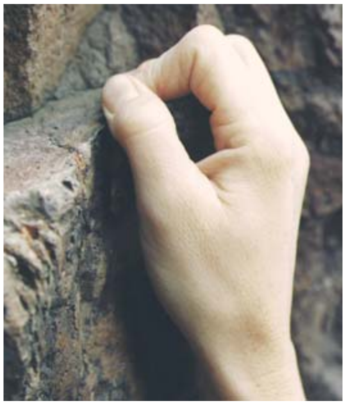
(c) Stack the thumb on top of the fingers for even greater strength on small holds.

(d) You can pull sideways (side cling) on vertical cracks or edges.

(e) You can use opposing side clings on a vertical crack.



PULL HOLD- OPEN HAND



PULL HOLD – CRIMP GRIP

PULL HOLD – CRIMP GRIP
WITH THUMB STACKED ON INDEX FINGER

SIDE PULL ON VERTICAL CRACK

DOWNCLING

OPPOSING SIDECLINGS

(3) ***Pinch holds.*** You simply pinch the hold with this technique.

PINCH HOLD

PINCH HOLD

(4) ***Hand jams.*** Like foot jams, the fingers and hands can be wedged or cammed into a crack so they resist a downward or outward pull. The hand can be placed in a crack a number of ways:

(a) Clench your fist and jam it into the crack.
(b) Insert the open hand thumb up into the crack; try to close your hand to improve grip.
(c) Insert the open hand thumb down into the crack; try to close your hand to improve grip.
(d) Insert your fingers into the crack.

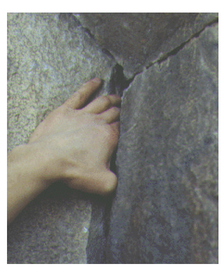
FIST JAM

FIST JAM

HAND JAM THUMB DOWN

HAND JAM THUMB TUCKED INTO PALM

HAND JAM THUMB UP



FINGER JAMS

Jamming technique for large cracks, or "off widths", requiring the use of arm, leg, and body jams, is another technique. To jam or cam an arm, leg, or your body into an off width, the principle is the same as for fingers, hands, or feet: you are making the jammed appendage "fatter" by folding or twisting it inside the crack. For off widths, you may place your entire arm inside the crack with the arm folded and the palm pointing outward. The leg can be used, from the calf to the thigh, and flexed to fit the crack.

Learning Step/ Activity 6 - Demonstrate the use of combination holds.

a. The positions and holds previously discussed are the basics and the ones most common to climbing. From these fundamentals, numerous combination techniques are possible. As you gain experience, you will learn more ways to position the hands, feet, and body in relation to the holds available.

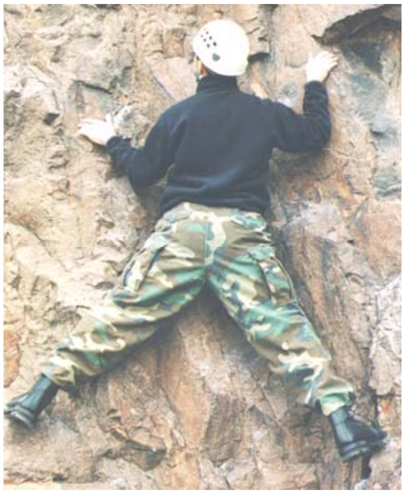
b. Sometimes, even on an easy route, you may come upon a section of the rock that defies the basic principles of climbing. Short of turning back, the only alternative is to figure out some combination technique which will work. Many of these type problems require the hands and feet to work in opposition to one another. Most will place more weight on the hands and arms than is desirable, and some will put you in an "out of balance" position. To make the move, you may have to "break the rules" momentarily. This is not a problem and is done quite frequently by experienced climbers. The key to using these types of combination techniques is to plan and execute them deliberately, without lunging or groping for holds, yet quickly, before the hands, arms, or other body parts tire. Still, most of these maneuvers require good technique more than great strength. Combination possibilities are endless. The following is a brief description of a few of the more common techniques.

(1) ***Change step.*** When you need to place one foot onto a hold that is occupied by the other foot you use the change step. It is commonly used when traversing to avoid crossing the feet. There are two ways to do this:

(a) You simply place your weight on the handholds while you reposition your feet. Simply hop from the foot placement and place the other foot onto the same foot placement you just hopped of off.

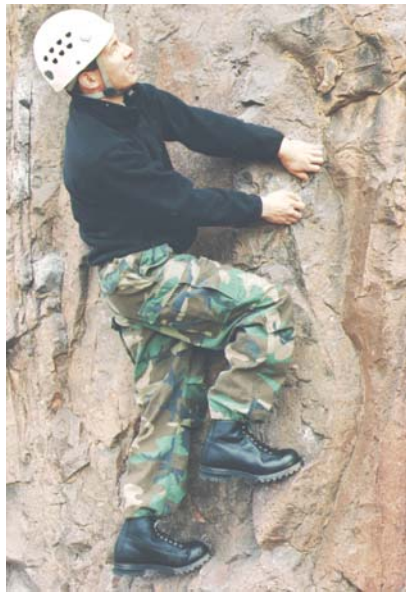
(b) You can also place the free foot on top of the foot that is on the rock. Then slide the bottom foot out and let the top foot slide into place on the rock.

(2) ***Stemming.*** When the feet work in opposition from a relatively wide stance, the maneuver is known as "stemming"



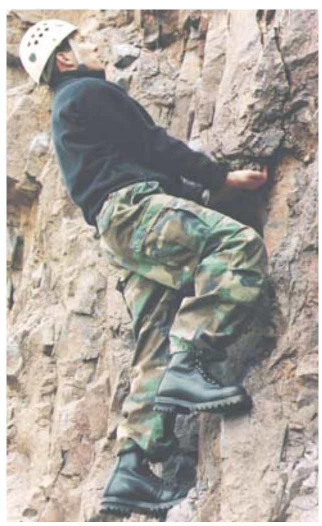
STEMMING

(3) ***Lieback.*** You can lie back onto your arms while the legs push on holds. This is a strenuous technique and may be difficult to get out of once you are in it. It can be very effective on cracks.



LIEBACK ON A FACE

(4) ***Undercling.*** An "undercling" is a classic example of handholds and footholds working in opposition. It is commonly used in places where the rock projects outward, forming a bulge or small overhang. Place your hands "palms-up" underneath the bulge, applying an upward/outward pull. Increasing this upward pull creates a "counterforce", or body tension, which applies more weight and friction to the footholds. The arms and legs should be kept as straight as possible to reduce fatigue. The climber can often lean back slightly in the undercling position, enabling him to see above the overhang better and search for the next hold.



UNDERCLING

(5) ***Mantling.*** Mantling is a technique that uses two push hold simultaneously to raise the body onto a ledge where there are few foot holds available.

(a) When the ledge is above head height, begin the mantle with pull holds by "hooking" both hands over the ledge. Pull yourself up until your head is above your hands, and you can begin to push down onto the ledge.

(b) Elevate yourself until the arms are straight and you can lock the elbows to relax the muscles.

(c) Rotate the hands inward during the transition from pull to push holds in order to place the palms more securely on the ledge.

(d) Once the arms are locked, raise a foot and place it on the ledge. The climber may have to remove one hand to make room for the foot. A mantle can be fairly strenuous, however most individuals should be able to support their weight, momentarily, on one arm if they keep it straight and locked.

(e) With the foot on the ledge, weight can be taken off the arms and the climber can grasp the holds that were previously out of reach.

(f) Once balanced over the foot, he can stand up on the ledge and plan his next move.

MANTLE SEQUENCE

WORK TOES UP THE ROCK UNTIL ARMS ARE EXTENDED

BRING ONE FOOT UP

MOVE ONE HAND FORWARD FOR BALANCE

ROLL ONTO ARM AND BEGIN

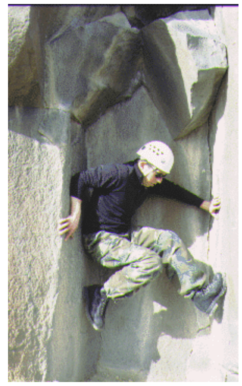
MAINTAIN BALANCE WHILE PLACING OTHER FOOT

BEGIN TO WALK AWAY

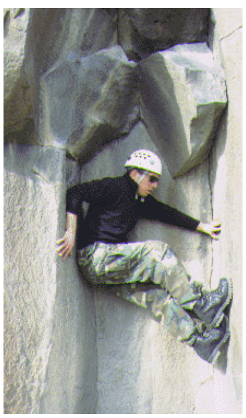
WALK AWAY FROM THE EDGE BEFORE STANDING

(6) ***Chimney.*** The chimney technique exerts cross pressure between the back and the feet, hands or knees. Many techniques and holds can be combined to move up a chimney.

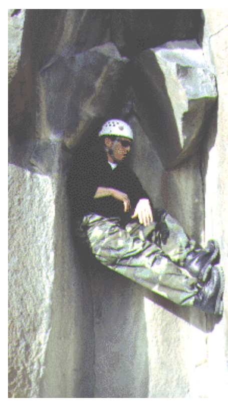
CHIMNEY SEQUENCE
BEGIN WITH ONE FOOT



BRING OTHER FOOT
INTO POSITION



FEET OPPOSING BACK



REST POSITION

BEGIN CLIMBING AGAIN

EXITING CHIMNEY

(7) ***Slab or friction technique.*** Since slab rock normally contains few, if any holds, the technique requires maximum friction and perfect balance over the feet. On lower angled slab, you can often stand erect and climb using full sole contact and other mountain walking techniques. On steeper slab, you will need to apply good smearing technique. Often, maximum friction cannot be attained on steeper slab from an erect stance. The climber will have to flex the ankles and knees so his weight is placed more directly over the balls of the feet. He may then have to bend at the waist to place the hands on the rock, while keeping the hips over his feet.

Pay attention to any changes in slope angle and adjust your body accordingly. Even the slightest change in the position of the hips over the feet can mean the difference between good grip, and a quick slip. You should also take advantage of any rough surfaces, or other irregularities in the rock as these will offer greater friction.

SLAB TECHNIQUE

(8) ***Down climbing.*** Down climbing is usually more difficult than ascending a given route. Some holds will be less visible when down climbing and slips are more likely to occur. You must often lean well away from the rock to look for holds and plan your movements. More weight is placed on the arms and handholds at times to accomplish this, as well as to help lower you to the next foothold. Hands should be moved to holds as low as waist level to give you more range of movement with each step. If the handholds are too high, you may have trouble reaching the next foothold. You must be very careful not to overextend yourself, which could force you to release handholds before reaching the next foothold.

(a) On easier terrain, you can face outward, and descend as you would any steep slope. As the steepness and difficulty increase, you can often turn sideways, which allows you to use the available holds. On the steepest terrain, you will have to face the rock and down climb using good climbing techniques.

(b) Descending slab formations can be especially tricky. The generally lower angle of slab rock may give you a false sense of security, and a tendency to move too quickly. Down climb slowly and deliberately. On lower angle slab you may be able to stand more or less erect, facing outward or sideways, and descend using good flat foot technique. On steeper slab, you will normally face the rock and down climb, using the same smearing technique as for ascending. An alternate method for descending slab is to face away from the rock in a "crab" position. Weight is still concentrated over the feet, but may be shifted partly onto the hands to increase overall friction. You are able to maintain full sole contact with the rock and see the entire descent route. Allowing the buttocks to "drag behind" on the rock will decrease the actual weight on the footholds, reducing friction, and lead to the likelihood of a slip.

DESCENDING SLAB IN THE "CRAB" POSITION

SECTION IV. SUMMARY

You now understand how to move efficiently on 4^{th} and 5^{th} class terrain. This will be applied in later lessons as you move over longer climbs and get more comfortable with exposure.

Check on Learning.

1. What are the duties of the spotter?
To insure the falling climber does not impact the head or spine; to help the climber land on the feet; to reduce the impact of a fall

2. What is the basic sequence for climbing?
Foot and hand placement, weight shift and movement (of the hands, feet, or body).

SECTION II. INTRODUCTION

Motivator: When 4th and 5th class terrain cannot be avoided, ropes can provide the margin of safety required to move personnel over this terrain. In order to use a rope safely for climbing, you must first learn how to connect yourself to the rope. There are many methods for connecting to a rope, and this block of instruction will provide you with some of these methods.

Terminal Learning Objective

ACTION	Tie into the climbing rope
CONDITION	Given a dynamic climbing rope, 25 foot 1" tubular nylon webbing and 16 foot sling rope
STANDARD	Soldier: - Tied an improvised seat harness and tied into the middle or end of the climbing rope within 10 minutes. Met all critical performance measures IAW the student or instructor evaluation plan. - Tied a rappel seat harness and tied into the middle or end of the climbing rope within 10 minutes. - Met all critical performance measures IAW the student or instructor evaluation plan.

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training.

Risk Assessment: Low

Environmental Considerations: None

Evaluation: You will be tested on your ability to tie an improvised seat harness and tie into the middle and end of a climbing rope IAW the student evaluation plan. If you fail to complete this action you will receive a NO-GO. You will be counseled and receive retraining. After re-training you will be given a second opportunity to re-test. If you fail to complete this action a second time you will receive a NO-GO and you will be dismissed from the course. Refer to the student evaluation plan for specific performance measures.

Instructional Lead-In: This lesson gives you a number of techniques for using and constructing harnesses as well as methods for tying a climbing rope to you.

SECTION III. PRESENTATION

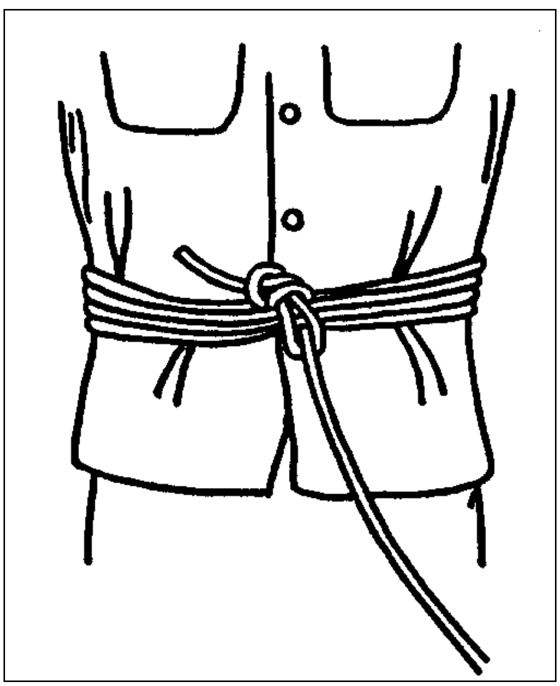
Learning Step /Activity 1- Tie into the end of the climbing rope with a bowline on a coil.

a. Traditionally, the standard method of attaching oneself to the climbing rope to the body was with a bowline on a coil around the waist. The extra wraps of this method distribute the force of a fall over a larger area of the torso than a single bowline would, and help prevent the rope from riding up over the rib cage and under the armpits. The knot must be tied snugly around the narrow part of the waist, just above the bony portions of the hips (pelvis).

b. To tie into the rope using the bowline on a coil:

(1) Stack a climbing rope and find one end; grasp the rope about one meter from the end and place this length over your right shoulder. The running end is to the back of the body.
(2) Starting at the bottom of the ribcage, wrap the standing part of the rope around your body and down in a clockwise manner at least four times. "Sucking in the gut" a bit when making the wraps will ensure a snug fit.
(3) With the standing portion of the rope in your left hand make a clockwise loop toward the body. The standing portion is on the bottom.
(4) Ensuring the loop does not come un-crossed, bring it up under the coils between the rope and your body.
(5) Pass the running end down through the loop, around the standing portion of the rope from right to left, and then back up through the loop.
(6) Pull on the running end of the rope and the standing portion of the rope to dress and set the knot.
(7) Safety the bowline with an overhand around the top wrap.

c. The bowline on a coil is a very safe and effective method for attaching to the rope when the terrain is low angled, **WITHOUT THE POSSIBILITY OF A SEVERE FALL**. When the terrain gets steeper, a fall will generate more force on you. This will be felt through the coils and can cause the coils to ride up against the ribs. Even in a relatively short fall, if the you end up suspended in mid-air and unable to regain footing on the rock, the rope around the waist can easily cut off circulation and breathing in a relatively short time.



BOWLINE ON A COIL

Learning Step/ Activity - 2 Tie into the middle of the climbing rope with a bowline on a coil.

a. To tie into the middle of the rope using the bowline on a coil:

(1) Stack a climbing rope and find middle of the rope; form a bight, grasp the rope about one meter from the bend in the bight and place this length over your right shoulder. The running end is to the back of the body.

(2) Starting at the bottom of the ribcage, wrap the standing parts of the rope around your body and down in a clockwise manner at least two times. "Sucking in the gut" a bit when making the wraps will ensure a snug fit.

(3) With the standing portion of the rope in your left hand make a clockwise loop toward the body. The standing portion is on the bottom.

(4) Ensuring the loop does not come un-crossed, bring it up under the coils between the rope and your body.

(5) Pass the running end down through the loop, around the standing portion of the rope from right to left, and then back up through the loop.

(6) Pull on the running end of the rope and the standing portion of the rope to dress and set the knot.

(7) Safety the bowline with an overhand loop knot around the top two coils.

Learning Step/ Activity 3- Tie an improvised seat harness.

a. The improvised seat harness is used when there is the possibility of a more severe fall or when a fall will leave you free hanging. It is constructed with a 25 foot length of one inch tubular nylon webbing. It is appropriate for all types of climbing as it distributes the force of a fall over the entire pelvic region and alleviates the danger of suffocation if you are hanging by the tie in connection only.

b. To tie the improvised seat harness:

(1) Begin with a 25 foot piece of 1 inch tubular nylon webbing. Measure 4 feet from one end of the webbing. Take a bight from the long side of the webbing. The bight should measure one half the distance around your mid thigh. Tie a leg loop with this bight using an overhand loop knot. Do not set the overhand loop knot. Place the leg loop over one thigh and adjust it so it is snug around your mid-thigh. Remove the leg loop.

(2) Make a second leg loop 6 inches from the first leg loop. Adjust it so that it is snug against your mid-thigh.

(3) Slip the leg loops over the feet and up to the crotch, with the knots to the front and the short end on your non-dominant hand side. The 6-inch cross strap must not have any twists in the webbing.

(4) Make 1 complete wrap around the waist with the short end, wrapping to the outside, and hold it in place on the hip; keep the webbing flat and free of twists when wrapping.

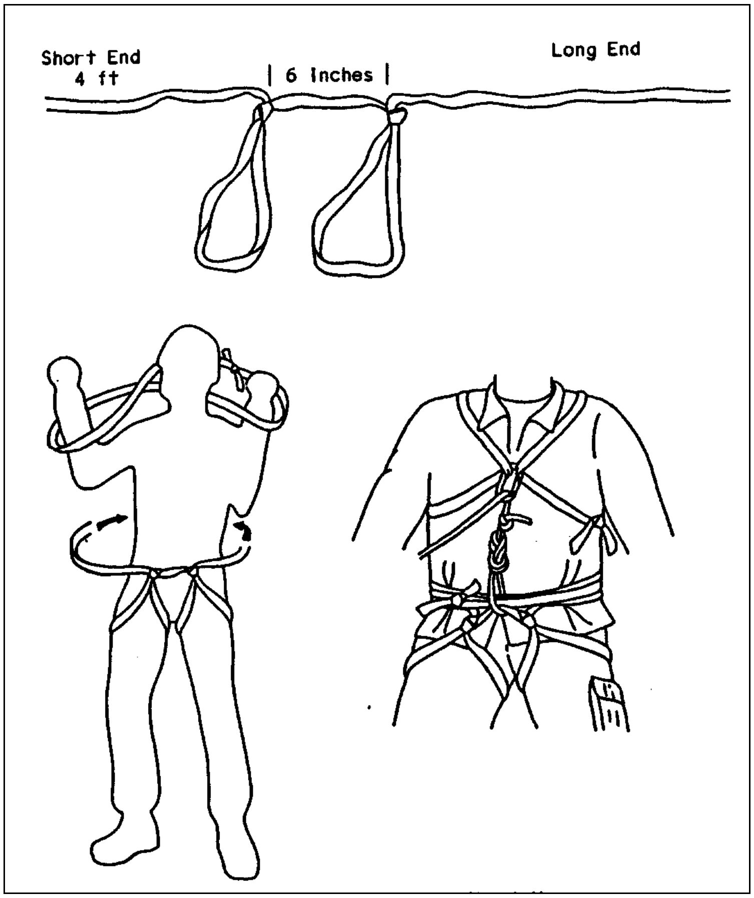
(5) Make 2 to 3 wraps around the waist with the long end in the opposite direction (wrapping to the outside), binding down on the short end to hold it in place. Keep the webbing flat and free of twists when wrapping. Both ends must finish on the same hip.

(6) Grasping both ends, adjust the waist wraps to a snug fit.

(7) Connect the ends with a water knot on the front of the hip, so you will be able to see what you are doing.

(8) Work out all of the slack in the waist straps to ensure all loops are snug.

(9) Tie all knots to standard.



IMPROVISED SEAT AND CHEST HARNESS

Learning Step/ Activity 4 – Tie the rappel seat harness.

a. To tie the rappel seat:

(1) Find the center of a 16 foot sling rope and place the bight at waist level on the guide hand hip.

(2) Reach behind and grasp one running end and bring it to the front and tie a double overhand knot.

(3) Run both ropes between the legs ensuring they don't cross. Pass the ends up under the waist rope, bisecting the rear pocket flap on the trousers. Pull up on the ropes, tightening the seat.

(4) From rear to front, pass the two ends through the leg loops creating a half-hitch on both hips.

(5) Bring the longer of the two ends across the front to the guide hand hip and secure the two ends with a square knot safetied with two overhand knots. Tuck any tails into the trouser pocket.

Rappel Seat

Learning Step/ Activity 5 - Tie the end of the climbing rope into a seat harness.

a. The attachment of the climbing rope to the harness is a CRITICAL LINK. The strength of the rope means nothing if it is attached poorly or incorrectly, and comes off the harness in a fall. Tie the end of the climbing rope to the seat harness with the figure-eight retrace knot.

b. To tie into the end of the rope:

(1) Find the end of a climbing rope and tie a figure-eight retrace knot around all waist straps and the six inch portion of webbing between the leg loops (cross strap).

(2) The loop of the figure-eight retrace knot will not exceed 12 inches.

(3) The knot must be tied to standard.

Learning Step/Activity 6 - Tie the middle of the climbing rope into a seat harness.

a. The climber ties the middle of the climbing rope to the seat harness with a double bowline knot.

(1) Find the middle of the climbing rope and tie a double bowline around all waist straps and the six inch portion of the webbing between the leg loops (cross strap).

(2) The loops of the double bowline will not exceed twelve inches.

(3) The knot must be tied to standard.

SECTION IV. SUMMARY

You now know how to construct the improvised seat harness and the rappel seat harness and you know how to tie into the middle or end of the climbing rope.

Check on Learning.

1. What knot do you tie in with when using an improvised seat harness and the end of the rope?
The figure-eight retrace knot.

2. What knot is used to tie into the middle of the rope?
The double bowline.

SECTION II. INTRODUCTION

Motivator: You now understand the basics of climbing and you are probably confident that you can negotiate 4th and easy 5th class bouldering problems close to the ground. Add in a few thousand feet of exposure and a heavy rucksack and you will probably want to use a rope. You and a partner can tie into a climbing rope, but unless you have the ability to use that rope to stop a fall, if one of you falls on steep terrain, it is likely that both of you will fall. This class will teach you to use the rope to stop a fall.

Terminal Learning Objective

ACTION	Demonstrate a basic top belay
CONDITION	Given an area with suitable features for establishing a top belay, adequate sling materials and carabiners and the requirement to belay a climber, the student will tie in to the climbing rope with a climber. Student will wear LCE, helmet and weapon during testing. Student may ground equipment while establishing the belay; equipment must be tied off if it is in danger of falling from belay position.
STANDARD	Soldier: - Demonstrated a non-extended seated hip belay within 15 minutes. Gave the command “BELAY ON” to stop time. - Demonstrated an extended seated hip belay and a mechanical belay using a Munter hitch within 10 minutes. - Demonstrated rope management procedures and commands while belaying a climber on the pitch. - Demonstrated the ability to arrest a falling climber. - Met all critical performance measures IAW the student/instructor evaluation plan.

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training. Ensure that students conduct buddy checks prior to climbing and that an instructor inspects all students before belaying/climbing.

Risk Assessment: Low

Environmental Considerations: None

Evaluation: You will be tested on your ability to establish a belay IAW the student evaluation plan. If you fail to complete this action you will receive a NO-GO. You will be counseled and receive retraining. After re-training you will be given a second opportunity to re-test. If you fail to complete this action a second time you will receive a NO-GO and you will be dismissed from the course. Refer to the student evaluation plan for specific performance measures.

Instructional Lead-In: You have already mastered the skills of rope management and knots, constructing anchors and tying in to the climbing rope. You will now use a combination of these skills to learn how to properly belay a climber.

SECTION III. PRESENTATION

Learning Step/Activity 1 - Watch a belayed climbing demonstration.

Belaying is a method of managing the rope in such a way that, should one person take a fall, the fall can be halted or arrested by another rope team member – the belayer. One person climbs at a time, while being belayed from above or below by another. The belayer manages the rope so that friction, or a brake can be applied to halt a fall. Belay techniques are also used to control the descent of personnel and equipment on fixed rope installations, and for additional safety on fixed ropes, rappels and stream crossing.

Watch my demonstrators.

You will notice that the climber and the belayer are checking each other to ensure that all parts of the belay system are correct. They are tied into the ends of the climbing rope. They use a series of standard commands to communicate with each other. You will learn more about these commands later. The climber is leading the route. The belayer is there to protect the climber if he takes a fall. Notice that the climber is placing anchors along the route. He will clip the rope to these anchors. Notice that the belayer is paying out rope as the climber moves up the route. This is known as giving rope. If the climber falls, the belayer will apply the brake to stop the fall. Now that the climber has reached the top of the route, he will establish an anchor. This will allow him to safely come off belay and establish a new belay to bring the second man up the route. This new belay is known as a top belay and is the type of belay you will establish later in this lesson.

Now that the top belay is established, the belayer and climber again communicate using standard commands and the climber ascends the route. Notice that the belayer is taking in rope to prevent any slack from developing between him and the climber. If the climber should fall, the belayer applies the brake and stops the fall of the climber. Once the climber reaches the top he will safety off and give the command OFF-BELAY. That concludes the demonstration.

Learning Step/Activity 2 – Manage the climbing rope for a belay.

a. To properly manage the rope for belaying you must be able to perform 3 basic functions:

(1) GIVE: Manipulate the rope to give the climber slack during movement.
(2) TAKE: Take up rope to remove excess slack.
(3) BRAKE: Apply brake to halt a fall.

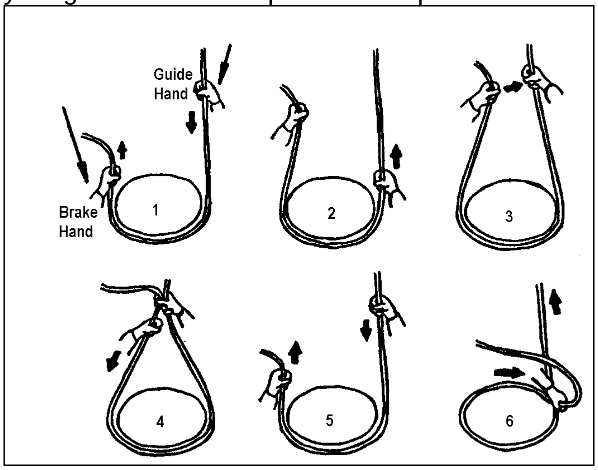
b. You must be able to perform all 3 functions while maintaining "total control" of the rope at all times. Total control means your brake hand is NEVER removed from the rope. Taking and giving rope, however, requires a certain technique to ensure the brake hand remains on the rope at all times.

c. Demonstration and execution of GIVE, TAKE and BRAKE.

Note: The instructor should lay a dynamic rope out into a circle large enough to accommodate himself and all students.

(1) Grasp the rope with both hands, and place it behind your back and around your hips. The hand on the section of the rope between you and the climber would be your guide hand. The other hand is your brake hand.
(2) Take in rope with your brake hand until your arm is fully extended. Your guide hand can also help to pull in the rope.
(3) Holding the rope in the brake hand, slide the guide hand out, extending the arm so the guide hand is farther away from the body than the brake hand.
(4) Grasp both parts of the rope, with the guide hand. Slide the brake hand back towards the body.
(5) Repeat the steps above to continue taking in rope.
(6) To apply the brake, bring your brake hand across your body and place it just above your US Army or name tape. The brake can be applied at any moment during the procedure.

(7) To give slack, simply allow the rope to slide through the grasp of the brake hand. You can use your guide hand to help feed the rope.



Learning Step/Activity 3 – Demonstrate a non-extended seated hip belay.

a. There are five steps to remember when setting up any belay:

(1) <u>Position and Stance.</u> Once the climbing route is picked, you, the belayer select your position. The position should allow you to maintain a comfortable, relaxed stance, as you could be in the position for a fairly long time. Large ledges that allow a well braced, seated position are preferred. Look for belay positions close to bombproof natural anchors.

(2) <u>Aim the Belay.</u> With the belay position selected, you must "aim" the belay. Figure out where the rope leading to the climber will run. Ask yourself: Which direction will the force of a fall come from? OR Which direction will the falling climber pull me?

(3) <u>Anchor the Belay.</u> For a climbing belay to be considered bombproof, you must be attached to at least one solid natural anchor(s) capable of withstanding the highest possible fall force. You and the anchor(s) must be ***in line*** with the direction of pull. You must also be ***snug*** against the anchor; that is there can be no slack between you and the anchor. This allows your stance and your belay anchors to absorb the force of a fall. You can use either a portion of the climbing rope or slings of the appropriate length to connect to the anchors.

(4) <u>Stack the Rope.</u> Once you are anchored into position, you must stack the rope to ensure there is no slack between you and the climber. When all of the slack is removed, the climber should sound off with "*THAT'S ME".* Stack the rope so that it is on your brake hand side. The rope should never be allowed to hang down over the ledge.

(5) <u>Attach the Belay.</u> The final step of the procedure is to attach the belay. You should make one quick, final inspection of your belay. When you are satisfied with your position, give the signal, "*BELAY ON*!".

b. A seated hip or body belay uses friction between the rope and the body as the rope is pressured across the clothing. For this scenario, assume you are at the top of a cliff and need to belay a climber up the cliff. The steps are as follows:

(1) Position and Stance: Select a position that allows you to sit and face the edge of the cliff. Ensure the position is close to a bombproof natural anchor(s). Use the terrain to strengthen your position and stance. Attempt to brace both feet against the rock to support your position. Attempt to sit in a slight depression, placing your buttocks lower than the feet. Straighten your legs for maximum support.

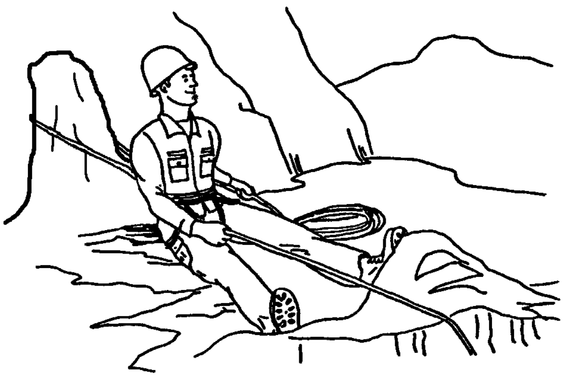
(2) Aim: Route the rope so that it runs from the tie in point on your harness, between your feet and directly to the climber.

(3) Anchor: From the position you have chosen, look to your rear and select a bombproof natural anchor that is in line with the rope running to the climber. Establish the anchor using the drape, wrap or girth method. Attach the carabiner from the anchor directly to the back of your improvised seat

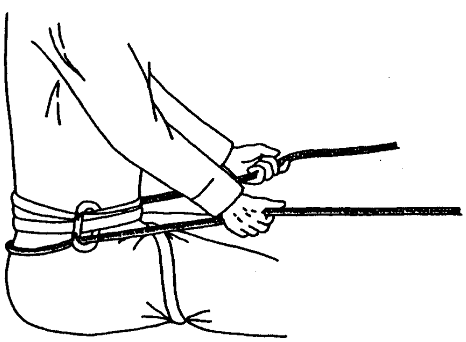
harness, ensuring that the carabiner gate opens up and away and is attached to all of the waist straps on the seat harness. Ensure you and the anchor are inline with the climber and that there is no slack between you and the anchor (snug).

(4) Stack the rope until all of the slack is removed between you and the climber, (you should hear *"THAT'S ME"* from the climber).

(5) Place the rope coming from the climber around the lower back. Your brake hand should be on the same side as the stacked rope (simply switch the stacked rope to the opposite side if you want/need that to be your brake hand). Place an oval carabiner into all portions of the waist straps on the guide hand side (the gate will open up and away from your body). Clip the rope into the carabiner. This is the guide hand carabiner and will prevent the rope from slipping up and over your head during braking. Inspect the system. When you are satisfied sound off with *"BELAY ON".*



SEATED HIP/BODY TOP BELAY



"GUIDE CARABINER" FOR
ROPE CONTROL IN A SEATED HIP/BODY BELAY

c. To belay:

(1) ***Take*** in rope with your brake hand until your arm is fully extended. Your guide hand can also help to pull in the rope.
(2) Holding the rope in the brake hand, slide the guide hand out, extending the arm so the guide hand is farther away from the body than the brake hand.
(3) Grasp both parts of the rope, with the guide hand. Slide the brake hand back towards the body. Release the rope you grabbed with your guide hand.
(4) Repeat the steps above to continue taking in rope.
(5) To apply the ***brake***, bring your brake hand across your body and place it just above your US Army or name tape. The brake can be applied at any moment during the procedure.
(6) To ***give*** slack, simply allow the rope to slide through the grasp of the brake hand. You can use your guide hand to help feed the rope.

NOTE: The belayer must ensure he is wearing adequate clothing to protect the body from rope burns when using a body belay.

Learning Step/Activity 4 – Demonstrate an extended seated hip belay.

a. It may be necessary to extend the belay out to a ledge, in order to communicate with your climber, or to get a more stable comfortable position etc. For this scenario, assume you are at the top of a cliff and need to belay a climber up the cliff. The anchors are well behind the edge of the cliff, but you want to be able to coach the climber as he moves up the rock. The steps for this are as follows:

(1) Position and Stance: Select a position that allows you to sit and face the edge of the cliff. Ensure the position is close to a bombproof natural anchor(s). Use the terrain to strengthen your position and stance. Attempt to brace both feet against the rock to support your position. Attempt to sit in a slight depression, placing your buttocks lower than the feet. Straighten your legs for maximum support.

(2) Aim: Route the rope so that it runs from the tie in point on your harness, between your feet and directly to the climber.

(3) Anchor: From the position you have chosen, look to your rear and select a bombproof natural anchor that is in line with the rope running to the climber. Establish the anchor using the drape, wrap or girth method. Attach the rope running from your tie-in point to the anchor carabiner using a clove hitch. Adjust the clove hitch to get to the desired position and stance. Ensure that the carabiner gate opens up and away. Ensure you and the anchor are inline with the climber and that there is no slack between you and the anchor (snug). Once in position, the rope must run from your harness around your guide hand hip to the anchor. This will ensure that you are inline with the force of the fall.

(4) Stack the rope until all of the slack is removed between you and the climber, (you should hear *"THAT'S ME"* from the climber).

(5) Place the rope coming from the climber around the lower back. Your brake hand is on the same side as the stacked rope. Place an oval carabiner into all portions of the waist straps on the guide hand side (the gate will open up and away from your body). Clip the rope into the carabiner. This is the guide hand carabiner and will prevent the rope from slipping up and over your head during braking. Inspect the system. When you are satisfied sound off with *"BELAY ON".*

c. To belay:

(1) ***Take*** in rope with your brake hand until your arm is fully extended. Use your guide hand to help pull in the rope.
(2) Holding the rope in the brake hand, slide the guide hand out, extending the arm so the guide hand is farther away from the body than the brake hand.
(3) Grasp both parts of the rope, with the guide hand. Slide the brake hand back towards the body. Release the rope you grabbed with your guide hand.
(4) Repeat the steps above to continue taking in rope.
(5) To apply the ***brake***, bring your brake hand across your body and place it just above your US Army or name tape. The brake can be applied at any moment during the procedure.
(6) To ***give*** slack, simply allow the rope to slide through the grasp of the brake hand. You can use your guide hand to help feed the rope.

Learning Step/Activity 5 – Demonstrate a mechanical belay using a Munter hitch.

a. The Munter hitch, when used in conjunction with a pear-shaped locking carabiner, is used to form a mechanical belay and can be used for all climbing applications. The holding power of a mechanical belay is vastly superior to any body belay, however rope management in a mechanical belay is more difficult to master and requires more practice.

b. Steps:

(1) Position and Stance: Select a position that allows you to sit and face the edge of the cliff. Ensure the position is close to a bombproof natural anchor(s). Use the terrain to strengthen your position and stance. Attempt to brace both feet against the rock to support your position. Attempt to sit in a slight depression, placing your buttocks lower than the feet. Straighten your legs for maximum support.

(2) Aim: Route the rope so that it runs from the tie in point on your harness, between your feet and directly to the climber.

(3) Anchor: From the position you have chosen, look to your rear and select a bombproof natural anchor that is in line with the rope running to the climber. Establish the anchor using the drape, wrap or girth method. Attach the carabiner from the anchor directly to the back of your improvised seat harness, ensuring that the carabiner gate opens up and away and is attached to all of the waist straps on the seat harness. Ensure you and the anchor are inline with the climber and that there is no slack between you and the anchor (snug).

(4) Stack the rope until all of the slack is removed between you and the climber, (you should hear *"THAT'S ME"* from the climber).

(5) Attach a pear shaped carabiner to the front of the improvised seat harness. The pear shaped carabiner is inserted around all waist straps and the cross strap and should open up and away from your body. Tie the Munter Hitch:

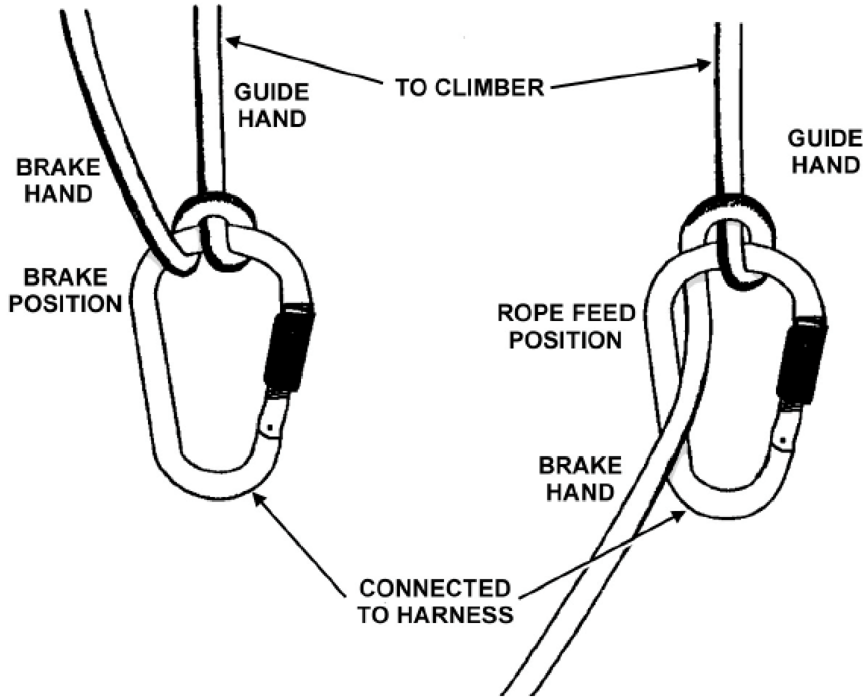
- Hold the rope going to the climber in both hands, palms down about 12 inches apart.
- With the right hand, form a loop away from the body toward the left hand. Hold the loop with the left hand
- With the right hand, place the rope that comes from the bottom of the loop over the top of the loop.
- Place the bight that has just been formed around the rope into the pear shaped carabiner. Lock the carabiner.

Inspect the system. When you are satisfied sound off with *"BELAY ON".*

c. To belay:

(1) Your brake hand is on the same side as the stacked rope. The hand on the rope running to the climber is the guide hand. Go to the rope feed position. Take in rope by pulling the rope towards you with the guide hand. Use the brake hand to help pull the rope in.
(2) Bring both rope parts together with your brake hand. Ensure the brake hand is closer to your body than your guide hand.
(3) Grasp both rope parts with your guide hand and slide the brake hand back towards the carabiner.
(4) Release the rope in your guide hand.
(5) Repeat the cycle.
(6) To brake, simply bring both rope parts together with the brake hand.
(7) To give rope, go to the rope feed position and pull rope away from you with the guide hand.

The Munter hitch is a two-way friction hitch. The Munter hitch will flip back and forth through the pear shaped carabiner as the belayer switches from giving slack to taking up rope.



MUNTER HITCH

Learning Step/Activity 6 - Tie the Munter mule knot.

a. This tie off procedure allows you to secure the Munter hitch and remove both hands from the rope while the climber is still on belay. It is often used as the first step in escaping the belay in order to render assistance to a climber that is injured or cannot negotiate the climb. The climber must not attempt to climb higher or lower during this procedure.

b. Steps:

(1) Go to the brake position.
(2) While maintaining the brake, take the brake strand and form a loop so that the running end of the brake strand is on top.
(3) Lay this loop on top of the rope running to the climber.
(4) Push a bight of rope from the brake strand up through the loop formed in step 2 forming an overhand slip knot.
(5) Dress the knot against the Munter Hitch.
(6) Lengthen the bight by pulling slack from brake strand side of the overhand slip knot.
(7) With this bight, tie an overhand loop around the portion of the rope going to the climber. The tail of this overhand loop must be at least 4 inches long. The Munter mule knot is complete.

c. To continue belaying:

(1) Remove the overhand tie-off from Step 7 above.
(2) While maintaining control of the brake strand, slowly remove the overhand slip knot. As the bight pulls through there will be a slight pop. Warn your climber that he may feel this on the rope.
(3) You are now in the brake position. Communicate with your climber that he can continue to climb.

Learning Step/Activity 7 - Demonstrate a standing hip/body or mechanical top belay.

a. Use the standing hip top belay on smaller ledges where there is no room for you to sit. What appears at first to be a fairly unstable position can actually be quite secure ***when belay anchor is placed at or above shoulder height*** to support the stance when the force will be downward. If it is below this height and a load is placed on you, you will be brought to your knees and possibly lose control of the belay.

b. Follow the steps to establish a hip belay or mechanical belay. The main exceptions are that you will remain standing and establish an anchor at or above shoulder height.

c. Belay using the techniques you have already learned.

Learning Step/Activity 8 – Describe the use of rope commands.

a. A series of standard voice commands were developed over the years to signal the essential rope management functions in a belayed climb. Each command is concise and sounds a bit different from another to reduce the risk of a misunderstanding between climber and belayer. They must be pronounced clearly and loudly so they can be heard and understood in the worst conditions.

The chart shows a conversation between belayer and climber with commands in capital letters and actions taken in lower case.

BELAYER	**CLIMBER**	**Meaning**
BELAY ON		The belay is on, you may climb when ready, the rope will be managed as needed
	CLIMBING	I am ready to climb
CLIMB (as a courtesy)		Proceed, and again, the rope will be managed as necessary
ROCK	ROCK	Protect yourself from falling objects. Signal will be echoed by all climbers in the area. If multi-pitch climbing, ensures climbers below hear.
Takes in rope	TAKE ROPE	Take in excess rope between us without pulling me off the route
Removes brake/tension	SLACK	Release all braking/tension on the rope so I can have slack without pulling the rope
Removes slack, applies brake	TENSION	Take all the slack, apply brake and hold me. My weight will be on the rope
Applies brake to arrest the fall	FALLING	I am falling
TWEN-TY-FIVE	Selects a belay position	You have app. 25ft. of rope left, start looking for next belay position
FIF-TEEN	Select a belay within the next few feet	You have about 15 ft. of rope left
FIVE	Set up a belay	You have about 5 ft. of rope left, set up the belay position ASAP.
THAT'S ME		You have no more rope.
Removes the belay, remains anchored, prepares to climb	OFF-BELAY	I have finished climbing and I am anchored. You may remove the belay.

b. Rope Tug Commands. Sometimes the loudest scream cannot be heard when you and the climber are far apart. This is especially true in windy conditions, or when the climber is around a corner, above an overhang, or at the back of the ledge. While climbing, the most important command is BELAY ON. For a rope tug command, the belayer issues three distinct tugs on the rope to signal BELAY ON.

SECTION IV. SUMMARY

You can now establish a basic belay. This fundamental skill translates to many situations in roped climbing. Other lesson will build on this skill.

Check on Learning.

1. What are the five steps to establishing any belay?
Position and Stance, Aim, Anchor, Stack the rope, Attach the Belay.

2. What are three things a belayer must do?
Give rope (slack), take rope (remove slack), brake (stop a falling climber).

3. What are two things a belayer must be? The belayer must be ***in line*** with the climber and ***snug*** against the anchor.

SECTION II. INTRODUCTION

Motivator: The vast majority of mountain routes you will select for movement should require nothing more than good mountain walking techniques, and possibly some easy climbing. However, some of these non-technical routes may be very exposed; if you slip, you can take a long fall. Obstacles to movement, avoided under normal circumstances, may need to be negotiated due to the tactical situation or lack of safer alternatives. Protecting a route with some type of rope installation will increase your unit's margin of safety on exposed terrain and allow you to move personnel over terrain that would otherwise be impassable. The fixed rope is an installation you can install and use to assist personnel over steep, exposed terrain.

Terminal Learning Objective

ACTION	Install a fixed rope
CONDITION	Given a climbing rope and a rack with adequate hardware and sling material. The installation will be constructed on a moderately steep slope or gully. The student will climb and fix the line; the grader will manage the rope and second the climb. Student will wear LCE, Ballistic Helmet and weapon for all portions of testing.
STANDARD	Soldier: - installed the fixed rope within 15 minutes - demonstrated movement procedures on the installation, including all methods of self-belay within 15 minutes - met all critical performance measures IAW the student/instructor evaluation plan

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training. Ensure that ambulance with medical personnel is at the rock site prior to the conduct of training. Ensure that instructors check installation prior to use.

Risk Assessment: Low

Environmental Considerations: None

Evaluation: You will be tested on your ability to install and move on a fixed rope IAW the student or instructor evaluation plan. If you fail to install the fixed rope properly or fail to demonstrate any of the movement techniques you will receive a NO-GO. After retraining, you will be re-tested. If you fail to install the fixed rope properly or fail to demonstrate any of the movement techniques a second time you will receive a NO-GO and you will be dismissed from the course. Refer to the student evaluation plan for specific performance measures.

Instructional Lead-In: You will now learn how to install and move on a fixed rope.

SECTION III. PRESENTATION

Learning Step Activity 1 – Install a fixed rope.

a. Fixed ropes, also called fixed lines, are low-load installations used to assist personnel over steep, exposed terrain.

b. To install a fixed rope:

(1) You and a second climber prepare to climb. Tie the improvised seat harness and tie into the end of the climbing rope. Stack the rope so that it feeds from the top as you climb. Choose a loading platform for the bottom of the fixed rope. Gather and carry all equipment necessary to establish an anchor at the top of the pitch. The second climber will manage the rope.

(2) Climb the pitch. Attempt to move over the easiest route possible. The climber managing the rope will let you know how much rope you have remaining. When twenty five feet of rope remains, the second climber sounds off with “TWENTY-FIVE”. When 15 feet of rope remains he sounds off with “FIF-TEEN”. When five feet of rope remains he sounds off with “FIVE”. When you reach the end of the rope you will hear the second sound off with “THAT’S ME”. These commands cue you to begin looking for a suitable anchor and unloading platform.

(3) Upon reaching the top of the pitch (or when coming to the end of the rope), you must find a suitable unloading platform. It should be clear of hazards and preferably back from any cliff edges.

(4) Establish an anchor for low load, alternating tension. A locking carabiner or two oval carabiners, gates opposite and opposed will accomplish this.

(5) You must establish a safety if you are closer than one body length from the edge. The easiest way to do this is to use take a length of rope from the harness, tie a clove hitch and insert it into the carabiner on the anchor.

(6) Take up any remaining slack. The second should manage the rope so that there is just enough rope remaining on the loading platform for soldiers to begin climbing. The second will sound off with “THAT’S ME” when this has been accomplished.

(7) Anchor the rope with a figure-eight loop knot. Manage the excess rope to prevent it from interfering with the fixed rope (stack the rope behind or to the side of the anchor). You can remain anchored to the installation and manage the unloading platform or untie and continue with other tasks.

(8) Give the command "CLIMB”. This signifies that the installation is ready for use.

Learning Step/Activity 2 – Move on a fixed rope.

a. There are two methods for ascending a fixed rope:

(1) Hand over hand technique: Grasp the rope and use it for assistance as you ascend the slope. Only one person moves on the rope at a time; a slip by one soldier could pull anyone else on the rope off their feet. When you complete the climb step away from the unloading platform and sound off with “CLIMB”.

(2) Camming technique: Grasp the rope with one hand, palm facing the ground, thumb pointing towards your body. Rotate the hand up. With the other hand, grasp the rope above the first hand and rotate this hand up. Repeat this process as you move up the pitch. This camming motion of the hands will increase the stability of the grip on the rope. When you complete the climb step away from the unloading platform and sound off with “CLIMB”.

b. These methods are used when on easy third and fourth class terrain where the consequences of a fall are not high. When the terrain becomes more difficult a self-belay can be used to provide additional protection.

Learning Step/Activity 3 – Move on fixed rope using a self-belay.

a. If the route followed by the fixed rope is exposed, there is probably enough of a hazard to warrant some additional protective measures. You can easily prevent a long, hard fall by tying a prussik around the fixed rope and attaching the prusik cord to your body. You simply slide the prusik along as you ascend. If you slip and lose control of the rope, the prusik will grab onto the rope and arrest the fall. A prusik used in this manner is referred to as a self-belay.

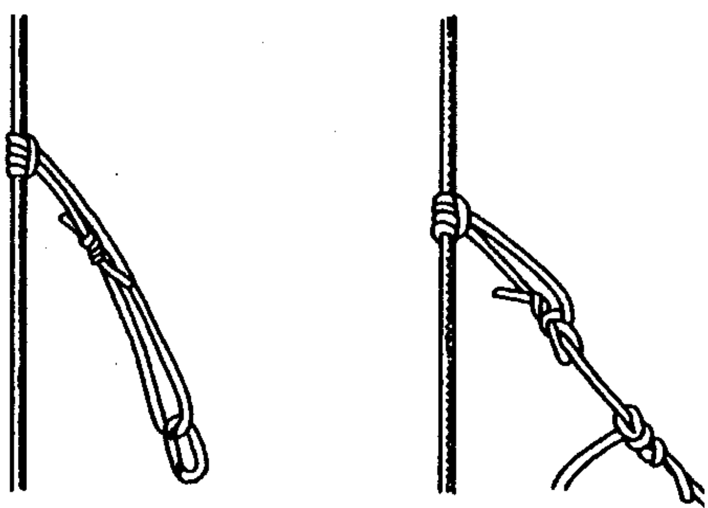
b. There are two methods for self-belay you will learn here:

(1) With a seat harness:

- Attach a locking carabiner to the improvised seat harness. Ensure the carabiner goes through all portions of the waist straps and the crotch strap and that the gate opens up and away from your body.
- Tie a 7mm x 6ft piece of cordelette into a continuous loop by joining the ends with a double fisherman's knot. The loop should be approximately three feet long when stretched out.
- Form a prusik knot on the fixed rope with the cordelette.
- Insert the portion of the loop opposite the prusik knot into the locking carabiner. The double fisherman's knot should be positioned so that it does not interfere with the prusik knot or the carabiner. Ensure the prusik is within arms reach so that you can recover if you take a fall.
- Ascend the fixed rope by sliding the prusik up the rope as you ascend.
- When you complete the climb, remove the prusik, step away from the unloading platform and sound off with "CLIMB".

(2) Without a seat harness:

- Tie one end of 7mm x 12 ft kernmantle rope around your waist with a bowline.
- The other end is then tied to the fixed rope with a prusik knot secured by a bowline. The ends exiting the locking bar of the prusik hitch are weighted equally. Again, the self-belay should hold the fixed rope within arms reach of the climber.
- Ascend the fixed rope by sliding the prusik up the rope as you ascend.
- When you complete the climb, remove the prusik, step away from the unloading platform and sound off with "CLIMB".



Self-Belay on a Fixed Rope

Method 1 **Method 2**

c. Additional considerations. If the rope is wet or icy, the prusik may not hold when weighted. Add another wrap to the prusik to increase the holding ability of the knot.

Learning Step/Activity 4 – Recover a fixed rope.

The best method of recovery is to have the last climber tie-in to the rope and ascend while being belayed from above. The climber can easily free the rope if it becomes caught on anything as it is taken up by the belayer. The Soldier acting as belayer should tie into the end of the rope before detaching the rope from the anchor. The belayer may use the same anchor for the belay that was used to anchor the fixed rope.

Learning Step/Activity 5 – Move on a fixed rope with intermediate anchors.

You have already learned how to install and move a fixed rope. Often the route you need to take will change directions. A fixed rope with intermediate anchors changes the direction of the rope or uses multiple ropes to protect a long section of terrain. The anchors effectively break the fixed rope into smaller sections. As you move on the rope you will need to move past the anchors. These are some techniques that you need to know in order to move safely on this type of fixed rope:

a. Use the seat harness method to establish a self belay.

b. Take a 5.5 foot piece of webbing and tie it in a continuous loop with a water knot to form a runner. Alternatively use cordelette. Girth hitch this runner to your harness.

c. Clip a locking carabiner to this runner. Clip the locking carabiner to the fixed rope and lock the carabiner.

d. Ascend the fixed rope until you come to an anchor point.

e. Remove the locking carabiner from the rope and clip it above the anchor on the next section of fixed rope and lock the carabiner.

f. Remove the prusik from the fixed rope and re-attach it to the next section of fixed rope.

g. Continue moving. If there are personnel moving behind you, signal to them that it is safe to move on the section of rope you just came off by yelling “CLIMB”.

h. Continue the above procedure until you are clear of the fixed rope.

NOTE: Instructor will demonstrate this process and then students will have a chance to practice.

NOTE: You may use a Kleimhiest knot, Bachman knot or an ascender in lieu of the prusik.

SECTION IV. SUMMARY

This basic rope installation is probably the most useful to military operations. You now have the skills to install and move on a fixed rope.

Check on Learning.

1. What are three methods of ascending a fixed rope?
Hand over hand, camming and self-belay

2. What can you do if the rope is wet and the prusik does not lock when weighted?
Add a wrap to the prusik.

3. What is the best way to recover a fixed rope?
Have the last climber tie into the rope and belay that individual from above.

SECTION II. INTRODUCTION

Motivator: You can quickly descend a steep slope by means of a rappel. Rappelling is a method of sliding down a rope which has been attached to a bombproof anchor. You control your speed by applying friction to the rope. You will learn to establish a rappel point, operate, and recover the system. Safety is always a primary concern as rappelling has contributed to many mountaineering accidents.

Terminal Learning Objective

ACTION	Rappel
CONDITION	Given 1 or 2 climbing ropes for the setup, a rack with adequate hardware and sling material, and appropriate terrain for all three rappel techniques. Student will wear LCE, ballistic helmet and weapon for all portions of testing. If weapon will interfere with set-up of installation it may be grounded.
STANDARD	Soldier: - Installed rappel point within 15 minutes - Demonstrated three rappel techniques within 15 minutes - Recovered a rappel point - met all critical performance measures IAW the student/instructor evaluation plan

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training. Ensure that ambulance with medical personnel is at the rock site prior to the conduct of training. Ensure that instructors check installation and inspect student prior to use of rappel installation.

Risk Assessment: Medium

Environmental Considerations: None

Evaluation: You will be tested on your ability to install a rappel point and demonstrate three rappel techniques IAW the student or instructor evaluation plan. If you fail to install a rappel point and demonstrate three rappel techniques you will receive a NO-GO. After retraining, you will be re-tested. If you fail to install a rappel point and demonstrate three rappel techniques a second time you will receive a NO-GO and you will be dismissed from the course.

Instructional Lead-In: This class will focus on establishing a basic rappel system and give you three methods of rappelling.

SECTION III. PRESENTATION

Learning Step Activity 1 – Install a retrievable rappel point.

a. First select the rappel site. You have already determined that there is a need for a rappel. There is a steep, vertical or overhanging cliff (obstacle) that you and/or your unit must move down. You should look for suitable anchors and a loading platform. Try to identify a suitable unloading platform. You must establish a safety if you are closer than a body's length from the edge. You should also determine if a single rope that is doubled over will reach the ground or if you will need to join two ropes together to reach the ground.

b. Once you have identified a site:

(1) Establish an anchor using either a drape, wrap or girth method. Attach a locking carabiner to the anchor webbing (alternatively, use two oval carabiners, gates opposite and opposed). Clear the loading platform of loose rock or debris; pad sharp edges that will contact the rope(s). Establish a safety line for yourself so that you can work near the edge.

(2) Find the middle of the climbing rope. Stack the rope on either side of the middle mark into two separate piles. Pass one of the piles through the webbing of the anchor. The middle of the rope should form a bight at the webbing. Never pull the rope through the webbing to get to the middle of the rope. This creates friction and can dangerously weaken the webbing.

(3) Prepare to throw the rope. S-fold the rope from the ends of the rope back to the anchor. Walk toward the edge dropping off coils closest to the anchor as you go. Separate the last 4-6 coils from the main pile and hold them in your other hand.

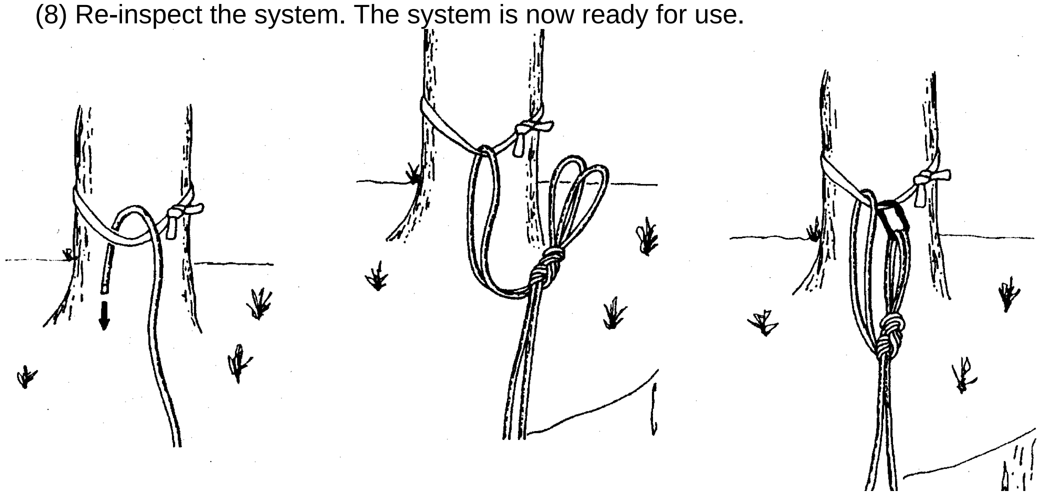
(4) Use an underhanded motion to throw the big pile of coils first and immediately after throw the little pile of coils (big first, little last). A few preliminary swings will ensure a smooth throw. The swings should be made with the arm nearly extended with the coil being thrown up and out. A slight twist of the wrist, so that the palm of the hand faces up, as the rope is thrown will allow the coils to separate easily, without tangling. Sound off with "ROPE" as you throw the rope (tactical situation permitting). Ensure the rope reaches the ground. If it becomes tangled, repeat this step.

(5) Pull up excess slack, if any, so that approximately 1 meter of rope remains on the unloading platform.

(6) Move back to the anchor, stacking any excess rope next to or behind the anchor.

(7) Tie a figure-eight loop on the doubled rope. The knot is set, but not dressed. Clip both loops into the locking carabiner and lock it down.

(8) Re-inspect the system. The system is now ready for use.



c. Additional considerations.

(1) If you are having trouble throwing the rope because of windy conditions, make the coils smaller and throw them hard, down and out.

(2) If a single rope is not sufficient to reach the ground, join two ropes together with a double fisherman’s knot, and then continue with the steps above. The double fisherman’s knot must be located on the rope part going through the anchor, between the anchor and the figure-eight on a doubled rope.

(3) If the unloading platform is not visible, only pull up enough slack to tie a figure-eight on a doubled rope.

(4) It is good practice to back up the anchor, especially if multiple personnel will be using the installation.

Learning Step/Activity 2 – Rappel.

a. There are three methods of rappelling you will use here:

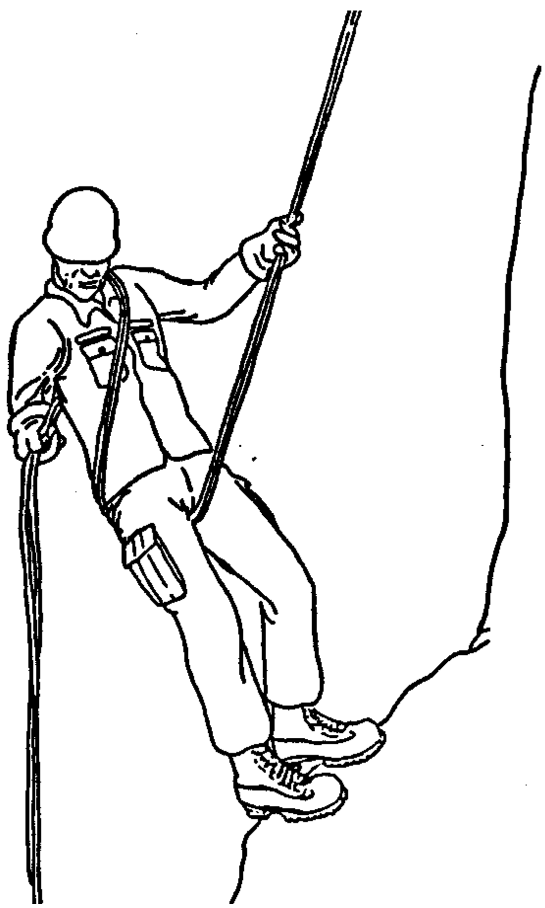
(1) Hasty Rappel. The hasty rappel is only used on moderate pitches. Its main advantage is that it is easier and faster than the other methods. Its main disadvantage is that the friction that controls descent is totally dependent on the muscles of your hands; hence steep descents must be avoided.

- Weapon is slung behind your back, muzzle down and toward guide hand side. LBV is buckled behind your back.
- Stand with your non-dominant (guide) hand shoulder facing the anchor with the rope behind you. The hand furthest from the anchor is your brake hand.
- Squat down, pick up the rope with both hands and place the rope horizontally across your upper back and under your arms. This is the rappel position.
- Go to the brake position. Bring your brake hand across your chest while simultaneously bringing your downhill leg up towards the anchor.
- Look over your brake hand shoulder and sound off with your last name and “ON RAPPEL”.
- Go to the rappel position and allow the rope to slide through your hands as you move downhill. Never remove the guide hand or brake hand while conducting a hasty rappel. Descend in a smooth controlled manner.
- Upon reaching the unloading platform, drop the rope, remove any twists and sound off with “OFF RAPPEL”.

(2) Body (Dulfersitz) Rappel. This rappel is used on moderate to vertical terrain. Never use the body rappel on overhanging terrain.

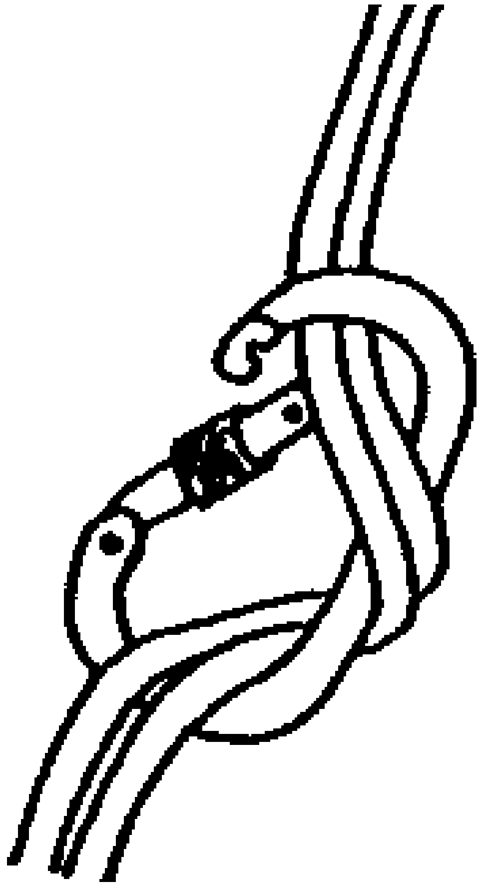
- Weapon is slung behind your back, muzzle down and toward guide hand side. LBV is buckled behind your back.
- Button your top button and turn your collar up to protect your neck. Remove any pin on rank. Face the anchor point and straddle the rope.
- Grasp rope from behind, run it around your brake hand hip, then diagonally across the chest and back over the guide hand shoulder. From there, the rope runs down the back, under the arm to the brake hand.
- Go to the brake position. Bring the brake hand across your chest. Both feet face the anchor.
- Look over your brake hand shoulder and sound off with your last name and “ON RAPPEL”.
- Step at a 45 degree angle down the slope while bringing your brake hand out and down hill. Allow the rope to slide through your brake and guide hands as you move down the slope. The foot corresponding to the brake hand should precede the other at all times. Never remove the guide hand or brake hand while conducting a body rappel. Do not squat down while conducting the body rappel. Descend in a smooth controlled manner.
- Upon reaching the unloading platform, drop the rope, remove any twists and sound off with “OFF RAPPEL”.

CAUTION: DO NOT RELEASE THE GUIDE HAND FROM THE ROPE. A FALL BACKWARDS AND A COMPLETE UNWINDING FROM THE ROPE WILL OCCUR RESULTING IN AN UNCONTROLLED FALL. BENDING AT THE WAIST WILL RESULT IN ALL SLACK COMING OUT OF THE ROPE AND LOCKING THE RAPPELLER IN THIS POSITION.



(3) Carabiner Wrap (Seat-Hip) Rappel. An improvised seat harness, commercially manufactured climbing harness or the rappel seat may be used for this activity. You will use the rappel seat for this course.

- Weapon is slung behind your back, muzzle down and toward guide hand side. LBV is buckled behind your back.
- Insert two non-locking steel oval carabiners through all waist loops of the rappel seat (gates opposite and opposed). Insert a large steel locking carabiner into the steel oval carabiners with the gate facing away and towards the guide hand side.
- Face the rappel rope with your guide hand toward the anchor. Insert both ropes into the locking steel carabiner.
- Take slack between the carabiner the anchor point and wrap it around the spine of the carabiner to form a round turn. Lock the gate. This results in a turn of doubled rope around the spine of the carabiner which does not cross itself when under tension.
- Grasp the ropes below the carabiner with the brake hand with the thumb pointing up the ropes toward the body. Hold the brake hand behind and slightly above the hip. This is the rappel position.
- Go to the brake position. Close your brake hand and press the ropes into the small of the back.
- Look over your brake hand shoulder and sound off with your last name and “ON RAPPEL”.
- Lean well out from the rock and make a smooth, controlled descent. On vertical terrain, your body should be in an “L” shape with the feet shoulder width apart, legs straight and buttocks parallel to the ground. Descend in a smooth controlled manner. Do not bound. The guide hand may be removed from the ropes, but the brake hand will never be removed.
- When you reach the unloading platform, clear the rope, remove any twists and sound off with “OFF RAPPEL”.



b. Additional considerations for the carabiner wrap rappel.

(1) You may need to stop during a rappel to free a stuck rope or remove loose rock or debris. To do this:

- Apply the brake.
- With your guide hand, reach behind your back, grasp the ropes and bring them around your guide hand hip.
- Now make three or more round turns or wraps around your guide hand side leg. Maintain your brake while you are doing this.
- Slowly release the tension from your brake onto the leg wraps. The friction of the leg wraps will hold you in place as you work with your hands.
- When you are ready to continue the rappel, first regain your brake with the brake hand. Use your guide hand to slowly un-wrap the leg wraps and put tension back on the brake hand. When you are completely unwrapped from the leg wraps, continue the rappel.

(2) If you are rappelling with heavy loads, on a single rope, or on wet or icy ropes and you want to apply more friction for greater control:

- Pass the rope from the brake hand to the guide hand.
- The guide hand becomes the brake hand. Apply the brake by bringing the rope across the chest.

AND/OR

- Add an additional wrap to the locking carabiner.

(3) Use a belay man for additional safety with the carabiner wrap rappel. This is known as the fireman's belay. To belay:

- Position yourself on the unloading platform.
- Grasp both ropes and sound off with "BELAY ON".
- If the rappeller loses control on the descent, pull down on both rope parts to stop the fall.
- Once the rappeller regains control of the rappel, you can relax your grip on the ropes and allow the rappeller to continue.

(4) Always attach yourself to the anchor with your safety arm prior to rappelling. Test the rappel while still attached with your safety arm before removing it and rappelling.

Learning Step/Activity 3– Use an Autoblock to control your descent.

a. Rappelling is a dangerous activity. You can lose control of your brake hand during the descent and potentially fall a long way. Like the fireman's belay, the autoblock is another control measure you can use with the carabiner wrap to prevent an accident.

b. Steps:

(1) Secure a 6' piece of cord and tie it into a continuous loop with a double fisherman's or figure-eight bend.
(2) Clip a locking carabiner to the leg loop on your brake hand side.
(3) Use your safety arm to attach yourself to the anchor. Rig for carabiner wrap rappel.
(4) Clip the cord to the locking carabiner. Now wrap the cord around both rope parts a minimum of four times.
(5) Clip the other end into the carabiner on your leg loop and lock it. Grab the autoblock and the rappel ropes with your brake hand.
(6) Go to the brake position and lean back. Test the autoblock by removing your brake hand from the rope. When you are satisfied, remove your safety arm and rappel.

c. As you rappel down you must keep your brake hand on the autoblock to keep it open and allow you to rappel. On lower angle terrain, you may need to feed rope through the autoblock to continue moving. As soon as you let go, the autoblock will engage and stop your descent.

Learning Step/Activity 4 – Recover the rappel point.

a. The last man to rappel will be responsible for retrieving the installation. To retrieve this installation:

(1) Remove and untie the figure-eight on a doubled rope. Normally the weight of the rope will pull any excess rope to the bottom. You may have to re-coil the rope and throw it to get it down the slope.
(2) Recover the carabiner(s).
(3) Rappel using one of the three methods you learned.
(4) After reaching the unloading platform, get clear of the rappel and remove any twists in the rope. Now pull on one side of the rope. It will feed through the webbing and fall free to the ground. If you are using two ropes, pull on the side of the rope with the knot to prevent it from becoming tangled in the anchor webbing.
(5) As the rope begins to fall, sound off with “ROPE” to warn others in the area of the falling rope.

b. The webbing at the top is the only thing that is left behind. The rope will burn the webbing as it feeds through and the webbing is no longer serviceable.

SECTION IV. SUMMARY

You know have the skills to rappel.

Check on Learning.

1. What are three methods of rappelling?
Hasty, body and carabiner wrap rappels.

2. Can the body rappel be used on vertical terrain?
Yes, but never on vertical terrain.

3. What can you do to control your descent if you are carrying a heavy load?
Pass the rope from the brake hand to the guide hand.
The guide hand becomes the brake hand. Apply the brake by bringing the rope across the chest.

AND/OR

Add an additional wrap to the locking carabiner.

4. How is the system recovered?

The last man to rappel will be responsible for retrieving the installation. To retrieve this installation:

(1) Remove and untie the figure-eight on a doubled rope. Normally the weight of the rope will pull any excess rope to the bottom. You may have to re-coil the rope and throw it to get it down the slope.
(2) Recover the carabiner(s).
(3) Rappel using one of the three methods you learned.
(4) After reaching the unloading platform, get clear of the rappel and remove any twists in the rope. Now pull on one side of the rope. It will feed through the webbing and fall free to the ground. If you are using two ropes, pull on the side of the rope with the knot to prevent it from becoming tangled in the anchor webbing.
(5) As the rope begins to fall, sound off with “ROPE” to warn others in the area of the falling rope.

5. Can the webbing at the top be re-used?
NO! The rope will burn the webbing as it feeds through and the webbing is no longer serviceable.

SECTION II. INTRODUCTION

Motivator: You may encounter a ravine or gorge that you unit must cross. Establishing a rope bridge to move everyone is often faster and more efficient than having everyone negotiate the obstacle.

Terminal Learning Objective

ACTION	Install a one-rope bridge
CONDITION	Given a climbing rope and a rack with adequate hardware and sling material. The installation will be constructed over a swift mountain stream or ravine, etc. Installation will be performed by a squad/team of no less than 5 personnel and evaluated collectively. Crossing technique will be graded individually. Site selection and anchors will be pre-selected and provided at the test site.
STANDARD	Squad: - Installed a one-rope bridge (primary static rope and back-up dynamic rope) within 45 minutes. For every 5 minutes over the time standard of 45 minutes, one point will be deducted - Scored a minimum of 35/50 points Soldier: - Performed as a member of the team during the installation of the one rope bridge. - Crossed the one rope bridge and met all critical performance measures IAW the student/instructor evaluation plan.

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training. Ensure that ambulance with medical personnel is at the rock site prior to the conduct of training. Ensure that instructors inspect installation and students prior to use.

Risk Assessment: Medium

Environmental Considerations: None

Evaluation: You will be tested on your ability to install and move on a one rope bridge IAW the student or instructor evaluation plan. If you fail to install and move on a one rope bridge you will receive a NO-GO. After retraining, you will be re-tested. If you fail to install and move on a one rope bridge a second time you will receive a NO-GO and you will be dismissed from the course.

Instructional Lead-In: This class will focus on installing, moving on and recovering a one rope bridge.

SECTION III. PRESENTATION

Learning Step Activity 1 – Install a one rope bridge.

a. The one rope bridge is a "tight rope" or high load installation used to move personnel and equipment over terrain obstacles such as swift flowing mountain streams, ravines, and other deep gullies. It is best to construct the one rope bridge using a static rope.

b. Site selection. Some considerations are:

(1) The maximum distance the rope bridge can span is roughly 2/3 of the actual rope length. For a 60 meter rope (200 ft), this equates to a distance 133 feet.

(2) The crossing site must have suitable "bombproof" anchors on both the near and far banks. Since the rope bridge is a high load installation, these anchors must be extremely strong. Large, healthy trees and solid rock formations are preferred. Try to find an anchor which is stronger than the climbing rope.

(3) The site must also have suitable loading and unloading platforms between the anchors and each edge of the obstacle so that personnel can safely get on and off the system.

c. Installation. The one rope bridge is best installed as a team of 5-8 members. Once you have identified a site:

(1) Designate a strong climber (swimmer) to take the rope to the far side of the obstacle and establish an anchor. If crossing a stream refer to 699-9033: Mountain Stream Crossing for belay techniques during a stream crossing. If crossing a ravine, getting across may involve a rappel down and a roped climb up the other side.

(2) Temporarily anchor the rope on the far side (e.g. tie rope around a tree with a bowline).

(3) Establish the transport tightening system.

- On the near side, pull the rope towards the near side anchor. Tie a wireman's knot with a 12 inch loop as close to the anchor as possible.
- Place two oval carabiners gates opposite and opposed into the loop of the wireman's knot. Gates should open away from the loop of the wireman's knot.
- Route the rope around the near side anchor point (if using a tree). Alternatively route the rope into the carabiner of the drape, wrap or girth anchor.
- Clip the rope back into the carabiners at the wireman's knot. This completes the transport tightening system.

(4) On the far side, pull the wireman's knot away from the near side anchor approximately 6-10 feet for a static rope or ¼ the distance from the near side anchor for a dynamic rope. This allows room to tighten the rope later.

(5) Anchor the rope on the far side. Use a tensionless anchor knot for a tree. A bowline is preferred if tying into the carabiner of a drape, wrap or girth hitched anchor. To tie the tensionless anchor:

- Tie a figure-eight loop in the end of the rope. The end of the rope is wrapped around and down the anchor three or more times.

- Attach the fixed loop of the figure eight to the standing part of the rope with a carabiner.

- Once the rope is under tension, the wraps should take a significant amount of the load off the figure eight knot making the knot easier to untie. More wraps generally equals less load on the knot. Avoid excess slack between the figure eight loop knot and the wraps.

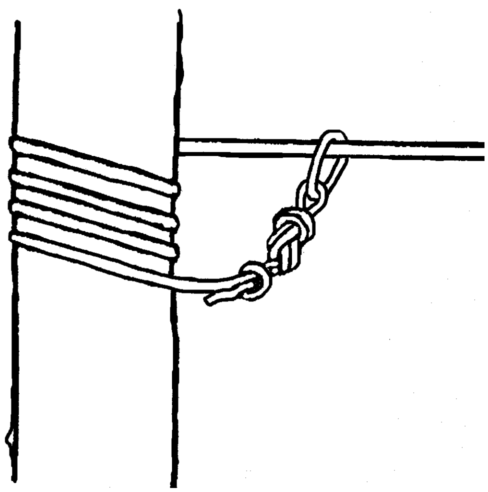
(6) Tighten the rope on the near side. No more than three personnel pull on the rope exiting the carabiners at the wireman's knot. The rope should only be tightened to a point where enough stretch is taken out to eliminate severe sagging once it is loaded. It is very important not to "over-tighten" the rope. If all the stretch is taken out of a rope, strength loss will be "SEVERE" and the chance of the rope breaking will be high. The rope does not have to be "guitar-string" tight. Once the rope is adequately tightened, the location of the wireman's knot should be close enough to the near anchor so personnel can easily load onto the system in front of the knot.

(7) Tie the transport knot:

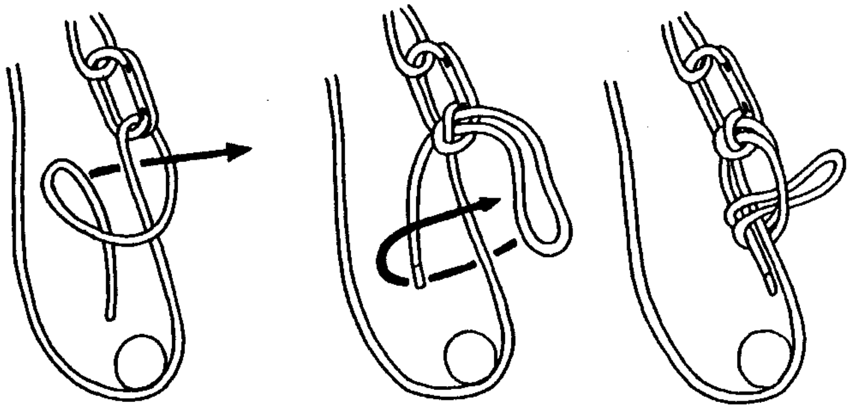
- As the three personnel maintain tension on the rope, another individual tightly grasps the two rope parts exiting the carabiners with both hands. The three personnel can let go.

- Another individual quickly ties the transport knot secured with a half-hitch. The bight of the completed knot should hang down and be at least 12 inches long to eliminate the chance of it working loose.

(8) Inspect the system. It is now ready for use.



Tensionless Anchor Knot



Transport Tightening System Secured with Transport Knot

d. Additional considerations:

(1) A second rope may be installed under less tension to increase safety. An individual would clip-in to both ropes when crossing.

(2) After tightening with the transport tightening system (Step 6), the rope may be tied off with the tensionless anchor on the near side.

Near Side Tensionless Anchor Knot

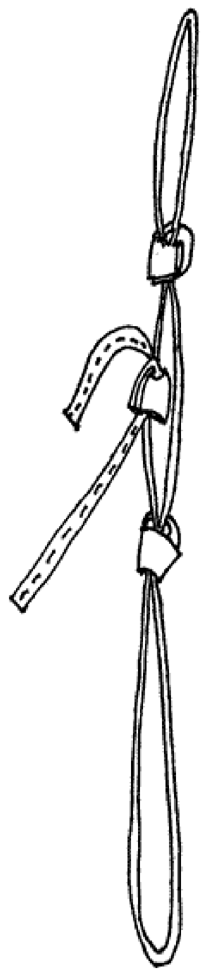
Learning Step Activity 2 – Cross a one rope bridge.

a. Preparation.

(1) Tie the improvised seat harness, the rappel seat harness or use a commercially manufactured harness. Clip a locking carabiner to the front of the seat harness. Weapon is slung behind your back, muzzle down and UNDER the LBV. LBV IS BUCKLED NORMALLY

(2) When moving with a rucksack a carrier sling must be utilized. The carrier sling ensures that the weight of the rucksack is on the rope and not on you. To create the sling:

- Tie a 9.5 ft piece of 1 inch tubular nylon webbing into a continuous loop using the water knot.
- Hold the loop so that the water knot hangs 1/3 the distance from the top of the loop. Tie an overhand loop knot one fist distance above the water knot. Tie a second overhand loop knot one fist distance below the water knot.
- You now have a sling with three loops – one small loop, one medium sized loop and one large loop. Girth hitch the small loop to the top frame of the rucksack.
- Place a carabiner on the medium sized loop opposite the water knot.



Carrier Sling

b. Crossing.

(1) Face the rope with the far side anchor to your left shoulder. Clip into the rope with the locking carabiner and lock the gate.

(2) Clip the carabiner on the carrier sling to the one rope bridge. Clip the large loop to another carabiner that is on the leg loop of the seat harness.

(3) Rotate your body under the rope. Your head will be towards the far side anchor. The rucksack should be positioned between your legs. Move hand over hand towards the far side. Do not place your feet on the rope.

(4) When you reach the far side, dismount in the same position that you hooked up in.

Learning Step Activity 3 – Recover a one rope bridge.

To retrieve the one rope bridge, the last man:

- recovers the rope and hardware on the near side.
- Rappels down the near side of the obstacle (if applicable). The far side can lower a rope and set-up a belay to bring the last man up the far side of the obstacle (if applicable).
- Additional techniques are covered for belaying the last man across a stream/river in Lesson 699-9033: Mountain Stream Crossing.

SECTION IV. SUMMARY

You now have the skills to install and move on a rope bridge.

Check on Learning.

1. What is the maximum distance that a one rope bridge can span?
½ to 2/3 of the total rope length.

2. How many personnel are used to tighten the transport tightening system?
Three personnel maximum.

SECTION II. INTRODUCTION

Motivator: Bouldering is one method of learning how to rock climb, but it limits you to short climbing routes. Top rope climbing is a training technique that allows you to work on longer climbs that are at or even slightly beyond your ability (up to half the length of the climbing rope) using the safety of a rope system.

Terminal Learning Objective

ACTION	Demonstrate basic rock climbing technique using a top rope
CONDITION	On a one pitch rock climb of approximately 5.4 Yosemite Decimal System (YDS) rating. Given the protection of a top rope belay and wearing standard military boots, LCE, and ballistic helmet
STANDARD	Soldier: - completed the climb within 15 minutes, - demonstrated proper technique, form and balance during the climb, - met all critical performance measures IAW the student evaluation plan.

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training. Ensure that ambulance with medical personnel is at the rock site prior to the conduct of training. Ensure that instructors check installation and inspect student prior to use of top-rope installation. Instructors will periodically inspect top rope anchors.

Risk Assessment: Medium

Environmental Considerations: None

Evaluation: You will be tested on your ability to climb and belay using a top rope IAW the student evaluation plan. If you fail to complete this action you will receive a NO-GO. You will be counseled and receive retraining. After re-training you will be given a second opportunity to re-test. If you fail to complete this action a second time you will receive a NO-GO and you will be dismissed from the course. Refer to the student evaluation plan for specific performance measures.

Instructional Lead-In: You will now receive instruction on how to use a top rope system.

SECTION III. PRESENTATION

Learning Step/ Activity 1 – Prepare to top rope climb.

a. Given an established top rope system, you and a partner can prepare to climb:

(1) As the climber you:

- Tie the improvised seat harness or a don a commercial harness and then tie into the end of the climbing rope.
- Remove all watches, rings and jewelry.
- Wear the helmet. Clean off the bottom of boots.
- Inspect the belayer to ensure he is prepared to belay.

(2) As the belayer you:

- Tie an improvised seat harness or don a commercial climbing harness. Attach a pearabiner to the climbing harness.
- Remove all watches, rings and jewelry.
- Wear the helmet.
- Create an anchor at the base of the climb. Attach the anchor to the climbing harness. This will prevent you from being pulled out of position and potentially losing control of the belay.
- Grab the end of the rope not attached to the climber and take up all slack between you and the climber
- Attach the rope to the pearabiner using a Munter Hitch. (the hip/body belay is not appropriate for top rope climbing)
- Inspect the climber to ensure he is prepared to climb.

Learning Step/Activity 2 – Conduct a top rope climb.

a. The climbing sequence is as follows:

(1) Belayer says "*BELAY ON*".
(2) The climber gives a courtesy "CLIMBING" when he is ready to begin climbing.
(3) The belayer responds with "CLIMB".
(4) The climber conducts the climb using the principles learned in the climbing class. The belayer manages the rope using the principles learned in the belay class.
(5) The climber ascends no higher than the locking carabiner at the top of the climb. The climber checks that the anchor system is solid and ensures that the gate to the locking carabiner is locked.
(6) When the climber is ready to be lowered, he says "*TENSION".*
(7) The belayer will remove the slack in the system by taking as much rope as he can and going to the brake position. The belayer will then respond with "*READY TO LOWER*". The climber will then say "*LOWER*".
(8) The belayer will pay out slack to lower the climber, slowly and under control. The belayer should be prepared to brake to halt the climber at any moment. The climber should be in a good "L" shape position as he is lowered. The climber keeps the arms out to the side to protect him from slamming into the rock should he loose footing. The climber must not grab the rope.
(9) When the climber reaches the ground, the climber says "*OFF BELAY*". At this time, the belayer disassembles the belay and the climber disconnects from the rope. Until the climber says "*OFF BELAY*" the belayer remains attentive to the climber.

Learning Step/Activity 3 – Belay with a tuber (aperture) style belay device.

a. Tuber style belay/rappel devices are common mountaineering equipment. You should know how to use this device to belay a climber.

b. To belay using this device:

(1) Take a bight of the climbing rope and pass it through the slot on the tuber style belay device.
(2) Clip the bight of rope and the retention device (usually a piece of metal) into the locking pearabiner on your climbing harness. Lock the carabiner. You are now ready to belay.
(3) Manage the rope using the same technique used with the Munter Hitch.
(4) The only difference is the brake position. To brake, pull the rope in your brake hand down towards your hip.

Learning Step/Activity 4 – Belay with a figure-eight descender.

a. Figure-eight descenders are another belay/rappel device used in mountaineering. You should also know how to belay with this device.

b. To belay:

(1) Take a bight of the climbing rope and pass it through the small end of the figure-eight descender. Clip the bight into the locking pearabiner and lock the carabiner.
(2) Manage the rope using the same technique used with the Munter Hitch.
(3) The only difference is the brake position. To brake, pull the rope in your brake hand down towards your hip.

SECTION IV. SUMMARY

You now know how to safely use a top rope system to train climbers. Use the top rope system to develop climbing ability; this will allow for the development of more advanced climbing techniques in later courses.

Check on Learning.

1. During a top roped climb, if the climber says "*FALLING*", how far could he fall if the belayer is performing as he should?

The climber should not fall as all slack should be kept out of the rope as the climber progresses. A slight falling sensation will be felt as a dynamic rope will stretch as the climber's weight comes onto the rope.

b. What does the climber say when he reaches the top of a climb?

"Tension!!!"

SECTION II. INTRODUCTION

Motivator: There will be times when proper climbing techniques are not enough to get you up a vertical obstacle. One individual can establish a fixed rope on a vertical or overhanging obstacle using aid techniques (discussed in other lessons). With improvisation you can easily ascend this fixed line and surmount the obstacle.

Terminal Learning Objective

ACTION	Ascend a fixed rope on a vertical or overhanging obstacle
CONDITION	Given a fixed rope on vertical terrain and adequate hardware and sling material
STANDARD	Soldier: - Conducted a prusik ascent of a fixed rope within 30 minutes. - Met all critical performance measures IAW the student/instructor evaluation plan.

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training. Ensure that ambulance with medical personnel is at the rock site prior to the conduct of training. Ensure that instructors check installation and inspect student prior to conducting ascent. Instructors will periodically inspect anchors. Students will ‘tie in short’ after ascending approximately 8 feet; students will continue to ‘tie in short’ every 10-15 feet after that.

Risk Assessment: Medium

Environmental Considerations: None

Evaluation: You will be tested on your ability to ascend a fixed rope on a vertical or overhanging obstacle IAW the student evaluation plan. If you fail to ascend a fixed rope on a vertical or overhanging obstacle, you will receive a NO-GO. After re-training you will be given a second opportunity to re-test. If you fail to ascend a fixed rope on a vertical or overhanging obstacle a second time, you will receive a NO-GO and you will be dismissed from the course.

Instructional Lead-In: This lesson covers the techniques for ascending a fixed line on vertical to overhanging terrain.

SECTION III. PRESENTATION

Learning Step Activity 1 – Ascend a fixed rope on a vertical or overhanging obstacle.

a. A simple method for ascending a fixed rope on vertical or overhanging terrain involves the use of prusik knots to ascend the rope.

(1) Don a commercial climbing harness or improvised seat harness. Tie into the end of the fixed rope with a re-traced figure-eight knot.

(2) Attach two locking pearabiners to the harness. Tie a 6 foot piece of cordelette into a loop with the double fisherman's knot. Clip the loop into the pearabiner. Bring the loop up to your head; the end of the loop should be at about eyebrow level. Adjust the cordelette as necessary; this adjustment is critical to an efficient ascent. Remove the cordelette from the pearabiner.

(3) Tie a three wrap prusik knot onto the fixed rope with the cordelette. Clip the loop into the pearabiner and lock it.

(4) Tie a twelve foot piece of cordelette into a loop with the double fisherman's knot. Separate the knot 6-8 inches by pulling on the short tails of the knot. Step into the loop (foot stirrup) you created when you separated the knot with one or both feet. Cinch the knot back down onto the foot. Bring the remainder of the cordelette up to your waist. Tie a figure-eight loop knot with a (approximately) nine inch loop. When fully extended, the top of this loop should be at your belly button. Adjust the cordelette as necessary; this adjustment is critical to an efficient ascent.

(5) After you have adjusted the long cordelette, remove it from your feet. Tie a prusik with the loop of the figure-eight knot below the first prusik knot. Replace the foot stirrup onto your foot.

(6) Slide the waist (top) prusik knot as high onto the rope as you can manage and weight the prusik by sitting back on it.

(7) Slide the foot prusik to within a fist distance of the waist prusik. Stand up to weight the foot prusik. You may need to grab the fixed line to help you stand in the foot prusik.

(8) Loosen the waist prusik, slide it as high as you can manage, and weight it. Loosen the foot prusik, slide it to within a fist distance of the waist prusik. Stand up to weight the foot prusik. Loosen the waist prusik, slide it as high as you can manage, and weight it.

(9) After you have moved about 8 feet, sit back on your waist prusik. Take a loop of rope just below your leg prusik and tie a figure-eight loop knot. Clip this to the locking pearabiner and lock it. This is called tying in short and prevents you from hitting the ground if both prusiks fail.

(10) Repeat the above procedure until you reach the top of the fixed rope. Continue to tie in short every 10-15 feet. Tie and clip the new knot before removing the previous tie in.

b. Additional considerations.

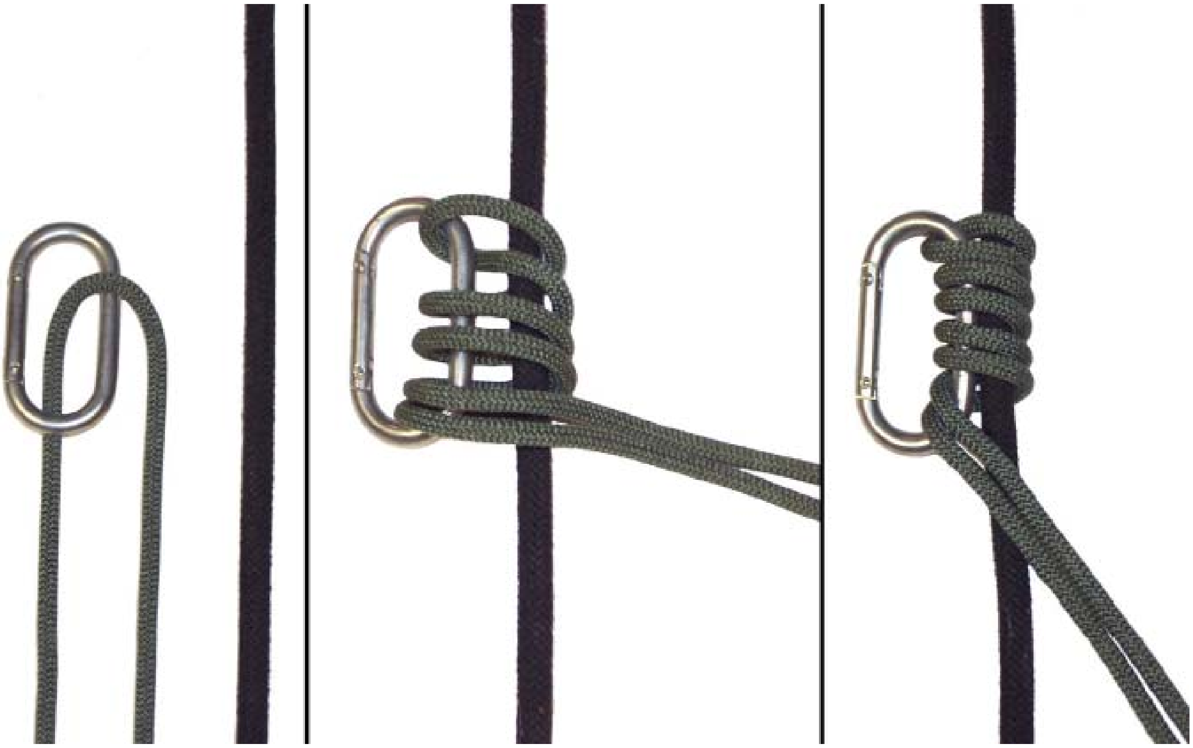
(1) For training purposes set-up a top-rope and belay the climber as he ascends the fixed line.

(2) If the prusik knots slide when weighted add a wrap to the prusik knot.

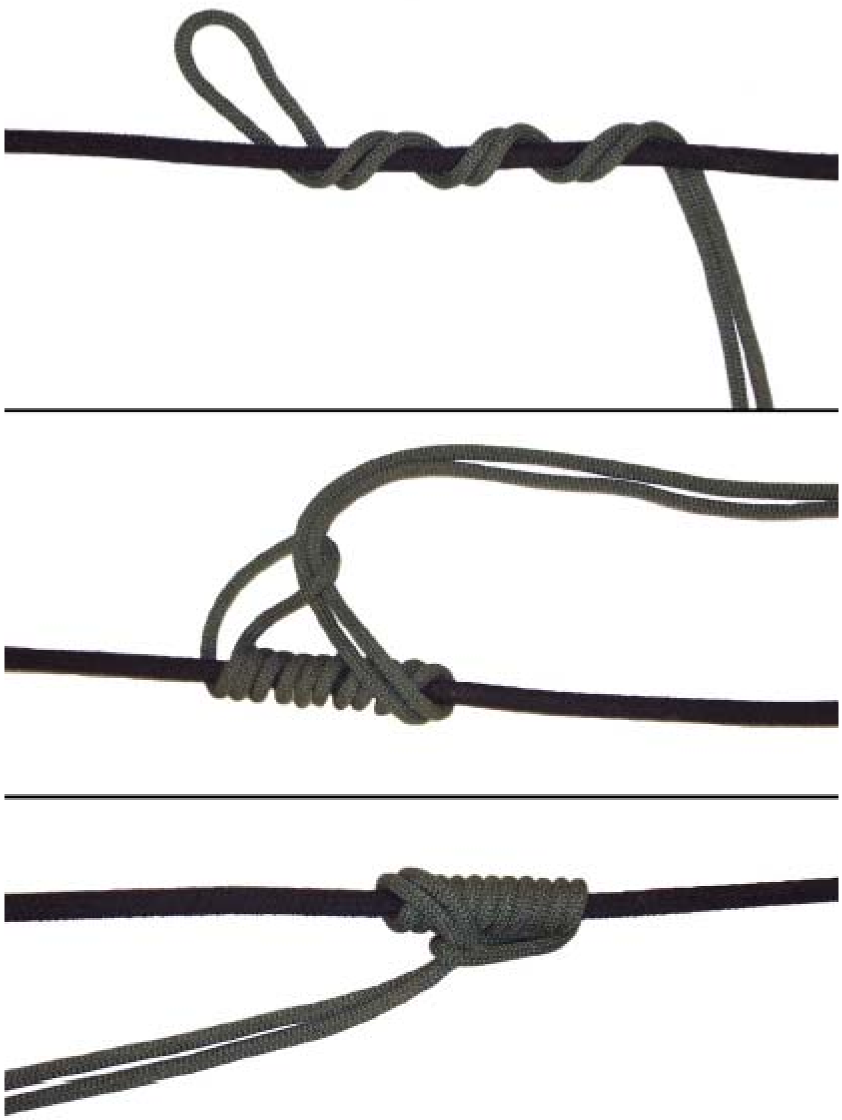
(3) You can descend using this system by reversing the procedure.

(4) You can use other friction knots or mechanical ascenders in place of the prusik knots. These include:

- The Bachman Knot. Tie a piece of cordelette into a loop with a double fisherman's knot. Clip the loop into a carabiner (preferably a locking carabiner). Wrap the cordelette around the spine of the carabiner and the fixed rope a minimum of three times. Clip the loop into a locking carabiner attached to your climbing harness. This knot will slide forward, but will lock when weighted.



- The Klemheist Knot can be tied with webbing or cordelette. Tie the webbing or cordelette into a loop. Lay a bight perpendicular to the fixed rope. Wrap the webbing down towards your body a minimum of three times. Bring the remaining portion through the original bight and pull down to complete the knot.



SECTION IV. SUMMARY

You now have the skills required to negotiate a fixed rope when the terrain is vertical or overhanging.

Check on Learning.

1. What measurements should you use for the waist prusik?

From the clip in point to your eyebrows.

2. What measurements should you use for the foot prusik?

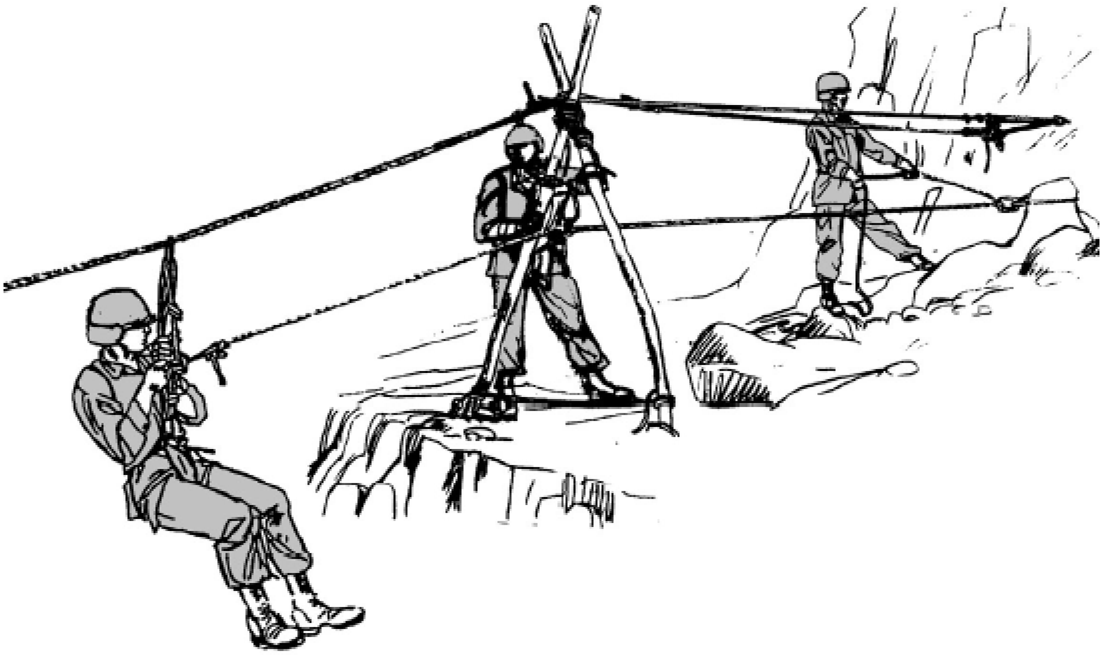
From the bottom of your boots to the belly button.

3. Which prusik should be on top?

Waist High, Legs Low

SECTION II. INTRODUCTION

Motivator: The suspension traverse is a variation of the one rope bridge used to move personnel and equipment. It adds artificial height to the rope bridge allowing you to clear an obstacle. It is ideally suited to moving larger amounts of equipment down a face when rappelling with the load would be too difficult. It is normally installed at an angle from the top to the bottom of the pitch, but may also be used on a horizontal plane in place of the standard one rope bridge to move heavier equipment across an obstacle.



Terminal Learning Objective

ACTION	Install a suspension traverse
CONDITION	Given three climbing ropes, a rack with adequate hardware and sling material, and A-frame poles appropriate for the ACTION. The installation will be constructed to negotiate an obstacle which may vary from the horizontal to the near vertical. The maximum distance the suspension traverse can span is approximately 1/2 to 2/3 of the rope length in use. This ACTION will be performed by a squad/team of no less than 5 personnel and evaluated collectively
STANDARD	Squad: - Installed a suspension traverse within 1 hour. For every five minutes over the time standard of one hour, one point will be deducted. - Scored 35/50 points IAW the student/instructor evaluation plan. - Lowered at least two persons or pieces of equipment on the system.

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training. Ensure that ambulance with medical personnel is at the rock site prior to the conduct of training. Ensure that instructors inspect installation and students prior to use.

Risk Assessment: Medium

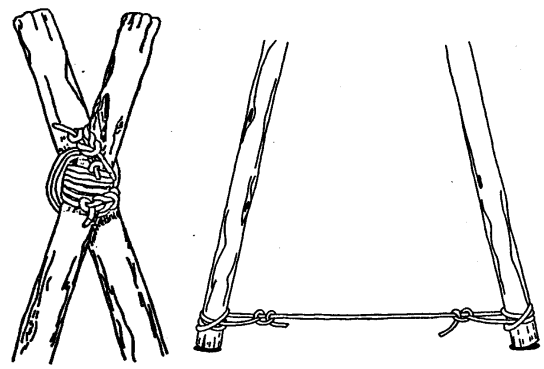
Environmental Considerations: None

Evaluation: You will be tested on your ability to install a suspension traverse and lower two persons or pieces of equipment IAW the student or instructor evaluation plan. If you fail to install a suspension traverse and lower two persons or pieces of equipment you will receive a NO-GO. After retraining, you will be re-tested. If you fail to install a suspension traverse and lower two persons or pieces of equipment a second time you will receive a NO-GO and you will be dismissed from the course.

Instructional Lead-In: You will now install a suspension traverse and lower two persons from the installation.

SECTION III. PRESENTATION

Learning Step Activity 1 – Install a suspension traverse.



a. Site selection.

(1) The maximum distance the rope bridge can span is roughly 2/3 of the actual rope length. For a 60 meter rope (200 ft), this equates to a distance of 133 feet.

(2) The crossing site must have suitable "bombproof" anchors on both the near and far side of the obstacle. Since the rope bridge is a high load installation, these anchors must be extremely strong. Large, healthy trees and solid rock formations are preferred. Try to find an anchor which is stronger than the climbing rope.

(3) The site must also have suitable loading and unloading platforms between the anchors and each edge of the obstacle so that personnel can safely get on and off the system. The A-frame is used to gain sufficient height at the loading platform to allow clearance for the load.

b. Assemble the A-frame:

(1) Select two sturdy poles. The exact size of the poles depends on the amount of load that will be placed on the system and how much height is needed. Generally, the poles will need to be about 10 feet long, and about 4-6 inches in diameter to support a typical load. The following terms are used to refer to the parts of an A-frame.

- Apex- near the top of the A-frame where the poles cross.
- Butt Ends- bottom of the A-frame poles that are placed on the ground. The larger ends of the poles should be used for the butt ends.

(2) Sight the A-Frame. Place the two poles in place as they would be in the finished installation. The A-Frame will be perpendicular to the traverse ropes and the apex will be inline with the near and far side anchors. Leave 12-18 inches of pole above the apex. On soft ground, create pockets for the butt ends about 6 inches deep. On hard ground, attempt to find natural pockets in which to place the butt ends of the poles. Mark the location of the apex on both poles.

(3) Lay the poles side by side on the ground. Line up the apex marks. With a 16 ft sling rope, tie a clove hitch around either pole at the apex marking. Leave approximately 18 inches of this rope at one end of the clove hitch. Ensure the locking bar of the clove hitch is toward the outside of the poles, away from the apex.

(4) Wrap the long end of the rope six to eight times horizontally around both poles, wrapping down toward the butt ends. It may be necessary to join another rope to the first by using a square knot. Position the knot on the outside of one of the poles so that it does not interfere with the vertical wraps to be made next. This square knot should be finished with overhand knots around the tail portions only. Make at least two additional wrap below the square knot before starting the vertical wraps.

(5) After completing the last horizontal wrap, stand the A-Frame up and spread the legs slightly. Place a half-hitch around the pole that ***__does__*** contain the clove hitch and start the vertical wraps. Make 4 to 6 vertical wraps or “fraps”, around the center of horizontal wraps. Pull each frap tight to secure the apex.

(6) On the second to last frap, insert a non-locking carabiner with the gate facing down and away from the apex. The use of this carabiner will be explained later.

(7) On the last frap pass the rope between the poles above the horizontal wraps and tie it off to the 18 inch end of rope coming from the clove hitch with a square knot. The wraps should be so tight that the overhand knots securing the square knot will not be able to be tied around any of the wraps. Tie the overhand knots in the tail ends as close to the knot as possible.

(8) Reposition the A-Frame to the site you selected earlier.

(9) Use a "spreader rope" to prevent the legs from collapsing when pressure is applied to the apex. Use a 12 foot piece of 6mm or 7mm cordelette. Attach one end to each leg 4-6 inches above the butt ends (measured from ground level) with a clove hitch, securing both ends around the standing part of the rope with two half-hitches. These hitches grip the poles well, allow for quick adjustment of the spreader rope, and are safe to use in this application.

c. Install the suspension traverse:

(1) Designate one Soldier to move to the far side of the obstacle. Carry two ropes (minimum of one will be a static rope) and sufficient materials to rig anchor(s).

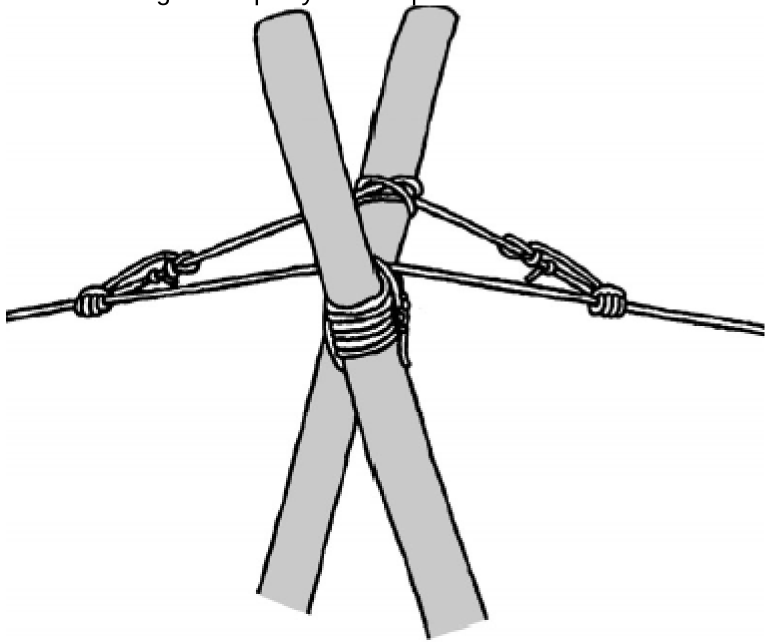
(2) Temporarily anchor both ropes to the far side anchor.

(3) Rig the near side anchor. Place padding at the apex. Place the static rope in the apex of the A-Frame and establish a transport tightening system.

(4) On the far side, pull the wireman’s knot away from the near side anchor approximately 6-10 feet from the near side anchor. Anchor the rope on the far side. Use a tensionless anchor knot for a tree. A bowline is preferred if tying into the carabiner of a drape, wrap or girth hitched anchor.

(5) Anchor the A-frame to the static rope in the following manner:

- Find the center of a 6mm or 7 mm X 12 ft cordelette and tie a clove hitch 4 inches above the apex.
- The locking bar of the clove hitch is to the inside of the A-frame.
- Secure both ends of this rope to the load rope, one above and one below the A-frame, with prusik knots secured with a bowline knot. The ends exiting the locking bar of the prusik hitch are weighted equally. This rope is referred to as the "stabilizing" rope.



Stabilizing Rope

(6) Tighten the rope with three personnel and at the same time adjust the A-Frame so that it best supports the system. Secure the rope with the transport knot. The A-Frame should bisect the angle created by the rope. Lock the A-Frame in place by adjusting the prusik knots of the stabilizing rope.

(7) Place padding above the static rope. Place the second rope in the apex of the A-Frame and establish a transport tightening system.

(8) On the far side, pull the wireman's knot away from the near side anchor approximately 6-10 feet from the near side anchor (or ¼ the distance of the span for a dynamic rope). Anchor the rope on the far side BELOW the primary rope. Use a tensionless anchor knot for a tree. A bowline is preferred if tying into the carabiner of a drape, wrap or girth hitched anchor.

(9) Tighten the rope just enough so that it runs parallel to the first rope. Secure the rope with the transport knot. Ensure this transport knot is off-set from the primary rope transport knot. This rope serves as a back-up.

d. Establish a belay:

(1) Stack a dynamic rope behind the near side anchor. Tie a figure-eight loop in the end and attach it to the carabiner at the apex of the A-Frame.

(2) Attach a short sling to the nearside anchor and clip the belay rope to it using a carabiner. (this is to redirect the rope to a separate anchor).

(3) Establish another anchor on the near side. This anchor should be located away from the loading platform but should be close enough to the edge to observe the personal or equipment moving on the

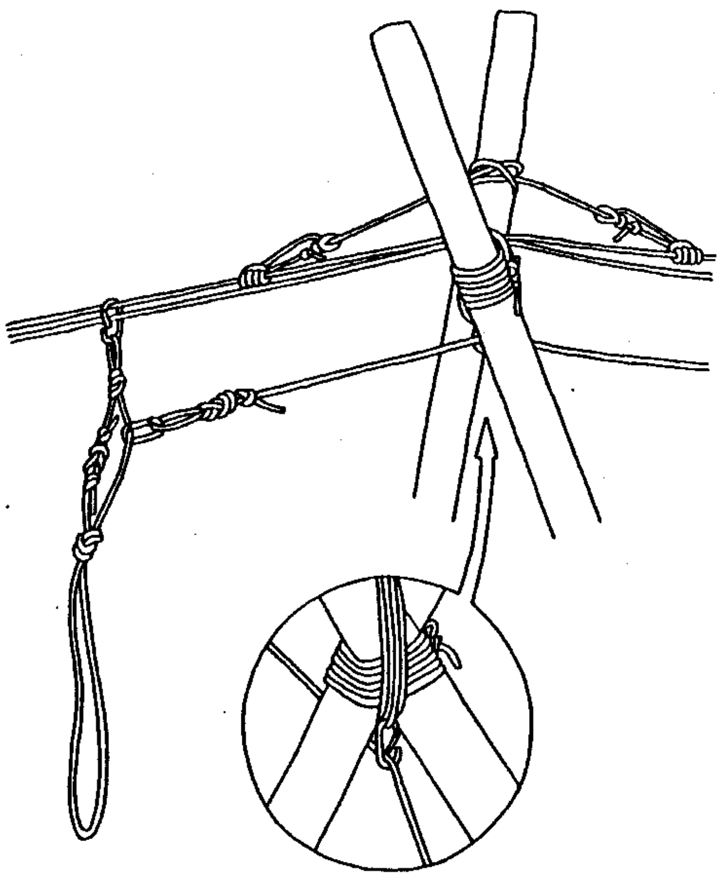
suspension traverse. Connect a pearabiner to this anchor. Attach the belay rope to the pearabiner with a Munter hitch. You will belay directly from the anchor. Restack the rope if necessary.

e. Use a carrying rope to attach loads to the suspension traverse and belay rope. To construct a carrying rope.

(1) Join the ends of a 16 foot sling rope with a square knot or double fisherman's knot tied to standard. Displace the knot 1/3 the distance down the loop. Tie an overhand loop knot one fist distance above the square knot. Tie a second overhand loop knot one fist distance below the square knot. You now have a sling with three loops – one small loop, one medium sized loop and one large loop.

(2) Attach the small loop to both ropes with a large steel locking D-shaped carabiner. Run the belay rope through the carabiner at the apex of the A-Frame and attach it to the medium sized loop of the carrying rope with a locking carabiner.

f. Re-inspect the entire system. It is now ready for use.



Carrying Rope with Belay Rope Attached

Learning Step/Activity 2 – Move personnel or equipment on the suspension traverse.

a. To move personnel on the suspension traverse:

(1) A belay man ensures the belay is properly established and signals “BELAY ON”.

(2) Run the long loop of the carrying rope through the all portions of the individual’s seat harness tie in point. Attach the long loop to the traverse rope carabiner and lock the gate.

(3) The belay man lowers the individual slowly and under control until the individual reaches the unloading platform. After unclipping from the system the individual signals “OFF BELAY”.

(4) The belay man pulls the belay rope back to the near side and the process is repeated as required.

b. To move equipment on the suspension, the procedure is essentially the same. Put the belay on. Run the long loop of the carrying loop through the load rigging, attach the long loop to the traverse rope carabiner and lock the gate. Lower the equipment until it reaches the unloading platform and can be removed from the rope. Retrieve the belay rope and repeat as required.

SECTION IV. SUMMARY

You now know how to install and move on a suspension traverse.

Check on Learning.

1. How is the A-Frame oriented in relation to the suspension traverse installation?
The A-Frame apex should be in line with the near side and far side anchors. The A-Frame should be perpendicular to the near and far side anchors. The A-Frame should bisect the angle created by the traverse ropes.

2. How many wraps and how many fraps are required for the A-Frame?
6-8 wraps and 4-6 fraps.

SECTION II. INTRODUCTION

Motivator: Casualty evacuation is difficult under any circumstance. In a mountain environment this task gets significantly more difficult. In addition to casualties inflicted by enemy action, in the mountains, the likelihood of casualties from the environment is increased. Detailed casualty evacuation plans are essential to any military operation. Successful planners of combat action in mountainous terrain have dedicated entire battalions to casualty evacuation and re-supply. Your ability to assist in casualty evacuation is a critical skill.

Terminal Learning Objective

ACTION	Evacuate a casualty in low angle mountain terrain
CONDITION	Given a simulated non-ambulatory patient, a SKEDCO litter, ropes, carabiners and other climbing equipment as required, a medic and a requirement to move the patient over 3rd class terrain to a suitable LZ for air evacuation
STANDARD	Squad: - Packaged a casualty for transport (horizontal lift or vertical lift designated by grader), using the SKEDCO within 15 minutes. - moved the patient over 3rd class terrain to a suitable LZ. - utilized the nine line medical evacuation protocol to call for a MEDEVAC within 15 minutes. - met all critical performance measures IAW the student/instructor evaluation plan.

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training. Ensure that instructors inspect any installations or patient rigging prior to use.

Risk Assessment: Medium

Environmental Considerations: None

Evaluation: You will be tested on your ability to package a casualty, move the casualty to a suitable landing zone and call for a MEDEVAC. This is a squad event. Any member of your squad may be called upon to call for the MEDEVAC. If you fail to execute this action to standard your entire squad will receive a NO-GO. After retraining, you will be re-tested. If you receive a second NO-GO, your entire squad will be dismissed from training.

Instructional Lead-In: This lesson gives you considerations for mountain casualty evacuation plans, as well as techniques for packaging and transporting casualties in mountain terrain and reviews medical evacuation procedures used by the military.

SECTION III. PRESENTATION

Learning Step Activity 1 – Describe fundamental evacuation principles and considerations.

a. The techniques of evacuation are proven techniques. They are, however, all subject to improvement and should be discarded or modified as better methods of handling victims are developed.

(1) When evacuating a victim from mountainous areas keep in mind that the purpose of a rescue operation is to save a life, and physical risk to the rescuers must be weighed against this purpose. However, there is no excuse for failing to make the maximum effort within this limitation. Work and expense should be no deterrent when a life is at stake.

(2) Rescues will be unplanned (improvised) or planned rescue operations. For a planned rescue, equipment that is especially suited and designed for rescue should be used. For training missions always have a medical plan developed before an emergency arises (plan for the worst and hope for the best). Ensure that the MEDEVAC plan is a comprehensive plan. It must be thought out and understood by all that may be involved in a potential rescue.

(3) The following actions will be done immediately at the rescue scene:

- Assume command. One person, and one person only, is overall in charge at all times.
- Prevent further injuries to the victim and to others. Use reasonable care in reaching the victim.
- Immediately ensure the victim has an open airway, resume victim’s breathing, control serious bleeding, and maintain moderate body warmth. If the victim is unconscious, continually monitor pulse. Protect the patient from environmental hazards.
- Do not move the victim until you have ascertained the extent of injuries, unless it is necessary to prevent further injuries or the victim is located in a dangerous location (for example, avalanche run-out zone, hanging glacier, possibility of falling rocks).
- Do nothing more until you have thoroughly considered the situation. Resist the urge for action. Speed is less important than correct action.
- Decide whether to evacuate with available facilities or to send for help. Speed in getting to a hospital must be balanced against the probability of further injury if working with inexperienced people, lack of equipment or wrong equipment, and terrain at hand.
- When the evacuation route is long and arduous, a series of litter relay points or stations should be established. These stations must be staffed with the minimum medical personnel to provide proper emergency treatment. When a victim develops signs of shock or worsens while being evacuated, he should be treated and retained at one of these stations until his condition allows evacuation.
- Helicopters or heated vehicles, if available, should be used for evacuation. While the use of aircraft or vehicles is preferred and can expedite a rescue operation, evacuation of a seriously wounded soldier should never be delayed to await aircraft, vehicle, or a change in weather.

Learning Step/Activity 2 – Plan rescue operations.

a. Every commander should have a medical evacuation plan before undertaking an operation. This plan should have contingencies included so as not to rely on a single asset.

b. When rescuing a casualty (victim) threatened by hostile action, environmental hazard, or any other immediate hazard, the rescuer should not take action without first determining the extent of the hazard and his ability to handle the situation. THE RESCUER MUST NOT BECOME A CASUALTY.

c. The rescue team leader must evaluate the situation and analyze the factors involved. This evaluation can be divided into three major steps:

(1) ***Identify the task.*** The task must be identified. In planning a rescue, the rescuer tries to obtain the following information:

- Who, what, where, when, why, and how the situation happened.
- Number of casualties by precedence (urgent, priority, routine, tactical immediate).
- Number of casualties by type (litter or ambulatory), and the nature of their injuries.
- Terrain features and location of the casualties.
- Tactical situation.
- If adequate assistance is available to aid in security, rescue, treatment, and evacuation.
- If treatment can be provided at the scene; if the victims require movement to a safer location.
- Equipment required for the rescue operation.

(2) ***Evaluate the circumstances of the rescue***.

- After identifying the task, relate it to the circumstances of the situation.

    - Are additional personnel, security, medical, or special rescue equipment needed?
    - Are there circumstances, such as aircraft accidents (mass casualties), that may require specialized skills?
    - What is the weather condition?
    - Is the terrain hazardous?
    - How much time is available?

- The time element may cause a rescuer to compromise planning stages or treatment (beyond first aid). Make a realistic estimate of time available as quickly as possible to determine the action time remaining. The key elements are the casualty's condition and environment.

- Mass casualties are to be expected on the modern battlefield. All problems or complexities of rescue are now multiplied by the number of casualties. Time becomes the critical element.

- Considerations for the main rescue group for a planned rescue are as follows:

    - Carry all needed equipment, hot food and drinks, stove, sleeping bags, tents, bivouac sacks, warm clothes, ropes, and stretchers.
    - Prepare the evacuation route (ground transport to hospital, walking trails, fixed lines, lowering lines, anchor points, and rescue belay points). If the victim is airlifted out, attach a paper with the medical actions that were performed on the ground (for example, blood pressure, pulse rate, drugs started, and so on).
    - When performing all rescues, the rescuers are always tied in for safety. With all rescue techniques, remember to think things through logically for safety and to prevent the rescuer from accidentally untying himself or the fallen climber.
    - Constantly inform the casualty (if they are conscious) as to what you are doing and what he must do.

(3) ***Plan the action.*** The rescue plan should proceed as follows:

- In estimating time available, the casualties' ability to endure is of primary importance. Age and physical condition may vary. Time available is a balance of the endurance time of the casualty, the situation, and the personnel and equipment available.
- Consider altitude and visibility. Maximum use of secure, reliable trails or roads is essential.
- Ensure that blankets and rain gear are available. Even a mild rain can complicate a normally simple rescue. In high altitudes, extreme cold, or gusting winds, available time is drastically reduced.
- High altitudes and gusting winds reduce the ability of fixed-wing or rotary-wing aircraft to assist in operations. Rotary-wing aircraft may be available to remove casualties from cliffs or inaccessible sites, and to quickly transport casualties to a medical treatment facility. Relying on aircraft or specialized equipment is a poor substitute for careful planning.

Learning Step/Activity 3 – Plan for mass casualties.

a. When there are mass casualties, an orderly rescue may involve further planning.

(1) To manage a mass casualty rescue or evacuation, separate stages are taken.

- FIRST STAGE: Remove personnel who are not trapped among debris or who can be easily evacuated.
- SECOND STAGE: Remove personnel who may be trapped by debris, but whose extraction only requires the equipment on hand and little time.
- THIRD STAGE: Remove the remaining personnel who are trapped in extremely difficult or time-consuming situations, such as moving large amounts of debris or cutting through a wall.
- FOURTH STAGE: Remove dead personnel.

(2) Evacuation of wounded personnel is based on the victim's condition and is prioritized as follows:

- PRIORITY ONE: Personnel with life-threatening injuries that require immediate emergency care to survive; first aid and stabilization are accomplished before evacuation.
- PRIORITY TWO: Personnel with injuries that require medical care but speed of evacuation is not essential.
- PRIORITY THREE: Injured personnel who can evacuate themselves with minimal assistance.
- PRIORITY FOUR: The logistics removal of dead personnel

Learning Step/Activity 4 – Evacuate a casualty in low angle mountain terrain.

a. Before receiving training in basic mountain evacuation, litter teams should receive instruction in military mountaineering and basic first aid. Litter bearers and medics must know the use and care of rope as an item of equipment. The members of litter teams must be proficient in the techniques of belaying and choosing belay points. Proper support and protection must be given to victims and litter bearers when evacuating over steep, difficult terrain.

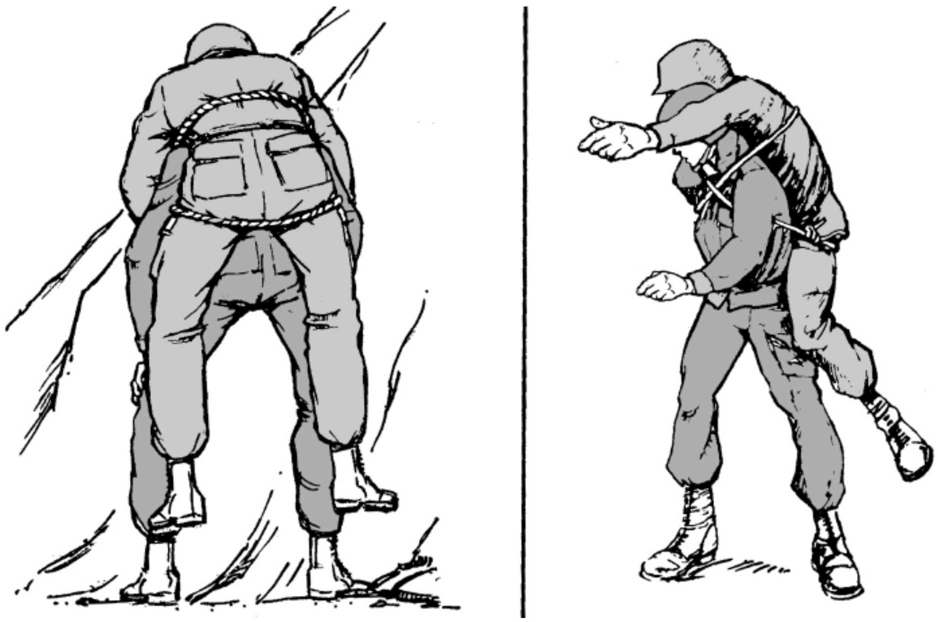
b. Preparation for evacuation. Although you may have saved the wounded Soldier's life by applying first aid, it can be lost through carelessness, rough handling or inadequate protection from the elements. Therefore, before trying to move a wounded Soldier, the type and extent of his injury must be evaluated. Dressings over wounds must be reinforced, and fractured bones must be properly immobilized and supported. Based upon the evaluation of the type and extent of the Soldier's injury, the best method of manual transportation is selected.

c. ***Manual Carries.*** You and other Soldiers may assist personnel who are not seriously injured but cannot evacuate themselves.

(1) ***One man carries***. The basic carries taught in the Soldier's Manual of Common Tasks (firemen's carry, two hand, four hand, saddleback, piggyback, pistol belt, and poncho litter) are viable means of transporting injured personnel; however, mountainous terrain lends itself to several other techniques:

- ***Sling Rope Carry***. The sling rope carry requires a 16-foot sling rope and two men – one as the bearer and the other as an assistant to help secure the casualty to the bearer's back. Conscious or unconscious casualties can be transported this way.
    - 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.
    - The assistant runs the ends of the sling rope under the casualty's armpits, crosses the ends, and runs the ends over the bearer's shoulders and back under the bearer's arms.

- The assistant runs the ends of the rope between the casualty's legs, around the casualty's thighs, and back around to the front of the bearer. Tie the rope with a square knot with two overhand knots just above the bearer's belt buckle.
- The rope must be 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 mountain coiled rope. It can be used to transport a conscious or unconscious victim.

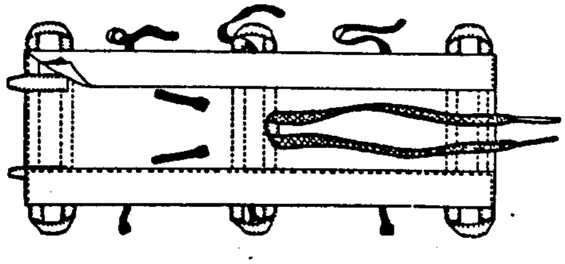
  - Place the casualty on his back.
  - Separate the loops on one end of the coil, forming two almost equal groups.
  - Slide one group of loops over the casualty's left leg and the other group over the right leg. The wraps holding the coil should be in the casualty's crotch with the loops on the other end of the coil extending upward toward the armpits.
  - The bearer lies on his back between the casualty's legs and slides his arms through the loops. He then moves forward until the coil is extended.
  - Grasping the casualty's arm, the bearer rolls over (toward the casualty's uninjured side), pulling the casualty onto his back.
  - Holding the casualty's wrists, the bearer carefully stands, using his legs to lift up and keeping his back as straight as possible.
  - Tie a sling rope around both the casualty and bearer at chest level, with a square knot. This keeps the victim upright. This also prevents the coils from slipping off the carrier's chest.

NOTE: The length of the coils on the rope coil and the height of the bearer must be considered. If the coils are too long and the bearer is shorter, the rope must be uncoiled and recoiled with smaller coils. If this is not done, the casualty will hang too low on the bearer's back and make it a cumbersome evacuation. A sling-rope harness can be used around the victim's back and bearer's chest, which frees the bearer's hands.

d. ***Litters.*** For more seriously injured personnel, you will need to use a litter to evacuate.

(1) Litter non-rigid, Nylon Pole less, NSN 6530-00-783-7510 is best issued to company medics, as it is lightweight, easy to carry and readily available. It weighs 3.5 pounds. The litter is suitable for low angle rescues, but the litter should not be used for above ground evacuation techniques such as rappelling, traverse lines and hauling lines in the vertical or horizontal position. To use it:

- Place the casualty in the center of the litter. Place the two crotch straps over the thighs. Secured the straps with the buckles. Carry the litter with a minimum of two or maximum of six personnel.
- For long carries, improvised litter poles can be inserted into folds of the litter.



Litter Non-Rigid Nylon Pole Less

(2) The SKEDCO stretcher is very well suited to mountain evacuation. It can be used in low or high angle rescue situations and can be used to hoist casualties into a helicopter. The SKEDCO stretcher can be used with most spine immobilization devices. The Oregon Spine Splint II (OSS II) is designed to be used with the SKEDCO stretcher and is used to immobilize a potential spine injury. Personnel must be trained in spine care management (EMT level training or equivalent) to use this device. Refer to www.skedco.com for instructions on the OSS II. To use the SKEDCO:

- Unroll stretcher and place next to patient.
- Place the casualty on litter with arms at sides (unless injured).
- Use the four body straps to secure the patient to the litter.
- Secure the foot straps last. The straps must run around the outside of feet.

Rig for horizontal ascent/descent (hoist operations):

- Insert head strap, (head strap is shorter) through lift slot, pass under sled and through slot on other side.
- Insert foot strap (foot strap is longer) through lift slot, pass under sled and through slot on other side. Ensure that this strap is routed UNDER the shin strap.
- Equalize both straps and secure to large locking steel carabiner.

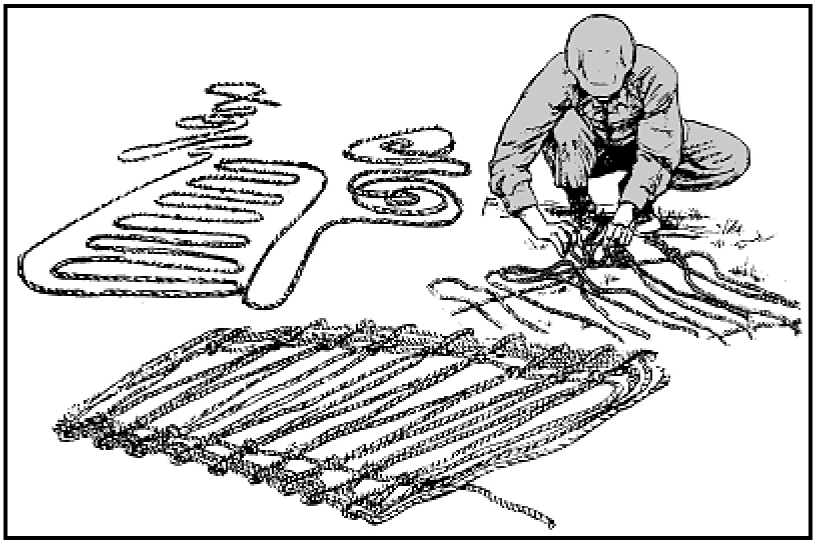
Rig for vertical ascent/descent (suitable for low angle or high angle evacuations):

- Tie figure eight knot at center of the 30 ft. rope and pass the ends through the grommets at the head end of the sled.
- Pass the rope through all remaining grommets and carry handles all the way to the foot end.
- Pass the rope through the grommets at the foot end from the inside out. Tie with a square knot.
- Pass the rope over the end of the sled and through the carry handles and secure with a square knot finished with overhand knots.
- Attach a large steel locking carabiner to the loop on the head end.

(3) A rope litter is a field expedient litter prepared using one rope. It requires 20 to 30 minutes to prepare and should be used only when other materials are not available.

- Start in the middle of the rope so that two people can work on the litter at once. Make 24 bights about 18 inches long from the rope
- With the remainder, of the rope make a clove hitch over each bight. After placing the clove hitches over the bights, slide them in 6 inches. Each clove hitch should be approximately 6 inches apart when the litter is complete.
- Line the litter with padding such as clothing, sleeping bag, or poncho liner.
- Pass the remainder of the rope through the bights outside of the clove hitches. Dress the clove hitches down toward the closed end of the bight to secure the litter and tie off the ends of the rope with clove hitches.

- The rope litter can be made more stable by adding poles. Secure two poles approximate 6 feet long and 2 inches in diameter. Slide the poles down through the bights on each side. Dress the clove hitches down against the poles.
- Four to six bearers are required to transport a casualty using this method.



Improvised rope litter

e. ***Low Angle Rescue.*** Rescue can be necessary at any time during mountain operations. Even when air evacuation is possible, you may need to move seriously injured personnel to a suitable landing zone. The size of the group in the mission will determine the type of rescue performed. With rope techniques given earlier in this text and sufficient personnel, an ascent of a moderately steep slope can be performed easily.

(1) Ascending: One individual moves up the slope and establishes a top belay. The end of the belay rope is attached to the head of the stretcher with a large steel locking carabiner. Additional personnel at the top belay can be used to pull the rope and the patient up. Personnel at the bottom are used at the bottom to lift the patient off the terrain and move him upward. When the patient reaches the belay station, he is secured and the process is repeated.

(2) Descending: The procedure above is reversed. Litter bearers will be required to keep the litter upright and prevent it from snagging or bouncing.

(3) High angle rescue (raising and lowering systems) is discussed Lesson 699-9041: Evacuate a casualty in high angle mountain terrain.

Learning Step/Activity 5 – Utilize a nine line MEDEVAC.

1. Location of Pickup Site
2. Radio Frequency & Call Sign
3. # Patients by Precedence
   (Type & Severity of Wound, Injury, or Illness)
4. Special Equipment Required
5. Number of patients
   L- Litter A- Ambulatory
6. Security at pick-up site
   N – No enemy troops in area
   P- Possible enemy troops in area (caution)
   E- Enemy troops in area (caution)
   X-Enemy troops in area (escort required)
7. Method of Marking pick-up site:
8. Patient nationality and status

9. NBC Contamination:
N-Nuclear B-Biological C-Chemical

SECTION IV. SUMMARY

Medical evacuation is a complex task that requires rehearsal. You now understand fundamental planning considerations and techniques for carrying out non-technical evacuations.

Check on Learning.

1. When evacuating a patient over lower angle terrain how should you rig the SKEDCO and why?

You should rig it for vertical raise/lower so that you can attach the SKEDCO to belay lines to provide a greater margin of safety to the patient as he is transported.

SECTION II. INTRODUCTION

Motivator: You have already received a class on low angle rescue procedures and improvised rescue techniques. You may be called upon to participate in or execute a high angle rescue. High angle rescue is a complex task that may involve working with other organizations and/or falling under the guidance of other organizations to include civilian rescue services. You need to know basic high angle rescue systems in order to be an effective team member in a real world evacuation.

Terminal Learning Objective

ACTION	Evacuate a mountain casualty in high angle mountain terrain
CONDITION	Given the requirement to move a casualty over 4th and 5th class terrain, helmet, harness with all associated safety equipment, 2 static ropes, adequate protection, slings, carabiners and other climbing equipment as required, a litter (such as the SKEDCO, UT2000 or Stokes litter), a team of at least 8 personnel with similar experience and equipment, one of whom is a medic
STANDARD	Team: - evacuated a casualty using a raising system on high angle terrain. - evacuated a casualty using a lowering system on high angle terrain.

Safety Requirements: All anchor systems will be inspected prior to loading. During practice sessions live 'casualties' will not be used.

Risk Assessment: Medium

Environmental Considerations: None

Evaluation: You will be tested on your ability to conduct high angle rescues IAW the student evaluation plan. If you fail to complete this action you will receive a NO-GO. You will be counseled and receive retraining. After re-training you will be given a second opportunity to re-test. If you fail to complete this action a second time you will receive a NO-GO and you will be dismissed from the course. Refer to the student evaluation plan for specific performance measures.

Instructional Lead-In: Sometimes in mountainous terrain a casualty will need to be raised or lowered on high angle terrain in order to be placed on low angle terrain. This lesson reviews some basic raising and lowering rescue systems.

SECTION III. PRESENTATION

Learning Step/Activity 1 - Task organize for high angle rescue.

a. Task organization should happen quickly and deliberately in any rescue situation.

(1) Team leader. The team leader controls the overall rescue effort. The team leader is the most experienced person on the ground. The team leader may or may not be involved with the actual rescue; it is usually best if he is not. The paramount concern in any rescue is the safety of the rescuers. The team leader must keep this in mind as the rescue is executed. In certain instances the team leader may have to make decisions that place the safety of the rescuers over recovering the casualty.

(2) Safety team - establishes a safety line at the top of the pitch and provides labor for raising/lowering systems.

(3) Treatment team - one should be a medic. Secures, stabilizes and attends the victim during the rescue.

(4) Ropes team - constructs the anchors and raising or lowering system and monitors throughout the entire operation.

(5) Receiving team – receives the patient and disconnects patient from the system.

b. Depending on the number of personnel available some of the teams may be combined or re-organized as the rescue is carried out.

Learning Step/Activity 2 – Lower a casualty (unattended, single pitch).

NOTE: All of the rescue systems described assume that the team has reached the location of the patient.

If you determine that the individual is ambulatory and coherent, you can lower him down the pitch unattended. Other rescue systems will build on this simple system:

(1) Safety team constructs a fixed line along the top of the pitch if it is needed.

(2) Team leader determines the most suitable place for anchors to be placed. The ropes team assembles the necessary equipment for the main line and belay lines. Static lines will be used for all raising or lowering systems.

(3) Treatment team provides first aid to stabilize injuries and prepares the patient to move.

(4) The receiving team moves down the pitch and gets ready to receive the patient. If there is another pitch to negotiate, the receiving team can begin constructing the anchors required to lower.

(5) Ropes team constructs an anchor for the main line. These anchors will be neat and clean to allow easy inspection:

- Construct a three point (minimum) pre-equalized anchor ensuring that each individual piece is bombproof (no marginal placements).

OR

- Construct a wrap three, pull two anchor or wrap two pull one anchor on a large solid tree.

OR

- Construct a deadman anchor; this is preferable in snow.

(6) Ropes team constructs a separate anchor for the belay line, using the same principles utilized for the main line anchor.

(7) Stack the main line rope. Tie a figure-eight loop to the bottom of the stack and attach it to the anchor master point with a locking carabiner. The main line carries the entire load. Attach the main line to the main line anchor:

- Use a Munter Hitch that is at least 2 meters from the edge (this allows for adequate friction when lowering).

OR

- Use a double carabiner brake.

(8) Stack the belay rope. Tie a figure-eight loop to the bottom of the stack and attach it to the anchor master point with a locking carabiner. Attach the belay line to the belay line anchor. The belay line does not carry any load. It serves as a back-up to the main line.

- Use a Munter hitch that is at least 2 meters from the edge.

OR

- Use the tandem prusik method with a releasable hitch like the alternate highway or the Mariner's hitch.

(9) Prepare to lower the casualty:

- Attach the patient to the main line and the belay line with a re-traced figure eight.
- One ropes team member manages the main line and one manages the belay line.
- The team leader checks all preparations prior to sending anyone over the edge.
- One team member gets in position to watch the casualty as he is lowered.

(10) Lower the casualty.

(11) Receive the casualty at the bottom of the pitch and move the patient to a safe location for further stabilization and evacuation.

Learning Step/Activity 3 – Lower a casualty using a litter and attendant (single pitch).

a. When the injuries do not allow for a patient to move independently, an attendant will be required to help the patient negotiate the pitch. In organized rescue situations you will use a rigid litter approved for use in raising and lowering systems. NWTC uses the SKEDCO litter for these systems.

(1) Safety team constructs a fixed line along the top of the pitch if it is needed.

(2) Team leader determines the most suitable place for anchors to be placed. The ropes team assembles the necessary equipment for the main line and belay lines. Static lines will be used for all raising or lowering systems.

(3) Treatment team provides first aid to stabilize injuries and packages the patient in the SKEDCO. Rig the SKEDCO for a horizontal lower.

(4) The receiving team moves down the pitch and gets ready to receive the patient. If there is another pitch to negotiate, the receiving team can begin constructing the anchors required to lower.

(5) Ropes team constructs an anchor for the main line. These anchors will be neat and clean to allow easy inspection:

- Construct a three point (minimum) pre-equalized anchor ensuring that each individual piece is bombproof (no marginal placements).

OR

- Construct a wrap three, pull two anchor or wrap two pull one anchor on a large solid tree.

OR

- Construct a deadman anchor; this is preferable in snow.

(6) Ropes team constructs a separate anchor for the belay line, using the same principles utilized for the main line anchor.

(7) Stack the main line rope. Tie a figure-eight loop to the bottom of the stack and attach it to the anchor master point with a locking carabiner. The main line carries the entire load.
Attach the main line to the main line anchor:

- Use a double carabiner brake.

(8) Stack the belay rope. Tie a figure-eight loop to the bottom of the stack and attach it to the anchor master point with a locking carabiner. Attach the belay line to the belay line anchor. The belay line does not carry any load. It serves as a back-up to the main line.

- Use a Munter hitch that is at least 2 meters from the edge.

OR

- Use the tandem prusik method with a releasable hitch like the alternate highway or the Mariner's hitch.

(9) Attach the main line to the patient and attendant:

- Tie a long tail bowline in the mainline. Attach the bowline to the steel locking D carabiner at the APEX of the SKEDCO rigging.
- Attendant ties into the end of the main line with a rethreaded figure-eight knot. Attendant ties a prusik using a rescue loop to the main line rope and attaches the rescue loop to the harness tie in point. This allows the attendant to adjust himself in relation to the patient. This is useful when the angle of the terrain varies.

(10) Attach the belay line to the patient and attendant:

- Tie a long tail bowline in the belay line. Attach the bowline to the steel locking D shaped carabiner at the APEX of the SKEDCO rigging. Lock the carabiner.
- Attendant ties into the end of the belay line with a rethreaded figure-eight knot.

(11) Prepare to lower the casualty:

- One ropes team member manages the main line and one manages the belay line.
- The team leader checks all preparations prior to sending anyone over the edge.
- One team member gets in position to watch the casualty as he is lowered.

(12) Lower the casualty. The patient and attendant will require assistance getting over the edge and onto vertical terrain. The attendant may require assistance during the lower. Other team members can rappel along side the attendant to assist in moving the patient over obstacles during the lower.

(13) Receive the casualty at the bottom of the pitch and move the patient to a safe location for further stabilization and evacuation.

Learning Step/Activity 4 - Lower a casualty using a litter and attendant (further than a single rope length).

a. Option 1:

(1) Safety team constructs a fixed line along the top of the pitch if it is needed.

(2) Team leader determines the most suitable place for anchors to be placed. The ropes team assembles the necessary equipment for the main lines and belay lines. Static lines will be used for all raising or lowering systems.

(3) Treatment team provides first aid to stabilize injuries and packages the patient in the SKEDCO. Rig the SKEDCO for a horizontal lower.

(4) The receiving team moves down the pitch and gets ready to receive the patient. If there is another pitch to negotiate, the receiving team can begin constructing the anchors required to lower.

(5) Ropes team constructs anchors for the main line. These anchors will be neat and clean to allow easy inspection:

- Construct a bombproof anchor. Approximately 8-12 inches above this anchor construct a second bombproof anchor. The anchor master point for this second anchor should be shorter than the anchor master point for the first anchor by approximately 8 inches.

(6) Ropes team constructs a separate anchor for the belay line, using the same principles utilized for the main line anchor.

(7) Stack one main line rope. Tie a figure-eight loop to the bottom of the stack and attach it to the anchor master point with a locking carabiner. Tie a second static rope to the end on top of the stack using an overhand with at least a 12 inch tail. Stack this second rope.

(8) Attach the main line to the main line anchors:

- Tie a Munter hitch onto the master point of the top anchor.
- Tie a second Munter Hitch to the master point of the second anchor on the top of the stack (side of the rope going to the patient and attendant).

(9) Repeat Step 8 with the belay ropes.

(10) Attach the main line to the patient and attendant:

- Tie a long tail bowline in the mainline. Attach the bowline to the steel locking D carabiner at the APEX of the SKEDCO rigging.
- Attendant ties into the end of the main line with a rethreaded figure-eight knot. Attendant ties a prusik using a rescue loop to the main line rope and attaches the rescue loop to the harness tie in point. This allows the attendant to adjust himself in relation to the patient.

(11) Attach the belay line to the patient and attendant:

- Tie a long tail bowline in the belay line. Attach the bowline to the steel locking D shaped carabiner at the APEX of the SKEDCO rigging. Lock the carabiner.
- Attendant ties into the end of the belay line with a rethreaded figure-eight knot.

(12) Prepare to lower the casualty:

- One ropes team member manages the main line and one manages the belay line.
- The team leader checks all preparations prior to sending anyone over the edge.
- One team member gets in position to watch the casualty as he is lowered.

(13) Lower the casualty. The patient and attendant will require assistance getting over the edge and onto vertical terrain. The attendant may require assistance during the lower. Other team members can rappel along side the attendant to assist in moving the patient over obstacles during the lower.

(14) Pass the knot on the main line:

- When the joining knot is approximately 12 inches from the Munter Hitch, stop lowering. Tie an MO on the upper anchor.
- Create an alternate highway on the load rope. Keep the prusik close to the Munter hitch on the lower anchor.

- Release the MO and lower until the alternate highway has the load.
- While maintaining control of the brake strand remove the Munter Hitch on the upper anchor.
- Tie an MMO on the upper anchor behind the knot (on the second static rope).
- Remove the Munter Hitch on the lower anchor. Tie a Munter hitch on the second static rope.
- Undo the MO on the alternate highway and slowly transfer the load back to the main line.
- The knot is passed. Recover the components of the alternate highway, remove the MO on the upper anchor and continue lowering.

(15) Pass the knot on the belay line using the same method detailed in Step 14.

(16) Receive the casualty at the bottom of the pitch and move the patient to a safe location for further stabilization and evacuation.

b. Option 2. This option assumes greater risk, but is useful when you cannot create the anchors required for Option 1.

(1) Safety team constructs a fixed line along the top of the pitch if it is needed.

(2) Team leader determines the most suitable place for anchors to be placed. The ropes team assembles the necessary equipment for the main lines and belay lines. Static lines will be used for all raising or lowering systems.

(3) Treatment team provides first aid to stabilize injuries and packages the patient in the SKEDCO. Rig the SKEDCO for a horizontal lower.

(4) The receiving team moves down the pitch and gets ready to receive the patient. If there is another pitch to negotiate, the receiving team can begin constructing the anchors required to lower.

(5) Ropes team constructs an anchor for the main line. These anchors will be neat and clean to allow easy inspection:

- Construct a three point (minimum) pre-equalized anchor ensuring that each individual piece is bombproof (no marginal placements).

OR

- Construct a wrap three, pull two anchor or wrap two pull one anchor on a large solid tree.

OR

- Construct a deadman anchor; this is preferable in snow.

(6) Ropes team constructs a separate anchor for the belay line, using the same principles utilized for the main line anchor.

(7) Stack one main line rope. Tie a figure-eight loop to the bottom of the stack and attach it to the anchor master point with a locking carabiner. Tie a second static rope to the end on top of the stack using an overhand with at least a 12 inch tail. Stack this second rope.

- Use a double carabiner brake.

(8) Stack the belay rope. Tie a figure-eight loop to the bottom of the stack and attach it to the anchor master point with a locking carabiner. Attach the belay line to the belay line anchor. The belay line does not carry any load. It serves as a back-up to the main line.

- Use a Munter hitch that is at least 2 meters from the edge.

OR

- Use the tandem prusik method with a releasable hitch like the alternate highway or the Mariner’s hitch.

(9) Attach the main line to the patient and attendant:

- Tie a long tail bowline in the mainline. Attach the bowline to the steel locking D carabiner at the APEX of the SKEDCO rigging.
- Attendant ties into the end of the main line with a rethreaded figure-eight knot. Attendant ties a prusik using a rescue loop to the main line rope and attaches the rescue loop to the harness tie in point. This allows the attendant to adjust himself in relation to the patient.

(10) Attach the belay line to the patient and attendant:

- Tie a long tail bowline in the belay line. Attach the bowline to the steel locking D shaped carabiner at the APEX of the SKEDCO rigging. Lock the carabiner.
- Attendant ties into the end of the belay line with a rethreaded figure-eight knot.

(11) Prepare to lower the casualty:

- One ropes team member manages the main line and one manages the belay line.
- The team leader checks all preparations prior to sending anyone over the edge.
- One team member gets in position to watch the casualty as he is lowered.

(12) Lower the casualty. The patient and attendant will require assistance getting over the edge and onto vertical terrain. The attendant may require assistance during the lower. Other team members can rappel along side the attendant to assist in moving the patient over obstacles during the lower.

(13) Pass the knot on the main line:

- When the joining knot is approximately 12 inches from the carabiner brake, stop lowering. Tie off the carabiner brake.
- Create an alternate highway on the load rope.
- Release the tie-off and lower until the alternate highway has the load.
- Remove the carabiner brake and reassemble it on the second static rope. Tie off the carabiner brake.
- Remove the MO on the alternate highway and lower the load back onto the main line.
- The knot is passed. Recover the components of the alternate highway, remove the tie-off for the carabiner brake and continue lowering.

(14) Pass the knot on the belay line using the same method detailed in Step 13.

(15) Receive the casualty at the bottom of the pitch and move the patient to a safe location for further stabilization and evacuation.

Learning Step/Activity 5 – Raise a casualty using an attendant and litter.

a. All but the treatment team will be topside preparing the raising system. In this scenario assume that the treatment team has moved to and secured the patient and has the end of the belay and main ropes. Both ropes are secure at the top.

(1) Safety team constructs a fixed line along the top of the pitch if it is needed.

(2) Team leader determines the most suitable place for anchors to be placed. The ropes team assembles the necessary equipment for the main lines and belay lines. Static lines will be used for all raising or lowering systems.

(3) Treatment team provides first aid to stabilize injuries and packages the patient in the SKEDCO. Rig the SKEDCO for a horizontal lift.

(4) The receiving team can assist the treatment team with the raising system.

(5) Ropes team constructs an anchor for the main line. These anchors will be neat and clean to allow easy inspection:

- Construct a three point (minimum) pre-equalized anchor ensuring that each individual piece is bombproof (no marginal placements).

OR

- Construct a wrap three, pull two anchor or wrap two pull one anchor on a large solid tree.

OR

- Construct a deadman anchor; this is preferable in snow.

(6) Ropes team constructs a separate anchor for the belay line, using the same principles utilized for the main line anchor.

(7) Attach the main line to the patient and attendant:

- Tie a long tail bowline in the mainline. Attach the bowline to the steel locking D carabiner at the APEX of the SKEDCO rigging.
- Attendant ties into the end of the main line with a rethreaded figure-eight knot. Attendant ties a prusik using a rescue loop to the main line rope and attaches the rescue loop to the harness tie in point. This allows the attendant to adjust himself in relation to the patient.

(8) Attach the belay line to the patient and attendant:

- Tie a long tail bowline in the belay line. Attach the bowline to the steel locking D shaped carabiner at the APEX of the SKEDCO rigging. Lock the carabiner.
- Attendant ties into the end of the belay line with a rethreaded figure-eight knot.

(9) Ropes team constructs a hauling system on the main line. A 3:1 is generally enough to haul, though a 5:1 can be used. Attach the belay rope to the anchor with a Munter hitch or a self-blocking device.

(10) Haul the casualty.

(11) Receive the casualty at the top of the pitch and move the patient to a safe location for further stabilization and evacuation.

SECTION IV. SUMMARY

After working these systems a few times, you can modify the systems to meet the needs of most rescue situations you will encounter.

Check on Learning.

1. The team leader must keep the safety of the ___________ in mind at all times.
rescuers

2. Why does the attendant need a prusik on the main line?

The prusik allows the attendant to adjust himself in relation to the patient.

SECTION II. INTRODUCTION

Motivator: A glacier can be a relatively fast and easy way to gain ground in a mountainous environment. In order to move on a glacier safely you must first understand what a glacier is, the dynamic forces it displays, hazards it may pose and a common set of terms so other people can understand what you may be saying.

Terminal Learning Objective

ACTION	Select a movement route on a glacier
CONDITION	Given the requirement to move over glaciated terrain, a map of the area, compass and altimeter.
STANDARD	Select a route that avoids common hazards associated with glacier travel.

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training.

Risk Assessment: Low

Environmental Considerations: None

Evaluation: You will be tested on your knowledge of glaciers during a one hour written exam. You must score a 70% on the exam in order to get a GO. If you fail to get a 70% on the exam, you will be re-trained and re-tested. If you fail a second time you will receive a NO-GO and you will be dismissed from the course.

Instructional Lead-In: This class will focus the formation, hazards and features of glaciated terrain.

SECTION III. PRESENTATION

Learning Step/Activity 1 – Define a glacier.

A glacier is a permanent mass of ice that is flowing downhill much like a river. Glaciers have their own unique terminology, features, hazards and techniques of moving on them.

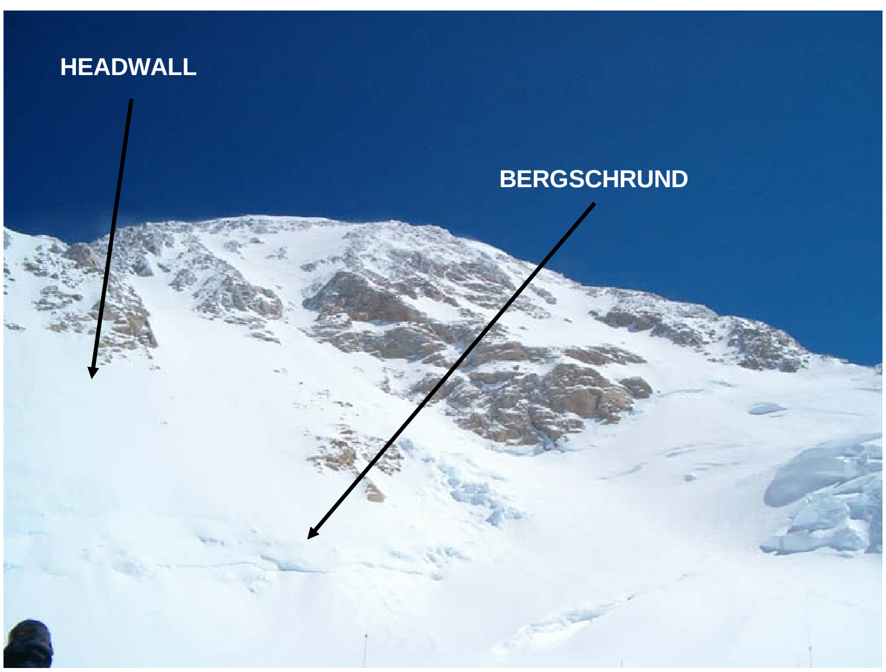
Learning Step/Activity 2 – Describe the formation of a glacier.

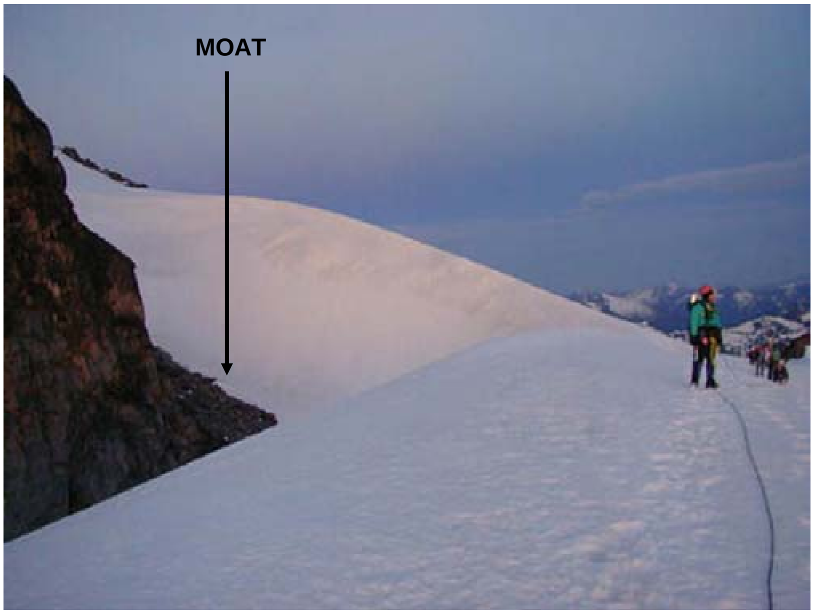
Formation. Snow falls in a cirque and accumulates over many years and by its own weight it forces the air out and becomes ice. As more and more snow accumulates more ice is formed until gravity takes over and the ice begins to move down hill. The weight of millions of pounds of ice makes a small film of water that acts as a lubricant enabling it to slide.

Learning Step/Activity 3 – Define the characteristics of a glacier.

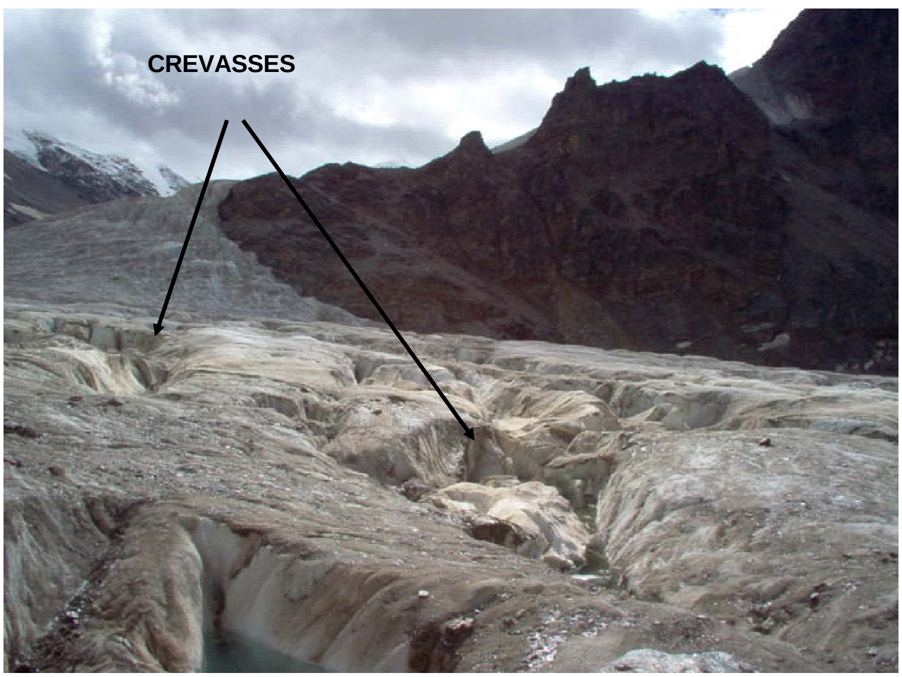
a. Glaciers are in constant motion. They will flow until they come to an area where they melt away or break apart in the sea. They are either surging or retreating. A surge is when the ice moves at a faster pace than normal. This does not always mean that the glacier is growing in mass. It is usually related to the amount of weight in the upper reaches of the glacier pushing the lower reaches along or an increase in underlying melt water. A retreating glacier is losing mass and receding back up its valley. On a map a glacier is depicted as an area of white with blue contour lines.

b. The headwall is where the glacier starts. This area also has the first crevasse known as a "Bergschrund". Often there will be a "moat" as well. The moat is the interface of rock and ice. The moat will continue down the flanks of the ice all the way to the terminus. Lower on the glacier, the moat will be more pronounced. On a map the moat is shown as a blue dashed line on the edge of the glacier. Bergschrunds and moats can pose a significant obstacle to movement from just their sheer size. Rock and ice fall are hazards here as well. This activity can occur at any time of the day, but most often occurs when the sun heats up the rock or ice causing the small bonds to melt.

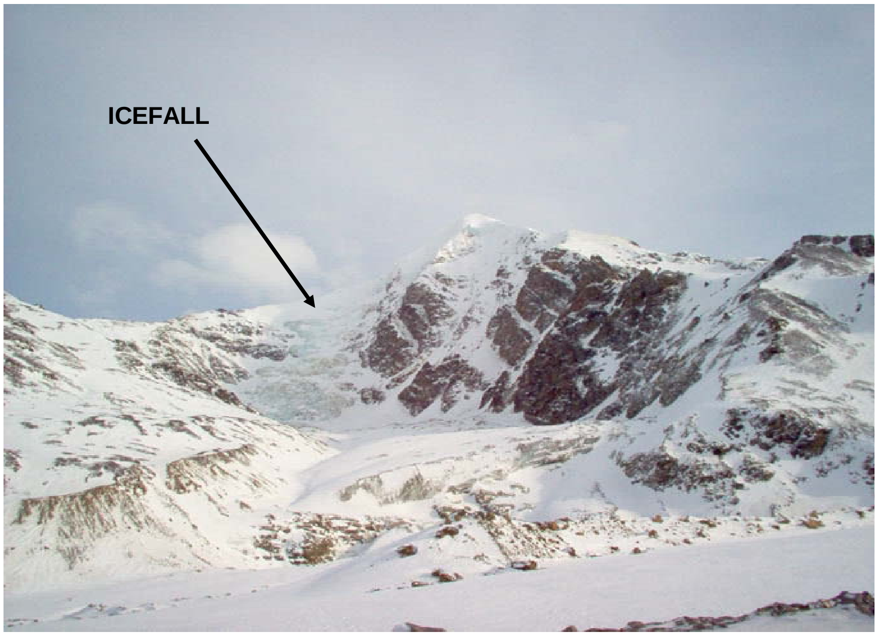



MOAT

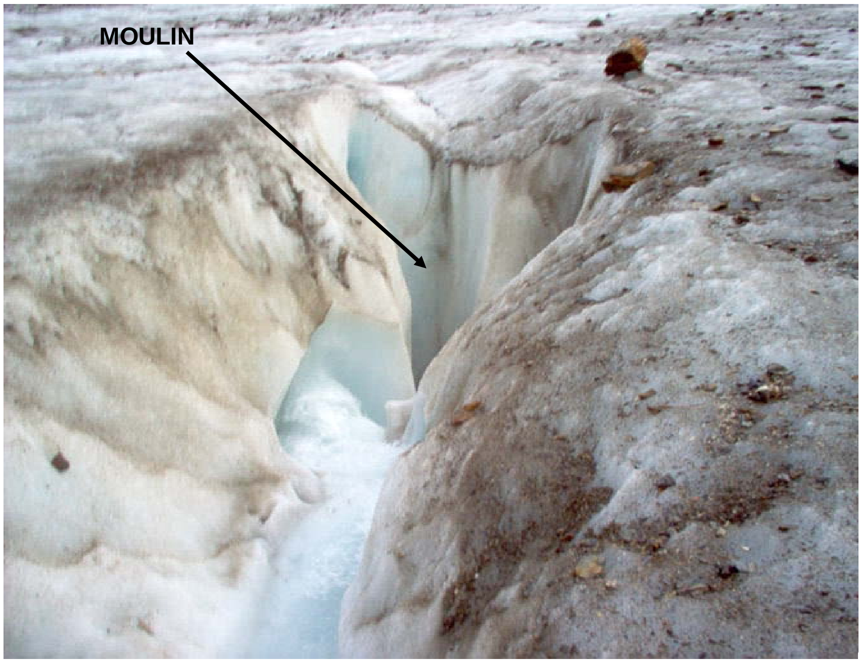
c. As a glacier moves it conforms to the land under it. It does this because the bottom 2/3 is very "plastic" or flexible ice. The upper 1/3 however is brittle and not very flexible. When the glacier runs over a steep section of more than 25 degrees the plastic layer will flex whereas the top will break. These breaks are called crevasses. Crevasses are very much an impediment to movement. They are usually one rope length or less in depth and can be small enough to jump across or wide enough to require a rather lengthy descent off one side and ascent of the other. During the winter they are covered by wind driven snow and can be totally hidden from view. These "snow bridges" can be very stable or flimsy depending on the conditions that created them. Heavy snow accompanied by high winds produce snow bridges that are very stable and can remain so all year. Light snow will produce small, weak snow bridges. Early in the winter when snow bridges are forming and late in the summer when they are deteriorating are the most dangerous times to be on them. Also in the summer during the late afternoon, snow bridges can become unstable. Mid winter and early spring when snow depth is at its greatest is the best time for travel on glaciers. Often the snow bridge will present itself as a sag in the snow cover. There may also be intermittent holes in the snow and still others may not present any indication at all. Always assume that crevasses are present under the snow cover and take appropriate measures. Glaciers flow fastest in the center. Because of this the sides are prone to crevasse formation because the ice resists being pulled away from the rock. When going around corners the outside bend is under tension and can create crevasses. The opposite is true for the inside bend where the ice is under compression. Where two glaciers flow together is an area of conflict between the two masses of ice. The force of the colliding ice sends up spectacular crevasse fields. Transverse crevasses (crevasses going perpendicular to the flow) are found in the center of the glacier; longitudinal crevasses (going parallel to the flow) are located where it widens and diagonal crevasses are found where it bends. On a map crevasses are depicted as blue slash marks. It must be noted that these marks only show the area of greatest crevassing. The absence of these marks does not mean the other areas do not have crevasses.



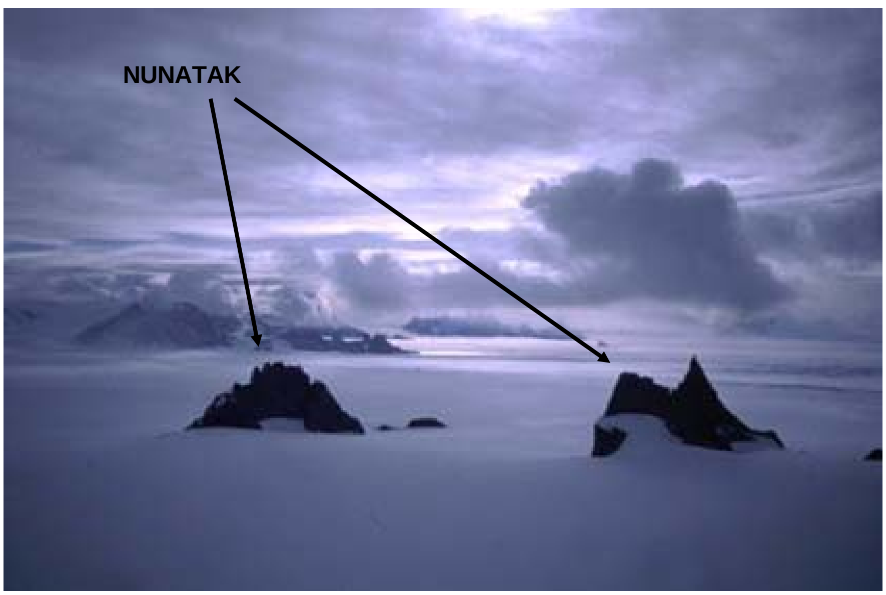
d. When a glacier flows over a cliff, the plastic layer cannot support the weight and the glacier breaks into chunks. This is called an ice-fall. The individual chunks of ice are called “seracs”. Ice-falls can be extremely dangerous because of continually falling seracs and the very intense route finding required. Crossing an icefall should only be attempted by the most experienced mountaineers. On a map an icefall is shown as closely spaced contour lines (like a cliff) with crevasse marks bisecting them.



e. Glaciers have drainage features on their surfaces. These drainages can be small creeks or raging rivers flowing across the top of the ice. They usually create their own crevasse-like channels. Crossing these drainages can be quite formidable as the water is just above the freezing point and immersion can be fatal. Wait until the flow decreases at night or very early morning. Some of the creeks flow into a hole called a “Moulin” or “ice mill”. These act just like a sewer drain on a city street, and connect to a myriad of under-ice passageways that eventually flow out of the terminus of the glacier. A fall into a Moulin can be fatal.

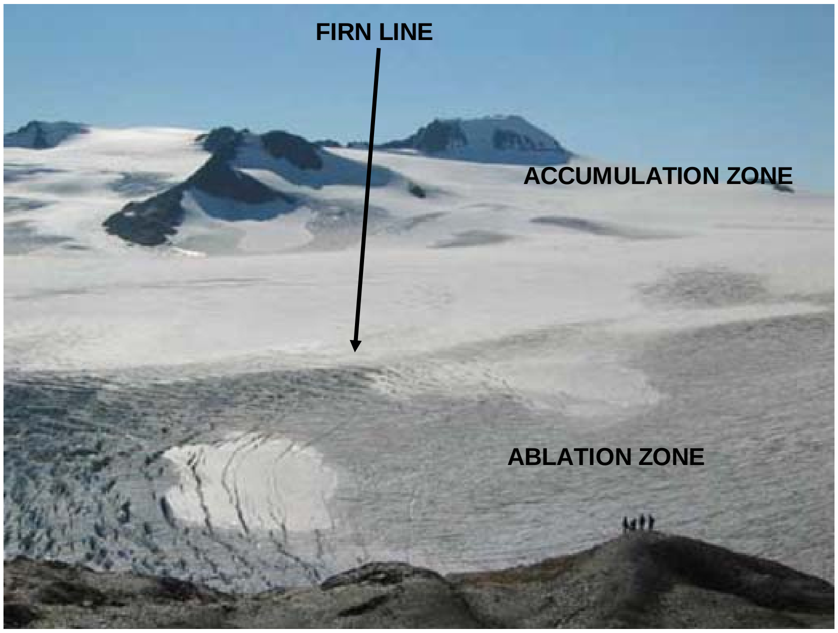


f. Nunataks are peaks that the glacier has flowed around instead of over. There are usually moats surrounding them, but can be a good place to camp if access is easy. On a map the contour lines will revert to brown.

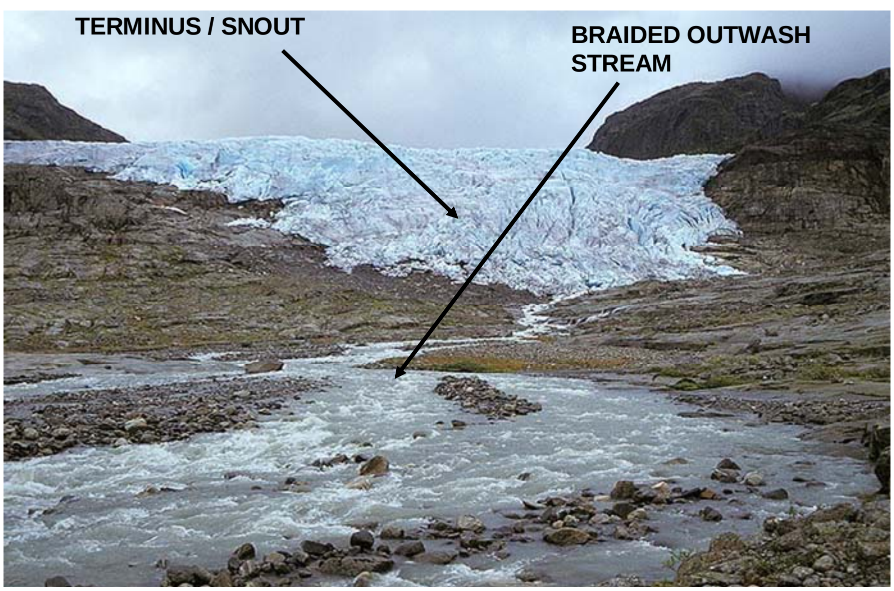


g. There are two main glacial zones:

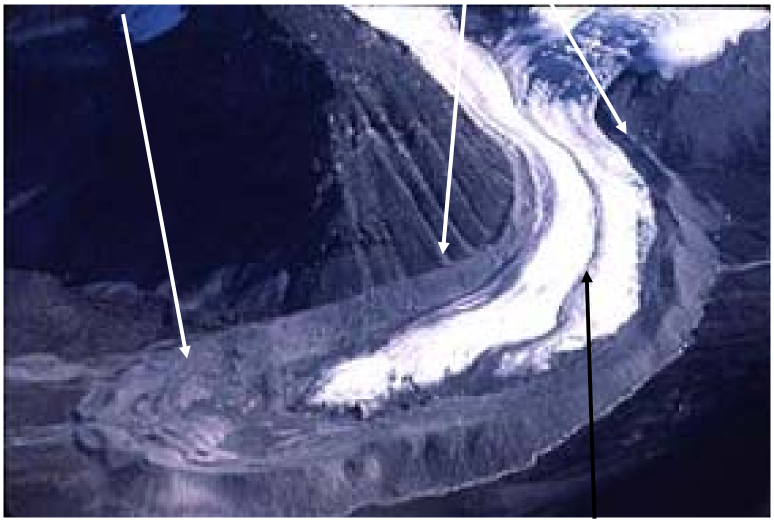
- Accumulation zone. The accumulation zone is where the snow accumulation exceeds snow melt. Un-roped travel in this area is not advised as crevasses are hidden by snow bridges.
- Ablation zone. The ablation zone is where snow melt exceeds accumulation. Un-roped travel is permissible in this area. The dividing line between the two zones is the “Firn line”. Firn, also called Neve’ is just old snow.



h. The end of the ablation zone is the terminus or snout. This area has the “window” where the water flows out into the braided outwash stream.

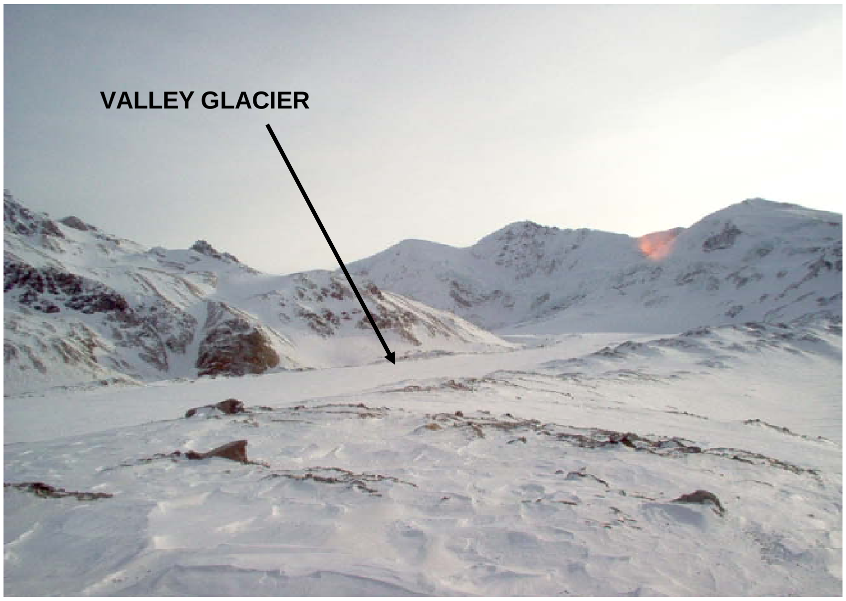


i. Moraines are rock debris that was deposited by the movement of a glacier. There are four types:
- Terminal moraine is the rock pile at the very limit of the glaciers advance.
- Lateral moraines are on the sides where the glacier pushed the rocks to the sides. Terminal and lateral moraines can have ice under the rock that can be exposed from time to time.
- Medial moraines are rocks deposited in the center of the glacier as it passes a nunatak or converges with another glacier. They appear as stripes along the long axis of the glacier.
- Ground moraine is the rock left between the terminal moraine and the snout. On a map moraine is depicted as brown dots.



Learning Step Activity 4 – Classify glaciers.

a. Valley glacier. Resides and flows in a valley.



b. Hanging and Cirque glacier. Cirque glacier flowing over the edge of the cirque.

c. Tidewater glacier. Glacier that flows into the sea.

d. Ice field. Large area of ice that is relatively stationary and feeds glaciers on its periphery.

ICEFIELD

SECTION IV. SUMMARY

You now have a general knowledge of glacial features and hazards. You will apply this knowledge when you get out onto glaciers and learn to travel and live on them.

Check on Learning.

1. What are the hazards associated with a moat?
   Rockfall, icefall, sheer size.

2. What is a terminal moraine?
   The rock pile that marks the far limit of the glaciers advance

SECTION II. INTRODUCTION

Motivator: You have already learned various techniques for mountain movement. You will need additional equipment and techniques to overcome the challenges of moving over snow and ice covered mountain terrain.

Terminal Learning Objective

ACTION	Move on gentle, moderate and steep snow/ice
CONDITION	Given an ice ax, crampons, and helmet on snow/ice slopes from 0-60 degrees
STANDARD	Soldier: - Moved on gentle and moderate snow covered terrain with an ice ax. - Self-arrested on gentle to moderate snow slopes. - Moved on gentle, moderate and steep snow and ice covered terrain with ice ax and crampons

Safety Requirements: Students will not glissade or self-arrest with crampons on. A safe run-out zone is mandatory for any glissading or self-arrest.

Risk Assessment: Medium

Environmental Considerations: In the Gulkana Glacier training area all trash will be packed out. Human waste will also be consolidated and packed out of the training area.

Evaluation: You will conduct a practical exercise that involves ascending and descending snow/ice covered slopes. You must participate in this exercise to pass the course. You will be tested on your knowledge of snow and ice movement during a one hour written examination at the conclusion of the course (Refer to training schedule for date/time of exam). You must score a 70% on the written exam. If you fail the written exam you will be given a second exam after re-training has been conducted. If you fail this second examination you will be dismissed from the course.

Instructional Lead-In: This lesson covers the techniques for moving over snow and ice covered mountainous terrain.

SECTION III. PRESENTATION

Learning Step Activity 1 – Move on gentle to moderate snow slopes with an ice ax.

a. The same fundamental techniques you learned during mountain walking techniques apply to snow covered terrain. There are other some techniques that we will talk about now that you can use to move efficiently and safely.

b. ***Ice ax positions.*** You already know how to carry an ice axe and use it in the cane position. When using the ice axe in cane position you can hold it with a self-arrest grip or a self-belay grip:

Ice axe in cane position

(1) ***Self-Arrest Grip***. Place your thumb under the adze. Place your palm and fingers over the pick. On the move the adze points forward. This position allows you to quickly self-arrest (described later) if you fall.

(2) ***Self-Belay Grip***. Rest your palm on top of the adze and wrap your thumb and index finger under the pick. When climbing the pick will point in the direction of travel. You can use it to provide a self belay as you ascend a slope. It is more difficult to self-arrest from while holding the ice ax in the self-belay position. You will need to rotate the shaft 180 degrees with your other hand if you need to get into the self-arrest position.

c. ***Self-Belay.*** Use the self-belay while ascending to prevent a minor slip from becoming a long, serious fall. To self-belay:

(1) Plant both feet firmly. While holding the ice axe in self-belay position, plunge the spike and shaft down into the snow ahead and slightly to the side of your uphill foot.

(2) Move your feet up to the ax. Remove the axe and place it further up the slope. Continue moving up the slope in this manner.

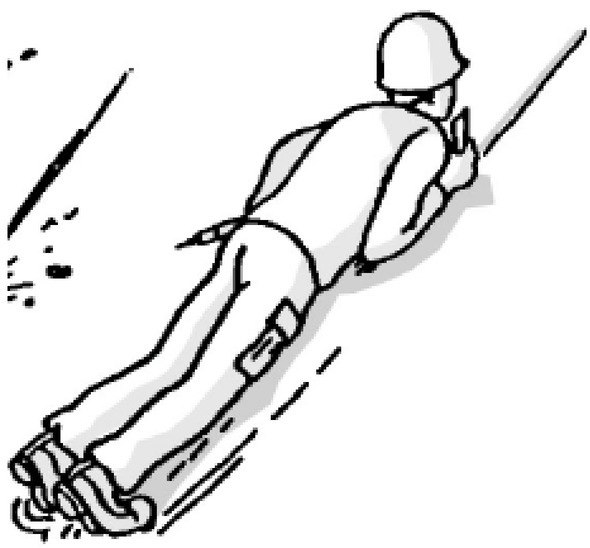
(3) If you fall, continue to hold the head and with your other hand grab the shaft of the ice axe where it enters the snow. Try to keep the shaft in a vertical position.

This technique is dependent upon a consolidated, deep snow pack that will accept most of the shaft of the ice ax. If this technique fails and you continue to slide, you will have to self-arrest.

d. ***Self-Arrest.***

(1) You can use the ice ax and the weight of your body to arrest a fall on snow covered terrain. First, you must know the proper ***self-arrest position***:

- Grasp the ice axe in the self-arrest grip with one hand. With the other hand, grasp the ice ax just above the spike.
- Hold the axe diagonally across your body. Hold the head at about shoulder height. Position the adze between your neck and top of your shoulder. Hold the spike end close to your hip that is opposite the ax head.
- Lie face down on the snow. Press the pick into the snow. Press your chest and shoulder onto the shaft of the ice ax. You should have most of your body weight pressing down onto the pick of the ax.
- Pick up on the spike end of the ice ax to press the pick further into the snow.
- Keep your legs spread apart and dig your toes into the snow. If you are wearing crampons keep your legs bent at the knees and DO NOT allow the crampons to come in contact with the snow until you come to a stop.



Self-Arrest Position

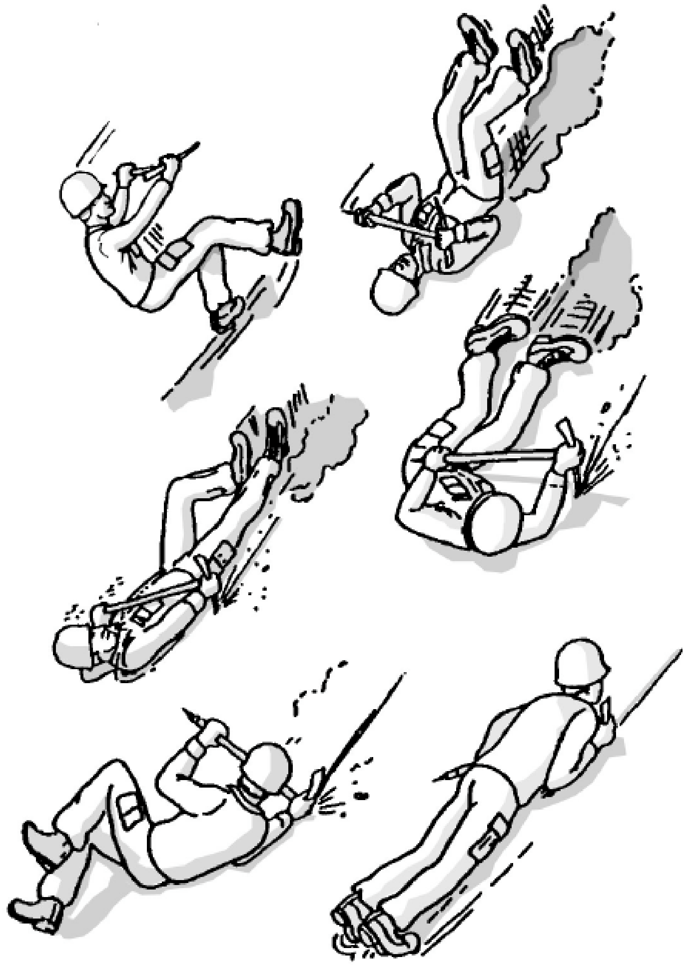
(2) If you fall on a snow slope, you may be rolling or spinning. First gain control of your body by whatever means necessary. You will then find yourself in one of four positions from which you can self-arrest:

- Head up slope, stomach on the slope and feet pointed down slope. Your body is in proper relation to the slope for an arrest. Go to the self-arrest position described above.

- Head up slope, back to the slope, feet pointed down slope. Roll your body towards the head of the ice ax. Go to the self-arrest position.

- Head down slope, stomach on the slope, and feet pointed up slope. Reach downhill and slightly off to the ax head side. Place the pick into the snow and pivot your body downhill and away from the head of the ax until your legs are pointing down slope. Go to the self-arrest position.

- Head down slope, back to the slope, and feet pointed up slope. Plant the pick in the snow near your hip. Rotate your body into a stomach down position, with the feet pointed down slope. Go to the self-arrest position.



(3) Additional Considerations:

- Self-arrest does have limitations. On extremely hard snow or ice the pick can bite too quickly causing a high potential for arm or shoulder injury. OR You may not be able to get the pick to bite in at all in which case you will continue to fall. These conditions may warrant belayed climbing techniques discussed in other lessons.
- If you lose your ax in a fall, get into the self arrest position. Clasp your hands together under your chest and try to dig them in to arrest your fall.

e. ***Ascend gentle to moderate snow slopes.*** The techniques for ascending and descending moderate snow slopes are similar to walking on hard ground with some exceptions:

(1) ***Diagonal Traverse Technique.*** The diagonal traverse is the most efficient means to ascend snow.

- Perform a basic rest step; place the lead (uphill) foot above and in front of the trailing (downhill) foot, and weight the trail leg. This is the in-balance position; the trail leg is in the rest step position and your body weight is supported by the skeletal structure. Hold the ice ax in the uphill hand. Place the ice ax in the snow above and to the front.
- Shift your weight to the leading (uphill) leg and bring the un-weighted trail (downhill) foot ahead of the uphill foot. You are now in an out of balance position because your bent uphill leg is bearing your body weight. Shift weight to the forward (downhill) leg and then move the uphill foot up and place it out ahead of the trail foot, returning to the in-balance position.
- Move the ax forward and repeat the sequence.
- Change directions using the same techniques you learned during mountain walking techniques.

(2) ***Direct Ascent.*** On gentle slopes, you can move directly up the fall line. The ax can be carried or used in the cane position. As the slope angle increases, herringbone the feet and continue in the cane position OR grasp the head of the ice axe with both hands. This is the ***stake position***.

Stake Position

(3) ***Step Kicking.*** Step kicking creates a path of steps. It is best used with the direct ascent technique on moderate slopes when the snow is soft enough to leave clear footprints. Harder snow and steeper angles may require transitioning to a diagonal technique while kicking steps.

- Swing your foot into the snow, allowing the weight and momentum of your leg to carve a step. At a minimum, the step should accept the ball of the foot. The steps should be angled slightly into the slope for added security.
- Succeeding climbers will follow directly in the steps of the trailbreaker, each one improving the step as he ascends.

f. ***Descend gentle to moderate snow slopes.***

(1) If the snow is soft and the slope gentle, simply walk straight down.

(2) Harder snow or steeper slopes call for the ***plunge step***, which must be done in a positive, aggressive manner. Face out, step off, and plant your foot solidly, driving the heel into the snow while keeping your leg lightly bent. Shift your weight to the new foot plant and continue down with the other foot. On steeper terrain it may be necessary to squat on the weighted leg when setting the plunge step. Keep your upper body erect or canted slightly forward.

g. ***Glissading.*** This technique is used to descend snow slopes fast, efficiently and under control. It can be done from a sitting or squatting position. The only piece of equipment required is the standard ice ax which serves as the rudder, brake and guide for the glissade.

(1) Choose an appropriate slope to glissade. Do not glissade on crevassed terrain. A safe run out must exist below you so that if you lose control you will not be injured before reaching it. You should be able to see the entire descent route. Remove crampons when glissading. You can inadvertently catch them on the snow, which could send you into a tumble or potentially cause breaks or sprains to the leg. It is also a good idea to don waterproof/resistant clothing and gloves prior to glissading.

(2) ***Sitting glissade***. Sit on the snow with your legs flat and heels and feet raised and pointed down slope. Hold the ax in the self-arrest position. Use the spike as a rudder to control direction of travel. Plunge the spike into the snow to control your speed. To stop, use the spike to slow down then bend your knees and dig your heels into the snow. You can control your speed on the descent by keeping your knees bent. If you gain too much speed, simply self-arrest.

(3) ***Squatting or crouching glissade.*** Get into a semi-crouched position with both knees bent and body weight directly over the feet. Hold the ice ax in the self-arrest position and use it to control your descent just as you did for the seated glissade.

Learning Step Activity 2 – Move on gentle, moderate and steep snow and ice covered slopes with crampons and ice ax.

a. The movement techniques described above have limitations. When slopes are covered with hardened snow and/or ice, you will need to use crampons and an ice ax for safe, efficient movement. Two different techniques evolved for using crampons – French (flat footing) and German techniques (front pointing). You will use a combination of these techniques to negotiate snow and ice covered slopes – this is known as combination or American technique.

b. ***French technique (flat footing)***. This technique follows the same principles you learned in mountain walking techniques. The main requirement for this technique is that all of the points of your crampons (with the exception of the front points), make contact with the snow/ice.

(1) On gentle terrain you simply walk; swing your foot out and around your fixed foot to avoid catching a crampon on your leg. Use the ice ax in cane position.

(2) As the slope gets steeper, go to a ***herringbone position*** and roll your feet outward in order to engage all points of the crampon with the snow or ice. Keep the knees bent and keep your weight centered over your feet. Continue to use the ice axe in cane position or go to the stake position.

(3) When the slope is too steep for the herringbone position to be comfortable, turn sideways to the slope and ascend the slope with the ***diagonal traverse technique***. Roll the ankles to keep all crampon points engaged with the snow/ice. You can point your feet downhill to relieve some of the pressure on the joints and to keep all points of your crampons engaged.

It may be difficult to use the ice axe in the cane position. Transition to the ***cross body position*** with the ice ax. Carry the ax across the chest, upslope hand on the shaft, spike towards the slope. The head of the ax is held away from the slope with the pick forward in preparation for self-arrest. Place the ax perpendicular to the slope. This position allows you to maintain balance with the spike.

Diagonal ascent, in-balance position, ice axe in cross body position.

Out-of-balance position

To execute the diagonal traverse technique:

- Start from an in-balance position as shown above. Cross the lower leg over the knee of the uphill foot to an out-of-balance position.
- Return to a position of balance.
- Replace the ax further up the slope and repeat.

To change directions during a diagonal traverse:

- Start in an in-balance position. Move to the out-of-balance position. Turn into the slope while moving and placing your other foot in the new direction of travel.
- Go to an in-balance position for the new direction of travel.
- Reposition your hands on the ice ax for the new direction of travel and continue moving up.

(4) As the slope gets even steeper, you can use the ice ax in ***anchor position*** for additional security. From an in-balance position, hold the ice axe in the downhill hand at the base of the shaft (closest to spike). Swing the ax like a hammer and stick the pick into the ice in front of and slightly above your head. The shaft should be parallel to the surface of the ice. Pull down on the head of the ax with your other hand and execute the diagonal traverse technique. Remove the ax and replace it further up the slope and repeat the diagonal traverse technique.

When you can no longer flat foot the slope, you will need to transition to the German technique or a combination of German and French technique.

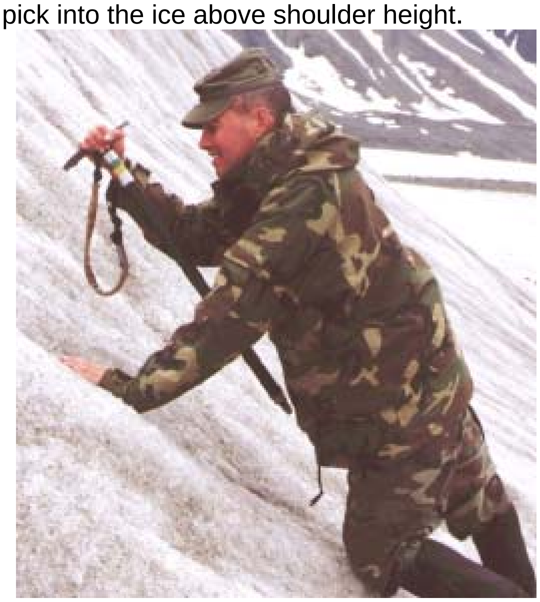
c. ***German (front pointing) and American (combination) technique***.

(1) On ice that is too steep to flat foot:

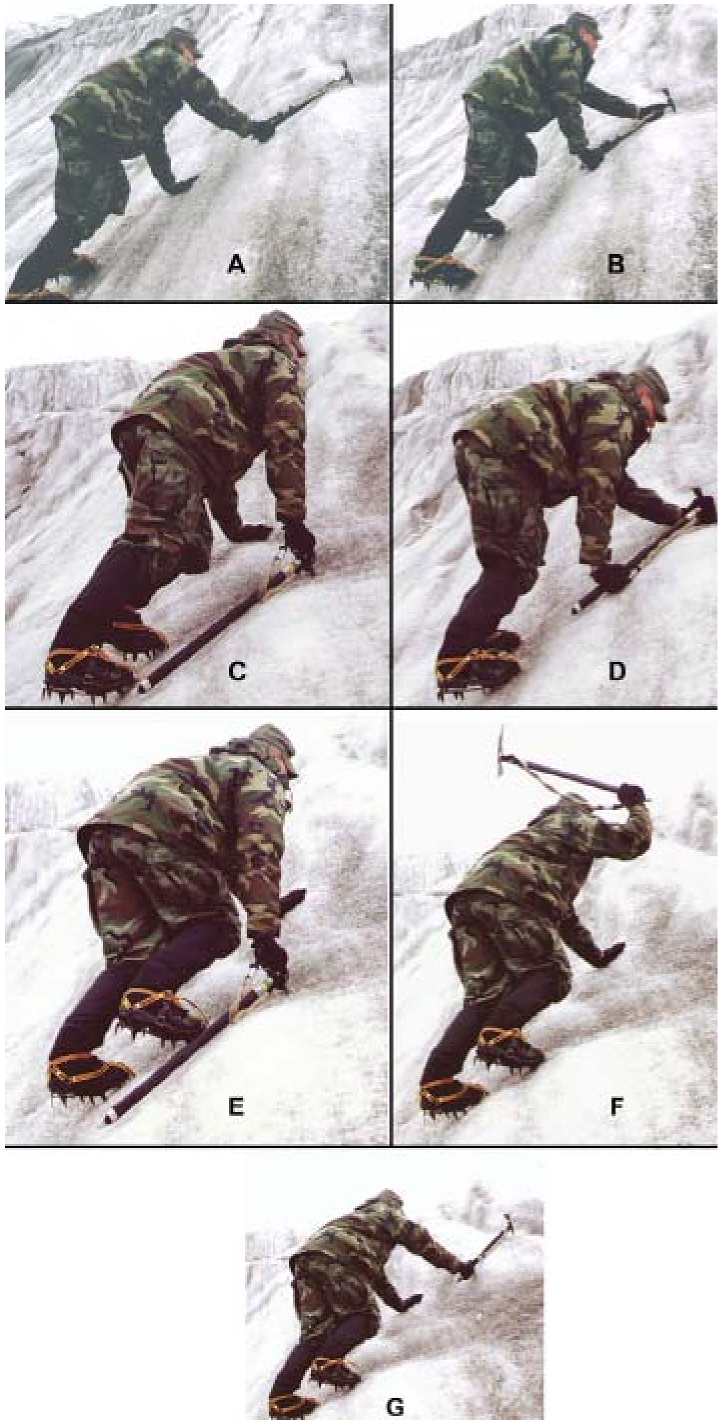
- Face the steep ice. Swing the ax like a hammer above your head. Kick one foot straight into the ice. Lower your heel slightly to allow the secondary points of the crampon (the ones immediately behind the front points) to engage the ice.
- Repeat with the other leg, placing the crampon on the same plane as the first crampon.
- The sequence is now like climbing a ladder. Make natural steps up the ice. Use of the ice ax is dependent upon the slope angle. There are a number of ax techniques to use:

- Use the ***low dagger position*** on lower angled slopes or if you are moving over a short steep section. Hold the ax by the adze, in the self-belay position and push the pick into the ice near waist level.

- Use the ***high dagger position*** on steeper slopes or harder ice and snow where more force is needed to place the ax. Hold the ice axe in the self-arrest position. Jab the pick into the ice above shoulder height.



- Use the ice ax in ***anchor position*** to essentially "climb" the ax. Front point up while sliding your hand up the shaft for balance. You should end up in a low dagger position. Remove the ax, place it higher up and continue front pointing.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- Use the ice ax in ***hammer position*** (also known as the overhead traction position) for the steepest sections. Place the axe high overhead, and front point up while keeping your hand low on the shaft and pulling straight down on the axe. Remove the ax and repeat the process.

(2) ***American (combination technique).*** You may be able to flat foot with one foot and front point with the other foot during a climb. The ***three o'clock position*** has one foot in a front point position and the other turned 90 degrees to the first in flat foot technique. All of the ice ax considerations are the same with this technique.

(3) Additional considerations:

- Front pointing is relatively simple and may feel more natural to a novice mountaineer. But it is less efficient than flat footing. The muscles of the calf are used with front pointing, while the stronger muscles of the thigh are used with flat footing.
- When you first start to front point, you may try to raise your calves. This is poor technique because it does not allow you to engage the secondary points; doing this may cause your front points may shear out of the ice.
- Two axes may be used when the ice becomes very steep or vertical. Use one tool for balance while you place a second tool higher than the first.
- In warm, wet snow conditions, snow can ball up underneath the foot while wearing crampons. This can prevent you from engaging the points of the crampons and could cause you to fall. One technique is to lift the boot and hit the side of the boot with the shaft of the ice ax to dislodge the snow. Another technique is to install anti-balling plates on the crampons. These can be purchased commercially or improvised with pieces of closed cell foam cut to fit the crampon and inserted between the boot and the crampon before donning. In these conditions, it may be prudent to remove the crampons altogether.

d. ***Descending.***

(1) Whenever possible, descend directly down the fall line. As the slope gets steeper gradually turn sideways. On steeper slopes bend at the waist and knees as if sitting. Keep the feet flat to engage all points of the crampons. Ensure that you keep most of your body weight over your feet to prevent crampons from skating out from underneath you. You can traverse in the cross body position. Use the ***crab position*** to keep points engaged. If the slope is too steep or the experience level of the Soldiers is in doubt, belay them down short sections or rappel down longer slopes.

Learning Step Activity 3 – Move on hard snow/ice without crampons (Cut steps).

a. Crampons and an ice ax are a luxury that most Soldiers will not have access to. When the mission calls for a unit to move over snow/ice covered terrain a small advance party with ice axes can cut steps to allow Soldiers to move over snow and ice covered terrain.

b. Cut steps straight up a slope or for a diagonal traverse. Steps can be cut in two ways.

(1) Slash steps are made with the adze of the ice axe. Start from an in-balance position. Hold the ax in the uphill hand at the base of the shaft (as you would in hammer position). Swing the ax nearly parallel to the surface. Cut out a small platform that can accommodate at least half of a boot. Angle the platform so that it slopes slightly inward. Step into the platform, and cut the next step in the same manner.

(2) Pigeonhole steps are cut in steeper ice by swinging the adze perpendicular to the surface of the ice. The finished platform should also be large enough to accept at least half of a boot and should slope slightly inward.

c. Additional considerations.

(1) For the diagonal traverse ascent cut the first step from an in-balance position, step up into the first step (in an out-of-balance position) and cut the next step. Continue this process until a direction change must be made. At the point of direction change, cut a step that is large enough for both feet. Step onto this platform and cut the next step in the new direction.

(2) Space steps so that they are convenient for each Soldier to use. For a direct ascent they should be shoulder width apart and spaced like the rungs of a ladder. For a diagonal traverse they should not cause a Soldier to have to lunge to get into each new step.

(3) Create a lip at the back of the step for handholds. Separate smaller handholds can also be cut into the slope.

(4) For short descents, steps should be cut directly down the fall line. A rappel is the preferred option for descending longer snow/ice covered slopes.

SECTION IV. SUMMARY

You now have the basic skills required to negotiate snow and ice covered terrain.

Check on Learning.

1. What is the low dagger position used for?

Use the ***low dagger position*** on lower angled slopes or if you are moving over a short steep section.

2. Why do you remove crampons when glissading?

You can inadvertently catch them on the snow, which could send you into a tumble or potentially cause breaks or sprains to the leg.

SECTION II. INTRODUCTION

Motivator: You have received a class on basic natural anchors. These are generally appropriate in all areas of the world, but you may find yourself conducting operations in cold, snow covered terrain. There are different tools and techniques that you need to be familiar with when working in this environment.

Terminal Learning Objective

ACTION	Rig snow and ice anchors
CONDITION	Given an assortment of applicable artificial anchors, ice ax, sling material, rope and terrain needed to establish the anchors
STANDARD	Soldier: - rigged a deadman anchor in snow for a load designated by the grader within 30 minutes. Anchor did not fail under load. Designated low load anchor will be tested by three individuals. Designated high load anchor will be tested by six individuals. - Placed a picket within 5 minutes capable of supporting a low load. - Constructed a snow bollard within 30 minutes capable of supporting a low load. - Placed an ice screw within 5 minutes capable of supporting a low load. - Placed a V-thread ice anchor within 10 minutes capable of supporting a low load. - met all critical performance measures IAW the student/instructor evaluation plan.

Safety Requirements: Ensure students are properly dressed and equipped prior to the conduct of training.

Risk Assessment: Low

Environmental Considerations: None

Evaluation: You will be tested on your ability to construct snow and ice anchors IAW the student or instructor evaluation plan. If you fail to properly set up any anchor system you will receive a NO-GO. After retraining, you will be re-tested. If you fail to properly set-up any anchor system a second time you will receive a NO-GO and you will be dismissed from the course.

Instructional Lead-In: This lesson gives you a number of anchor options that you can use in ice and/or snow covered terrain.

SECTION III. PRESENTATION

Learning Step/Activity 1 – Construct a deadman anchor in snow. (a.k.a. T-slot anchor).

a. As we have already learned a deadman anchor is any object buried in the ground and used as an anchor. This anchor can also be constructed in snow. The steps are as follows:

(1) Dig a trench deep and at a right angle (90º) to the direction of pull. The trench should be dug just large enough for the anchor (usually a snow picket, ice axe, ski or pack), to fit. The depth of the trench is dependent upon the consistency of the snow. For firm, compacted snow the trench will be shallower than light, dry, fresh snow. The front wall of the trench is undercut by digging down at an angle.

(2) A second trench, or rope trench, is dug from the direction of pull at snow level angling downward to the bottom of the main trench, forming a "T" with the main trench. It should be wide enough for a rope, or sling to fit in.

(3) Ensure the vertical angle between the front wall of the main trench and the rope trench is slightly less than perpendicular (<90º). This will keep the anchor from being pulled up and out under load.

(4) Place the anchor in the main trench and attach a sling to it. The sling is placed in the second trench. It should be slightly longer than the trench it lays in. Keep knots out of the hole for easy inspection.

(5) Both trenches should be filled back in and the snow packed down. The end of the sling is exposed for attachment of the rope and the knot in the sling is exposed for inspection.

(6) The rope is attached to the sling with a carabiner(s). The gate should face up, and open away from the anchor. Alternatively, use two carabiners with gates opposite and opposed or a single locking carabiner for high load and/or alternating tension installations.

b. Additional considerations:

(1) If you are having trouble getting the anchor to work because of the consistency of the snow, increase the surface area of the anchor – using a ski or pack may work better than an ice axe or snow picket in loose snow.

(2) When using an ice axe, mentally divide the shaft into three equal sections. Girth hitch the webbing or cord at the upper third (closer to the head than the spike) of the ice axe. Place the ice axe with the pick down into the trench. A second ice axe can be used as a revetment.

(3) Do not use ski poles or trekking poles as an anchor; they are not strong enough to support a load.

Learning Step/Activity 2 – Place a snow picket.

a. The angle for placing a picket depends upon the angle of the slope. You must strive to place the picket so that it can withstand the load placed on it while having the greatest possible area of snow to pull against. Use head of the ice axe to place the picket:

(1) To place the picket on a gentle slope or flat snow surfaces, angle the picket 10 degrees back from the direction of pull and drive it into the snow until just the top attachment point (hole) is exposed.

(2) To place the picket on a steep slope, place the picket so that it is at approximately 45 degrees from the upper slope to the picket. Alternatively, hold the picket vertically, tip it back 10 degrees and drive it in until just the top hole is exposed.

(3) Attach a runner to the attachment point. Attachment carabiner must open up and away from the picket and the hanging carabiner opens up and away from the picket. The picket is ready for use.

b. Additional considerations:

(1) If the picket cannot be driven in all the way to the top hole, the carabiner should be placed in the hole closest to the snow surface to reduce leverage. It may also be tied off with a short loop of webbing or rope.

(2) An ice ax can be used in place of a picket. When using an ice ax as a snow anchor, it should be inserted with the widest portion of the ax shaft facing the direction of pull. The simplest connection to the ax is to use a sling or rope directly around the shaft just under the head. If using the leash, ensure it is not worn or frayed or cut from general use and is of appropriate strength and does not twist the ax when loaded. A carabiner can also be clipped through the hole in the head.

(3) Pickets can be equalized using self-equalization or static equalization methods.

Learning Step/Activity 3 – Construct a snow bollard.

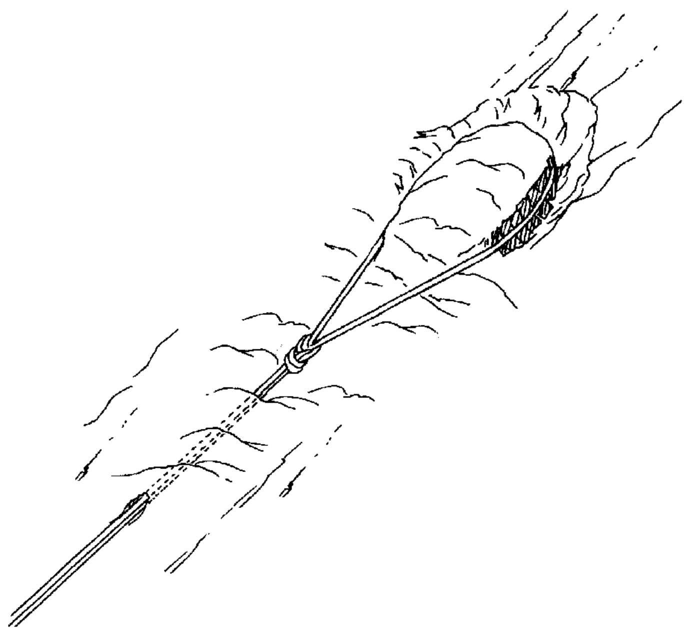
a. This is an artificial anchor shaped generally like a horseshoe; It is formed from snow and constructed with the ice ax. In effect, you are improvising a boulder in the snow. Here is how to construct one:

(1) Lay out the bollard in the shape of a horseshoe. The width should not be less than 3 feet for well bonded, hard packed snow and ten feet or more for snow that is not well consolidated.

(2) Using the adze of the ice axe, cut a trench 1-1.5 feet deep and 6-8 inches wide. Undercut the trench towards the center of the horseshoe to prevent the rope or webbing from sliding up over the horseshoe when loaded.

(3) The middle of the climbing rope or a loop of webbing is draped over the bollard. The backside of the bollard can be reinforced with ice axes, pickets, or other equipment for added strength.

NOTE: Do not disturb the snow that makes up the bollard.



Learning Step/Activity 4 – Place an ice screw.

a. To place an ice screw:

(1) Choose a spot for an ice screw. Shallow depressions are generally stronger than bulges in the ice.

(2) Clear away all rotten, brittle ice from the surface and make a small hole with the ax pick or adze.

(3) Using your palm on the top of the ice screw, twist the ice screw back and forth until the threads catch. In solid ice, place the screw perpendicular to the direction of pull. If the ice is brittle, angle the screw 100 degrees (10 degrees from perpendicular) from the direction of pull.

(4) Turn the screw until the eye or the hanger of the ice screw is flush with the ice. If you are having difficulty turning the screw, you can use the pick of the ice axe (refer to picture above) to assist with placement.

(5) Orient the hanger in line with the intended direction of pull.

(6) Attach a runner to the ice screw. Ensure both carabiners open down and out. The placement is now ready for use.

b. Additional considerations.

(1) While turning the screw resistance should be constant and ice should spill out of the tube as you place the screw. If at any point there is no resistance, the screw has hit an air pocket; remove the screw and find another location.

(2) Melting of the ice around a screw over a period of time must be considered. The effective time/strength for an ice screw placement is limited. The screw will heat from solar radiation or the ice can crack or soften. Solar radiation can be nearly eliminated by covering the screw with ice chips or snow once it has been placed. If repeated use is necessary for one installation such as top roping, the screws should be inspected frequently and relocated when necessary.

(3) After removing the ice screw, gently tap the screw (avoid tapping the threads) on a boot or ice axe to clear the tube of any ice. Failure to do so will make the screw difficult or impossible to place.

Learning Step/Activity 5 – Rig a V-thread ice anchor (Abalakov sandwich or ice hourglass).

a. The V-thread is a v-shaped tunnel bored into the ice using ice screws. A piece of cord or webbing is threaded through the tunnel and tied off to create an anchor. Special tools are sold to assist with threading the anchor or you can make one with a piece of wire coat hanger.

b. To construct the anchor:

(1) Screw a 22 cm ice screw into the ice. Angle the screw up 10 degrees from the anticipated direction of pull and 60 degrees to one side.

(2) Back the screw out halfway. Place a second screw 6-8 inches from the first, angling it to intersect the first hole at its bottom. Remove both screws.

(3) Thread a length of cordelette or webbing into one side of the tunnel. Use a V-thread tool or a section of coat hangar bent at the end to pull the webbing out of the other side of the tunnel. A wired-stopper can also be used to do this.

(4) Hold both ends of the cord or webbing and saw it back and forth; this removes any sharp edges created by the intersection of the tunnel.

(5) Tie the cord off with a double fisherman's knot or the webbing with a water knot. Insert a carabiner with the gate facing down and out. The anchor is ready to use.

c. Additional considerations. If there is any doubt as to the strength of the anchor, two or more V-threads can be created and equalized using either self-equalization or static equalization.

SECTION IV. SUMMARY

You now have the ability to rig anchors in snow or ice. Provided they are constructed correctly, these anchors can be used to rig all of the rope installations you learned.

Check on Learning.

1. How do you place a snow picket on flat or gentle terrain?

Place the picket 10 degrees back from perpendicular to the slope, away from the direction of pull.

2. What is the minimum size for a snow bollard?

Three feet wide in hard pack snow and 10 feet or more in unconsolidated snow.

SECTION II. INTRODUCTION

Motivator: Below the snow line of a glacier there is generally no need for rope teams. All of the hazards are exposed and you can easily avoid them. The techniques you learned in snow and ice movement should be sufficient. On stepper sections you may want to establish fixed ropes, belay climbers or rappel on the descent, but roped travel is generally unnecessary. It can be hazardous to rope up on exposed glacial ice. If one team member falls, it will be difficult or impossible for the other team members to arrest the fall on the bare ice. But once you are above the snow line, the hazards are hidden and you must establish rope teams.

Terminal Learning Objective

ACTION	Move on glaciated terrain as a rope team
CONDITION	On snow, ice and glacier, given a 60m 9-10mm rope per 3-4 individuals, adequate climbing equipment and sling material, ice ax and crampons
STANDARD	Soldier: - Moved on glaciated terrain as a rope team. - Demonstrated self-rescue techniques from a crevasse fall. - Rescued a fallen climber from a crevasse using brute force, Z-pulley and U-pulley methods. - Used running belays on steep snow/ice and glaciated terrain. - Met all critical performance measures IAW the student/instructor evaluation plan.

Safety Requirements: Ensure that students are properly dressed and equipped prior to the conduct of training. Ice mills or moulins are dangerous; students and instructors will give wide berth to these obstacles. No one will jump into a crevasse; ‘victims’ will be lowered into crevasses. One man will remain top side to observe any individuals who are lowered into crevasses.

Risk Assessment: Medium

Environmental Considerations: None

Evaluation: You will be tested on your ability to move on a glacier as a member of a rope team IAW the student or instructor evaluation plan. If you fail to move on a glacier as a member of a rope team you will receive a NO-GO. After retraining, you will be re-tested. If you fail to move on a glacier as a member of a rope team a second time you will receive a NO-GO and you will be dismissed from the course.

Instructional Lead-In: This class will focus on roped movement over snow, ice and glaciated terrain.

SECTION III. PRESENTATION

Learning Step Activity 1 – Move on glaciated terrain as a rope team.

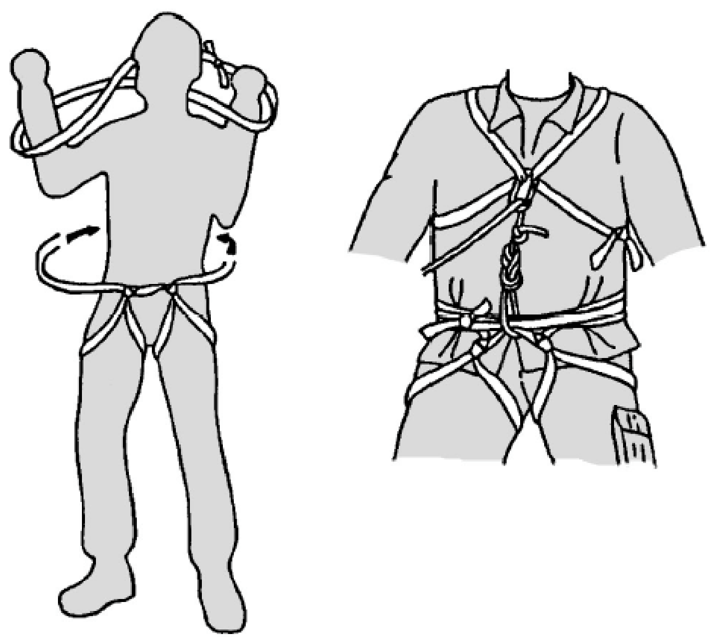
a. ***Prepare the team for movement***.

(1) You will need the following climbing equipment (minimum required):

- Harness, preferably a commercial harness with gear loops.
- 5 carabiners (2 locking carabiners)
- 1 waist cordelette
- 1 foot cordelette
- 1 picket with sling and carabiner
- 1 ice screw with carabiner
- Helmet, ice ax and crampons, skis or snowshoes
- 2 each 9 foot piece of 1 inch tubular nylon webbing

(2) Don an improvised seat harness or a commercial climbing harness. Clip two locking carabiners to the tie in point of the seat harness.

(3) Don an improvised chest harness. Take a 9.5 foot piece of 1 inch tubular nylon webbing, and join the ends with a water knot. Put a single twist in the webbing forming two loops. Place an arm through each loop, just as you would put on a jacket and drape the sling over the shoulders. The twist or cross in the webbing should be in the middle of your back. Join the two loops at the chest with a carabiner. Off-set the knot so that it does not interfere with the rucksack straps. The chest harness should be worn over the outermost layer of clothing.



(4) Prepare the rope for travel. For a three man rope team, tie a figure-eight loop at both ends and in the middle of the rope. For a four man rope team, divide the rope into thirds. Tie four figure eight loops, one at each end and one at each of the division points.

(5) Prepare the rucksack for travel. Join the ends of a 9.5 foot piece of 1 inch tubular nylon webbing. Girth hitch this sling to the frame of the rucksack. Attach a carabiner to the sling.

NOTE: For the remainder of this lesson, a three man rope team is discussed.

(6) Clip into a figure-eight loop on the rope. Clip the rope into the chest harness.

(7) Create a waist prusik. Tie it onto the rope with a three wrap prusik. Clip it into the second locking carabiner on the seat harness and lock the carabiner.

(8) Create a foot prusik. Attach it to rope (between the first prusik knot and the chest harness) with a prusik with three wraps and tuck the end of the cordelette into a pocket. It is ready for use in this position. You may elect to keep this cordelette off the rope and instead hang it from your harness.

(9) Don skis, snowshoes or crampons.

(10) Don the pack and clip the carabiner to the rope between the climbing harness and the chest harness.

b. ***Additional considerations***.

(1) If traveling with a sled, connect the rear of the sled to the rope with cordelette using the prusik knot. Then attach the sled to the rucksack. Ensure the prusik knot is engaged. If you fall into a crevasse, the prusik knot will prevent the sled from hitting you from above. If you are the last man on the rope team, it is not recommended that the last man travel with a sled because you cannot keep it from hitting you in the event of a fall.

(2) All items should be secured to either you or the rope/harness to prevent inadvertent release and loss of necessary items or equipment.

(3) If you are the middle man, you have a decision to make. The question is usually asked, 'Which side of the rope do I put the waist prusik onto?' It is generally accepted practice to put it on the rope that goes to the lead rope team member. You can also place a second piece of 6 foot cordelette on the rope that goes to the trail team member.

(4) Five or more individuals should not rope together. The length of rope between individuals will not be long enough to span the width of most crevasses.

(5) Keep extra clothing in the top of the rucksack or in a place that is easily accessible. While traveling, you will often be lightly dressed. If you fall into a crevasse, and need to be hauled out, you may be waiting for a while and you will need access to clothing to keep you warm.

(6) There are two schools of thought on the chest harness. One says that you should clip into the chest harness during movement. This prevents you from flipping upside down in the event of a crevasse fall. The disadvantage is that if you need to arrest the fall of another climber, the load on you will pull from chest height. This could hamper your ability to arrest. The other school of thought says that you should not clip in at all during travel. If you fall into a crevasse upside down, you can right yourself and then clip into the rope to keep you upright. Here at the NWTC, you will clip into the chest harness for travel.

c. ***Movement.*** Now that the rope is attached to all rope team members, proper rope management is essential:

(1) All rope team members start in a safe area.

(2) Belay the first rope team member out the safe area. The purpose of this belay is to prevent the first rope team member from taking a long fall into a crevasse. To belay:

- The second member of the team takes up the slack between himself and the climber by sliding the waist prusik along the rope until all of the slack is removed.

- The second rope team member belays the leader out by allowing the rope to slide through the prusik. If the lead climber takes a fall, the prusik will lock off and the second rope team member can arrest the fall by executing self-arrest.
- When all of the slack is removed between the first two rope team members, the second rope team member begins moving.
- The third rope team member belays the second rope team member in the same manner.

(3) Keep the rope extended between all climbers. The rope should not be taut but should not have undue slack. A good rule of thumb is that the rope should run from the harness to the ground at about a 45 degree angle.

(4) To help keep slack out of the rope, the rope team leader sets a pace the others can follow. For their part, the second and third climbers must try to closely match the pace of the leader so the rope stays extended. At sharp turns, there is a tendency for the rope to go slack as the climber in front of you heads in a new direction and then to tighten as you near the turn yourself. Throughout the turn, adjust your pace to keep out the slack.

c. ***Route selection and hazard evaluation.***

(1) Above the firn line, there are several tips for detecting crevasses:

- Keep an eye out for sagging trenches in the snow that mark where gravity has pulled down on snow over a crevasse. A sagging trench on the surface of the snow is a prime characteristic of a hidden crevasse.
- Be wary after storms. New snow can fill a sagging trench and make it blend into the surrounding surface. Be especially alert in areas where you know crevasses form, such as where a glacier makes an outside turn or where the slope angle increases.
- Sweep your eyes to the sides of the route regularly, checking for open cracks to the left or right. Cracks could hint at the presence of crevasses extending beneath your path.

(2) Use your best judgment about the stability of snow bridges. Snow conditions, the time of year, temperature, and recent storm events all have an effect on the stability of snow bridges. You can usually get a good feeling about how firm snow bridges and how much precaution you need to take after just a few minutes of travel. In general you should:

- Cross a crevasse at a right angle to its length.
- Use skis or snowshoes to distribute your weight over as wide an area as possible.
- Not stop rope team movement when any one team member is standing on an obvious snow bridge/crevasse.

(3) If the snow bridge conditions are particularly dangerous you can:

- Keep the rope tight between rope team members and be prepared to self-arrest as the lead rope team member crosses a snow bridge.
- Probe suspicious looking areas. If your probe locates a crevasse, continue probing to find its true lip. Probe with your ice ax, thrusting the shaft into the snow a couple of feet ahead of the snow you are standing on. Keep the ax perpendicular to the slope and thrust it in with a smooth motion. If resistance to the thrust is uniform, you have established that the snow is consistent to at least the depth of your ax. If resistance lessens abruptly, you've probably found a hole. If your route must continue in the direction of this hole, use further ax thrusts to establish its extent.
- Make end runs around large crevasses with weak snow bridges. Travel to one end of the crevasse to bypass it. This can be time consuming but is a very safe option.
- Climb into a crevasse, cross it at the bottom, and climb out the other side. This tactic should be attempted only by a strong, highly trained, and well-equipped party that is ready to provide a good belay, plus assistance in case the crevasse bottom collapses and leaves the climber hanging.

(4) Certain crevasse patterns preclude the rule of keeping the rope at right angles to the crevasses. If the route demands travel that is parallel to crevasses, travel in ***echelon formation***. Travel in a parallel direction on either side of the crevasses you are traveling by. The rope team will be strung out diagonally, the team leader up front, with the other rope team members staggered on either side of the crevasses. This formation is safest on stable, heavily crevassed glaciers where location of the crevasses is known and the risk of hidden holes is small. The formation offers an alternative to following in the leaders' footsteps through a maze of crevasses where single-file travel is impractical.

Learning Step/Activity 2 – Rescue a fallen climber from a crevasse.

NOTE: While rescuing a victim from a crevasse you must always be anchored or belayed in some manner (tied-in and self-belayed or clipped into a bombproof anchor). Keep this in mind as you undertake the rescue. Understand that if you fail to do this, you can fall into the same or another crevasse and further compound the problem.

a. If a team member falls into a crevasse, the remaining members go into self-arrest, assess the situation, and use the necessary technique to extricate the person from the crevasse. The general sequence of events for crevasse rescue is:

(1) Arrest the fall.
(2) Anchor the rope.
(3) Check the victim and decide on a rescue method.
(4) Prepare the lip.
(5) Execute the rescue plan.

b. Crevasse Rescue. This scenario is based on a three man rope team where the lead rope team member (number 1), falls into a crevasse. Number 2 is the middle rope team member and Number 3 is the trail rope team member.

(1) ***Arrest the fall***. The remaining rope team members go into team arrest. Fall away from fallen rope team member and go to the self-arrest position. Most crevasse 'falls' are not very dramatic. One rope team member may partially break through a snow bridge. Usually the remainder of the team can keep the rope tight while the fallen rope team member wallows out of the hole and back onto solid ground.

(2) ***Anchor the rope***. In a more serious fall you must anchor the rope going to the fallen climber. To do this:

- Number 3 ensures that number 2 can hold number 1. Number 3 tells number 2 that he is going to get up. Number 3 slowly releases his portion of the load onto number 2, prepared to go back into self-arrest should number 2's position begin to fail.
- Once number 2 is confident that he can hold the load, number 3 comes forward to number 2's position, using the waist prusik as a self-belay.
- Number 3 establishes two bombproof anchors. Deadman anchors are best. Establish the anchors between number 1 and number 2 if possible.
- Number 3 ties a three wrap prusik onto the rope below number 2, with a piece of cordelette. Clip the cordelette into the anchor with a locking carabiner. Lock the carabiner. Slide the prusik towards the fallen rope team member until it is tight against the anchor. This prusik is often referred to as the ratchet prusik.
- Number 2 slowly releases the load onto the anchor, prepared to go back into self-arrest should the anchor fail.
- Number 2 and 3 clip into the anchor with a safety line.
- Number 3 unclips from the rope, and removes the waist prusik. Number 3 replaces the waist prusik on the rope below the ratchet prusik. Number 3 clips back into the waist prusik with the locking carabiner on the seat harness.

(3) ***Check the victim and decide on a rescue method***.

- Number 3 moves towards the victim using the waist prusik as a self-belay. Number 3 brings an ice ax or pack to the edge.

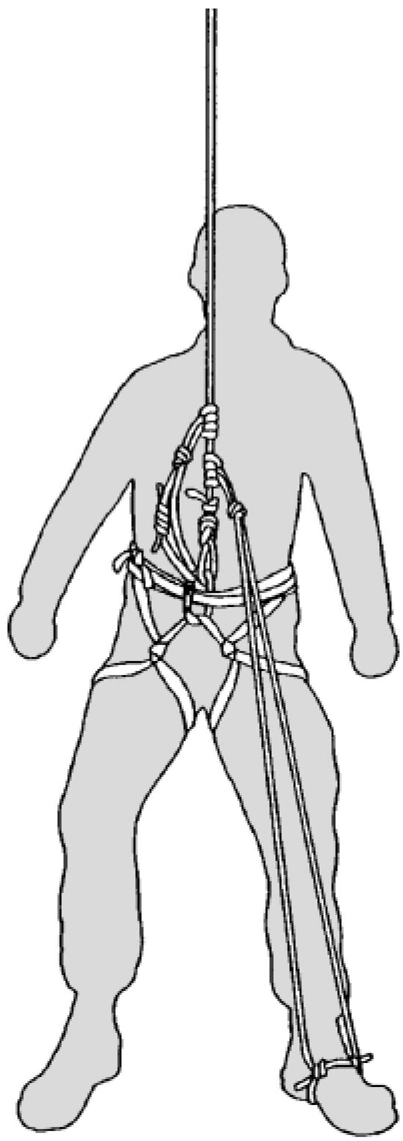
- Number 3 and Number 1 decide on a rescue method. The options are:
    - Self rescue. Specifics are discussed in Step 5.
    - Team rescue. Brute force, Z-pulley and U-pulley techniques are discussed in Step 5.

(4) ***Prepare the lip***. The rope can become entrenched in the snow and hamper the rescue efforts of the team. To prevent this:

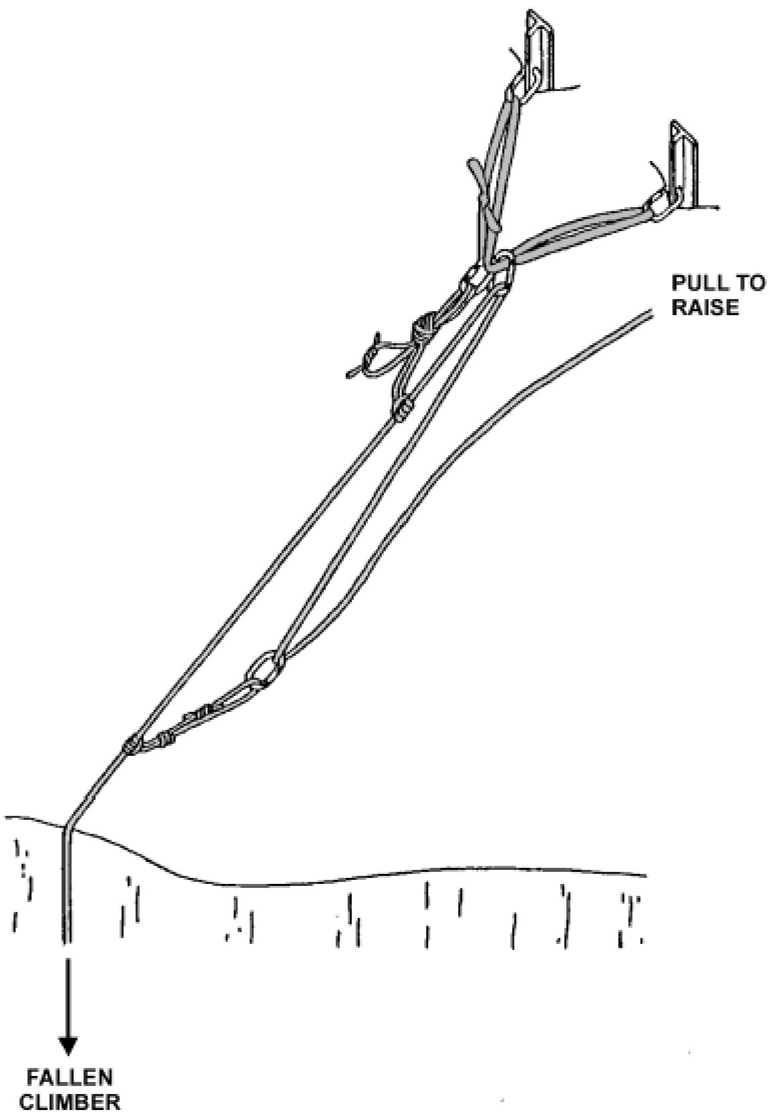
- The Number 3 man places an ice ax or pack under the rope. Secure the padding to the load rope to prevent it from falling onto the victim. The number 3 man may need to dig to get the padding under the rope.

(5) ***Execute the rescue plan***:

- Self-rescue is the first choice. Use the prusik ascent technique to get out of the hole:
  - Take off your pack and let it hang below you. You may elect to have the number 2 and number 3 haul the pack out for you.
  - Attach the foot prusik if you have not already done so and ascend out of the hole.
  - It may be difficult to get over the lip. The number 3 can assist the climber out of the hole. One technique is to tie a prusik onto the rope just above the lip that the climber can use as a hand hold to pull himself out of the hole.



- Use a Z-pulley system to haul the fallen climber out of the crevasse:
    - After preparing the lip, Number 3 moves back to the main anchor. Number 3 takes the slack rope coming from the ratchet prusik and clips it into a locking carabiner at the main anchor point. Number 3 then takes the slack rope as close to edge of the crevasse as is safe.
    - Number 3 places another prusik with a cordelette on the load rope below (closest to the fallen climber) his self-belay prusik. Clip a carabiner to the cordelette. Attach the slack rope to the carabiner. This becomes the running prusik or moveable pulley.
    - Number 3 moves back to the main anchor point.
    - The number 2 and 3 both pull on the slack rope to begin hauling the fallen climber. One person will need to tend the prusik at the main anchor (ratchet prusik) so that the rope slips freely through it as it is pulled.
    - Eventually, the running prusik will approach the main anchor prusik. Stop hauling before the two meet. Re-set the running prusik by loosening it and sliding it back down to the fallen climber.
    - Repeat the above steps until the climber is at the lip. Take care not to pull too hard when Number 1 reaches the lip. You can injure the climber. If the climber is able, he can climb out of the hole while number 2 and 3 offer a belay with the Z-pulley system.



- Use a U-pulley system to haul the climber out of the crevasse. This system is effective when when you have a four man rope team, or when the load rope is so entrenched that it will interfere with self-rescue or Z-pulley techniques. It is also useful when the middle man of one rope team goes in and another rope team is available to assist; the other rope team can come forward and quickly haul the climber out. This procedure assumes a four man rope team:

    - Establish another anchor point (again use two bombproof anchors).
    - Take slack from the rope and tie a figure-eight loop knot. Clip it into the new anchor point with a locking carabiner. Lock the gate. Ensure there is slack between the new anchor point and the original anchor point.
    - The number 3 man clips a locking carabiner (with a pulley if you have it) to a bight in this rope and moves towards the fallen climber with the rope and padding for the lip. The Number 3 must be on a belay or self-belay while doing this.
    - Prepare the lip.
    - Lower the locking carabiner to the fallen climber and have him clip it to his harness.
    - Number 2 and Number 3 can then pull on the slack side of the rope to raise the fallen climber. The Number 4 man must tend the original load rope prusik to belay the climber out of the hole.

- Brute force method. If other rope team(s) are in the area, they can simply pull with the main rope team and free the fallen climber. Do not use this method unless you can communicate with the fallen climber. Do not use this method if the fallen climber is injured.

c. Additional considerations.

(1) The Bachman knot can be used in place of the main anchor (ratchet) prusik. This knot will tend itself and allow all team members to focus on hauling.

(2) Pulleys can make hauling more efficient. For the Z-pulley use a pulley at the ratchet prusik attachment and the running prusik attachment.

(3) If you meet significant resistance while hauling STOP. Check the fallen climber. He may be stuck under an overhang or the rope may have become entrenched. You will need to take corrective action to free the stuck rope or devise another plan to get the fallen climber out.

(4) For self-rescue with a sled, you will need to pass the sled prusik:

- Ascend until you reach this prusik. Hang from you waist prusik.
- Take another piece of cordelette or webbing and place a new friction knot (prusik, Kleimheist knot, Bachman knot) above the sled prusik.
- Attach the new friction knot to your harness with a locking carabiner. Down climb the rope slightly until the new friction knot takes your load.
- Remove the foot prusik and re-tie it above the sled prusik.
- Remove the original waist prusik and continue ascending the rope.

(5) Another option for the foot prusik is the Texas prusik system.

- Tie a figure-eight loop in the middle of a 12 foot length of 6-7mm cordelette.
- Tie an overhand knot (stopper knot) approximately 1 foot from each end of the cord.
- Form the foot stirrups. With the tail from one overhand, tie a double overhand knot around the standing portion of the rope to form a loop. Repeat with the other overhand on the other standing portion of the rope. You now have two adjustable loops. The stopper knot keeps the double overhand knot from tightening too much around your foot and cutting off circulation. You will need to adjust the stirrups to fit your foot.

- After adjusting the foot stirrups, place one stirrup on each foot. The top of the figure-eight loop should be at your belly button. Continue to make adjustments until you have met this requirement.
- To use the system, tie a prusik onto the climbing rope with the figure-eight loop below the waist prusik. Step into the stirrups and ascend using the same technique you learned earlier. The main disadvantage with this system is that the Texas prusik cordelette can only be used for self-rescue; it cannot be used in other systems without untying it.

(6) Rescuers must ensure that they are belayed or anchored throughout all steps of any rescue.

Learning Step/Activity 3 – Use running belays on steep snow/ice and glaciated terrain.

a. Running belays allow a team to move on steep snow covered terrain where it may be difficult to self arrest. Running belays are an efficient method of offering a rope team a greater margin of safety on steep terrain without having to stop to establish belays:

(1) The rope team prepares for movement. The rope team leader should gather extra pickets, ice screws, slings and ice anchors. The entire team begins moving.

(2) On steep sections, the rope team leader places an anchor (protection) and clips the rope into the protection. He continues to place protection keeping one piece of protection between himself and the second climber. The team adjusts pace/stops as leader places protection and continues moving.

(3) As the second climber reaches this protection, he clips the rope behind him into the protection and then removes the rope leading to the first climber.

(4) The last climber recovers the protection. As the leader runs out of protection the team gathers together in a safe area, the leader takes control of the protection, and the team continues movement.

b. If one climber falls, all climbers should attempt to self arrest. If self-arrest fails, the protection will take the load of the falling climber.

Learning Step/Activity 4 – Bivouac on a snow covered glacier.

a. When locating a bivouac site or a gathering area where the team might need or want to un-rope, at least one person will need to “probe” the area for hidden crevasses. To prepare a site for bivouac:

(1) The rope team leader picks a site. He assembles a probe and prepares to probe the site. The second rope team member belays the rope team leader as he probes.

(2) Push the probe down into the snow until you hit solid ice. Probe in two-foot intervals in all directions within the site. Mark boundaries with wands or other items, skis, poles, etc.

(3) If the probe suddenly has no resistance while pushing down, a crevasse is present. Attempts to outline the crevasse can be futile if the crevasse is large. Relocate the proposed area far enough away to avoid that crevasse; sometimes only a few feet one way or the other is all that is required to reach a good platform.

(4) As a safe area is cleared the third rope team member can move forward to probe. The middle man can belay him as well.

(5) Once a sufficient area is cleared all team members can move into the area and un-rope.

b. Prepare the shelter site.

(1) The shelter site should be dug in. Usually a solid snow surface can be found a few inches to a few feet down. Prepare an area big enough to accept the tent, personal equipment and cooking area. You should be able to walk around the tent; in a storm you must be able to clear snow from around the tent.

(2) Re-probe the area after digging to ensure that you did not miss any crevasses.

(3) Construct snow walls around the perimeter to protect the tent from winds and blowing snow. You pile loose snow around the tent site or cut blocks and build walls. For block construction, move the soft snow from the digging area into the wall foundation areas. Remove this down to a consolidated layer of snow. Cut blocks approximately 1x1x2 feet and construct the walls by interlocking the blocks with overlapping placements. The walls should be slightly higher than the tent. At a minimum, build walls on the windward side of the tent site.

c. Additional considerations.

(1) There should be no un-roped movement outside the probed/marked areas. If there is a need for a latrine area, probe a route away from the site and probe the latrine area also. If a dugout latrine is necessary, probe again after digging.

(2) Multiple tent sites can be connected, this keeps tents closer together. Probe all area between the tents if you plan to move in those areas. Closer tents will ease the ability to communicate between tent groups/rope teams.

SECTION IV. SUMMARY

You now have the skills required to travel and live on a glacier.

Check on Learning.

1. What is the preferred method of crevasse rescue?

Self-rescue

2. What are the steps to crevasse rescue?

(1) Arrest the fall.
(2) Anchor the rope.
(3) Check the victim and decide on a rescue method.
(4) Prepare the lip.
(5) Execute the rescue plan.

3. Why do you prepare the lip?

To prevent an entrenched rope from interfering with the rescue.

4. What technique can you use if the rope is entrenched and will interfere with a self-rescue?

U-Pulley

SECTION II. INTRODUCTION

Motivator: Operations conducted in mountainous terrain may often require the crossing of swift flowing rivers or streams. Such crossings should not be taken lightly. The force of the flowing water may be extremely great and is most often underestimated. All rivers and streams are obstacles to movement. They should be treated as danger areas and avoided whenever possible. When rivers or streams must be crossed, there are a variety of techniques you may choose from, depending upon the type of stream, its width, speed of the current, and depth of water.

There are limits on the safe use of these techniques. Not all mountain rivers or streams will be fordable with these techniques. If a water obstacle is too wide, swift, or deep, an alternate route should be used, or the crossing will require major bridging by engineers. It may require the use of rafts or boats. Reconnaissance of questionable crossing sites is essential.

Terminal Learning Objective

ACTION	Cross a mountain stream
CONDITION	In a field environment given a moderate flowing mountain stream or river, with adequate entry and departure points and suitable “holding” areas, a 16 foot sling rope, 1 steel oval non-locking carabiner, and helmet
STANDARD	Soldier: - Crossed using individual techniques. - Crossed as a team member. - Crossed using a hand line.

Safety Requirements: Upstream lookout will be posted for all crossings. Down stream safeties with throw bags will be posted for all crossings. Written risk assessment conducted by NCOIC/OIC and present at site; assessment will continue throughout the exercise as conditions change.

Risk Assessment: Medium

Environmental Considerations: None

Evaluation: You will conduct a practical exercise that involves individual, team and hand line crossing techniques for crossing a mountain stream. You must participate in this exercise to pass the course. You will be tested on your knowledge of mountain stream crossing during a one hour written examination at the conclusion of the course (Refer to training schedule for date/time of exam). You must score a 70% on the written exam. If you fail the written exam you will be given a second exam after re-training has been conducted. If you fail this second examination you will be dismissed from the course.

Instructional Lead-In: This lesson covers the techniques for crossing mountain streams which have a depth generally not exceeding waist deep.

SECTION III. PRESENTATION

Learning Step Activity 1 – Identify a crossing site for a mountain stream.

a. Reconnaissance of the route (map, and/or aerial photo) may not always reveal that a water obstacle exists. In a swamp, for example, un-fordable sloughs may not show on the map, and they may be concealed from aerial observation by a canopy of vegetation. Whenever it is possible that your unit will be required to cross a water obstacle, you must plan some type of crossing capability.

b. Site selection is extremely important once you determine that you must make a crossing. Look for a high place from which you can get a good view of the obstacle and possible crossing sites. A distant view, perhaps from a ridge, is often better than a close view from a riverbank. Site selection must be made before the arrival of the main body.

c. A dry crossing on fallen timber or log jams is preferable to attempting a wet crossing. Depending upon the time of year, the closer you are to the source, or headwaters, the better your chances are of finding a natural snow or ice bridge for crossing. If a dry crossing is unavailable, the following considerations should be made:

(1) The time of day of the crossing can be an important factor. Although early morning is generally best because the water level is normally lower during this period, recent weather is a big factor; there may have been heavy rain in the last eight hours. As glaciers, snow, or ice melt during the day, the rivers rise, reaching their maximum height between mid afternoon and late evening, depending on the distance from the source. Crossings, if made during the early morning, will also allow clothing to dry more quickly during the heat of the day.

(2) A crossing point should normally be chosen at the widest, and thus shallowest, point of the river or stream. Sharp bends in the river should be avoided since the water is likely to be deep and have a strong current on the outside of the bend. Crossings will be easiest on a smooth, firm bottom. Large rocks and boulders provide poor footing and cause a great deal of turbulence in the water. Places where two channels come together usually have a deep hole and are capable of producing whirlpools. A 'riffle" is usually shallow, but the speed of the current usually increases and the bed is covered in rocks. Small outcrops of land or rocks that produce whirlpools should be avoided.

(3) Many mountain streams, especially those which are fed by glacier run-off, contain sections with numerous channels. It is often easier to select a route through these braided sections rather than trying to cross one main channel. A drawback to crossing these braided channels, however, is the greater distance to the far bank may increase exposure time and often the sand and gravel bars between the channels will offer little cover or concealment, if any.

(4) The crossing site should have low enough banks on the near and far side to allow a man carrying equipment to enter and exit the stream with relative ease. If a hand line or rope bridge is to be constructed, the crossing site should have suitable anchors on the near and far bank, along with safe loading and unloading areas. Natural anchors are not a necessity, however taking the extra time to find a site with solid natural anchors will probably be less than the time required to construct artificial anchors. In some areas, above the tree-line for example, artificial anchors may have to be constructed. Dead man anchors buried in the ground, or under a large pile of boulders work well.

(5) Log jams and other large obstructions present their own hazards. Logs floating downstream will generally get hung up in shallower sections creating the log jam. Once a log jam is formed, however, the water forced to flow around it will erode the stream bottom. Eventually deep drop-offs or holes may develop, especially around the sides and off the downstream end of the log jam. A log jam that totally bridges a section of the stream may be the best way to cross. A wet crossing in the vicinity of a log jam should be performed a good distance below or above it. Some things to consider when crossing near log jams are:

- Cross well to the downstream side when possible.
- Keep a sharp lookout for floating timber that could knock you off your feet.

- If you must cross on the upstream side stay well upstream from the log jam. If a person is swept off his feet and caught in the debris of the jam, he could easily drown. A hand line will greatly increase safety here.

(6) When possible, select a crossing site which has enough natural protection on the near and far banks so that security teams may be placed out and enough cover and concealment is available for the size of the element making the crossing. When cover and concealment is minimal, as in the higher alpine zones, the crossings must be conducted as efficiently as possible to minimize exposure to enemy observation.

Learning Step Activity 2 – Prepare men, weapons and equipment for a mountain stream crossing.

a. Prepare men and equipment for a crossing as far in advance as feasible. Final preparation should be completed in a security perimeter on the near side just before crossing. Preparation includes:

(1) Waterproof water-sensitive items. Wrap radios, binoculars, SOI, papers, maps and any extra clothing in waterproof bags (trash bags also work well), if available. These bags also provide additional buoyancy in case of a fall.

(2) Trousers are un-bloused and shirts are pulled out of the trousers. All pockets are buttoned. This allows water to escape through the clothing. Otherwise the clothing would fill up and retain water which would weigh the body down; especially critical if an individual ever has to swim to shore. Depending on the circumstances of the crossing (i.e., tactical situation, temperature of the air and water) the crossing can be made in minimal clothing so that dry clothing is available after the crossing. Boots should be worn to protect feet from rocks, however, socks and inner soles should be removed; on the far side the boots can be drained and dry socks replaced.

(3) Load Carrying Equipment (LCE) harness and Load Bearing Vest (LBV) is unbuckled and worn loosely. It is extremely difficult to remove a buckled harness in the water in an emergency. Body armor should also be removed.

(4) Normally in slow moving streams with sandy or gravel bottoms, helmets are removed and placed in the rucksack. If you have to resort to swimming it is easier done without the helmet. However, when crossing swift flowing streams, especially those with large rocks and other debris, the risk of head injury if you slip is high. In this case the helmet should be worn with the chinstrap fastened.

(5) The rucksack should be worn well up on the shoulders and snug enough so it doesn't flop around and cause you to lose your balance. The waist strap MUST be unbuckled so you can get rid of the pack quickly if you are swept off your feet and have to resort to swimming. If a pack has a chest strap it must also be unbuckled. Secure everything well within your pack. It is easier to find one large pack than to find several smaller items.

(6) Individual weapons should be attached to the pack or slung over the shoulder.

(7) Identify any non-swimmers; provide personal flotation devices if possible or take steps to improvise flotation devices.

(8) Familiarize everyone with techniques for swimming:

- Jettison any equipment that restricts movement.
- Get on your back, place the feet together and downstream and face downstream. Use your arms to keep your head out of the water and maneuver towards shore. Look for obstacles and maneuver away from them. Use your legs to push away from large rocks or other obstacles that cannot be avoided.
- Do not fight the current. Use it to help you maneuver downstream and towards shore.
- Avoid backwater eddies and converging currents as they often contain dangerous currents. Breathe between the wave troughs.

- If the shore is too far to reach, seek out the closest and safest spot, such as a sandbar, and get out of the water as quickly as possible.
- Get dry quickly as hypothermia can set in fast after cold water immersion.

(9) Designate an upstream lookout. The upstream lookout observes the stream for objects floating in the water that may present a hazard to the personnel crossing below. Post security with this individual.

(10) Designate a downstream safety. This individual should be a strong swimmer and should be equipped with a 30 meter rope in a throw-bag, and a flotation vest. Post security with this individual.

Learning Step Activity 3 – Cross a mountain stream individually.

NOTE: Instructors demonstrate the task for students step by step. Upon completion of the demonstration, have the students practice.

a. Whenever possible, and when the degree of experience permits, streams should be forded individually in order to affect a speedier crossing. You should be able to cross most streams with mild to moderate currents and water depths of not much more than knee deep using proper technique. The individual crossing technique is as follows:

(1) Face upstream at a 45º angle to the current. Lean slightly into the current to help maintain balance. To reduce the current's force, you may choose to face more sideways as this will reduce the surface area of the body against the current.

(2) Step off with the downstream foot. Step off with the current. Shuffle the feet along the bottom. Do not lift the feet (they may be swept away by the current). Do not cross one foot in front of the other. Take short, deliberate steps.

(3) Move across the stream at a slight downstream angle. This allows you to work with the current.

(4) Feel for obstacles, holes and drop-offs with the lead (downstream) foot and adjust your route accordingly. If an obstacle is encountered, place the feet on the upstream side of it where the turbulence is less severe and the water normally shallower.

(5) Look upstream for floating debris that could sweep you off your feet.

(6) If one is available, use a staff to increase balance. A long ice axe, ski poles or a sturdy tree limb can serve as this third point of contact. Use the staff on the upstream side as pictured below. You can lean on the staff for support. Move the staff first, then shuffle the feet. This allows you to maintain two points of contact with the stream bed at all times.

Individual Crossing With Staff

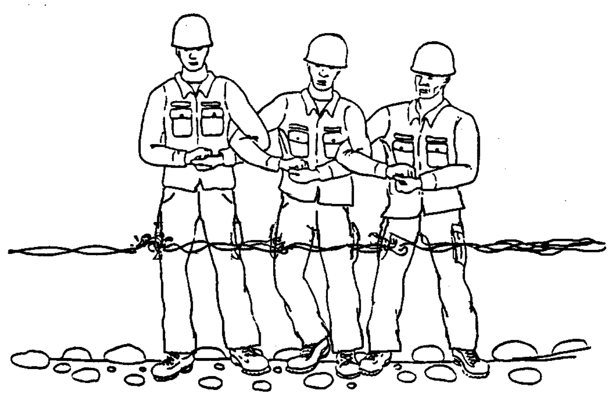
Learning Step Activity 4 – Cross a mountain stream as a team.

NOTE: Instructors demonstrate the task for students step by step. Upon completion of the demonstration, have the students practice.

a. When the water level begins to reach thigh deep or anytime the current is too swift for personnel to safely perform an individual crossing, a team crossing may be used:

(1) Two to five individuals cross arms with each other and lock their hands in front of themselves. The largest individual should be on the upstream end of the line as he will break the current for the group. The line formed faces the far bank.

(2) Move across the stream using the same principles as for individual crossings. The line should cross parallel to the direction of the current. The team still moves at a slight downstream angle, stepping off with the downstream foot in the lead. One team member is designated to call cadence so that the team moves smoothly. The man on the upstream side looks upstream for debris that could hit the group.



Team Method For Stream Crossing

Learning Step Activity 5 – Cross a mountain stream using a hand line.

NOTE: Instructors demonstrate the task for students step by step. Upon completion of the demonstration, have the students practice.

a. When the water level begins to reach waist deep or the current is too swift for a team crossing, the chosen site must be closely examined. The stream at this point may very well be impassable. A crossing site which may be unsafe for individual or team crossings can be made safe with the installation of a hand line or rope bridge. Crossing on a hand line will still require each individual to enter the water and get wet. If a one-rope bridge can be constructed, it may require only a couple of individuals to enter the water. Deciding whether to install a hand line or a rope bridge will depend on the anchors available, height of the anchors above the water, and the distance from the near and far anchors.

b. If it is possible to use a rope high enough above the water to enable soldiers to perform a dry crossing, then a rope bridge should be installed as such. If this is impossible, and the rope must be installed to assist in a wet crossing, then it should be installed as a hand line. Whether a hand line or rope bridge is to be installed, someone will have to cross the stream with one end of the rope and anchor it on the far side. This duty should be performed by the most capable and strongest swimmer in the party. To set-up the hand line:

(1) Designate an individual to take the rope to the far side. This individual must be a strong swimmer and must understand different techniques for building anchors.

(2) The individual wears a helmet and seat harness or a Swami Belt and a Personal Floatation Device. The first man across carries no equipment with him except for what is absolutely necessary to anchor the rope. To construct a Swami Belt:

- Take a 16 foot sling rope. Form a bight in the middle of the sling rope.
- Place the middle of the rope on the left side of the hip between the top side of your hip and the bottom of the rib cage.
- Wrap the rope around the waist and tie it off to the bight with a square knot on a doubled rope. Finish the square knot with overhand knots.

(3) Clip a non-locking steel or aluminum oval carabiner to the back of the harness or Swami Belt.

(4) Belay the individual across the stream. Tie a figure-eight loop at the end of the belay rope and clip it to the oval carabiner at the back of the harness. This allows the individual to free himself from the rope if he needs to. NEVER tie directly into the rope when being belayed for a stream crossing. If the crosser is swept away and becomes entangled he must be able to release himself quickly from the rope and swim to shore as best he can. The individual may also choose to tie a fixed loop into the end of the belay rope and hang on to it, so he can immediately release it in an emergency. If the crosser must release the rope at any time, he will have to rely on his own water survival skills and swimming ability to get to shore. The belay man sets up a seated hip-belay, but does not anchor the belay, does not use a guide hand carabiner and does not tie into the rope. The brake hand should be on the downstream side.

(5) The individual uses individual crossing techniques to find a crossing point where he can stay on his feet and where the water does not come above his waist. If he loses his feet during the crossing, the belayer will apply the brake causing the swimmer to pendulum back to the near side shore. Rescuers should be poised on the near bank at points where the individual will pendulum back, should he fail to reach the far bank. The initial crossing site should be free of obstacles that would snag the rope and prevent the pendulum back to the bank for an easy recovery.

(6) Upon reaching the far side, the crosser anchors the rope ensuring there is adequate space to unload soldiers. The far side anchor should be downstream from the near side anchor so that the rope will run at a 30-45 degrees angle downstream from the near anchor, rather than straight across the stream.

(7) Anchor the rope on the near bank using a transport tightening system ensuring there is enough space to load soldiers.

(8) Belay the next man across with a second rope. This rope provides additional safety in the event the soldier loses his grip on the hand line. The second man across carries the first man's equipment across. The second will cross in the following manner:

- A belayer on the near side establishes a hip belay, but does not anchor the belay, does not use a guide hand carabiner and does not tie into the rope. The brake hand should be on the downstream side.

- The second man will clip directly to the hand line with a non-locking carabiner. Tie a figure-eight loop at the end of the belay rope and clip it to the oval carabiner at the back of the harness. He then begins to move across.

- Once across the second will clove hitch the rope to the anchor to prevent loss.

- The belayer ties a bowline on a bight in the belay rope. If the span is such that the belay rope cannot be managed from both sides, attach another rope to the end of the belay rope on the near side using a double fisherman's knot.

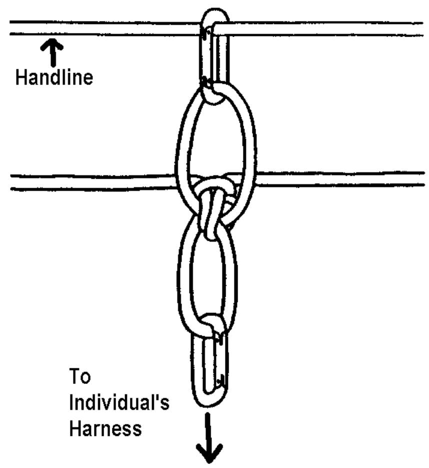
- This man now establishes a second belay on the far side. He does not anchor the belay, does not use a guide hand carabiner and does not tie into the rope. The brake hand should be on the downstream side.

- The near side belay man takes in rope until the bowline on a bight reaches the near side.

- Clove hitch the ends of the belay rope to an anchor point on both sides to prevent the loss of the rope. The hand line can now be used for the remainder of the unit.

c. Crossing procedure is as follows:

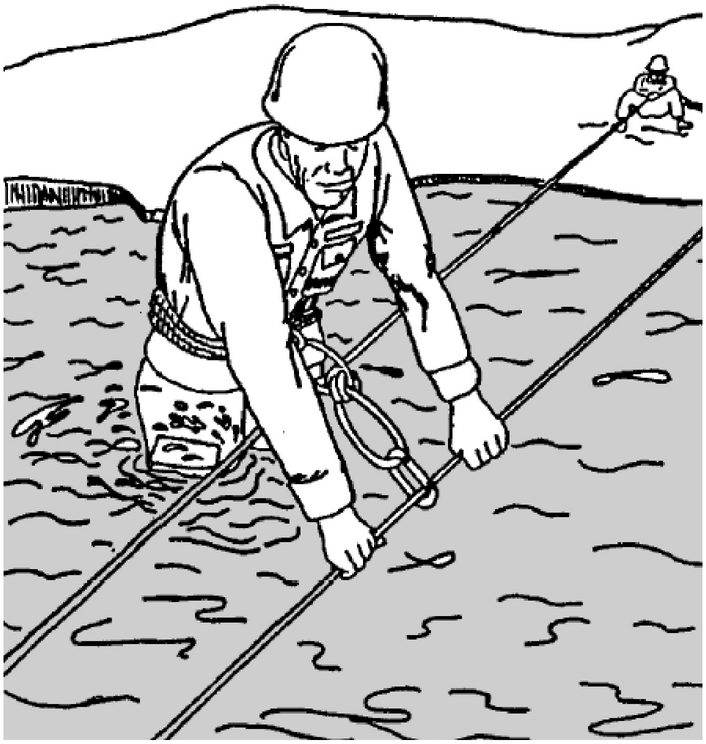
(1) Fix one loop of the bowline on a bight to the hand line with a locking carabiner; attach the second loop to the Soldier with a carabiner on the front of the harness or swami belt. Soldier is positioned on the downstream side of the handline.



Belay Rope For Crossing A Hand Line.

(2) Establish a hip belay on both the near side and far side to manage the belay rope. The belay men sets up a seated hip-belay, but does not anchor the belay, does not use a guide hand carabiner and does not tie into the rope. The brake hand should be on the downstream side.

(3) The crosser uses the hand line to assist in the crossing. If the crosser loses his footing, both belayers go to the brake position. The crosser should try to regain his feet. If after a short time the crosser cannot regain his footing, he should be pulled to the far side by the belay rope.



(4) Once the crosser makes it to the far side, the near side pulls the rope back until the bowline on a bight reaches the near side again. The process is now repeated for all but the last man.

(5) The last man recovers the installation. This individual clips a figure-eight loop at the end of the rope to the rear of his harness and is belayed across in the same manner as the first man across. This man should also wear a Personal Flotation Device.

SECTION IV. SUMMARY

Stream crossing is a complex task with a high risk involved. You now have the skill set to move across a mountain stream; use caution, as a seemingly mundane event can turn deadly if all procedures are not followed.

Check on Learning.

1. What is the maximum depth for individual crossing?
Below knee deep.

2. What is the crossing depth for team crossing?
Up to mid thigh deep.

3. When should you install a hand line?
When the water is waist deep.

4. If the water is deeper than waist deep can you safely cross using the techniques you learned in this class?
No. You should attempt to find another crossing site or use an alternative means.